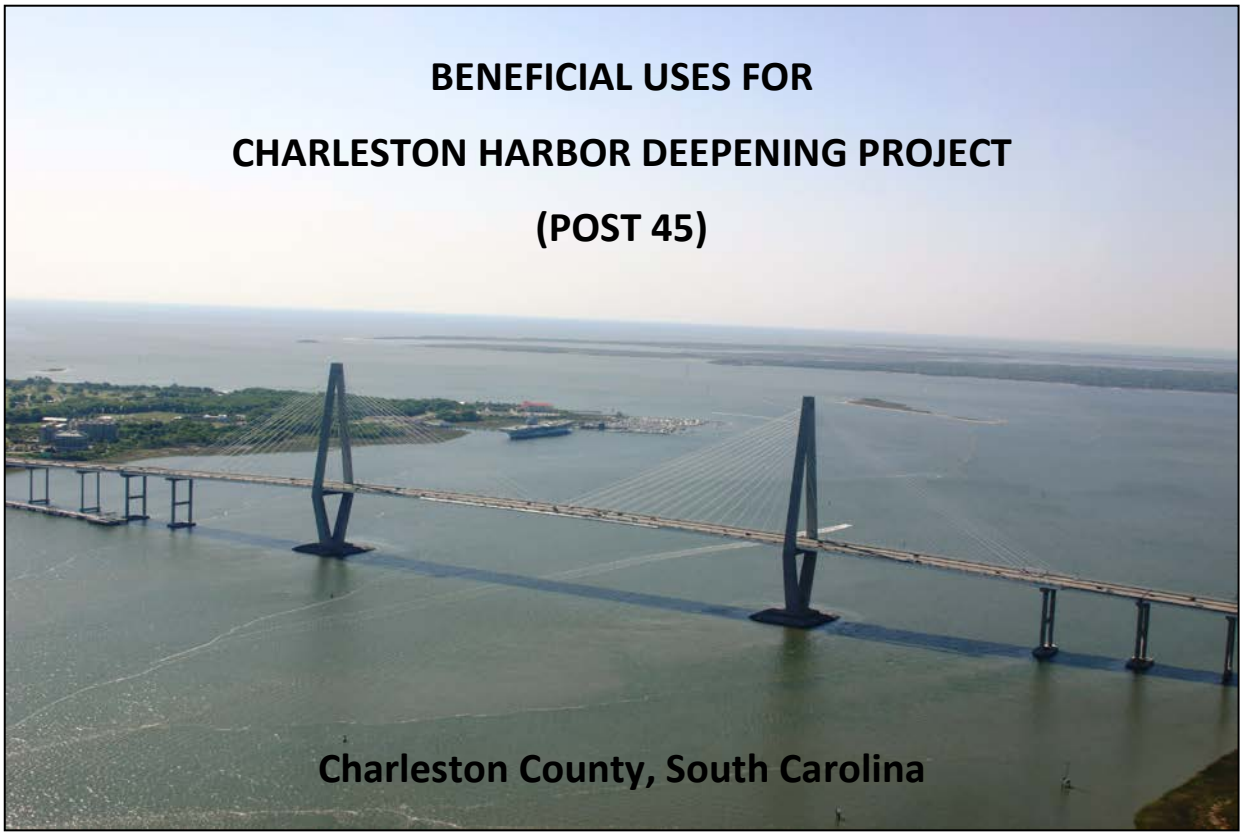
US Army Corps
Of Engineers®
Charleston District

FINAL SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT



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Prepared by

U.S. Army Corps of Engineers, Charleston District

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1.0 Project Background

The Federal Government has placed considerable emphasis on using dredged material in a beneficial manner. Statutes such as the Water Resources Development Acts of 1992, 1996, 2000, and 2007 demonstrate that beneficial use has been a Congressional priority. The United States Army Corps of Engineers (USACE) has emphasized the use of dredged material for beneficial use through such regulations as 33 CFR Part 335, ER 1105-2-100, and ER 1130-2-520 and by Policy Guidance Letter No. 56. ER 1105-2-100 on page E-69 requires that "all dredged material management studies include an assessment of potential beneficial uses for environmental purposes including fish and wildlife habitat creation, ecosystem restoration and enhancement and/or hurricane and storm damage reduction."

Opportunities exist for beneficial use of dredged material associated with the dredging of new work material during the construction of the Charleston Harbor Post 45 Navigation Project. In accordance with ER 1105-2-100, the USACE is considering beneficial use of dredged material as a part of the project. USACE regulations (ER 1105-2-100) state that, "where environmentally beneficial use of dredged material is the least cost, environmentally acceptable method of disposal, it is cost shared as a navigation cost." The incremental costs of a beneficial use that is above the least cost disposal option would need to be funded by a non-Federal sponsor or cost-shared according to the applicable authority. The beneficial use concepts and alternatives discussed below may or may not be constructed, particularly if the costs are greater than the least cost disposal option and a non-Federal sponsor is not identified to pay for the incremental increase in cost.

The USACE has two continuing authorities that address beneficial uses of dredged material. Section 204 of the Water Resources Development Act (WRDA) of 1992 established programmatic authority which allows the USACE to carry out ecosystem restoration projects in connection with dredging for construction, operation, or maintenance of authorized navigation projects. Section 207 of WRDA 1996 allows the USACE to select a disposal method that is not the least cost if it is determined that the incremental costs are reasonable in relation to the environmental benefits (Section 207 amended Section 204 of WRDA 1992 – both are codified at 33 USC 2326). Under each of these authorities, the incremental cost above the least cost disposal base plan will be shared with a non-Federal sponsor. The USACE, Charleston District, intends to maximize the beneficial use of dredged material where: 1) suitable, environmentally-acceptable options exist, 2) it is the least cost disposal option, and/or 3) a cost-sharing sponsor can be identified.

This Environmental Assessment (EA) is a supplement to the Final Integrated Feasibility Report and Environmental Impact Statement for the Charleston Harbor Post 45 Study ("IFR/EIS," USACE, 2015). In the Final IFR/EIS, Dredging and Dredged Material Management was addressed in Section 4.2, and Beneficial Use of Dredged Material in Section 4.2.6. The IFR/EIS stated that "[d]uring the PED phase, options for beneficial uses that are cost-effective and meet regulatory and environmental protection requirements would be pursued," (Section 4.2.6), and that "[f]inal designs, decisions to implement, and environmental considerations/clearances would take place during the PED phase" (Section 4.2.6.8). A Record of Decision was signed on 12 January 2016.

2.0 Proposed Post 45 Project

In July 2015, the USACE Charleston District released the IFR/EIS for the Charleston Harbor Post 45 Study. The Recommended Plan (RP) is a Locally Preferred Plan (LPP) that proposed the following navigation improvements:

- Deepen the existing entrance channel from a project depth of -47 feet to -54 feet mean lower low water (MLLW) over the existing 800-foot bottom width, while reducing the existing stepped 1,000- foot width to 944 feet from an existing depth of -42 feet to a depth of -49 feet.
- Extend the entrance channel approximately three miles seaward from the existing location to a depth contour including a -54-foot MLLW project depth plus overdepths.
- Deepen the inner harbor from an existing project depth of -45 feet to -52 feet MLLW to the Wando Welch container facility on the Wando River and the Hugh Leatherman Terminal on the Cooper River, and -48 feet MLLW for the reaches above that facility to the North Charleston container facility (over expanded bottom widths from 400 to 1,800 feet).
- Enlarge the existing turning basins to an 1800-foot diameter at the Wando Welch and new South Carolina State Ports Authority (SCSPA) terminals to accommodate Post Panamax Generation 2 and 3 container ships and widen selected reaches (Figure 1).
- Enlarge the North Charleston Terminal turning basin to a 1650-foot diameter for Post Panamax Generation 2 container ships.
- Place dredged material and raise dikes at the existing upland confined disposal facilities at Clouter Creek, Yellow House Creek, and/or Daniel Island; and for material dredged from the lower harbor, place at the Ocean Dredged Material Disposal Site (ODMDS) and expand. Place rock to create hardbottom habitat near the entrance channel as a least cost, beneficial use of dredged material.

A plan view of the inner channel project footprint can be seen in Figure 1.

Figure 1 Proposed deepening and widening in the upper and lower harbor

The pre-construction, engineering, and design (PED) phase started in December 2015 upon signing of a Design Agreement between the USACE and the SC Ports Authority. Consistent with the Final IFR/EIS, this Supplemental EA provides the PED phase evaluation of beneficial uses of dredged material for the new work material dredged from the channel. The "Alternatives Evaluated in Detail" in Section 6.2, below, were all identified in the IFR/EIS as options that would receive additional analysis or development during the PED phase. This EA also includes the process and results of fine-tuning the construction methodologies and locations of artificial reefs (previously evaluated during the Feasibility Phase in the Final IFR/EIS) near the entrance channel, and of identifying any existing SCDNR approved reefs that could be supplemented with rock material from the channel. Potential environmental impacts of the proposed rock placement for beneficial use were previously evaluated in detail in the Post 45 Final IFR/EIS (which is incorporated by reference). Section 7.0 of this EA sets forth the Proposed Action which, to the extent it is adopted, would be pursued as part of the RP.

The Final IFR/EIS also committed to perform ship simulation and evaluate the minimization of channel widening measures during the PED phase. A report documenting the results of the ship simulation analysis and recommended widening reductions will be released separately. This EA does not address ship simulation or widening reductions (no additional environmental review is anticipated because the maximum widening footprint is already evaluated in the Final IFR/EIS and Record of Decision).

3.0 Purpose and Need for the Proposed Action

The purpose of the proposed action is to: (1) reasonably maximize the environmental opportunities to provide beneficial uses of new work dredged material from the Post 45 deepening project, (2) determine the technical, economic, and environmental feasibility of protecting and restoring valuable natural and cultural resources in the Charleston Harbor area, and (3) to identify which alternatives would require a sponsor to share the cost of project implementation. Although adequate disposal site capacity exists for construction of the Post 45 project, the USACE is committed to evaluating beneficial uses to support the USACE Regional Sediment Management (RSM) practices and the USACE Engineering with Nature (EWN) principles. Beneficial use projects also aid in maintaining capacity in existing disposal areas and thereby reducing future maintenance costs associated with disposal area operations and maintenance.

Certain areas within the harbor are subject to wave and wake activity, as well as strong currents from tidal action. These areas include but are not limited to Crab Bank, Shutes Folly, and Ft. Sumter. Crab Bank has been designated as an "Important Bird Area" in South Carolina and is established as "Crab Bank Seabird Sanctuary." Another resource of concern in the harbor is Shutes Folly. Shutes Folly provides nesting habitat for colonial seabirds due to its isolated nature, small size, and lack of predators. It is one of only nine active nesting sites in the entire state. Castle Pinckney, an important historic site, sits on the southern tip of Shutes Folly. Fort Sumter National Monument, established in 1948 and listed on the National Register of Historic Places in 1966, sits at the mouth of the harbor on the southern side of the navigation channel. Beneficial use options were explored to augment these resources and delay the inevitable shoreline changes and erosion that have been occurring over the years.

In support of the proposed action, this Supplemental EA elaborates on the suite of potential beneficial use actions originally identified in the Final IFR/EIS that may be eligible to be implemented. In order to be

eligible for implementation, an option must be environmentally-acceptable and either (1) able to be included in the least cost disposal method, or (2) a cost share sponsor has been identified to cover all or a portion of the additional costs above the least cost dredging and disposal alternative. The report will discuss: (1) the purpose and need for the proposed action (2) the existing conditions specific to various resources within the harbor, (3) the anticipated environmental impacts of the proposed actions, and (4) the relationship and compliance with applicable laws and regulations.

4.0 Scope and Incorporation by Reference

This Supplemental EA was prepared in accordance with applicable portions of Engineer Regulation (ER) 200-2-2, *Procedures for Implementing the National Environmental Policy Act (NEPA)* and the Council on Environmental Quality (CEQ) *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (40 Code of Federal Regulations (CFR) Pts. 1500-1508). As previously noted, the NEPA document to be supplemented is the Charleston Harbor Post 45 Final FR/EIS, which is incorporated by reference. This Supplemental EA will further describe the beneficial use of dredged material actions proposed for new work construction associated with the Charleston Harbor Post 45 Navigation Project and determine the magnitude of their associated environmental impacts. If the impacts are considered insignificant, and the beneficial use actions and impacts of the Proposed Plan do not represent either a substantial change to the RP relevant to environmental concerns or present significant new circumstances or information relevant to environmental concerns, a Finding of No Significant Impact (FONSI) would be issued. The conditions, project description, and environmental effects described in the Final IFR/EIS are still valid, and this Supplemental EA is designed to operate in accordance with the tiering regulations under 40 CFR 1502.20 and 1508.28. This document also serves to demonstrate compliance with other applicable laws and regulations.

5.0 Existing Conditions

This section will describe the relevant existing environmental conditions within the affected environment prior to outlining the various alternatives that were considered and evaluated for this project. A majority of the existing conditions discussion for the affected resources can be found in the Post 45 Final IFR/EIS and are incorporated by reference (e.g., tides, currents, relative sea-level change, surface water quality, groundwater, wetlands, hardbottom habitat, essential fish habitat, protected species, marine mammals, fisheries, birds, invasive species, air quality, hazardous materials, noise, coastal barrier resources). The below sections will describe in more detail the conditions associated with the various beneficial use options in a more site-specific manner, where possible.

5.1 Crab Bank Description

Oblique view of Crab Bank from NW looking SE
Picture by SCDNR

South Carolina has several areas that are considered seabird sanctuaries/islands. These include, Tomkins Island, Deveaux Bank, Bird Key, Shutes Folly, Crab Bank, and Marsh Island, etc. Crab Bank is located in Charleston Harbor, just south of the mouth of Shem Creek near Mount Pleasant (Figure 1). Reviewing historical nautical charts reveals that the island was originally a large sand bar and was officially noted as an island in the 1965 nautical chart. Crab Bank was created with dredge material in the 1950's and 1960's (based on rough USACE dredging records and historical nautical charts). While the island fluctuates in size constantly, it has largely been migrating towards the north and west over the last 25 years. The island presently has little area that is above mean high water as evidenced visually (see above inset picture) and by recent topography data (Figure 2).

Crab Bank is becoming increasingly more important for sea and shorebirds because of marked declines in nesting birds at other sites over the last few years (Nathan Dias, personal communication, 2/9/2012). Crab Bank has been designated as an "Important Bird Area" in South Carolina and is established as "Crab Bank Seabird Sanctuary". The South Carolina Department of Natural Resources (SCDNR) indicates that, "Crab Bank supports colonies of nesting waterbirds because of its isolated nature and lack of mammalian predators. Although all species may not nest on the island each year, examples of species that have used the island include: brown pelican, least tern, royal tern, black skimmer, gull-billed tern, sandwich tern, common tern, laughing gull, Wilson's plover, American oystercatcher, willet, great egret, snowy egret, tricolored heron and ibis. Besides providing nesting habitat, the sanctuary provides winter loafing and feeding areas for numerous species. (https://www.dnr.sc.gov/mlands/managedland?p_id=215, accessed in 2015). The public significance of Crab Bank was demonstrated during the NEPA scoping period for Post 45 when approximately 20 of the comments received requested that material be used to expand/enhance the island. Additionally, Crab Bank is recognized as one of five active nesting sites in South Carolina and as being "vital to the survival of at least fifteen species of birds" (http://coastalconservationleague.org/pelicam/).

Figure 2 Crab Bank existing topography and bathymetry (MLLW)

5.2 Shutes Folly / Castle Pinckney Description

Shutes Folly provides nesting habitat for colonial seabirds due to its isolated nature, small size, and lack of predators. It is one of only nine active nesting sites in the entire state. Skimmers and oyster catchers have been observed utilizing the shell hash that faces the eastern side of Shutes Folly. The island has been noted by Charleston Harbor Wildlife as being "often considered for restoration." They state that, "in 1997, wildlife biologists pressed for the island as a sight for dredge spoil to boost the small seabird colony there…" http://charlestonharborwildlife.com/iwa/cp-sf/). The island has little high ground above mean high water (MHW) (see inset picture above) (Figure 3). The majority of Shutes Folly is privately owned.

Oblique view of Shutes Folly from NW looking SE
Picture by SCDNR

Castle Pinckney, an historic site, sits atop the southern tip of the island about 1,950 ft from the Navigation Channel (Figure 1). It is one of the oldest fortifications of its kind still in existence and was built to provide defense of the coast. It is one of a series of forts consisting of Fort Sumter, Fort Moultrie, The Battery, Fort Johnson, and others which made up the defenses of Charleston during the War Between the States. In 1794, Congress approved the establishment of a system of port and harbor fortifications from Maine to Georgia. Charleston was one of the ports selected for fortification. Castle Pinckney was constructed of logs and sand on the south shore of Shutes Folly Island in Charleston Harbor. It was rebuilt in brick in 1809. During the latter half of 1861, Castle Pinckney served as a prison for Yankee soldiers captured during the First Battle of Manassas. Over the years since then, the Castle has changed ownership numerous times and is currently owned by the Castle Pinckney Historical Society. The fort is included as one of three ownership parcels that make up the island of Shutes Folly. The other two parcels are owned by a private land owner.

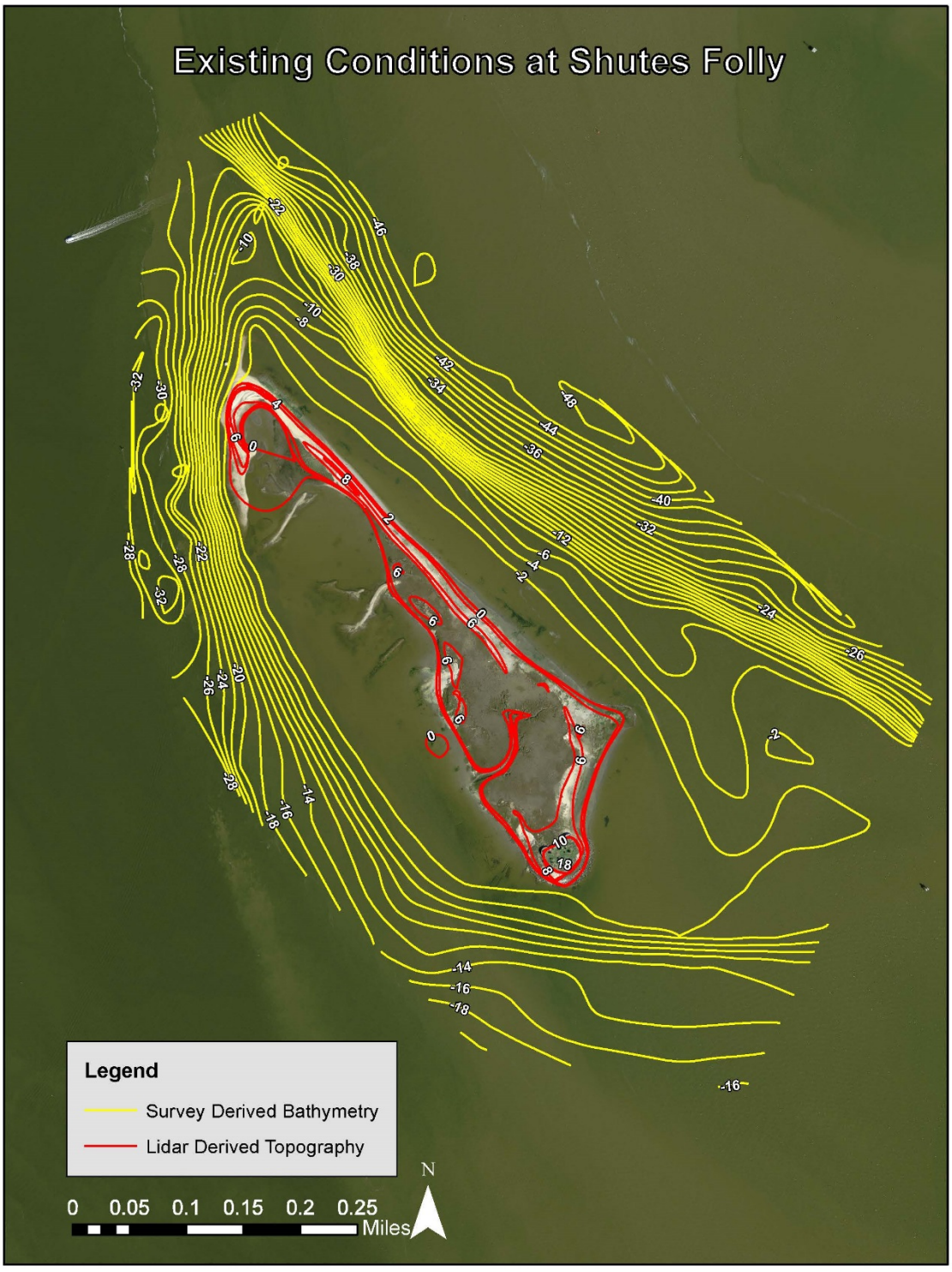


Figure 3. Shutes Folly existing topography and bathymetry (MLLW)

5.3 Ft. Sumter Description

The Fort Sumter National Monument was established in 1948 and listed on the National Register of Historic Places (NRHP) in 1966. The remnants of this masonry fort, associated with the Civil War defense of Charleston, stand on the south side of the mouth of Charleston Harbor, and are located approximately 2,925 ft from the Navigation Channel. The south and east faces of the fort are particularly exposed to wave action. In a letter to the USACE dated 29 September, 2011, the NPS indicated that the gap in the existing stone breakwater allows waves to crash directly against the brick masonry especially at high tide. The USACE analysis presented in Appendix A of the Post 45 IFR/EIS concludes that the island has been accreting along the east and south faces in the recent past (USACE, 2015).

5.4 Morris Island Description

Morris Island is an approximately 840 acre uninhabited island just south of the mouth of Charleston Harbor (Figure 4). On June 16, 2016, USACE staff performed a reconnaissance effort to visually inspect the terminus of the south jetty of Charleston Harbor due to reports that there was flanking (i.e., water going around the landward end) occurring at the terminus of the southern jetty at Morris Island. Flanking around the jetty would create a bypass channel, erode the island, potentially undermine the emerged jetty on the land and adversely affect the function of the jetties. With sea level rise, the risk of flanking becomes even greater as more opportunities exist for high tides to flank the jetty.

View of the slumping occurring at the south jetty on Morris Island

Along with the noted flanking, there was escarpment of the dune along the toe in some places and the inland tip (near harbor – known as Cumming's Point) had dying cypress trees. It appeared that at high tide there was not much dry beach habitat and that astronomical tides and/or storms had been causing many of the cedar trees to die back. As the jetty emerged onto the land there was obvious subsidence and movement of the stone (see picture). The subsidence was evidenced by the high and low spots along the emerged jetty, with large gaps along the top. The harbor side beach was a few inches higher than the ocean side of the beach and in spots maybe up to a foot. Ebb tide sediment collected across the island is a possible reason for this. It is speculated that due to the size and weight of the stone, displacement of stone likely occurred during extreme storm events such as Hurricane Hugo.

Figure 4. Morris Island existing topography and bathymetry (MLLW)

5.5 Physical Characteristics (Wind, Waves, Tides, Currents)

Wind and wave conditions are important considerations for this project due to their potential erosive forces that can impact harbor shorelines. The wind and wave conditions within Charleston Harbor are thoroughly documented within the Post 45 IFR/EIS (sections 2.4.1, 2.4.2, and 2.4.3, and Appendix A – Engineering, USACE 2015). Winds are predominantly out of the southwest, but the strongest (fastest 10%) are mainly from the north-northeast. The tidal range throughout the harbor is relatively uniform with the astronomically-generated high and low tides ranging from about 5 to 6 feet above MLLW throughout a given year. On a high spring tide, the majority of Crab Bank and Shutes Folly are submerged and have minimal areas seldom covered by water (supratidal land). Currents within the study area are generally about 1 knot while ebb currents near Fort Sumter may reach up to 4 knots. Strong currents have been observed adjacent to the eastern side of Shutes Folly.

During the Feasibility Phase, USACE performed an analysis of shoreline changes that have occurred over the last approximately 20 years (IFR/EIS, USACE, 2015, Appendix A). Table 1 documents the results of the analysis over the study period. Throughout the study period Crab Bank condensed in size and migrated towards the northeast or towards the Mt Pleasant side of Charleston Harbor (Figure 5). The island has lost approximately 13 acres of dry land since 1994. Shutes Folly has been slowly eroding on all sides and has lost approximately 10 acres of land since 1994. The small tidal sand island on the northern point appears to be migrating towards the main northern shoreline of the island. The rip-rap armoring on the face of Castle Pinckney appears to be stable and preventing any further erosion (Figure 6). . The channel and ocean-facing sides of Fort Sumter are armored with rip-rap and throughout the study interval appears to remain stable. The tidal marsh/sand flat area to the leeward side of the island appears to be slowly accreting material in a very dynamic way (Figure 7), and has actually accreted about 1 acre of dry land since 1994.

Table 1. Historic shoreline change on resources within Charleston Harbor (1994-2011)

AREA	Crab Bank	Crab Bank	Castle Pinckney	Castle Pinckney	Fort Sumter	Fort Sumter	Drum Island	Drum Island	Main Harbor (water area)	Main Harbor (water area)
YEAR	(SQ FT)	(AC)	(SQ FT)	(AC)	(SQ FT)	(AC)	(SQ FT)	(AC)	(SQ FT)	(AC)
1994	781266	17.94	1301690	29.88	203388	4.67	12266700	281.60	670011010	15,381.34
1999	565391	12.98	1062780	24.40	212680	4.88	12060800	276.88	681643010	15,648.37
2006	358917	8.24	1017670	23.36	220457	5.06	11934300	273.97	672035970	15,427.82
2011	218185	5.01	850508	19.52	241195	5.54	11717700	269.00	708561980	16,266.34
	LOSS/GAIN									
1994-1999	-215,875	-4.96	-238,910	-5.48	9,292	0.21	-205,900	-4.73	-11,632,000	-267.03
1999-2006	-206,474	-4.74	-45,110	-1.04	7,777	0.18	-126,500	-2.90	9,607,040	220.55
2006-2011	-140,732	-3.23	-167,162	-3.84	20,738	0.48	-216,600	-4.97	-36,526,010	-838.52
1994-2011	-563,081	-12.93	-451,182	-10.36	37,807	0.87	-549,000	-12.60	-38,550,970	-885.01

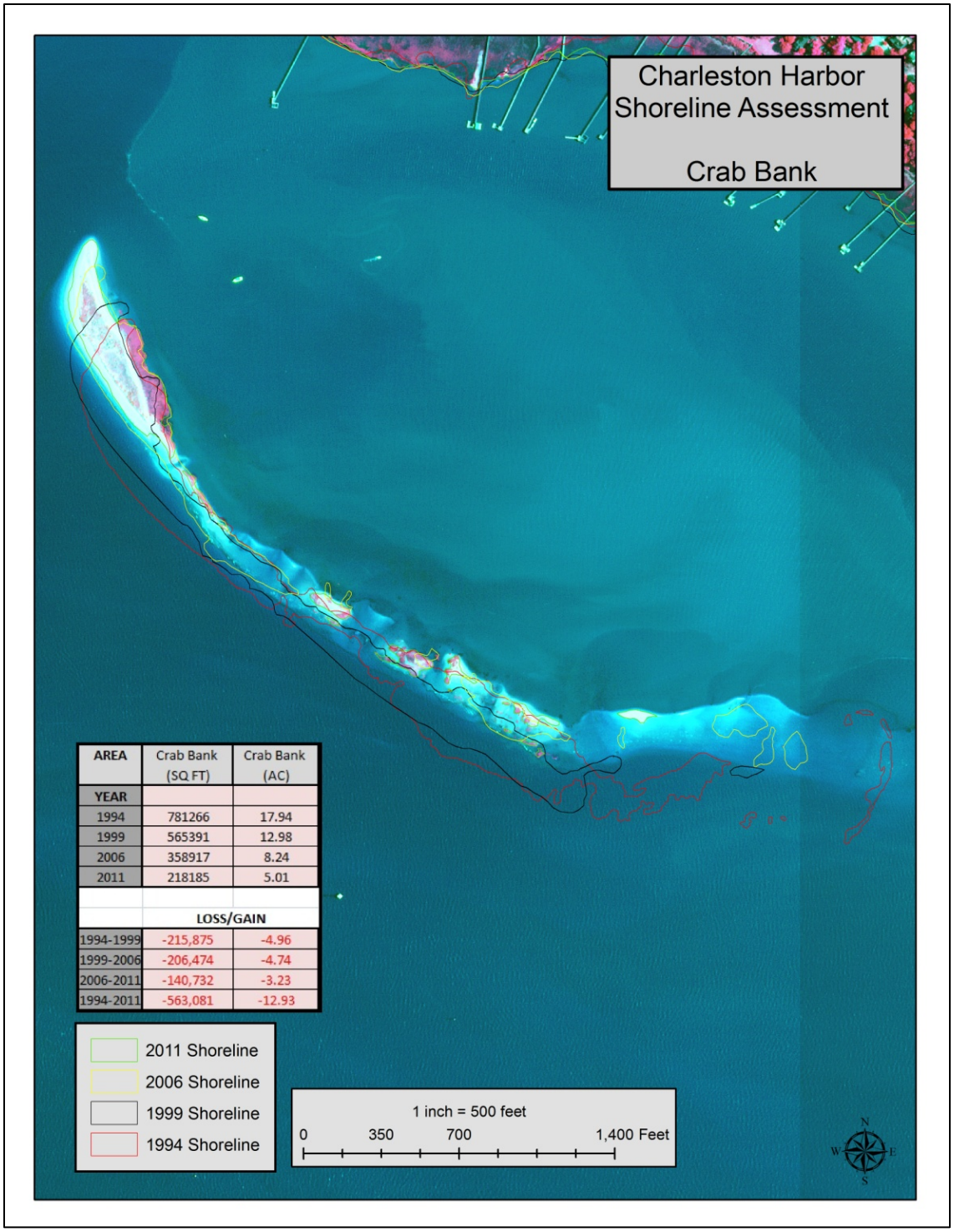


Figure 5. Crab Bank shoreline changes (1994-2011)

