

Biological Assessment of Threatened and Endangered Species

*for Maintenance Dredging and Open Water Placement at Hilton Head Island,
South Carolina*

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Executive Summary

To maintain existing marina basins and access channels on Hilton Head Island, the South Island Dredging Association (SIDA) seeks to dredge and place approximately 300,000 cubic yards of silt, clay, and sand materials south of the mouth of Calibogue Sound. Proposed dredge areas include Harbour Town Marina, Gull Point Marina, South Beach Marina, Baynard Cove Creek's Community Dock, Port Villas, and channels leading to these areas. The dredging is needed because shoaling of these areas and the existing shallow depths prevent navigation of recreational and commercial vessels in many areas during much of the tidal cycle. SIDA proposes to place the material at the near-shore open water estuarine placement site located south of Hilton Head Island because it is the preferred alternative (GEL Engineering 2012).

The US Army Corps of Engineers (USACE) regulates the wetlands and waters of the United States pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act and issues permits for projects that may impact these resources. Accordingly, the proposed maintenance dredging project requires a USACE Section 404/10 permit.

As part of the permitting process, the USACE is required to comply with the requirements of the National Environmental Policy Act of 1969 (NEPA), an umbrella law that requires review of projects for potential impacts to the environment. As such, NEPA requires compliance with the Endangered Species Act (ESA), which is administered by the United States Fish & Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS). USFWS or NMFS will typically request that the USACE include a Biological Assessment (BA) or biological evaluation (BE) as part of the permitting review process if species listed as endangered or threatened under the ESA or critical habitat are or may be present in the project vicinity. The USACE will then typically make the BA or BE a requirement prior to a permit decision.

This BA provides information regarding the proposed project and identifies any effects that the project may have on federally listed species. Potential effects from the project include the effects to the creeks from dredging, as well as effects to fish communities and habitats at the dredged material placement site. Federally protected species that are listed for Beaufort County and may have habitat or occurrence in the project area were considered and are included in the following list. Most of these species will not be affected because either they are not present at all or extremely rare in the project areas, or they are not present during the time period when the proposed project will take place (noted with an asterisk).

- West Indian manatee (*Trichechus manatus*)
- Bald eagle (*Haliaeetus leucocephalus*)
- Wood stork (*Mycteria americana*)
- Piping plover (*Charadrius melodus*)
- Finback whale (*Balaenoptera physalus*) *
- Humpback whale (*Megaptera novaeangliae*) *
- North Atlantic right whale (*Eubalaena glacialis*) *
- Sei whale (*Balaenoptera borealis*) *
- Blue whale (*Balaenoptera musculus*) *

- Sperm whale (*Physeter macrocephalus*) *
- Green sea turtle (*Chelonia mydas*) *
- Kemp's ridley sea turtle (*Lepidochelys kempii*) *
- Leatherback sea turtle (*Dermochelys coriacea*)
- Loggerhead sea turtle (*Caretta caretta*)
- Shortnose sturgeon (*Acipenser brevirostrum*) *
- Atlantic sturgeon (*Acipenser oxyrhincus*)

The potential project effects were evaluated based on review of available data and a site inspection of the areas to be dredged. This analysis includes the following elements:

- Description of the proposed action;
- Summary of the alternatives considered for the project;
- Literature review of previous site-specific studies describing the project area environment, as well as literature review of studies on the effects of dredged material placement in open water in South Carolina and the US;
- Description of the existing conditions observed during site surveys of the proposed dredging action area;
- Descriptions of federally listed species and habitat in the action area;
- Estimates of effects on federally listed species and habitats; and
- Descriptions of avoidance, minimization and mitigation for the project.

Table ES-1 summarizes the potential effects of the proposed project. In this table a "may affect, but not likely to adversely affect" determination is presented as "not likely to adversely affect."

The proposed project will have no effect on the following species because they are not present, extremely rare, or far off shore during the season in which the project would be conducted: bald eagle, finback whale, humpback whale, North Atlantic right whale, sei whale, sperm whale, green sea turtle, Kemp's ridley sea turtle, and shortnose sturgeon.

