ATTACHMENT I
Biological Assessment

SEA ISLAND SHORE PROTECTION PROJECT

SEA ISLAND 2018 BEACH NOURISHMENT
Submitted in Conjunction with
Permit Number SAS–2015–00742–AMENDED

SUPPLEMENTARY
BIOLOGICAL ASSESSMENT &
ESSENTIAL FISH HABITAT ASSESSMENT

Prepared for:

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[2473–BA&EFH]
March 2018

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TABLE OF CONTENTS

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1.0 INTRODUCTION AND PURPOSE

This Supplementary Biological Assessment (BA) and Essential Fish Habitat (EFH) Assessment is prepared at the request of the US Army Corps of Engineers (USACE), the US Fish & Wildlife Service (USFWS), and National Marine Fisheries Service (NOAA–NMFS) for Sea Island in Glynn County, Georgia (P/N SAS–2015–00742). Sea Island is an ~5-mile-long barrier island along the ocean in front of St. Simons Island near Brunswick (GA). It is separated from St. Simons Island by Black Bank River and Village Creek. One of a series of barrier islands within the Georgia Bight, it is flanked by Little St. Simons Island to the north and Jekyll Island to the south.

Sea Island was established as a private development in the 1920s and is managed by the Sea Island Company (Sea Island Acquisition, LLC (SIA)—Owner (applicant), c/o Scott K Steilen, President). The proposed Sea Island beach restoration project would restore ~16,500 linear feet (lf) (3.13 miles) along the shoreline of Sea Island in addition to ~1,200 lf south of the existing south groin. The island beach is bordered to the north by Hampton River Inlet and to the south by Gould's Inlet. It is sheltered by the shoals of both inlets and shoals associated with Brunswick Harbor (Fig 1.1). These factors generally control waves, sand transport, and the overall morphology of the island.

This BA/EFH is a supplement to the BA dated October 2015 (revised January 2017) prepared for the original application for "The Reserve at Sea Island Shore Protection Project." The Supplementary BA is submitted because the applicant is now proposing to obtain nourishment sand via dredge from offshore deposits and is increasing the length of beach to be restored. The general purpose of a BA/EFH is to assist the USFWS and NMFS in their analysis of potential effects of an action on protected natural resources, specifically, endangered and threatened species.

The original application and the BA in connection with it has been reviewed and signed off on by NOAA-NMFS. By letter of 19 October 2017, NOAA-NMFS completed formal consultation for the Reserve project and concluded that the Reserve project's potential effects to listed species were discountable, insignificant, or beneficial, and that the proposed action is not likely to affect listed species under NMFS' purview. By letter dated 15 January 2016—NMFS, Habitat Conservation Division, determined that any adverse impacts to Essential Fish Habitat (EFH) from the Reserve project would be minimal and offered no EFH conservation recommendations pursuant to the Magnuson-Stevens Fishery Conservation and Management Act or the Fish and Wildlife Coordination Act.

As a result, this BA addresses dredging and nourishment, but also gives effects determination for a groin.

A Biological Opinion (BO) is required for major construction activities which require federal permitting and could significantly affect the quality of the human environment as referred to in the National Environmental Policy Act (NEPA) of 1969 (42 USC 4321 et seq). The requirement is set forth under Section 7(c) of the 1973 Endangered Species Act (ESA), in which the BO fulfills consultation requirements of Section 7(a)(2). The BO is called for if federally-listed species or designated critical habitats may be present in the affected area (USFWS).

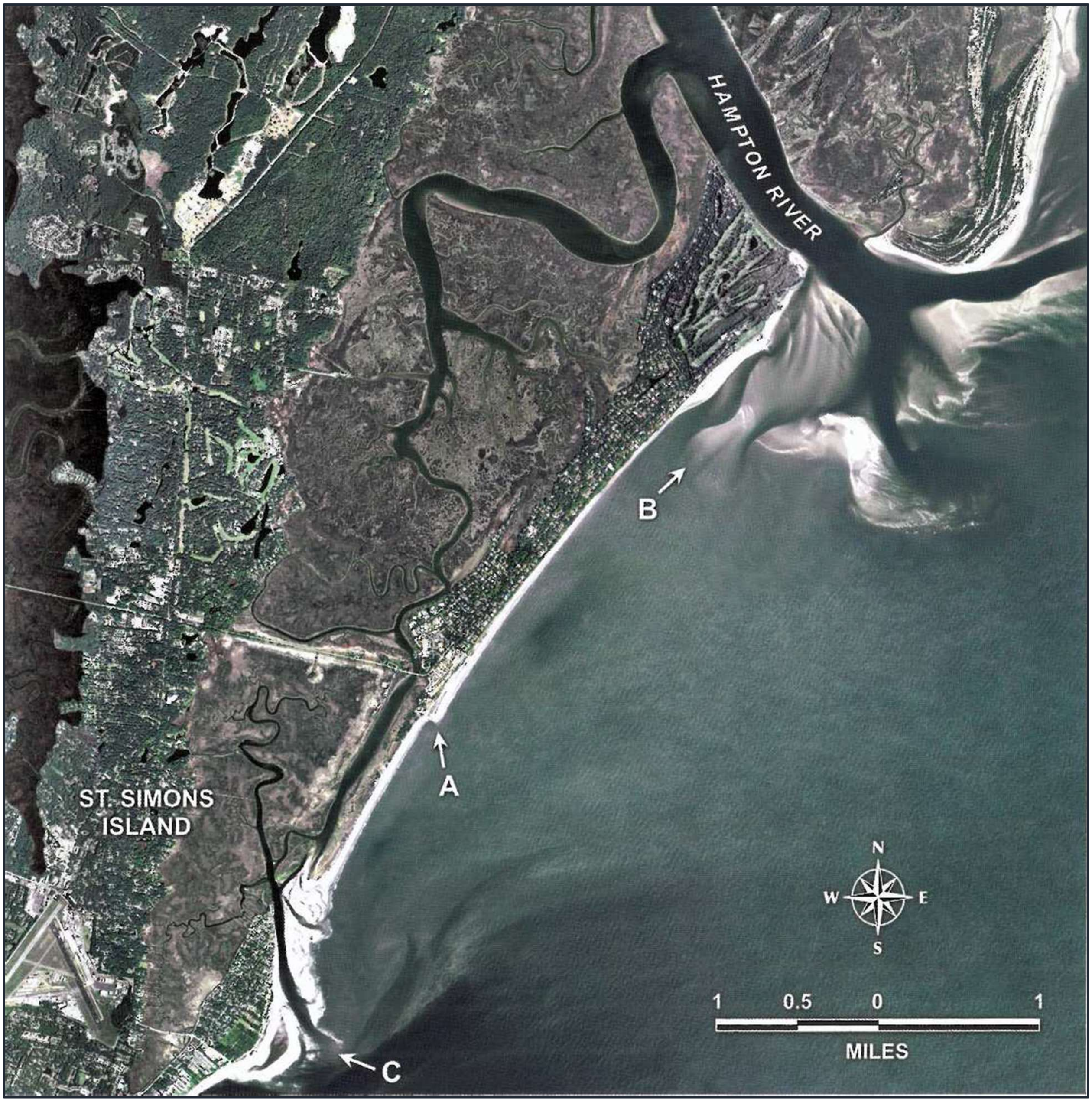

FIGURE 1.1. Vertical aerial image of Sea Island (GA) in 2009 showing extensive intertidal and subtidal shoals (ebb tidal deltas) of Hampton River Inlet and Goulds Inlet (“C”). “A” is the south groin/breakwater and “B” points to inshore shoals which influence the shape of the adjacent beach. [From Hayes & Michel 2013]

“The primary role [of the BO] is to document an agency’s conclusions and the rationale to support those conclusions regarding the effects of their proposed actions on protected resources” (USFWS; fws.gov/midwest/endangered/section7/ba_guide.html). The following information is provided to comply with statutory requirements to use the best scientific and commercial information available to assess risks posed to listed and/or proposed species and designated and/or proposed critical habitat by proposed federal actions. The proposed work requires federal action through the USACE to issue permits through Section 10 of the Rivers and Harbors Act and Sections 401 and 404 of the Clean Water Act.

This document provides details on:

- The proposed, additional work for the project.
- The proposed project area, including existing physical and biological attributes.
- Listed and proposed species that “may be present.”
- Present habitat conditions of all identified species.
- The possible impact of the proposed action on each species.
- Findings for species in Section 6.

For the current project, the applicant is requesting a permit to construct a groin (1,200 lf south of an existing groin) and restore the beach using sand from accreting areas of the island. The applicant is applying for an addendum to the original application for purposes of expanding the length of beach for nourishment and performing the supplemental work via hydraulic dredge using an offshore borrow area. In 2015, the applicant obtained authorization from the Shore Protection Committee (SPC) to construct a 350-foot-long rock T-head groin and conduct nourishment along the 1,200-foot (ft) reach located south of the south groin to provide storm protection to the upland development known as the Reserve at Sea Island. The SPC authorized the project under SPC Permit #438 on 15 December 2015. The project was advertised on public notice by the USACE Savannah District on 16 December 2015 (SAS-2015-00742).

Due to accelerated erosion caused by named storms, the applicant conducted extensive meetings and correspondence with USACE and determined that the Reserve project should be expanded to include a full-scale, beach-nourishment project for the Sea Island beach. The smaller Reserve groin and nourishment project will provide storm protection to the Reserve, and the larger nourishment project will provide beach-quality sediments from an offshore borrow source to restore the storm protection, wildlife habitat, and recreational functions of the Sea Island beach. The nourishment project will also provide a sand reservoir to allow for future sand recycling to address historic erosion patterns on the managed beach portion of the island. For purposes of completeness and because the additional work will involve different types of impacts, the present document provides more information for USFWS and NMFS to evaluate the proposed project. The additional work will include beach nourishment and dune construction (Fig 1.2).

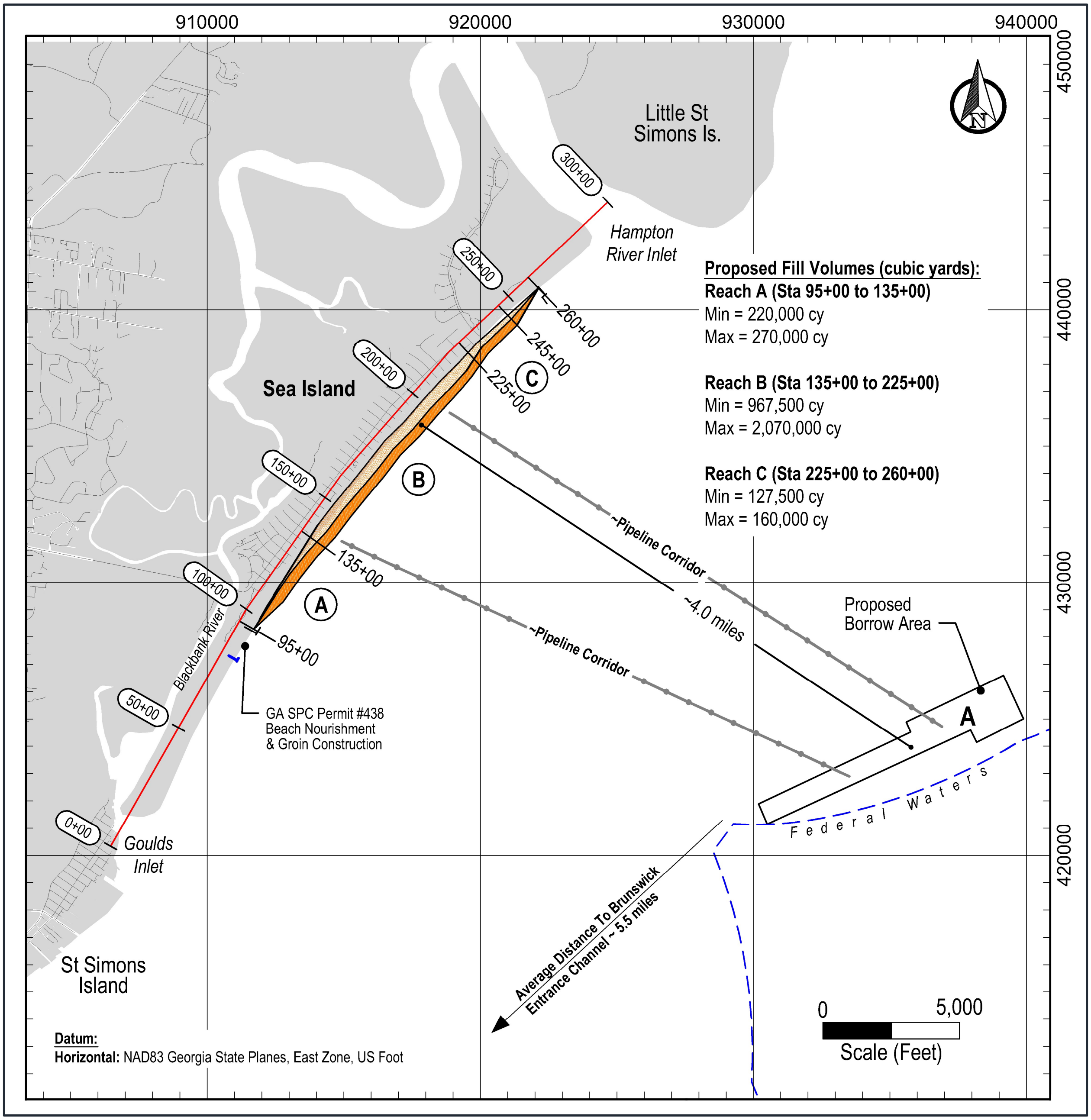

FIGURE 1.2. Overall project plan for supplementary beach nourishment work under P/N SAS–2015–00742.

The amendment request under the permit is being submitted in response to accelerated erosion along portions of the island, particularly erosion associated with Hurricanes *Matthew* in October 2016 and *Irma* in 2017. The owner has a stated goal of placing new sand on the beach during the winter–spring of 2019. The renourishment and stabilization of Sea Island beach and the subsequent benefits to Glynn County and Sea Island as a whole will bring positive impact to this historically and culturally rich area.

The proposed nourishment would include initial placement via dredge of ~1,315,000 cubic yards (cy) of beach-quality sediment along 17,700 lf (3.35 miles) of the developed area of Sea Island as illustrated in Figure 1.2. The project encompasses five reaches:

- Reach “1” extends ~1,200 lf south of the south groin (referenced to as the “Reserve”).
- Reach “A” extends from the existing south groin on Sea Island 4,000 lf north to approximately East 9th Street.
- Reach “B” will extend 9,000 lf from approximately East 9th Street to East 35th Street.
- Reach “C” will extend ~3,500 lf north from East 35th Street to an existing north groin.

Sand will be obtained from an offshore borrow area within Georgia state waters situated on bathymetric high areas that are well removed from inlet shoals or Brunswick entrance channel. The proposed borrow area is ~4 miles southeast of Sea Island with rough dimensions of 10,000 lf by 1,700 lf (~255 acres) (Fig 1.3). Nourishment sand will be pumped to the beach, shaped, and graded to slopes and elevations similar to native beaches in the area (Fig 1.4). A protective dune will be constructed using nourishment sand along up to 10,000 lf of Sea Island. The majority of the nourishment volume will be placed along Reach “B” which has experienced severe erosion in recent years. Plans call for nourishment to restore a continuous dry-sand beach between existing groins and to supplement the volume with sufficient material to perform sand transfers (recycling) within the project area after hydraulic nourishment is complete.

This addendum to SAS-2015-00742 includes plans to perform periodic sand transfers within the Sea Island beach system via land-based equipment and will include transfers as needed from Reach “A” and Reach “C” to affected portions of the project area to maintain the project purpose. This work would be consistent with previously authorized beach management recycling work performed by the applicant following the 1990 and 1997 nourishment projects. See the permit application and narrative for further information.

The timing and scale of the proposed sand transfers would depend on the timing of the new south groin construction and the specific localized erosion conditions in the future. The applicant proposes to measure the rate of sand losses and gains by reach and to transfer sand as warranted for the pr oject purposes . The schedule and need for future sand transfers is expected to vary depending on the frequency of erosion events.

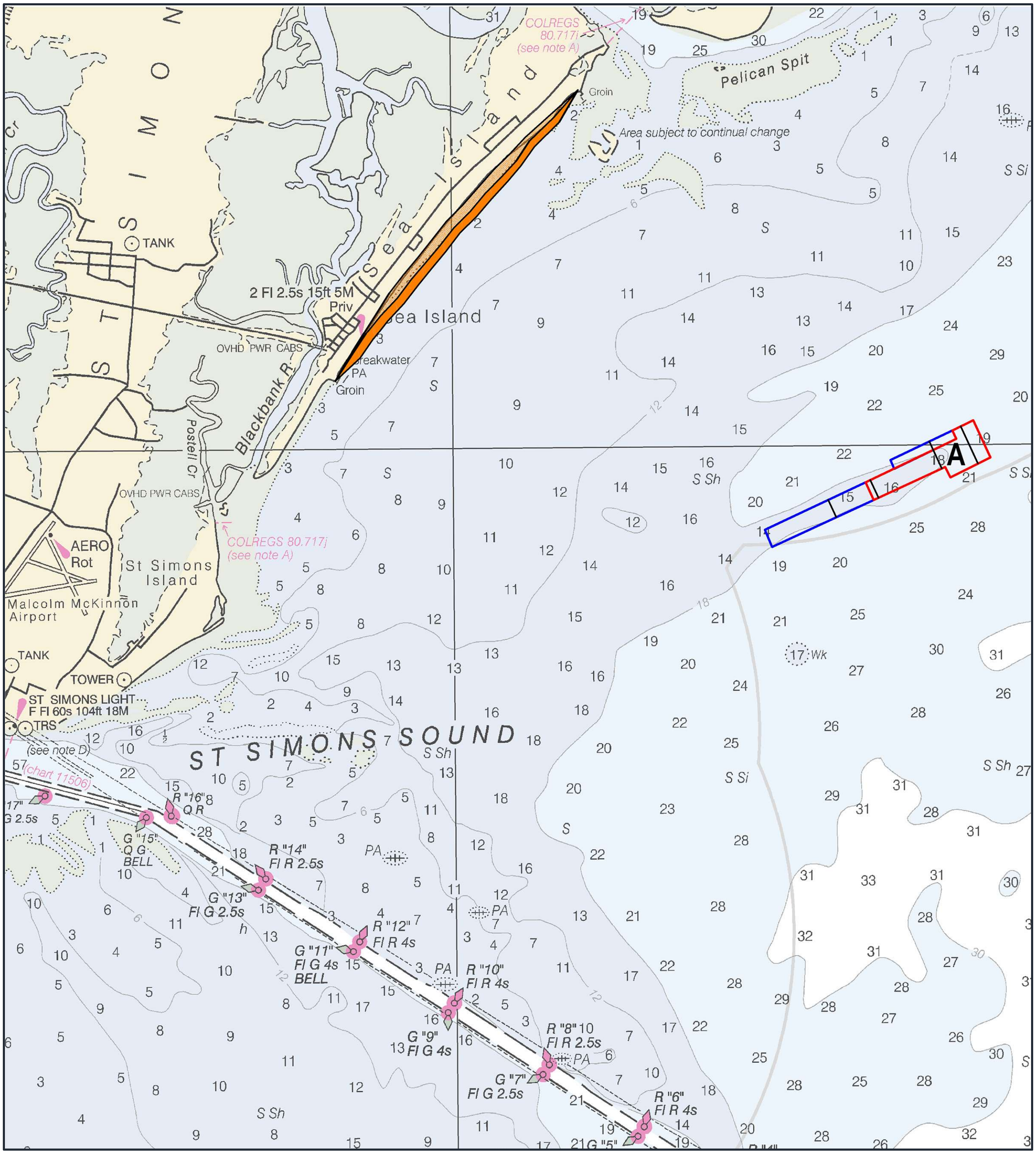

FIGURE 1.3. Amended project plan showing additional areas directly impacted by offshore dredging (Area "A") and the beach zone encompassing ~3 miles along Sea Island.

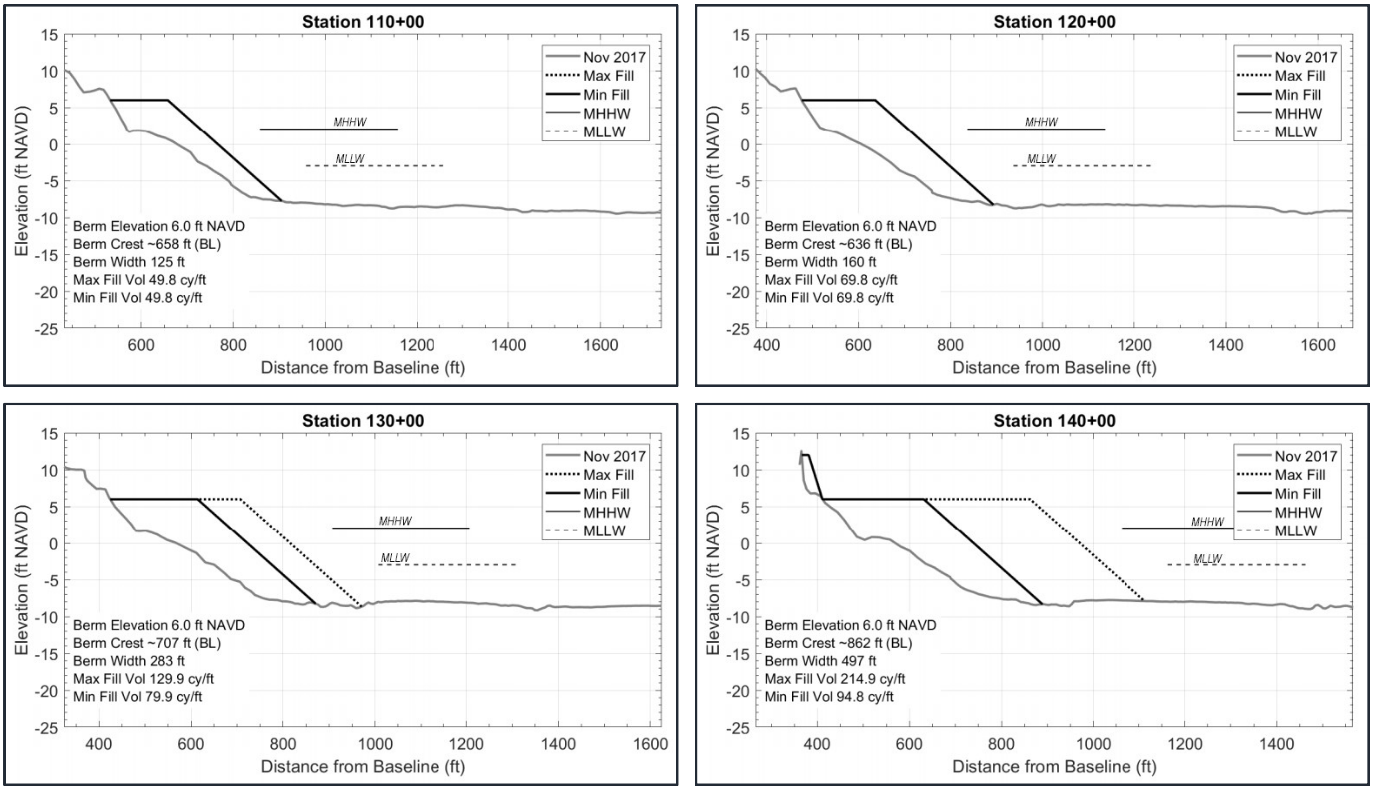

FIGURE 1.4. Representative nourishment cross-sections showing the anticipated minimum (solid line) and maximum fill template along Sea Island. Sections at the ends of the nourishment limits will be tapered back to the existing beach. The proposed dry-beach elevation and intertidal slope will seek to match the native beach. An artificial dune will be constructed along areas that have exposed seawalls and presently lack any dry-sand area. See Figure 1.2 for station locations.

1.1 Overall Project Purpose & Basic Purpose of Each Activity in or Affecting US Waters

The purpose of the project is for beach restoration, including the following:

- Provide a higher level of shoreline protection for adjacent upland properties.
- Restore a viable dry-sand beach to accommodate existing recreational uses.
- Replenish chronic erosion and sand losses since 1997 and provide sufficient material to manage and maintain the design beach.
- Provide a restored foredune.
- Provide additional environmental habitat for turtles, birds, and beach flora and fauna.
- Address the alongshore variations in erosion rates.
- Provide a reservoir of excess sand to recycle to erosional areas of the beach in the future, including reaches south of the existing south groin, the center of the island, and north of the north groin.

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2.0 DESCRIPTION OF THE PROPOSED PROJECT

2.1 Beach Nourishment

The nourishment design is based on the present condition of the beach, historical erosion rates, impacts from recent hurricanes, storm protection requirements, appropriate recreational use requirements, environmental considerations, and available budget. Existing sand deficits by section along the beach were determined by comparing beach volumes seaward of shore-protection structures. A target minimum profile was defined in terms of a sand quantity per unit length of beach (cubic yards per foot—cy/ft) designed to withstand normal seasonal changes in the profile while maintaining a continuous dry-sand beach. For Sea Island, healthy sections of beach which meet this criterion were found to contain ~125 cy/ft measured to −7 ft NAVD datum (CSE unpublished beach monitoring data 2017). Each section of the beach was compared to this value to determine volume deficits.

The nourishment plan includes sufficient volume to restore the deficit in the area between the existing groins, including the volume necessary to accommodate the Reserve project, as well as advance nourishment to account for anticipated future erosion. The advance nourishment volume is designed to accommodate a minimum of five years of normal erosion to over ten years of erosion. The final nourishment volume will depend on the bids for construction and the budget available. The minimum-scale project will be 1,315,000 cy and the maximum scale will be 2,500,000 cy. Table 2.1 lists the proposed fill lengths, volumes, and fill density by reach. Adjustment in fill volumes will be made according to beach conditions at the time of construction, but with an effort to maintain approximate proportionate adjustments along all reaches from the minimum volumes listed in Table 2.1. The applicant anticipates the final project will be close to the minimum scale project, but future erosion events could require additional dredging operations over the life of the permit.

TABLE 2.1. Proposed beach nourishment volumes by reach. *[Applicant's project baseline in feet (engineering nomenclature) extending from Gould's Inlet (0+00) to Hampton River Inlet (285+00). **Reach 1 is 1,200 lf extending from the south groin at station 95+00 and will be nourished via sand transfers from Reach A unless the timing of nourishment is contemporaneous with groin construction so that it may be nourished via hydraulic methods when Reaches A, B and C are being completed. Volume for Reach 1 is included in the Reach A volumes.]

Reach	Stationing*	Locality	Length (ft)	Minimum Volume (cy)	Maximum Volume (cy)	Fill Density Range (cy/ft)
1**	~83+00-95+00	The "Reserve"	~1,200	(120,000)**	N/A	N/A**
A*	95+00–135+00	South Groin to ~9th Street	4,000	220,000	270,000	55–67.5
B	135+00–225+00	~9th Street to ~34th Street	9,000	967,500	2,070,000	107.5–230
C	225+00–260+00	34th Street to North Groin	3,500	127,500	160,000	36.4–45.7
Total	95+00 – 260+00	South Groin to North Groin	17,700	1,315,000	2,500,000	79.7-151.5

Figure 2.1 is a graph of the October 2017 beach volumes by station (500-ft intervals) along Sea Island (solid red line), the target minimum beach volume (dashed red line), and the deficit volume by station (difference between the red lines), and the proposed nourishment volumes. Historical studies confirm that sand tends to move from the center to the ends of Sea Island (Griffin & Henry 1984, Oertel 1993–2016, CSE unpublished data 2017). The nourishment plan takes this natural transport pattern and historical erosion rates into account by placing advance fill along Reach B.

As stated previously, Reach A volumes include the quantities to construct the activities authorized under SPC Permit #438 including repair of recent hurricane impacts. Depending upon the final construction schedule, the sand required for the Reserve project would be placed either directly by the dredge operation, or by mechanical transfer from Reach A.

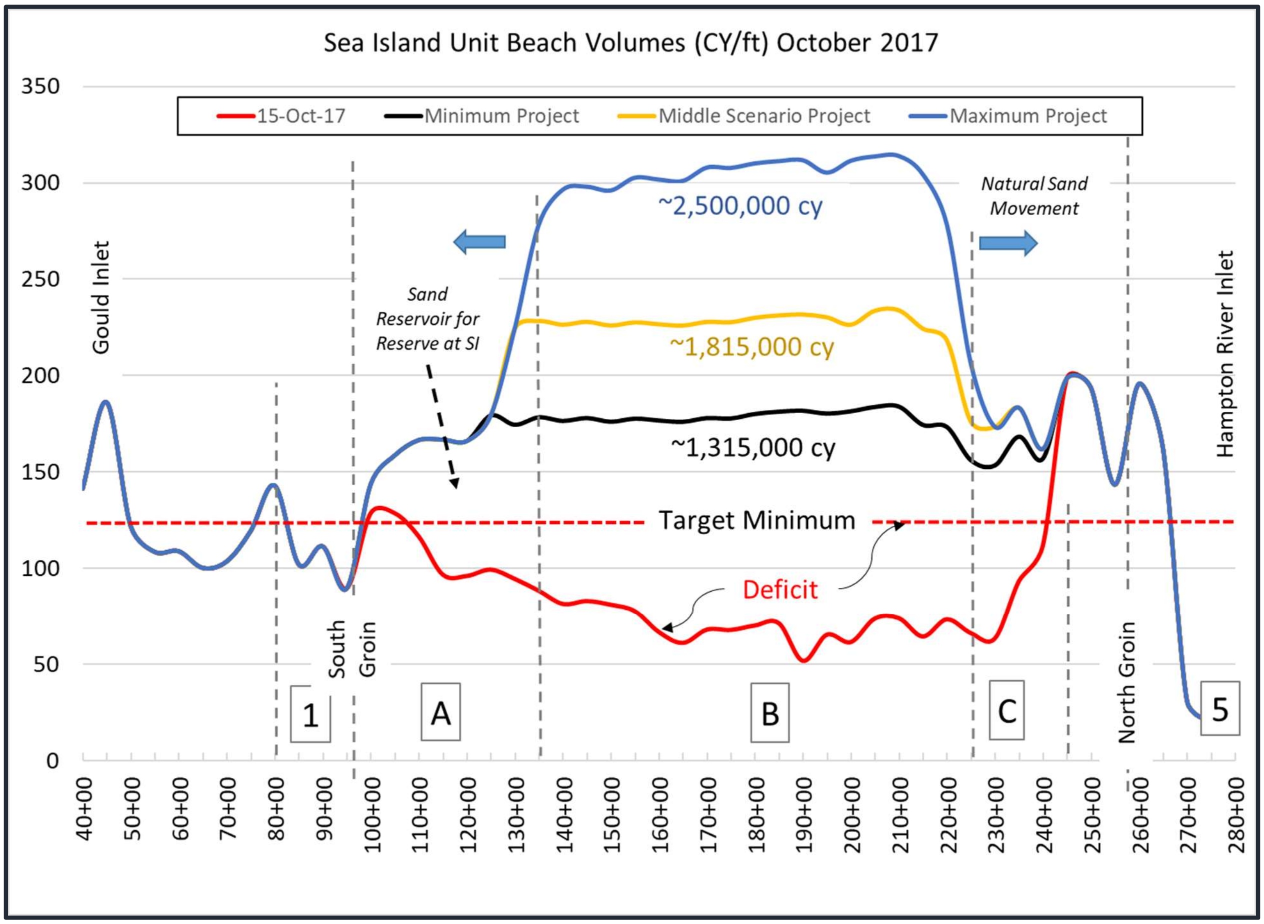

FIGURE 2.1. Graph showing the October 2017 post storm beach volumes along Sea Island (red), the target minimum beach volume for a dry beach (measured to −7 ft NAVD), and the resulting unit volumes after nourishment under the proposed minimum volume (1,315,000 cy) and maximum volume (2,500,000 cy). Principal reaches are A, B, and C (see Fig 1.2). Reach A would provide a sand reservoir for mechanical transfers to Reach 1 ("Reserve") under the original permit SAS 2015-00732. The addendum permit application also calls for periodic mechanical sand transfers from Reaches A and C to areas the length of the project area (Reaches 1, A, B, C) and Reach 5 as needed to fulfill the project purposes.