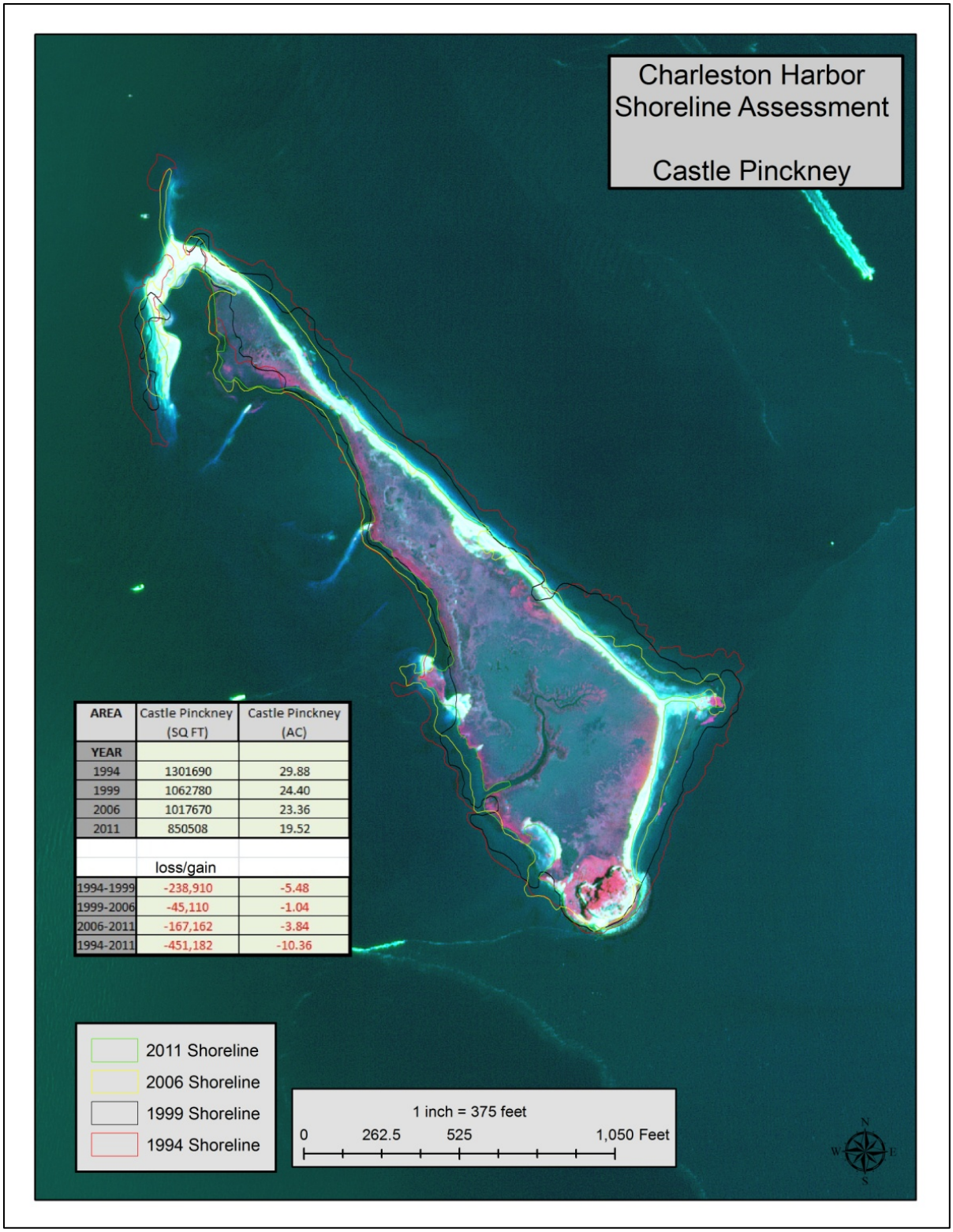
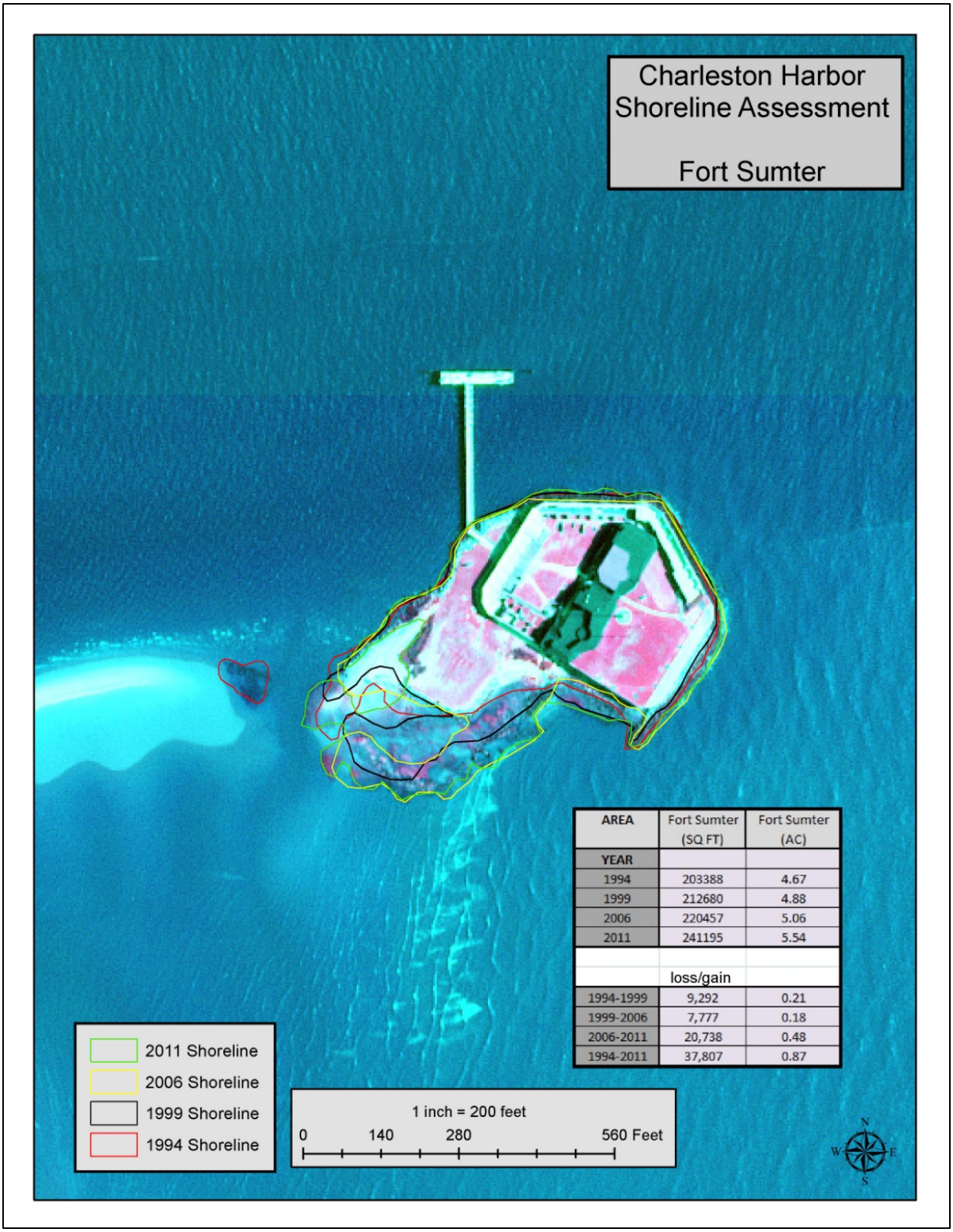


Figure 6. Shutes Folly shoreline changes (1994-2011)



AREA	Fort Sumter (SQ FT)	Fort Sumter (AC)
YEAR		
1994	203388	4.67
1999	212680	4.88
2006	220457	5.06
2011	241195	5.54
	loss/gain	
1994-1999	9,292	0.21
1999-2006	7,777	0.18
2006-2011	20,738	0.48
1994-2011	37,807	0.87

Figure 7. Ft. Sumter shoreline changes (1994-2011)

5.6 Water Quality

Water quality In Charleston Harbor is classified as SB by the South Carolina Department of Health and Environmental Control (SCDHEC 2002). The SB rating applies to tidal salt water suitable for survival and propagation of aquatic life; primary and secondary contact recreation; crabbing and fishing for market purposes and/or human consumption.

Salinity concentration in the river affects the estuarine habitat in many ways. Along with tidal inundation, salinity generally determines the marsh vegetation species; it directly affects the fish, crustacean and clam populations; and it influences the dissolved oxygen (DO) concentrations. Salinity in the river is also of concern from a water usage perspective. Bushy Park is a freshwater reservoir located in the upper reaches of the Cooper River and used by local industry for water supply. Salinity intrusion to the estuary can cause periodic increases in chloride concentration above acceptable limits at the reservoir. These events typically occur during periods of drought, very high tides, sustained wind conditions or storm events. To counter salinity intrusion events, there are several monitoring stations in the harbor and the freshwater discharge from Lake Moultrie can be managed by increasing flow during these events to lower salinity concentrations in the Cooper River (USACE 2006). Based upon hydrodynamic modeling of the Charleston Harbor system associated with the Post 45 project, 10^{th} percentile (lowest) DO between March and October in the lower harbor is around 5 mg/L with a mean around 6 mg/L (USACE, 2015 – Appendix H). As part of the Magnuson-Stevens Act consultation, the National Marine Fisheries Service (NMFS) requested more water quality data to gain a better understanding of the DO conditions throughout the harbor during the critical months of July, August, and September (when DO is typically the lowest). These data are presented in tables within Appendix H of the Post 45 Essential Fish Habitat (EFH) Assessment and are incorporated by reference. In the bottom layer of the hydrodynamic model, DO conditions in the lower harbor ranged from 4.8 to 5.1 mg/L (cells H1-H5). Due to these values for modeled DO as well as the temporary timeframe of construction, it is not anticipated that DO will be a concern during the construction of these beneficial use projects.

5.7 Sediments

Nearly all of the surficial soils in the Charleston area are Quaternary in age, and they unconformably overlie the Tertiary strata. The soils generally consist of interbedded sequences of clay, clayey to clean quartz sand, and fossiliferous sand which may be overlain by Holocene peat, silt, clean sand, or tidal marsh deposits (Weems and Lemon, 1993). A detailed description of sediment quality can be found within the IFR/EIS (USACE, 2015), Section 2.4.5. The following sections briefly describe the specific sediment composition within the reaches of the navigation channel proposed for beneficial use options and the areas where sediment will be placed beneficially.

In-Channel and Harbor Sediments

Throughout the harbor, grain size varies from silt to sandy material and can be represented by the percent sand in a sample. The South Carolina Department of Natural Resources (SCDNR) has tested surficial sediment composition and chemistry within Charleston Harbor for the last few decades through the South Carolina Estuarine and Coastal Assessment Program (SCECAP). Figure 8 depicts the average percent sand within Charleston Harbor sediments as interpolated from SCDNR SCECAP data and sediment testing data

collected for this project. As shown in this figure, the percent sand found throughout the majority of the harbor is commonly below 90%, and is important to note because 90% sand is a commonly used threshold for determining beach compatible material.

The work by SCDNR covered all areas of the harbor, not just the Federal Navigation Channel. In order to determine the nature of the sediments within the navigation channel, and to build on the sediment sampling/testing work that was performed during the Feasibility Study, 49 additional vibracores were conducted in the lower harbor and entrance channel (see Anamar 2015 [Appendix F] and American Vibracore Services 2016 [Appendix G]). Each vibracore was divided vertically into multiple samples for physical analysis testing. While few of the individual vibracores contained 90% or greater sand over the entire length of the core, many of the cores contained high quantities of sand over the majority of the length of the core in some areas of the lower harbor and entrance channel. The testing revealed substantial quantities of sandy material in the Bennis Reach and Rebellion Reach areas of the lower harbor (see Figure 9). In an ICT meeting on 30 September 2015, USACE discussed that there is a very limited quantity of material in the channel that is 90% sand or greater. The ICT indicated that a threshold of 65% sand would be adequate for various beneficial use projects within Charleston Harbor. Using 65% sand or greater as a threshold for suitable beneficial use material, approximately 1,200,000 yd^3 of material was identified that could be used beneficially. Using the same 65% sand threshold, the testing also revealed approximately 500,000 yd^3 of material in the entrance channel that could be used beneficially (see Figure 10).

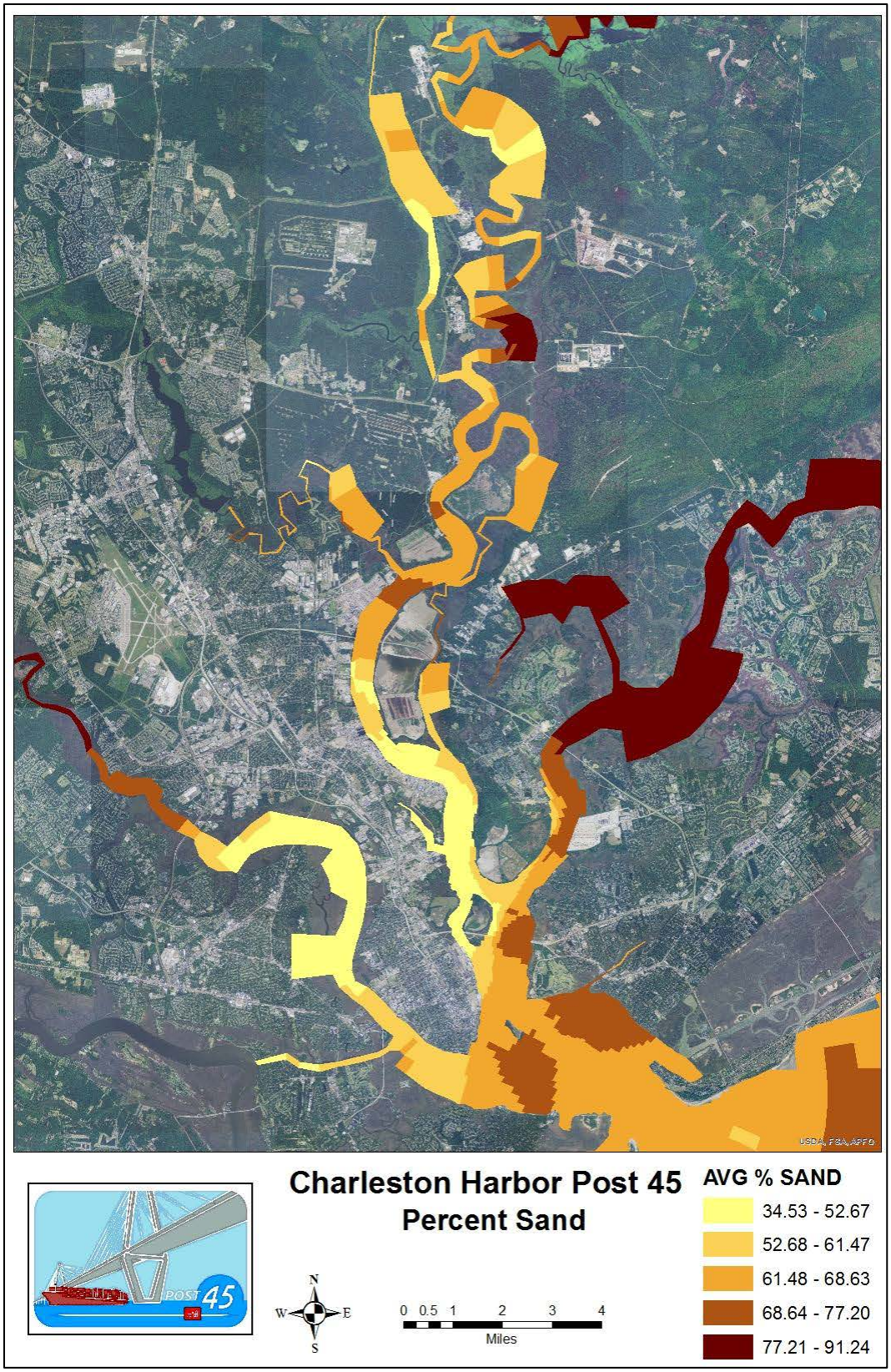


Figure 8. Charleston Harbor sediment composition

Figure 9. Location of sandy material in Bennis Reach and Rebellion Reach

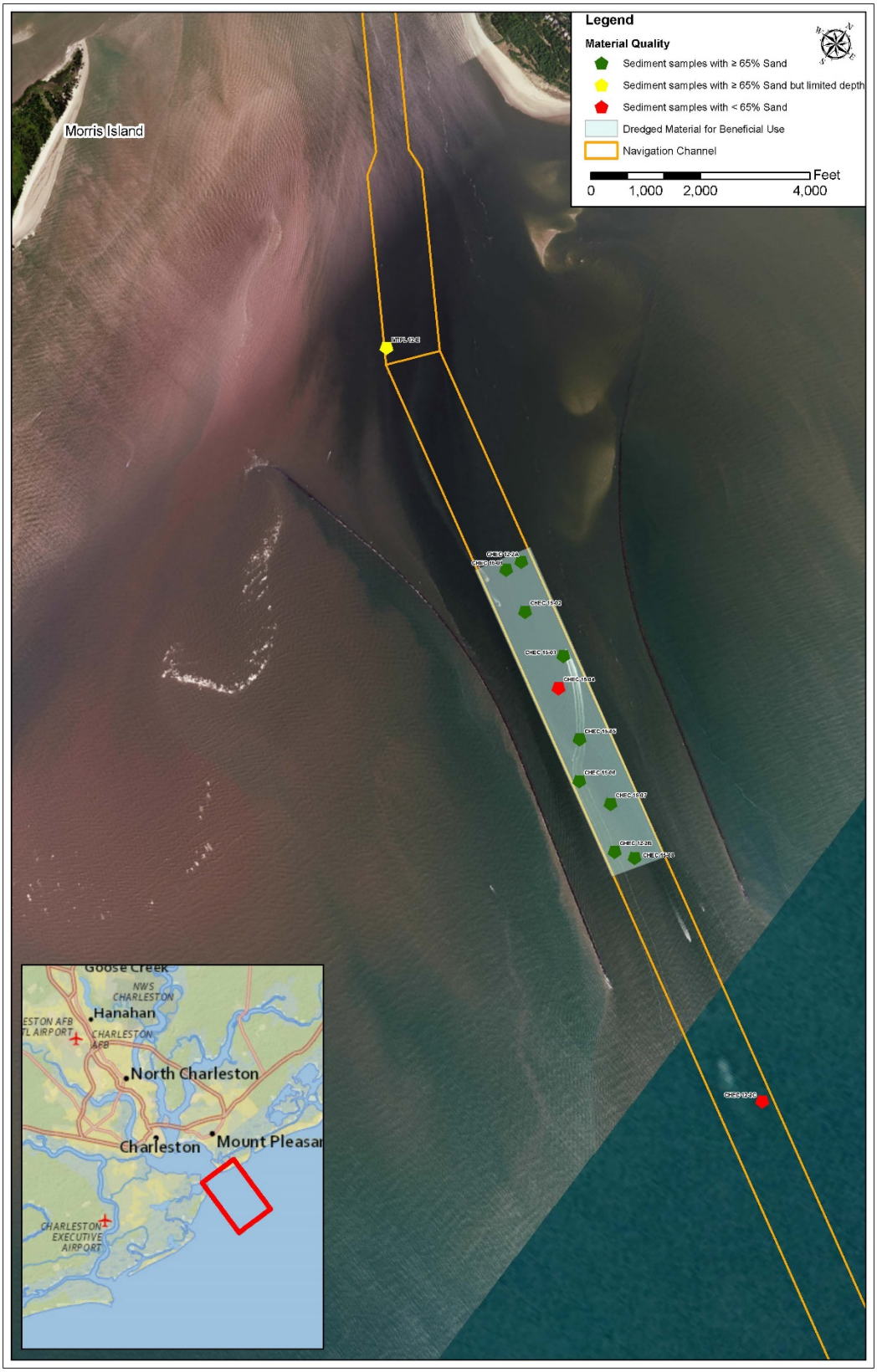


Figure 10. Location of sandy material in Entrance Channel

Crab Bank, Shutes Folly, and Fort Sumter In-situ Sediments –

In support of USACE efforts to understand the sediment composition and benthic composition of Crab Bank and Shutes Folly, SCDNR performed a transect analysis across the islands to characterize the existing conditions (Tweel and Sanger 2015a, Appendix A). Five transects were established across each island and samples were taken between the sub-tidal environment across the high point of the island and to the subtidal environment on the other side of the island (Figure 11).

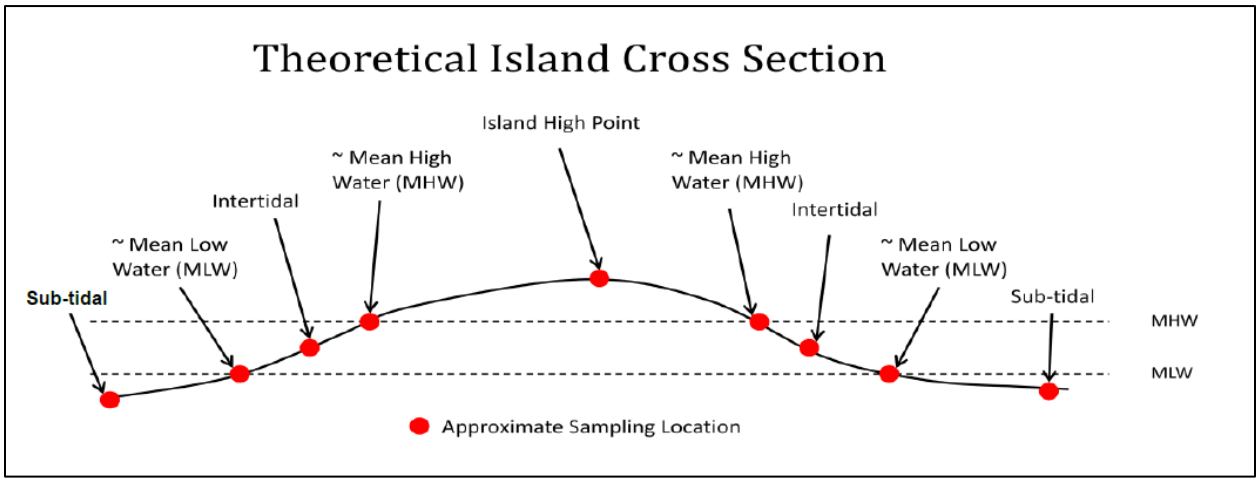


Figure 11. Sampling locations across Crab Bank and Shutes Folly transects

Sediments and habitat types vary considerably along Crab Bank and Shutes Folly (Figures 12 and 13, respectively). The dominant grain size on both islands is fine sand (61% of samples). An additional 22% of Crab Bank samples were characterized by medium sand, while the same percent of Shutes Folly samples tends toward very fine sand. Transects C and D along Crab Bank was dominated by more silts and clays, and are likely remnants from marsh that occupied this area in the recent past. The largest area of remaining marsh is along Transect A at the northeastern shoreline. The southern transect has some of the lowest elevations and sediments were characterized by sand and a larger proportion of $CaCO_3$ than elsewhere on the island. The mean phi size for Crab Bank was 2.3 (fine sand). Mean phi size for Shutes Folly was 2.7.

USACE evaluated sediments along the west and south side of Ft. Sumter in a similar manner (Figure 14). Samples were taken to an environmental lab for analysis. Results of this analysis indicate that the material accreting on the south and west faces of Morris Island is greater than 90% sand.

Figure 12. Habitat types along Crab Bank

Figure 13. Habitat types along Shutes Folly

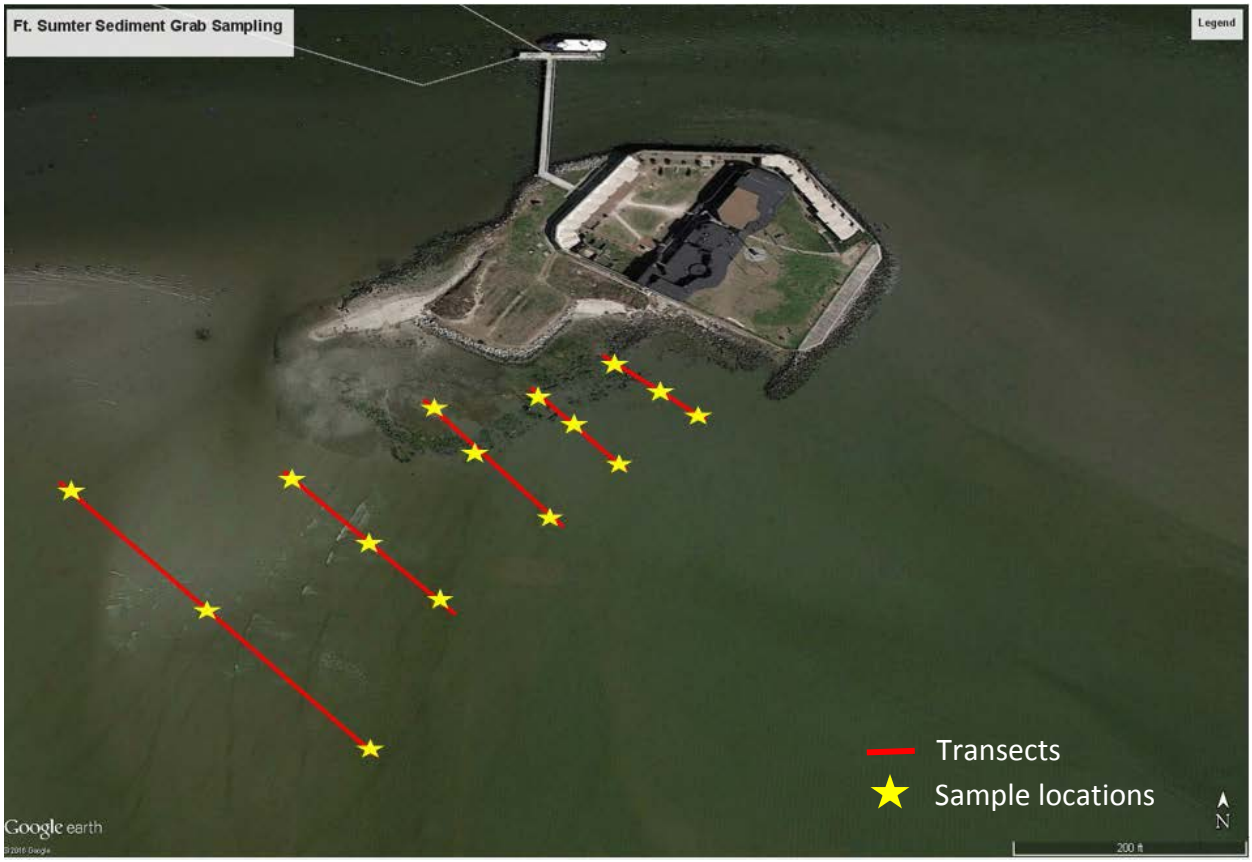


Figure 144. Sampling location for sediment composition analysis

5.8 Wetlands

Wetlands play a vital role in the ecosystem due to their many functions including nutrient retention, wildlife habitat, flood attenuation, nursery habitat, etc. Wetlands within the project area are predominantly polyhaline emergent marshes. These marshes experience average salinities between 18 and 35 parts per thousand. A review of the most recent data available using Environmental Systems Research Institute (ESRI) data reveals that Crab Bank has approximately 1.9 acres of saltmarsh vegetation (Source: ESRI, Digital Globe, GeoEye, Earthstar Geographics, World Imagery Basemap). The amount of saltmarsh has been decreasing over the years as the size of the island has decreased. While wetlands on Shutes Folly are more stable and established than those at Crab Bank, there is still a concern with the loss of saltmarsh as sea level rises and erosion of the emergent island occurs. The vegetation is spotty across the approximately 1 mile length of Crab Bank. The largest area of marsh is located on the northern portion of the island and is approximately 0.8 acres in size. Emergent saltmarsh also occurs on the west side of Shutes Folly.

Surrounding most of the harbor is a fringing area of saltmarsh and mudflats. Saltmarsh vegetation consists of cordgrass species (*Spartina sp.*) and black needlerush (*Juncus roemerianus*). Higher elevation emergent marsh areas contain sea oxeye (*Borrichia frutescens*), salt grass (*Distichlis spicata*), and salt meadow hay (*Spartina patens*). Wetlands around the Charleston Harbor provide high quality habitat used by many

species of fish and crustaceans for feeding, breeding, and nursery areas. The tidal marshes also contribute important organic materials to the waters. Protecting and preserving wetlands is important to the USACE.

5.9 Benthic organisms

Dominant species in the harbor channels include mollusks, polychaetes, oligochaetes, nematodes, and amphipods (USACE 2006). Populations in the navigation channel are assumed to be not as stable and numerically abundant as nearby wetlands and mudflats due to the frequent disturbance by ongoing maintenance.

In support of USACE efforts to understand the sediment composition and benthic composition of Crab Bank and Shutes Folly, SCDNR performed a transect analysis across the islands to characterize the existing conditions (Tweel and Sanger 2015b). Five transects were established across each island and samples were taken between the sub-tidal environment across the high point of the island and to the subtidal environment on the other side of the island (Figure 11). The following sections describe the results for each island.

Crab Bank – The habitat of Crab Bank was generally sandy intertidal and subtidal areas and contained relatively similar macroinvertebrate communities for the most abundant species. A few of the transects contained marsh sites at the northern end of Crab Bank and the middle transect. The macroinvertebrate community consisted of mostly of polychaetes (Figure 15), particularly *Leitoscolopolos fragilis* and *Streblospio benedicti*. The marsh habitats at the eastern portion of the northern transect contained the greatest overall abundance, mostly of polychaetes and oligochaetes. The middle transect (transect C) contained the highest crustacean density on the island, and was largely driven by amphipods and isopods. The west side of the middle transect contained high silt/clay content and the bivalve *Petricolaria pholadiformis*. Lower elevation sites tended to contain fine sand or greater, and the higher sites contained a greater proportion of calcium carbonate than the lower sites.

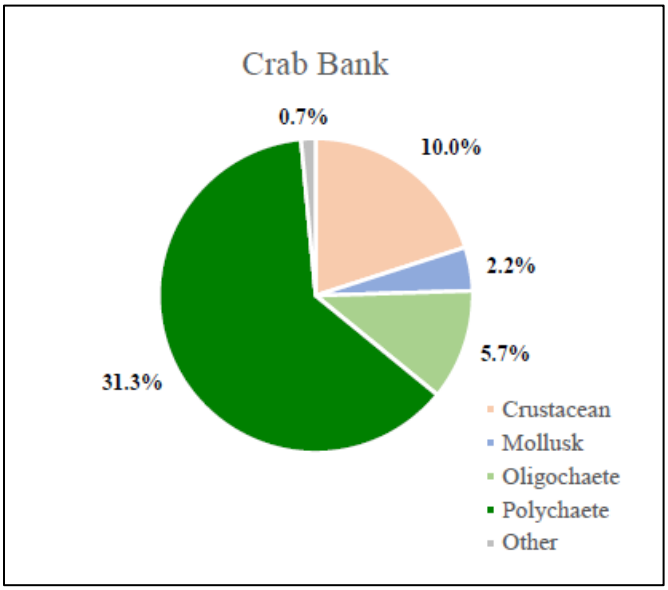


Figure 155. Macroinvertebrate community of Crab Bank

Shutes Folly – The habitat of Shutes Folly had higher range of elevations and sediment types than on Crab Bank, which translated to a greater variety of habitats ranging from salt marsh and subtidal mud flats to supratidal oyster shell deposits. The overall abundance on Shutes Folly was much higher (3.6 times) than at Crab Bank, and was dominated by crustaceans and oligochaetes (Figure 16). The primary driver of this increased abundance was the high intertidal abundance of crustaceans and oligochaetes in the marsh habitat. The northern transect (transect A) was characterized by whole oyster shell. Also, the eastern high point of the island and down to the intertidal sites along each transect were dominated by whole oyster shell. These sites contained relatively low abundance of macrobenthos, but the dominant organism was the isopod Sphaeroma destructor. The western subtidal site was the only site to contain *Brachiodontes exustus* (scorched mussel) and *Crassostrea virginica* (eastern oyster). The middle and southern transects (transects C and E) transition from subtidal flats at the eastern end to oyster shell rake and salt marsh and sand flats on the western end. The flats on the western end extend more gradually than on the eastern side of the island. The western side has two shore-perpendicular bars of washed oyster shell between transects C and E. The flats support several live oyster beds in the western embayment. Macrobenthos of the middle transect was dominated by salt marsh organisms such as tanaids, enchytraeids, and the polychaete *Capitella capitate*. The shelly habitats of the eastern side were comprised of isopods, oligochaetwes and the polychaete *Streblospio benedicti*. The southern transect (transect E) was similar to the middle transect but had more abundance due to the high silt/clay content in the marsh on the eastern side of the island.