No Critical Habitat Areas exist in the action area, and no listed species records were found, except for a manatee in Harbour Town Marina during the summer. Leatherback and loggerhead sea turtles may be present in the project action area as they do nest and forage on Hilton Head Island. However, they are unlikely to be affected by the proposed project. The project includes removal of a very small area of beach at the Braddock Cove Creek inlet, but this is considered low-quality turtle nesting habitat. Therefore, these turtles may be affected, but are unlikely to be adversely affected by the proposed project.

The wood stork and piping plover are unlikely to be affected by the project despite a minor loss of potential foraging habitat in the dredged areas, which is considered insignificant as compared to the available foraging habitat. The applicant will apply every practical measure to avoid and minimize this habitat loss and disturbance. The Atlantic sturgeon is unlikely to be affected by the project despite the loss of potential foraging habitat in the dredged material placement area. The location of the placement area was chosen to meet the objective of an inland open water placement site while minimizing harm to

all species of concern, listed and managed species, and hard bottom habitats (which are more vulnerable to dredging impacts than the unconsolidated sandy bottom habitat at the selected placement site).

Table ES-1. Summary of potential project effects on federally listed species

Listed Species	Effects	Summary
West Indian manatee	Unlikely to adversely affect	Temporary disturbance of habitat
Bald eagle	No effect	No individual or habitat impacts
Wood stork	Unlikely to adversely affect	Minor loss of foraging habitat (shallow tidal creek)
Piping plover	Unlikely to adversely affect	Minor loss of foraging habitat (shallow tidal creek)
Seabeach amaranth	No effect	Not present in project area
Finback whale	No effect	Not present in project area
Humpback whale	No effect	Not present in project area
North Atlantic right whale	No effect	Not threatened by project actions or methods
Sei whale	No effect	Not present in project area
Sperm whale	No effect	Not present in project area
Green sea turtle	No effect	Extremely rare in proposed project area
Kemp's ridley sea turtle	No effect	Extremely rare in proposed project area
Leatherback sea turtle	Unlikely to adversely affect	Very small loss of beach at inlet area that is unlikely nesting habitat.
Loggerhead sea turtle	Unlikely to adversely affect	Very small loss of beach at inlet area that is unlikely nesting habitat
Shortnose sturgeon	Unlikely to adversely affect	Unlikely to be present in project area.
Atlantic sturgeon	Unlikely to adversely affect	Disturbance of marine foraging habitat from dredged material placement.

1 Introduction and Description of the Proposed Action

The South Island Dredging Association (SIDA) has requested a permit to conduct maintenance dredging in Baynard Creek, Braddock Creek and Harbour Town Yacht Basin on the south end of Hilton Head Island, South Carolina (Figure 1- 1). The US Army Corps of Engineers (USACE) regulates the wetlands and waters of the United States pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act and issues permits for projects which may impact these resources. Accordingly, the proposed maintenance dredging project requires a USACE Section 404/10 permit.

As part of the permitting process, the USACE is required to comply with the requirements of the National Environmental Policy Act of 1969 (NEPA), an umbrella law that requires review of projects for potential impacts to the environment. As such, NEPA requires compliance with the Endangered Species Act (ESA) which is administered by the United States Fish & Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS). USFWS or NMFS will typically request that the USACE include a Biological Assessment (BA) as part of the permitting review process if species listed as endangered or threatened under the ESA or critical habitat are or may be present in the project vicinity. The USACE will then typically make the BA a requirement prior to a permit decision.

This maintenance dredging will remove sediments that have settled in these navigation channels. The project will not include dredging of new areas or to depths beyond those previously permitted and dredged (i.e., there is no “new work” material to be dredged). The project dredge areas and proposed dredge depths are summarized in Table 1-1.