Nourishment will be accomplished by hydraulic dredge (cutterhead suction dredge), pipelines to the beach, and heavy equipment (bulldozers and loaders) shaping the fill on the beach. Temporary sand-training dikes will be used to contain the slurry discharge parallel to the shore. Once the sand is pumped onto the beach, bulldozers will shape the fill into the design template from the backshore to the approximate mean sea-level (MSL) contour. Sand below MSL will be shaped and redistributed to a natural profile by waves. Sand fencing and/or native vegetation will be installed in strategic locations along a proposed dune following nourishment, in accordance with a Georgia Department of Natural Resources (GADNR)-approved vegetation plan.

The principal nourishment sections will consist of a nearly horizontal berm at +7 ft NAVD (~4.4 ft above local mean high water). Berm widths will vary according to fill density. The seaward slope will be initially constructed at 1 on 25, then will adjust naturally to waves and tides. Figure 2.2 (panels a–d) illustrates the nourishment plan superimposed on a 2016 rectified, aerial orthophoto of Sea Island. The approximate limits of the berm and toe of fill are shown for the minimum and maximum proposed nourishment volumes. Figure 2.3 illustrates representative nourishment sections for each reach. The aerial orthophoto used in Figure 2.2 was obtained in spring 2016 before Hurricane *Matthew* (October 2016) and Hurricanes *Irma*. In general, the active dry-sand beach along Sea Island is situated between the +6-ft and the +8-ft NAVD elevations. During neap tides and low wave conditions, dry sand may be found at lower elevations. Native vegetation is generally limited to elevations above +7-ft NAVD at Sea Island (CSE unpublished data).

2.1.1 Artificial Dune

The nourishment plan incorporates an artificial dune along up to 10,000 lf between stations 135+00 and 235+00. This is in addition to the planned protective dune extending along up to ~1,200 lf from the south groin toward the south along the "Reserve". The dune will toe into the seaward crest of the existing revetment and will be no higher than +12 ft NAVD with a crest width of 15–20 ft. The seaward dune slope will be 1 on 4 or gentler, merging with the constructed berm at +7 ft NAVD. Proposed dune and beach-fill sections are illustrated on Figure 2.3. Sand fencing and/or native dune grasses will be installed along the artificial dune soon after completion of nourishment following GADNR specifications and guidance.

The alongshore limits of the dune will be determined based on conditions at the time of construction. The applicant's goal is to re-establish a continuous protective dune along Reaches A, B, and C, as well as construct dunes in Reach 1 as shown in the initial application for this permit and supporting design drawings.

2.1.2 Borrow Area

The applicant, through its consultant CSE, completed a sand search and confirmation borings for the proposed offshore borrow area. Cores were initially obtained over portions of the Hampton River Inlet delta (seaward shoals) and a bathymetric high ~4 miles east/southeast of Sea Island. Following discussions with state experts (Dr. C. Alexander, Skidaway Institute, pers comm, March 2017), the applicant elected to focus the sand search on the bathymetric high. Twenty-five (25) additional borings were obtained within a grid ~2 miles long and 0.5 mile wide. CSE also collected detailed bathymetric data to map the area (Fig 2.4).

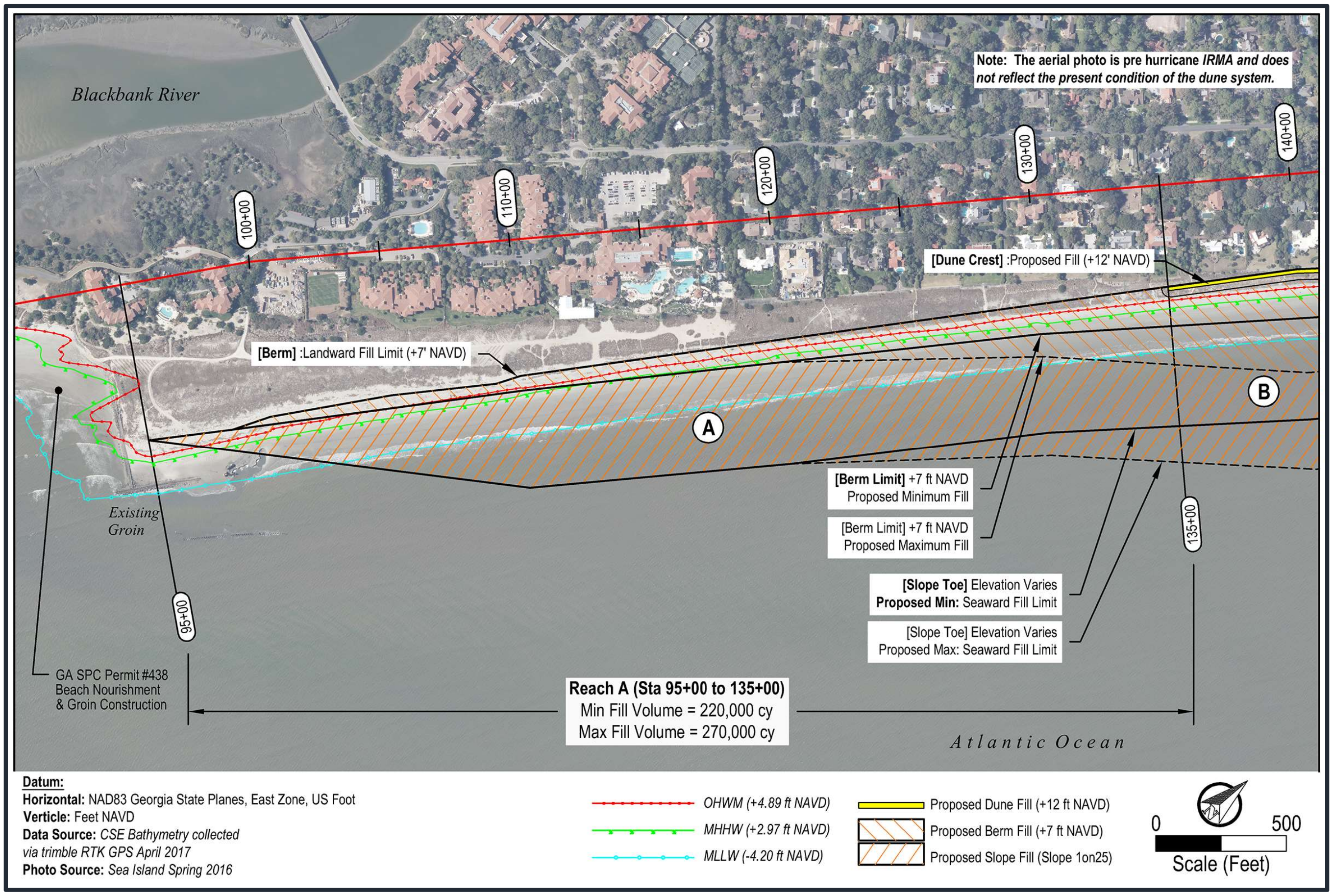

FIGURE 2.2a. Proposed nourishment plan superimposed on 2016 aerial orthophoto of Sea Island showing the approximate limits of fill. The "Reserve" portion of the project under the original application extends south ~1,200 lf from the south groin (approximate project station 95+00).

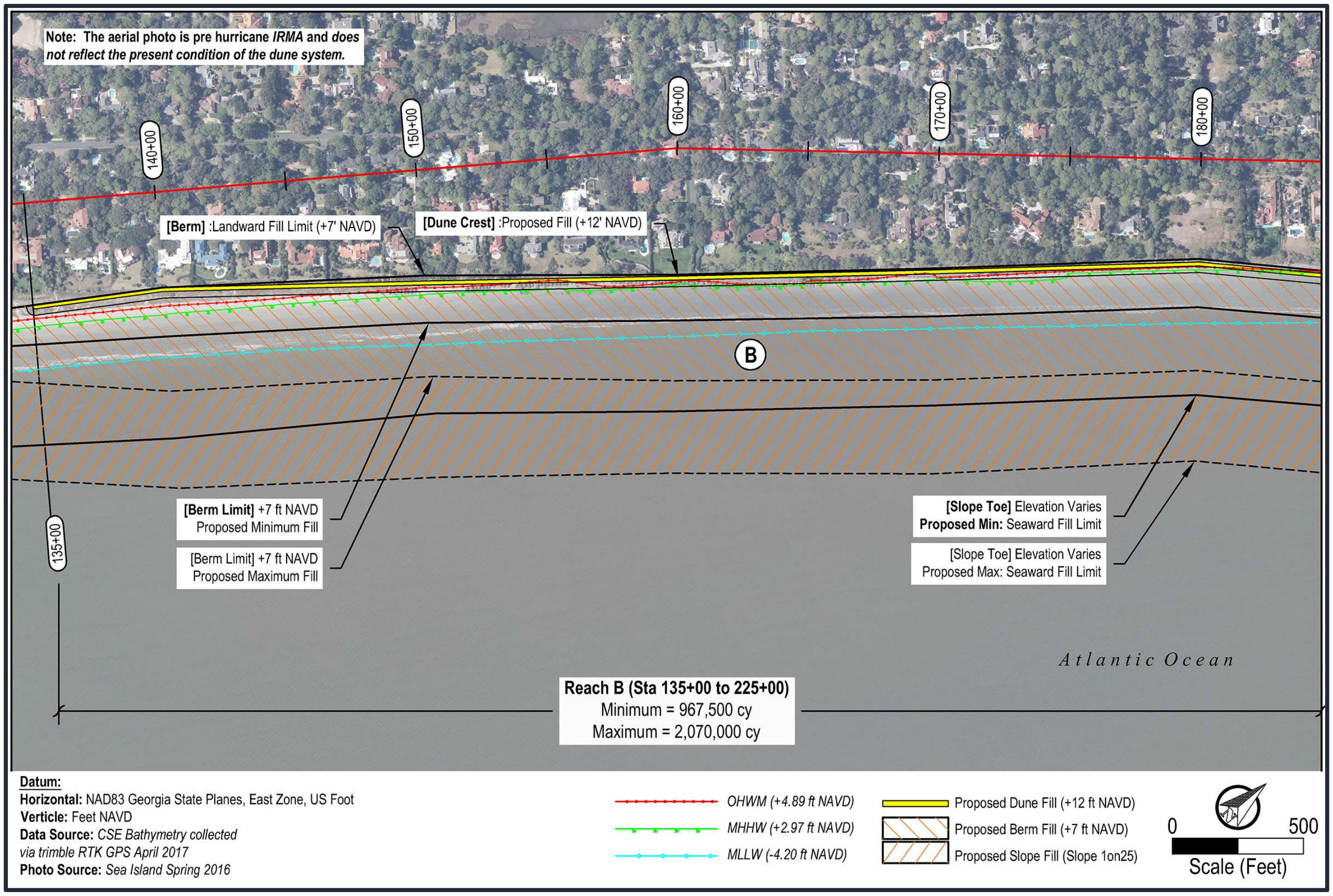

FIGURE 2.2b. Proposed nourishment plan superimposed on 2016 aerial orthophoto of Sea Island showing the approximate limits of fill.

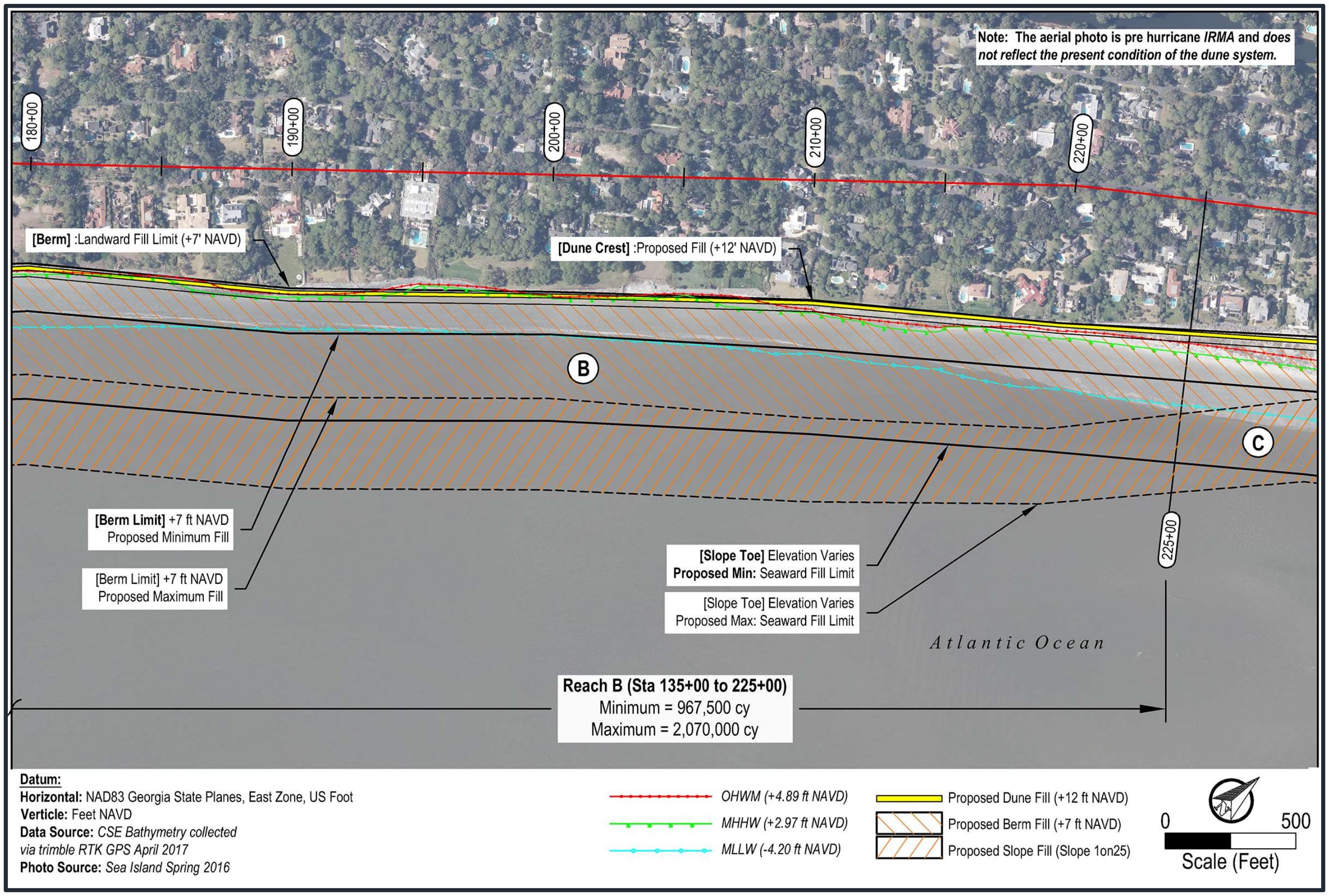

FIGURE 2.2c. Proposed nourishment plan superimposed on 2016 aerial orthophoto of Sea Island showing the approximate limits of fill.

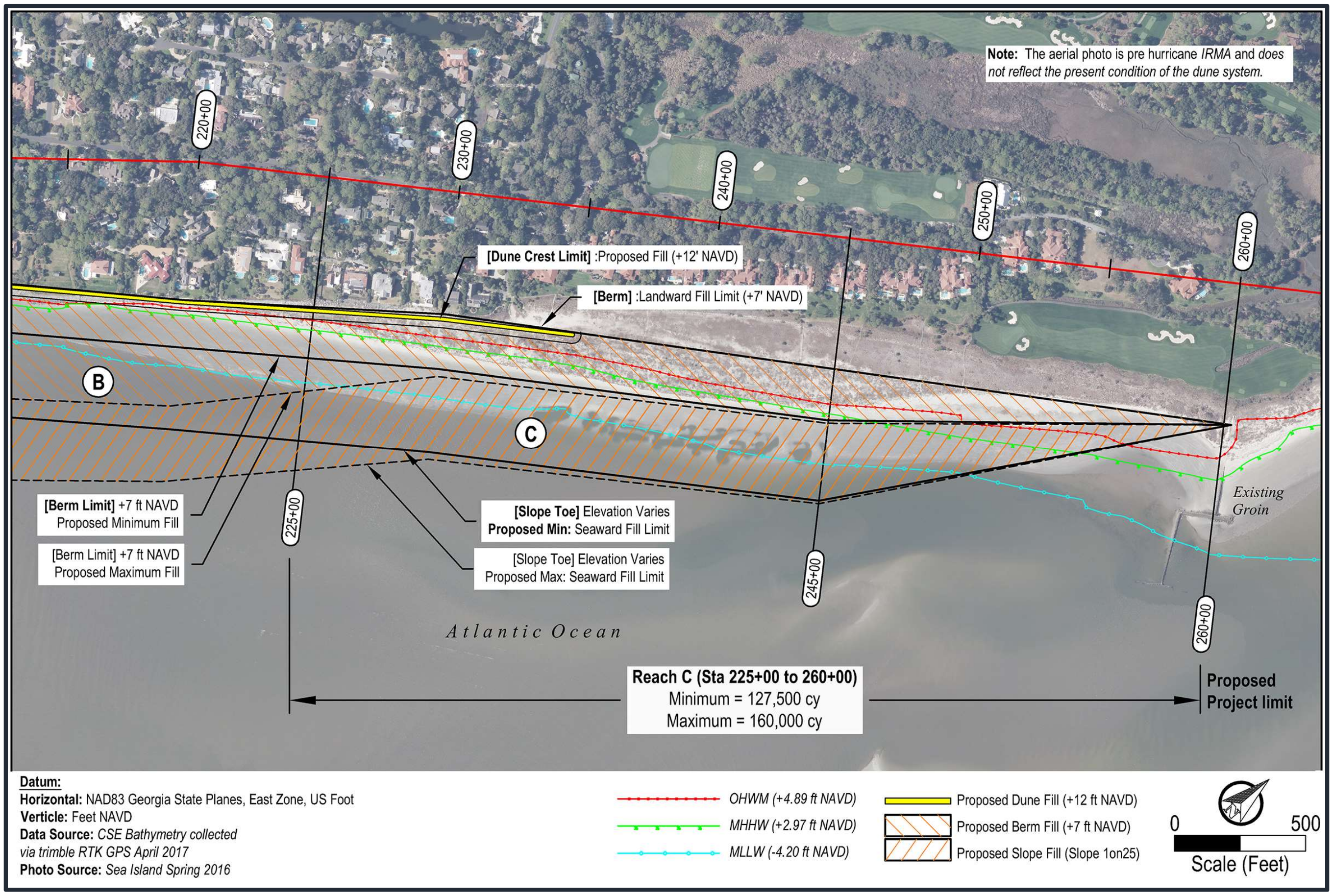

FIGURE 2.2d. Proposed nourishment plan superimposed on 2016 aerial orthophoto of Sea Island showing the approximate limits of fill.

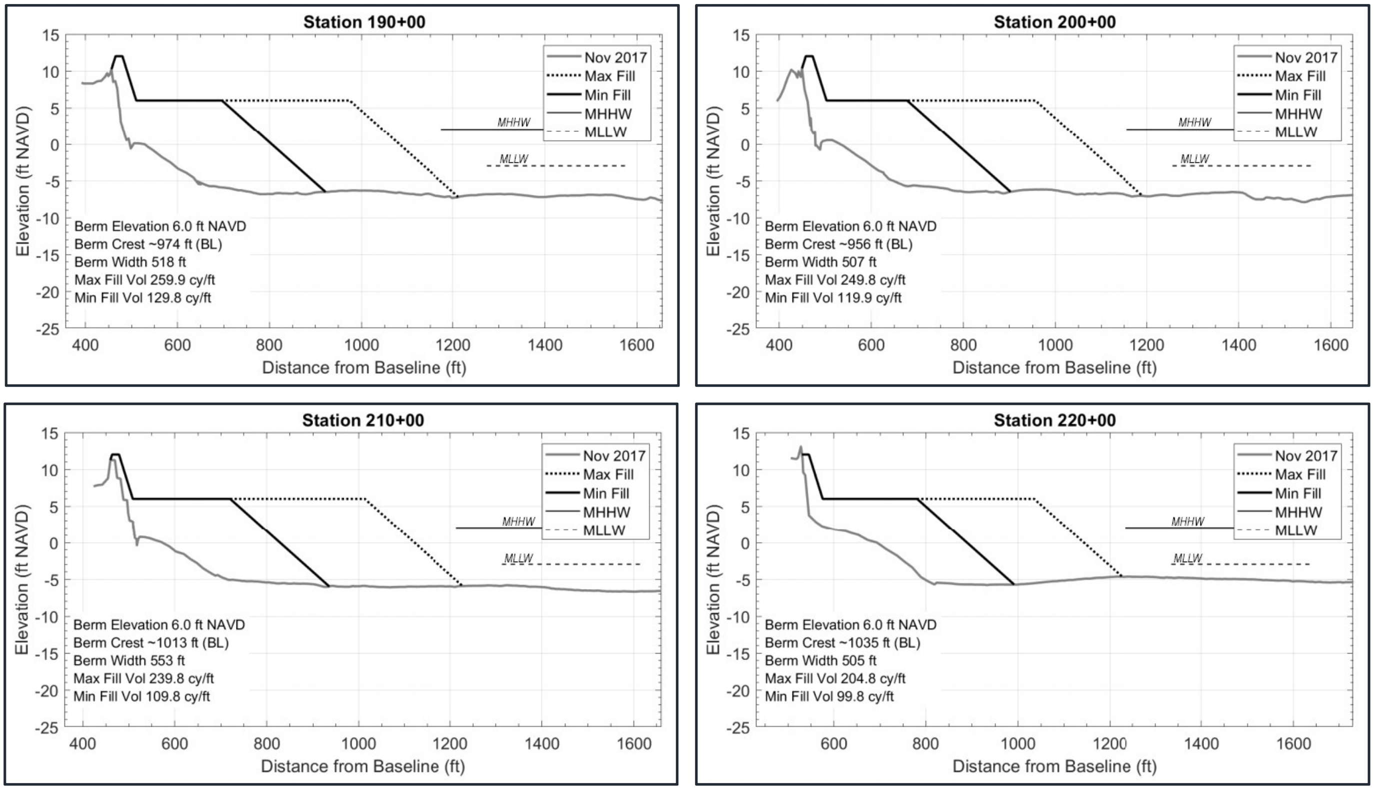

FIGURE 2.3. Additional proposed beach-fill sections showing the anticipated minimum and maximum berm widths along the central portion of Reach "B" and the proposed artificial dune to be placed seaward of the existing seaward crest of the seawall. Note highly eroded condition of the beach in October 2017 which provides no dry-sand habitat at these stations.

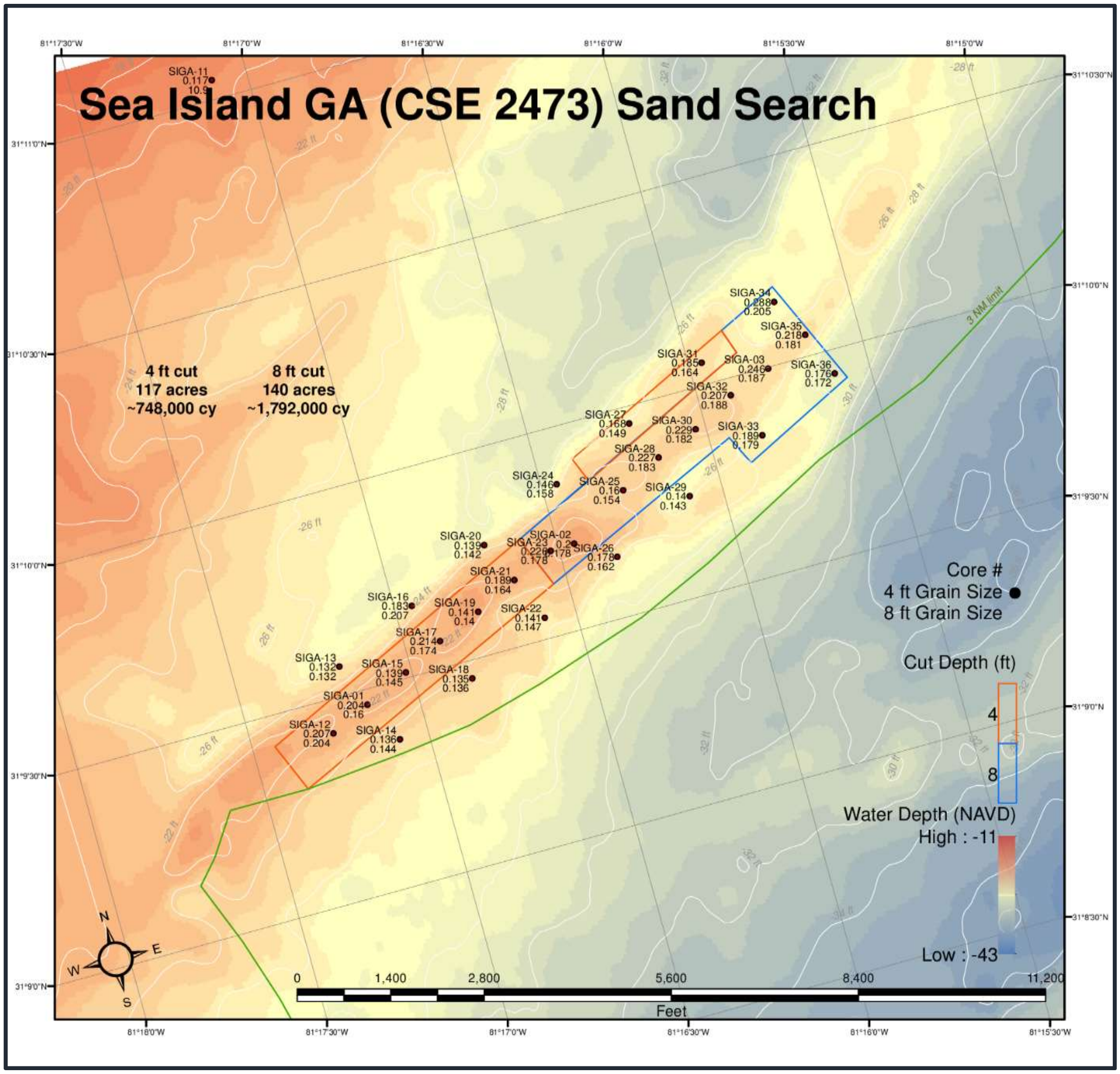

FIGURE 2.4. Proposed borrow area offshore of Sea Island within Georgia state waters. A total of 19 borings are within the borrow area.

A cultural resources study is underway (magnetometer, side-scan, and willow seismic surveys) in accordance with GADNR standards for such surveys, to identify the presence of obstructions, vessel remains, or other objects that would adversely impact dredging operations. Tidewater Atlantic Research Inc (TAR—Dr. Gordon Watts) is conducting the survey for the applicant and has coordinated the trackline spacing and related specifications for the investigation with Georgia State Historic Presentation Office (GASHPO). Results will be submitted as soon as they are available (anticipated March 2018).

A total of 28 confirmation borings averaging over 9 ft long were obtained by the applicant. These borings provide relatively close-spaced sediment samples for laboratory analysis. Accompanying this permit application is a "Geotechnical Data Analyses" (CSE 2018, Attachment H) which provides details of the survey and sediment quality analysis.

Figures 2.5 shows the bathymetry and core locations in and around the proposed borrow area along with key sediment statistics. Based on the sediment grain size and low-percent mud in the sediments, the applicant delineated a 255-acre area inside the Georgia state 3-nautical-mile limit as shown in Figure 2.4. The area is directly represented by 19 borings and is flanked by another 9 borings just outside the selected area. Core density is ~13 cores per acre. Table 2.2 lists the composited grain-size statistics for the upper 4 ft and 8 ft of substrate based on weighted results of individual samples and anticipated dredge cut depths (CSE 2018).

The proposed borrow area was found to contain beach-quality sediments similar in texture and color to the beach sediments along Sea Island (CSE 2018). Most of the northeastern half of the proposed borrow area is proposed for excavations to 8 ft of substrate. The southwestern half is proposed for 4–6 ft cuts. Mean sediment grain size within the proposed borrow area varies from 0.14 millimeter (mm) to 0.29 millimeter with composite means ranging from 0.17 mm to 0.20 mm, depending on the substrate depth (CSE 2018). As Table 2.2 shows, the overall mean grain size is 0.184 mm. Other composite parameters include shell content (11.4 percent), gravel content (1.5 percent), and mud content (~3 percent).