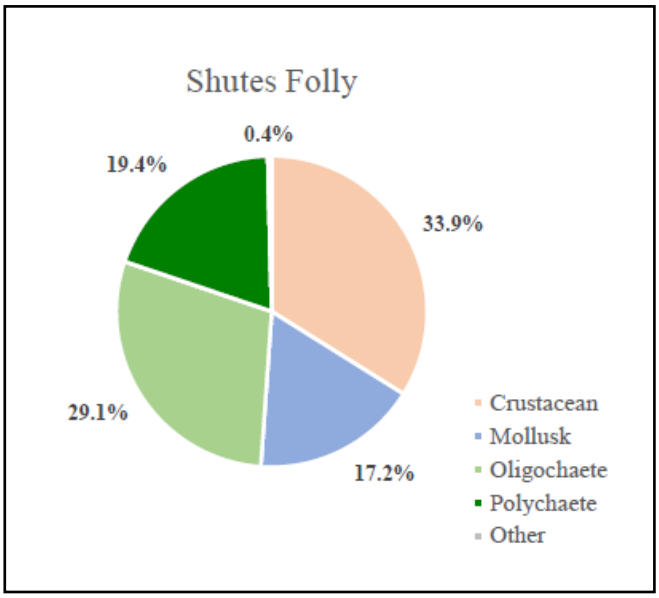


Figure 16. Macroinvertebrate community of Shutes Folly

5.10 Essential Fish Habitat

The EFH Assessment integrated into this Supplemental EA was prepared in accordance with the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (MSA 16 U.S.C. 1855 (b)) including the Sustainable Fisheries Act (SFA [16 U.S.C. 1801]) amendment of 1996. The MSA was reauthorized in 2006. The SFA requires identifying habitats needed to create sustainable fisheries and comprehensive

fishery management plans with habitat inclusions. EFH is defined by National Marine Fisheries Service (NMFS) (2004) and approved by the Secretary of Commerce acting through NMFS (50 CFR 600.10) as:

> "*…those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA § 3(10))*."

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) set forth a new mandate for the NMFS, regional fishery management councils (FMC), and other federal agencies to promote the protection, conservation, and enhancement of Essential Fish Habitat (EFH). The EFH provisions of the Magnuson-Stevens Act support one of the nation's overall marine resource management goals to maintain sustainable fisheries. The Magnuson-Stevens Act's final rule, to manage fishery resources and their habitats, was released on January 17, 2002. The National Marine Fisheries Service (NMFS) and affiliates, the South Atlantic Fishery Management Council (SAFMC) and the Mid-Atlantic Fishery Management Council (MAFMC), oversee the managed species and their habitats potentially found within the proposed project's footprint [National Oceanic and Atmospheric Administration (NOAA) 2009b, NOAA 2009c]. In addition, the Atlantic States Marine Fisheries Commission (ASMFC) serves as a roundtable for cooperative discussion between 15 Atlantic States, coordinating the protection and administration of the states' shared near shore fishery resources (ASMFC 2009).

The combination of fishery and habitat management with emphasis on healthy and diverse estuarine and marine ecosystems meets the EFH mandates of the Magnuson-Stevens Act. If a construction, permitting, funding, or other proposed action potentially affects EFH(s), then applicable federal permitting agencies must consult with the NMFS. The EFH consultation ensures the potential action considers the effects on important habitats and supports the management of sustainable marine fisheries (NOAA, South Atlantic Region 2008).

Charleston Harbor supports significant fish and wildlife resources including many marine and estuarine species. The estuary supports large populations of penaeid shrimp and blue crabs which are economically important species. Demersal (living near the bottom of the sea) fish species include Atlantic croaker; bay anchovy; Atlantic menhaden; spotted hake; weakfish; spot; blackcheek tonguefish; white catfish; and silver perch. Other fish of commercial or recreational value are commonly found in Charleston Harbor; including flounder; red drum; spotted seatrout; bluefish; spot; and black drum. Six anadromous fish species; Atlantic sturgeon; shortnose sturgeon; American shad; blueback herring; hickory shad; and striped bass; and one catadromous species; American eel; use Charleston Harbor and its tributaries as migration routes and spawning areas. The following Essential Fish Habitats occur within the beneficial use project areas: tidal wetlands, tidal creeks, oyster reefs, estuarine water column, and intertidal and subtidal mudflats (shallow sub-bottom habitat). All of these types are thoroughly described in the EFH Appendix of the Post 45 IFR/EIS and are hereby incorporated by reference (USACE, 2015, Appendix H). Oyster reef habitat around Crab Bank and Shutes Folly is shown in Figure 17.

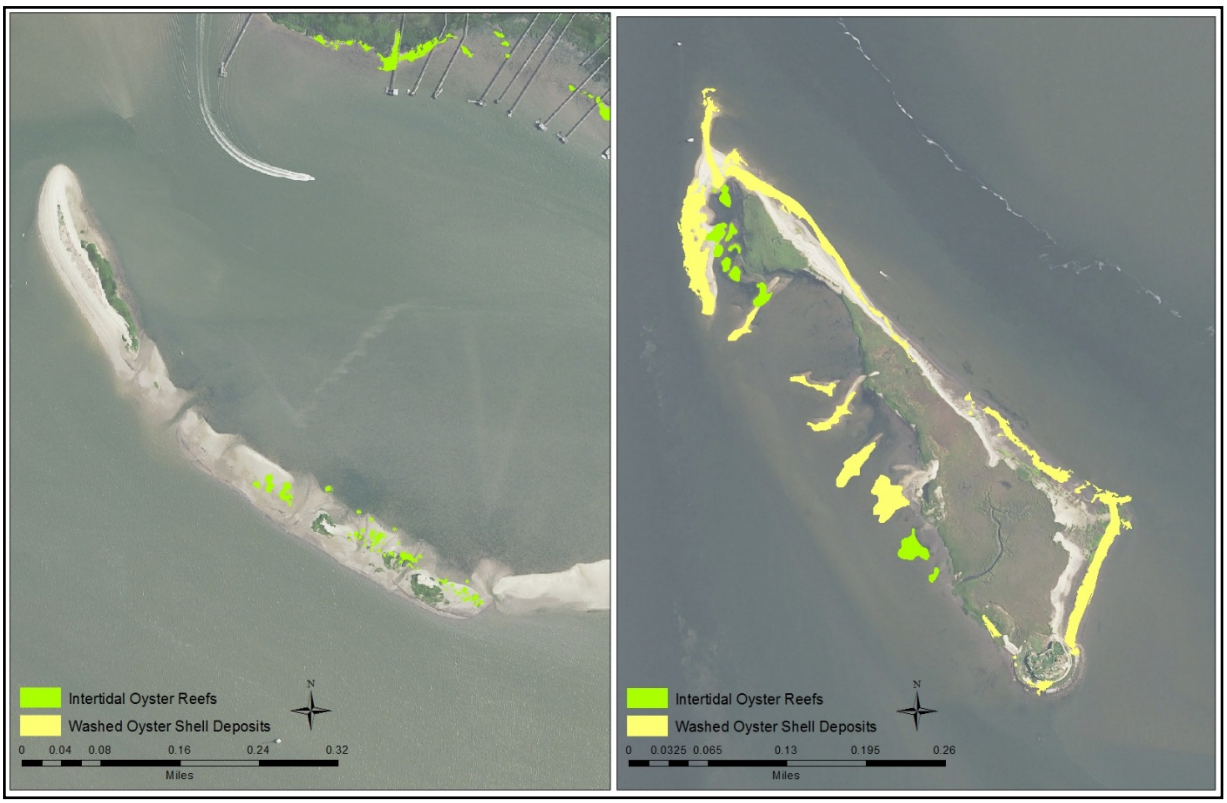


Figure 167. Oyster reef habitat at Crab Bank and Shutes Folly

Species that may occur in the project area habitats are noted in Table 2, if managed by either the South Atlantic Fisheries Management Council (SAFMC) or the NMFS or if either entity has developed fishery management plans for that species. Detailed descriptions of the managed species can be found within Appendix H of the IFR/EIS (USACE 2015), and are incorporated by reference.

***Shrimp*.** In the southeastern United States, the shrimp industry is based on the white shrimp (*Litopenaeus setiferus*), brown shrimp (*Farfantepenaeus aztecus*), pink shrimp (*Farfantepenaeus duorarum*), and the deeper water rock shrimp (*Sicyonia brevirostri*). The royal red shrimp (*Pleoticus robustus*) also occurs in deeper water and sustains a limited harvest. For the above species, Habitat Areas of Particular Concern (HAPC) within the project area include estuarine and marine water columns within the inlet, which includes the potential beneficial use project areas. These areas are the connecting water bodies between inshore estuarine nursery areas, offshore marine habitats used for spawning and growth to maturity. EFH for rock shrimp and royal red shrimp occurs in deeper offshore waters.

Table 2. Fishery management plans and managed species that may occur in the project area

Common Name	Species
Shrimp	
brown shrimp	*Farfantepenaeus aztecus*
pink shrimp	*Farfantepenaeus aduorarum*
rock shrimp	*Sicyonia brevirostris*
royal red shrimp	*Pleoticus robustus*
white shrimp	*Litopenaeus setiferus*
Snapper Grouper Complex	
Jack crevalle	*Caranx hippos*
gag grouper	*Mycteroperca microlepis*
black sea bass	*Centropristis striata*
mutton snapper	*Lutjanus analis*
red snapper	*Lutjanus campechanus*
lane snapper	*Lutjanus synagris*
gray snapper	*Lutjanus griseus*
yellowtail snapper	*Ocyurus chrysurus*
spadefish	*Chaetodipterus faber*
white grunt	*Haemulon plumieri*
sheepshead	*Archosargus probatocephalus*
hogfish	*Lachnolaimus maximus*
Coastal Migratory Pelagics	
king mackerel	*Scomberomorus cavalla*
Spanish Mackerel	*Scomberomorus maculatus*
cobia	*Rachycentron canadum*
Mid-Atlantic FMP species which occur in South Atlantic	
bluefish	*Pomatomus saltatrix*
summer flounder	*Paralichthys dentatus*
Federally Implemented FMP	
lemon shark	*Negaprion brevirostris*
bull shark	*Carcharhinus leucas*
blacknose shark	*Carcharhinus acronotus*
finetooth shark	*Aprionodon isodon*
dusky shark	*Carcharhinus obscurus*
bonnethead shark	*Sphyrna tiburo*
Atlantic sharpnose shark	*Rhizoprionodron terraenovae*

For the Post 45 EFH Assessment, the white shrimp was used as a representative species. White shrimp are especially important in South Carolina. The species is subject to both recreational and commercial fisheries. The local agency responsible for management of white shrimp stocks within South Carolina waters is the SCDNR. Detailed species information can be found in the IFR/EIS, USACE 2015, Appendix H. Figure 18 shows where white shrimp have been captured in the Charleston Harbor estuary during SCECAP and other inshore fisheries sampling efforts. Only approximately two-dozen sites produced samples with white shrimp, and none of those were near Crab Bank, Shutes Folly, nor Morris Island. However, based on discussions with local fishing groups, the Crab Bank area is used for recreational shrimp baiting. For white shrimp species summary, see the SCDNR website (https://www.dnr.sc.gov/marine/species/whiteshrimp.html).

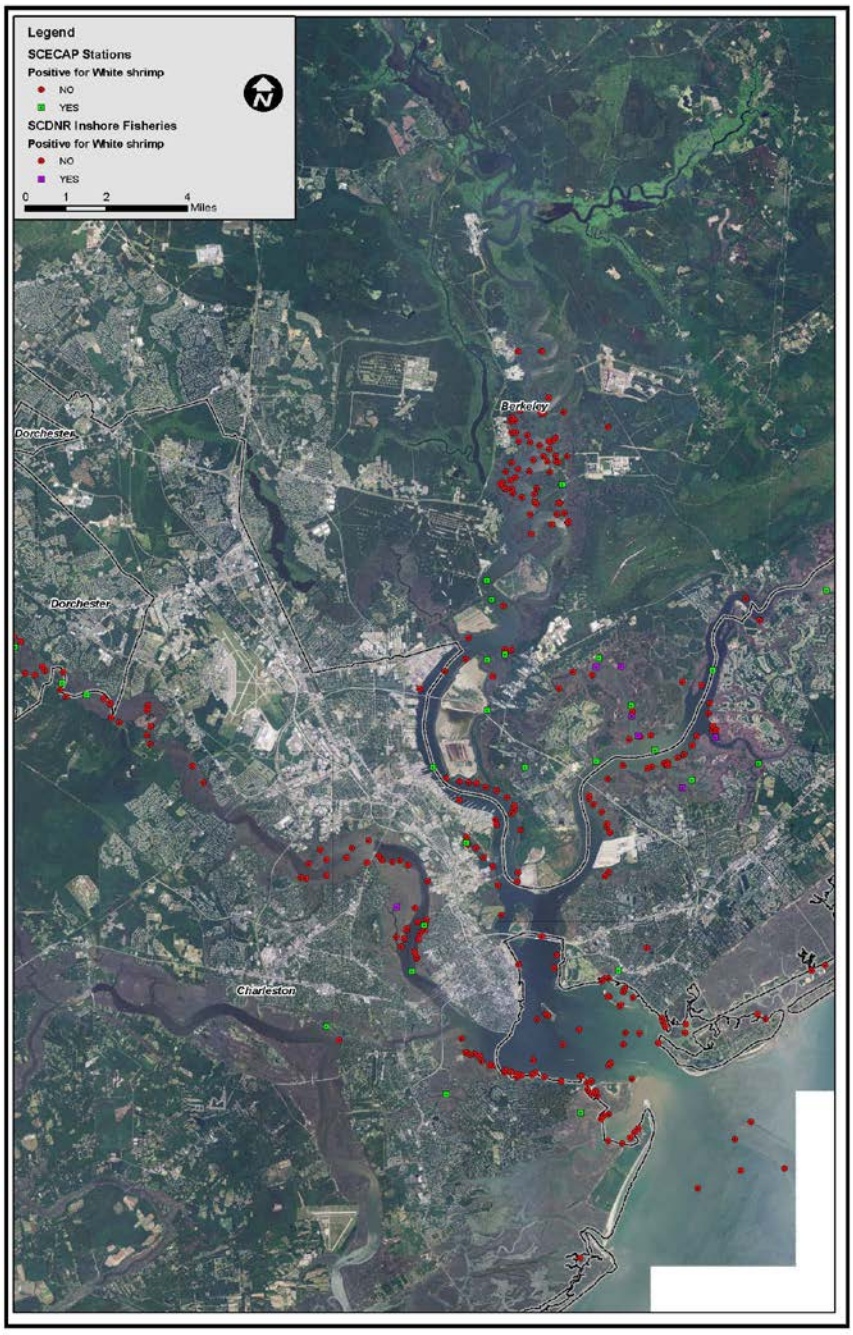


Figure 178. White Shrimp captures during SCECAP trawls.

***Snapper Grouper Complex*.** This complex of 10 families of fishes containing 73 species is managed by the South Atlantic Fishery Management Council (SAFMC). There is variation in specific life history patterns and habitat use among the snapper grouper complex species. For specific life stages of estuarine dependent and nearshore snapper grouper species, EFH includes areas inshore of the 100 - foot-deep ocean contour, such as the salt and brackish marshes, tidal creeks, soft sediments found in Charleston

Harbor, and unconsolidated bottom occurring in the navigation channel. EFH-HAPC for species of the complex is found throughout the project area in the Charleston Harbor.

Within the Post 45 IFR/EIS and EFH Assessment, the gray snapper was used as a representative species. Gray snapper (*Lutjanus griseus*) is a popular gamefish, and one of many species that makes use of both inshore/estuary habitats as well as deeper, offshore habitats. In South Carolina waters, they are generally affiliated with reefs, oyster bars, rocky areas, and estuaries, particularly among seagrass beds if present as well as over soft and sand-bottom areas (Bester 2014). Spawning (broadcast, with demersal eggs) occurs April through November and peaks during summer in estuaries. When individuals reach approximately 8 cm, they move toward shallow rocky areas and coastal reefs (Bester 2014). As the fish approach 20 cm, they may have a preference for habitats with salinities between 9 and 23 ppt (Serrano et al. 2010). Figure 19 shows SCDNR inshore fisheries catch data for gray snapper; apparently approximately 8 to 10 miles upstream of Daniel Island in the Cooper River, there are important gray snapper nurseries.

***Coastal Migratory Pelagics*.** King and Spanish mackerel and cobia are coastal migratory pelagic species managed by the SAFMC. EFH for these species include the inlet and, in a more general sense, any high salinity bays which may occur in the project vicinity. Many coastal pelagic prey species are estuarine-dependent in that they spend all or a portion of their lives in estuaries. Accordingly, the coastal pelagic species, by virtue of their food source, are to some degree also dependent upon estuaries and can be expected to be adversely affected if the productive capabilities of estuaries are greatly degraded.

Within the Post 45 EFH Assessment (IFR/EIS, USACE 2015, Appendix H), the king mackerel was used as a representative species due to a marked decrease in landings since 1998. SCDNR (2013a) explained recreational and commercial fishing trends for the past 35 years (Figure 20):

- Recreational catch. "The recreational catch, while variable year-to-year, has been on a declining trend since the mid 1980s. The relatively low recent 10 year average (compared to the entire time series) reflects the low total catch in the last ten years. The most recent 10 year average total catch (2002-2012) was one-third the average catch for the entire time series.
- Commercial landings. "Commercial landings for king mackerel reflect a similar trend to the recreational landings with peak landings occurring in the 1980s and early 1990s. There has been a steady decline in commercial landings since 1990 with the latest 10 year average (2002-2012) landings at 23,400 lbs versus 115,873 lbs for the previous ten years (1991-2001)."

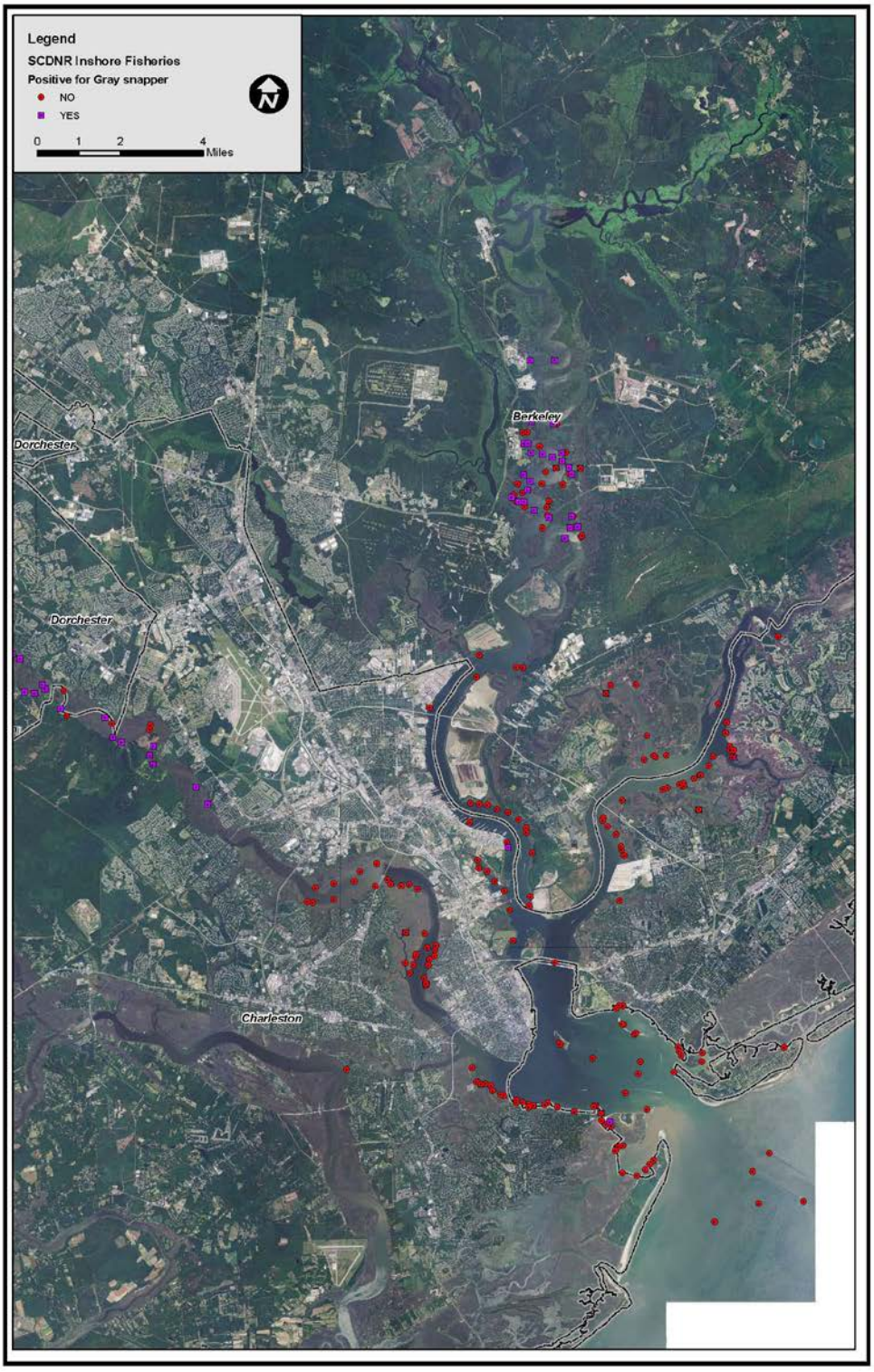


Figure 18. Gray snapper captures during SCECAP trawls

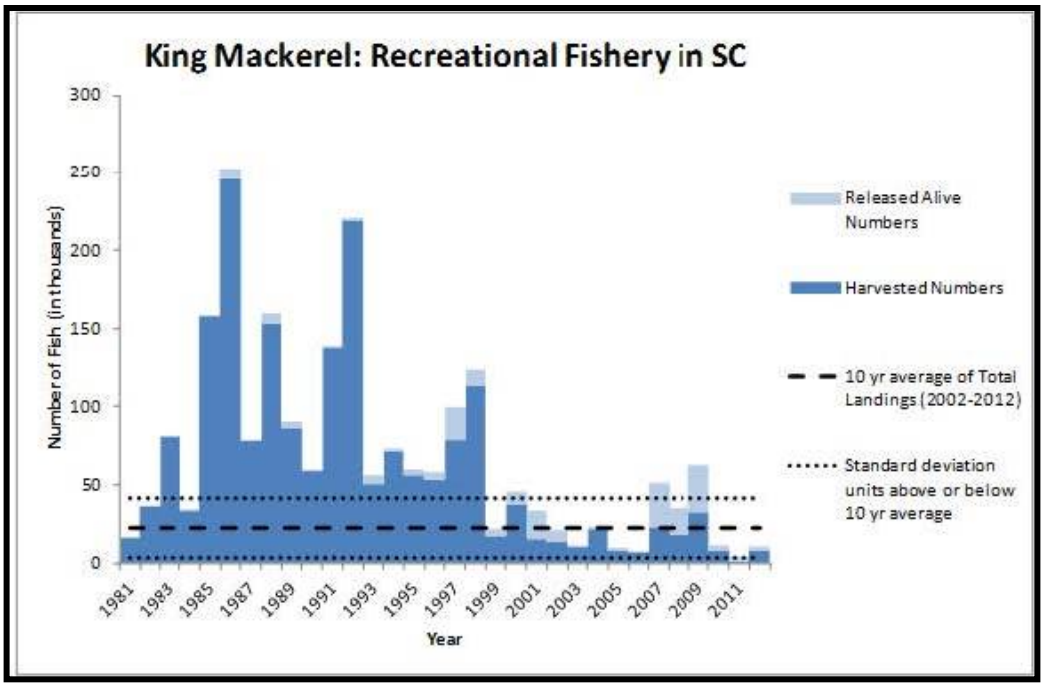


Figure: SCDNR (2013a)

Figure 19. King mackerel recreational fishery catch in South Carolina (1981-2013)

Mid-Atlantic Species in South Atlantic Region. Bluefish and summer flounder are two species listed in the Mid-Atlantic Fisheries Management Plan that occur in the South Atlantic. Bluefish juveniles and adults are listed as using estuaries from North Carolina to Florida and are common in Charleston Harbor including the vicinity of the navigation channel.

Highly Migratory Species. The sharks listed in Table 2 are included in the Highly Migratory Species (federal) Fishery Management Plan, and are relatively common in Charleston Harbor. EFH for the shark species include the inlet and estuarine and shallow coastal waters which all include navigation channels.

5.11 Threatened and Endangered Species

The ESA of 1973 (16 USC § 1531–1534) establishes protection and conservation of threatened and endangered species and the ecosystems upon which they depend. USFWS and the NOAA Fisheries Service (NOAA Fisheries) administer the Endangered Species Act (ESA) and may designate critical habitat for each species it protects. Under the ESA, an endangered species is defined as a species in danger of extinction throughout all or a significant portion of its range. A threatened species is defined as a species likely to become an endangered species in the foreseeable future. Section 7 of the ESA requires all federal agencies to consult with USFWS or NOAA Fisheries, as applicable, before initiating any action that may affect a listed species. All principal aspects of the new work construction have been previously evaluated in the USACE Biological Assessment and NMFS Biological Opinion on the subject project (Appendices F1 and F2 of the IFR/EIS, USACE 2015). The purpose of this action is to only further evaluate the effects of the proposed beneficial use alternatives, including on listed species or critical habitat.

Table 3. Threatened (T) and Endangered (E) Species Potentially Present in the Project Vicinity

Common Name	Scientific Name	Status	Date Listed
Marine Mammals			
humpback whale	*Megaptera movaeangliae*	E	12/2/1970
North Atlantic right whale	*Eubalaena glacialis*	E	12/2/1970
West Indian Manatee	*Trichechus manatus*	E	10/21/1972
Turtles			
Kemp's ridley sea turtle	*Lepidochelys kempii*	E	12/2/1970
leatherback sea turtle	*Dermochelys coriacea*	E	6/2/1970
loggerhead sea turtle	*Caretta caretta*	T	7/28/1978
green sea turtle	*Chelonia mydas*	T	7/28/1978
Fish			
Atlantic sturgeon	*Acipenser oxyrhynchus*	E	4/6/2012
Shortnose sturgeon	*Acipenser brevirostrum*	E	3/11/1967
Birds			
American Wood Stork	*Mycteria Americana*	E (proposed for downlisting to "T")	2/28/1984
Piping Plover	*Charadrius melodic*	T	12/11/1985
Rufa Red Knot	*Calidris canutus rufa*	T	1/12/2015
E - Federally endangered	*T - Federally threatened*		

The following sections briefly summarize important life history traits and distribution of species listed in Table 3 within the project area.

5.11.1 Sea Turtles

Four of the six species of sea turtles in U.S. waters may be found in the Charleston Harbor and nearby areas and are federally protected under the ESA. These species include the green, loggerhead, leatherback, and Kemp's Ridley sea turtles. Of these, the loggerhead is the most common in South Carolina waters.

5.11.1.1 Green Turtle

Green sea turtles are globally distributed within tropical and subtropical waters. Along the Atlantic and Gulf coasts of the United States, they can be found from Texas to Massachusetts and around the U.S. Virgin Islands and Puerto Rico. This species uses beaches for nesting and coastal areas and open ocean convergence zones for feeding. Green turtles' preferred habitats are seagrass beds and worm-rock reefs, which are located primarily in shallow-water environments along the Atlantic coast. South of North Carolina, green sea turtles are expected to occur year-round in waters between the shoreline and the 50-meter isobath. Green sea turtles are known to nest in substantial numbers in the southeastern United States. Nesting takes place from April through September, with an incubation period of approximately 2 months (FWC 2002, DoN 2007b). In 2016, three stranded green turtles were recorded in the Charleston Harbor Vicinity (www.seaturtle.org/strand, accessed August 12, 2016). Green sea turtles are expected to

occur within the vicinity of the proposed action area throughout the year. No critical habitat has been designated for this species in the project area. Additional information on the green sea turtle can be found within the Biological Assessment and NMFS Biological Opinion for the Charleston Harbor Post 45 Study (USACE 2015, Appendix F1 and F2).

5.11.1.2 Loggerhead Turtle

In the project area, the loggerhead is listed as the Northwest Atlantic Ocean Distinct Population Segment (DPS) and is the most common sea turtle in South Carolina. Loggerhead sea turtles are circumglobal, inhabiting continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters. The species has been observed as far as 500 miles offshore. They are the most abundant sea turtle found in U.S. coastal waters. About 90% of the total nesting in the United States occurs on the south Atlantic coast of Florida (Fritts et al. 1983). Loggerhead densities seem to be highest during summer months (Fritts et al. 1983), and they forage on benthic invertebrates, fish, and aquatic vegetation.

South Carolina's coastal waters are a migration path for loggerheads at all times of the year, and South Carolina's beaches are within the species' nesting range in the United States (North Carolina to Mexico). Loggerheads consistently occur off Charleston Harbor during spring, summer, and fall and sporadically occur in the Charleston Harbor estuarine system (USACE 2006). They have been thoroughly monitored in the southeastern region, both in terms of monitoring nesting density and sampling for juvenile loggerhead turtles in shallow coastal waters. SCDNR has been monitoring sea turtle nests since the 1970s. The relative abundance of sea turtle nests on the various beaches surveyed along the South Carolina coastline have been summarized in the GIS layer files to represent turtle nest densities/km of beach (Figure 21). Loggerhead sea turtles regularly strand along the coast of South Carolina. In 2016, 31 stranded loggerhead turtles were recorded in the Charleston Harbor vicinity (between Isle of Palms and Folly Beach) (www.seaturtle.org/strand, accessed August 12, 2016). Loggerheads are expected to occur within the vicinity of the proposed beneficial use areas throughout the year.

Critical habitat has been designated in the action area for the Northwest Atlantic Ocean loggerhead sea turtle Distinct Population Segment. The critical habitat in the action area includes nearshore reproductive habitat in areas just south of the Charleston Harbor Entrance Channel (LOGG-N-07) (Figure 22). Additional information on the loggerhead sea turtle can be found within the Biological Assessment for the Charleston Harbor Post 45 Study (USACE 2015, Appendix F1).