Table 1-1. Dredge areas and depth for each site

Location	Acres	Depth (MLW)
Harbour Town Marina		
Entrance Channel	6.5	-8
Marina	8.3	-8
Braddock Cove Creek		
Entrance Channel to South Beach Marina, including Gull Point Marina	12.6	-8
South Beach Marina	2.1	-8
Upstream of S. Beach Marina to Port Villas	2.6	-6
Baynard Cove Creek		
Entrance Channel	13.6	-8
Community Dock	1.5	-5
Creek	3.3	-6
TOTAL	50.5	

SIDA proposes to place approximately 300,000 cubic yards of dredged materials at the mouth of Calibogue Sound. The project dredge and placement areas are shown in Figure 1-2. The placement site is within the inland waters of Calibogue Sound. As shown by Figure 1-2, the site is on the landward side of the baseline points and tangents from which the territorial sea is measured. “Ocean waters” are defined as the waters of the open seas lying seaward of the baseline.

Because of the quantity of material to be dredged, and the fact that only a small dredge can navigate the creeks to excavate the material (which limits the production rate of the dredge), the project will require up to 6 months to complete. The proposed project would start in the month of November and continue through the winter and spring months, ending as late as the end of April. The duration of the impact for the tidal creeks will be weeks for the creeks, and months for the open water areas.

Limiting dredging to ebb tides was evaluated as a means of further ensuring the transport of materials away from the shoreline of Hilton Head. However, numerical modeling (MGA, 2012) indicates that no significant adverse water quality effects will occur by dredging during all tidal cycles. Furthermore, dredging during only ebb tides is not practical because it would double the duration of time to complete the project. This would require two years of work instead of one, thus extending the period of impact and disturbance.

Based on a review of geotechnical data collected by Applied Technology and Management (ATM) (1999) and by GEL Engineering (GEL) (2008), the maintenance material is mostly silt and clay with a variable fraction of sand. Material composition and sediment grain size depends upon the location from which it is extracted. Table 1-2 summarizes the 2008 grain size analysis data for the dredge sites.

Table 1-2. Summary of grain size distribution at dredge sites

Sample	Site Description	Sand	Coarse silt	Fine silt	Clay
HT-2	Harbour Town Marina – entrance	8	12	38	42
HT-3	Harbour Town Marina – center of basin	22	16	28	34
Gull PT-1	Gull Point Marina in Braddock Cove Creek	5	15	38	42
S. Beach-1	South Beach Marina in Braddock Cove Creek	5	21	46	28
Brad-2	Middle of Braddock Cove Creek	8	18	34	40
Bay-2	Middle of Baynard Cove Creek	6	26	30	38
CD-1	Community dock in Baynard Cove Creek	7	25	31	37
Average		9	19	35	37
Standard Deviation		6.0	5.2	6.2	5.0

The project proposes to use a small hydraulic dredge with a maximum intake diameter of 16 inches (although a 10-inch dredge will most likely used), and transport the materials via a pipe to Placement Site 5 (Figure 1-2). Site 5 is located in an area with rippled sand bottom habitat. The location of the proposed pipeline discharge at Placement Site 5 is approximately 4,600 feet from the shoreline of Hilton Head Island and approximately 8,100 feet from the shoreline of Daufuskie Island. Figure 1-3 also shows an alternative dredged material placement site (Site 2) that is discussed in this report. Site 2 is an

alternative placement site that was considered previously, but it was removed from consideration in order to reduce the potential project impacts. The dredging footprint ranges from 35 to 50 feet wide in the channels, depending upon the channel's width and distance from oyster reefs and saltmarsh.

The pipeline would also be 16 inches in diameter or less. It would lead from the dredging site along the shoreline in water depths sufficient for it to remain off the bottom and convey sediments to the placement site. The pipeline would be floated at the surface except when crossing channels, where it would need to be submerged and anchored (using heavy chains with weights on the ends) so that it does not create a navigation hazard.

GEL Engineering (2012) and ATM (2000a) conducted detailed evaluations of the alternative designs for the proposed project, including potential alternative placement sites for the dredged material (e.g., upland sites and ocean sites). The proposed project evaluated in this report is the only practicable and feasible project identified by GEL Engineering (2012).

Based on the above project description, the action area for the project includes 50.5 acres of intertidal mudflat and unconsolidated subtidal unvegetated habitats in the dredging footprint, as well as up to 56 acres of sandy bottom habitat in the placement area at the mouth of Calibogue Sound. The action area is described in detail in Section 4 (Existing Conditions in the Dredging Action Area).