Figure 2.6 shows composite grain-size distributions for the beach and three composite depths within the proposed borrow area. CSE (2018) computed the overfill factor (R_A) for the applicable borings and cut depths using the existing beach grain size as the "native." The resulting R_A's average 1.3, which suggests the borrow material will perform similarly as the existing sediments on Sea Island beach (CERC 1984). Sediment quality in the proposed borrow area is similar to the native size distribution (Fig 2.6).

The proposed borrow area is in water depths between 20 ft and 30 ft NAVD. These depths are considered too shallow for operations via ocean-certified hopper dredge. Therefore, the applicant anticipates that construction will be via cutterhead dredge anchored over the borrow area and positioned by tugs. Such operations confine the daily movement to broad swings over ~300 ft widths of the borrow area as the cutterhead cuts a digging face and the pumps draw in a sediment-water slurry. Figure 2.7 shows representative bathymetric sections through the borrow area and the anticipated excavation depth. The sand slurry will be pumped to shore via submerged pipeline for direct deposit on the beach. The small quantities of mud in the borrow area are expected to remain in suspension and mix with sediments in the water column. Care will be taken to avoid significant accumulations of muddy sediments on the beach. Should the dredge encounter significant layers of stiff clay which produce "mud rollers" on the beach, the dredge will be relocated to other areas within the permitted borrow area.

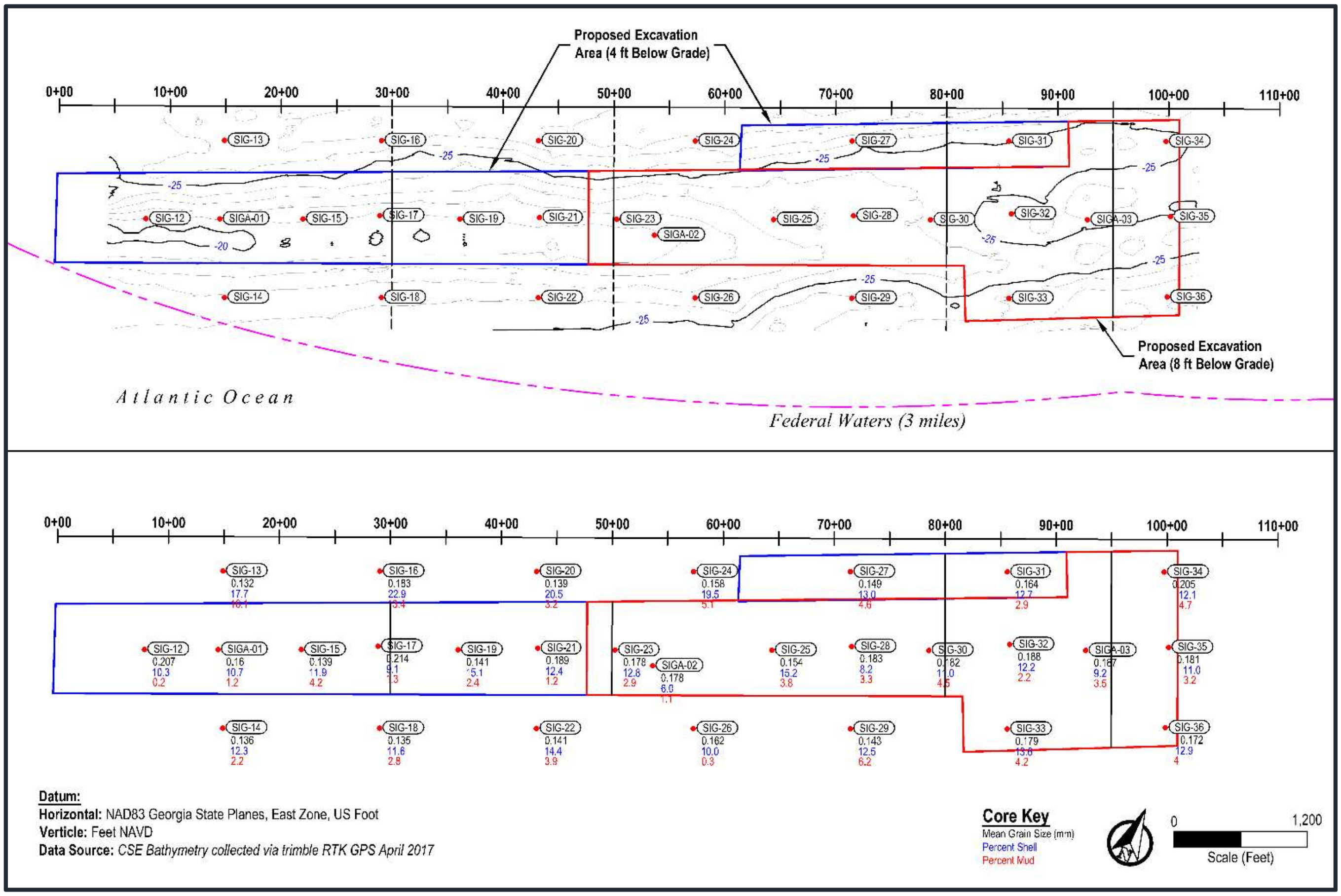

FIGURE 2.5. Proposed borrow area bathymetry, core locations, and key statistics composited to the indicated excavation depth.

TABLE 2.2. Borrow area sediment statistics—weighted composites to the indicated substrate ("cut") depth based on individual core samples (see CSE 2018—*Geotechnical Data Analyses* for details).

2473 Sea Island GA		Mean (mm)	STD (mm)	Shell (%)	Gravel (%)	Mud (%)	Ra	Munsell color
Sample	Cut Depth							
SIGA 1	4 ft	0.204	0.487	10.7	2.4	1.2	1.16	5Y-5/2
SIGA 12	4 ft	0.207	0.568	10.3	2.7	0.2	1.04	5Y-6/2
SIGA 15	4 ft	0.139	0.573	11.9	0.9	4.2	1.97	5Y-5/2
SIGA 17	4 ft	0.214	0.513	9.1	1.7	1.3	1.09	5Y-5/2
SIGA 19	4 ft	0.141	0.611	15.1	0.6	2.4	2.24	5Y-5/1
SIGA 21	4 ft	0.189	0.551	12.4	1.0	1.2	1.12	5Y-7/1
SIGA 25	4 ft	0.154	0.488	15.2	1.7	3.2	1.45	5Y-5/2
SIGA 27	4 ft	0.168	0.459	12.4	1.2	6.4	1.36	5Y-5/1
SIGA 31	4 ft	0.185	0.467	11.8	1.4	4.9	1.26	5Y-5/1
SIGA 2	8 ft	0.200	0.604	5.7	0.9	1.1	1.01	5Y-5/2
SIGA 3	8 ft	0.187	0.519	9.2	1.3	3.5	1.18	5Y-5/1
SIGA 23	8 ft	0.226	0.513	11.5	1.3	2.9	1.07	5Y-5/2
SIGA 28	8 ft	0.183	0.522	8.2	0.9	3.3	1.19	5Y-5/2
SIGA 30	8 ft	0.182	0.476	11.0	1.9	4.5	1.26	5Y-6/2
SIGA 32	8 ft	0.188	0.440	12.2	2.1	2.2	1.28	5Y-5/1
SIGA 33	8 ft	0.179	0.486	13.6	1.4	4.2	1.26	5Y-5/1
SIGA 34	8 ft	0.205	0.456	12.1	2.0	4.7	1.19	5Y-5/2
SIGA 35	8 ft	0.181	0.488	11.0	1.4	3.2	1.25	5Y-5/1
SIGA 36	8 ft	0.172	0.493	12.9	1.3	4.0	1.29	5Y-5/2
TOTAL AVERAGE		**0.184**	**0.511**	**11.4**	**1.5**	**3.1**	**1.30**	

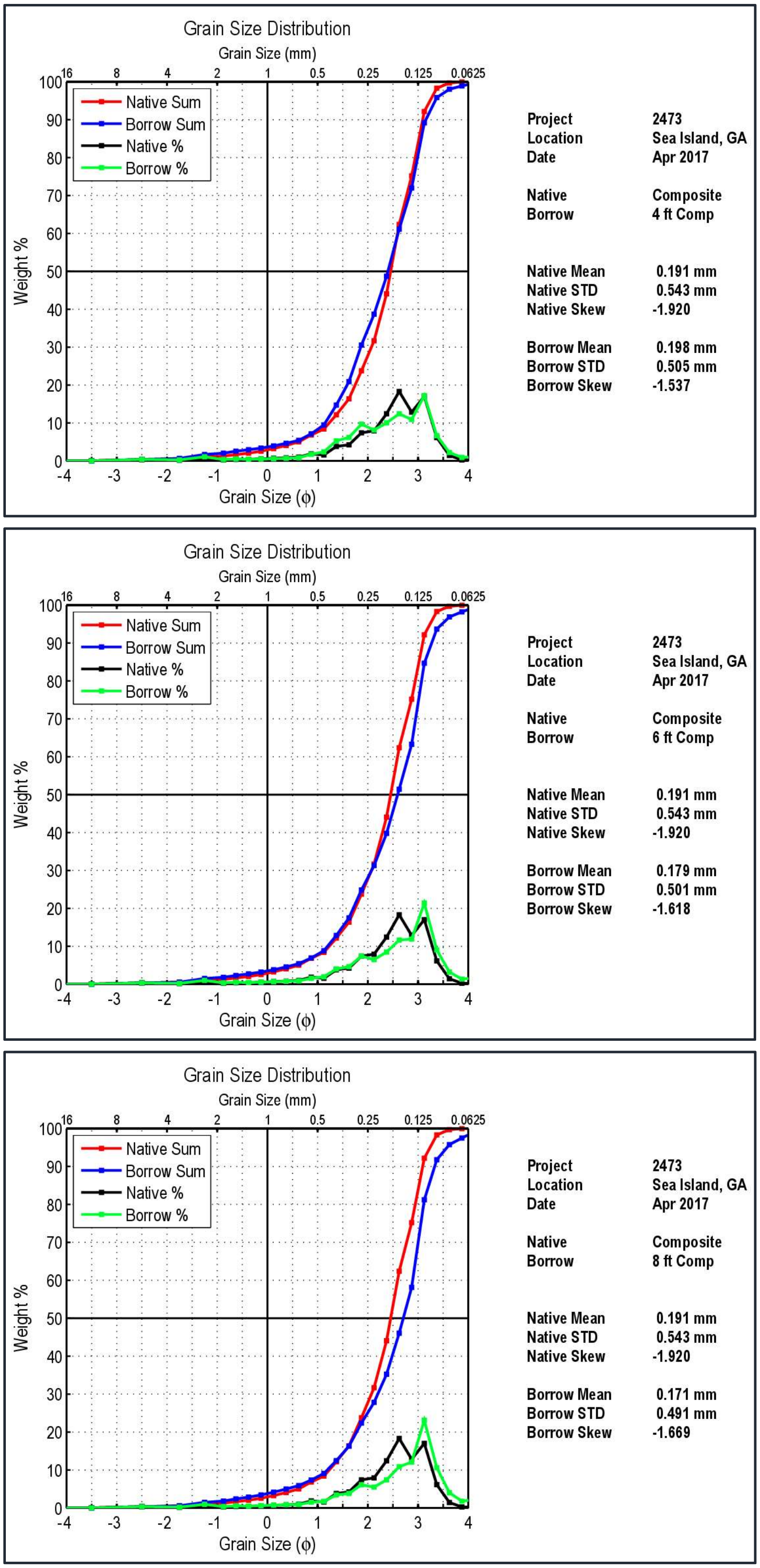

FIGURE 2.6. Frequency and cumulative frequency grain-size distributions (GSDs) for the Sea Island beach ("native") and proposed borrow area (4 ft and 8 ft composites – "Comp").

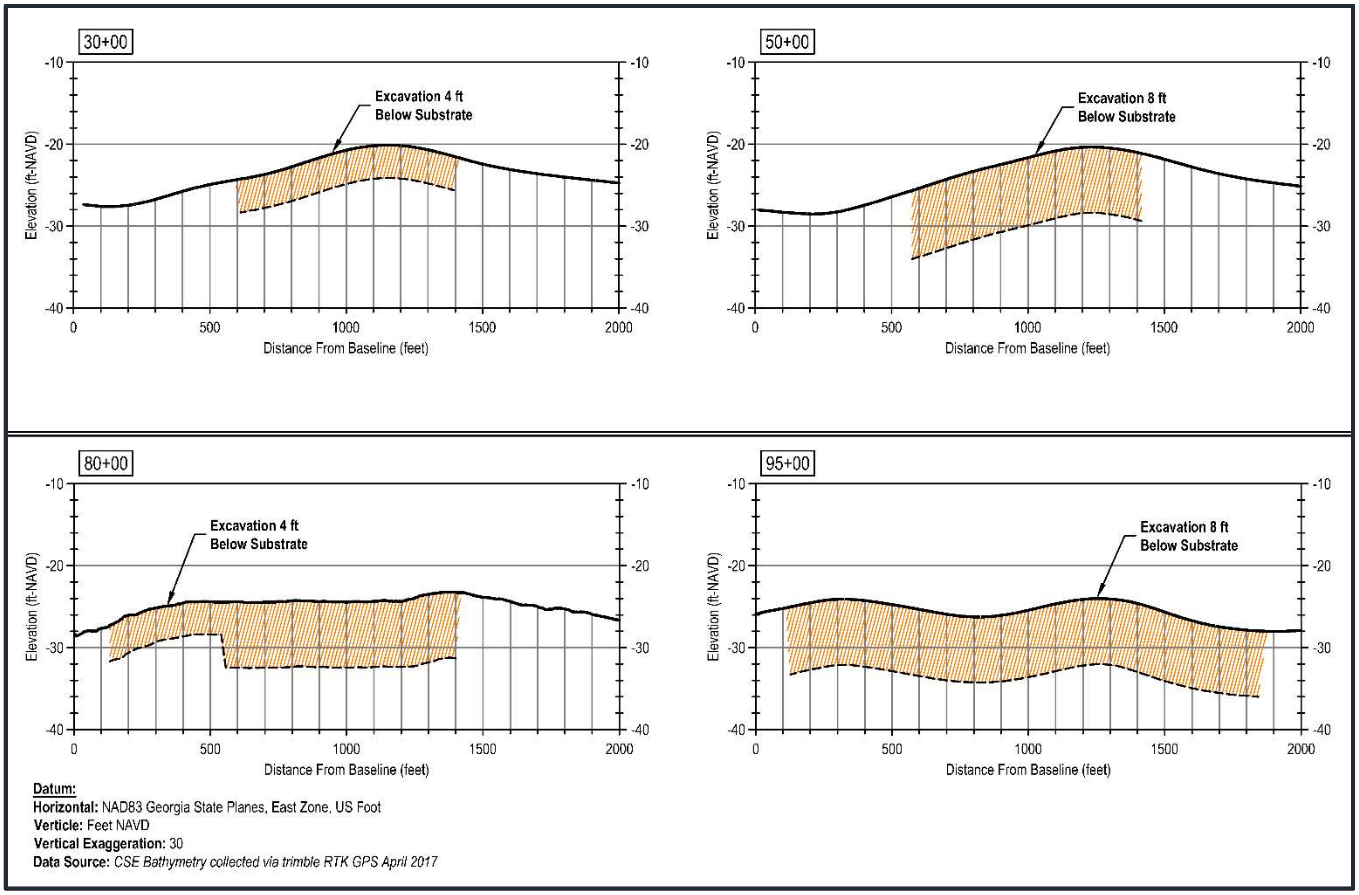

FIGURE 2.7. Representative dredge-cut sections through the offshore borrow area. See Figure 2.5 for section locations.

2.2 Shore Protection History

Sea Island has been developed as a premier resort and residential community since the 1920s. Like many US barrier islands, it has sustained erosion over time due to irregular wave patterns and sediment transport around the shoals of Hampton River Inlet and Brunswick Harbor entrance. Gould's Inlet, an unstable migrating channel at the downcoast end of the island has also influenced the Sea Island shoreline. Sea-level rise of nearly 1 ft over the past century has also been a factor, but is less important to the shoreline dynamics at decadal time scales because of local influences of the tidal inlets. Large-scale changes in nearshore shoals at the ends of Sea Island modify the flow of sand along the island and cause irregular shoreline changes that complicate management of the beach.

In response to the dynamic changes along Sea Island, most of the shoreline was armored by the early 1980s. Sloping concrete seawalls and quarry-stone revetments were constructed along the back beach as erosion encroached on development. Much of the dry-sand beach along the island was lost to erosion in the 1980s. Since then, the applicant has completed three nourishment projects via hydraulic dredge as listed in Table 2.3. These projects total ~2,500,000 cy with the majority of the sand obtained from the inshore shoals of Hampton River Inlet. All projects were completed between 1986 and 1997.

In conjunction with the 1990 nourishment project, the applicant constructed two groins (near stations 95+00 and 260+00) for purposes of retaining a portion of the nourishment volume within Sea Island. The applicant implemented a sand-recycling program between 1993 and 2015 under the 1990 nourishment permit and periodically shifted sand from accumulation areas (groin "fillets") to the center of the island. Recycling was generally performed every other winter as needed based on beach monitoring surveys. This program was successful in maintaining a sand cover over most of the sloping concrete seawall most of the time and in providing a viable dry beach for recreation and turtle nesting along much of the island.

TABLE 2.3. Three nourishment projects via hydraulic dredge have been completed by the applicant since the 1980s. Proposed borrow area is within Georgia state waters but away from Hampton River Inlet and Brunswick navigation channel.

Sea Island Beach Nourishment History				
Year	**Funding Source**	**Status**	**Project Type**	**Volume (cy)**
1986	Sea Island Company	Completed	Black Banks River Borrow Area (BA) Dredging	~192,000
1990	Sea Island Company	Completed	Hampton River Inlet BA via Dredge	~2,000,000
1997	Sea Island Company	Completed	Hampton River Inlet BA via Dredge	~350,000
2018–2019	**Sea Island Company**	**Proposed**	**Offshore BA Dredging**	**Up to 2,500,000**

Surveys by Oertel (1993–2015) indicate that a total of ~1.3 million cubic yards were recycled along Sea Island between 1990 and 2015. A typical recycling volume has been ~150,000 cy per event. Using Oertel's shoreline monitoring data, the applicant estimates the underlying erosion rates along the center of the island since 1990 have ranged from 3 cubic yards per foot per year (cy/ft/yr) to 8 cy/ft/yr, after factoring out the recycling impacts. Rates of this order are many times greater than the expected shoreline recession rate due to sea-level rise (<0.5 ft/yr). The applicant proposes to counteract erosion for at least 5–10 years via addition of a sand volume that exceeds the underlying erosion rates along Sea Island.

2.3 Present Beach Conditions

During the past two years, Sea Island has been impacted by Hurricane Matthew and Hurricane Irma. These events have exacerbated erosion and eliminated the dry-sand beach along the center ~2 miles of shoreline. The applicant has established a survey control line and has measured profiles at 500-ft spacing along the island. These data were used by CSE to determine how much sand per unit length of shoreline is contained in a healthy beach section (~125 cy/ft from the seawall to –7 ft NAVD) and to compare that value with the amount at each profile. The analysis, combined with the underlying erosion rates, provided a measure of scale of the project needed for beach restoration (see Fig 1.1). Presently, over half of the Sea Island ocean-front lacks any dry sand beach area at high tide, which leaves the rock revetments exposed and results in the absence of habitat for sea turtle nesting and other species. (Fig 2.8).

The activities proposed are located outside of the ±80-acre area on the south end of the island that is protected in perpetuity by a conservation easement held by the St. Simons Land Trust. This conservation easement was given voluntarily by the applicant to insure that no additional development would occur south of the Reserve project authorized by SPC permit #438.

FIGURE 2.8. Ground photos at low tide near Station 175+00 and Station 215+00 in Reach "B" on 13 October 2017 after Hurricane *Irma* (D Giles, CSE). Note complete loss of the upper beach face and the lack of a dry-sand berm.

2.4 Alternatives Considered

The applicant has evaluated various shore-protection and beach-restoration alternatives since the 1970s. The applicant has evaluated this proposed action in accordance with 40 CFR Section 230 and has determined that the preferred alternative represents the LEDPA (*Least Environmentally Damaging Practicable Alternative*). See the accompanying narrative to the permit application.

The applicant's preferred alternative includes:

- Construction of a 350-ft T-head terminal groin at the western project limits in Reach 1.
- Dune construction and beach nourishment at The Reserve (Reach 1) by trucking sand from the south groin fillet, or by hydraulic means.
- Placement via hydraulic (cutterhead) dredge and pipelines of an anticipated 1,315,000 cy (but no more than 2,500,000 cy) of beach-quality sediment form the identified borrow area along up to 17,700 lf of shoreline (Reaches 1, A, B, C).
- Periodic recycling and management of the nourished beach as appropriate.

As shown in Figure 2.2, the project encompasses work in:

- Reach 1, south of the south groin.
- Reach A, which extends from the existing south groin on Sea Island 4,000 lf north to approximately East 9th Street.
- Reach B, which extends 9,000 lf from approximately East 9th Street to East 34th Street.
- Reach C, which extends 3,500 lf north from East 34th Street.

The preferred alternative will satisfy the overall project purpose and represents the LEDPA. Impacts to the beach and the offshore borrow site are temporary and minor, and are expected to recover in a short period of time. The preferred alternative will restore storm protection and may provide an additional ~90 acres of dry-sand beach, providing habitat for turtle nesting, shorebird roosting, and recreational use.

Several sand sources were considered but rejected as borrow areas.

<u>Black Banks River Shoals (1986 borrow source)</u> — This area was rejected because it does not contain sufficient volume to meet the goals and objectives of the proposed project. The applicant rejected potential dredging at this location.

<u>Hampton River Inlet Shoals (1990 and 1997 borrow source)</u> — This area contains extensive beach-quality sands, which have accumulated as part of the ebb-tidal delta of the inlet. It also contains a subaerial area in close proximity (Hupps Bar, sometimes referred to as Pelican Shoals), which has provided important shorebird habitat. The applicant rejected potential dredging at this location.

<u>Brunswick Entrance Channel Shoals</u> — This area was considered but rejected because it is further distant from most of the project area. The applicant rejected potential dredging at this location.

Gould's Inlet Shoals — This area was rejected because the available volumes in the ebb-tidal delta are considered insufficient to achieve the goals and objectives of the applicant. Additionally, this location provides a significant habitat for shorebirds, and is located in designated critical habitat for piping plover (GA-14). The applicant rejected potential dredging at this location.

Upland Sand Sources — Upland sand sources were rejected because of the scale of the project. An upland sand source of the magnitude required for this project is not readily identifiable. Inland sand sources would have to be loaded at the source, trucked to the beach over local roads, then spread by mechanical equipment along the beach. Volumes over 1 million cubic yards would require upward of 80,000 truckloads and would cause extensive damage to existing roads.

The applicant also evaluated an alternative dredging technique as follows.

Excavations via Hopper Dredge — This alternative was considered but rejected based on discussions with US dredging companies that have ocean-certified dredges licensed to operate in offshore waters. Generally, ocean-certified hopper dredges require water depths of >25 ft at low tide. The hopper is pumped full and the vessel transits to a pumpout point relatively close to shore. Water depths over the proposed borrow area are less than 25 ft at low tide, limiting how large a load US hopper dredges could take on before hitting the bottom. Water depths between the proposed borrow area and the shore gradually shoal, which would preclude the location of a convenient pumpout close to shore. A final consideration that is applicable in this case is the greater risk that hopper dredges pose to certain threatened and endangered marine mammals such as the right whale which is known to frequent the waters near the borrow area.

The applicant also considered a number of different fill configurations along the beach.

Profile Nourishment Below Low Water — This alternative was rejected because it is more difficult to control the slurry and the lower shore face at Sea Island toes into the gently sloping platform off the island at depths of approximately −6 ft to −8 ft NAVD. Low wave energy along the Georgia coast limits the rate of bar movement as evidenced by the persistence of detached intertidal shoals off the northern end of Sea Island. Profile nourishment is sometimes feasible where there is a likelihood the deposits will quickly move onshore by natural processes and build up the visible beach. This would not be a viable alternative for achieving the goals and objectives of the applicant in the Sea Island setting.

Placing All Nourishment on the Subaerial Beach and Existing Dunes — This alternative placement configuration was rejected because of the scale of the project and the excessive height of fill that would be required to accommodate the planned volumes. Any sand placement extending well above the normal dry-beach level becomes subject to scarping and chronic recession until sufficient material shifts downslope. Such scarps would inhibit recreation and turtle nesting while altering the character of the beach.

Eliminating Dune Construction — This alternative was rejected by the applicant because natural dune growth tends to be relatively slow. This is generally related to the limited dry-beach widths found along the Georgia coast where high tide produces a much wider wet-sand beach. Georgia's temperate climate promotes rapid propagation of vegetation along sections of dry beach that become stable for a couple of years. As vegetation propagates toward the normal yearly uprush limit, the dry-sand area narrows, reducing an aeolian supply to the dunes. These factors inhibit dune growth and would delay reaching the level of dune protection desired by the applicant. Therefore, the applicant proposes to construct a continuous foredune along Reach B where erosion encroaches daily on the existing rock revetments, with additional dune work in Reaches 1, A, and C as discussed elsewhere.

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3.0 LIST OF SPECIES

The proposed project, on Sea Island, in Glynn County (GA), is located on the southeast coast, about halfway between Savannah and Jacksonville (FL). Sea Island is included among the four barrier islands—Jekyll Island, St. Simons Island, Sea Island, and Little St. Simons Island, that comprise the "Golden Isles." Of these islands, three are inhabited and are heavily populated and developed along the shoreline (glynncounty. org). The maritime forests, estuaries, marshes, and miles of beach and dune systems of the islands provide habitat for many coastal species. Threatened and endangered species occurring or potentially occurring in Glynn County (GA) on the beach and within littoral zone areas are provided in Table 3.1 (GADNR, USFWS). Table 3.2 lists the threatened and endangered marine species in Georgia as determined by and under the jurisdiction of NOAA–NMFS (NOAA Fisheries or NMFS).

3.1 General Effects on Listed Species and Critical Habitat

The proposed Sea Island shoreline protection project will be conducted along the ocean beach, in the littoral zone, and offshore ocean. No forested land, inland coastal plain, freshwater habitats, or estuarine wetlands are located in the project limits. The proposed project will potentially affect few of the 62 species of plants and animals on the Federal Endangered and Threatened Species List (fws.gov/athens/endangered.html).

Of the 25 threatened and endangered plants listed for federal protection in Georgia, none are documented as occurring in Glynn County. Were Coastal Plain species such as the endangered hairy rattleweed, Canby's dropwort, or American chaffseed to occur in the county, it is highly unlikely they would occur in or near the project area as they prefer inland habitats not located on or near the beach, dunes, or dune fields. Therefore, no threatened or endangered plants would be affected by the proposed project (fws.gov/ athens/endangered/ teplants.html).

Of note is the lack of occurrence of the seabeach amaranth (*Amaranthus pumulus*), listed as threatened in North Carolina and South Carolina (USFWS 1996a). It is typically addressed in BAs for these states, where it has been observed on beaches, lower foredunes, and overwash flats (Fussell 1996). Although seeds can remain dormant for many years, this species has not been documented in either North or South Carolina since 2005 and 2004 (respectively) (nps.gov/articles/caha_sba2015.html; biologicaldiversity.org/campaigns.esa_works/profile_pages/SeabeachAmaranth.html). Because the southernmost range of this plant is not known to extend beyond Charleston County (SC), it is therefore not known to occur in Georgia (Weakley et al 1991).

TABLE 3.1. Threatened and endangered species. The following table contains species that are known to or are believed to occur in Glynn County (GA) on or near beaches and the littoral zone (USFWS, GADNR).

Sources:
fws.gov/athens/pdf/GA_Endangered_Species_Fact_Sheet_40104.pdf
fws.gov/athens/endangered.html
gakrokow.github.io/natels/element_lists.html?order_by=sname&group=all_groups&status=us&rank=s1s2&show_rank=true&show_status=true&show
georgiabiodiversity.org/natels/element_lists.html

Common Name	Scientific Name	Status
Birds		
Piping plover	*Charadrius melodus*	T, State T, CH
Red knot	*Calidris canutus rufa*	E, State R
Fish		
Atlantic sturgeon	*Acipenser oxyrinchus**	E, State E
Shortnose sturgeon	*Acipenser brevirostrum**	E, State E
Mammals		
Blue whale	*Balaenoptera musculus*	E
Fin(back) whale	*Balaenoptera physalus**	E
Humpback whale	*Megaptera novaengliae*	E, State E
North Atlantic right whale	*Eubalaena glacialis*	E, State E, CH
Sei whale	*Balaenoptera borealis*	E
Sperm whale	*Physeter macrocephalus*	E
West Indian manatee	*Trichechus manatus*	T, State E
Plants – No plants classified as E or T occur along beach or littoral zone in Glynn County.		
Reptiles		
Green sea turtle	*Chelonia mydas**	E, State T
Hawksbill sea turtle	*Eretmochelys imbricata*	E
Kemp's ridley sea turtle	*Lepidochelys kempii**	E, State E
Leatherback sea turtle	*Dermochelys coriacea**	E
Loggerhead sea turtle	*Caretta caretta**	T, State T, CH

Key to Species Status

*	The FWS and the NMFS share jurisdiction of this species.
CH	PP: Units GA-13, GA-14 RW: Unit 2, southeastern US calving area
E	Federally Endangered (and/or state Endangered as listed by GADNR)
T	Federally Threatened (and/or state Threatened as listed by GADNR)
R	Proposed for removal from the List of Endangered and Threatened Wildlife and Plants

TABLE 3.2. Georgia threatened and endangered marine species under NOAA-NMFS. [*Green turtles are listed as threatened, except for breeding populations of green turtles in Florida and on the Pacific Coast of Mexico, which are listed as endangered.]