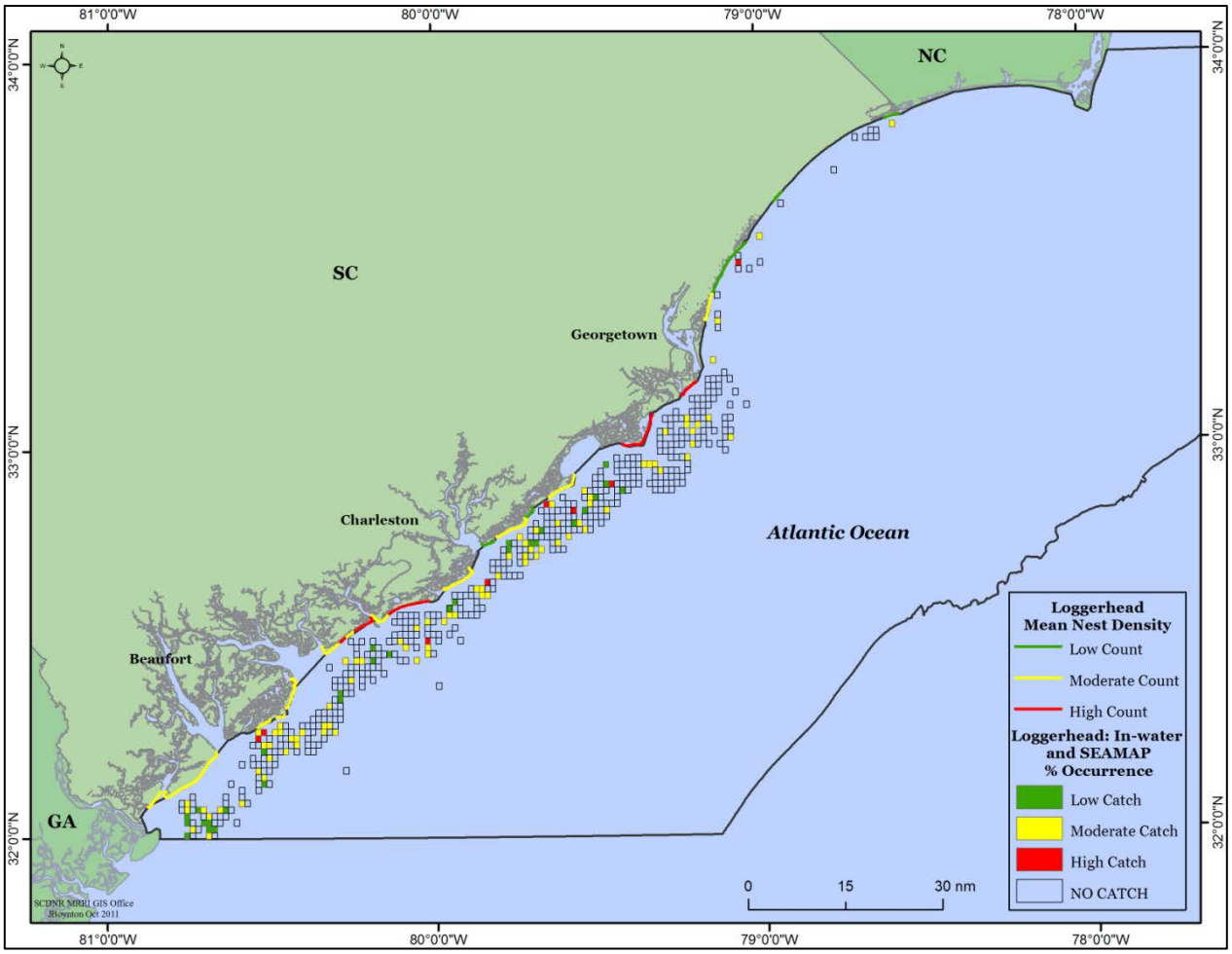


Figure 201. Data summary of the relative abundance (#nests/km) and distribution of loggerhead sea turtle nests along the South Carolina coastline, and juvenile loggerhead sea turtles caught by trawl in the in-water sea turtle surveys and SEAMAP trawl surveys

Source: Van Dolah et al. 2011

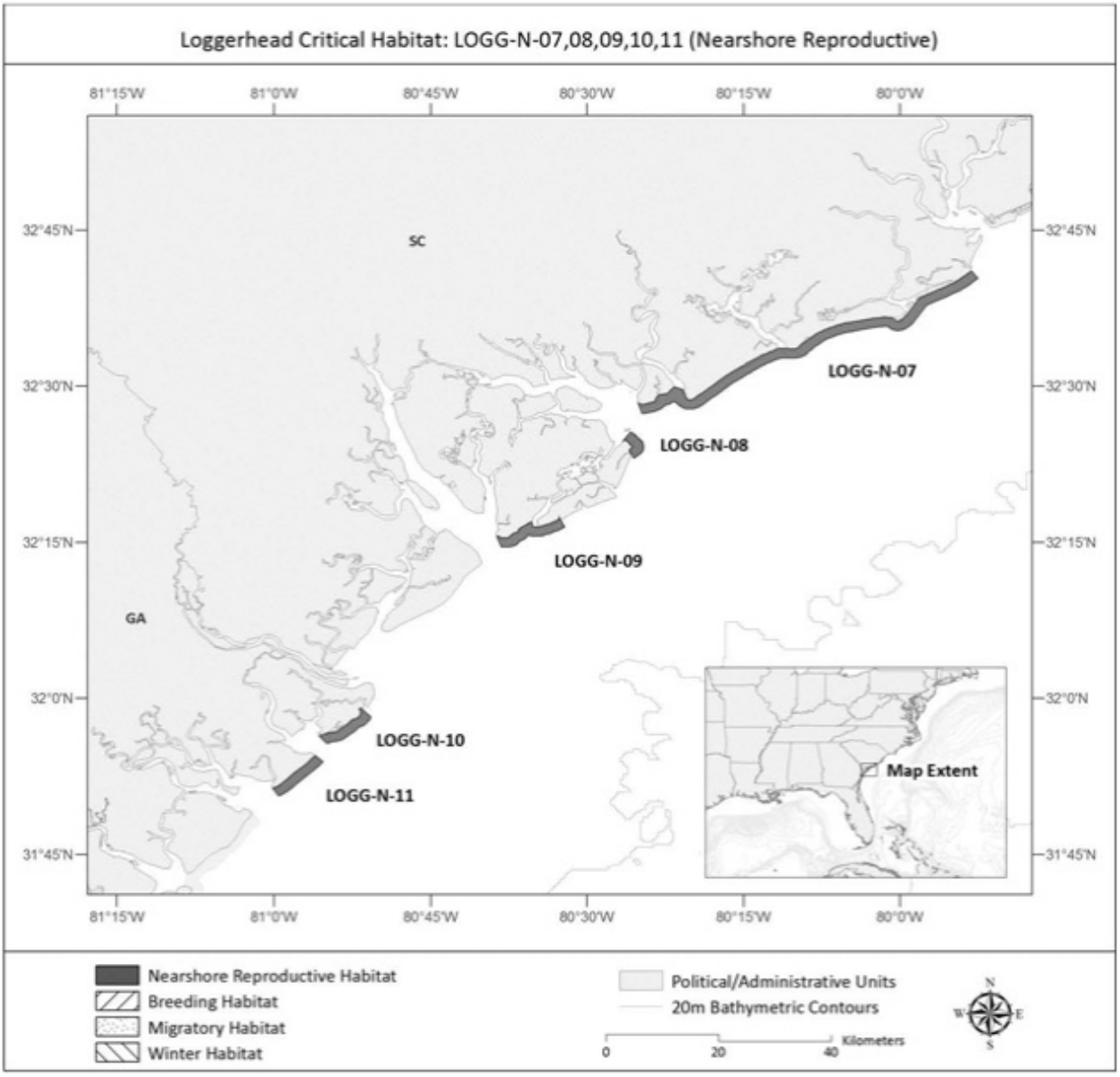


Figure 212. Critical Habitat in the Action Area for the Northwest Atlantic Ocean Loggerhead Sea Turtle Distinct Population Segment

Source: *http://www.nmfs.noaa.gov/pr/species/turtles/criticalhabitat_loggerhead.htm#maps*

5.11.1.3 Leatherback Turtle

The leatherback sea turtle is the most widely distributed sea turtle species and is probably the most oceanic of all sea turtles, preferring deep waters (Rebel 1974). Leatherback sea turtles migrate widely and have been reported as far north as Nova Scotia (Lazell 1980). Although generally a deep-diving pelagic species that feeds on jellyfish, they do move seasonally into coastal waters to feed on large jellyfish that are associated with rivers and frontal boundaries. Major rookeries are rare for this species, and dispersed

nesting is common. Nesting occurs from March through July, with an incubation period of 55 to 75 days (DoN 2007).

Leatherbacks are present off the coast of South Carolina. In 2016, five stranded leatherback turtles were recorded in the Charleston Harbor vicinity (between Isle of Palms and Folly Beach) (www.seaturtle.org/strand, accessed August 12, 2016). While there is potential for leatherbacks to be present off the coast of South Carolina during migration, they are not expected to be common within the proposed beneficial use areas. No critical habitat has been designated for this species in the project area. Additional information on the leatherback sea turtle can be found within the Biological Assessment for the Charleston Harbor Post 45 Study (USACE 2015, Appendix F1).

5.11.1.4 Kemp's Ridley Turtle

The Kemp's Ridley sea turtle is probably the most endangered of the sea turtles. They are shallow-water benthic feeders and primarily inhabit the Gulf coasts of Mexico and the United States, but are occasionally found as far north as Nova Scotia and Newfoundland in the North Atlantic. This species is found in submerged habitats where there is muddy or sandy substrate where they feed on crabs, fish and mollusks.

Kemp's Ridley sea turtles are not common off the coast of South Carolina; however, immature individuals are encountered in the nearshore and coastal water of South Carolina (USFWS 1998). Juvenile Kemp's Ridleys use South Carolina waters as developmental foraging grounds (www.dnr.sc.gov/seaturtle/lk.htm). Subsequently, sub-adult turtles return to neritic zones of the Gulf of Mexico or northwestern Atlantic Ocean to feed and develop until they reach adulthood (www.nmfs.noaa.gov/pr/species/turtles/kempsridley.htm). In 2016, 11 stranded Kemp's Ridleys were recorded in the Charleston Harbor vicinity (between Isle of Palms and Folly Beach) (www.seaturtle.org/strand, accessed August 12, 2016). Accordingly, Kemp's Ridley sea turtles could be present in the proposed beneficial use areas. No critical habitat has been designated for this species in the project area. Additional information on the Kemp's Ridley sea turtle can be found within the Biological Assessment for the Charleston Harbor Post 45 Study (USACE 2015, Appendix F1).

5.11.2 Marine Mammals

All marine mammals are protected under the Marine Mammal Protection Act of 1972 (MMPA) and are under the jurisdiction of NMFS or USFWS. With certain exceptions, the MMPA prohibits the taking of marine mammals in U.S. waters by U.S. citizens on the high seas and the importation of marine mammals and marine mammal products into the United States. (NMFS 2005). Therefore, all marine mammals encountered in the offshore region of Charleston must be given due consideration. The emergence of terms, legislation, and monitoring organizations created after the MMPA, such as the ESA of 1973, the USFWS Endangered Species Program, and the International Union for the Conservation of Nature (IUCN), require that certain species be given greater protection and consideration (IUCN 2008). These populations are more sensitive to and are negatively impacted by factors such as habitat loss, pollution, harvesting, and vessel traffic. Therefore, regulation that protects these species from extinction is fundamental.

5.11.2.1 North Atlantic Right Whale

The historic range of the North Atlantic right whale was from temperate areas to subarctic locations in the North Atlantic Ocean (NAVFAC 2008). Some individuals have been sighted migrating over extremely

deep waters, but most sightings occur in coastal and continental shelf waters. Individuals have been reported as far south as the Gulf of Mexico, although these occurrences are rare. Currently, their distribution is highly influenced by season and specific activities. Calving occurs between November and April in southeastern U.S. waters. In February 2015, NOAA Fisheries proposed to expand the designated critical habitat for endangered North Atlantic right whales in the northwestern Atlantic Ocean, including areas that will support calving and nursing. The rule would expand the critical habitat to roughly 29,945 nmi^2, and includes northeast feeding areas in the Gulf of Maine/Georges Bank region and calving grounds from southern North Carolina to northern Florida (Figure 23).

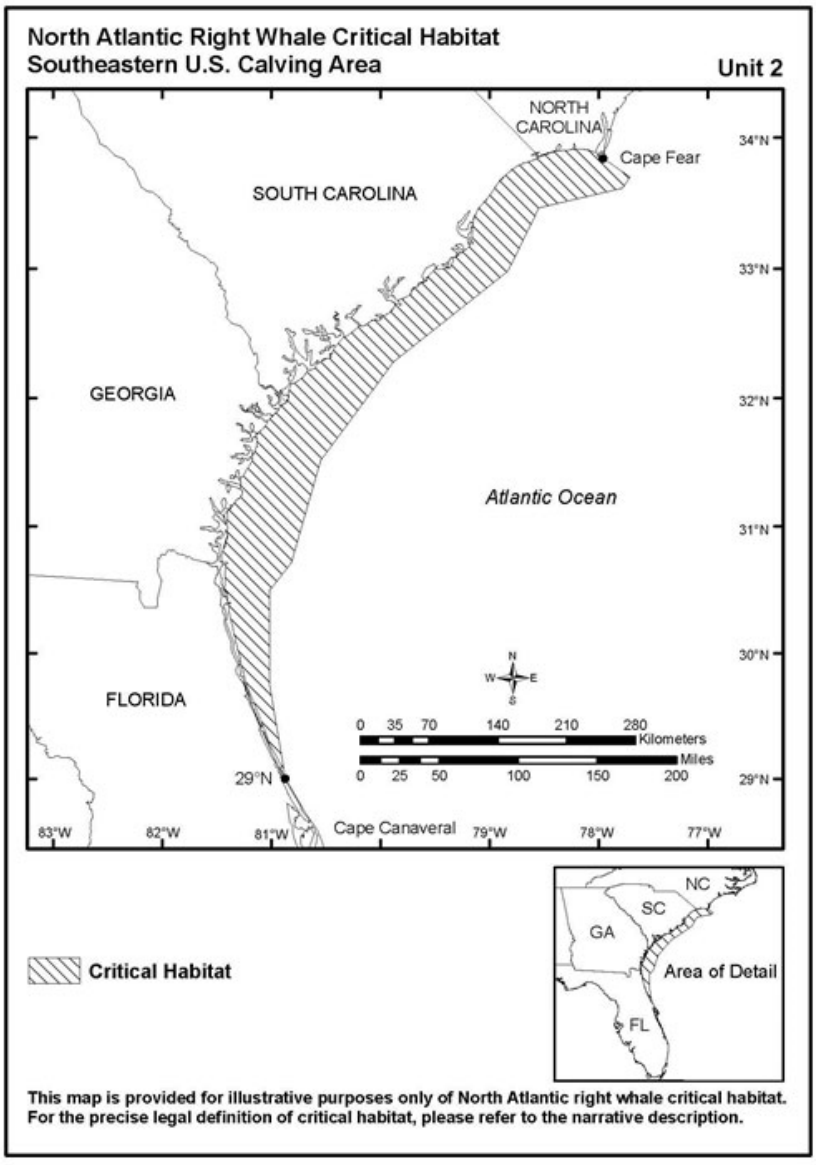


Figure 22. Southeastern Calving Critical Habitat for North Atlantic Right Whales

Feeding primarily occurs from spring until fall in coastal waters of the northeastern United States and Canada where their prey (zooplankton) is abundant. When North Atlantic right whales are not occupied with reproductive or paternal duties, their distribution is strongly linked to the distribution of their prey,

which is comprised of various zooplankton species, particularly those with high lipid content. Migration for feeding is a critical activity, as both the quality and quantity of their food source are important. Although general distributional patterns do exist, information for many individuals throughout the winter is not well documented (NMFS 2004, 2006a). Figure 24 provides a summary of the whale sightings along the South Carolina coastline from November and April from 2002-2010.

Coastal South Carolina is within the range of designated critical habitat, and right whales would be expected to occur off the coast of South Carolina during their seasonal migrations. Charleston is within the Mid-Atlantic Region, for the purposes of right whale management, an area that extends approximately from Block Island Sound, Rhode Island, to Port of Savannah, Georgia, between known right whale high-use areas in the northeast and winter calving areas in the southeast (MMS 2009). The Mid-Atlantic Region is a migratory corridor for pregnant females moving from northeast to southeast in fall (September to November) and for mother/calf pairs departing winter calving area in the southeast headed for the northeastern United States (March through May), and is likely used by calving females from December to March. The mother-calf pairs stay close to shore, with 94% of sightings within 30 nmi (56 km) of shore and 80% of sightings in depths less than 90 feet (27 m) (MMS 2009). Please see Appendix F1 in USACE 2015 for more information.

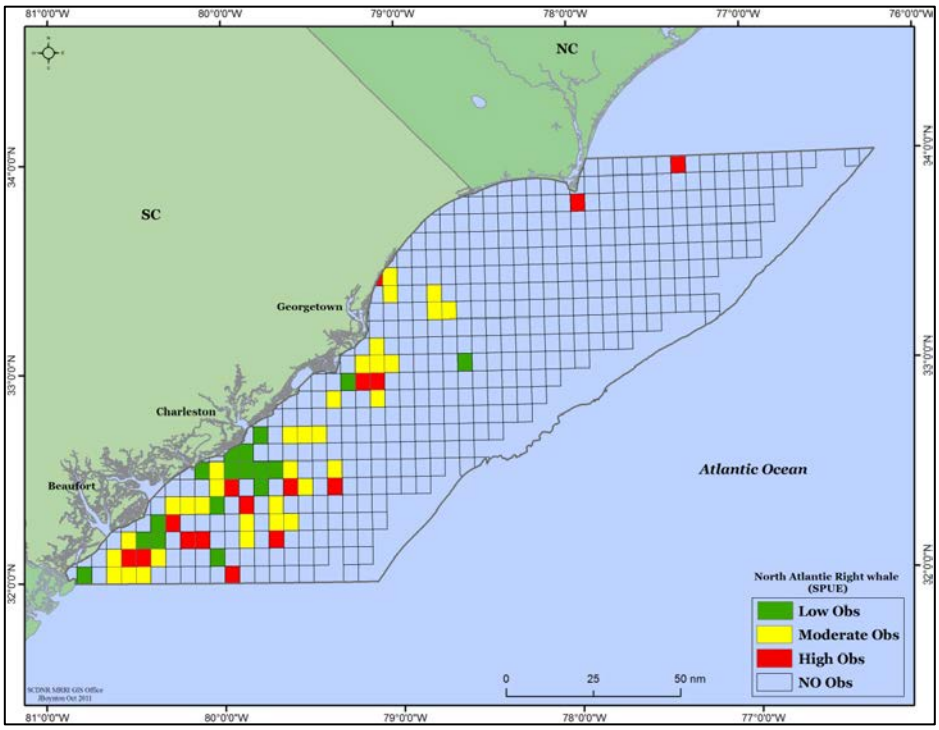


Figure 23. Example of the Relative Abundance and Distribution of North American Right Whale Sightings along the Coast of South Carolina

Source: Van Dolah et al. 2011

5.11.2.2 Humpback Whale

Humpback whales are found in all of the world's oceans and were listed as endangered in 1973. In general, summers are spent at high-latitude feeding grounds from southern New England to Norway, and

migration during the winter is to the West Indies, over shallow banks and along continental coasts, where calving occurs. Most humpback whale sightings are in nearshore and continental shelf waters; however, humpback whales frequently travel across deep water during migration. Calving peaks from January through March, but some animals have been documented arriving as early as December, and a few not leaving until June. Strandings occur each year, for which over 50% of the animals exhibit scarring or fresh wounds due to fishing gear entanglement or boat collisions (DoN 2002). Humpback whales migrate south to calving grounds during the fall and make return migrations to the northern feeding grounds in spring. Please see Appendix F1 in USACE 2015 for more information.

5.11.2.3 West Indian Manatee

The West Indian manatee can be found along coasts and inland waters of the southeastern United States, eastern Mexico, the Greater Antilles (Hispaniola, Cuba, Puerto Rico, Jamaica), and Central America down to as far as northern Brazil. Manatees inhabit both salt and fresh water of sufficient depth (5 feet to usually less than 20 feet) throughout their range (USACE 2006). Manatees may be encountered in shallow, slow-moving water bodies such as canals, rivers, estuarine habitats, and saltwater bays, although on occasion they have been observed as much as 3.7 miles (6 km) off the Florida Gulf coast. Manatees require warm water, migrating to warmer waters whenever the temperature falls below 20^{o}C. They are herbivorous, subsisting on seagrasses, large algae, and freshwater plants. Manatees reproduce slowly, reaching sexual maturity at 5 to 9 years of age and bearing a single young (rarely twins) every 2 to 5 years.

Threats to the manatee include natural mortality due to cold and red tide poisoning and human-induced mortality from loss of habitat, watercraft collisions, pollution, litter, and water control structures. According to Waring et al. (2009), roughly a third of documented manatee mortality is due to human-related causes, the vast majority from collisions with watercraft.

Manatees are known to visit the Charleston Harbor area in the summer months (April through November) as they migrate up and down the coast (USACE 2006). Given their migratory habits, manatees can be assumed to occur in the Charleston Harbor and surrounding waters. Please see Appendix F1 in USACE 2015 for more information.

5.11.3 Fish

5.11.3.1 Atlantic Sturgeon

The historic range of the Atlantic sturgeon is from St. Croix, Maine, to the St. Johns River, Florida. They spend most of their lives in marine waters and migrate up rivers in February and March to spawn. A large U.S. commercial fishery (100,000 to 250,000 lbs/year) existed for the Atlantic sturgeon from the 1950s through the mid-1990s; the origin of the fishery dates back to colonial times (NOAA NMFS 2009). The Atlantic sturgeon is managed under a fishery management plan (FMP) implemented by the Atlantic States Marine Fisheries Commission (ASMFC). They implemented a coast-wide moratorium on the harvest of wild Atlantic sturgeon in late 1997/early 1998. This moratorium is to remain in effect until there are at least 20 protected-year classes in each spawning stock (anticipated to take up to 40 or more years). NMFS followed this with a similar moratorium for federal waters.

Threats from dredging, water quality, and commercial by-catch likely contribute to the population decline of this species. The status of Atlantic sturgeon was initially reviewed in 1998 after USFWS and NMFS received a petition to list the species under the ESA; it was determined at that time that listing was not warranted. In 2003, a workshop sponsored by NMFS and USFWS was held to review the status of the Atlantic sturgeon. The workshop concluded that some populations seemed to be recovering while others continued to be depressed (NOAA NMFS 2009). As a result, NMFS initiated a second status review of the Atlantic sturgeon in 2005 to re-evaluate whether this species required protection under the ESA. That status review was completed in 2007, and the Status Review Team recommended that Atlantic sturgeon in the United States be divided into the following five DPSs: Gulf of Maine; New York Bight; Chesapeake Bay; Carolina; and South Atlantic. After reviewing the available information on the two DPSs located within the NMFS Southeast Region (Carolina and South Atlantic), NMFS determined that listing these two DPSs as endangered is warranted. The Final Listing Rule for South Atlantic and Carolina DPSs of Atlantic sturgeon in the southeast region was published in the *Federal Register* on February 6, 2012 (77 FR 5914).

Based upon telemetry monitoring of the Atlantic sturgeon by SCDNR, this species is noted to occur within Charleston Harbor and the vicinity of the proposed beneficial use projects. Critical Habitat for the Atlantic Sturgeon was proposed in June 2016 (Federal Register Vol. 81, No. 107). The proposed Critical Habitat near the project vicinity is Carolina Unit 7, Santee-Cooper Unit (Figure 25). This Critical Habitat starts at the NMFS identified river mile 0, which is around the Customs House and just upstream of the project area. Please see Appendix F1 in USACE 2015 for more information.

5.11.3.2 Shortnose Sturgeon

The shortnose sturgeon is the smallest of the three sturgeon species that occur in eastern North America. It is an anadromous fish that spawns in coastal rivers along the east coast of North America from the St. John River in Canada to the St. Johns River in Florida (http://www.nmfs.noaa.gov/pr/species/fish/shortnosesturgeon.htm, accessed September 9, 2014). In the southern portion of the range, they are found in the St. Johns River in Florida; the Altamaha, Ogeechee, and Savannah rivers in Georgia; and in South Carolina, the river systems that empty into Winyah Bay and the Santee/Cooper River complex that forms Lake Marion. It prefers the nearshore marine, estuarine, and riverine habitats of large river systems. Shortnose sturgeon, unlike other anadromous species in the region such as shad or salmon, do not appear to make long-distance offshore migrations. They are benthic feeders. Juveniles are believed to feed on benthic insects and crustaceans, and adults primarily feed on mollusks and large crustaceans.

Shortnose sturgeon have been documented by SCDNR to occur in the areas proposed for beneficial use projects. Recent hydroacoustic studies have also noted that inter-basin movement via the ocean by shortnose sturgeon is more common than previously believed (B. Post SCDNR pers. comm.). Please see Appendix F1 in the IFR/EIS (USACE 2015) for more information.

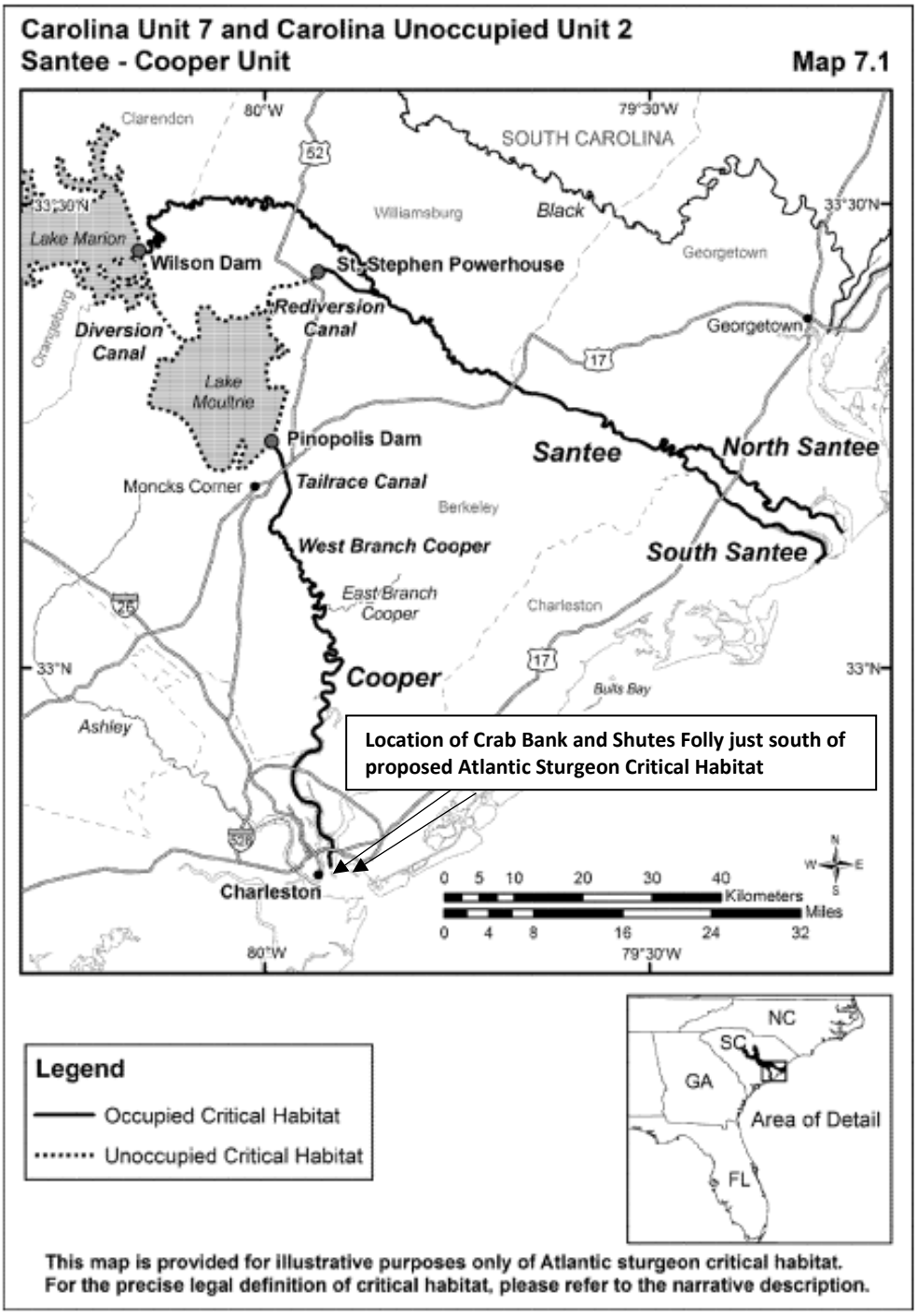


Figure 24. Atlantic Sturgeon proposed Critical Habitat near the project area

5.11.3 Birds

5.11.3.1 American Wood Stork

Wood storks are large, long-legged wading birds, about 50 inches tall, with a wingspan of 60 to 65 inches. The plumage is white except for black primaries and secondaries and a short black tail. The head and neck are largely unfeathered and dark gray in color. The bill is black, thick at the base, and slightly decurved. Immature birds are dingy gray and have a yellowish bill (http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B06O). Wood storks in Georgia and South Carolina initiate nesting on a seasonal basis regardless of environmental conditions. They lay eggs from March to late May, with fledging occurring in July and August (Federal Register/Vol. 75, No. 182/ September 21, 2010). Wood storks typically utilize freshwater and estuarine wetlands, and primarily nest in cypress or mangrove swamps. They feed in freshwater marshes, narrow tidal creeks, or flooded tidal pool. Habitat loss, pollution and loss of prey base are the major threats to wood stork populations. This reduction is attributed to loss of wetland habitat as well as to changes in water hydroperiods from draining wetlands and changing water regimes by constructing levees, canals, and floodgates to alter water flow in south Florida. Wood storks have a unique feeding technique and require higher prey concentrations than other wading birds. The 2006 nesting totals indicate that the Wood stork population has reached its highest level since it was listed as endangered in 1984 and since the early 1960s with over 11,000 nesting pairs documented in FL, GA, SC and NC during the 2006 breeding season. Since listing, the number of nesting pairs is increasing, the number of nesting colonies is increasing, and the nesting range is growing. Even though threats that affect wood storks appear to be continuing at the same levels, the conclusion is that the overall population status is improving. Please see Appendix F1 in USACE 2015 for more information.

5.11.3.2 Piping Plover

There are three recognized populations of piping plovers in North America; Atlantic Coast, Northern Great Plains, and the Great Lakes population. The Atlantic Coast population winters from North Carolina to Florida with some nesting occurring in North Carolina. The Atlantic Coast piping plover population breeds on coastal beaches from Newfoundland to North Carolina (and occasionally in South Carolina) and winters along the Atlantic Coast (from North Carolina south), the Gulf Coast, and in the Caribbean where they spend a majority of their time foraging (www.fws.gov/northeast). Piping plovers have been observed in the following counties in South Carolina: Beaufort, Charleston, Colleton, Georgetown, Horry and Jasper (http://ecos.fws.gov). Piping plovers typically nest in sand depressions on un-vegetated portions of the beach above the high tide line on sand flats at the ends of sand spits and barrier islands, gently sloping foredunes, blowout areas behind primary dunes, sparsely vegetated dunes, and washover areas cut into or between dunes. They head to their breeding grounds in late March or early April and nesting usually begins in late April; however, nests have been found as late as July (Potter, et al., 1980). Feeding areas include intertidal portions of ocean beaches, washover areas, mud flats, sand flats, wrack lines, and shorelines of coastal ponds, lagoons, or salt marshes (USFWS, 1996). Prey consist of worms, fly larvae, beetles, crustaceans, mollusks, and other invertebrates (Bent, 1928).

Loss and degradation of habitat due to development and shoreline stabilization have been major contributors to the decline of piping plovers in southeast. The current commercial, residential, and

recreational development has decreased the amount of coastal habitat available for piping plovers to nest, roost, and feed. Furthermore, beach erosion and the abundance of predators, including wild and domestic animals as well as feral cats, have further diminished the potential for successful nesting of this species. There are 15 areas in South Carolina with designated Critical Habitat for the Piping plover. These extend along beaches from Little River Inlet to Beaufort County near Hilton Head Island. South Carolina has 187 sandy miles of beach shoreline available, 56 miles of which are nourished within critical habitats, resulting in 30% of affected sandy shoreline in critical habitat units (USFWS, 2009). A total of 5618 acres are designated Critical Habitat in South Carolina; However, there are no critical habitat areas in the proposed project area (http://www.fws.gov/plover/#maps).

5.11.3.3 Rufa Red Knot

Red knots are migratory shorebirds. Their migration is one of the most impressive, with many individuals annually flying over 9,000 miles from the Arctic breeding grounds to the tip of South America. The red knot is about 9 inches tall, with a wingspan of 20 to 22 inches. During the breeding season, red knots exhibit black, brown and chestnut colored plumage above and a pinkish-cinnamon breast and face. In winter, the plumage changes to pale gray above and white below with a white eyebrow. Its legs are a greenish/blackish in color, with a black, slightly tapered but otherwise straight bill (http://www.dnr.sc.gov/marine/mrri/acechar/specgal/knotred.htm).

Red knots winter in the coastal United States from Cape Cod to Mexico and South America and spend the summer on islands in the High Arctic. Red knots breed in the Arctic planes and islands above the Arctic Circle in the summer. Southern migration begins in the fall towards South America. Knots migrate in large numbers and will often fly over 1,500 miles before stopping over at winter feeding grounds. Wintering grounds are coastal beaches and mud flats along both the Pacific and Atlantic coasts from California and Massachusetts south to South America. In SC, they winter all along the coast, primarily on sandy beaches and mud flats. During the wintering stopovers knots feed on marine worms, small mollusks and most importantly in the southeast United States horseshoe crab eggs. Habitat loss, pollution, toxins, disease, hunting and loss of prey base are the major threats to red knot populations. No critical habitat has been published for the red knot but is likely to be by the beginning of 2015. It is not expected that critical habitat would be within the proposed project area.