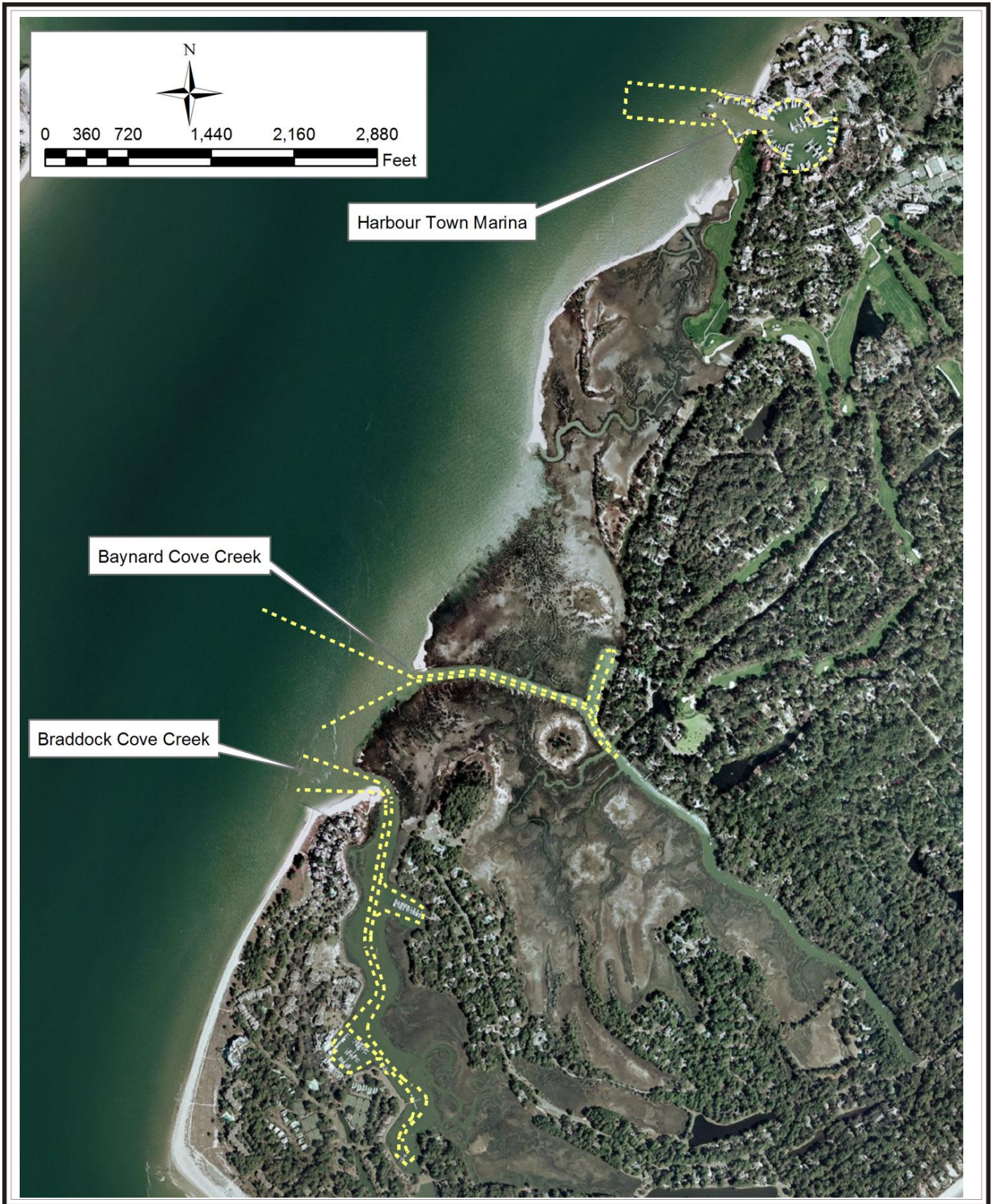


Figure 1-1. Overall proposed areas to be dredged.