Sources:
nmfs.noaa.gov/pr/species/esa/ sero.nmfs.noaa.gov/protected_resources/index.html
georgiawildlife.com/sites/default/files/wrd/pdf/fact-sheets/2009_humpback_whale.pdf]

Species	Common Name	Scientific Name	Status
Fish	Atlantic sturgeon	*Acipenser oxyrhynchus oxyrhynchus*	E
	Shortnose sturgeon	*Acipenser brevirostrum*	E
Sea Turtles	Green sea turtle	*Chelonia mydas*	T*
	Hawksbill sea turtle	*Eretmochelys imbricata*	E
	Kemp's ridley sea turtle	*Lepidochelys kempii*	E
	Leatherback sea turtle	*Dermochelys coriacea*	E
	Loggerhead sea turtle	*Caretta caretta*	T
Marine Mammals	Blue whale	*Balaenoptera musculus*	E
	Fin whale	*Balaenoptera physalus*	E
	Humpback Whale	*Megaptera novaengliae*	E
	North Atlantic Right whale	*Eubaleana glacialis*	E
	Sei whale	*Balaenoptera borealis*	E
	Sperm whale	*Physeter macrocephalus*	E

Species proposed for listing:	None
Designated Critical Habitat:	Loggerhead (Units LOGG-N-12, LOGG-N-13) and right whale (Unit 2, southeastern US calving area
Proposed Critical Habitat:	None in the area of this proposed project

Also of note are the gopher tortoise (*Gopherus polyphemus*) (proposed T) and the eastern indigo snake (*Drymarchon couperi*)(T). Currently a candidate species, the gopher tortoise is proposed for threatened status under the ESA. The gopher tortoise prefers longleaf, pine habitat with well-drained, sandy soil. The eastern indigo snake also prefers the same habitat where it uses gopher tortoise burrows as refuge. This habitat is not found in or near the project area; therefore, neither the gopher tortoise or indigo snake will be affected by the proposed project (Normandeau 2017).

Five bird species are federally listed as endangered or threatened in Georgia, including the American wood stork (T), Kirtland's warbler (E), piping plover (T), red-cockaded woodpecker (E), and the red knot(T). Of these, the American wood stork, piping plover, and red knot have been documented in Glynn County (GA). (fws.gov/athens/endangered.html; fws.gov/athens/pdf/GA_Endangered_Species_Fact_Sheet_40104. pdf).

Kirtland's warbler is a very rare species in Georgia where only 12 records exist for this bird and only six in the last 50 years. No sites exist showing occurrences of Kirtland's warbler in recent decades. Those records that do document sightings named Cumberland Island, St. Mary's, and Savannah, along with one sighting each at St. Simons Island and Jekyll Island both in Glynn County. However, their occurrence is so rare, they are unlikely to occur at Sea Island or in the proposed project area (georgiawildlife.com/sites/default/ files/wrd/pdf/fact/sheets/kirtlands_warbler_2010.pdf).

In Georgia today, the red-cockaded woodpecker is found mainly in five population centers of federally managed public pine forest preserves because they prefer mature, open pine forest as habitat. In recent years, it has not been documented in Glynn County, neither does it occur in habitat near or in the proposed project area. Therefore, this species will not be affected by the proposed project (georgiawildlife.com/ sites/default/files/wrd/pdf/fact-sheets/red_cockaded_woodpecker_2010.pdf).

The American wood stork uses coastal habitat, but their habitats are typically inland from beaches and the littoral zone. No work will be conducted in their habitats, and therefore, they will also not be affected by the proposed project (georgiabiodiversity.org/natels/range_maps2.html).

In addition, migratory birds, including shorebirds and bald eagles, are protected by the federal Migratory Bird Treaty Act and the Bald and Golden Eagle Act. Many shorebirds frequent beaches and coastlines for foraging and resting as they migrate for winter and are often observed on Sea Island and nearby areas. Generally speaking, shorebirds are highly mobile and easily find alternative sites for feeding and foraging. The Sea Island area has been developed for many years, and the beach has undergone serial nourishment projects, making it likely the birds are accustomed to construction activities. It is likely that shorebirds will be temporarily affected by the proposed project.

A full list of the migratory birds that could be affected by activities at the proposed project site may be found in the USFWS's Information for Planning and Conservation (IPaC) Trust Resources Report (ecos.fws.gov/ipac/) (Normandeau 2017).

Those threatened or endangered species that may be present in or near the project area during construction include: piping plover (T), red knot (E), Atlantic sturgeon (E), shortnose sturgeon (E), West Indian manatee (T), loggerhead sea turtle (T), other species of sea turtles (E), and several species of whales (E). Two critical habitats were identified in the IPaC report—these were habitats for wintering piping plover (Unit GA-14, 66 FR 36070, 10 July 2001) and North Atlantic right whale (Unit 2, 59 FR 28805, 3 June 1994). In 2016, critical habitat for the right whale was extended to Unit 2 south beyond Cape Canaveral (FL) (81 FR 4838, 27 January 2016). Normandeau (2017) also addressed critical habitat for the loggerhead sea turtle north and south of Sea Island.

4.0 SPECIES ASSESSMENTS

4.1 Piping Plover (T)

In the Southeast Region, the Atlantic Coast piping plover (*Charadrius melodus*) has been listed as threatened under the ESA since 1986. In Georgia, the piping plover is also listed as threatened by the state under the Georgia Wildlife Protection Act of 1973. The piping plover breeds on coastal beaches from Newfoundland to North Carolina and occasionally in South Carolina. It is not known to breed in Georgia, but it is recognized as a protected species that winters along Georgia's coastline (georgiawildlife.com/sites/default/files/wrd/pdf/fact-sheets/piping_plover_2016.pdf). Winter grounds include the Atlantic Coast, the Carolinas and Georgia, the Gulf Coast, and the Caribbean (USFWS 1996b).

In 2008, estimates for the Atlantic Coast breeding population were 1,848 breeding pairs. The interior breeding population was estimated at about 150 pairs, and in the Great Lakes Region, where they are listed as federally endangered, the population numbered about 70 nesting pairs (georgiabiodiversity.org/profiles/charadrius_melodus.pdf). The largest proportion of the Great Lakes piping plover population is thought to winter in South Carolina and Georgia. Little Egg Island Bar and Little St. Simons Island are key locations for wintering individuals from the Great Lakes (georgiawildlife.com/sites/default/files/wrd/pdf/fact-sheets/piping_plover_2016.pdf).

A USFWS (2001) Final Rule designated "critical habitat" for piping plover in its wintering range. Figures 4.1 and 4.2 show Unit GA-8 on St. Catherines Island (GA) to Unit GA-16 on the Florida border, which include two critical habitat units for wintering piping plover on or near Sea Island (GA-13 and GA-14). Unit GA-13 covers the entire beach of Little St. Simons Island, and Unit GA-14 covers the southern end of Sea Island and East Beach St Simons Island (USFWS 2001, Normandeau 2017).

In Georgia, a mid-winter survey for the piping plover and other shorebirds has been conducted annually since 1996 to track wintering populations. A one-day event, the survey covers all beach habitat suitable for the piping plover and other shorebirds on the Georgia Coast. During the first survey in 1996, a total of 124 individual piping plover were documented; the following year, 123 were counted. During 2006–2010, the mid-winter survey in Georgia averaged 168 piping plovers per year, an increase that may be due to a nationally growing population. Protecting migratory stopover and wintering sites, as well as the individuals themselves, will ensure opportunities for this species to breed in subsequent years (georgiabiodiversity.org/profiles/charadrius_melodus.pdf).

Piping plover nest above the high-tide line on coastal beaches, sand flats at the ends of sand spits and barrier islands, gently sloping foredunes, blowout areas behind primary dunes, sparsely vegetated dunes, and washover areas cut into or between dunes. As previously stated, they are not known to breed in Georgia. Feeding areas include intertidal portions of ocean beaches, washover areas, mud flats, sand flats, wrack lines, and shorelines of coastal ponds, lagoons, or salt marshes. Loss and degradation of habitat due to coastal development and shoreline stabilization (armoring) have been major contributors to the decline of the species (USFWS 1996b).

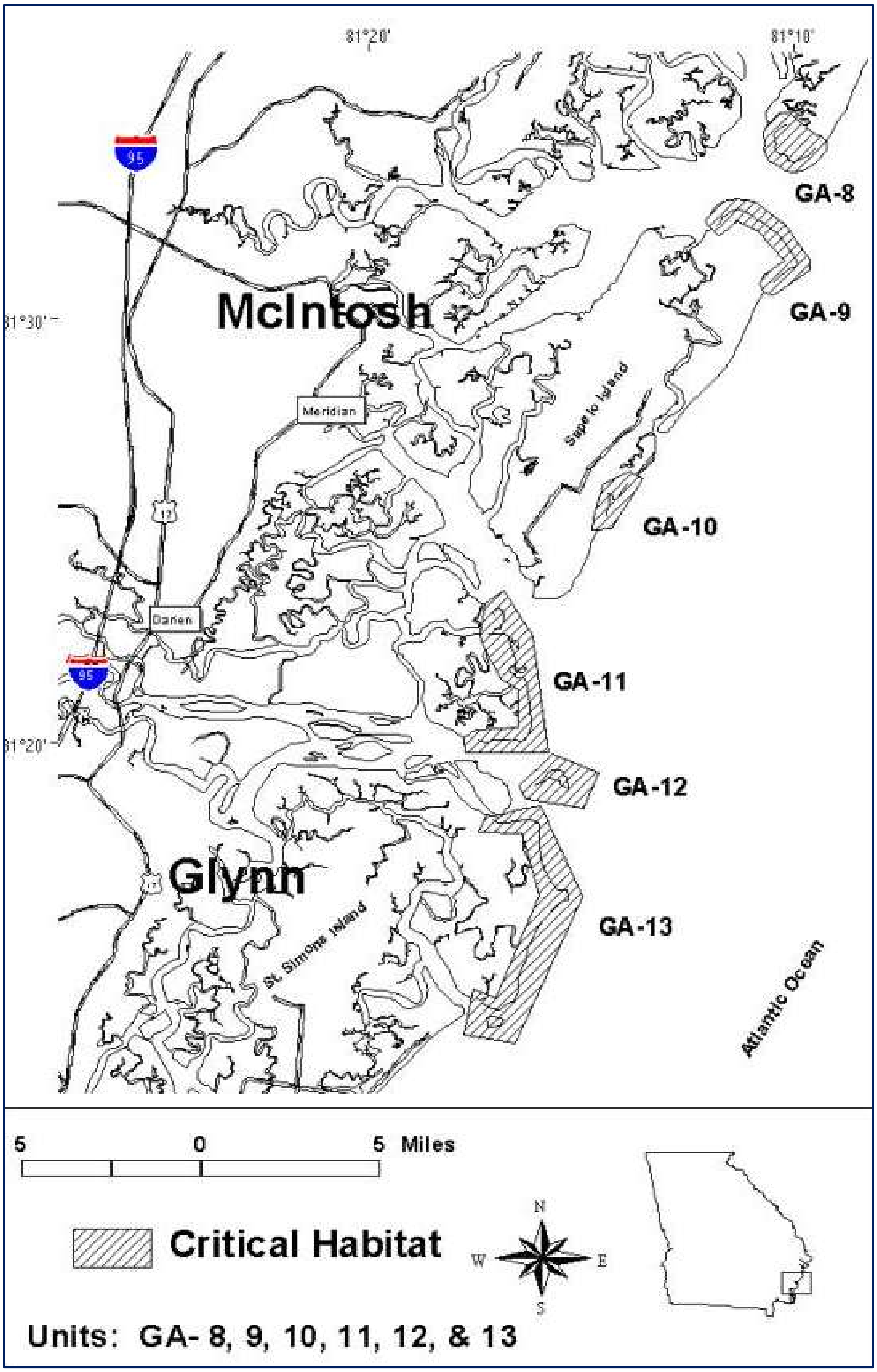

FIGURE 4.1. Designated Critical Habitat for wintering piping plover—Unit GA-8 (on St Catherines Island) to Unit GA-13 (on Little St Simons Island). [Source: USFWS 2001, Normandeau 2017]

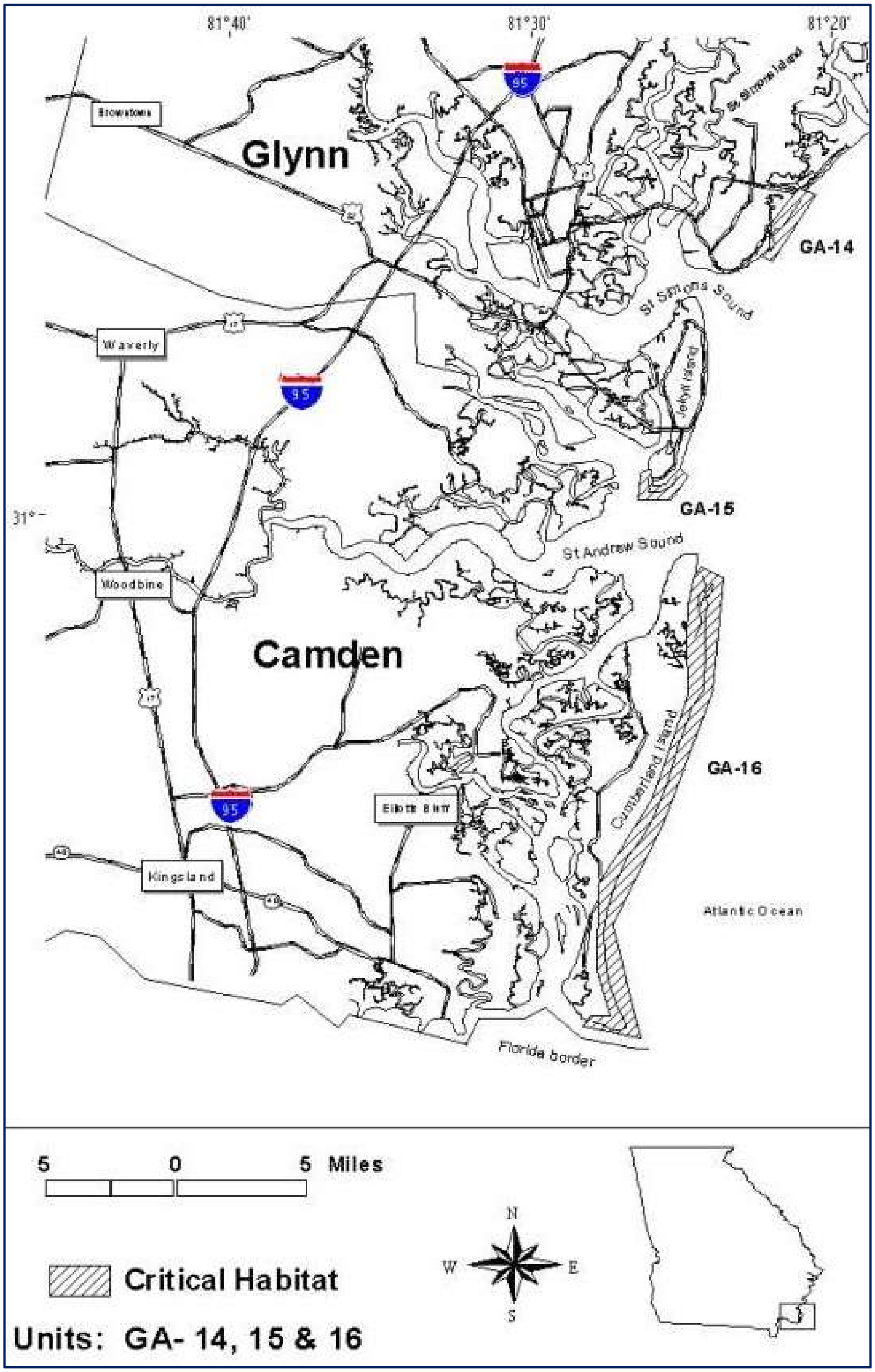

FIGURE 4.2. Designated Critical Habitat for wintering piping plover—Unit GA-14 (southern end of Sea Island and East Beach, St Simons Island) to Unit GA-16 (on Cumberland Island). [Sources: USFWS 2001, Normandeau 2017]

The presence of the piping plover is well-documented in developed and undeveloped Georgia coastal areas, wildlife refuges, and the Cumberland Island National Seashore. Some wintering birds arrive in Georgia as early as late June and early July, but most do not arrive until October. The earliest arrivals are usually adult females and immature birds that were born that summer. Barrier islands along the Georgia and South Carolina coasts are a major wintering area for this species (georgiawildlife.com/sites/).

In Georgia these include: Little Tybee, Williamson, Wassaw, Ossabaw, St. Catherines, Blackbeard, Sapelo, Wolf, Little St. Simons, Jekyll, and Cumberland Islands. They also occur on Wolf Island Bar and Little Egg Island Bar (georgiabiodiversity.org/natels/range_maps2.html), which are located in the mouth of the Altamaha River, north of Little St. Simons Island. Due to the Sea Island development, high usage, and high traffic, piping plover usage near or within the proposed project area is expected to be low. (georgiabio-diversity.org/profiles/charadrius_melodus.pdf). Most piping plovers leave the state for northern breeding areas by April (georgiawildlife.com/sites/default/files/wrd/pdf/factsheets/piping_ plover_2016.pdf).

Given the presence of piping plover in these island and bar areas and the species tendency to relocate within dynamic shorelines, it is possible for piping plover to migrate on or near Sea Island. **Therefore, this species may use the area for roosting or feeding and may be present in the proposed project area during construction, although they are more likely to utilize the higher quality habitats found at Gould's Inlet and Little St. Simons Island.**

4.2 Rufa Red Knot (T)

The rufa red knot (*Calidris canutus rufa*) is a type of sandpiper with white-gray coloring and a straight, black bill. Medium to large in size, it is roughly 9 inches long, with a wingspan of 20 inches (USFWS 2005). In 2014, it was listed as threatened under the ESA (USFWS 2014). It breeds in Alaska, Canada, and Greenland, mostly on coastal islands (georgiawildlife.com/sites/default/files/wrd/pdf/factsheets/ red_knot_2010.pdf). An epic migrator, the red knot makes annual round-trips between Tierra del Fuego and Canada. Its abilities were recognized in *The National Geographic*, where one long-lived, banded individual was cited as flying more miles than separate the earth and the moon (Franzen 2018). Red knots typically fly more than 9,000 miles to a southern destination, such as South America or one of the southeastern states of North Carolina, South Carolina, Georgia, and Florida (dnr.sc.gov/wildlife/species/ coastalbirds/shorebirds/RedKnot.html).

In June, it returns to the arctic tundra, where its plumage turns a reddish or "rufous" color on its head and body during breeding season (dnr.sc.gov/wildlife/species/coastalbirds/shorebirds/Red Knot.html). During migration, this species uses coastal beaches, usually at or near the mouth of bays, estuaries, or tidal inlets. Staging sites are associated with high wave energy coastal areas. Wintering sites are generally intertidal habitats such as beaches with significant wave action or currents (georgiawildlife.com/sites/default/files/ wrd/pdf/fact-sheets/red_knot_2010.pdf).

Red knots rely heavily on horseshoe crab eggs as a food source, timing its migration when horseshoe crabs are laying eggs in such locales as Delaware Bay. The increase in horseshoe crab harvesting is thought to be a major factor in the decline of red knot populations since the 1980s. Along with threats from coastal development and climate change, the species has never fully recovered from being hunted heavily during the early 20th century (fws/gov/pipermail/fws-southeastnews/2014-December/000617. html).

Wintering and migrating red knots are drawn to Georgia coastal areas where they forage on bivalves, gastropods, and crustaceans on sandy beaches, tidal mudflats, and salt marshes. Data show they stop for several weeks to rebuild energy reserves before continuing their migration to breeding grounds (USFWS 2014). According to GADNR, knots can be found on any Georgia barrier beach, but the islands they use most often in the winter and spring are Little Tybee, Wassaw, St. Catherines, St. Catherines Island Bar, Blackbeard, Sapelo, Little St. Simons, and Cumberland. Wolf Island, Little Egg Island Bar, and Little St. Simons Island at the mouth of the Altamaha River north of the project area support the only known late summer and fall staging site on the East Coast of the US. These sites have been known to attract as many as 12,000 knots at one time (georgiawildlife.com/sites/default/files/wrd/pdf/factsheets/red_knot_2010. pdf).

Along with over-harvesting of horseshoe crabs, threats to red knot habitat in Georgia include development, oil spills, wetlands degradation, declining invertebrate populations, and sea level rise (NJDEP 2007). In some areas, red knots may be flushed repeatedly by beach traffic in developed areas, resulting in the knots abandoning otherwise suitable sites (georgiawildlife.com/sites/default/ files/wrd/pdf/fact-sheets/red_knot_2010.pdf). The many red knot sites cited above indicate the possible presence of red knots along Sea Island.

Given the species mobility, its frequent presence at neighboring islands, and the site-to-site number fluctuations, rufa red knots may use the area for roosting or feeding and may be present in the proposed project area during construction.

4.3 Atlantic Sturgeon (E)

The Atlantic sturgeon *(Acipenser oxyrinchus)* occupies much of the same habitat as the shortnose sturgeon and is similar in appearance. The Atlantic sturgeon is larger than the shortnose and has a smaller mouth and different snout shape. Sturgeon reach up to 14 ft long and weigh up to 800 pounds. In the South, spawning occurs between the salt front and fall line of large rivers, beginning in February or March (ASMFS 2011). Following spawning, Atlantic sturgeon typically inhabit coastal estuarine waters with gravel or sand substrate. Adult sturgeon typically feed on benthic invertebrates such as mussels, worms, and shrimp. They rarely venture in the Atlantic Ocean (fisheries.noaa.gov/stories/2012/01/31_atlantic_ sturgeon.html, or georgiawildlife.com/sites/default/files/wrd/pdf/fact-sheets/shortnose_sturgeon_2013. pdf).

Atlantic sturgeon have historically been present in major estuary and river systems from the St. Croix River (ME) to the St. Johns River (FL). They are now thought to be absent from at least 14 rivers that they historically used. Sturgeon are currently present in 38 rivers spanning this range, with spawning occurring in least 20 (fisheries.noaa.gov/stories/2012/01/31_atlantic_sturgeon.html). Between 1950 and 1998, commercial fishing led to a decline in the sturgeon population, after which a moratorium was enacted to prevent fishing for or taking wild Atlantic sturgeon.

To manage the Atlantic and shortnose sturgeon populations, NOAA Fisheries has identified five distinct population segments (DPS), including the South Atlantic, Carolina, Chesapeake, New York Bight, and Gulf of Maine. All were listed as endangered in 2012, except for the threatened Gulf of Maine DPS (NOAA) (fisheries.noaa.gov/stories/2012/01/31_atlantic_sturgeon.html). In Georgia, the Atlantic and shortnose sturgeons occur within the South Atlantic DPS, which runs from the Edisto River (SA1–SC) to St Mary's River (SA7–GA/FLA). The Atlantic Sturgeon is currently in danger of extinction due to population decline over a protracted period, dramatic decreases in spawning, and impacts and threats that prevent population recovery (nmfs.noaa.gov/pr/pdfs/species/atlanticsturgeon_south-atlantic_dps. pdf).

Compared to historic levels, Atlantic sturgeon population in the South Atlantic DPS are extremely low and have remained so for the past 100 years. The Altamaha River (GA) spawning population, likely the largest in the Southeast, is at ~6 percent of its historic level. The remaining riverine spawning populations in this DPS are estimated to be at less than 1 percent of previous numbers. NOAA–NMFS reported that an estimated 8,000 spawning adult females occurred in South Carolina, and 11,000 spawning adult females occurred in Georgia prior to 1890.

Currently, there are an estimated 343 adult Atlantic sturgeon spawning annually in the Altamaha River, and less than 300 adults spawning each year in each of the remaining spawning populations in the South Atlantic DPS (nmfs.noaa.gov/pr/pdfs/species/atlanticsturgeon_south-atlantic_dps.pdf). In Georgia, South Atlantic DPS Units begin with SA3 and SAU1 at the Savannah River (SC/GA) to SA7 at St. Marys (GA/FL). Unit SA5 (Altamaha River, GA) and Unit SA6 (Satilla River, GA) are geographically closest to Sea Island, framing the island to the north and south (respectively) (Fig 4.3).

Because the proposed project will occur near high-salinity estuarine areas, Atlantic sturgeon may be present in the project area.

4.4 Shortnose Sturgeon (E)

The shortnose sturgeon (*Acipenser brevirostrum*) ranges along the Atlantic seaboard from southern Canada to northeastern Florida (Gilbert 1989) in rivers, estuaries, and tidal areas where fresh and salt water mix. Historical accounts indicate that this species was once abundant throughout Georgia waters, although early records are considered unreliable because of confusion distinguishing the shortnose from the Atlantic sturgeon (*Acipenser oxyrinchus*). Under threat for many decades, the shortnose sturgeon was originally listed as endangered by the USFWS in 1967. It was later federally protected as endangered under the ESA of 1973 (NMFS 1998) and is state protected as endangered in Georgia.

Shortnose sturgeon prefer slow current and turbid water with bottom substrates having abundant organic debris, sand, and silt (van den Avyle 1984). After spawning in April and May, shortnose sturgeon in Georgia move downstream and spend the rest of the year in coastal plain rivers, estuaries, or along the coast within a few miles of the shore (Marchette & Smiley 1982). NMFS (2000) reported that the species is considered very hardy, due to its ability to survive under extremely stressful conditions. However, during the 20th century, the species was severely affected by river pollution, incidental fish catch, commercial fishing, habitat alteration, and riverine development. Recent protection efforts under the ESA have seen slow reversals of its decline (fisheries.noaa.gov/pr/species/fish/shortnose- sturgeon.html).

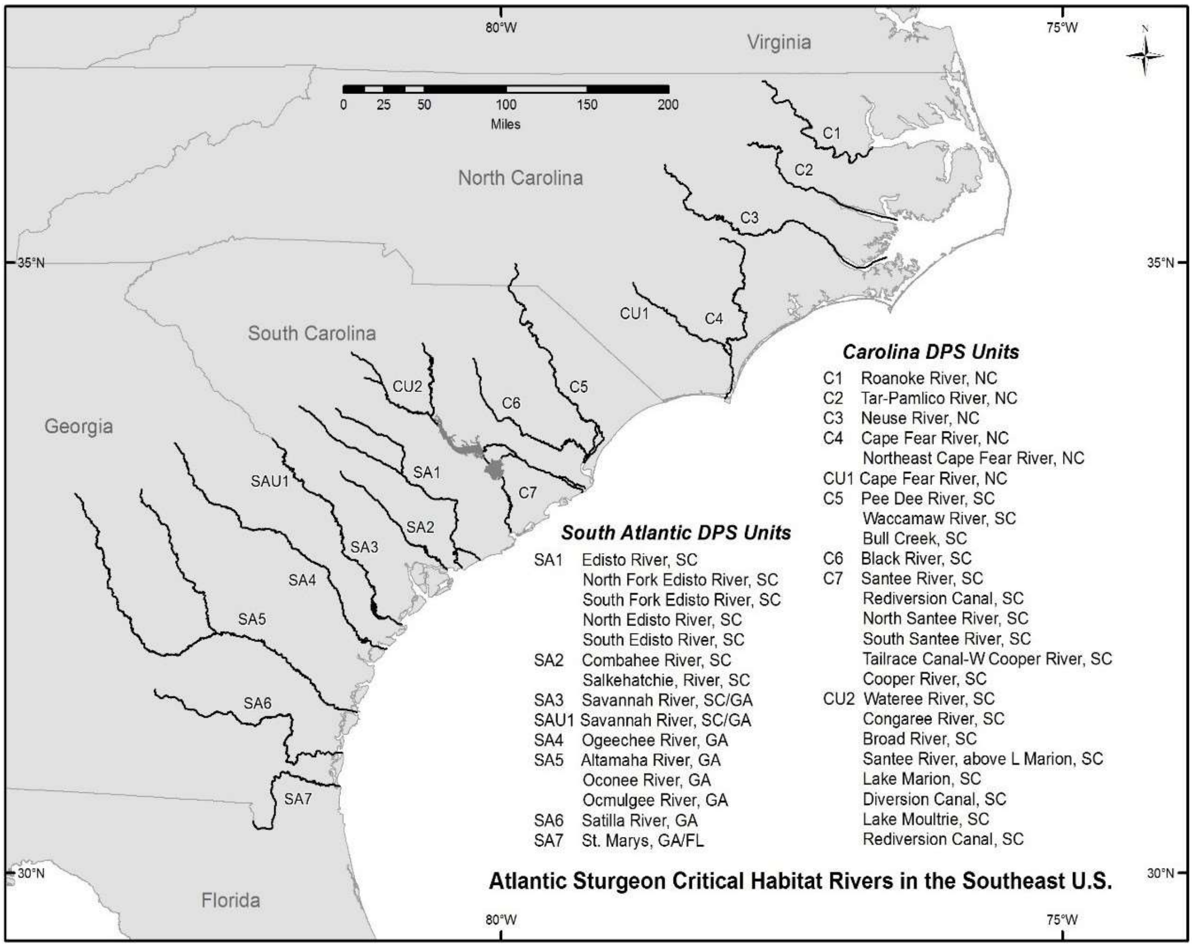

FIGURE 4.3. Map of the South Atlantic Distinct Population Segment (DPS) and Carolina DPS Units for North Carolina, South Carolina, and Georgia for atlantic sturgeon critical habitat. Note Georgia DPS Units begin SA3 and SAU1 at the Savannah River (SC/GA) and go to SA7 at St. Marys (GA/FLA). Units SA5 (Altamaha River, GA) and SA6 (Satilla River, GA) are geographically closest to Sea Island.

[Source: google.com/search?q=Boundaries+of+South+Atlantic+Region+DPS+for+sturgeon&tbm]

Known populations of shortnose sturgeon in Georgia occur in the following rivers: Savannah, Ogeechee, Altamaha, Satilla, and St. Mary's. The Altamaha River contains the largest population south of the Delaware River. Shortnose sturgeon population movements between the Ogeechee River and the Altamaha River population have been documented, indicating their probable origin from a larger metapopulation. Recent sampling has documented shortnose sturgeon in the Satilla and St. Mary's rivers, and other evidence (juveniles) indicates there may be reproduction in the Satilla River system (georgiawildlife. com/sites/default/files/wrd/pdf/fact-sheets/shortnose_sturgeon_2013.pdf).