5.12 Avian Habitat

Various areas within Charleston Harbor are utilized by many species of shorebirds for nesting and feeding. Species commonly observed are the American oystercatcher (*Haematopus palliatus*), plovers (*Charadrius sp.*), willet (*Catoptrophorus semipalmatus*), sandpipers (*Scolopacidae*), lesser/greater yellow-legs (*Tringa flavipes/T. melanoleuca*), and gulls/terns (*Laridae*). Shorebirds typically feed by foraging for invertebrates in mud flats and sandy beaches. Plovers are medium sized birds with short, thick bills. They run to feed on vulnerable invertebrates. Avocets are larger shorebirds with long recurved bills that feed by using both tactile and visual methods. Foraging activity is usually focused around periods of low tide, where they feed in the intertidal zone. During high tides, shorebirds roost in flocks on the high beach, marsh, and sometimes on docks (Sanders and Murphy 2009). Sanders et al., (2004) stated that the American

Oystercatcher has been identified as an "extremely high priority" shorebird by the US Shorebird Conservation Plan partly due a decline in suitable beach habitat.

Seabirds tend to nest on small coastal islands in mixed colonies. The three common families of seabirds are Pelecaniae (pelicans), Pynchopidae (skimmers), and Laridae (gulls and terns). Seabirds that frequent the South Carolina coast are the sandwich tern (*Thalasseus sandvicensis*), least tern (Sterna albigrons), royal tern (*Thalasseus maximus*), common tern (*Sterna hirundo*), eastern brown pelican (*Pelecanus occidentalis*), Forster's tern (*Sterna forsteri*), gull-billed tern (*Gelochelidon nilotica*), and black skimmer (*Rynchops nigra*). The least tern is listed as state threatened due to a loss of nesting habitat (Thompson et al 1997). All of the birds are subject to loss of suitable nesting habitat (Murphy et al., 2009). Seabirds usually nest on isolated coastal islands that are high enough to prevent overwashing, yet small enough to not support mammalian predators (Murphy et al 2009). They are picivorous and feed in nearshore and estuarine waters. During the nesting season, foraging occurs within 10 to 15 miles of their nesting sites including the nearshore and estuarine waters of Charleston Harbor.

Migratory birds in South Carolina represent three families: Scolopacidae (sandpipers), Charadriidae (plovers), and Recurvirostridae (avocets). Migrations can span across continents. Migratory shorebirds in South Carolina may be transient on northbound flights in the spring, southbound in the fall, or even wintering birds. Surveys of migrant shorebirds over the last three decades indicate that populations are on the decline (Manomet 2004).

Several features within Charleston Harbor are notable for their importance for local biota. In fact, several sites in or near the harbor are so important for nesting migratory birds, the state of South Carolina has closed them to human access for all or part of the year. One of these sites is the Crab Bank Seabird Sanctuary, which is closed from March 15 to October 15 for the protection of nesting birds and their young. Typical bird species using these sites include black skimmers, brown pelicans, willet, Wilson's plover, and various tern species (sandwich, least, royal, common, Forester's, and gull-billed). The sites are preferred due to both the availability of grounds for nest creation as well as forage, i.e., small fish for supplying the chicks.

SCDNR provided a nesting update for both Crab Bank and Shutes Folly (email data from Felicia Sanders, 2016) (Table 4). While these data don't necessarily indicate any notable trends related to these two sites, they clearly show the importance of these islands to nesting habitat for seabird nesting.

Table 4. Seabird nesting numbers for Crab Bank and Shutes Folly (2009-2015)

	2009		2010		2011		2012		2013		2014		2015	
	Crab Bank	Shutes Folly	Crab Bank	Shutes Folly	Crab Bank	Shutes Folly	Crab Bank	Shutes Folly	Crab Bank	Shutes Folly	Crab Bank	Shutes Folly	Crab Bank	Shutes Folly
BLACK SKIMMER	51	112	143	70	53	N/A	79	4	8	58	10	N/A	50	106
BROWN PELICAN	907	74	589	59	722	139	463	N/A	304	35	517	348	647	8
GULL-BILLED TERN	13	89	9	35	42	3	N/A	47	62	N/A	N/A	N/A	9	40
ROYAL TERN	1466	N/A	1032	N/A	2661	N/A	1581	N/A	1140	N/A	1337	N/A	1677	N/A
SANDWICH TERN	6	N/A	N/A	N/A	320	N/A	475	N/A	347	N/A	240	N/A	603	N/A

Although the seabird sanctuaries are known to provide necessary habitats for migratory bird species discussed above, many other species frequent the sanctuaries and other areas/habitats within and near the project area. Such birds roost and forage in surrounding coastal environments such as tidal flats, mud

flats, and beaches during the winter months. Species likely to occur are listed in Table 5, along with their associated habitats.

Table 5. Avian species with the potential to occur in the project area

Common Name	Scientific Name	Legal Status	SCDNR Priority Ranking	Sand/ Beach	Mud -flat	Pond	Salt Marsh	Open Water
American avocet	*Recurvirostra americana*		High		X	X		
American bittern	*Botaurus lentiginosus*	State Concern	Highest				X	
American coot	*Fulica americana*		Moderat			X		
*American oystercatcher	*Haematopus palliatus*	State Concern	Highest		X	X	X	
Bald eagle	*Haliaeetus leucoephalus*	State	High			X		X
Belted kingfisher	*Ceryle alcyon*		High			X		X
Black rail	*Laterallus jamaicensis*	State Concern	Highest				X	
*Black skimmer	*Rynchops niger*	State Concern	Highest	X		X		X
Black-backed gull	*Larus marinus*			X	X	X		X
Black-bellied plover	*Pluvialis squatarola*		High	X	X			
Black-crowned night heron	*Nyticorax nycticorax*		Highest			X	X	
Black-necked stilt	*Himantopus mexicanus*		Highest	X	X	X		
*Brown pelican	*Pelecanus occidentalis*		High				X	X
Clapper rail	*Rallus longirostris*		Highest				X	
Common moorhen	*Gallinula chloropus*		High			X		X
Common tern	*Sterna hirundo*		Highest	X		X	X	X
Double-crested cormorant	*Phalacrocorax auritus*					X		X
Dunlin	*Calidris alpina*		High	X	X			
Foresters tern	*Sterna forsteri*		High	X		X	X	X
Glossy ibis	*Plegadis falcinellus*		Moderat		X	X	X	
Great blue heron	*Ardea herodias*		Moderat			X	X	
Great egret	*Ardea alba*		High			X	X	
Greater yellowlegs	*Tringa melamoleuca*		High		X	X	X	
*Gull-billed tern	*Sterna nilotica*	State Concern	Highest	X		X		X
King rail	*Rallus elegans*		Highest				X	
Laughing gull	*Larus atricilla*			X	X	X		X
Least tern	*Sterna antillarum*	State Threatened	Highest	X		X		X
Little blue heron	*Egretta caerulea*	State Concern	Highest		X	X		
Long-billed dowitcher	*Limnodromus scolopaceus*		Moderat		X	X		
Osprey	*Pandion haliateus*					X		X
Piping plover	*Charadrius melodus*	Fed Threatened	Highest	X	X			
Red knot	*Calidris canutus*	Fed Threatened	Highest	X	X		X	
Ring-billed gull	*Larus delawarensis*			X	X	X	X	X
*Royal tern	*Sterna maxima*		High	X		X		X
Ruddy turnstone	*Arenaria interpres*			X	X			
Sanderling	*Calidris alba*		Highest	X	X			
*Sandwich tern	*Sterna sandvicensis*		Highest	X		X		X
Semipalmated plover	*Charadrius semipalmatus*		Moderat	X	X			
*Snowy egret	*Egretta thula*		Moderat		X	X		
Sora	*Porzana carolina*		High				X	
Spotted sandpiper	*Actitis macularia*			X	X			
*Tricolored heron	*Egretta tricolor*		High				X	
Virginia rail	*Rallus limicola*		High				X	
Whimbrel	*Numenius phaeopus*		Highest	X	X		X	
*White ibis	*Eudocimus albus*		Highest		X	X		
Willet	*Tringa semipalmata*		High	X	X			
Wilson's plover	*Charadrius wilsonia*	State Threatened	Highest	X	X			
Wood stork	*Mycteria americana*	Fed Threatened	Highest			X		X
Yellow rail	*Coturnicops*		Highest				X	
Yellow-crowned night heron	*Nyctanassa violacea*		Highest			X		X

**Noted by SCDNR as a species that nests on the islands*

Some of the notable areas providing various habitat functions are detailed below. Many of these sites are not only used by bird species, but also by other vertebrate species that are associated with birds (in many cases preying on eggs, chicks, and fledglings).

5.13 Coastal Barrier Resources

The primary land-based regulatory boundary that can influence activities in the nearshore coastal zone is the Coastal Barrier Resources System (CBRS) established by the Coastal Barrier Resources Act of 1982 (CBRA). The CBRS is comprised of undeveloped coastal barriers along the Atlantic, Gulf, and Great Lakes coasts. The law encourages the conservation of hurricane-prone, biologically rich coastal barriers by restricting federal expenditures that encourage development, such as federal flood insurance through the National Flood Insurance Program. Activities that could adversely affect the biological resources or stability of CBRS sites are a concern to USFWS.

Within the vicinity of the proposed beneficial use projects there is the Morris Island Complex (M006) (Figure 26).

5.14 Cultural and Historic Resources

Cultural resources are defined by the National Historic Preservation Act (NHPA) as prehistoric and historic sites, structures, districts, or any other physical evidence of human activity considered important to a culture, a subculture, or a community for scientific, traditional, religious, or any other reason. Several federal laws and regulations protect these resources, including the NHPA of 1966, the Archaeological and Historic Preservation Act of 1974, the American Indian Religious Freedom Act of 1978, the Archaeological Resources Protection Act of 1979, and the Native American Graves Protection and Repatriation Act of 1990. Documentation of historic/cultural resources is important for this project because Charleston Harbor provides an environment that is rich in prehistoric and historic human activity, and its geological setting is characterized by sediment types, especially heavy silts and clays, that are well known for preserving shipwrecks and their contents.

Section 106 of the NHPA and its implementing regulations, 36 CFR Part 800, requires an assessment of the potential impact of an undertaking on historic properties that are within the proposed project's Area of Potential Effect (APE), which is defined as the geographic area(s) "within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist." The APE for the proposed beneficial use actions was determined to consist of the direct action area where construction will be occurring and material placed.

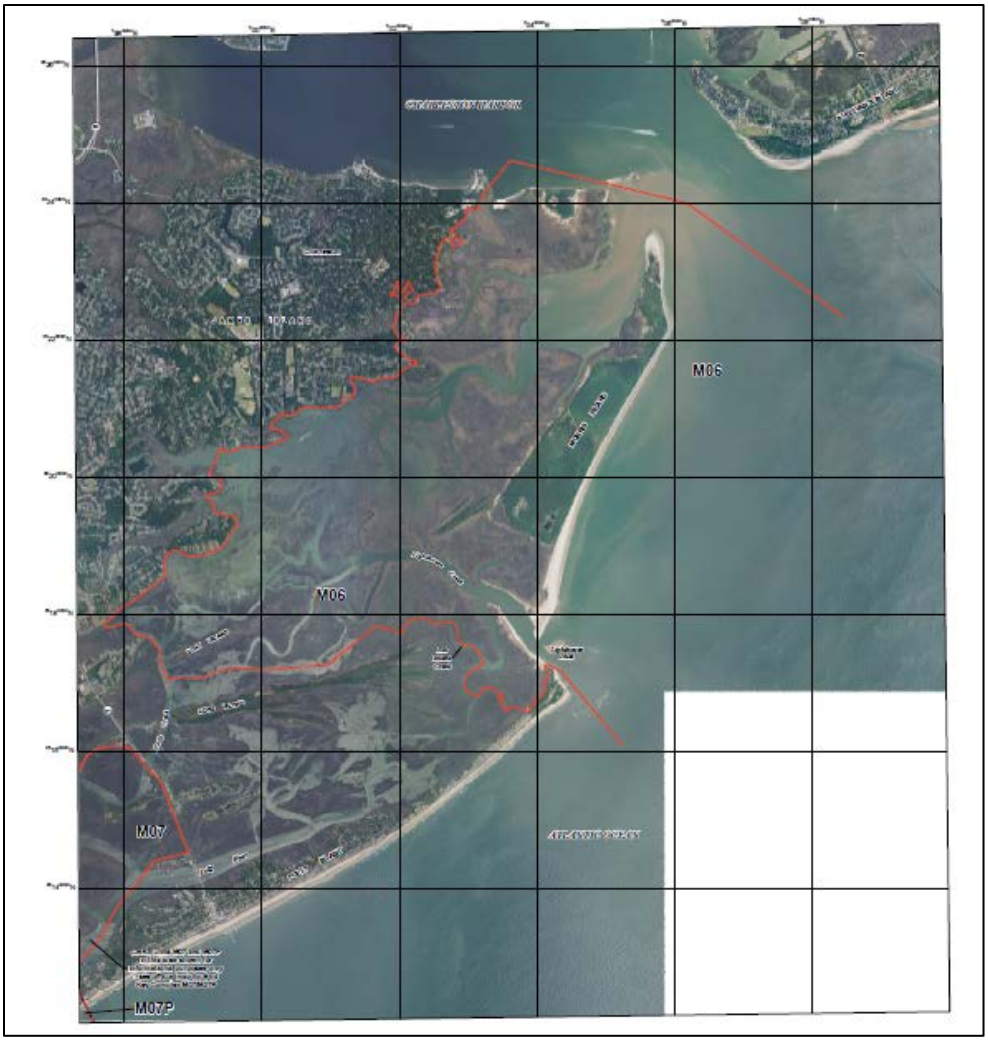


Figure 25. Morris Island Complex (M06) of the Coastal Barrier Resources System

All information regarding cultural and historic resources contained within the IFR/EIS (USACE 2015) is incorporated by reference. Coordination with the South Carolina Department of Archives and History (SCDAH) and South Carolina Institute for Archaeology and Anthropology (SCIAA) regarding Section 106 has occurred. There are no known historic resources located on Crab Bank or around the potential placement areas for Shutes Folly (Arch Site and personal communication with Jim Spirek, SCIAA). Morris Island is the site of Battery Wagner which was a fortification built at the mouth of Charleston Harbor.

5.15 Aesthetics and Recreation

Charleston is a historic seaport, and has been associated with vessels of increasing size for hundreds of years. A scenic setting is provided by the harbor and river and the numerous vessels common to these waters, including commercial and recreational boats as well as vessels calling on the Port. The estuarine environment provides opportunities for boating and fishing, as well as an escape from the faster pace of land-based activities. Several boat ramps and marinas are located in Charleston Harbor.

Crab Bank is a tourist attraction for wildlife viewing trips originating from Shem Creek and other areas of Charleston Harbor. In fact, Crab Bank recently was fitted with a video camera so that viewers could watch the birds nesting, loafing, and foraging on and around the sand bank (https://www.youtube.com/watch?v=kYd66zI3_gY&feature=player_embedded).

Morris Island provides recreational opportunities for those who wish to boat out to the island. Numerous tour companies offer trips to the island. The island and the surrounding waters are used for recreational fishing including guided tours and individuals. Other opportunities include wildlife viewing, shell collecting, metal detecting, water sports, and other beach related activities.

5.16 Socioeconomics

On February 11, 1994, the President issued Executive Order (E.O.) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations.* The order required that Federal agencies conducting programs, policies, and activities that substantially affect human health or the environment to determine whether there is a disproportionately high and adverse human health or environmental effects on minority and low-income populations.

6.0 Alternatives Evaluated

During the feasibility phase, USACE hosted a meeting with the Post 45 Interagency Coordination Team (ICT) on April 29, 2013 to discuss the various opportunities for beneficial uses of dredged material in more detail and provide preliminary information about the types of analyses that would be needed, monitoring requirements, construction methods, construction windows, physical characteristics of material, etc. Based on a review of the information gained from this meeting and subsequent follow up coordination including both USACE and resource agency prioritization the following options were identified and incorporated into the Final IFR/EIS:

- ODMDS berm creation
- Hardbottom habitat creation
- Crab Bank enhancement
- Shutes Folly Island (Castle Pinckney) protection
- Fort Sumter/Fort Moultrie protection
- Nearshore placement off Morris Island.

While this list presented a broad picture of the alternatives, the initiation of the PED phase allowed USACE the opportunity to reevaluate these and other alternatives. USACE met again with the ICT on September 30, 2015 to discuss the fine tuning of various alternatives. A field trip was held on October 1 to visit potential sites at Crab Bank, Shutes Folly, and Ft. Sumter. USACE started with the below detailed list of alternatives that were developed in coordination with the USACE Charleston District established Interagency Coordination Team (ICT).

Alternative 1a. Crab Bank Enhancement – Place material along the high point of the island and western side towards the navigation channel.

Alternative 1b. Crab Bank Enhancement – Place material along the south end of the island because it is more eroded and at a lower elevation than the northern portion of the island.

Alternative 1c. Crab Bank Enhancement – Place material on the Mt. Pleasant side (northeast side) of the island to create/expand marsh habitat

Alternative 1d. Crab Bank Enhancement – Place material on northwest side of the island to create more shallow sub-bottom habitat

Alternative 2a. Shutes Folly Enhancement – Create/expand marsh on west side of island.

Alternative 2b. Shutes Folly Enhancement – Enlarge eastern frontal sand bank of island that is currently covered in whole dead oyster shell.

Alternative 3a. Use rock material to build up a berm around the perimeter of the Ocean Dredged Material Disposal Site

Alternative 3b. Use rock material to create artificial reefs near the entrance channel

Alternative 4. Create an offshore bird nesting island

Alternative 5. Offshore fish attractant and wave attenuation berm

Alternative 6. Place sandy material into the used portions of the Folly Beach sand borrow areas

Alternative 7a. Marsh Creation on landward side of Morris Island

Alternative 7b. Marsh Creation at Drum Island fringing marshes

Alternative 7c. Marsh creation along fringing marshes of Clouter Creek and Daniel Island disposal areas.

Alternative 8. Use material to build up an eroding dike along the Intracoastal Waterway behind Breech Inlet.

Alternative 9a. Fort Sumter shoreline protection – Use dredged rock to create revetment or breakwater

Alternative 9b. Fort Sumter shoreline protection – Use dredged rock to create submerged reef to break up wave energy

Alternative 9c. Fort Sumter shoreline protection – fill geotextile tube(s) in front of Ft. Sumter and backfill with fine material.

Alternative 10. Place material around Morris Island Lighthouse

Alternative 11. Commercial sale

Alternative 12. Create oyster reefs with dredged rock and place along select locations within the harbor.

Alternative 13a. Place material in the nearshore area of Morris Island.

Alternative 13b. Place material on the beachfront of Morris Island

Alternative 14. Use dredged rock for shoreline protection in high erosion areas

Please see Appendix G of this Supplemental EA for a table depicting the interagency discussions about these alternatives.

Environmental considerations in alternative formulation for beneficial use of dredged material include whether placement would be in sensitive and incompatible areas, such as:

- Shipping lanes, anchorage areas, and navigation restrictions
- Essential fish habitat (EFH), including habitat areas of particular concern (HAPC)
- Breeding, spawning, nursery, feeding, or passage areas of living resources
- Geographically limited fisheries and shellfisheries
- Shrimp trawling areas
- Areas of hard and live bottom
- Artificial reefs, fish havens, known critical spawning areas
- Threatened and endangered species and critical habitat
- Mineral extraction sites (sand borrow areas)
- Significant natural or cultural resources of historical importance

6.1 Alternatives Considered but Eliminated from Further Evaluation

During the feasibility and PED phases, USACE considered the aforementioned wide range of alternatives. This section describes the alternatives that were considered during the project planning process for this proposed action but are not being carried forward for further analysis and the rationale for eliminating them. Based on the current conditions, the following alternatives were eliminated from detailed analysis in this Supplemental EA.

6.1.1 Alternative 1b - Crab Bank South End Enhancement

This alternative involved the placement of material along the south end of the island because it is more eroded and at a lower elevation than the northern portion of the island. This alternative was eliminated as a standalone alternative because it would essentially create two separate islands. This is not as desirable a condition due to the potential to create an inlet between the high points of the island: the northwest section and the newly created portion along the south end. This alternative was not preferred because keeping with the historical condition was deemed more favorable by the ICT.

6.1.2 Alternative 1c - Crab Bank Salt Marsh Enhancement

This alternative involved the placement of material on the Mt. Pleasant side (northeast side) of the island to create/expand marsh habitat. This alternative was eliminated because without enlarging the channel-side beachfront of the island, placement behind the island would not be as stable, as observed by the sparse marsh existing there now. Additionally, the preferred alternative would allow for the potential natural recruitment of saltmarsh by protecting the back side of the island from overwash on high tides.

This alternative could be a consideration for future beneficial use of finer grained maintenance dredging material and could be evaluated under a future USACE Continuing Authorities Program Study.

6.1.3 Alternative 1d - Crab Bank Sub-bottom Habitat Enhancement

This alternative involved a site specific project on Crab Bank whereby material would be placed on the northwest side of the island to create more shallow sub-bottom habitat. Working specifically on this portion of the island was not favorable because spreading the material across the island to restore the historic island profile and footprint was more preferred. Also, building up sub-bottom habitat on the northwest side could affect safe recreational navigation, as it's close to an area where recreational boaters currently leave and return to Shem Creek when not in the navigation channel.

6.1.4 Alternative 2a - Shutes Folly Enhancement-Enhance Marsh Habitat

This alternative consisted of using a cutterhead dredge for dredged material placement to build up shallow sub bottom habitat to achieve an elevation consistent with the existing marsh in the area. While there may be an opportunity to do this with future maintenance dredging, this option presented timing constraints and environmental constraints due to the necessary type of material and potential for EFH impacts and real estate issues. This option could be a consideration for a future beneficial use project using dredged maintenance material.

6.1.5 Alternative 4 - Island Creation

Island creation, similar to Tompkins Island that was created in the mouth of the Savannah River, was considered for this project. Since it would involve creating new high ground, USACE considered areas that were already relatively shallow in order to reduce costs. During coordination with resource agencies, an area was identified just south of the south jetty near where the jetty becomes emergent. This area is relatively shallow (< 20 feet MLLW) and would not be as much of an impediment to navigation. In order to create an island within this area, rip rap would be needed to stabilize the exposed portions of it. Without riprap, it would erode due to exposure to ocean wave action. This would allow it back into the littoral drift but would not provide stable bird habitat. The use of rip rap would increase the cost of the project and goes beyond a viable beneficial use alternative. There are environmental considerations that would need to be addressed dependent on the amount of sand percentage and EFH issues. This alternative could have ramifications on the shrimping industry as this area is used for shrimp trawling. A version of the island configuration was modeled using the Coastal Modeling System (Appendix I). The report concluded that a "considerable portion of the sediments (would migrate) back into the Navigation Channel. Some coarse sediment deposited along the outside of the southern jetty and some fine sediment moved offshore in front of Morris Island shorelines." It is possible that more detailed modeling would be required in order to determine the longevity of the project since it's in a high energy area. Due to the reasons presented above, this alternative was eliminated from further evaluation.

6.1.6 Alternative 5 - Offshore fish and wave attenuation berm

This alternative involved the placement of material in between the ODMDS and the shoreline of Morris Island. The purposed would be to create a sand mound to mimic a large sand shoal complex for fish habitat. A secondary purpose would have been to potentially attenuate wave energy. This alternative was considered but eliminated from further consideration due to complexities with surveying for hardbottom habitat and cultural resources. Material that would be suitable for this was more effective

for utilization closer to shore due to pumping distances. As a result of interagency coordination, it was determined that where possible, material should go closer to the shoreline.

6.1.7 Alternative 6 – Refill Folly borrow areas

The historic borrow areas for Folly Beach renourishment have been depleted. While an ongoing search is currently underway, this alternative would have attempted to place beach quality material in the borrow areas for future reuse on Folly Beach. This alternative was eliminated due to lack of beach compatible material for future placement on a developed beach (i.e., insufficient sand content), excessive pumping/travel distance, and due to high costs associated with the double handling of material to realize these benefits. Could be further investigated with a cost sharing sponsor for the oceanward material which has an unknown sand content.

6.1.8 Alternatives 7a, 7b, and 7c – Marsh Creation (Thin Layer Placement)

This alternative involved thin layer placement of dredged material at Morris Island (in an area known as Cummings Point), Drum Island and fringing marshes of Cooper and Wando Rivers. This alternative provides a potential one time option that could be easy and inexpensive to implement with varying transportation costs due to pumping distances, and logistical requirements. This placement method consists of placing dredged material in a relatively "thin" layer over emergent vegetation or shallow bottom habitat to maximize positive environmental effects by nourishing/restoring/creating wetlands. For this type of project, typically a cutterhead dredge equipped with a nozzle on the discharge line to spray a small layer of dredged sediment onto the existing or degraded marsh. This placement method is becoming, in suitable site-specific conditions, a more attractive sustainable sediment management alternative as the adverse impacts of sea level rise on wetlands are becoming more appreciated by federal and state stakeholders. Areas that are most feasible for this are shorelines in close proximity to where cutterhead dredging occurs. These areas include fringing marshes along the Cooper River. Other opportunities exist along fringing marshes of the Wando River although they are not as likely to occur if dredging with a clamshell occurs. However, new material in the Cooper and Wando will contain marl and therefore would not make a suitable marsh substrate. Segregating a thin layer of unconsolidated materials from the marl will be expensive and inefficient. Maintenance material consisting of unconsolidated fine material mixed with sand could possibly be used for this purpose. For these reasons, this alternative was eliminated for this study that is only evaluating the uses associated with dredging of new work (deeper) material. This alternative could be a consideration for future beneficial use of finer grained maintenance dredging material and could be evaluated under a future USACE Continuing Authorities Program Study.

6.1.9 Alternative 8 – Dredged Material Containment Area Dike Rebuilding

This alternative involved using material to build up an eroding dike along the Intracoastal Waterway behind Breech Inlet. This alternative involved too long of a pumping distance to be cost-effective and would involve additional mobilization of land based equipment for precise earth moving work to create a suitable dike for sediment containment. Additionally, there were geotechnical concerns over the suitability of the material for dike material. Therefore, this alternative was eliminated from further analysis.

6.1.10 Alternative 9a –Ft. Sumter Revetment/Breakwater Creation

This alternative involved using dredged rock to create a revetment or breakwater in front of Ft. Sumter. This feature was conceptualized to be around the east and south face of the Fort. The feature would have served to break up wave energy prior to reaching the shoreline of Ft. Sumter. After a detailed geotechnical review of the rock strength data, the limestone rock material was not deemed strong enough (i.e., hard enough) to withstand the high energy environment in this exposed area of the harbor. The USACE determined that these engineering concerns would not allow it to meet the engineering specifications for either a breakwater or revetment contained with Engineering Regulation (ER) 1110-2-1407 (Hydraulic Design for Coastal Shore Protection Project). The USACE evaluated the possibility that the instability of the limestone in this environment could cause displacement of the material that may further compromise the existing concerns about the integrity of the Fort armoring.

6.1.11 Alternative 9b – Fort Sumter Underwater Berm/Reef Creation

This alternative involved using dredged rock to create an underwater berm/reef in front of Ft. Sumter. The submerged berm/reef was conceptualized to be around 1500 ft long and it would have been placed in approximately 5-10 feet of water and no higher than mean low water. The berm/reef would have served to break up wave energy prior to reaching the shoreline of Ft. Sumter. An additional benefit would have been the creation of substrate for benthic invertebrates and for fish habitat. After a geotechnical review of the rock strength data, the rock material was not deemed strong enough (i.e., hard enough) to withstand the high energy environment in this exposed area of the harbor. The USACE determined that these engineering concerns would not allow it to meet the engineering specifications for either a breakwater or revetment. The USACE evaluated the possibility that the instability of the limestone in this environment could cause displacement of the material that may further compromise the existing concerns about the integrity of the Fort armoring. No further analysis was done to support the wave dissipation capability of the concept.

6.1.12 Alternative 10 – Placement around Morris Island Lighthouse

This alternative involved the pumping of unconsolidated material into the nearshore environment off of Morris Island around the lighthouse. Construction was conceptualized as a pipeline being used to pump out a slurry of material into an identified location. The benefits of this involved getting material back into the littoral drift rather than removing it from the littoral system by placing in the ODMDS. Additionally, it could serve as material to attenuate wave action around the lighthouse. Ultimately, the material pumping distances were too far to be cost effective as a least cost option. This alternative could be pursued if a sponsor is willing to take on the additional cost of environmental compliance and construction.

6.1.13 Alternative 11 – Commercial Sale of Dredged Material

This alternative involved the ability of the dredging contractor(s) to sell the material for commercial uses such as development fill, brick creation, etc. This alternative was eliminated from this analysis because there are no blanket prohibitions if a contractor wants the dredged material, is willing to pay for transportation that doesn't delay the least cost disposal option, and has appropriate authorizations to do so.

6.1.14 Alternative 12 - Oyster Reef Creation

This alternative involved the use of limestone rock for oyster substrate. Limestone rock is a good substrate for oyster spat recruitment. If an eligible non-Federal sponsor is willing to pay the incremental cost difference, rock dredged from the entrance channel could be loaded onto a barge and a bulldozer could push the material into intertidal areas of select locations within the harbor. This alternative could be pursued if a sponsor is willing to take on the additional cost of environmental compliance and construction.

6.1.15 Alternative 13a – Nearshore Placement off Morris Island

This alternative involved the pumping of unconsolidated material into the nearshore environment off of Morris Island. Construction was conceptualized with a pipeline being used to pump out a slurry of material into an identified location. The benefits of this involved placing material back into the littoral drift rather than removing it from the littoral system by placing in the ODMDS. Ultimately, the material pumping distances were too far to be cost effective as least cost option. This alternative could be pursued if a sponsor is willing to take on the additional cost of environmental compliance and construction.

6.1.16 Alternative 14 – Use Rock as Shoreline Protection

During the feasibility phase, USACE explored the possibility of using dredged limestone rock to protect the shorelines of sensitive historic and/or natural resources within the harbor. Some of these areas included Ft. Sumter, Castle Pinckney/Shutes Folly, Crab Bank, and Ft. Moultrie. This alternative was eliminated for the same reasons discussed in Alternative 9b.

6.2 Description of Alternatives Evaluated in Detail

6.2.1 No Action Alternative

Future conditions associated with not providing for beneficial use opportunities would result in dredged material capacity being used at placement areas rather than potential environmental enhancement locations. The no action alternative does not capitalize on environmental enhancements that could be achieved through the use of dredged material.

6.2.2 Alternative 1a - Crab Bank Enhancement

Dredged material could be used to enlarge Crab Bank by placing material on the west side of the island running from north to south. This would help support the avian species that utilize the island for nesting, roosting, and foraging (Figure 27). Crab Bank has been designated as an “Important Bird Area” in South Carolina and is established as “Crab Bank Seabird Sanctuary”. SCDNR indicates that, “Crab Bank supports colonies of nesting water birds because of its isolated nature and lack of mammalian predators. Although all species may not nest on the island each year, examples of species that have used the island include: brown pelican, least tern, royal tern, black skimmer, gull-billed tern, sandwich tern, common tern, laughing gull, Wilson's plover, American oystercatcher, willet, great egret, snowy egret, tricolored heron and ibis. Besides providing nesting habitat, the sanctuary provides winter loafing and feeding areas for numerous species (https://www.dnr.sc.gov/mlands/managedland?p_id=215). While the island fluctuates

in size constantly, it has largely been migrating towards the north over the last 15 years. Further demonstrating a need for beneficial use of dredged material at Crab Bank, the USACE performed a shoreline change assessment and determined that the island has decreased in size from 17.94 acres of dry beach habitat in 1994 to 5.01 acres in 2011 (IFR/EIS, USACE 2015, Appendix A). USACE coordinated with resource agencies to discuss this option and agencies seemed to indicate that Crab Bank was the preferred option. Several agencies noted this in letters to USACE during the feasibility study (IFR/EIS, USACE 2015, Appendix Q). This size of the island is dependent upon obtaining funds from a cost-sharing sponsor for costs above the least cost disposal method.