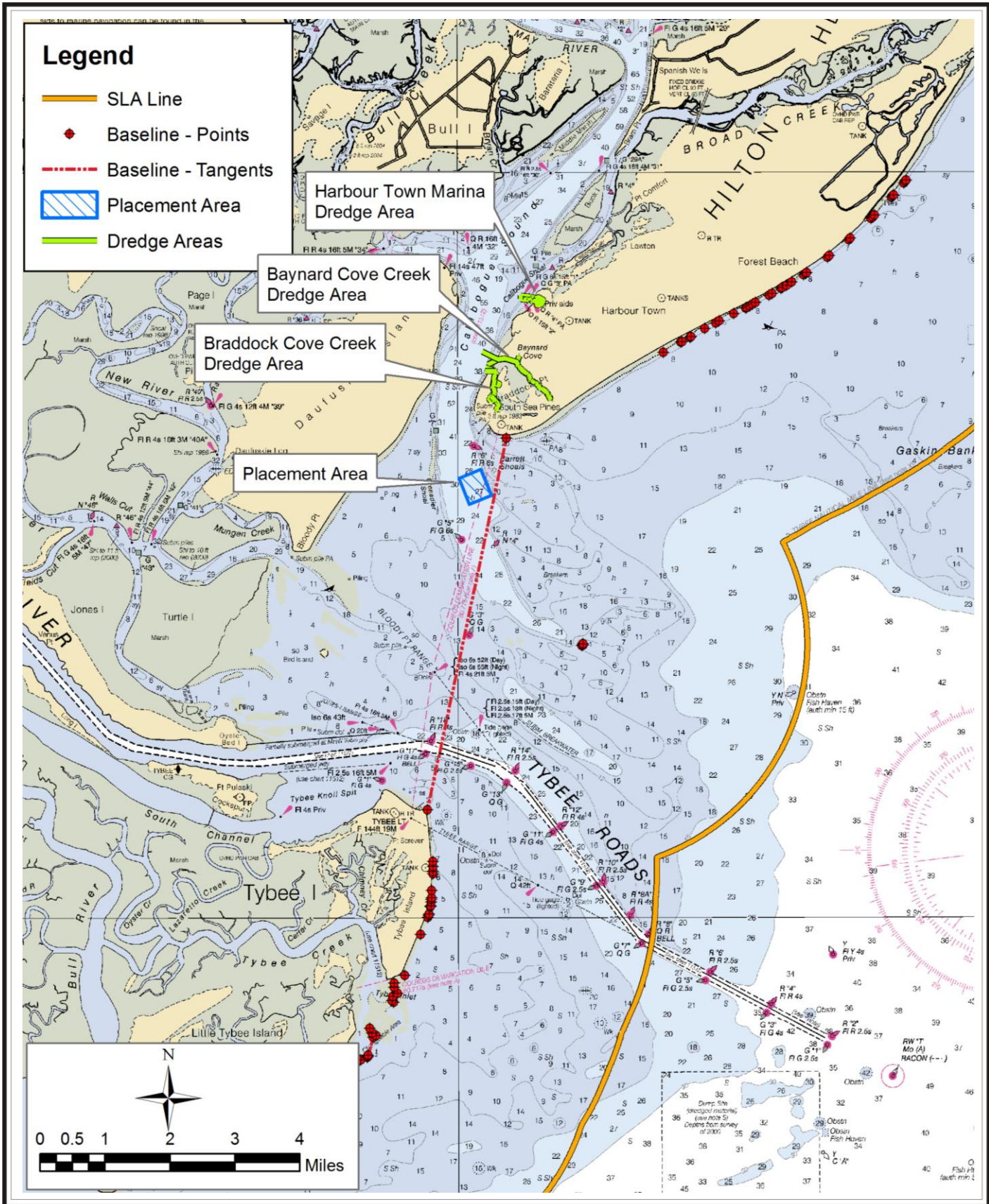


Figure 1-2. Project location map.