The main type of habitats needed by shortnose sturgeon are (1) non-tidal freshwater areas for spawning and occasional over-wintering, (2) tidal areas near the fresh/saltwater mixing zone for juveniles year-round and for adults during summer, and (3) high-salinity estuarine areas for adults during winter. The shortnose sturgeon feeds on crustaceans, mollusks, insects, and the stems and leaves of macrophytes (fisheries. noaa.gov/pr/species/fish/shortnose-sturgeon.html).

Juveniles generally remain in deep-water areas throughout the day. At night, adults forage in willows immediately adjacent to deep-water areas they occupied during the day. The proposed project does not include the type of habitat used by shortnose sturgeon for feeding. Any shortnose sturgeon present in the project area would most likely be non-spawning adults (NMFS 1998). Shortnose sturgeon will avoid the noise and activity generated by the fixed dredge operations.

However, because the proposed project will occur near high-salinity estuarine areas, shortnose sturgeon may be present in the project area.

4.5 Sea Turtles

Five threatened or endangered sea turtle species inhabit Georgia coastal waters. They are the green, hawksbill, leatherback, Kemp's ridley, and loggerhead sea turtles. Since 1977, NOAA Fisheries and USFWS have shared jurisdiction over protection of these sea turtles, which are listed in the ESA (nmfs.noaa.gov/pr/species/). GADNR is the state resource agency that works with NOAA Fisheries and USFWS to protect wildlife and marine animals.

In a major effort to conserve sea turtles worldwide, NOAA Fisheries and USFWS collaborated with the shrimp trawl fishing industry to develop turtle excluder devises (TEDS) in the late 1970s to reduce sea-turtle mortality from incidental capture in shrimp trawl nets. Since 1989 the US has prohibited the importation of shrimp harvested in a manner that adversely affects sea turtles (nmfs.noaa.gov/pr/species/). NOAA Fisheries and USFWS have also developed measures to protect and monitor sea turtles during onshore beach nourishment activity and offshore dredge operations. For permit requests, it is standard procedure with beach nourishment projects to provide plans to protect, monitor, and provide mitigation when necessary for the loggerhead and other sea turtles (NRC 1990).

To present current data on sea turtle activity in Georgia, data in this BA is mainly drawn from the Sea Island Sea Turtle Program, GADNR, and SeaTurtle.org. SeaTurtle.org is based in North Carolina and partners with state agencies, including GADNR. It compiles and posts sea turtle data from community volunteers, colleges/universities, and federal and state resource agencies (SeaTurtle.org/about/). GADNR has granted permission to use posted data in this report, provided it is noted that the data are preliminary in nature.

4.5.1 Green Sea Turtle (T)

The largest hard-shelled sea turtle—the green sea turtle (Chelonia mydas)—grows to a maximum of about 4 ft and 440 pounds (USACE-DOI-NPS 2015). It is classified as threatened under the ESA. Occurring in both tropical and temperate seas and oceans, the North American distribution of the green sea turtle ranges from Massachusetts to Mexico and from British Columbia to Baja California (USFWS 1991). Green sea turtles generally favor protected waters inside reefs, bays, estuaries, and inlets. Primary habitats appear to be lagoons and shoals supporting an abundance of marine grass and algae. These turtles are predominantly herbivorous, feeding upon marine algae and willow beds of marine grasses.

Additional food sources may include mollusks, sponges, crustaceans, and jellyfish. In April 2016, NOAA and USFWS issued a final rule to list 11 Distinct Population Segments (DPS) of green sea turtles. Eight segments were listed as threatened and three were listed endangered. The green turtle occurring in Georgia waters is part of the Northwest Atlantic DPS and is listed as threatened (nmfs.noaa.gov/pr/species/).

While relatively large numbers of green turtles exist worldwide, their numbers are declining, due to over-harvesting of eggs and adults for meat, fibropapillomatosis disease, nesting habitat destruction, and incidental capture in commercial fishing gear and dredge operations (nmfs.noaa.gov/pr/species/). Nesting habitat consists of open beaches with a sloping platform and minimal human disturbance. Eastern US nesting is limited primarily to the east coast of Florida with 200–1,100 nests reported annually, compared to the Cape Hatteras National Seashore (NC), with 23 nests reported in 2013, the highest number since 2006 (USACE-DOI-NPS 2015).

Based on numbers reported to Seaturtle.org for Sea Island and neighboring Little St. Simons and St. Simons Islands, green sea turtle nesting appears to be infrequent to rare (seaturtle.org). For the years 2013–2017, only one green sea turtle nest was identified on Sea Island (2013). Similarly, in 2013, two green turtle nests were identified at Little St. Simons Island, but none in years following up to 2017. In that same period, no green turtle nests were documented at St. Simons Island (seaturtle.org).

In the first two weeks of 2018, perhaps due to unseasonably cold temperatures, five green turtle strandings were reported, four of which occurred in Glynn County; three on Jekyll Island, one on Sea Island, and one on Cumberland Island. In 2017, one green turtle stranding was reported in Georgia, occurring on Little Cumberland Island. No strandings were recorded for Glynn County in 2017. In 2016, two were reported offshore of Tybee, two in St. Simons Sound, and one on the state border near Cumberland Island. In 2015 and 2014, only one stranding was reported on Cumberland Island and none were reported in 2013 for the entire state (seaturtle.org/ strand/summary/gmap).

Although documented sightings near Sea Island are low, it is possible that green sea turtles may be found in waters offshore of Sea Island in the proposed project area.

4.5.2 Hawksbill Sea Turtle (E) and Leatherback Sea Turtle (E)

The hawksbill sea turtle *(Eretmochylis imbricata)* and leatherback sea turtle *(Dermochelys coriacea)* are found mainly in tropical waters of the Atlantic, Pacific and Indian Oceans. The hawksbill and leatherback sea turtles were listed as endangered throughout their global range under the 1973 ESA, as amended (originally designated 1970).

In the US, hawksbill nesting occurs mainly from June to December in Puerto Rico, the US Virgin Islands, and Florida. Nesting is most common in Puerto Rico, where two offshore islands are designated critical habitat. In the continental US, the hawksbill is most common in Texas and Florida, although they have been observed from the Gulf States to as far north as Massachusetts (Plotkin et al 1995). They are commonly associated with healthy coral reefs and are found along narrow creeks, submerged rocky areas, willow coastal areas, and lagoons of oceanic islands (USFWS 1991). Their diet includes algae, mangrove, barnacles, clams, sponges, snails, fish, and sea urchins.

Hawksbill sea turtles infrequently occur along the Georgia coast, which is indicated by the lack of reported occurrences of hawksbill (seaturtle.org). For the period 2009–2017 (with 2009 the earliest year of data provided), no documented occurrences of hawksbill nests on the Georgia coast are recorded. Between 1997 and 2017, stranding data on the hawksbill sea turtle along the coast of Georgia showed two stranded hawksbills documented in 1998, one in 2008, and one offshore in 2010 (seaturtle.org/strand/summary/gmap).

Leatherback sea turtles occur more often than Hawksbill sea turtles in Georgia waters, although documented sightings are also very low (seaturtle.org, USACE-DOI-NPS 2015). The largest of all turtles, leatherbacks are an open-ocean species that sometimes move into willow bays, estuaries, and river mouths. It is the deepest diving and most wide-ranging of all sea turtles. In the continental US, nesting occurs from about March to July, mainly in Florida, but has also been reported in Georgia, South Carolina and North Carolina (fws.gov/northflorida/, USACE-DOI-NPS 2015). Their preferred diet is jellyfish and may also include sea urchins, squid, shrimp, fish, blue-green algae, and floating seaweed.

According to Seaturtle.org, one leatherback sea turtle nest was recorded on Sea Island in 2014 during the period 2013–2017. In 2017, the following leatherback sea turtle strandings occurred in Georgia waters; four on Tybee Island, one on Blackbeard Island, one on Sea Island, one on St. Simons Island, one in the Cumberland Island National Seashore, and four floating offshore of Sea Island and St. Simons Island (seaturtle.org/strand/summary/gmap).

Although documented occurrences of Hawksbill and Leatherback sea turtles near Sea Island are low, it is possible that they may be found in waters offshore of Sea Island in the proposed project area.

4.5.3 Kemp's Ridley Sea Turtle (E)

The Kemp's ridley sea turtle *(Lepidochelys kempii)* is the most endangered of the sea turtles and was listed as endangered throughout its range under the ESA, as amended (originally designated in 1970) (USACE-DOI-NPS 2015). One of the smallest of the sea turtles, it inhabits willow coastal and estuarine waters, often in association with subtropical shorelines of red mangrove. Its diet consists of crabs, fish, jellyfish and a variety of mollusks (nmfs.noaa.gov/pr/species/turtles/kempsridley.html.2015). Nearly the entire population nests on ~25 miles of beach in Mexico between April and July, although some nests occur in Texas and infrequently in other states (USACE-DOI-NPS 2015, p 52; fws.gov/northflorida/).

The major habitats for the adult Kemp's ridley are the nearshore and inshore waters of the northern Gulf of Mexico, especially Louisiana. After nesting, female Kemp's ridleys move to foraging areas, which range from the Yucatan Peninsula to southern Florida. Hatchlings swim offshore where they drift with floating sargassum seaweed for food and protection and are carried to the Atlantic Ocean on the Gulf Stream (nmfs.noaa.gov/pr/species/turtles/kempsridley.html). Overharvesting of eggs, juveniles and adults for food and other products has been a major factor in this species decline (NOAA 2000). According to NMFS data collected for four sea turtle species, the Kemp's ridley sea turtle is most at risk of drowning by incidental capture in commercial fishing gear, specifically, otter trawls, skimmer trawls, and try nets (NOAA–NMFS–SERO 2012).

According to seaturtle.org, for the years 2013–2017, two Kemp's ridley sea turtle nests were documented on Sea Island (2017). In 2017, Seaturtle.org documented one Kemp's ridley stranding on East Beach at St. Simons Island, and one was found on Jekyll Island near St. Simons Sound (seaturtle.org/strand). In 2016, two stranded Kemp's ridleys were documented on St. Simons Island, four on Jekyll, and one on the Cumberland Island National Seashore. In 2015, one stranding was reported for Tybee, one for Sapelo, one on Sea Island, three on St. Simons Island, three on Jekyll Island, and five on Cumberland Island, with one offshore of Cumberland (seaturtle.org/strand). In 2014, only four strandings occurred, with one documented on Sea Island. Considering the overall number of strandings in recent years and the lack of nests, this confirms the studies showing that Kemp's ridley is mostly a migrating sea turtle off Georgia waters (nmfs.noaa.gov/pr/species/turtles/kempsridley.html).

Although documented occurrences of Kemp's ridley sea turtles near Sea Island are low, it is possible that they may be found in waters offshore of Sea Island in the proposed project area.

4.5.4 Loggerhead Sea Turtles (T, CH)

Loggerhead sea turtles *(Caretta caretta*) are found worldwide in temperate and tropical regions of the Atlantic, Pacific and Indian Oceans. They are named "loggerhead" in recognition of their large skulls, which support strong jaws for crushing conchs and crabs (dnr.sc.gov/seaturtle/cc.htm). In the US, they are the most abundant species found in coastal waters. In 2011, NOAA Fisheries identified nine Distinct Population Segments (DPS) worldwide for loggerhead sea turtle protection. Four of these DPS are classified as threatened under the ESA and five are classified as endangered. Loggerheads in Georgia are classified as threatened under the Northwest Atlantic Ocean DPS (nmfs.noaa. gov/pr/species/).

Major nesting areas occur along the southeast US coast from North Carolina to Florida with about 80 percent occurring in Florida (nmfs.noaa.gov/pr/species/). Loggerheads are known to nest an average of approximately four times within a nesting season (USFWS 2007). The inter-nesting interval varies around a mean of about 14 days. Females are believed to mate prior to the nesting season (and possibly only once) and then lay multiple clutches of fertile eggs during the season. Mean clutch size varies from about 100 to 125 along the southeastern US coast. The incubation period is related to nest temperature on the order of 60 days. Sex determination in loggerhead hatchlings is temperature-dependent, with highest nest temperatures tending to lead to more females.

Upon emergence from nests, hatchlings head to the surf zone to swim rapidly offshore. Like Kemp's ridley sea turtles, loggerhead hatchlings become associated with sargassum rafts and debris lines, while juveniles prefer willow-water bays and estuaries. They feed on crustaceans, mollusks, squid, jellyfish, fish, and plants. At maturity, they move offshore and can be found at the edge of the continental shelf, feeding on benthic invertebrates and foraging around coral reefs and artificial reefs. After growing to a carapace length of about 45 centimeters (cm), loggerheads migrate to nearshore and estuarine waters of the eastern US, the Gulf of Mexico, and the Bahamas and begin their sub-adult stage. As adults, loggerheads become migratory for breeding purposes (NMFS–USFWS 1991). During the warmer months, loggerheads are found throughout marine and estuarine waters of Georgia. They have been observed 62 miles (104 km) offshore in the Gulf Stream, as well as in saltmarsh creeks and tidal rivers (georgiawildlife.com/sites/default/files/wrd/pdf/fact-sheets/loggerhead_sea_turtle_2011.pdf).

For sea turtles known to occur in Georgia waters, the loggerhead is the most common nesting species, laying eggs on every barrier island from Cumberland Island in the south (near Florida) to Tybee Island in the north (near South Carolina). In Georgia, the nesting season runs May through October, with nesting activity greatest in June and July. Typically, nest hatch occurs from August through the end of October. Genetic testing has found that the breeding loggerheads in Georgia have been identified as part of a distinct cohort that breeds in North Carolina, South Carolina, and North Florida south to Cape Canaveral (georgiawildlife.com/sites/default/files/wrd/pdf/fact-sheets/loggerhead_sea_turtle_2011.pdf).

As a threatened species on the state and federal level, the loggerhead sea turtle is under the jurisdiction of NMFS while in their marine environment, and the USFWS during terrestrial nesting periods. GADNR coordinates sea turtle conservation efforts in the state. Because loggerhead nests are subject to predation, poaching and habitat destruction, GADNR leads the Sea Turtle Cooperative to mark, protect and monitor nests during spring and summer. Refuges and preserves where loggerhead sea turtles are known to nest include Little Tybee Island Natural Area, Wassaw Island National Wildlife Refuge, Ossabaw Island Heritage Preserve, Blackbeard Island National Wildlife Refuge, Sapelo Island Wildlife Management Area, Wolf Island National Wildlife Refuge, Jekyll Island State Park, and Cumberland Island National Seashore (Georgia wildlife.com/sites/default/ files/wrd/pdf/fact-sheets/loggerhead_sea_turtle_2011.pdf).

The USFWS has designated two critical habitat units along the Georgia coast, LOGG-N-12 and LOGG-N-13. As shown on the map of Figure 4.4, these units are located north and south of the project area and do not include Sea Island. However, Sea Island beaches are actively used for loggerhead turtle nesting, as shown by the numbers of nests in the last 20 years in Table 4.1 and Figure 4.4 (Normandeau 2017).

TABLE 4.1. Loggerhead sea turtle nests along Sea Island (GA) for the period 1990–2017. [Source: Normandeau 2017; www.seaturtle.org.]

Loggerhead Sea Turtle Nests Along Sea Island (GA) (1990–2017)							
1990	51		**2000**	62		**2010**	86
1991	111		**2001**	60		**2011**	62
1992	70		**2002**	73		**2012**	102
1993	39		**2003**	100		**2013**	85
1994	91		**2004**	26		**2014**	40
1995	101		**2005**	51		**2015**	111
1996	52		**2006**	64		**2016**	110
1997	49		**2007**	52		**2017**	66
1998	79		**2008**	74		**Average**	**73.1**
1999	105		**2009**	76		**Std. Dev.**	24.2

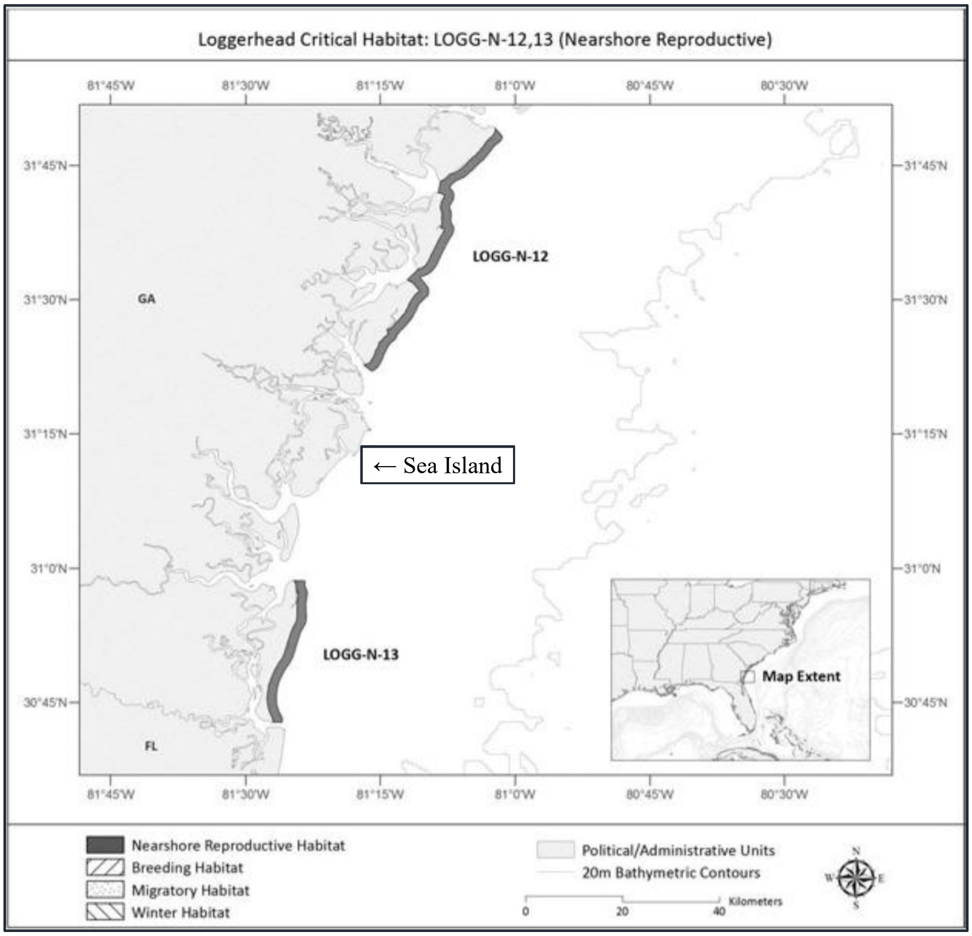

FIGURE 4.4. Map of USFWS designated critical habitat for the loggerhead sea turtle along the Georgia Coast, specifically in islands contiguous to Sea Island (GA). [Source: Normandeau 2017]

Loggerhead sea turtle stranding data from seaturtle.org indicates the presence of this species in waters near and offshore of Sea Island. For 2017, two loggerheads were found stranded on Sea Island, three at Little St Simons Island, five at St Simons Island, 11 at Jekyll Island, and three floating in St. Simons Sound. For 2016, data show six strandings on Sea Island, three on Little St Simons and two floating offshore, 12 on St Simons, and 13 on Jekyll Island; 2015 data show four at Sea Island with one floating offshore, one at Little St Simons Island with two floating offshore, four on St Simons, and 11 at Jekyll Island (seaturtle.org/strand/).

Trends in loggerhead nesting effort are currently the best estimate of the Georgia population of this species (GADNR 2016). The loggerhead nesting trend for the Northern Recovery Unit (NRU) (including Georgia and Florida), determined from daily surveys of 11 beaches within the NRU from 1983 to 2008, indicated a significant downward trend of 1.3 percent per year ($p = 0.03$; Conant et al 2009). However, more recent data document loggerhead nesting numbers have been increasing over time with a long-term upward trend of ~3 percent per year in Georgia (GADNR 2016). The Georgia season count in 2016 was 3,292 nests (GADNR 2016). This count is the latest in a string of robust nesting counts and surpasses the state's long-term recovery goal of 2,800 nests by the year 2028 (Seaturtle.org 2016). In addition to 2016, Georgia also had relatively high nest counts in 2013 (n = 2,313 nests), 2015 (n=2,333) and 2017 (n=2,187). Seaturtle.org 2017 (Normandeau 2017).

Extensive nesting data on Sea Island indicates that it is highly probable that loggerhead sea turtles are likely to occur in the proposed project area.

4.5.5 Census of Sea Turtle Nesting on Sea Island

For over 20 years, Sea Island has operated the Sea Island Sea Turtle Program, in which it monitors sea turtles and provides education to residents and visitors (Fig 4.5). The program coordinates with and works under guidelines provided by the GADNR. The Sea Turtle Program conducts daily dawn patrols of the 5-mile beach during turtle nesting and hatching season using the protocols developed by GADNR and other guidelines. Guidelines include inventory, species identification, nest relocation, predator control, and preparation of the nesting databases (Normandeau 2017).

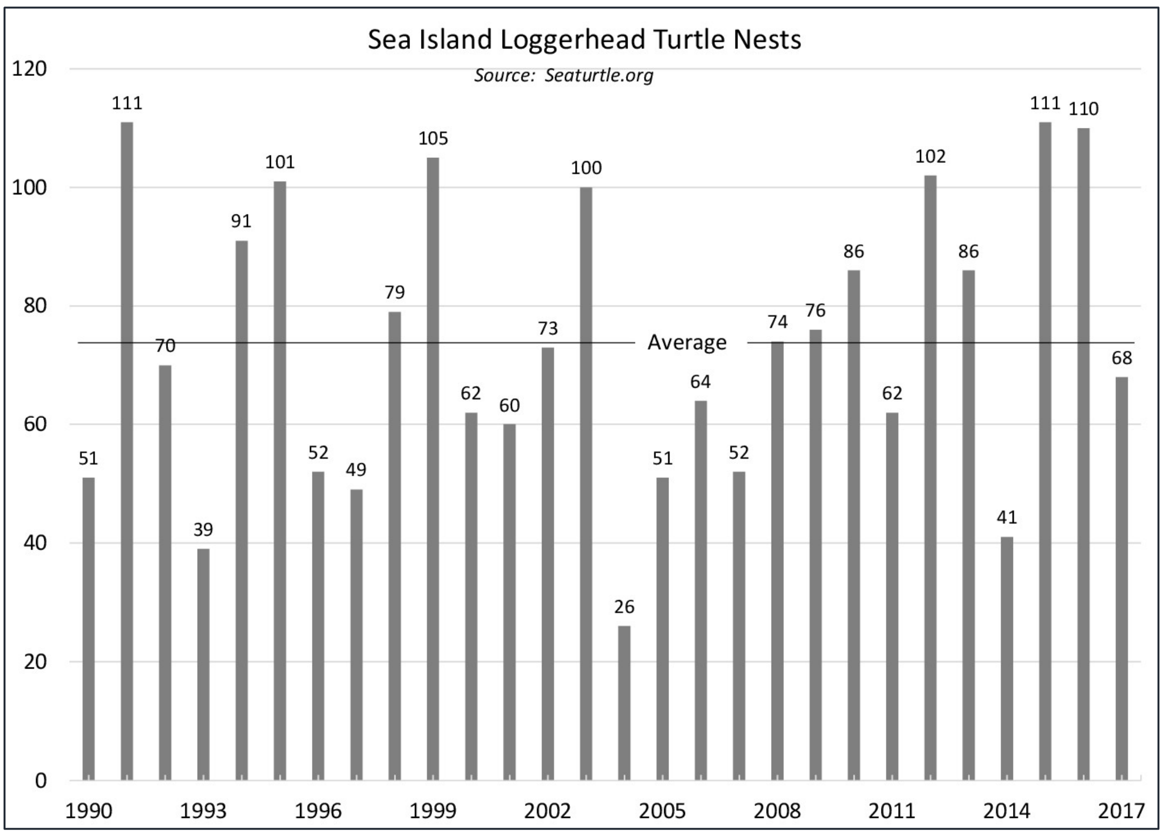

FIGURE 4.5. Bar graph showing variation in Sea Island nest census over a span of 26 years. [Source: SeaTurtle.org.]

The Sea Turtle Program has been collecting data on turtle nests since at least 1991 up to present day, providing data to Seaturtle.org since 2008. GADNR notes that the nesting data represents the best long-term data for assessing population status of species, which is used to assess effects of human activities on recovery (Normandeau 2017). For the 2017 nesting season, Sea Island documented 66 loggerhead turtle nests, compared to 110 nests in 2016, 111 in 2015 and 40 in 2014 (seaturtle.org/nestdb/index.shtml?view=2&year=2015). The proposed project includes beach nourishment of approximately 16,000 lf, of beach, of which nearly 10,000 lf currently lacks preferred dry beach area for nesting. After the project is completed, Sea Island is expected to have more habitat suitable for nesting.

The final project schedule will be determined in coordination with environmental agencies with appropriate measures in place for varying windows (ie – turtle monitoring). No construction activities will take place during sea turtle hatching season (1 August to 31 October). The proposed project is anticipated to be conducted between 1 November and 30 April, to minimize potential impacts to sea turtles. If the project schedule requires construction after May 1 protective measures will be employed.

4.5.6 Current Threats to Continued Use of Project Area by Sea Turtles

Loggerhead and other sea turtle species face threats in the project area that are the same as the primary threats they face worldwide. Research has shown that marine turtle populations have greatly declined since the 1970s, mainly due by incidental drownings in fishing gear and loss of nesting habitat. [NOAA Fisheries defines fishing gear as longlines and gillnets, trawls, traps, pots, and dredges (Table 4.2).] Sea turtles are also threatened by illegal directed harvest in many places around the world. For the loggerhead, directed harvest mainly occurs in the Bahamas, Cuba, and Mexico. Other threats are habitat disturbance/destruction, pollution, and ship strikes (nmfs.noaa.gov/pr/species/ turtles/loggerhead.html).

Crouse et al (1987) reported that the most serious threat to sea turtles appeared to be loss of breeding females as a result of commercial shrimping. On shore, human encroachment on traditional nesting beaches has also exacerbated the threat and contributed to the decline in the last 30 years. NMFS (2003) and USACE (2006) suggest that a combination of poorly placed nests (often along highly eroded beaches), coupled with unrestrained human use of the beach by vehicles and foot traffic, has impacted loggerhead turtles. Steep beach escarpments, house lights, sand fences, and other physical barriers often cause the mature females to select poor nesting sites at the toes of dunes, which causes higher nestling mortality rates (Schwartz 1977, Epperly et al 1995, seaturtle.org/nestdb/?view=2.2013).

Loggerhead turtle nests are protected from human activity by federal and state law in Georgia. According to 2016 data reported on Seaturtle.org, loggerhead turtle nest losses are most often caused by raccoons and coyotes, and egg losses are mostly due to raccoons, and coyotes, plus the single eggs taken from each nest for research purposes (seaturtle.org/nestdb/index/shtml?view=2). On some Georgia barrier islands, feral hogs have been the main cause of nest disruption and egg losses (georgiawildlife.com/sites/default/files/wrd/pdf/fact-sheets/loggerhead_sea_turtle_2011.pdf).

TABLE 4.2. Estimated sea turtle interactions, captures, and mortalities for all gear types. [Source: NOAA–NMFS–SERO (2012). According to source, all numbers are estimates based on best available data. Data provided here is as given by source with no years or time period for collecting or synthesizing; authors noted compilation of several data sets and implied that sources dated from 2000s.]

	Gear Component	Green	Leatherback	Kemp's Ridley	Loggerhead	All Species
Interactions	Otter Trawl	12,391	1,393	402,083	78,405	494,272
	Skimmer Trawl	1,175	0	25,698	1,255	28,128
	Try Nets	310	34	10,052	1,960	12,356
	All combined	**13,876**	**1,427**	**437,833**	**81,620**	**534,756**
Captures	Otter Trawl	1487	167	48,250	9,409	59,313
	Skimmer Trawl	202	0	3,646	202	4,050
	Try Nets	310	34	10,052	1,960	12,356
	All Combined	**1,999**	**201**	**61,948**	**11,571**	**75,719**
Mortalities	Otter Trawl	1,339	144	42,466	7,656	51,605
	Skimmer Trawl	43	0	841	45	929
	Try Nets	0	0	0	0	0
	All Combined	**1,382**	**144**	**43,307**	**7,701**	**52,534**

NOAA Fisheries Southeast Region (SERO) [2012] developed Table 4.2 to examine the threat to marine sea turtles of the southeastern shrimp fisheries industry by gear type. The table summarizes the estimated impact on green, leatherback, Kemp's ridley, and loggerhead turtles based on interactions, captures, and mortalities. Kemp's ridleys and loggerheads experience the greatest impact. An estimated 43,307 Kemp's ridley and 7,701 loggerhead deaths occurred from commercial fisheries trawl and net gears out of a total 52,534 deaths to all species combined (NOAA–NMFS-SERO 2012).

In an earlier publication for NOAA–NMFS, Plotkin et al (1995) examined the impact of various activities on loggerhead sea turtle survival. Shrimp trawling is ranked number one (highest) in relative importance, with an estimated 5,000-50,000 mortalities per year. Other fisheries are responsible for an estimated 500–5,000 mortalities per year and ranked 2.5 (moderate to low) in relative importance. Collisions with boats and dredging are responsible for 50–500 mortalities per year (ranked number 3.0 – low in relative importance).

Other causes of mortality are ranked low or unimportant including beach development, entanglement, oil platform removal, direct takes, power plant entrainment, recreational fishing, beach vehicles, and beach lighting. Toxins and ingestion of plastics or other debris are not ranked because of limited information. Beach nourishment is the only activity listed in Table 4.3 that is ranked number 4.0 (unimportant) in relation to the other causes of mortality. If considered in terms of percentages of mortalities, the data in Table 4.3 suggest that shrimp trawling activities account for about 90 percent of turtle deaths each year; other fishing activities account for about 9 percent; and dredging or collisions with boats account for about 0.9 percent each year. Thus, these four causes account for over 99 percent of the mortalities, numbers that dwarf all other causes.

TABLE 4.3. Estimated annual numbers of deaths and the relative importance of sources of human-induced mortality of juvenile and adult loggerhead sea turtles (Caretta caretta) in US waters.