Figure 26. Crab Bank beneficial use concept identified in Post 45 Final IFR/EIS

6.2.3 Alternative 2b – Shutes Folly Enhancement

Dredged material could be used to enlarge Shutes Folly to a previous condition by placing material on the northeast side of the island. This would help support the avian species that utilize the island for nesting, roosting, and foraging (Figure 28). Shutes Folly provides nesting habitat for colonial seabirds due to its isolated nature, small size, and lack of predators. It is one of only nine active nesting sites in the entire state. Skimmers and oystercatchers like the shell hash that faces the eastern side of Shutes Folly. The island has been noted by Charleston Harbor Wildlife as being "often considered for restoration." They state that, "in 1997, wildlife biologists pressed for the island as a sight for dredge spoil to boost the small seabird colony there…" (http://charlestonharborwildlife.com/iwa/cp-sf/). Additionally, Castle Pinckney, a historic site, sits atop the island. This size of the island is dependent upon obtaining funds from a cost-sharing sponsor for costs above the least cost disposal method.

Figure 27. Shutes Folly beneficial use concept identified in Post 45 Final IFR/EIS

6.2.4 Alternative 3a – Rock berm around ODMDS

This action is fully described and evaluated in the Charleston Harbor Post 45 Final IFR/EIS (USACE 2015). Rock placement would consist of dredged rock from the entrance channel. The majority of the material would be smaller sized rock dredged with a cutterhead dredge. The Final IFR/EIS included a preferred design where the berm would be topped with rock dredged with a mechanical dredge as a beneficial use component of the project (USACE intent was to maximize the size of this rock consistent with beneficial use parameters) to remove rock from the channel. However, that document also stated that a cutterhead dredge could be used for the entire berm resulting in smaller size materials and reduced cost. See the Final IFR/EIS, USACE 2015, at Section 4.2.6.1, App. H at 5, and App. I at 22. Further evaluation has indicated that mechanical dredging would not be the least cost disposal alternative. The dredging contractor will not be required to use a certain equipment type in order to create the berm. The primary purpose of the berm is for sediment containment as per the evaluation of the berm performance that was modeled during the Environmental Assessment of the ODMDS modification. Secondary purposes include fish habitat creation and hardbottom habitat creation.

6.2.5 Alternative 3b – Rock Reefs near Navigation Channel

This alternative would involve the creation of two mitigation reefs, six beneficial use reefs, and additional reef creation at SCDNR identified artificial reefs. This action is fully described and evaluated in the IFR/EIS (USACE 2015), and all findings from that document are still valid. As with Alternative 3a above, further evaluation of construction methodologies and costs for the beneficial use reefs during PED have resulted in the conclusion that the beneficial use reefs will need to be constructed with restrictions on dredging

equipment type being removed from consideration and rock size being un-specified. The USACE committed to evaluating the seafloor in the area of the proposed reefs in order to avoid impacts to existing hardbottom habitat and/or any cultural resources. During the PED phase, the USACE performed these geophysical surveys and groundtruthing to aid in the siting of these reefs.

6.2.9 Alternative 13b - Beach Placement on Morris Island

This alternative would involve the placement of predominantly sandy material on the eroding shoreface of Morris Island around the landward terminus of the south jetty of Charleston Harbor. The jetty has been experiencing some flanking and escarping of the dunes in that area. The alternative is described fully below.

7.0 Description of the Proposed Action

The proposed action consists of multiple beneficial use alternatives that were identified in the Final FR/EIS (USACE 2015) and which may be implemented and constructed contingent upon funding from a cost-sharing sponsor for incremental costs beyond the least cost disposal method. It is the intent of the US Army Corps of Engineers to use as much material for beneficial uses as is reasonably possible and where policies allow. Therefore this Supplemental EA further evaluates and selects multiple alternatives to assess potential impacts and benefits. It is important to note that all of the below options are dependent upon an eligible non-Federal sponsor partnering with the USACE on the additional costs beyond least cost disposal (none are least cost disposal methods).

7.1 Crab Bank Enhancement

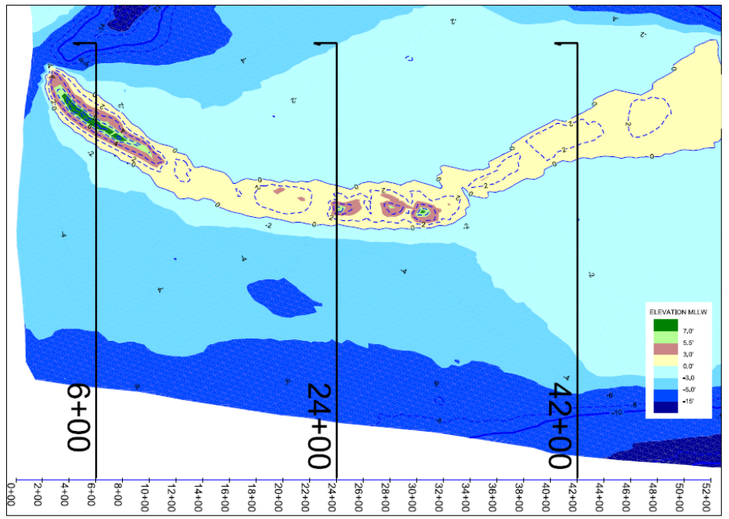
Crab Bank, an eroding island in the middle of Charleston Harbor, could be enhanced/enlarged using new work dredged material from Bennis and Rebellion Reaches of the navigation channel (Figure 29). Figure 9 shows the area within the navigation channel that material will be dredged from. Geotechnical analysis of material within this area reveals that there is roughly 800,000 cy to 1,200,000 cy of material depending on if full overdepth dredging is reached. This beneficial use alternative is not a least cost disposal option and would require an eligible non-Federal sponsor to fund completely or share in the increased costs over the least cost placement alternative.

A clamshell dredge or a cutterhead pipeline dredge could be used to excavate the material from the available reaches of the channel. If a clamshell or other mechanical dredge is used, the material will be deposited into a scow. An offloader will be used in conjunction with the scow between the channel and Crab Bank (which would not be required if a cutterhead is used). Approximately 4,000 ft of pipeline would run from the dredging area or offloader area to the Crab Brank placement area. Similar to beach nourishment jobs, some heavy machinery will likely be utilized to control the placement and flow of material. This equipment could include front end loaders and bulldozers. The equipment could be used to build up temporary containment dikes using existing material from the island in order to contain the discharge of material. Effluent would be allowed to discharge from discrete breaks in the containment berms. The contractor would be required to make efforts to minimize turbidity released from the site; however, it is assumed that fine material would wash away into the surrounding waters similar to what occurs during the dredging operation. This would be temporary in nature and would cease upon

completion of construction. The USACE will not dictate exact construction methodology, and other methods could be used if deemed cost-effective. It is anticipated that construction would initiate on the northern portion of the island because this is currently the highest elevation and provides a good starting platform for shore-based equipment. Construction could occur in this area between October 15 and April 15 to avoid periods of high bird nesting activity. Temporary protection would be afforded to the existing saltwater marsh only in the northwestern part of the island, which provides the greatest area of wetland habitat. Similar avoidance of the remaining small, patchy areas would limit cost effective construction and affect the outcome and viability of the beneficial use project. It is anticipated that construction would continue south and eastward. Once the construction has moved beyond the largest area of bird nesting (the northwestern portion), construction would be allowed to occur year-round. Discussions with SCDNR and USFWS have indicated that this approach would not have significant effects on the nesting birds and the long term benefit would outweigh any temporary disturbance. Section 5.4.14 of the IFR/EIS (USACE 2015) identified a dredging window in the channel at the mouth of the inlet and underneath the Ravenel Bridge for the new work construction only. The window states that no dredging will occur within Mt. Pleasant Reach, Rebellion Reach or between the jetties in Ft Sumter Reach between April 1 and September 30 to avoid impacts to larval fish in an SCDNR identified fish spawning hotspot. Additionally, no new work dredging will occur 1000' on either side of the Ravenel bridge during this same time period.

It is anticipated that between 800,000 and 1,200,000 cy of material could be placed upon the island for this project. Placement will be in a non-uniform pattern to allow for greater topographic complexity and therefore greater habitat diversity. This will allow for minimal amount of upland equipment required to grade the material thereby creating a less uniform surface. The contractor could be provided a range of elevations to target for island height. For example, the current high point of the island is roughly 8' MLLW. As a conceptual design, the contractor could target a range between 6.5' (roughly 1' above mean high tide) and 10' (an acceptable maximum height from ICT coordination) MLLW (Figure 30). This should minimize construction cost and benefit habitat rather than creating a uniform and flat surface. These methods could change slightly depending on the contractor chosen method to complete the project construction. General guidelines will be provided to the contractor consistent with what is provided in this documentation. In order to achieve a better cost, exact construction methodology will not be specified.

Figure 28. Crab Bank conceptual design (MLLW)



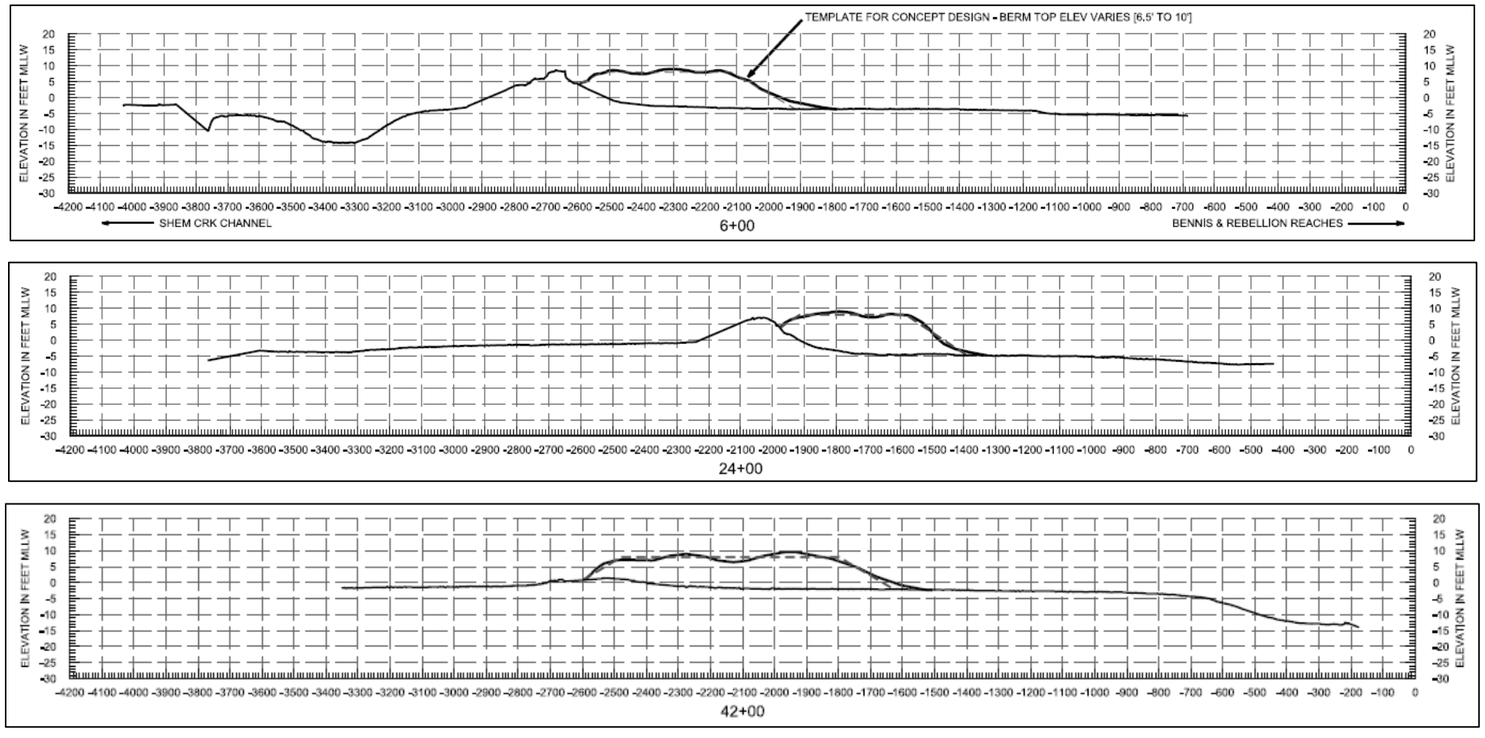


Figure 30. Conceptual design for variable surface elevation for Crab Bank

7.2 Shutes Folly Enhancement

Shutes Folly is also an eroding island in the middle of Charleston Harbor. It could be enhanced/enlarged using dredged material from Bennis and Rebellion Reaches of the navigation channel. Figure 9 shows the area within the navigation channel that material will be dredged from. As stated above, geotechnical analysis of material within this area reveals that there is roughly 800,000 cy to 1,200,000 cy of material depending on if full overdepth dredging is reached. Some material could go to Crab Bank and some could go to Shutes Folly if an eligible non-federal sponsor is willing to completely fund or share in the additional construction cost. This beneficial use alternative is not a least cost disposal option and could require an eligible non-Federal sponsor to fund the increased costs over the least cost placement alternative.

The anticipated methodology would be similar to the Crab Bank option description above. This potential beneficial use option anticipates roughly 300,000 cy of material to be placed along the eastern and southern faces of the island (Figure 31). For this potential option, approximately 2,000 ft of pipeline would run from the dredging area or offloader area to the Shutes Folly placement area. These methods could change slightly depending on the contractor chosen method to complete the construction. Temporary protection would be afforded to the existing saltwater marsh along the western part of the island during the construction process. Placement would be in a non-uniform pattern to allow for greater topographic complexity and therefore greater habitat diversity. This will allow for minimal amount of upland equipment required to grade the material thereby creating a less uniform surface. The contractor could be provided a range of elevations to target for island height. For example, the current high point of the island is roughly 10’ MLLW. As a conceptual design, the contractor could target a range between 6.5’ and 10’ MLLW, similar to the Crab Bank option (Figure 31).General guidelines will be provided to the contractor consistent with what is provided in this documentation. In order to achieve a better cost, exact construction methodology will not be specified. This option, if constructed, could provide increased area for shorebird nesting, roosting, and foraging. It could also provide temporary protection to Castle Pinckney on the southern portion of the island. It is important to note that the size of this option is dependent upon funding from a cost-sharing sponsor and enough suitable material.

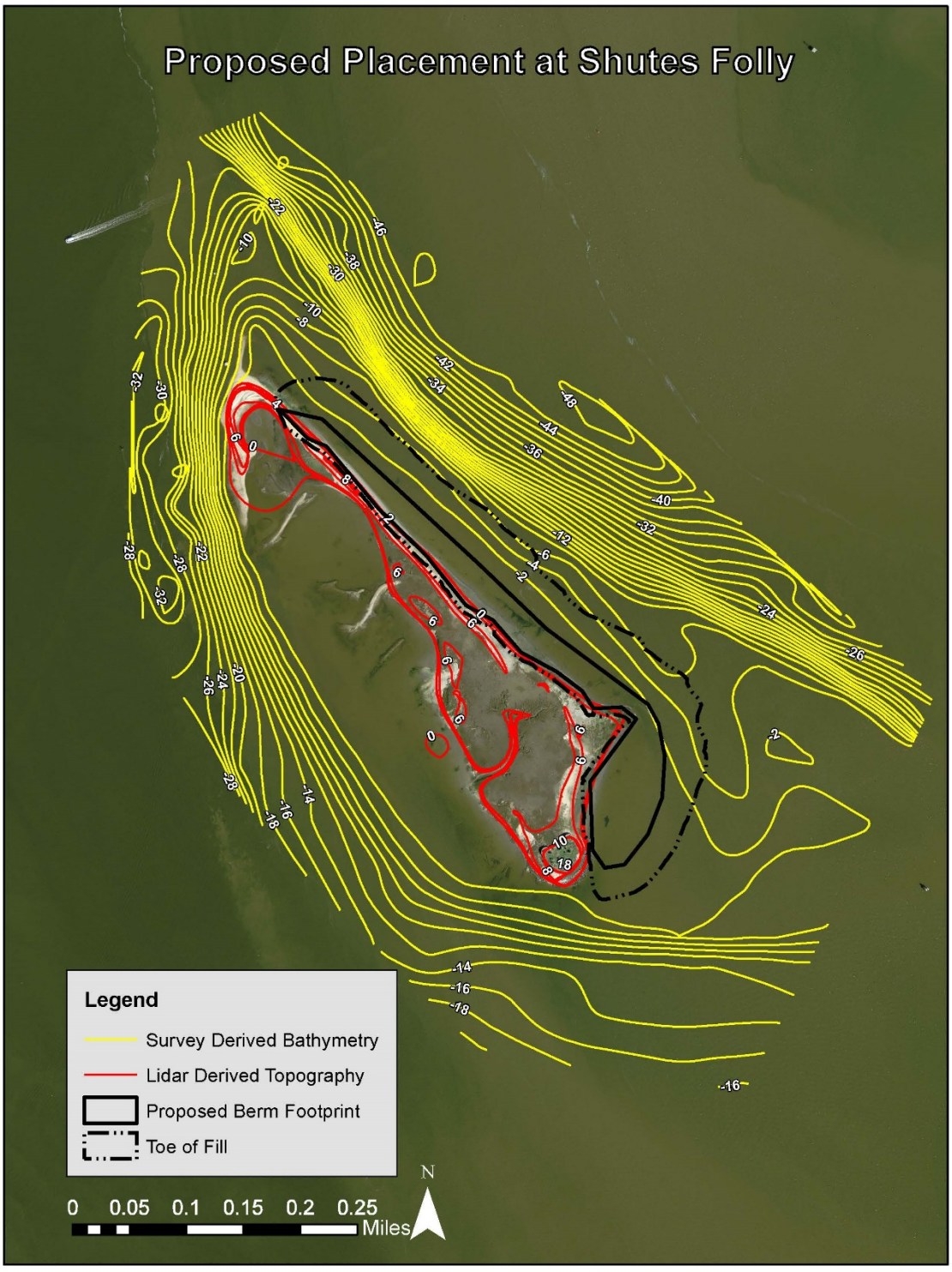


Figure 29. Shutes Folly conceptual design (MLLW)

7.3 Morris Island Beach Placement

Morris Island, an eroding island at the mouth of Charleston Harbor could be enhanced by providing for the placement of approximately 350,000 cy of material from the Ft. Sumter Reach of the Navigation Channel (Figure 10). Placement would occur north and south of the terminus of the south jetty of Charleston Harbor (Figure 32). As previously noted, this area of the island is undergoing flanking of the jetty which could create a bypass channel, further erode the island, potentially undermine the emerged jetty on the land and adversely affect the function of the jetties. This alternative is not the least cost, but may be constructed as a part of the USACE Charleston Harbor Operation and Maintenance program if the benefits to protect the Southern Jetty are deemed cost effective.

It is anticipated that a hopper dredge would be used to excavate material within this portion of the navigation channel. Physical testing of samples taken from within the Ft. Sumter Reach indicates available new work dredged material to consist of greater than 65% sand. A pumpout station located just north of the south jetty could be used to initiate pumpout of material from the hopper dredge. Approximately 7,500 ft of pipeline would be required to run from the pumpout station to the beach placement area. Work would occur from October through March due to the dredging window for new work construction established in the Post 45 IFR/EIS. Shore-based equipment, such as bulldozers and front end loaders would be required to move the pipeline around and ensure proper placement of material. It is anticipated that work would proceed similar to beach nourishment projects with temporary dikes for containment of material. The conceptual design beachfill concept consists of an 8 ft MLLW elevation berm, about 200 ft wide along about 6,000 ft of beachfront (3000 south of the jetty, 3000 north of the jetty). This berm ties in to the existing 8 ft contour line. In the area about 800 feet either side of the jetty a 12 ft berm extends from the existing 12 ft contour line with a width of about 150 ft, then stepping down to a 8 ft berm about 100 ft wide. The exact dimensions of this beachfill would be dependent upon design and cost considerations. The conceptualized option gives an idea of a maximum footprint. Design and construction are such that a protrusion will not be created whereby excessive erosion of the new material would occur.

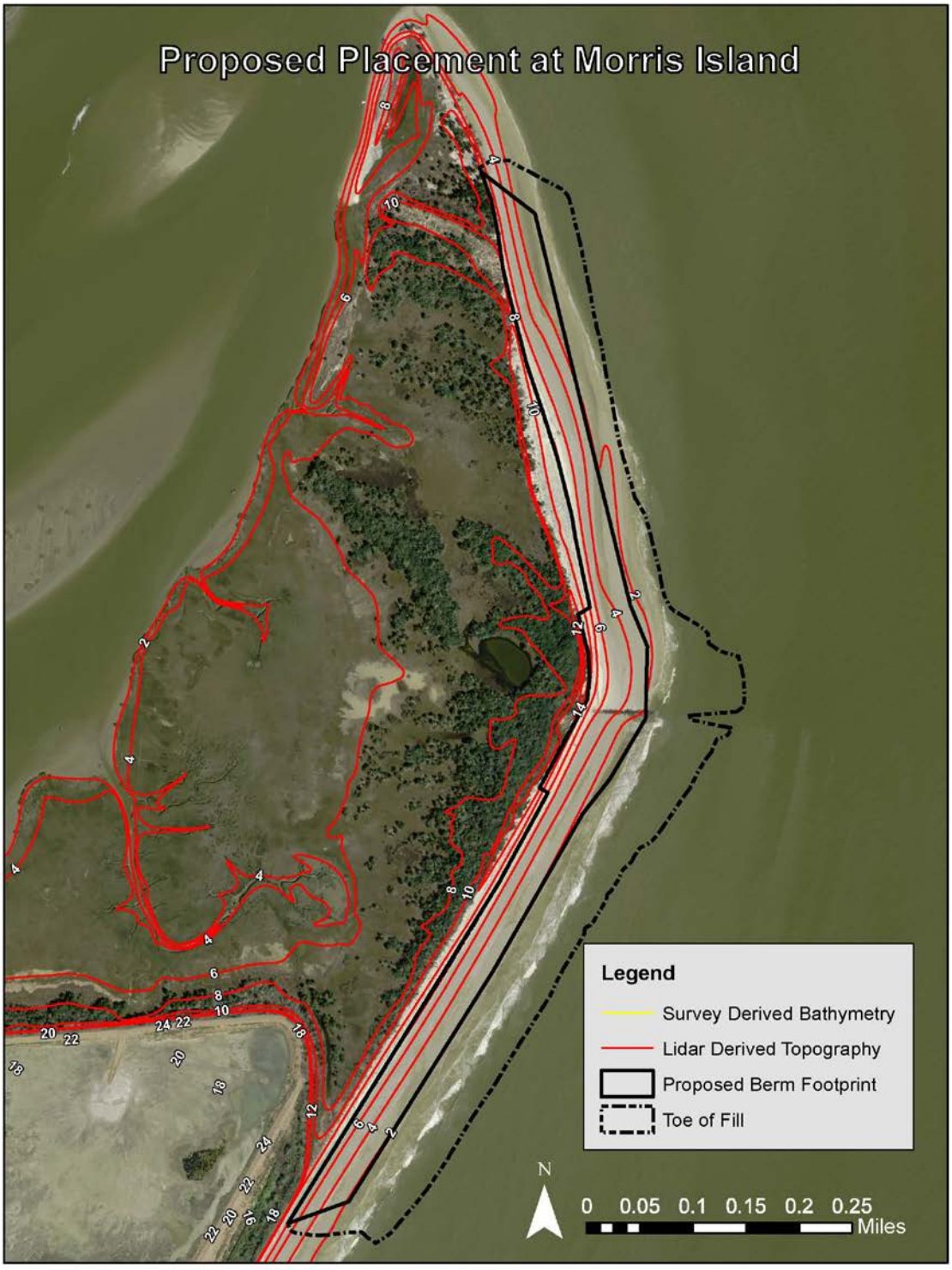


Figure 30. Morris Island conceptual design (MLLW)

7.4 Artificial Reef Creation / ODMDS Berm Construction

In the Charleston Harbor Post 45 Final IFR/EIS (USACE, 2015), USACE committed to disclosing the locations of these reefs (Figures 33 and 34) after an analysis of existing hardbottom and cultural resources to avoid. This section serves to disclose the locations of the artificial reefs proposed for construction. As explained in the Final IFR/EIS (USACE 2015), it is anticipated that eight 33-acre reefs will be created with dredged rock from the entrance channel. All environmental clearances for artificial reef creation with dredged material have been obtained during the feasibility phase. Two of the reefs will be created for mitigation resulting from the impacts to hardbottom habitat within the entrance channel. Six of the reefs could be created as beneficial use options if the dredging methods are the least cost placement alternative, consistent with the USACE/EPA "Federal Standard" (33 CFR Parts 335 to 338). Additional rock material could be placed at the existing SCDNR Charleston Nearshore Reef Site. An additional beneficial use of rock material was conceptualized to result from the creation of a "U"-shaped berm around the western, southern, and eastern side of the Ocean Dredged Material Disposal Site (ODMDS). The berm could serve 3 purposes: (1) Sediment containment, (2) Fish habitat, and (3) Hardbottom habitat.

The Final IFR/EIS discussed that the 2 mitigation reefs could be created using a mechanical dredge (e.g., clamshell or backhoe dredge) to dredge large (size undefined) rock from the channel to create substrate for low to high relief reef creation in an otherwise patchy and low relief area. The 6 additional beneficial use reefs, the Charleston Nearshore Reef and the ODMDS berm were conceptualized with a preferred design using a "base" of material dredged with a cutterhead and then topped with larger material from a mechanical dredge. In this way, these beneficial use options would create substantial habitat for nearshore fish species and substrate for invertebrates. The PED phase resulted in an opportunity for USACE to further refine the options and anticipated construction methodology, develop plans and specifications for construction, and assess the cost of various beneficial use options.

During the PED phase it was confirmed that the mitigation reefs will have a size requirement to ensure larger pieces of rock for the placement. In order to achieve this, it is anticipated that a mechanical dredge (either backhoe or clamshell) will be used; however, the contractor could meet these requirements through other methods as well. Regarding the beneficial use reefs and ODMDS berm, through further geotechnical analysis and discussions with industry, USACE determined that the likely least costly dredging and disposal method for the rock material is the use of a cutterhead dredge. Due to this, the beneficial use reefs (6 total) as well as the ODMDS berm and SCDNR reefs will have no size restriction and could be dredged with either a cutterhead or a mechanical dredge. This will ensure the best costs are achieved and that it will remain with the Federal Standard as the least cost, environmentally acceptable, disposal option. A cutterhead dredge could result in the rock being dredged into smaller rock pieces (i.e., jagged pieces likely up to basketball size) as well as a mixture of gravel and cobble. If the contractor uses a mechanical dredge for the construction of the beneficial use, the rock fragments could be larger in size. A combination of material types may also occur. While smaller rock from a cutterhead may not produce a substrate quite as stable for a hardbottom benthic community, it will still be a beneficial use for fish habitat enhancement and provide some hardbottom benefits from rock fragments. Consistent with the Final IFR/EIS, ROD, and Final Chief's Report, the reef construction is anticipated to create essential fish habitat and result in significant habitat benefits to a variety of offshore resources, including incidental

benefits to both recreational and commercial fishing. The beneficial use reefs will be constructed in water ranging from roughly -35 to -45 feet MLLW and will not be subject to frequent wave activity. The beficial use reefs will not likely be as stable as the mitigation reefs; however, the 100' buffer between the reef sites and nearby hardbottom habitat will minimize any sediment transport impacts to hardbottom communities. The dredging method will still allow for some larger rock to be present which will provide substrate for benthic invertebrates and structure for fish species.

Figure 33 demonstrates the proposed layout for these reefs and distinguishes between the mitigation reefs and the beneficial use reefs. The reefs were located to avoid existing hardbottom habitat and cultural resources. These areas to be avoided are indicated in Figure 28. Scows could be used to transport the material to the reefs. Each reef could be established as sixteen 300' x 300' cells to ensure an even distribution of material across the reef locations (Figure 34). In this manner, the reefs would maintain a mounded shape and allow for more diverse habitat structure across approximately 33 acres each. If constructed with larger rock, the habitat could be more suitable for invertebrate growth and hardbottom habitat development along with the fish habitat benefits. If constructed with smaller rock and/or gravel/cobble, the habitat could serve as a fish attractant and still have the potential for benthic invertebrate recruitment. Any of the placement techniques results in an enhancement to nearshore fisheries resources. After construction, bathymetric surveys will be performed of all rock placement and can be made available for viewing.

Since the feasibility study, USACE and SCDNR have discussed the possibility of placing more dredged rock material at additional SCDNR reef sites. Two of the possible reef sites are part of the Marine Protected Area program. Area 51 is a 1.5 mile x 1.5 mile area located in 70 feet of water off the SC coast and was established in April of 1998. Area 53 was established in April of 2003 with the same dimensions as Area 51 however it was located in 105 feet of water. Each of the SCDNR reefs would be created similar to the beneficial use reefs, in that the type of dredge / size of rock will not be specified. SCDNR has agreed to receive this material at these reefs depending upon the additional cost above the least cost disposal option. SCDNR could choose to select none of the reefs or could select any and/or all of the reefs for construction. All the identified reef sites are presently approved. Table 6 presents some of the characteristics of the reefs for easier viewing.