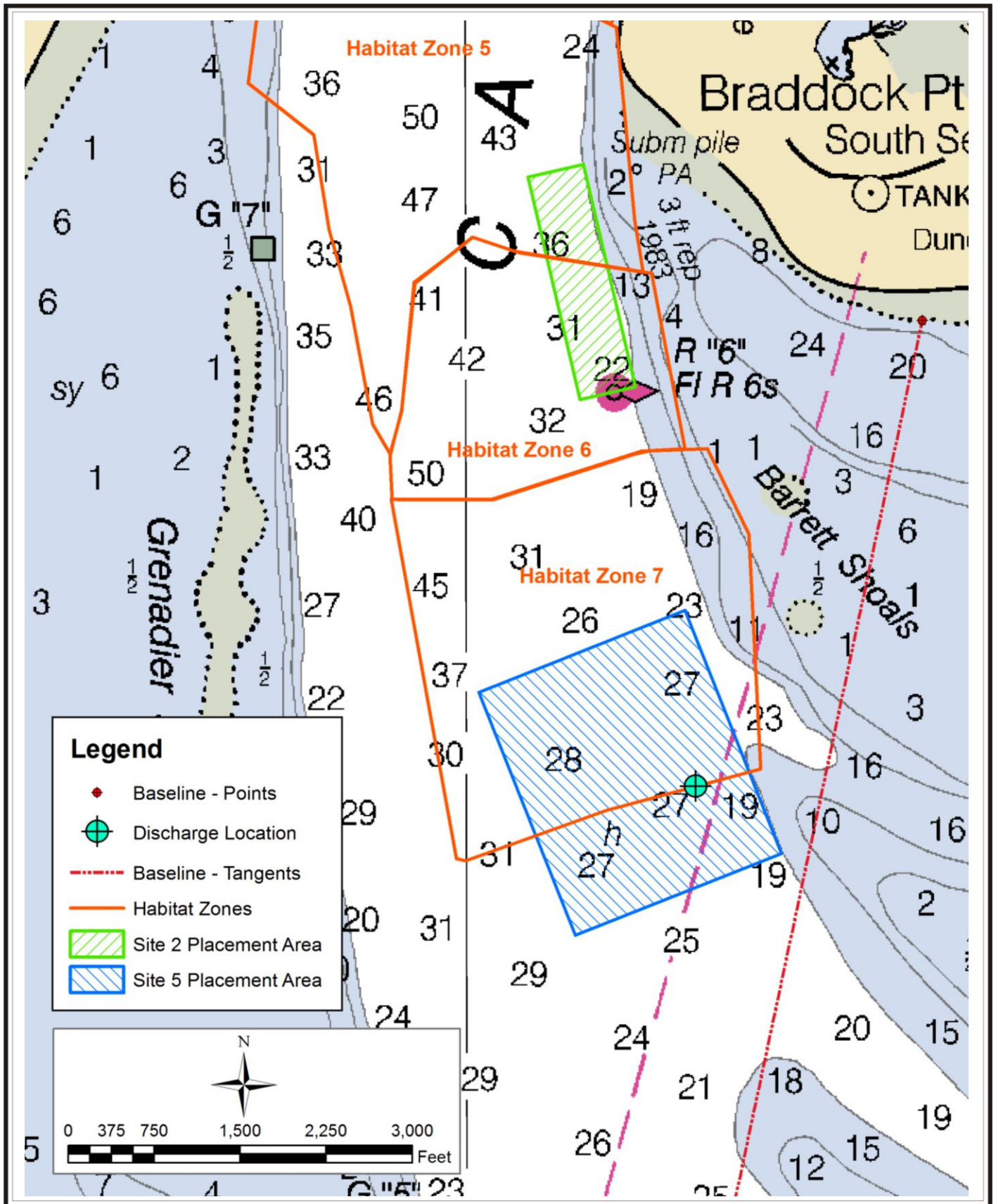


Figure 1-3 Dredged material placement area alternatives, including proposed Sites 5 and earlier alternative Site 2. Included are habitat zones identified by ATM (2000a).