[Source: Plotkin et al 1995, adapted from National Research Council (NRC) 1990]

Human-Induced Mortality of Juvenile and Adult Loggerhead Sea Turtles		
Cause	**Mortalities / Year**	**Relative Importance**
Shrimp Trawling	5,000–50,000	1.0
Other Fisheries	500–5,000	2.5
Beach Development	?	3.0
Dredging	50–500	3.0
Entanglement	?	3.0
Oil Platform Removal	10–100	3.0
Collisions with Boats	50–500	3.0
Directed Take	5–50	3.0
Power Plant Entrainment	5–50	3.0
Recreational Fishing	?	3.0
Beach Vehicles	?	3.0
Beach Lighting	?	3.5
Beach Replenishment	?	4.0
Toxins / Ingestion of Plastics or Other Debris	?	?
Key: Relative Importance: 1 = high; 2 = moderate; 3 = low; 4 = unimportant		

To partially address the problem of turtle takes in the shrimping industry, NMFS began to champion the development and use of turtle excluder devices (TEDs) in the late 1970s. By the late 1980s, most shrimping states, Georgia included, had enacted regulations that mandated use of TEDs (dnr.sc.gov/seaturtles/teds.htm). While TEDs have demonstrated success, they have not eliminated takes, and shrimping remains by far the greatest threat to sea turtles (Plotkin et al 1995, NOAA–NMFS– SERO 2012).

Coastal sand loss has had a direct impact on turtle nesting activities. Long-term (chronic) as well as short-term (storm) erosion has degraded many beaches, reduced the area of dry beach needed for turtle nests, and left dune escarpments fronted by wet sand beaches. Such conditions either eliminate habitat or significantly increase the probability of nests being eroded or flooded prior to hatching. This condition has persisted along the center of Sea Island beach during the past five years where erosion has eliminated the dry-sand beach and exposed rock revetments and a buried seawall.

In the Reserve project area, tall dunes with significant escarpments and little to no dry sand beach has resulted in limited nesting in recent years. Most of the nests laid in this area have required relocation in accordance with GADNR guidelines. For the period of 2008 to 2016, 24 nests were documented in the Reserve project area. Two (2) were left in situ, three (3) were relocated within the project area, and 19 required relocation outside of the project area. At least 40 percent of the Sea Island oceanfront lacks nesting habitat as of October 2017 (see project in Section 2.0).

Studies concerning the effects of sediment disposal on beaches are mixed regarding the impacts on turtle nesting. In some cases, beaches are used as a general repository for dredged sediment, particularly from navigation projects. Such sediments may be incompatible with the beach, contain high proportions of mud, and produce a change in the typical beach profile. Some beaches where regular sediment disposal associated with navigation projects occurs have shown the same nesting and hatch rate success as unnourished beaches (eg – Topsail Island NC – USACE 2006). Other beach disposal projects have indicated a reduction in nesting and hatchling success where the sediments contained excessive mud (eg – Atlantic Beach NC – 2005) or shells (eg – Pine Knoll Shores – 2002) (Mihnovets & Godfrey 2004, Holloman & Godfrey 2006).

Variations in hatchling success have also been attributed to the sediment quality and color of the nourishment sand (Ackerman 1996, Holloman & Godfrey 2006), although data are insufficient to confirm whether the outcomes are positive or negative. For example, darker nourishment sediments are considered to raise incubation temperatures which, in turn, promote the hatching of females (Mrosovsky et al 1984, Mrosovsky 1988, Mrosovsky & Provancha 1992). Crouse et al (1987) reported loss of breeding females to be the most serious threat to the species, suggesting that hatching more females would be a desirable outcome.

Some evidence from Bogue Banks (NC) has shown that an eroding beach with high dunes and low nesting numbers will see its nesting rate increase after nourishment, despite differences in sediment quality among various projects (CSE 2006). Table 4.4 lists the number of nests for Bogue Banks Island prior to beach nourishment. The number varied from a high of 44 nests per year in 1992 to a low of five per year in 1994, with an average of ~30 nests per year over six years.

TABLE 4.4. Bogue Banks (NC) sea turtle data prior to nourishment (1990–1995). Note: Monitoring effort on most of Bogue Banks (NC) was not standardized until the mid-1990s. Monitoring IB/SP and Atlantic Beach (NC) was not standardized until 2002. [Source: NCWRC Sea Turtle Nesting Database]

Season	Nests	False Crawls	Hatchling Success	Notes
1990	41	n/a	n/a	No data on FC or HS
1991	42	n/a	n/a	No data on FC or HS
1992	44	n/a	64.2	No data on FC, HS based on n = 20 nests
1993	20	n/a	73.6	No data on FC, HS based on n = 17 nests
1994	5	1	81.4	HS based on n = 5
1995	29	4	40	HS based on n = 9
FC = false crawls			HS = hatchling success	

Between 1995 and 1999, Bogue Banks was impacted by 4–5 major hurricanes, yet no beach nourishment had occurred prior to 2001. The beaches comprising Bogue Banks Island include Ft. Macon, Atlantic Beach, Pine Knoll Shores, Salter Path/Indian Beach, and Emerald Isle. The first substantial nourishment projects at Bogue Banks were completed between 2001 and 2003. Specifically, Pine Knoll Shores was nourished in 2002, Salter Path/Indian Beach in 2002 and 2004, Emerald Isle in 2003 and 2005, and Atlantic Beach in 2005. Subsequent nourishment events have occurred frequently, including in 2005, 2007, 2008, 2011, 2013, and 2014.

Table 4.4 showed the number of nests and false crawls along Bogue Banks between 1996 and 2005, and Table 4.5 continues the count along Bogue Banks between 2006 and 2015. Combining the two tables provides a total 20-year trend of average density of nests/mile/year and average density of false crawls per mile per year (Holloman & Godfrey 2006, carteretcountync.gov/336/Sea-Turtle-Monitoring/Summary Sheet). After 20 years (1996–2015), the evidence still supports the findings that the nesting rate did not decline along the 25-mile-long developed island after beach nourishment.

TABLE 4.5. Summary (1996–2005) of turtle nesting and false crawls for Bogue Banks (NC). Note: 1996–2000 are pre-nourishment years. [Source: Holloman & Godfrey 2006, carteretcountync.gov/336/Sea-Turtle-Monitoring/Summary Sheet]

Turtle Nesting	Miles	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Ft. Macon	1.2	0	5	3	3	2	NR[(a)]	NR	NR	0	3
Atlantic Beach	4.5	NR	NR	1	NR	NR	NR	NR	2	3	3
Pine Knoll Shores	4.5	1[(f)]	11	3[(c)]	4	1	NR	5	9	5	15[(h)]
Salter Path/ Indian Beach	2.5	1	NR	2[(d)]	NR	NR	NR	1	5	4	4[(i)]
Emerald Isle	11.5	15[(g)]	18	16[(e)]	31[(b)]	14	21	13	22	9	14[(j)]
Totals	**24.2**	**17**	**34**	**25**	**38**	**17**	**21**	**19**	**38**	**21**	**39**
False Crawls	**Miles**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Ft. Macon	1.2	3	2	12	0	0	NR	NR	NR	0	0
Atlantic Beach	4.5	NR	NR	0	NR	NR	NR	NR	21	7	2
Pine Knoll Shores	4.5	0	1	25	0	0	NR	7	26	5	4
Salter Path/ Indian Beach	2.5	0	NR	6	NR	NR	NR	0	10	6	2
Emerald Isle	11.5	0	1	1	30	6	19	12	23	2	15
Totals	**24.2**	**3**	**4**	**44**	**30**	**6**	**19**	**19**	**80**	**20**	**23**
Nest/False Crawl Ratio		5.7	8.5	0.6	1.3	2.8	1.1	1.0	0.5	1.1	1.7

NOTES:
(a) NR = no report
(b) ~22 nests lost because of Hurricanes *Dennis* and *Floyd* and erosion
(c) 2 nests lost because of Hurricane *Bonnie*
(d) 2 nests lost because of Hurricane *Bonnie*
(e) ~9 nests lost because of Hurricane *Bonnie* and erosion
(f) One nest lost because of Hurricane *Fran*
(g) 15 nests lost because of Hurricanes *Fran* and *Bertha*
(h) 2 nests lost because of Hurricane *Ophelia*
(i) One nest lost because of Hurricane *Ophelia*
(j) 6 nests lost because of Hurricane *Ophelia*

Drawing from Table 4.5 and omitting data for Emerald Isle, which skews the data, the average number of nests per year pre-nourishment (from 1996 to 2001) was six nests. The average annual number since nourishment through 2005 was ~15. When Emerald Isle is included in the calculation (from 1996 to 2001), the average nesting rate for all beaches is ~26 per year. For 2001–2005, the first period after nourishment, the rate is ~28 per year (Holloman & Godfrey 2006, carteretcountync.gov/336/Sea-Turtle-Monitoring/SummarySheet).

In 2007, Pine Knoll Shores East and West was nourished under a federal Section 933; Emerald Isle, Pine Knoll Shores, and Salter Path/ Indian Beach were nourished in response to Hurricane Ophelia; Ft Macon received sediment disposal on its beach from the Morehead City Navigation Project. In 2008, Pine Knoll Shores East received disposal, and in 2011, Atlantic Beach and Fort Macon received disposal. In 2013, Pine Knoll Shores and Emerald Isle were nourished post-Hurricane Irene, and in 2014, Atlantic Beach and Fort Macon received disposal on their beaches (Moffatt & Nichol 2015). While nourishment continued during the period 2006–2010, the average annual number of nests for all beaches was ~35 per year, and from 2011 to 2015, the average number was ~32 nests per year (Table 4.6).

The impact of nourishment on nesting success along Bogue Banks remained unclear the first ten years due to the two post-nourishment hurricanes (Isabel in 2003, Ophelia in 2005) and at least four pre- nourishment hurricanes (1996–1999). In the early 1990s, before hurricanes exacerbated the historical erosion rate of ~2 ft/yr (NCDENR 2004), ~30 nests per year had been reported for the entire island, including Emerald Isle (see Table 4.4). This number was equaled (on average) between 2002 and 2005, a post-nourishment period that included two hurricanes and was equaled (on average) or exceeded from 2006 to 2015, a post-nourishment period that included one hurricane (Irene). Virtually all of Bogue Banks (~25 miles) had been nourished as of 2005 (CSE 2006, protectthebeach.com) and continued to be nourished up to 2014 (Moffatt & Nichol 2015). Turtle nesting on that island is now wholly on nourished beaches, which is similar to conditions on many southeastern US nesting beaches (Nelson & Dickerson 1988/1989, Crain et al 1995).

In South Carolina, SC United Turtle Enthusiasts (SCUTE) [hobcawbarony.org] reported that in their ~70-mile-long turtle monitoring area of northern coastal South Carolina, 40–50 percent of nests occur along Debidue Beach (a private resort beach). Approximately 40 percent of Debidue Beach has been nourished four times since 1990. South of Charleston (SC) down to Savannah (GA)—Edisto Beach, Edisto Beach State Park, Hunting Island, and Hilton Head Island have also been nourished multiple times since 1990. These also maintain relatively high densities of turtle nests compared with many unnourished sites in South Carolina. Based on these results, a clear reduction in nesting frequency does not appear to be associated with nourished beaches in North or South Carolina.

TABLE 4.6. Summary (2006–2015) of turtle nesting and false crawls for Bogue Banks (NC). [Source: Holloman & Godfrey 2006, carteretcountync.gov/336/Sea-Turtle-Monitoring/Summary Sheet]

Turtle Nesting	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	20-Year Average Density (nest/mi/yr)
Ft. Macon	NR	NR	6	6	5	4	2	5	0	7	2.1
Atlantic Beach	2[k]	1	7	4	4	4	1	9	0	6	0.5
Pine Knoll Shores	5	3	7	4	11	ND[n]	0	9	1	6	0.9
Salter Path/ Indian Beach	6[l]	2	5	5	5	3	6	3	2	2	0.9
Emerald Isle	20[m]	16	8	16	29	17	30	10	16	15	1.1
Totals	**33**	**22**	**33**	**35**	**54**	**28**	**39**	**36**	**19**	**36**	**1.2**
False Crawls (fc)	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**20-Year Average Density (fc/mi/yr)**
Ft. Macon	NR	NR	1	3	1	1	0	0	1	4	1.2
Atlantic Beach	0	4	0	2	4	2	1	5	1	2	0.6
Pine Knoll Shores	1	2	6	3	6	ND	1	10	0	2	1.1
Salter Path/ Indian Beach	1	1	1	0	1	0	1	3	1	4	0.7
Emerald Isle	11	20	6	4	14	13	4	5	15	5	0.9
Totals	**13**	**27**	**14**	**12**	**26**	**16**	**7**	**23**	**18**	**17**	**0.9**
Nest/False Crawl Ratio	0.4	1.2	0.4	0.3	0.5	0.6	0.2	0.6	0.9	0.5	0.7

NOTES:
(a) NR = no report
(b) ~22 nests lost because of Hurricanes *Dennis* and *Floyd* and erosion
(c) 2 nests lost because of Hurricane *Bonnie*
(d) 2 nests lost because of Hurricane *Bonnie*
(e) ~9 nests lost because of Hurricane *Bonnie* and erosion
(f) One nest lost because of Hurricane *Fran*
(g) 15 nests lost because of Hurricanes *Fran* and *Bertha*
(h) 2 nests lost because of Hurricane *Ophelia*
(i) One nest lost because of Hurricane *Ophelia*
(j) 6 nests lost because of Hurricane *Ophelia*
(k) One nest lost because of Tropical Storm Ernesto
(l) One nest lost because of Tropical Storm Ernesto
(m) 4 nests lost because of Tropical Storm Ernesto
(n) No data

In Georgia, only two islands, Tybee Island and Sea Island, have conducted nourishment activities. Tybee Island was last nourished in 2015 under a project conducted by the USACE–Savannah District. Data for the period 2013–2017 for loggerhead turtle nesting activity in Tybee Island is provided in Table 4.7. Total successful loggerhead nests for the state of Georgia for that same period are provided for comparison. For

Sea Island, which conducted the main nourishment event in 1990, trends in sea turtle nesting in the years following the nourishment also does not show a correlation between reduction in nesting frequency and nourishment activities. In fact, following the 1990 nourishment, 114 nests were recorded on Sea Island, 60 of which (57 percent) were located in the nourished beach. For the years 1990 through 1998 following nourishment, an average of over 50 percent of sea turtle nests on Sea Island were located in the nourished beach (Sea Island Turtle Program).

TABLE 4.7. Tybee Island (GA) Loggerhead Sea Turtle data 2013-2017 compared against State of Georgia totals. [Source: www.seaturtle.org]

Season	Nests	False Crawls	Emerged Hatchlings	Mean Emergence Success	State of Georgia Total Nests
2013	21	6	1429	64.7%	2289
2014	18	8	1391	77.3%	1201
2015	10	13	581	48.3%	2319
2016	13	11	840	55.9%	3289
2017	25	18	2130	78.9%	2152

For the developed shoreline of Sea Island, there was little to no suitable habitat for sea turtle nesting prior to the beach nourishment projects in the early 1990s. The nourished beach has provided sea turtle habitat, although with erosion that has been exacerbated by recent hurricanes, much of the center portion of the developed shoreline currently has little to no dry sand beach and thus poor to non-existent preferred nesting habitat.

4.5.7 Cumulative Effects of Actions in the Project Area on Sea Turtles

Little is known about sea turtle natural mortality rates. However, it is believed that declines in populations are a direct result of loss of habitat and human actions. Erosion of nesting beaches can result in partial or total loss of suitable nesting habitat. Dynamic coastal processes, including storms and sea- level rise, also influence habitat availability. Shoreline armoring is implemented to protect upland structures, and ultimately, this reduces the available habitat. Shoreline armoring includes sea walls, rock revetments, and sandbag installations. Beach armoring can result in permanent loss of a nesting beach through accelerated erosion or elimination of a dry sand beach, which existed in the project area prior to the previous nourishment and sand recycling program implemented by the applicant.

Under the Georgia Shore Protection Act (1979), beach restoration and nourishment is preferred over structural shoreline stabilization, which includes seawalls and rock revetments. Where such structures are necessary, and there is no reasonable or viable alternative, either low-sloping porous rock structures or other techniques that minimize shoreline erosion are required. Within “the Golden Isles” barrier islands, there is precedent for armoring. The islands of Tybee, Sea, St Simons, and Jekyll comprise about 19 miles of beach shoreline, of which a reported 55 percent is armored (beachapedia.org). For St. Simons and Sea

Island, approximately 88% of the beach shoreline is protected by a rock revetment. All of the Sea Island developed shoreline was armored by 1990.

Clutches found seaward of coastal armoring structures may be inundated at high tide or washed out by increased wave action near the base of structures. Rock revetments, riprap, and sand bags can cause nesting turtles to abandon nesting attempts or to create improperly sized and shaped egg cavities, if there are inadequate amounts of sand cover near these structures.

Reductions in nesting success have been documented on severely compacted nourished beaches. Compaction level measurements at ten nourished, east coast Florida beaches led researchers to conclude that 50 percent were hard enough to inhibit nest digging, 30 percent were questionable as to whether their hardness affected nest digging, and 20 percent were probably not hard enough to affect nest digging (USACE 2005). In general, Florida beaches nourished from offshore sites tended to be harder than natural beaches. While some may soften over time through erosion and accretion of sand, others may remain hard for ten years or more (USACE 2005).

However, it is not known if these conclusions about Florida beaches are applicable to Georgia. Tilling after nourishment is commonly implemented as a mitigation measure (CSE 2006), but it is unclear whether this has a significant impact on turtle nesting frequency and nest viability. Compaction testing data from the latest Sea Island beach recycling event indicated that most of the project area met compaction requirements post-construction.

4.6 West Indian Manatee (T)

The West Indian manatee *(Trichechus manatus)* is a large aquatic mammal, which can reach a length of over 14 ft and weigh over 3,000 pounds. Manatees occur in two subspecies: the Antillean manatee *(Trichechus manatus manatus)* and the Florida manatee *(Trichechus manatus latirostris)*. It is the Florida manatee that ranges into Georgia waters (Lefebvre et al 2001). Due to habitat recovery and population expansion, the manatee was re-classified by the USFWS from endangered to threatened under the ESA in 2017. It retains the same federal protections under the Marine Mammal Protection Act (MMPA) (fws.gov/southeast/wildlife/mammal.manatee).

The species range includes the southeastern US, eastern Mexico, Central America, South America, and the Greater Antilles. USFWS estimates their range-wide population to be about 13,000, with more than 6,500 in the southeastern US and Puerto Rico. Manatees are nicknamed seacows because they are herbivores. They prefer willow, near-shore areas where they feed on submergents, ie seagrass and eelgrass, and floating or emergent vegetation (fws.gov/southeast/wildlife/mammal/manatee/).

When surveys began in 1991, the population estimate in Florida was ~1,300. Today, the range-wide population is estimated to be at least 13,000 manatees, with more than 6,500 in the southeastern United States and Puerto Rico. When aerial surveys began in 1991, there were an estimated 1,267 manatees in Florida. Today there are more than 6,300 in Florida, representing a significant increase over the past 25 years. In the past, a large percentage of mortality (especially of calves) was due to collisions with watercrafts and the loss of suitable habitat through incompatible coastal development. While these threats remain a concern, population numbers have improved as conservation efforts have increased (fws.gov/northflorida. manatee/SARS/FR00001606_Final_SAR_WIM_FL_Stock.pdf; Rathbun et al 1982, 1990).

The species lives in riverine and coastal areas with fresh, brackish or salt water. During winter months, the Florida manatee prefers the inland or coastal waters of peninsular Florida, Georgia or Alabama, sheltering in or near warm-water springs, industrial effluents and outfalls (fws.gov/northflorida/manatee/SARS/FR00001606_Final_SAR_ WIM_FL_Stock.pdf).

Numerous wildlife refuges in the southeast provide habitat and protection to the manatee, including the following in Georgia (from north to south)—Wolf Island and Black Beard Island (part of Savannah Coastal Refuges Complex), Harris Neck, and Wassaw Refuges (fws.gov/southeast/wildlife/mammal/manatee/). Manatees thrive in the Altamaha River, which flows 137 miles from its inland origin at the confluence of the Oconee and Ocmulgee Rivers to the Atlantic Ocean. As the river flows along the northern border of Glynn County, manatees may enter the ocean between Egg Island and Wolf Island National Wildlife Refuge, ~10 miles north of Sea Island.

In the summer, manatees expand their range, traveling as far north as Rhode Island and all states between. GADNR reports frequent manatee sightings in Georgia occurring in all tidal waters from April to October, from Cumberland Island to Savannah (georgiawildlife.com/coastal-boating-caution-slow- down-watch-manatees-sea-turtles, 18 April 2017). Manatees are known to migrate up and down the coast, but are not known to be resident for long. Sightings are believed to span all seasons. Based on this data, the manatee is considered a year-round resident with a maximum population in the late summer months.

Since the proposed construction will likely occur between 1 November and 30 April with possible extension to July, the manatee (as a year-round resident) may be present in the proposed project area. However, sightings are most often reported in the summer months when there is no proposed construction.

4.7 US East Coast Whales

Of the six whales listed as endangered in the ESA and protected by the MMPA, the humpback and right whale are the species most commonly sighted off the Georgia coast. The remaining species, the blue, finback, sei, and sperm, are not known to migrate through state waters (georgiawildlife.com/sites/default/files/wrd/pdf/fact-sheets/2009_humpback_whale.pdf).

4.7.1 Blue, Finback, Sei, and Sperm Whales (all E)

Blue whales *(Balaenoptera musculus)* are the largest living animals, growing in length to over 100 ft. They are found mostly in the Southern Ocean and southern hemisphere, although numerous sightings have been reported in the North Pacific, including areas off California (Fiedler et al 1998). They are generally not observed close to shore off the US East Coast. Blue whales seek feeding areas with large concentrations of krill. Oceanic areas near the continental shelf edge, where upwelling occurs, are favorable feeding habitat for blue whales (Gambell 1979). Such conditions and large populations of krill generally do not occur along the inner shelf off Georgia. **It is unlikely that blue whales will be present during construction or in the proposed project area.**

Finback whales *(Balaenoptera physalus)* are second in size to blue whales, reaching lengths over 80 ft. Three populations are recognized, including one in the North Atlantic. They prefer deep, offshore waters of the major oceans, primarily in temperate to polar temperatures and less often in tropical waters (nmfs.noaa.gov/pr/species/mammals/whales/fin-whale.html, Aguilar & Lockyer 1987). They are commonly observed off New England and Nova Scotia, but are extremely rare off the Carolinas or Georgia coast. Whale survey teams have reported finback whale observations only twice before in Georgia waters, in 1996 and 2000 (flickr.com/photos/wildliferesourcesdivision/). Finback whales feed on planktonic crustacea, some fish, squid, and krill (Nemoto 1970). Their range in the North Atlantic extends from the Arctic Circle to the Greater Antilles and Gulf of Mexico. **It is unlikely that finback whales will be present during construction or in the proposed project area.**

Sei whales *(Balaenoptera borealis*) reach lengths of 60 ft and are observed in the North Atlantic between the Arctic Circle and Gulf of Mexico. They are listed as endangered, due to over-harvesting during the middle of the 20th century. Sei whales feed mostly on pelagic copepods, but their diet may include small schooling fishes, euphasiids, and amphipods (Mizroch et al 1984). **It is unlikely that sei whales will be present during construction or in the proposed project area.**

Sperm whales *(Physeter macrocephalus)* are the largest of the toothed whales, reaching lengths of 40 ft (females) to 60 ft (males). According to the American Cetacean Society (acsonline.org/factpack/spermwhl.htm), they are relatively abundant, with an estimated population of 360,000 individuals. Their main source of food is medium-sized, deep-water squid, with secondary sources including some species of fish, skate, octopus, and smaller squid. They are recognized as the deepest divers among the great whales and typically stay submerged for 20–50 minutes in depths of 1,000–3,000 ft. The nature of their feeding preferences generally precludes their observation in Georgia state waters. **It is unlikely that sperm whales will be present during construction or in the proposed project area.**

4.7.2 The Humpback Whale (T) and the North Atlantic Right Whale (E)

Of the two remaining whale species, the humpback whale and the North Atlantic right whale are known to occur in waters offshore of the proposed project area. Both whales have designated critical habitat off the Georgia coast, but in different areas. The right whale has designated critical habitat (Unit 2) offshore of the proposed project area (Fig 4.5).

The humpback whale (*Megaptera novaeangliae*) is listed as a federally-protected threatened species (downlisted 2016) under the 1973 ESA and the 1973 Georgia Endangered Wildlife Act (thestate.com/news/local/articles161106918; georgiawildlife.com/sites/default/files/wrd/pdf/fact-sheets/2009_humpback_whale.pdf). Inhabiting all major oceans, humpbacks in the US occur in both the Pacific and Atlantic Oceans. In

April 2015, NOAA Fisheries proposed delisting 10 of the 14 humpback whale DPS. Of the remaining four, NOAA proposed listing two as threatened and two as endangered. One of the proposed ten de-listings is the West Indies population that migrates through the western Atlantic to its northern Atlantic feeding grounds (USACE–DOI–NPS 2015). This DPS includes the migratory route through Georgia waters.

According to NMFS, the best humpback population estimate for the Northern Atlantic is about 11,500 individuals. They are a favorite of whale-watchers, known for acrobatic displays when breaching or slapping their long pectoral fins, heads or tails on the surface of the water. They can be 60 ft long and weigh 25–40 tons, and are often found breeding and feeding in protected waters over willow banks and shelf waters (nmfs.noaa.gov/pr/species/mammals/whales/humpback-whale.html).

In winter, humpback whales breed and have their calves in subtropical or tropical areas (eg – the Dominican Republic and the West Indies). In summer, humpbacks are found in high latitude feeding grounds ranging from the Gulf of Maine to western Greenland (nmfs.noaa.gov/pr/species/mammals/whales/humpback-whale.html; Conant 1993). Feeding grounds may include a large range along the US East Coast where their major prey includes small schooling fish (eg – haddock, herring, mackerel, pollock, etc) and large zooplankton, such as krill. They are reported to pass through Georgia waters between December and April, peaking in number from January through March (georgiawildlife.com/sites/default/files/wrd/pdf/fact-sheets/2009_humpback_whale.pdf).

Barco et al (2002) theorized that the mid-Atlantic served as a supplemental feeding ground for humpbacks. Suspecting a species under-count, scientists are assembling a new photographic catalogue to provide more current and accurate information on humpback whale populations in the mid-Atlantic (fisheries.noaa.gov/pr/sars/pdf/stocks/atlantic/2015/f2015_rightwhale.pdf). The main causes of injury and mortality to humpback whales are due to entanglement in gear and fishing lines and ship strikes. Van der Hoop et al (2013) reviewed 1,762 mortalities and injuries of eight species of whale from 1970 to 2009. Of those, data for 203 humpbacks were reported with 116 (57 percent) caused by entanglements and 31 (15 percent) caused by ship strikes (fisheries.noaa.gov/pr/sars/pdf/stocks/atlantic/2015/f2015_rightwhale.pdf).

Sightings and strandings of humpbacks do occur off the southeast and mid-Atlantic Coasts; those documented are sometimes identified as juvenile non-breeding individuals (georgiawildlife.com/sites/default/files/wrd/pdf/fact-sheets/2009_humpback_whale.pdf). In a study between 1985 and 1992, humpback whale stranding data showed an increase in strandings, particularly along the Virginia and North Carolina coasts (Wiley et al 1995). Wiley et al (1995) posited that these areas were becoming increasingly important habitat for juvenile humpbacks, recently separated from their mothers.

Records maintained by the National Park Service (NPS) for the Cape Hatteras National Seashore (CAHA) in North Carolina have shown 23 strandings off their shores between 1997 and 2008. Following that period, NPS reported one humpback whale stranding in 2009, three in 2010, and four strandings each in 2011 and 2013 (USACE–DOI–NPS 2015). In 2017, an increase in humpback strandings on the coast from Maine to North Carolina (26 in 2016, 18 as of June 2017) caused NOAA to declare an unusual mortality event (UMI) (thestate.com/ news/local/articles161106918).

During aerial whale surveys of South Carolina and Northern Georgia conducted by marine mammal scientists, one humpback whale was sighted on 28 March 2012 in the northern Georgia coastal area. It was observed to be logging (resting) at the surface, then taking several dives before heading south (NOAA 2012). The following year, White and Taylor (NOAA 2013) reported that four live humpback whales were observed within the South Carolina-northern Georgia (SCGA) study area during the 2012–2013 season. One sighting was a pair seen traveling northeast (30 November 2012), and the second was a pair sighted 19 March 2013 as they headed south (NOAA 2013).

Humpback whale winter calving grounds off the coasts of Georgia and Florida have been designated as critical habitat. The region just north of the critical habitat, including northern Georgia and South Carolina, has long been considered an important migratory route. Waters offshore of Sea Island are within the migratory route, but are not part of designated critical habitat for humpback whale. Surveys and photo-identification data since 2004 have suggested that some individuals use the area, not only as a migratory route, but for residency as well. The majority of time when humpback whales are known to be present (October through April) will coincide with the project construction period (1 November to 30 April). **Based on the possible presence of the species, the applicant concludes that humpback whales may be in the vicinity of the proposed project area.**

The North Atlantic right whale (*Eubalaena glacialis*) is listed as a federally protected endangered species under the 1973 ESA and the MMPA. It is state protected under the 1973 Georgia Endangered Wildlife Act. The right whale is further protected by federal designated Critical Habitat (Unit 2), which includes the winter calving grounds off the coasts of Georgia and Florida and an important migratory route off Georgia and South Carolina. Unit 2 boundaries cover nearshore and offshore waters from Cape Fear (NC) to ~31 nautical miles south of Cape Canaveral (FL) (nmfs.noaa.gov/species/mammals/whales/ north-atlantic-right-whale.html) (Fig 4.6). These boundaries also include the area of the proposed project (Normandeau 2017). The southeastern US is now considered one of seven locations where right whales are known to gather seasonally (fisheries.noaa.gov/pr/sars/pdf/stocks/atlantic/2015/f2015_ rightwhale.pdf).