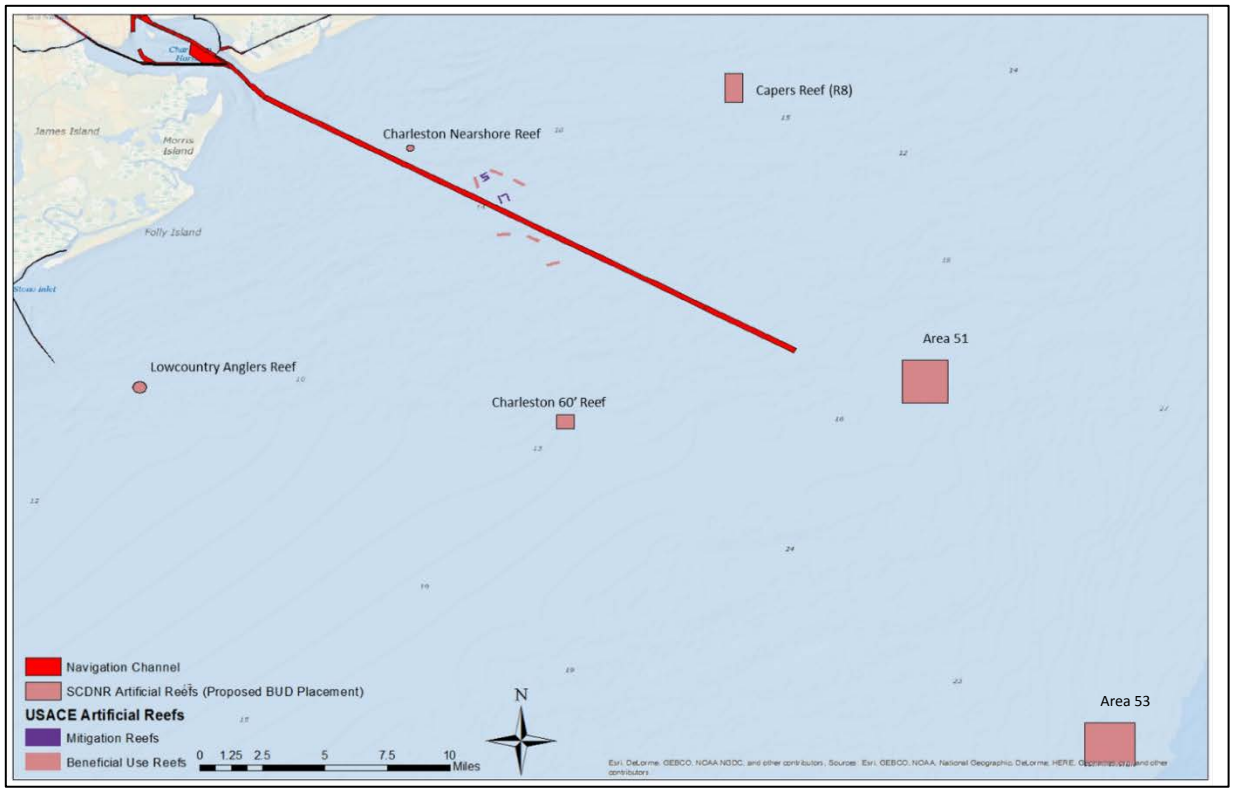


Figure 31. Broad view locations for proposed artificial reef creation

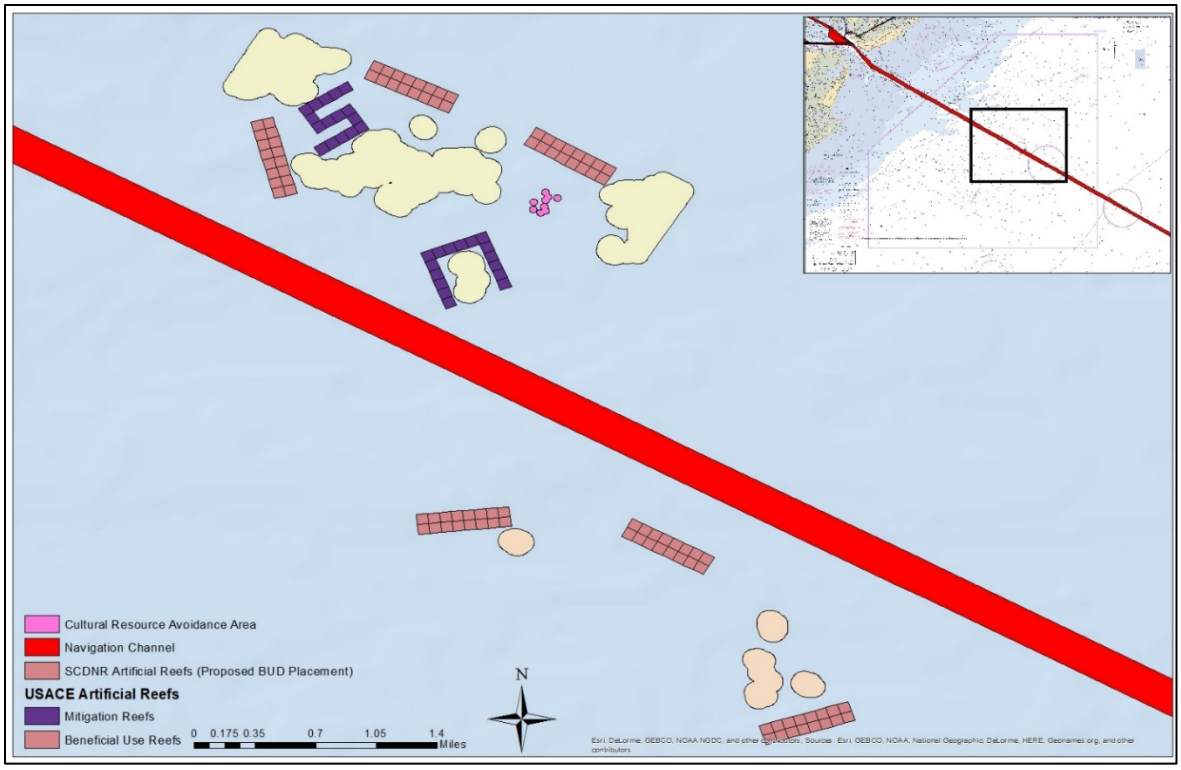


Figure 32. Design layout for USACE artificial reefs near the entrance channel

Table 6. Description of characteristics for proposed artificial reefs

Reef Name	Predominant Material Type	Excavation Method (anticipated)	Transportation Method (anticipated)	Placement Description	Benefits
USACE Mitigation Reef 1	Limestone Rock (Edisto Formation)	Mechanical Dredge (clamshell or backhoe)	Scow	16 300'x300' cells (mounded formation – large rock)	Hardbottom habitat creation and fisheries enhancement
USACE Mitigation Reef 2	Limestone Rock (Edisto Formation)	Mechanical Dredge (clamshell or backhoe)	Scow	16 300'x300' cells (mounded formation – large rock)	Hardbottom habitat creation and fisheries enhancement
ODMDS Berm Creation	Limestone Rock (Edisto Formation)	Unspecified (likely cutterhead)	Scow	"U" shaped berm approximately 46,000 linear feet roughly 10 feet off the bottom (max height <25' MLLW)	Sediment containment, fisheries enhancement, potential hardbottom habitat
USACE Beneficial Use Reef 1	Limestone Rock (Edisto Formation)	Unspecified (likely cutterhead)	Scow	16 300'x300' cells (mounded formation – small rock/cobble)	Fisheries enhancement, potential hardbottom habitat
USACE Beneficial Use Reef 2	Limestone Rock (Edisto Formation)	Unspecified (likely cutterhead)	Scow	16 300'x300' cells (mounded formation – small rock/cobble)	Fisheries enhancement, potential hardbottom habitat
USACE Beneficial Use Reef 3	Limestone Rock (Edisto Formation)	Unspecified (likely cutterhead)	Scow	16 300'x300' cells (mounded formation – small rock/cobble)	Fisheries enhancement, potential hardbottom habitat
USACE Beneficial Use Reef 4	Limestone Rock (Edisto Formation)	Unspecified (likely cutterhead)	Scow	16 300'x300' cells (mounded formation – small rock/cobble)	Fisheries enhancement, potential hardbottom habitat
USACE Beneficial Use Reef 5	Limestone Rock (Edisto Formation)	Unspecified (likely cutterhead)	Scow	16 300'x300' cells (mounded formation – small rock/cobble)	Fisheries enhancement, potential hardbottom habitat

USACE Beneficial Use Reef 6	Limestone Rock (Edisto Formation)	Unspecified (likely cutterhead)	Scow	16 300'x300' cells (mounded formation – small rock/cobble)	Fisheries enhancement, potential hardbottom habitat
SCDNR Charleston Nearshore Reef	Limestone Rock (Edisto Formation)	Unspecified (likely cutterhead)	Scow	Placement of dredged rock material with targeted center point within designated area	Fisheries enhancement, potential hardbottom habitat
SCDNR Lowcountry Anglers Reef	Limestone Rock (Edisto Formation)	Unspecified (likely cutterhead)	Scow	Placement of dredged rock material with targeted center point within designated area	Fisheries enhancement, potential hardbottom habitat
SCDNR Charleston 60' Reef	Limestone Rock (Edisto Formation)	Unspecified (likely cutterhead)	Scow	Placement of dredged rock material with targeted center point within designated area	Fisheries enhancement, potential hardbottom habitat
SCDNR Capers Reef	Limestone Rock (Edisto Formation)	Unspecified (likely cutterhead)	Scow	Placement of dredged rock material with targeted center point within designated area	Fisheries enhancement, potential hardbottom habitat
SCDNR MPA Area 51	Limestone Rock (Edisto Formation)	Unspecified (likely cutterhead)	Scow	Placement of dredged rock material with targeted center point within designated area	Fisheries enhancement, potential hardbottom habitat
SCDNR MPA Area 53	Limestone Rock (Edisto Formation)	Unspecified (likely cutterhead)	Scow	Placement of dredged rock material with targeted center point within designated area	Fisheries enhancement, potential hardbottom habitat

8.0 Environmental Impacts

This section will evaluate impacts associated with the Crab Bank and Shutes Folly enhancement options, the Morris Island beach placement option, and the no action alternative. The impacts of these proposed beneficial use options will be evaluated together in this section, since the methodology is similar for all three possible options. This section will only evaluate the construction of the aforementioned options. All dredging (i.e., excavation) related impacts have been previously evaluated in the Final IFR/EIS and do not warrant further evaluation.

Regarding the artificial reef creation, this document merely serves to publicly disclose the location of the mitigation and beneficial use reefs after cultural and hardbottom surveys were performed in PED. The five additional SCDNR artificial reef sites which are being considered by SCDNR and their partners for augmentation using limestone rock from the entrance channel are existing, approved reefs (see Figure 33). Generally, no new impacts would be realized beyond what was discussed within the Final IFR/EIS and supporting documentation, including 404(b)(1) evaluation (see Appendix M2 of the Final IFR/EIS for SCDNR nearshore reef placement 404(b)(1) analysis) and endangered species (the creation of artificial reefs was addressed through the previous NMFS consultation – no new consultation is warranted for reef siting). However, additional discussion of reef siting is included in section 8.9 Cultural and Historic Resources, below. Implementation of these beneficial use reef creation options is contingent upon costs and/or the availability of a cost-share partner.

8.1 Physical Characteristics (Wind, Waves, Tides, Currents)

As previously stated, Charleston Harbor is a tidal estuary that experiences diurnal tides. These tidal changes result in relatively strong currents on the ebb and flood tide. Wind waves and swell from the ocean also affect the hydrodynamics within the harbor and therefore shoreline changes.

No Action Alternative: Under the no action alternative, waves, tides, and currents will not be changed. Continued tidal and current action will further erode these islands and cause shifts in the amount of subaerial beach present. Sea level rise would exacerbate the loss of surface area of the islands and habitat.

Action Alternatives: Under the proposed action alternatives, one or more islands will be increased in their respective sizes. However, each of the alternatives is merely expanding the island footprint back to a similar historical footprint. Since no significant new features are being created, it is not anticipated that any of the proposed beneficial use options would have any distinctive hydrodynamic changes, nor will they impact natural circulation or sedimentation patterns from what has historically occurred in the past. Placement of material to enlarge and elevate the islands could temporarily offset the impacts of sea level rise.

8.2 Water Quality

No Action Alternative: Under the no action alternative, water quality will not be altered within the harbor and/or nearshore waters.

Action Alternatives: Significant impacts to water quality are not anticipated from implementation of any of the proposed beneficial use options. The dredging of material and resultant temporary turbidity plumes have previously been evaluated in the Final IFR/EIS. The sediment testing and elutriate analyses performed during the feasibility phase did not reveal that these reaches contained significant concentrations of any toxic or harmful substances. However, temporary and minor decreases in water quality are anticipated. Increased turbidity will be associated with construction at the immediate sites. The duration of the turbidity plume in the water column depends upon water temperature, salinity, currents, and sediment grain size (ICES 1992). The distance of sediment transport is dependent upon current strength, storm resuspension, water salinity and temperature, and sediment grain size (ICES

1992). For the potential beneficial use options (Crab Bank, Shutes Folly, Morris Island), the material from the channel is approximately 65% sand or greater. The remainder of the material is silts and clays.

Safeguards (i.e., containment dikes) could be used to minimize excess turbidity and suspended solids entering any adjacent water body. If necessary, additional temporary erosion and sedimentation control features will be conducted. At all times, protective measures shall be taken to prevent chemicals, fuels, oils, and greases from entering area waters. Chemical analysis of sediments from the navigation channel has revealed no significant concentration of toxic or harmful substances that could adversely affect water quality of the area (USACE 2015). Hence, water quality impacts from project construction would only be temporary and minor and the State's Classification Standards should not be contravened. Waters of the State of South Carolina would not be significantly affected and water clarity would return to ambient conditions shortly after completion of construction. No significant impacts are expected to result from the construction, dredging, and disposal operations. As required by the Clean Water Act, a Section 404(b)(1) evaluation for the effects of conducting the proposed action has been prepared and is included as Appendix H. A water quality certification (WQC) for the proposed action was granted by the SC Department of Health and Environmental Control on March 16, 2015. This WQC is still considered valid. This document was prepared in partial compliance with one of the conditions of the WQC (i.e., "provide DHEC the opportunity to review additional beneficial use plans"). If DHEC has concerns with the proposed action, USACE will work with them to resolve these problems for the Final EA.

8.3 Wetlands

No Action Alternative: Under the no action alternative, land loss along Crab Bank and Shutes Folly would continue to occur and potentially cause all or most of the supratidal area to be inundated on high tides. This could reduce the amount of intertidal marsh in the area. The patchy wetlands would continue to experience temporal changes in size and structure composition as the erosion continues. This scenario would severely limit the ability for continued use of the island for nesting shorebirds as their nests would become inundated on high tides. Sea level rise rate increases would exacerbate these impacts and cause them to occur sooner.

Action Alternatives: Under the various action alternatives, material from the navigation channel would be placed on the islands. As stated in Section 5.8, roughly 1.9 acres of wetlands exist on Crab Bank. This number changes from year to year based upon movement and erosion of the island. Wetland protection is only anticipated for the marsh complex on the northwest portion of the island. This marsh is the only significant area of existing marsh habitat. The approximately 0.8 acre fragment of marsh on the northern end would be protected with temporary sediment containment measures during construction. The remainder of the patchy wetlands will be impacted by the placement of material during construction. As previously stated, these wetlands are patchy and sporadic in nature and the overall benefit of the project outweighs the loss of this sporadic vegetation. Avoidance of these pocket wetlands would create additional expenses and inefficiencies when constructing the project. These areas are not supporting significant nursery habitat. The total estimated acreage of small wetland impacts is approximately 1.1 acres. These patchy wetlands are not significant in the overall context of saltwater wetland habitat within Charleston Harbor. Additionally, enlarging the channel-facing beachfront of the island would allow for the potential natural recruitment of saltmarsh by protecting the back side of the island from overwash on

high tides. For Shutes Folly, the placement is not anticipated to have a significant impact on the approximately 12 acres of saltwater marsh on the west side of the island. Temporary sediment containment will be provided during the construction to prevent material from filling in the marsh. No wetlands on Morris Island will be impacted.

Both the Crab Bank and Shutes Folly options afford the opportunity for natural expansion of marsh habitat due to the increased volume of material placed on the island. Neither option would vegetate any areas; rather, natural vegetation would be allowed to occur. A more substantial island could allow for sediments to fall out behind the island and create new marsh over time.

8.4 Benthic Habitat

No Action Alternative: This alternative would result in no additional impacts to benthic habitat. Benthic community structure would change in areas of Crab Bank, Shutes Folly and Morris Island where erosion is likely to continue in the future. As these areas transition to subbottom habitat and are less exposed to intertidal variation the macroinvertebrate community will change.

Action Alternatives: The placement of the dredged material within the ecosystem would temporarily displace benthos; however, the area should repopulate rapidly. Impacts to benthos would occur through direct burial of the benthic habitat on all constructed portions of the islands. The disposal can adversely affect infauna, including both macro and micro benthic organisms by burying them or forcing motile organisms to migrate from the area. The area of burial is expected to be approximately 80, 27, and 64 acres for Crab Bank, Shutes Folly, and Morris Island, respectively. These impacts will be temporary in nature as repopulation will commence immediately after construction is completed. Recovery would be similar to beach projects and is expected within 6 months to one year. Species composition should be similar to that which existed prior to construction. These impacts are acceptable due to the long-term benefits of island enhancement outweighing the temporary burial impacts, and the fact that the proposed options are merely restoring the islands to a historical position.

Benthic impacts can also occur due to burial of benthic organisms in the area of the turbidity plume where sedimentation can occur. The effects of sedimentation on the benthos include smothering and decreased gas exchange, toxicity from exposure to anaerobic sediments, reduced light intensity, and physical abrasion (Wilber et al., 2005). Mobile species may be forced to leave; however, surrounding habitat is similar in nature and impacts will be minor and temporary. Benthic infauna can exhibit some ability for vertical migration activity following sediment placement (Bolam, 2011), although the degree of migration depends upon species and sediment type. Since sedimentation from the proposed beneficial use options would be dispersed across a broad area and no substantial depositional areas are anticipated, benthic impacts are anticipated to be minor.

8.5 Essential Fish Habitat

Impacts to EFH for the placement of material for these options could be to emergent wetlands, subbottom habitat, oyster reef, estuarine water column, and coastal inlets.

No Action Alternative: Essential Fish Habitat would immediately remain unaffected in its current state; however, as previously discussed, as Crab Bank and Shutes Folly continue to erode and migrate, there

could be less area that is intertidal and more area that is consistently submerged. This could reduce the amount of intertidal marsh in the area. The patchy wetlands on Crab Bank would continue to experience temporal changes in size and structure composition as the erosion continues. In the vicinity of Morris Island, minor changes to EFH related to sea level rise (SLR) and erosion would continue in the future.

Action Alternatives: Impacts to EFH for all projects consists of the reduction of shallow sub-bottom habitat, the loss of minimal amounts of saltwater wetlands, and the loss of a minimal amount of oyster reef habitat. As stated in Section 8.3, roughly 1.9 acres of wetlands exist on Crab Bank, and approximately 1.1 acres of those wetlands would be impacted by burial during the construction of the proposed beneficial use project. This acreage area changes from year to year based upon movement and erosion of the island. Wetland impacts to Shutes Folly and Morris Island are not anticipated.

Shallow subbottom habitat will be buried during the construction of the proposed options. The loss or burial of subbottom habitat is not significant because the harbor has a large amount of this habitat type and recovery is expected to occur quickly. Edge habitat surrounding the islands will increase due to a larger circumference of all islands.

As stated in the No Action Alternative section, without the proposed options, wetland losses and migration could continue to occur. Habitat loss on each of the islands has been substantial over the years (see Section 5.4). These options would increase their size to a previous condition and in the case of Crab Bank, it could allow for the natural establishment of wetlands on the north and east side of the island. Because the benefits of this project to the shorebirds are substantial compared to the loss of shallow water habitat and small patchy wetlands, no mitigation is being proposed, nor is any warranted. These options are being pursued as beneficial use alternatives to traditional disposal in the ODMDS.

Temporary increase in turbidity will be associated with the placement of material for the proposed beneficial use options. However, these impacts will not be significantly greater than those already anticipated to occur as a result of the dredging itself. The location of the plumes will, however, be different than the dredging operations within the channel. Turbidity affects different life stages of fishes. Colby and Hoss (2004) found that sediment concentrations affect estuarine fish foraging success differently for different species. The severity of turbidity effects tends to be greatest for early life stages and for adults of some highly sensitive species (Newcombe and Jenson 1996, Wilber and Clarke 2001). In fact, many fish thrive in turbid estuarine environments (Blaber and Blaber 1980 and Cyrus and Blaber 1992). This may be due to reduced risk of predation due to reduced visibility and potentially greater availability of prey due to recently removed substrate containing benthic organisms. Due to the relatively small scale of these options, the additional, temporary turbidity impacts are anticipated to be minimal. No managed species will be adversely affected by the proposed construction of beneficial use options and no long term adverse effects to any managed species are anticipated. USACE previously proposed a dredging window (no dredging from April 1 through September 30) to avoid potential impacts to spawning fish by avoiding dredging at two separate SCDNR fish spawning 'hotspots'. The first of these is at the mouth of the harbor (called the "Grillage") and the second is 1000' on either side of the Ravenel Bridge.

In the Mitigation, Monitoring and Adaptive Management Plan (Appendix P, USACE 2015) for the Post 45 Final IFR/EIS, USACE committed to refining the area of direct impacts to hardbottom habitat within the Entrance Channel. The data would be used to increase the resolution of the direct impact footprint and

better characterize the resources within the direct impacts area. The Final IFR/EIS indicated that an approximately 28.6 acres of hardbottom habitat could be impacted as a result of new dredging impacts within the Entrance Channel. This approximation was determined using best available data at that time. During the PED phase USACE issued two contracts to refine the area of hardbottom impacts. Dial Cordy and Associates performed the identification and characterization of hardbottom habitat within the anticipated direct impacts area (Appendix C). Based upon these results, USACE contracted with Geodynamics, LLC to perform additional side scan sonar and hardbottom analysis further seaward of the Dial Cordy survey area to ensure that all potential areas of hardbottom habitat were identified (Appendix H). USACE then merged the two datasets and found that approximately 32.7 acres of direct impacts to hardbottom habitat would occur as a result of the deepening of the channel (Figure 35).

USACE previously described the mitigation calculations and methods within Appendix I of the Final IFR/EIS (USACE, 2015). The mitigation calculations factored in both direct and indirect impacts. Indirect impacts were determined to be from turbidity related temporary disturbance to 186.3 acres of hardbottom within 75 m from the edge of the channel. Using the same parameters in a Habitat Equivalency Analysis (HEA) that were shown in Appendix I of the Final IFR/EIS (USACE, 2015), and updating the HEA with the refined impact acreage resulted in a required mitigation reef of 34 acres assuming a 3.5 year recovery time. If the recovery took up to 10 years, the required mitigation reef would need to be 36.4 acres (Appendix L). This is an increase from the predicted 29.8 acres to 32.5 acres from the IFR/EIS, for 3.5 years and 10 years of recovery, respectively.

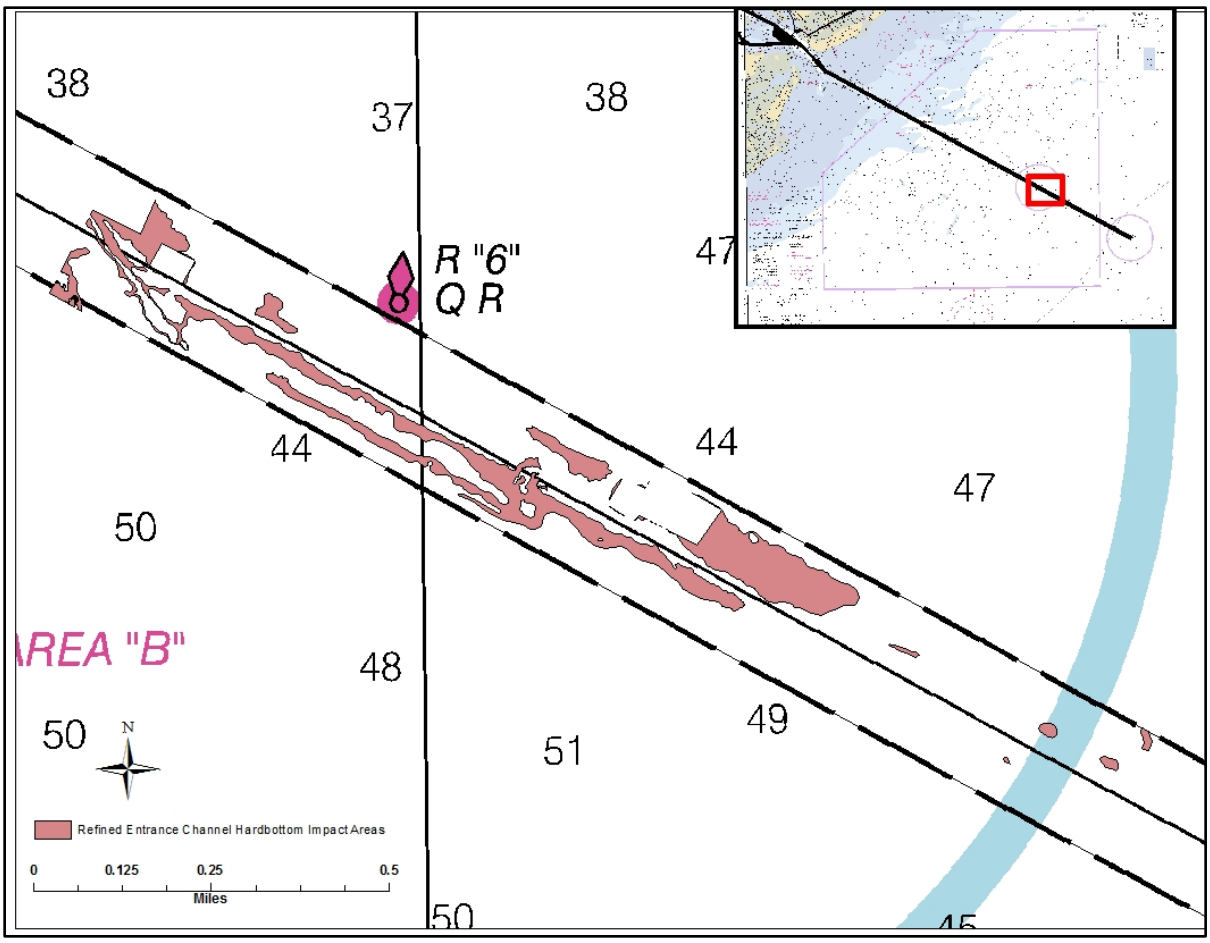


Figure 335. Location of new dredging hardbottom impacts within the Entrance Channel

8.6 Threatened and Endangered Species

No Action Alternative: The no action alternative would not have an impact on any T&E species.

Action Alternatives: All dredging related impacts have been previously addressed in the USACE 2014 Biological Assessment and the NMFS 2015 Biological Opinion (Final IFR/EIS, USACE 2015, Appendices F1 and F2). Therefore, this assessment will only address additional impacts from the construction of the proposed beneficial use options.

The impact producing factors associated with dredged material disposal include:

- Burial of habitat
- Increased turbidity and sedimentation
- Disturbance of sessile biota and finfish assemblages
- Modification of bathymetry and topography
- Potential change in benthic community structure

The following sections discuss the USACE decision-making for an effects determination for the relevant threatened and endangered species. Table 7 summarizes the potential effects on these listed species from the placement of material for these options.

Sea Turtles:

(1) **Habitat.** Located within Charleston Harbor, the proposed options will not affect nesting beaches or nearshore habitats for sea turtles. Morris Island is infrequently used by nesting sea turtles and the addition of sand to the island will only serve to increase the footprint of suitable habitat. Turtles utilizing the inshore waters of Charleston Harbor will be able to find suitable habitat for feeding and will not be impacted by the proposed beneficial use options. Loggerhead sea turtles may infrequently use Morris Island for nesting. Since the proposed options will not occur within designated loggerhead critical habitat, there will be no effect on critical habitat.

(2) **Food Supply.** As previously discussed, the principal food sources of these species are crustaceans, mollusks, other invertebrates, fish, and plant material. Construction activities at the proposed beneficial use sites (Morris Island, Shutes Folly, and Crab Bank) have the potential for a temporary and minor impact on food availability by burying and altering the benthic habitat and creating temporary increases in turbidity. The effect of increased turbidity on sea turtles is expected to be minimal due to the short duration of the reduced water clarity. The effects of burial on benthic infauna are considered minor because it is anticipated that the recovery time for benthic epifauna and infauna will be relatively quick. In a study on the effects of dredging and open-water disposal on benthic macroinvertebrates in SC, Van Dolah et al., (1984) found that the detrimental effects on the benthic macrofauna were minimal. They attributed the minimal impacts to strong currents dispersing sediments, surface disposal, and disposal during a period of time with low faunal recruitment. The disposal operations at Crab Bank and Shutes Folly are anticipated to similarly have no detrimental effect on the community structure and any higher trophic affects.

(3) **Life Period**. The proposed options will have no effect on the life period of any sea turtles.

(4) **Effect Determination**. None of the options will adversely affect sea turtle nesting nor their ability to access beach nesting habitat. Sea turtles do not utilize Crab Bank or Shutes Folly and nesting is very uncommon on Morris Island. Each of the last 2 years has seen only four nests along all of Morris Island (seaturtle.org). Because of this, USACE has determined that the proposed beneficial use options at Crab Bank and Shutes Folly will have no effect on either the loggerhead, Kemp's ridley, green, or leatherback sea turtles. The Morris Island placement may affect, but is not likely to adversely affect, loggerhead sea turtles, and it will have no effect on the green, Kemp's ridley, or leatherback sea turtles. Additionally, the proposed beneficial use options will have no effect on loggerhead Critical Habitat since none of the primary constituent elements will be significantly altered.

Marine Mammals:

(1) **Habitat.** Located within Charleston Harbor, the proposed options at Crab Bank, Shutes Folly, and Morris Island will not affect habitats for any species of marine mammals. Right whales rarely come near the coast or within the harbor near the proposed beneficial sites. Given their coastal habits and their pattern of distribution and migration, humpback whales are not likely to be in the vicinity of the proposed beneficial use option areas during their migration to and from the Caribbean, and a few may winter in or near the area. None of the options will affect any of the primary constituent elements for the right whale critical habitat. Manatees are frequent visitors to Charleston Harbor,

but their habitat will not be altered by the proposed beneficial use options.

(2) **Food Supply.** The proposed beneficial use options involve the disposal of predominantly sandy material on harbor islands (Crab Bank and Shutes Folly) and along an eroding beach front (Morris Island). The options would have no effect on the food supply for the humpback and right whale, nor the manatee. The productivity of the nearshore ocean will not be diminished by the proposed options.

(3) **Life Period.** The occurrence of these species is usually associated with migrations. The NMFS indicates that the areas off South Carolina are increasingly utilized as calving grounds (Federal Register 81:17, 1/27/2016). Since the proposed action does not alter any of the primary constituent elements (PCE's) for right whale critical habitat it will have no effect on critical habitat, nor the ability of the right whale or humpback whale to travel through the region. While the projects may affect manatees through operation of waterborne construction equipment, it is not likely to adversely affect them because USFWS standard manatee conditions will be used for the construction to minimize and avoid impacts to this species.

(4) **Effect Determination.** It is the determination of USACE that the proposed beneficial use projects will have no effect on the right whale or humpback whale. Additionally, the proposed options will not adversely modify right whale critical habitat. The proposed beneficial use options may affect, but are not likely to adversely affect, the manatee with the implementation of the USFWS standard manatee conditions.

Fish – Shortnose and Atlantic Sturgeon:

(1) **Habitat.** Located within Charleston Harbor, the proposed options will not significantly affect habitats for either the shortnose or Atlantic sturgeon. These fish are highly mobile and will likely swim to another area of the harbor during the construction process. Extensive studies have been done on the behavioral responses of fish to increased turbidity. These studies measured reactions such as cough reflexes, swimming activity, gill flaring, and territoriality that may lead to physiological stress and mortality; however, specific studies on sturgeon responses are limited, and the effects here will be very short-term. The effects of suspended sediment on fish should be viewed as a function of concentration and exposure duration (Wilber and Clarke, 2001). The behavioral responses of adult salmonids for suspended sediment dosages under dredging-related conditions include altered swimming behavior, with fish either attracted to or avoiding plumes of turbid water (Newcombe and Jensen, 1996). Water quality impacts to sturgeon as a result of proposed activities are expected to be temporary, with suspended particles settling out within a short time frame or moved out of the area due to tidal influences. These sediment disturbance impacts are expected to be minimal in nature and are not expected to have a measurable effect on water quality beyond the frequent natural increases in sediment load from storm activity. If constructed, there would be no long term impacts to sturgeon habitat in Charleston Harbor as a result of these beneficial use options. The options are not significantly altering the islands and are merely restoring the islands back to a previous historical position. The proposed listing of Critical Habitat for the Atlantic sturgeon includes waters of Charleston Harbor; however, since the options are just outside the designated area, there will be no effect on Atlantic Sturgeon critical habitat.

(2) **Food Supply.** The proposed beneficial use options involve the disposal of predominantly sandy material. Impacts to food supply would be similar to those discussed above under Sea Turtles. The productivity of the area will not be diminished by the proposed dredging.

(3) **Life Period.** Atlantic and shortnose sturgeon are both anadromous fish species; however, their habitat ranges, as a component of their migration cycle, are slightly different. Atlantic sturgeon spawn in freshwater but primarily lead a marine existence; whereas, shortnose sturgeon spawn at or above head-of-tide in most rivers and rarely occur in the marine environment aside from seasonal migrations to estuarine waters. However, recent research by SCDNR indicates that interbasin and interstate movements do occur for shortnose sturgeon. Both species are likely to travel by or spend time near the project area. In the Cape Fear River, NC, Moser and Ross (1995) observed that shortnose sturgeon appeared to be most active in the night and early morning and, when migrating, they stayed mid-channel, in the upper to middle portion of the water column. During the daytime shortnose sturgeon preferred deep holes. Since spawning occurs upstream of the construction operations, impacts to eggs and larvae are not expected. However, spawning migration pathways may occur within the vicinity of proposed beneficial use options. Specific migratory pathways of significance within the action area are not known, although ongoing SCDNR studies are indicating heavy usage of Charleston Harbor for both species of sturgeon (Bill Post, Unpublished data). However, the proposed options will not significantly alter their ability to migrate to and from spawning grounds or to utilize habitat in their range.