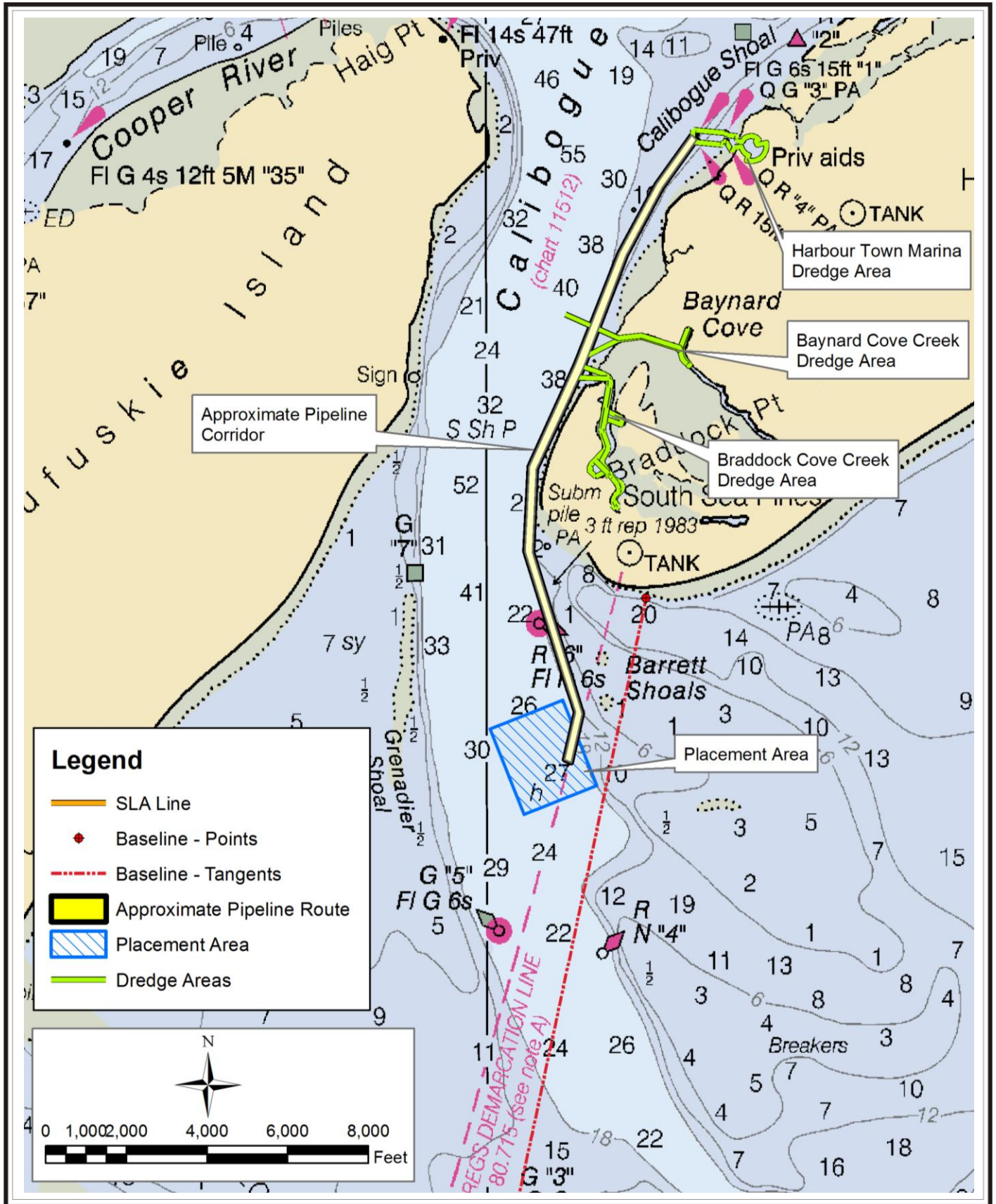


Figure 1-4. Project action area map.

2 Literature Review

Literature reviewed for the proposed project included the studies done in the affected area. The north or east end of the island on the Port Royal Sound has been studied by other investigators and BAs for nearby projects were reviewed to identify unpublished sightings or other observations that may be relevant. These include the Hilton Head Beach Renourishment study, bird observations from Hilton Head Audubon Society, Hilton Head Sea Turtle Monitoring, and South Carolina Department of Natural Resources (SCDNR) sea turtle monitoring both on shore (nesting) and from trawls (SCDNR 2012). Email correspondence with NMFS Protected Resources Division and SCDNR staff also helped gather the most up to date available information on protected resources. The most site-specific study was a benthic survey conducted by Barry Vittor and Associates (BVA) of the proposed inshore and nearshore placement sites (BVA 2000). Engineering and environmental studies prepared by ATM for the 2000 permit application (ATM 2000), and studies and correspondence by Olsen and Associates and GEL Engineering were also reviewed.