Right whales occur along the US East Coast and Canada from the Florida Keys to the Gulf of St Lawrence. They can reach a length of 60 ft and can weigh 100 tons; they feed primarily on copepods and euphausiids. In the spring, they congregate in Cape Cod Bay and the Great South Channel off Massachusetts to feed on zooplankton. By mid-summer, at least two-thirds of the population can be found in the Bay of Fundy and Roseway Basin south of Nova Scotia (Caswell et al 1999; neaq.org/conservation_and_research/projects/ project_pages/right_whale_research.php). The Bay of Fundy is believed to be a primary summer and fall nursery for first-year calves. In the fall–winter months, pregnant right whales migrate some 1,200 miles to the coast of Georgia and northeast Florida to calve. Juveniles, non- pregnant females and some males join them. December through March is considered the prime calving season, before they begin migrating north with their young (rightwhales.neaq.org/2009/03/40-calving-ground.php).

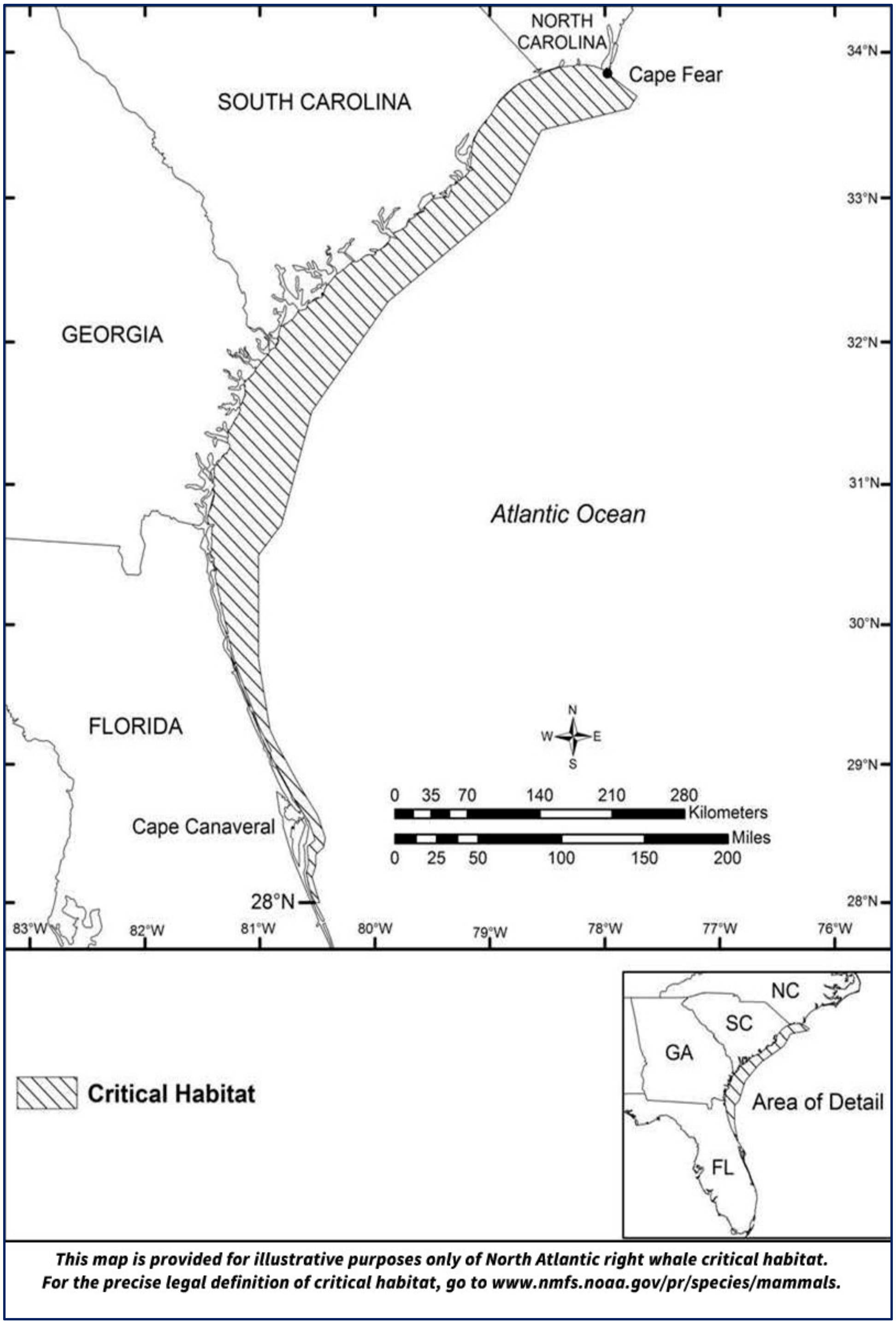

FIGURE 4.6. North Atlantic right whale critical habitat – Unit 2 – Southeastern US calving area. [Source: NOAA NMFS]

Once thought to be decimated by 16th and 17th century whalers, today the right whale population is believed to be 12,000–15,000 in number. A recent study of 400-year-old whale bones determined that the population has been small for centuries with a limited genetic diversity. The population today is now considered little different from the one of the past, which may have numbered only a few thousand (Walker 2010, news.bbc.co.uk/earth/hi/earth_news/ newsid_8518000/8518597.stm).

Right whales are known to swim close to the shoreline, which exposes them to an increased chance of injury from collisions with boats and ships (Schmidly 1981, NMFS 1984). Normandeau (2017) reported that most of the right whale sightings in the Southeast are 1–15 nm offshore. Scientists have discovered that ship strikes—the leading cause of right whale mortality—have become more lethal, as ship speeds have increased (Knowlton & Kraus 2001). Efforts are underway to reduce ship strikes by establishing speed zones and re-routing shipping lanes. Fishing line/gear entanglement is also a serious cause of injury and eventual death to right (and all) whales. This is due in part to manufacturing changes in material, now so strong that whales are unable to break free. As part of their conservation efforts, marine scientists are urging product and practice changes within the commercial fishing industry (neaq.org/conservation_and_research/projects/project_pages/_right_whale_research.php).

To better conserve this species, marine mammal research teams representing academic institutions, NOAA, USFWS, Sea to Shore Alliance, the New England Aquarium and volunteers from the northeast and southeast are collaborating to identify and track right whales. Scientists follow right whales from migration routes and feeding sites, to breeding, calving, and escort areas (neaq.org/conservation_and_research/projects/project_pages/right_whale_research.php). By tracking right whale movements since the late 1980s, scientists have now succeeded in genetically sampling over 503 individual right whales, more than the 400 estimated to be alive (Right Whale Research Blog.Rightwhales.neaq.org).

Aerial surveys conducted by scientists in 2011–2012 and 2012–2013 collected data on the spatial and temporal distribution and use patterns of right whales off northern Georgia and South Carolina coasts. In 2011–2012, 50 aerial surveys were conducted from North Myrtle Beach (SC) to St. Catherines Island (GA) from 15 November 2011 to 15 April 2012. Preliminarily, 27 right whale sightings consisting of 70 right whales were documented (including re-sightings of 14 individuals). Sightings consisted of 5 cow/calf pairs, 7 single whales, and 15 groups of two or more adult/juvenile right whales (NOAA 2012).

In 2012–2013, right whale studies included a total of 49 aerial surveys from 15 November 2012 to 15 April 2013. Survey territory was divided into three sections, ending with the third area extending from Hilton Head Island (SC) to St. Catherines Island (GA), well past Sea Island. In this study, they preliminarily reported 14 right whale sightings, consisting of a total of 25 right whales. These consisted of ten cow/calf pairs, three single whales, and one group of two adult right whales. They also documented two whales with new propeller scars/wounds. The study found that 36 percent of the right whale sightings occurred November–January, while 64 percent occurred February–April. The greatest percent of sightings occurred in March at 36 percent of all whales documented (NOAA 2013). Having observed the temporal distribution of right whales there since 2006, scientists believe that this area and the southern mid-Atlantic may also serve as residency waters for the right whale (NOAA 2013).

In recent years, NOAA has also observed a northward trend in right whale observations from Florida and Georgia to South Carolina coastal areas. This trend has caused NOAA to include the South Carolina coast in the critical habitat designated in Georgia and Florida. In 2016–2017, residents in both Georgia and South Carolina reported right whale sightings off such nearshore locations as beaches, piers, and jetties (postandcourier.com/news/foot-long-humpback-whale-spotted-off-southcarolina-shore-win-ter/article_efbf0ce2-d297-11e6-882f-ef1e94fa9183.html).

The proposed project will occur within the time period whale sightings have occurred (1 November to 30 April). This is the same timeframe of right whale migration – south in fall, north in spring – passing through state waters. **Based on the possible presence of the species in Georgia waters, the applicant concludes that the right whale may be in the vicinity of the proposed project area.**

5.0 SUMMARY OF PROTECTIVE MEASURES

This section outlines proposed protective measures that will be implemented by the applicant during the proposed activity. These are in addition to the protective measures relevant to the Reserve project and included in the earlier BA. These measures follow recommendations outlined by the USFWS (eg – 2008, 2013, 2015, 2016) in previous Biological Opinions issued for similar projects [Isle of Palms (SC) 2008, Folly Beach (SC) 2013, Buxton (NC) 2015, Edisto Beach (SC) 2016], as well as other recommendations for monitoring endangered species during offshore dredging operations (NMFS 1997). The applicant is committed to the protection of federally listed species. To minimize potential impacts to such species in the project area, the following commitments to reduce impacts are anticipated:

1) Full-time NMFS-certified endangered species observer(s) will be present on the dredge(s) during periods prescribed by regulatory and resource agency officials to document visible sea turtle activity, monitor any sea turtle takes, and watch for and alert the dredge operator of manatees or whales (especially right whales or humpbacks) in the area. Observers will be on the bridge of the dredge during the daily periods prescribed under special conditions of the permit.

2) Measures to avoid impacts to manatees will be followed as described in, "Guidelines for Avoiding Impacts to the West Indian Manatee in North Carolina Waters," by the USFWS, expected to be applicable to Georgia waters [cf – fws.gov/nc-es/mammal/manatee-guidelines.pdf].

3) All project personnel will follow NMFS marine mammal stranding report procedures.

4) Lights will be directed offshore and shielded if work is conducted during turtle nesting season.

5) A standardized turtle nest monitoring and relocation program is in place for Sea Island under the direction of the Sea Island Sea Turtle Program and GADNR. In the unlikely event that work is conducted during nesting season, project managers will coordinate with the turtle team, relying on the team to provide its usual activities:

    a) daily patrols of active beach disposal areas at sunrise.
    b) relocation of any nests identified in areas to be impacted by fill placement (under the supervision of the Sea Island Naturalist or GADNR personnel).
    c) notification of escarpment formations that hinder nesting.
    d) monitoring of hatchling success of the relocated nests.

6) The applicant will submit sediment samples of the borrow sand material to the Department for approval to assess the composition, sand grain size and color prior to the start of the project.

7) The groin will be constructed of such material and in such a manner to be adjustable and removable. A detailed plan must be provided to the Department for approval prior to construction. Should the Department determine the groin to have negative impacts to the sand-sharing system, the applicant will submit an adjustment or removal plan for the groin to the Department for approval within 60 days following Department notice to remove. Adjustment or removal must be completed within a

timeframe approved by the Department. A decision to adjust or remove will be based on the following criteria:

a) Quantifiable adverse effects upon other shoreline locations or;
b) If groins are no longer merely holding sand that was added to the system through the beach nourishment, but also trapping sand from the longshore sediment transport.

8) Beach profile surveys within the project site and immediately south of the project site will be conducted using methods as approved by the Department at the following times:

a) pre-construction.
b) post-construction.
c) 6 months, 1 year, 2 years, 3 years, 4 years, and 5 years after the post-construction survey.
d) more frequently after significant storm events, if warranted.

9) Construction will only be allowed outside the loggerhead turtle nesting and hatching season (1 May to 31 October). No construction will occur between May 1 and October 31.

10) Within 90 days after completion of each post-construction survey, an engineering report will be prepared that presents, summarizes and interprets the survey data and assesses the project performance. This will include a quantification of shoreline and volumetric changes within and adjacent to the beach fill area along the monitoring area.

11) Following construction, the contractor will cross-till the project from the high tide wave rush to the seaward toe of the constructed dune feature. The dune feature should also be tested for compaction prior to the planting of vegetation or sand fence construction. If compaction readings are greater than 500 CPU at any of the test depths (6 inches, 12 inches, 18 inches) for two consecutive stations, the dune feature will be tilled.

12) Annual surveys for compaction will be completed in February for 5 years following completion of the project. Sand compaction should be measured at a maximum of 500 ft. intervals along the fill area Compaction will be measured at 3 stations along three transects corresponding to the landward, middle and seaward portion of the fill berm. An additional measurement should be taken from the dune feature. At each measurement station, a cone penetrometer will be pushed to depths of 6, 12, and 18 inches three times (3 replicates) and the compaction readings will be averaged to produce a final reading at each depth for each station. If the average value for any depth exceeds 500 cpu for any 2 or more adjacent stations (including the dune feature), that area will be tilled prior to May 1. Tilling will be completed to a depth of 36 inches. A representative from Georgia DNR should be present during the compaction testing (contact: Mark Dodd, 912-264-7218).

13) An annual summary of compaction surveys and the actions taken will be submitted to the Department. A report on the results of compaction monitoring will be submitted to the Department prior to any tilling actions being taken. This condition will be evaluated annually and may be modified if necessary to address sand compaction problems identified during the previous year.

14) Visual surveys for escarpments along the beach fill area will be made after construction and completed in February for five years following completion of the project. Escarpments in excess of 18 inches extending more than 100 ft will be mechanically leveled to natural beach contour prior to 1 April.

15) Visual surveys for escarpments along the beach fill area will be made weekly, and after storm events, from April 1 through October 31. Escarpments that interfere with marine turtle nesting or that exceed 18 inches in height for a distance of 100 ft or more will be graded to the natural beach contour with guidance from the pertinent regulatory agencies.

16) Sand of similar quality to the existing beach will be used to reduce any changes in physical characteristics of the beach that may affect turtle nest survival.

17) The applicant will perform periodic surveys of the proposed project area to estimate the volumetric erosion.

18) The applicant will implement reasonable and prudent measures for protection of sea turtles as detailed in Section 5.0, subject to final revisions by the USFWS and state and federal resource and regulatory agencies.

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6.0 SUMMARY OF EFFECT DETERMINATIONS

6.1 Piping Plover

The USFWS has designated piping plover critical habitat in areas that do not include the Sea Island development and the proposed project area. This species does not nest in Georgia, but it can be found regularly during migration, wintering on Little Tybee, Williamson, Wassaw, Ossabaw, St. Catherines, Blackbeard, Sapelo, Wolf, Little St. Simons, Jekyll, and Cumberland Islands and Wolf Island Bar, Little Egg Island Bar, and St. Catherines Island Bar. [Little St. Simons and Cumberland Islands have particularly large numbers (georgiabiodiversity.org/profiles/charadrius_melodus.pdf)].

It is possible that the piping plover may be present in the project area, due to piping plover presence at nearby bars, tidal flats and beaches, such as Wolf Island, Wolf Island Bar, Little St. Simons Island, Little Egg Island Bar, and Gould's Inlet. Foraging, sheltering, and roosting habitat may be impacted over the short-term by construction activities that coincide with piping plover migration in the area. The amount of area disrupted by construction activities at any given time will be limited to a relatively small portion of the project length. It is more likely that the piping plover would be utilizing high quality habitat without human presence at Little St. Simons and Gould's Inlet. The project is expected to provide benefits for up to a decade in the form of expanded roosting and foraging habitat through the addition of beach-quality sand to the Sea Island beach system.

While actual project operations are underway, the applicant has determined that the proposed project may affect, but is not likely to adversely affect piping plover. Long-term, the applicant has determined that the proposed project may positively affect the piping plover by expanding potential habitat.

6.2 Rufa Red Knots

No critical habitat for the rufa red knot has been designated in the proposed project area, nor do red knots nest on barrier islands in Georgia including Sea Island. However, red knots are known to roost and forage on barrier islands in Georgia. They are reported to occur in high numbers at Wolf Island, Little Egg Island Bar, and Little St. Simons Island, which are geographically closest to Sea Island and the proposed project area. These islands support the only known late summer and fall staging site on the east coast of the US, attracting as many as 12,000 knots at one time (georgiawildlife.com/sites/default/files/wrd/pdf/fact-sheets/red_knot_2010. pdf).

During construction, the project area will continue to be available to red knots for foraging and roosting during winter migration. Although the red knots' general migration pattern is similar to the piping plover, the species uses a wider range of habitat. Red knots have shown less site fidelity than piping plovers, easily finding alternate habitats nearby when disturbed. Construction activities will temporarily alter beach and dunes. Equipment used during construction will likely force red knots to utilize other areas near the proposed project, but they are known to readily adapt to relocation. It is likely that red knot would utilize the higher quality habitat found on Little St. Simons Island and Gould's Inlet. Immediately following the completion of the proposed project, potential impacts will be eliminated. Therefore, no direct or indirect impacts are expected. Following construction activities, the beach morphology is expected to return to a natural configuration as the nourishment profile equilibrates over time.

Due to the availability of alternate habitat and temporary construction impact, the applicant has determined that the proposed project may affect, but is not likely to adversely affect, red knot. Long-term, the proposed project is likely to affect the red knot positively by expanding potential habitat.

6.3 Atlantic Sturgeon and Shortnose Sturgeon

Because the project area is located on the Sea Island beach and nearshore area and is located between ~7 and 11 miles south of the Altamaha River, it is unlikely that the proposed project would impact Atlantic or shortnose sturgeon habitat. No impacts to sturgeon habitat are anticipated during or after the proposed project, as construction will not impede ingress/egress between the ocean and nearby river mouths and sounds. Offshore, activity and noise from dredging operations should deter sturgeon from swimming in the area.

Therefore, the applicant has determined that the proposed project may affect, but is not likely to adversely affect, the Atlantic sturgeon or the shortnose sturgeon.

6.4 Reptiles

6.4.1 Green, Hawksbill, Leatherback, and Kemp's Ridley Sea Turtles

The hawksbill sea turtle does not nest on Georgia beaches and is so rare in offshore waters, no local data are available about their presence. Because the green, leatherback and Kemp's ridley turtles rarely nest in Georgia, the proposed project is highly unlikely to adversely impact nesting habitat. However, as indicated by Seaturtle.org stranding data for green, leatherback and Kemp's ridley sea turtles, these species do migrate in offshore waters. They are particularly likely to appear during the warmer months of the year when the species are observed closer to shore. The noise and disturbance of hydraulic dredge operations may deter sea turtles from swimming near (seaturtle.org), and the proposed dredging window will occur during the colder months of the year when it will be less likely that they will be encountered in the project area.

Qualified endangered species observers will be on board the dredge for periods prescribed by federal regulations to protect and monitor potential movements during dredging activities. In instances where a marine turtle may be spotted or involved in a take, lines of communication will be established among all parties involved in the proposed project to specify procedures for shutting down the dredge and reporting incidents to the authorities prior to resuming work. Notwithstanding protective measures anticipated by the applicant, the chance of encountering migrating sea turtles during construction still exists. Due to the rare occurrences of hawksbill, green, Kemp's ridley, and leatherback sea turtles in the project area, the applicant has determined that the nourishment and groin projects would have the following effect:

The applicant has determined that the proposed project may affect but is not likely to adversely affect the hawksbill sea turtle.

The applicant has determined that the proposed project may affect but is not likely to adversely affect nesting or hatchling green sea turtles.

The applicant has determined that the proposed project may affect but is not likely to adversely affect nesting or hatchling Kemp's ridley sea turtles.

The applicant has determined that the proposed project may affect but is not likely to adversely affect nesting or hatchling leatherback sea turtles.

6.4.2 Loggerhead Sea Turtles

As enumerated in Table 4.1 and Figure 4.5, loggerhead sea turtle nesting activities have been recorded within the project area on Sea Island. Construction is proposed to be conducted during the non-nesting season (November 1 through April 30). If unforeseen circumstances arise that would require construction during nesting season, additional protective measures will be employed to minimize potential adverse effects to loggerhead sea turtles. Should it be necessary to continue the project into May or later months, the following precautionary measures will be taken to minimize impacts to sea turtles during the nesting season:

- No dredging will occur because of operational considerations at all times of the year.
- If any construction of the project occurs during the period between May 1 and July 31, daily nesting surveys will be conducted beginning May 1 or a date prescribed by resource agencies.
- The daily surveys will be performed between sunrise and 8:00 a.m., and will continue until the end of the project, or July 31, whichever is earlier. No dredging operations will be conducted during hatching season (1 August – 31 October)
- Any nests found in the area that may be impacted by construction activities will be moved to a safe location.
- The nesting surveys and nest relocations will be performed only by or under the direct supervision of Sea Island staff authorized by GADNR to conduct relocations.
- For any construction activities occurring during the period 1 May through 31 July, staging areas for equipment and supplies will be located off the beach to the maximum extent possible.
- For any construction activities occurring during the period 1 May through 31 July, all on-beach lighting associated with the project will be limited to the minimum amount necessary around active construction areas to satisfy Occupational Safety and Health Administration (OSHA) requirements.

Immediately following completion of construction, the applicant will perform cone penetrometer compaction testing of the newly constructed sand berm and surveys of escarpments will be conducted in accordance with conditions stated in Section 5.0.

The above-stated precautions and mitigation measures should minimize potential effects of nourishment activities to nesting sea turtles and emerging sea turtle hatchlings. Completion of the project will restore lost habitat and protect existing turtle nesting habitat.

The applicant has determined that the nourishment and groin construction will have the following effects on loggerhead sea turtles:

The applicant has determined that the if nourishment is conducted during non-nesting season and in accordance with the stated protective measures, the proposed project is not likely to adversely affect nesting loggerhead sea turtles.

The applicant has determined that the if nourishment is conducted during non-nesting season and in accordance with the stated protective measures, the proposed project is not likely to adversely affect hatchling loggerhead sea turtles.

For nourishment conducted during nesting season, the applicant has determined that the proposed project may affect but is not likely to adversely affect nesting sea turtles if carried out in accordance with the stated protective measures.

No work will be conducted during loggerhead sea turtle hatching season. Therefore, the proposed project will have no effect on hatchling loggerhead sea turtles.

For construction and maintenance of the 350-foot-long T-head groin at the Reserve (SPC Permit #438), the applicant has concluded the following;

For groin construction conducted during non-nesting season, the applicant has determined that the proposed activity will have no effect on nesting or hatchling loggerhead sea turtles.

For groin construction conducted during nesting season, the applicant has determined that the project may affect but is not likely to adversely affect nesting loggerhead sea turtles if carried out in accordance with the stated protective measures.

No groin work will be conducted during loggerhead sea turtle hatching season. Mitigative measures require that nests located within 300 meters (~1,000 ft) of the groin should be relocated so that the groin will not interfere with the return of hatchlings to the sea. Therefore, the proposed project may affect but is not likely to adversely affect hatchling loggerhead sea turtles.

6.5 West Indian Manatee

Following the effect determination for the Folly Beach (SC) nourishment project (USACE 2005), the proposed work at Sea Island is currently scheduled to occur during the time of year when manatees are generally not present in the area. If schedule or weather changes cause construction to be performed when conditions are more favorable for the presence of manatees, then precautions will be taken to ensure that any manatees in the vicinity are not harmed or harassed. Because of their migration along the Georgia coast, it is possible for the manatee to occur in the vicinity of Sea Island.

However, the applicant will rely on the required endangered species observers stationed on the dredge to spot manatees during prescribed times. Avoidance measures, along with the onboard endangered species monitors (as prescribed by federal regulations and/or special conditions of the permits) are expected to provide adequate safeguards for manatees. The proposed work is to be performed with an anchored suction cutterhead dredge, which manatees typically avoid because of the sounds transmitted during operations and the slow movement of the dredge.

Therefore, the applicant has determined that the proposed project may affect but is not likely to adversely affect manatees.

6.6 Whales

Only two species, the humpback whale and right whale, would normally be expected to occur within the project area during any portion of the construction period. The other four species of whales are not expected to be present in the project area, because their migration patterns typically are much further offshore or in other oceans. Humpbacks and right whales have been sighted in summer months, but the majority of sightings have typically occurred during their migration between November and April, the same time that project operations are planned to occur (USACE 2005, NOAA 2012, White & Taylor 2013).

Because the proposed work may occur when whales are present, the applicant will rely on the required endangered species observers stationed on the dredge to spot whales and sea turtles during prescribed times. The presence of a hydraulic pipeline dredge at fixed position in the project area should pose no direct impacts to humpback or right whales. However, during times when the dredge and support equipment are being moved, vessels will be required to alter course and stop if necessary to avoid any approaching whales. The dredge(s) will have endangered species observers on board and will follow procedures outlined in the permits for endangered species protection. These avoidance measures along with onboard endangered species monitors (as prescribed by federal regulations and/or special conditions of the permits) are expected to provide adequate safeguards for whale species.

Therefore, it has been determined that the proposed project may affect but is not likely to adversely affect humpback or right whales.

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7.0 ESSENTIAL FISH HABITAT ASSESSMENT

Amendments to the Magnuson–Stevens Fishery Conservation and Management Act (1996), overseen by the South Atlantic Fishery Management Council (SAFMC 1998), mandated that NMFS and other federal agencies identify and protect certain marine and fish habitats. Habitat areas particularly important to federally managed species were delineated as Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC). Any federal actions which fund, permit, or carry out activities that have potential effects on EFH require NMFS consultation. Since the proposed project is to be permitted by the USACE, EFH consultation is required. Table 7.1 lists designated EFH and Habitat Areas of Particular Concern (HAPC) for the southeast region. Table 7.2 lists fisheries with management plans and managed species.

In 1995, a scientific review panel of SAFMC recommended the designation of a series of Marine Protected Areas (MPA) for the southeast for those areas at risk of being recreationally and commercially overfished. SAFMC defines MPAs as "a network of specific areas of marine environments reserved and managed for the primary purpose of aiding in the recovery of overfished stocks and to ensure the persistence of healthy fish stocks, fisheries, and associated habitats." In Georgia, a deepwater MPA was designated for species in the snapper/grouper complex 69 nm southeast of Wassaw Sound, which is ~55 miles from Sea Island. Fishing of snapper/grouper species managed under the Georgia MPA is prohibited by federal law (www.scsea grant.org/, www.safmc.net/Library/pdf/). As a result of this protection, snapper/grouper species populations have improved.

For more information regarding HAPC and fish species that may occur in the project area based on their occurrence in Georgia waters, see USACE (2014—Appendix B Essential Fish Habitat, Tybee Island, Georgia Shore Protection Project 2014–2015 Renourishment. June 2014).

TABLE 7.1. Categories of EFH and HAPC in the Southeastern US. Areas shown are identified in Fishery Management Plan amendments of South Atlantic Fishery Management Council (SAFMC 1998) and are included in Essential Fish Habitat: New Marine Fish Habitat Mandate for Federal Agencies, February 1998 (rev. 10/2000, Appendices 6–7). *Indicates habitat type may be impacted by the proposed project. **USACE (2013)

<table>
<tr><th>Essential Fish Habitat (EFH)</th><th></th><th colspan="2">Habitat Areas of Particular Concern (HAPC)</th></tr>
<tr><td>Estuarine Areas</td><td></td><td colspan="2">South Atlantic [area-wide]</td></tr>
<tr><td>Aquatic Beds
Estuarine Emergent Wetlands
Estuarine Scrub / Shrub Mangroves
Estuarine Water Column
Intertidal Flats
Oyster Reefs & Shell Banks
Palustrine Emergent and Forested Wetlands
Submerged Aquatic Vegetation (SAV)</td><td></td><td colspan="2">Council Designated Artificial Reef
Hard Bottoms
Hermatypic (reef forming) Coral Habitat & Reefs
Hoyt Hills
Sargassum Habitat
Special Habitat Management Zones
State-Designated Areas of Importance to Managed Species
Submerged Aquatic Vegetation (SAV)</td></tr>
<tr><td>Marine Areas</td><td></td><td>Georgia</td><td>South Carolina</td></tr>
<tr><td>Artificial / Manmade Reefs
Coral & Coral Reefs
Live / Hardbottoms
Sargassum
Water Column*</td><td></td><td>Gray’s Reef National Marine Sanctuary** (30 miles from Sea Island)</td><td>Hurl Rocks
~260 mi NE of Sea Island
Charleston Bump
150-175 mi E-NE of Sea Island
Broad River
runs into Port Royal Sound near Beaufort
~80 miles from Sea Island</td></tr>
</table>

TABLE 7.2 Fishery management plans and managed species for the South Atlantic region (2009).