(4) **Effect Determination.** It is the determination of USACE that while the proposed beneficial use options may affect Atlantic and shortnose sturgeon based on a temporary disturbance during construction, the beneficial use options are not likely to adversely affect them. Additionally, the proposed options will have no effect on the proposed Critical Habitat for the Atlantic Sturgeon.

Birds:

(1) **Habitat.** Located within Charleston Harbor, the proposed options will not significantly affect habitats for either the red knot or the piping plover. Discussions with USFWS indicate that the red knot and piping plover do not use Crab Bank or Shutes Folly. There is a greater potential for both of those shorebirds to utilize the north end of Morris Island, although documented sightings are rare. Wood storks form large colonies in shallow waterbodies containing inundated vegetation or man-made platforms. Wood storks have been sighted in the Charleston Harbor vicinity, but these islands are not commonly used by wood storks. There is no established critical habitat within the option areas for any of the bird species.

(2) **Food Supply.** Piping plovers feed along sandy shorelines digging for small macroinvertebrates. They display a characteristic “foot trembling” scratch to bring their prey to the surface. Red knots are migratory shorebirds stopping along the Carolina coast to feed along sandy shorelines and mud flats. One important food source along the eastern Atlantic is horseshoe crab eggs. Wood storks forage for small fish in estuarine rivers or impoundments in South Carolina. They use tactile feeding techniques, foraging in shallow water and snapping their bills closed as soon as contact with prey is made. Within the area wood storks have been observed foraging but not nesting (Personal Communication, Morgan Wolf, USFWS- Charleston ES office, 28 Oct 2013).

(3) **Life Period.** While the lifespan of the piping plover is unknown, mating in the Atlantic Coast

populations is known to occur in the spring from Canada to North Carolina with occasional nesting recorded in South Carolina. Red knots are a long lived species but exact lifespan remains unknown. One bird was documented to be 20 years old or more (http://www.fws.gov/northeast/redknot/pdf/Redknot_BWfactsheet092013.pdf). Red knots breed in northern Canada and Alaska in the summer and typically have 4 eggs to a nest. Red knots are territorial during breeding and gather in huge numbers to nest and then migrate in the winter. Migration routes take birds through South Carolina in the spring/fall on their way to their final wintering grounds in southern Argentina. Wood storks typically reproduce at age 4 and fledge 2 to 3 chicks per nest. The storks are monogamous and raise offspring together. Their lifespan is between 11 and 15 years old (http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B06O).

(4) **Effect Determination.** Based upon the information provided above, the proposed beneficial use options at Crab Bank and Shutes Folly will have no effect on the piping plover, red knot, or wood stork. The beneficial use options may affect, but is not likely to adversely affect the piping plover and red knot on Morris Island due to a higher likelihood of presence. The Morris Island option will have no effect on the wood stork.

Table 7. Summary of Effect Determination by Species

Listed Species	Effect Determination	Summary
West Indian Manatee	May affect, not likely to adversely affect	Temporary habitat disturbance

North Atlantic Right Whale	No effect; No effect on Critical Habitat	Rarely present in action area
Humpback Whale	No effect	Rarely present in action area
Piping Plover	No effect; May affect, not likely to adversely affect for Morris Island; No effect on Critical Habitat	Not present at Crab and Shutes; Temporary beach disturbance at Morris Island
Rufa Red Knot	No effect; May affect, not likely to adversely affect for Morris Island	Not present at Crab and Shutes; Temporary beach disturbance at Morris Island
Wood Stork	No effect	Not likely to utilize habitat
Atlantic Sturgeon	May affect, not likely to adversely affect; No effect on Critical Habitat	Disturbance of foraging habitat
Shortnose Sturgeon	May affect, not likely to adversely affect	Disturbance of foraging habitat
Loggerhead Sea Turtle	No effect; May affect, not likely to adversely affect for Morris Island; No effect on Critical Habitat	Unlikely to utilize the action area
Kemp's Ridley Sea Turtle	No effect	Unlikely to utilize the action area
Leatherback Sea Turtle	No effect	Unlikely to utilize the action area
Green Sea Turtle	No effect	Unlikely to utilize the action area

8.7 Avian Habitat

Various shorebirds and seabirds birds utilize areas in the general vicinity of the beneficial use options. The immediate project area at Crab Bank contains minimal area of suitable nesting habitat for shorebirds. However, this habitat has been documented by SCDNR as supporting significant shorebird nesting habitat for the State.

No Action Alternative: This alternative would result in diminishing habitat for shorebirds over time as the islands slowly continue to erode.

Action Alternatives: It is anticipated that the proposed activities will in the long run provide up to approximately 80 acres at Crab Bank and approximately 27 acres at Shutes Folly of additional habitat that can be used by these birds and minimize competition on the island and decreasing chance of disease. The USACE Savannah District created a dredged material island (called Thompkins Island) at the mouth of the Savannah River is the early 2000s. It was noted that gulls and pelicans began to use the site immediately as deposited sands became emergent from the water surface. The District also noted that the construction equipment only displaced birds from the immediate construction area and not from the entire island. Costa (2004) indicated that local birders estimated that in mid-summer in the middle of construction of the island that about 2,000 birds of various types, including migrating birds, were found on the island. Thompkins Island is now part of the SCDNR Heritage Trust Program, which recognizes the site for the valuable habitat it provides. Due to these factors, it is anticipated that the action alternatives will have a long term positive impacts on bird usage in the area, even if some temporary displacement occurs during the construction.

8.8 Coastal Barrier Resources

No Action Alternative: This alternative would result in no additional impacts on the Morris Island Unit; however, without a beneficial use project, erosion will continue to occur. Continued erosion could cause additional loss of dune habitat and the amount of dry beach habitat on the island.

Action Alternatives: The USFWS was consulted with on the beneficial use alternatives and they indicated that the USFWS Regional Office confirmed that dredged material placement behind the south jetty of Morris Island is an allowable action within the CBRA zone and is not prohibited (Mark Caldwell, email dated July 21, 2016). The proposed project at Morris Island would have a beneficial effect on the island by providing for additional sediment placement in an area that is experiencing erosion. This placement introduces new material to the littoral system and could temporarily minimize the habitat loss along this portion of the island.

8.9 Cultural and Historic Resources

Cultural and historic resources were considered during the project planning. Coordination has been ongoing with the South Carolina Department of Archives and History and the State Underwater Archaeologist at the South Carolina Institute for Anthropology and Archaeology pertaining to any known anomalies that would have to be avoided for any of the beneficial use alternatives.

No Action Alternative: This alternative will not result in additional impacts to any historic properties. Erosion of Shutes Folly will continue to cause a concern for Castle Pinckney on the south end of the island. An existing breakwater provides protection; however harbor islands are constantly in a state of flux and the erosion that has been occurring on the eastern flank will likely continue in the future.

Action Alternatives: Battery Wagner was a concern to the SHPO and the SCIAA due to its assumed location near the terminus of the south jetty on Morris Island. SCIAA performed magnetometer work in certain nearby areas to try to identify any portions of the historic fort. While the exact boundaries are still unknown, SCIAA provided USACE a map detailing avoidance areas due to potential anomalies. The construction contractor will be provided this information within the plans and specifications as avoidance areas. USACE will require the construction contractors to be aware that the potential for finding cultural resources in this area still exists. In addition, SCIAA requested that an archaeologist monitor the construction site when operating within 100 yards on either side of the jetty due to the potential for the undertaking to encounter remains of Battery Wagner. If during the course of work, cultural resources are uncovered, work will cease immediately and the Charleston District will coordinate with SHPO and SCIAA before additional work is performed. Additionally, placement operations will have no impact on any historic structures on Crab Bank or Shutes Folly. Prior to construction, an archaeologist will perform a pedestrian survey of the intertidal zone at Shutes Folly due to the potential for encountering historic resources and/or human remains. At Crab Bank, a preconstruction side scan sonar and magnetometer survey will be performed on the main channel (southwest) side of Crab Bank. The survey will cover the extent of the construction footprint. Results will be shared with SHPO and SCIAA.

Regarding the proposed construction of eight artificial reefs (Final IFR/EIS, USACE, 2015), USACE performed a background investigation and a remote sensing survey in consultation with the South Carolina Department of Archives and History and the South Carolina Institute for Archaeology and

Anthropology (SCIAA) (Appendix E). Two survey zones were evaluated and consisted of side scan sonar, subbottom profiling, and magnetomer surveys (Figure 36). A total of 144 magnetic anomalies and 25 sidescan sonar contacts were recorded within the APE. A total of 104 anomalies and 16 sonar targets were recorded in Mitigation North, and 40 anomalies and seven sonar targets were recorded in Mitigation South. Analysis of the data indicates a lack of anomalies or sonar targets that can be considered potentially significant. Furthermore, a review of the subbottom data did not detect any buried paleofeatures that would have the potential to contain submerged prehistoric sites in Mitigation South. The single paleofeature recorded in Mitigation North is buried approximately 10 feet deep and will not be affected. On August 17, 2016, the SHPO conditionally concurred that no additional survey work is necessary and that, with a 100-foot buffer around the cluster of magnetic anomalies (M18, 19, 22, 23, 57, and 24) and the acoustic anomaly (C008), no historic properties will be affected (see Appendix E).

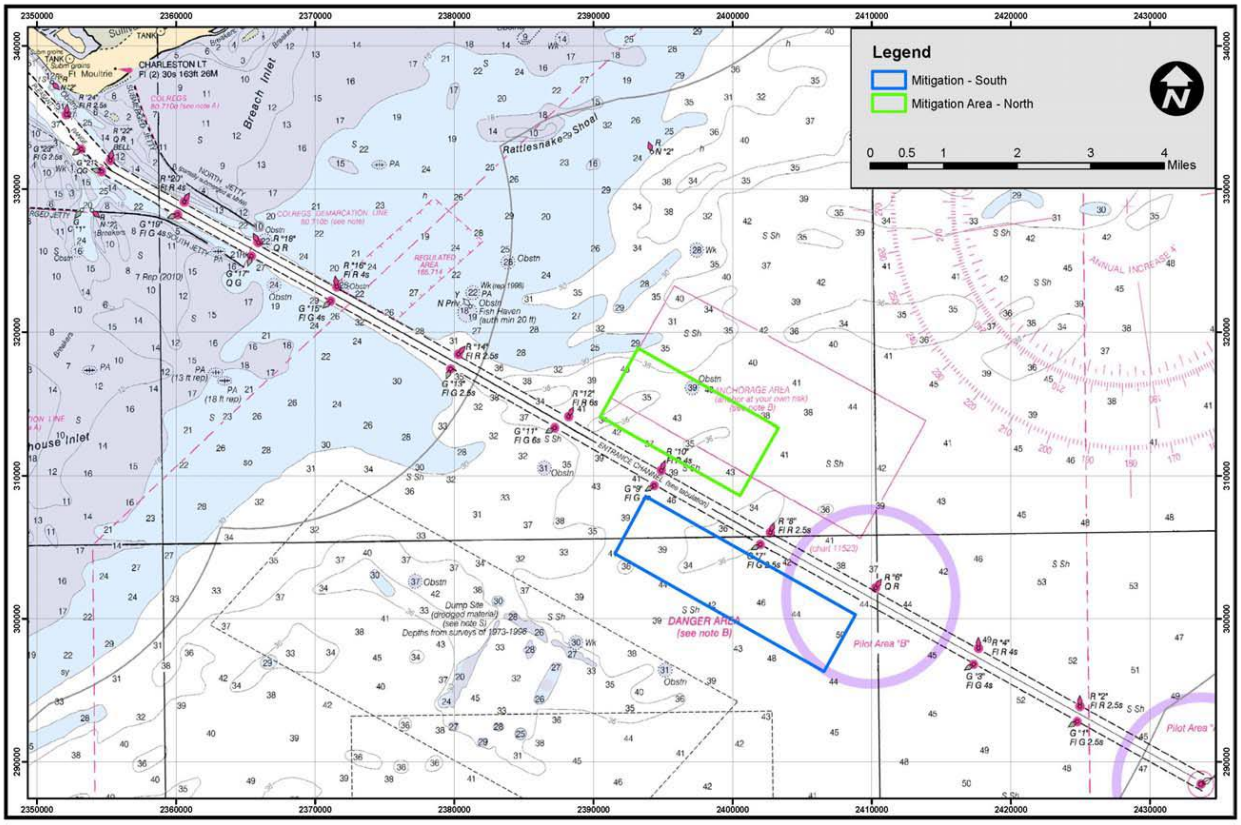


Figure 346. Location of North and South Mitigation Survey Areas

8.10 Aesthetics and Recreation

No Action Alternative: Minor impacts to aesthetics and recreation would be anticipated under this scenario. Presently, multiple companies offer ecotours to Crab Bank for recreation and for bird watching. As the island continues to erode, opportunities for recreation will decrease. Additionally, the Coastal Conservation League and the Nature Conservancy have recently installed a bird video camera on Crab Bank called the "pelicam". This camera could be compromised over time under the no action alternative scenario if erosion and migration of the island continues to occur. Shutes Folly and Morris Island also

receive recreational activity. Many people fish in the surrounding areas.

Action Alternatives: Aesthetics would be reduced in the project area during construction, due to the physical presence of the heavy equipment used in the construction process. However, these impacts would be temporary and insignificant. Once the construction is complete, the aesthetic values provided by the restored habitats would have many beneficial impacts. Presently, Crab Bank is barely visible on spring high tides. Since the island has been migrating and eroding over the years, this trend would continue without the project. Depositing of material at Crab Bank would make it a more prominent feature in the lower harbor. Crab Bank is a major tourist attraction and fishing area. Multiple companies offer waterborne tours of Crab Bank originating from Shem Creek. A more prominent island will be a benefit to these companies and will provide more opportunity outside of bird nesting season for people to utilize the island. Shellfish harvesting will not be impacted because it is restricted within Charleston Harbor.

8.11 Socioeconomics

No Action Alternative: This alternative will not create disproportionately high and adverse human health or environmental impacts on any minority or low income populations.

Action Alternatives: All of the dredging related aspects have been previously addressed in the Post 45 Final IFR/EIS. These proposed beneficial use options are not designed to create a benefit for any group or individual, but rather benefits on a nationwide basis. The proposed beneficial use of dredged material options occur relatively far from any areas of significant populations. There are no indications that the proposed activities would be contrary to the goals of E.O. 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, or would create disproportionately high and adverse human health or environmental impacts on minority or low income populations of the surrounding community.

8.12 Air Quality

The impacts to regional air quality are described within the Final IFR/EIS.

No Action Alternative: This alternative would not result in additional adverse impacts to air quality.

Action Alternatives: The proposed beneficial use options would result in in some minor, short term air quality impacts. Emissions are expected to occur and would result from the operation of the dredge, construction equipment, and any other support equipment, which may be on or adjacent to the job site. The Final IFR/EIS evaluated the emissions from the Post 45 Project. The only additional emissions would come from the temporary use of shore-based equipment such as bulldozers and front end loaders. An additional pump out station may also be used depending on the dredging method. The proposed beneficial use options would have negligible additional air quality impacts as the additional equipment used for construction would be offset by the reduction in travel distance for dredge material disposal. The project area is currently in attainment with National Ambient Air Quality Standards parameters. The proposed action would not affect the attainment status of the project area or region.

8.13 Noise.

No Action Alternative: This alternative would not result in additional adverse impacts to surrounding noise levels.

Action Alternatives: The impacts from noise to the human environment and wildlife are described within the Final IFR/EIS and are incorporated here by reference. Noise from the additional construction equipment, and other associated support equipment would be evident in the project area. While this noise would be evident to workers, immediate residences, and passersby in proximity of the project, it would be short-term and insignificant.

8.14 Hazardous, Toxic, and Radioactive Waste (HTRW)

No HTRW concerns are anticipated for the proposed beneficial use options. The dredged material will be the same as described in the Final IFR/EIS (USACE, 2015) and associated appendices, as well as in Section 5.6 above.

8.15 Protection of Children.

On April 21, 1997, the President issued Executive Order (EO) 13045*, Protection of Children from Environmental Health and Safety Risks*. To the extent permitted by law and appropriate, and consistent with the federal agencies' mission, the Corps of Engineers shall make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children; and shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks. Neither the No Action nor the Action alternatives pose disproportionate environmental health risks or safety risks to children in the vicinity of the project.

8.16 Cumulative Impacts

The National Environmental Policy Act (NEPA), as implemented by Council on Environmental Quality (CEQ) regulations (40 CFR §§ 1500 -1508) requires federal agencies, including the USACE, to consider cumulative impacts in rendering a decision on a federal action under its jurisdiction. According to 40 CFR § 1508.7, a *cumulative impact* is the impact on the environment that results from the incremental impact of the proposed beneficial use options when added to other past, present, and reasonably foreseeable future actions regardless of the agency (federal or non-federal) or person that undertakes such other actions; cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Many wetlands within Charleston Harbor and other important habitats have been and continue to be lost or eroded. Much of this loss is due to the cumulative impacts of associated with sea level rise and wave/wake/current action associated with an estuarine environment in a developed area, and many of these impacts are not directly recoverable. The proposed beneficial use options could result in improvements in environmental quality to minimize these losses. The options provide the opportunity to establish such benefits towards improving environmental quality and minimizing the loss of these important resources.

As a result of the implementation of any or all of the proposed beneficial use options there will be a minor temporary cumulative impact on water quality, benthic habitat, and EFH; however, all these impacts are temporary and minor. The cumulative impacts from the beneficial use options would be different than if the material were disposed of in a conventional manner (in this case, the alternative for disposal would mean loss of capacity at the ODMDS). However, this cumulative impact is only a short term affect and will recover quickly after completion of the beneficial use options. No long term impacts to these resources of concern are anticipated. Regulations require the dredged material to be disposed of such that all suspended and dissolved portions after dilution meet all applicable water quality criteria [40 CFR 227.13(c)(2)(i)] and do not cause any adverse biological effects [40 CFR 227.27(b)]. The goal of these requirements is to eliminate any adverse effects associated with individual contaminants or any synergistic effects of multiple contaminants present in the dredged material. Consequently, the proposed action is not expected to contribute significantly to the cumulative impacts of regional activities on water quality.

The options will not induce development on any of the islands. The options could result in more research efforts to monitor bird activity on the island and could result in increased recreational visitation. Additionally, if either the Crab Bank or Shutes Folly options are constructed, there is a potential to use future maintenance material for beneficial creation or enhancement of saltmarsh associated with those islands. This concept could be evaluated separately through a Section 204 Continuing Authorities Program study.

Based on the positive environmental benefits of the proposed options and the temporary and minor nature of the cumulative impacts, it has been determined that no significant cumulative impacts would occur.

8.17 Climate Change and Air Quality

Section 6.21 of the Final IFR/EIS includes a brief discussion of EO 13653, "Preparing the United States for the Impacts of Climate Change," and references the more detailed discussion in Appendix A to the IFR/EIS which was conducted consistent with ETL 1100-2-1 and the USACE Responses to Climate Change (RCC) Program. Using the USACE Institute of Water Resources (IWR) online Sea-Level Rise calculator and spreadsheet (ER 1110-2-8162), the historical trend at Charleston is estimated to be 2.94 mm (0.12 inches)/yr. The ER was also used to determine various rates of sea level change under different scenarios (low, intermediate, and high) and could result in 0.57 ft of sea level rise over 50 years. The analysis indicated that sea level rise would increase over 50 years 0.57 ft in the low scenario (based on the historical rate), 1.08 feet in the intermediate scenario, and 2.74 feet in the high scenario. Based on these scenarios, it is even more important to implement the proposed beneficial use actions, as keeping sand within the harbor or nearshore littoral system is preferable to placing the material in an ODMDS. In addition to the fisheries development and enhancement provided by the Artifical Reefs and ODMDS Berm, the proposed beneficial placements in Charleston Harbor will decrease vulnerability and increase resilience to sea level rise. Implementation of one or more of the proposed beneficial use options will not appreciably change the overall Greenhouse Gas (GHG) emissions for the Post 45 Project. An Air Emission Inventory is contained within the Final IFR/EIS for the Post 45 Project. The addition of shore based

equipment such as bulldozers and front end loaders will not substantially alter the findings of the Air Emission Inventory or increase GHG emissions for the Project."

8.18 Irreversible and Irretrievable Commitment of Resources.

NEPA (42 U.S.C. § 4332 Section 102(2)(C)(v) as implemented by CEQ regulation 40 CFR 1502.16) requires an analysis of significant, irreversible effects resulting from implementation of a proposed action. An irreversible commitment of resources is one in which the ability to use and/or enjoy the resource is lost forever. An irretrievable commitment of resources is one in which, due to decisions to manage the resource for another purpose, opportunities to use or enjoy the resources as they presently exist are lost for a period of time. The commitment of resources refers primarily to the use of nonrenewable resources such as fossil fuels, water, labor, and electricity. It may also refer to natural resources.

The construction of any or all of the proposed beneficial use options indirectly requires:

- An irreversible commitment of energy and resources used to transport and dispose of material at the site;
- An irreversible commitment related to economic costs associated with monitoring activities;
- An irreversible commitment related to human labor resources associated with these beneficial use options.

Energy (electricity and natural gas) and water consumption, as well as demand for services, would not increase significantly as a result of implementation of the proposed action. The commitment of these resources does not present any significant impacts.

The proposed beneficial use options would, if constructed, represent an improvement over the No-Action alternative from the standpoint of reducing the irretrievable commitment of resources. Dredged material would be put to a positive use of value to the environment rather than being simply disposed of and taking up disposal capacity.

9.0 Environmental Compliance

NEPA requires that all Federal agencies use a systematic, interdisciplinary approach to protect the human environment. This approach promotes the integrated use of natural and social sciences in planning and decision-making that could have an impact on the environment. NEPA requires the preparation of an environmental impact statement (EIS) for any major Federal action that could have a significant impact on quality of the human environment. Since the proposed beneficial use options, if constructed, will not significantly affect human health or the environment, supplementation of the Final IFR/EIS is not warranted. Upon completion of the Final Supplemental EA, the project will be in full compliance with the NEPA.

9.1 Clean Water Act

The USACE has obtained a water quality certification from the State of South Carolina pursuant to the Clean Water Act (CWA) for the discharge of dredged or fill material into navigable waters by the proposed activity. All state water quality standards would be met. In conjunction with the Final IFR/EIS, this Final

Supplemental EA contains sufficient information to demonstrate that the proposed options are in compliance with the CWA. A joint public notice was filed for the release of the Draft IFR/EIS and the 401 certification. On 16 March 2015, SCDHEC issued a certification in accordance with Section 401 of the CWA, with conditions pursuant to R. 19-450 et. seq., 1976. The conditions of the 401 can be found within the Final IFR/EIS and the USACE is committed to adhering to all conditions of the Certification. One of the conditions was that, "The final plans for beneficial uses of the dredged spoil material shall be provided to the DHEC for final approval prior to finalizing the Pre-construction Engineering and Design or PED." This document serves to satisfy that requirement. After review of the Draft Supplemental EA, SCDHEC had no additional comments on the project (Email dated 28 November 2016).

9.2 Wetlands

CWA Section 404 and implementing USACE regulations at 33 C.F.R. 336(c) (4) and 33 C.F.R. 320.4(b) require the USACE to avoid, minimize, and mitigate impacts to wetlands. The proposed beneficial use alternatives have been evaluated using the CWA Section 404(b)(1) Guidelines and found to be in compliance with the requirements of these guidelines (Appendix J).

9.3 Coastal Zone Management Act (CZMA)

In accordance with the CZMA, it was been determined that the proposed deepening of the Federal navigation channel would be carried out in a manner that is fully consistent with the enforceable policies of the SC CMP. With conditions, the SCDHEC – concurred with the USACE consistency determination for the Final IFR/EIS on 8 December 2014. One of the conditions was that, "The final plans for beneficial uses of the dredged spoil material shall be provided to the Department for final approval." This document serves to satisfy that requirement. After review of the Draft Supplemental EA, SCDHEC had no additional comments on the project (Email dated 28 November 2016).

9.4 Clean Air Act (CAA)

The proposed beneficial use options are in compliance with the CAA. All air emissions resulting from the proposed action would be temporary and minor. No long term changes would occur to air quality in the region as a result of any of the proposed options. The study area is in an attainment area for all air quality criteria and the proposed option will not cause the study area to go out of attainment. The SCDHEC – Bureau of Air Quality offered strategies to benefit air quality during construction, including utilizing alternatively fueled equipment, utilizing emission controls applicable to equipment, reducing idling time on equipment, minimizing fugitive dust emissions through good operating practices.

9.5 US Fish and Wildlife Coordination Act

This project is in compliance with this Act. The project has been coordinated with the US Fish and Wildlife Service and other State and Federal natural resource agencies. Input from the USFWS, including any conservation recommendations under Section 2(b) of this Act, will be considered and incorporated into the Final EA and project plans as they are developed.

9.6 Endangered Species Act

The ESA protects threatened and endangered species by prohibiting federal actions that would jeopardize the continued existence of such species or that would result in the destruction or adverse modification of any critical habitat of such species. ESA Section 7 (Interagency Cooperation) requires that consultation regarding conservation of such species be conducted with USFWS and/or NMFS prior to project implementation. Integrated within this Final Supplemental EA, the USACE has evaluated potential impacts of the proposed beneficial use options on threatened and endangered species and associated critical habitat. USFWS and NMFS are asked to certify or concur with the USACE findings that the proposed activity will have no effect or will not adversely affect endangered or threatened species.

9.7 Marine Protection Research and Sanctuaries Act (MPRSA)

The transportation of dredged material for the purpose of dumping (or disposal) into ocean waters is regulated by Section 103 of the Marine, Protection, Research and Sanctuaries Act (MPRSA) of 1972, as amended. EPA promulgated implementing regulations in 40 CFR Subchapter H - Ocean Dumping (Parts 220-228). Section 103 does not govern the proposed beneficial uses of dredged material. The Crab Bank Enhancement, the Shutes Folly Enhancement, and the Morris Island Beach Placement would all occur within Charleston Harbor and outside of the ocean waters subject to the MPRSA. The SCDNR Nearshore Reef Placement would occur within the Territorial Sea, and is regulated pursuant to Section 404 of the CWA (33 USC 1344) and the 404(b)(1) Guidelines (40 CFR 230.2; Beneficial Use Planning Manual, EPA/USACE, Oct. 2007). The Artificial Reefs include fisheries development as a sole or a primary purpose. EPA regulations exclude the "placement or deposit of ... materials for the purpose of developing, maintaining, or harvesting fisheries resources; provided such placement is regulated under or is a part of an authorized State or Federal program ..." (40 CFR 220.1(c)(2)). The placement of dredged material for the reefs will be regulated under Section 10 of the Rivers and Harbors Act of 1899 and the National Fishing Enhancement Act of 1984. Therefore, evaluation under Section 103 of MPRSA is not required."

9.7 Magnuson-Stevens Fishery Conservation and Management Act (MSA)

This Act requires federal action agencies to consult with the National Marine Fisheries Service (NMFS) if a proposed action may affect Essential Fish Habitat (EFH). Incorporated into this Final Supplemental EA, the USACE evaluated potential project impacts on NMFS-managed fish species and their Essential Fish Habitats. Impacts would occur to the water column, shallow sub-bottom habitat, wetlands, and oyster reefs. These impacts are temporary and minor considering the positive environmental benefits associated with any or all of the options. Concurrent with this EA, USACE is requesting conservation recommendations, if any, from NMFS pursuant to the Magnuson-Stevens Act.

9.8 Anadromous Fish Conservation Act

All beneficial use options under consideration within this Supplemental EA are in compliance with this Act. USACE considered habitat impacts specifically to sturgeon species. Mitigation would not be required for the minor adverse effects on these species due to temporary turbidity increases affecting water quality. No long term impacts are anticipated.

9.9 Marine Mammal Protection Act (MMPA)

The MMPA prohibits the take of marine mammals including the West Indian manatee, North Atlantic right whale, and humpback whale. Protective measures for marine mammals would be implemented. The project is being coordinated with USFWS and NMFS. The project is in compliance with this Act and no incidental harassment would occur with the implementation of USFWS standard manatee conditions. NMFS and USFWS are asked to concur with the USACE findings that the proposed activity will have no effect or will not adversely affect endangered or threatened marine mammal species.

9.10 National Historic Preservation Act (NHPA)

The USACE evaluated the potential for adverse impacts to archaeological or historic resources within an Area of Potential Effects (APE). For the artificial reef siting, two anomalies will be avoided with a 100 foot buffer around anomalies C008 and M18, 19, 22, 23, 57, 24, and around a feature marked, "terrace" within Appendix D. The SC Institute for Archaeology and Anthropology (SCIAA) also provided avoidance areas for pipelines for beach placement on Morris Island if constructed. These avoidance areas will be incorporated in future plans and specifications. USACE has determined that the proposed beneficial use options would have no effect on historic properties, and the SHPO concurred with this determination on December 13, 2016.

9.11 Executive Order 11990, Protection of Wetlands

This EO directs all Federal agencies to minimize the destruction, loss, or degradation of wetlands; and preserve and enhance the natural beneficial values of wetlands in the conduct of the agency's responsibilities. Direct wetland impacts resulting from the disturbance and burial of small patchy wetlands on Crab Bank would occur as a result of this option. USACE has planned to avoid the most significant area of marsh in the northwestern area of Crab Bank. The positive impacts of this option outweigh the loss of the insignificant patchy wetlands and no mitigation is proposed. It is anticipated that the proposed option at Crab Bank could allow for the natural recruitment of saltmarsh species on the northern (Mt. Pleasant) side of the island. No other wetland impacts are anticipated

9.12 Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations

In accordance with this EO, the USACE has determined that no group of people would bear a disproportionately high share of adverse environmental consequences resulting from the proposed beneficial use options.

9.13 Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks

This EO ensures that all Federal actions address the unique vulnerabilities of children. In accordance with this EO, the USACE has determined that no children would bear a disproportionately high share of adverse environmental consequences resulting from the proposed work.

9.14 Migratory Bird Treaty Act; Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

This Act makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations. The USACE does not anticipate that migratory birds would be adversely (directly or indirectly) affected by the proposed action. The proposed beneficial use options could create expanded habitat to support seabird and migratory bird nesting as well as other habitat usage. USACE has proposed to avoid construction during the nesting season between March 15 and October 15 in the northwestern portion of Crab Bank where seabird nesting is currently concentrated.

10.0 Monitoring

USACE has already conducted pre-disposal surveys of the potential beneficial use sites to determine the topography of the islands and the bathymetry of the aquatic area and surroundings. Additional surveys of the benthic community and sediment composition have also been completed. These data will used as a baseline for comparisons of future monitoring information. Following dredging activities, USACE will conduct surveys to evaluate and document the final constructed footprint of the island. It is anticipated that the island will continue to be susceptible to environmental variables that affect sediment transport, erosion and movement of the island. Due to the public and agency interest in these beneficial use options, USACE will work with SCDNR and other agencies and organizations, where possible and funding allows, to assist with surveys of the islands and to document their changes over time. These efforts could consist of vegetation monitoring, island topography monitoring, bird usage, benthic characterization, sediment composition, etc. Since the proposed actions are for the beneficial use of dredged material, no requirement for specific mitigation or monitoring is warranted.

11.0 List of Agencies, Interested Groups and Public Consulted

- Ashley River Scenic Advisory Council
- Cape Romain Bird Observatory
- Castle Pinckney Historical Society
- Coastal Conservation Association
- Coastal Conservation League
- Environmental Protection Agency
- National Marine Fisheries Service
- National Park Service
- Natural Resources Conservation Service
- South Atlantic Fishery Management Council
- South Carolina Department of Archives and History
- South Carolina Aquarium
- South Carolina Department of Health and Environmental Control – Bureau of Water

- South Carolina Department of Health and Environmental Control – Office of Ocean and Coastal Resource Management
- South Carolina Department of Natural Resources
- South Carolina Institute for Archaeology and Anthropology
- South Carolina Sea Grant Consortium
- South Carolina Saltwater Anglers
- South Carolina State Ports Authority
- United States Fish and Wildlife Service
- United States Geological Survey

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