SNAPPER GROUPER COMPLEX

Sea basses and Groupers (Serranidae) - 21 species

Gag	*Mycteroperca microlepis,*
Red grouper	*Epinephelus morio*
Scamp	*Mycteroperca phenax*
Black grouper	*Mycteroperca bonaci*
Rock hind	*Epinephelus adcensionis*
Red hind	*Epinephelus guttatus*
Graysby	*Cephalopholis cruentata*
Yellowfin grouper	*Mycteroperca venenosa*
Coney	*Cephalopholis fulva*
Yellowmouth grouper	*Mycteroperca interstitialis*
Tiger grouper	*Mycteroperca tigris*
Goliath grouper	*Epinephelus itajara*
Nassau grouper	*Epinephelus striatus*
Snowy grouper	*Epinephelus niveatus*
Yellowedge grouper	*Epinephelus flavolimbatus*
Warsaw grouper	*Epinephelus nigritus*
Speckled hind	*Epinephelus drummondhayi*
Misty grouper	*Epinephelus mystacinus*
Black sea bass	*Centropristis striata*
Bank sea bass	*Centropristis ocyurus*
Rock sea bass	*Centropristis philadelphica*

Wreckfish (Polyprionidae) - 1 species

Wreckfish	*Polyprion americanus*

Snappers (Lutjanidae) - 14 species

Queen snapper	*Etelis oculatus*
Yellowtail snapper	*Ocyurus chrysurus*
Gray snapper	*Lutjanus griseus*
Mutton snapper	*Lutjanus analis*
Lane snapper	*Lutjanus synagris*
Cubera snapper	*Lutjanus cyanopterus*
Dog snapper	*Lutjanus jocu*
Schoolmaster	*Lutjanus apodus*
Mahogany snapper	*Lutjanus mahogoni*
Vermilion snapper	*Rhomboplites aurorubens*
Red snapper	*Lutjanus campechanus*
Silk snapper	*Lutjanus vivanus*
Blackfin snapper	*Lutjanus buccanella*
Black snapper	*Apsilus dentatus*

Porgies (Sparidae) - 9 species

Red porgy	*Pagrus pagrus*
Sheepshead	*Archosargus probatocephalus*
Knobbed porgy	*Calamus nodosus*
Jolthead porgy	*Calamus bajonado*
Scup	*Stenotomus chrysops*
Whitebone porgy	*Calamus leucosteus*
Saucereye porgy	*Calamus calamus*
Grass porgy	*Calamus arctifrons*
Longspine porgy	*Stenotomus caprinus*

Grunts (Haemulidae) - 11 species

White grunt	*Haemulon plumieri*
Black margate	*Anistotremus surinamensis*
Margate	*Haemulon album*
Tomtate	*Haemulon aurolineatum*
Sailor's choice	*Haemulon parra*
Porkfish	*Anisotremus virginicus*
Bluestriped grunt	*Haemulon sciurus*
French grunt	*Haemulon flavolineatum*
Cottonwick	*Haemulon melanurum*
Spanish grunt	*Haemulon macrostomum*
Smallmouth grunt	*Haemulon chrysargeryum*

SNAPPER GROUPER COMPLEX (continued)

Jacks (Carangidae) - 8 species

Greater amberjack	*Seriola dumerili*
Crevalle jack	*Caranx hippos*
Blue runner	*Caranx crysos*
Almaco jack	*Seriola rivoliana*
Banded rudderfish	*Seriola zonanta*
Bar jack	*Caranx ruber*
Lesser amberjack	*Seriola fasciata*
Yellow jack	*Caranx bartholomaei*

Tilefishes (Malacanthidae) - 3 species

Tilefish	*Lopholatilus chamaeleonticeps*
Blueline tilefish	*Caulolatilus microps*
Sand tilefish	*Malacanthus plumier*

Triggerfishes (Balistidae) - 3 species

Gray triggerfish	*Balistes capriscus*
Ocean triggerfish	*Canthidermis sufflamen*
Queen triggerfish	*Balistes vetula*

Wrasses (Labridae) - 2 species

Hogfish	*Lachnolaimus maximus*
Puddingwife	*Halichoeres radiates*

Spadefishes (Eppiphidae) - 1 species

Atlantic spadefish	*Chaetodipterus faber*

COASTAL MIGRATORY PELAGICS

Cero	*Scomberomorus regalis*
Cobia	*Rachycentron canadum*
King mackerel	*Scomberomorus cavalla*
Little tunny	*Euthynnus alletteratus*
Spanish mackerel	*Scomberomorus maculates*

DOLPHIN WAHOO

Dolphinfish	*Coryphaena hippurus*
Wahoo	*Acanthocybium solandri*

GOLDEN CRAB

Golden crab	*Chaceon fenneri*

SHRIMP

White shrimp	*Litopenaeus setiferus*
Pink shrimp	*Farfantepenaeus duorarum*
Brown shrimp	*Farfantepenaeus aztecus*
Rock shrimp	*Sicyonia brevirostris*
Royal red shrimp	*Pleoticus robustus*

SPINY LOBSTER

Spiny lobster	*Panulirus argus*

SARGASSUM

Sargassum fluitans
Sargassum natans

CORAL, CORAL REEFS AND LIVE/HARD BOTTOM HABITAT

The management unit for coral includes coral belonging to the Class Hydrozoa (fire corals and hydrocorals) and coral belonging to the Class Anthozoa (sea fans, whips, precious corals, sea pens and stony corals). Coral reefs constitute hardbottoms, deepwater banks, patch reefs and outer bank reefs as defined in the Coral, Coral Reefs and Live/Hardbottom Habitat FMP (SAFMC 1982). In addition, live rock comprises living marine organisms, or an assemblage thereof, attached to a hard substrate, including dead coral or rock (but excluding individual mollusk shells).

7.1 Impacts on EFH and HAPC

For the proposed project at Sea Island (GA), work would encompass the areas shown in Figure 7.1, including Borrow Area “A” and the sections of Sea Island beach demarcated for nourishment. For the Reserve portion of the project, NMFS, Habitat Conservation Division, determined that any adverse impacts to EFH from the Reserve project would be minimal, and offered no EFH conservation recommendations pursuant to the Magnuson-Stevens Fishery Conservation and Management Act or the Fish and Wildlife Coordination Act.

Below, the Essential Fish Habitats (EFH) and Habitat Areas of Particular Concern (HPAC) are addressed by category.

Neither the South Atlantic (area-wide) or Georgia/South Carolina HAPC are expected to be impacted. Three designated HAPCs are situated in regional waters as follows (Table 7.1):

- Broad River – runs on west side of Laurel Bay into Port Royal Sound near Beaufort (SC) and ~80 miles north of Sea Island.
- Charleston Bump – 150-175 miles east-northeast of Sea Island.
- Hurl Rocks – ~260 miles northeast of Sea Island.

As noted in Table 7.1, the closest HAPC to Sea Island is the Broad River HAPC, which is ~80 miles north of Sea Island. Georgia’s designated HAPC is the Gray’s Reef National Marine Sanctuary, which is 30 miles north of Sea Island. Because of its distance from Sea Island, Gray’s Reef is not expected to be impacted by the proposed project.

The EFH Estuarine Areas designated for protection in Table 7.1 are not located in or adjacent to the potential impact areas of the proposed project and therefore will not be impacted. These include: estuarine scrubs/shrubs, oyster reefs and shell banks, forested and marsh wetlands, aquatic beds, and seagrass beds (CSE 2011). This BA-EFH will discuss the surf zone, which includes subtidal and intertidal areas. The surf zone generally includes the area from the point at which waves are cresting off a beach to the highest point at which a wave washes on shore.

Of the remaining EFH, species present in the surf zone and marine water column, including non-motile species short-term, would be impacted by the proposed project. However, fish and other mobile animals are unlikely to be directly impacted, due to their ability to avoid areas of disturbance (CSE 2011). Marine Areas listed in Table 7.1 and the surf zone are discussed further below, with the exception of coral and coral reefs, which do not apply.

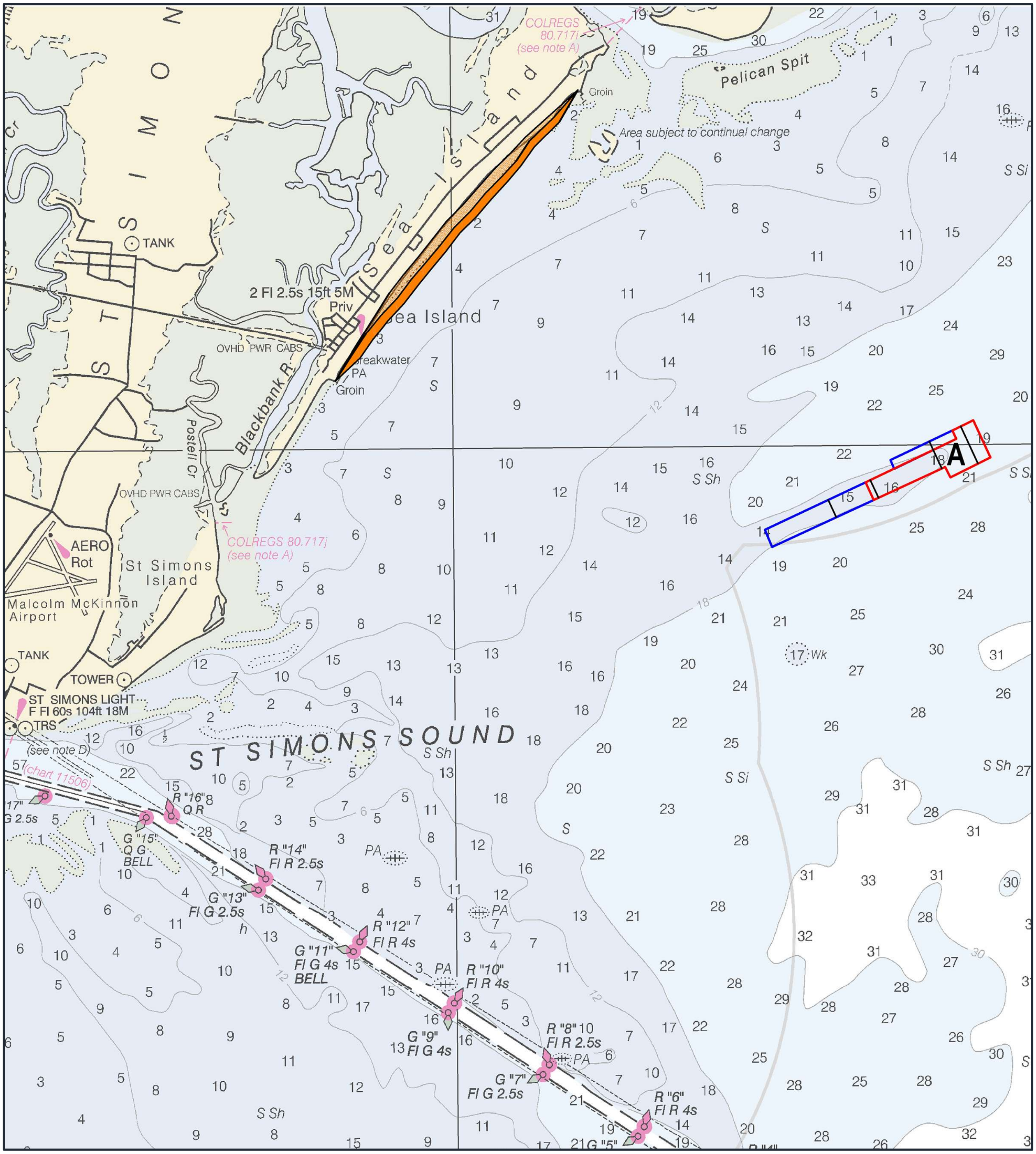

FIGURE 7.1. The proposed project borrow area ("A") is situated over a bathymetric high in Georgia state waters. Water depths are typically −20 ft to −30 ft NAVD. The nourishment will be pumped by dredge along ~3 miles of oceanfront along the center of Sea Island.

7.1.1 Impacts to Artificial Reefs

The artificial reef development program in Georgia was initiated in 1970 by the former Georgia State Game and Fish Commission. Currently managed by GADNR–Coastal Resource Division (CRD), the program oversees over 20 artificial reefs located 6–23 nautical miles (nm) offshore in 30–70 ft water depths. The reefs have been placed to attract a variety of fish species for recreational and sport fishing, and to improve hardbottom habitat in Georgia waters. The nearest artificial reefs to Sea Island appear to be ALT (6 nm east of Little St Simons Island), DRH (15 nm east of Little St Simons Island), and F (9 nm east of Jekyll Island).

Another artificial reef is the JY Reef, which is located further out than the Gray's Reef National Marine Sanctuary, about 45 miles northeast of Sea Island. Reef JY is comprised of a variety of conveyances with steel components, from subway cars and barges, to landing craft, liberty ships, and battle tanks (GADNR-CRD 2001, coastalgadnr.org/sites/default/files/crd/Reefs/GeorgiaOffshoreReef Web.pdf, Google Earth). These reefs are northeast and southeast (respectively) of the proposed project area. Adverse impacts to artificial reef areas are not expected to occur, since construction of the proposed project will not be performed in close proximity to any reef.

Nourishment activity will involve pumping material from a borrow area ~4 miles offshore (within Georgia state waters), through the dredge pipeline onshore, which will deposit quality sand and shell fragment material (>95 percent) onto the beach. This activity will have no effect on reefs or other underwater obstructions, including exposed hardbottom. Elevated turbidity levels occur during dredging in the immediate vicinity of borrow sites and disposal sites, but decrease rapidly as suspended sediments settle or disperse (Hanes 1994). Turbidity increases in the presence of muddy sediments, which are more commonly encountered offshore. Beach sediments have little mud because of the high energy associated with surf zones.

7.1.2 Impacts on Hardbottom

The term "hardbottom" refers to areas of rock or consolidated sediments in temperate, subtropical, and tropical regions, generally located in the ocean rather than in the estuarine system. Along the South Atlantic states, hardbottom ranges from the shoreline and nearshore (within the state's three-mile jurisdictional limit) to beyond the continental shelf edge (>656 ft deep) (NOAA 2007; Street et al 2005). Hardbottom habitats are known to be present north of the project area and have been identified by geotechnical sampling (Fig 7.2).

The applicant will prohibit any pipelines or anchoring to occur on hardbottom that is unknown presently, but may be detected at the time of construction. As discussed above, over 20 artificial reefs are located in Georgia waters with the closest reefs appearing to be ALT (6 nm east of Little St Simons) and F (9 nm east of Jekyll Island). There are no known occurrences of hard bottom in the immediate vicinity of the proposed project. The material being excavated from the offshore borrow sites is sediment which has been determined to match closely the sand on the current beach (CSE 2018). Increases in turbidity will be temporary and localized to the dredge excavation area.

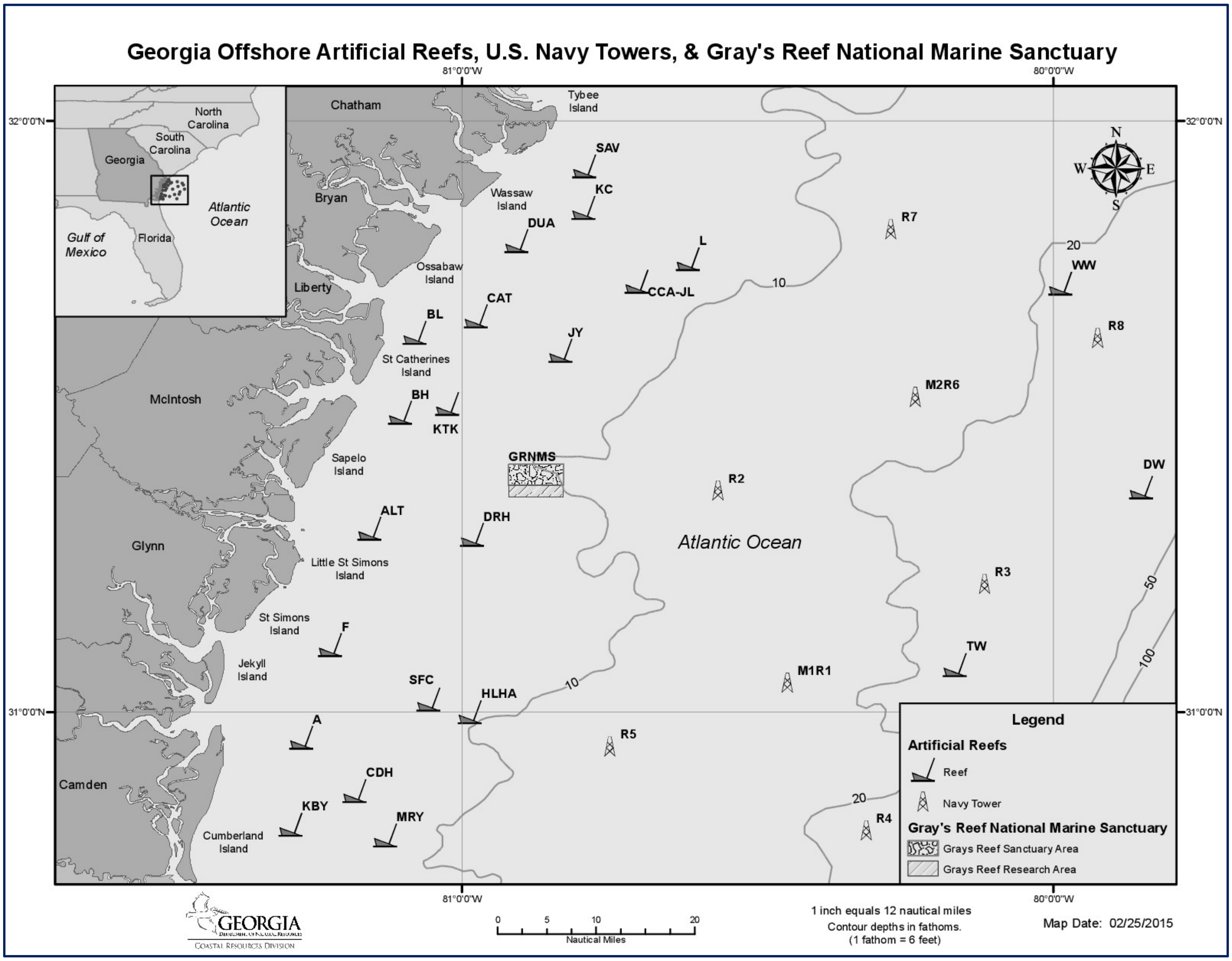

FIGURE 7.2. Seafloor environments identified by USGS (2007) in the vicinity of Sea Island. See text for details. Borings within the borrow areas show unconsolidated sediments within the upper 6 ft of substrate. Artificial reefs are also shown.

7.1.3 Impacts on Sargassum

Sargassum is a pelagic, brown algae which occurs in large floating mats in the waters of the continental shelf, in the Sargasso Sea, and in the Gulf Stream. It is a major source of biological productivity in nutrient-poor regions of the ocean. Masses of sargassum provide extremely valuable habitat for a diverse assemblage of marine life, including juvenile sea turtles, sea birds, and over 100 species of fish. Unregulated commercial harvest of sargassum for fertilizer and livestock feed has prompted concerns over the potential loss of this important resource. Under certain wind conditions, relatively small masses of sargassum have been known to wash ashore near or in the proposed project area. Sargassum will not be subject to impacts associated with the proposed project, since it is not commonly found in the proposed project area, and construction activity will occur on the beach (CSE 2012).

7.1.4 Estuarine and Marine Water Column

The marine water column connects all other aquatic habitats and is the "medium of transport for nutrients and migrating organisms between river systems and the open ocean" (SAFMC 1998). Estuarine and marine water column environments in the proposed project area include the beach areas and surf zone of Sea Island. A variety of marine life is known to be present in the water column of the South Atlantic region. As noted in the SAFMC (1998) Habitat Plan for the South Atlantic Region: Essential Fish Habitat Requirements for Fishery Management Plans of the South Atlantic Fishery Management Council (safmc.net/ecosystem-management/safmc-habitat-plan/), these include:

- Freshwater-spawning species, such as striped bass, herring, and sturgeons.
- Estuarine-dependent species, such as flounder, blue crab, penaeid shrimp, red drum.
- Migratory pelagic species such as cobia, bluefish, Spanish and king mackerel.

Construction, excavation and disposal activities of the proposed project may cause impacts in the estuarine and marine water column in the immediate areas of borrow and deposition sites that could potentially impact nearshore and intertidal resources. These impacts may include minor and short- term, suspended-solids sediment plumes and related turbidity, as well as the release of trace constituents from the sediment.

The impacts associated with the proposed project may be similar, on a smaller scale, to the effects of storms. Storm effects may include increased turbidity and suspended sediment load in the water column and, in some cases, changes in fish community structure (Hackney et al 1996). Severe storms have been documented to create conditions of fish kills, but such situations are not associated with beach disposal of dredged sand.

In an environmental report (USDOI–MMS 1999) on the use of federal offshore sand resources for beach and coastal restoration, the US Department of Interior, Minerals Management Service stated:

> *"In order to assess if turbidity causes an impact to the ecosystem, it is essential that the predicted turbidity levels be evaluated in light of conditions such as during storms. Storms on the Mid-Atlantic shelf may generate suspended matter concentrations of several hundred mg/l (eg Styles and Glenn, 1999). Concentrations of plumes decrease rapidly during dispersion. Neff (1981, 1985) reported that solids concentrations of 1000 ppm two minutes after discharge decreased to 10 ppm within one hour. Poopetch (1982) showed that the initial concentration in the hopper overflow of 3,500 mg/l decreased rapidly to 500 mg/l within 50 meters. For this reason, the impact of settling particles from the turbidity plume is expected to be minimal beyond the immediate zone of dredging."*

Beach disposal of dredged/excavated sediments can affect fishery resources and essential fish habitats through increases in turbidity and burial of beach resources, such as benthic organisms. These impacts may create localized short-lived, stressful habitat conditions and may result in the temporary displacement of fish and other biota. However, the sediment proposed for disposal on the beach averages >95 percent sand and shell fragments (<5 percent fine-grained material). Due to the low mud content in the sediment, turbidity-induced water column impacts are expected to be localized, short- term, and minor (CSE 2012).

7.1.5 Impacts on the Surf Zone

Environmental issues relating to benthic habitat and resources should be considered for proposed beach nourishment or restoration projects. Some of the most significant include:

1) Impacts to and recovery of the benthic invertebrate community on the intertidal and willow subtidal beach.
2) Potential impacts to commercially and recreationally important shorebirds and/or fishes in the surf zone, mainly due to the effects on their benthic invertebrate prey and because of enhanced turbidity along the shoreline.
3) Impacts to and recovery of the benthic invertebrate community at the borrow sites.
4) Potential impacts to commercially or recreationally important demersal fishes and crusta- ceans, in part because of the effects on their benthic invertebrate prey (CSE 2011).

The proposed project at Sea Island along its developed shore may have a direct impact on benthic and fish species in the surf zone and up to 1–4 miles offshore near dredge operations. During project construction, turbidity in the surf zone would increase in the immediate area of sand pumping and placement. This increase in fine material may cause the temporary displacement of various species of sport fish, including cobia and mackerel.

A study performed by NMFS (2003) on the effects of beach nourishment on nearshore macroinfauna concluded that beach nourishment projects using offshore dredged material have no harmful effects, provided that the sediments are similar to those where they are placed [Saloman & Naughton 1984, USACE (Burlas et al) 2001, Dean 2002]. In the present case, sediment quality would match closely, which should facilitate species recovery in the impacted areas. Temporary reduction in benthic macro- invertebrate abundance and/or diversity may negatively impact coastal migratory pelagics, which are assumed as juveniles to feed on benthic organisms and plankton in the surf zone.

Impacts of beach nourishment on intertidal organisms have been well-documented. In general, the benthic community recovers within one year of the project if compatible material is placed (Van Dolah et al 1992, 1994; Jutte et al 1999, 2002; USACE 2001, 2013; Bergquist et al 2009, 2011a,b). A study conducted on Bogue Banks (NC) by Reilly and Bellis (1983) is used as a seminal study on beach projects throughout the Southeastern US. In this study, Reilly and Bellis (1983) concluded that beach nourish- ment virtually destroys existing intertidal macrofauna, but that recovery is rapid once the pumping operation ceases. In most cases, recovery occurs within one or two seasons following the sediment placement: "… a speedy recovery largely depended on recruitment from pelagic larval stocks." Most species fell into this category. The few that did not recruited instead from neighboring beaches and were slower to recover.

In its previously referenced report, the USDI–MMS (1999) provided the following assessment of the potential impacts to beach fauna from beach nourishment:

> *"As with benthic organisms living in borrow areas, benthic organisms are significantly impacted by beach nourishment activities (Nelson 1985; Van Dolah et al 1992). These impacts, however, are considered shorter in duration than the impacts observed in offshore borrow areas. Because benthic organisms living in the beach habitats are adapted to high energy environments, they are able to quickly recover to original levels following beach nourishment events; sometimes in as little as three months (Van Dolah et al 1994; Levison and VanDolah, 1996). This is again attributed to the fact that intertidal organisms are living in high energy habitats where disturbances are more common. Because of lower diversity of species compared to other intertidal and willow subtidal habitats (Hackney et al 1996), the vast majority of beach habitats are recolonized by the same species that existed before nourishment (Van Dolah et al 1992, Nelson, 1985; Levison and Van Dolah, 1996; Hackney et al 1998)."*

Short-term increases in turbidity are expected in the surf zone due to the release of excavated material. In an ecosystem restoration study of Hunting Island, the USACE (2004) concluded that:

> *"Since animals associated with high energy beaches are continually subjected to effects of erosion and accretion and major physical changes resulting from storms and hurricanes, initial construction and any periodic nourishments...will not unduly stress beach and intertidal animals beyond their adaptive capacities."*

In planning for the 2005 Folly Beach renourishment project, the USACE–Charleston District recognized that non-motile benthic animals would be adversely affected by the placement of sand. But the district also recognized that recolonization was expected to be relatively rapid with reestablishment of the beach zone community within 1–2 years in affected areas (USACE 2005). Monitoring studies of the Folly Beach project by SCDNR (Bergquist et al 2009) found that *"burrowing macroinvertebrates showed little evidence of nourishment impact. Ghost shrimp increased in density following nourishment."*

A recent study was completed in connection with a large-scale nourishment project at Nags Head (NC) (CZR–CSE 2014), which included seasonal sampling of benthic macroinvertebrates before and after nourishment. Nourishment occurred in summer of 2011 and by fall 2011 (the first sampling event), the total abundance and richness of the benthic community was not significantly different than the pre-project or control site samples. In that project, borrow material closely matched the native beach, and the beach macrofauna community rapidly recovered from the impacts of nourishment. The Nags Head project was 10 miles long and required five months to construct (May–October). It is likely that completed sections of the project were recovering their benthic community long before the entire project was completed due to the way beach fill moves alongshore as construction progresses without prolonged adjustment at any locality.

Species that spawn along beaches are able to leave the immediate vicinity to spawn. Species offshore are able to relocate from borrow area(s) during dredging operations. Pullen and Naqvi (1983) observed that fish species left the area temporarily during dredging operations and returned when dredging ceased. Studies of nearshore borrow areas after dredging offshore of South Carolina revealed no long- term impacts to fisheries (both fish and planktonic organisms) as a result of dredging (Van Dolah et al 1992, 1998). The applicant has submitted a monitoring plan to GADNR-CRD and USACE with the permit application (Appendix A). It includes pre, post, and out-year monitoring of elevation and sediments in the borrow area. No benthic fauna monitoring is proposed based on the extensive body of research in Southeastern waters.

The proposed project will result in excavation and mortality of ~250 acres of surficial benthic organisms in the borrow area. (Note: This assumes use of a cutterhead dredge and average excavation depth of 4 ft.) Filling operations will bury up to 200 acres of willow beach and inshore habitat (ocean shoreline), resulting in mortality and displacement of existing benthic populations. Nourishment will create an additional ~90 acres of dry sand beach before full profile equilibration (habitat for turtle nesting, shorebird roosting, and recreational area). A wider dry beach will allow natural expansion of the foredune and its associated vegetation. The re-created wet-sand beach will be similar to or greater in area than the previous wet-sand beach buried by the fill. It is expected that these areas will recolonize naturally and rapidly with a similar suite of species (Jutte et al 2002, CZR–CSE 2014).

Based on the species assessments and the project plans, **it has been determined that the proposed project would not have significant individual or cumulative adverse impacts on EFH or fisheries managed by the SAFMC and NMFS.**

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8.0 SUMMARY

The findings presented in Section 4.0 and Section 6.0 outline potential impacts to endangered and threatened species which may occur in the proposed project area. The restorative nature of the project and the lack of impacts to freshwater or estuarine wetlands indicate that no mitigation for the action is required. Work would likely occur 1 November to 30 April in the year of construction, with a possible contingency period of 1 May to 31 July. The proposed nourishment project is similar to previous projects along Sea Island and will address the large gradients in erosion from the center of the island to the ends of the island.

The project will restore and preserve dry sand and dune habitat used by shorebirds and endangered and threatened species. Impacts of beach nourishment projects are well understood and, when designed properly, are limited to temporary impacts to the immediate beach and borrow area. The borrow area has been selected to minimize placement of silt-sized particles on the beach and to closely match the native grain size distribution along the beach.

Construction of the proposed project would occur during periods of low biological activity in winter to minimize impacts to benthic organisms and to sea turtles. If logistics necessitate construction extending into turtle nesting season, no cutterhead dredging will occur, and standard sea turtle conservation measures will be incorporated into the scope of the project. Long-term, the proposed project will potentially provide more habitat for species of concern, including the piping plover, red knot, green sea turtle, and loggerhead sea turtle. It will also provide hard substrate (~0.4 acre) in the inter-tidal zone, which will attract sessile organisms. Table 8.1 summarizes findings of impacts associated with the proposed project.

It is the applicant's conclusion that all potential effects from the project are discountable, insignificant, or beneficial, and therefore the proposed action is not likely to adversely affect listed species in the project area.

TABLE 8.1. Summary of findings of this biological assessment regarding the impacts on endangered species at Sea Island (GA). [*Impacts can be minimized if construction activities are performed outside the nesting season.]

<table>
<tr><th colspan="2">SPECIES</th><th>OCCURS IN PROPOSED ACTION AREA</th><th>FINDING</th></tr>
<tr><td colspan="4">NO EFFECT</td></tr>
<tr><td colspan="2">American Wood Stork</td><td>No</td><td>No effect</td></tr>
<tr><td colspan="2">Bald Eagle</td><td>No</td><td>No effect</td></tr>
<tr><td colspan="2">Kirtland's Warbler</td><td>No</td><td>No effect</td></tr>
<tr><td colspan="2">Red-Cockaded Woodpecker</td><td>No</td><td>No effect</td></tr>
<tr><td colspan="4">MAY AFFECT, NOT LIKELY TO ADVERSELY IMPACT</td></tr>
<tr><td colspan="2">Piping Plover</td><td>Yes</td><td>May Affect, Not Likely To Adversely Affect</td></tr>
<tr><td colspan="2">Red Knot</td><td>Yes</td><td>May Affect, Not Likely To Adversely Affect</td></tr>
<tr><td colspan="2">Atlantic Sturgeon</td><td>Potentially</td><td>May Affect, Not Likely To Adversely Affect</td></tr>
<tr><td colspan="2">Shortnose Sturgeon</td><td>Potentially</td><td>May Affect, Not Likely To Adversely Affect</td></tr>
<tr><td rowspan="2">Sea Turtles:</td><td>Hawksbill Kemp's Ridley Leatherback</td><td>Potentially</td><td rowspan="2">May Affect, Not Likely To Adversely Affect*</td></tr>
<tr><td>Green & Loggerhead Sea Turtles</td><td>Yes</td></tr>
<tr><td colspan="2">West Indian Manatee</td><td>Potentially</td><td>May Affect, Not Likely To Adversely Affect</td></tr>
<tr><td rowspan="2">Whales</td><td>Sei, Sperm, Blue, And Finback</td><td>Potentially</td><td rowspan="2">May Affect, Not Likely To Adversely Affect</td></tr>
<tr><td>Humpback & Right Whale</td><td>Yes</td></tr>
</table>

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