2.1 Dredge Areas

Because of the lack of detailed information specific to the creeks and tributaries around Hilton Head Island, (including those areas proposed to be dredged), documents describing adjacent areas were also reviewed. To the east of the area to be dredged are the mouth of Broad Creek and the May River, both of which have management plans (Town of Hilton Head 2002, OCRM and Hilton Head 2008). The May River is an Outstanding Resource Water meaning its surface waters provide outstanding recreational opportunities, support valuable fisheries and wildlife habitat, have good water quality, and are not significantly impacted by human activities. No project related impacts were identified from reviewing the plan for the May River or Broad Creek.

The SCDNR dredging advisory (Appendix A) summarizes the likelihood of occurrence of select species for the three habitat types present in the project area: smaller inlet entrances, high salinity bay or sound, and high salinity creeks (Van Dolah and Berquist 2009). Listed species considered include sea turtles, shortnose sturgeon, and Atlantic sturgeon (*Acipenser oxyrhincus*). The tabular matrix provides a useful reference. For the inlet and sound areas, the advisory's tables show a high to moderate likelihood of presence for green, loggerhead, and Kemp's Ridley sea turtles from April through November. Due to their different behavior and temperature regulation capabilities, leatherback turtles show a different pattern of distribution, with a moderate to high likelihood of presence from April to June and again from October to November, and low risk to leatherbacks during December and January. The matrix reports no presence of sea turtles in high salinity tidal creeks.

For Atlantic sturgeon, the SCDNR tables shows a high to moderate likelihood of presence in high salinity sounds from October through February, with low likelihood in September and no presence during the summer months for high salinity sounds. The tables report no likelihood of presence of sturgeon during any season in high salinity creeks. For smaller inlets, the tables show low likelihood for Atlantic sturgeon in January, September, and early October, moderate likelihood of presence in February through March,

and late October through early November, and high likelihood in late November through December (Van Dolah and Berquist 2009).

The nesting and trawl data confirm the expected increased likelihood of presence for green, loggerhead, and Kemp's ridley sea turtles in the proposed project area from May through October, and leatherbacks found in the ocean in the spring and fall, as well as nesting in the early summer (Murphy et al. 2006, Rabon et al. 2003).

However, despite the "no likelihood of presence" determined for Atlantic sturgeon in the summer in high salinity sounds, the only information obtained during this literature review concerning sturgeons in Calibogue Sound was anecdotal observations by boaters of leaping Atlantic sturgeon in June and early July of 2007, 2010, and 2011.

The 2007 joint public notice for construction of Lands End groin was also reviewed because it is immediately adjacent to the mouth of Braddock Cove Creek, where the proposed project seeks to remove a small area of accreting sand spit. The permit application included rehabilitating an existing timber groin by removing 585 cubic yards of material for grading purposes, and placing 2,800 cubic yards of bedding and rip rap to create a 300 foot long stone groin. The USACE determined that the proposed project would have no effect on listed species (USACE 2007).

2.2 Dredged Material Placement Area

The effects of dredging vary, and much depends on the type of habitat that the dredged material is placed upon, with similar grain sizes being the best match. In terms of the fish community, the egg and larval life stages are the most vulnerable to physiological effects and habitat changes. With these parameters in mind, understanding the details of the affected coastal habitat is critical.

BVA's 2000 study provides the best available information on the area proposed for dredged material placement. In this study, habitat maps were created using a combination of techniques. Side-scan sonar conducted by ATM was complemented by a rigorous collection effort using dredge and grab methods to confirm mapped bottom types and characterize the benthic and epibenthic communities. Grab and dredge samples were collected and species were identified and enumerated. The resulting combination of species richness for a given location and habitat mapping throughout the mouth of Calibogue Sound was used to characterize the benthic habitats and avoid impacts due to dredged material placement (BVA 2001).

The joint public notice and other public information for the proposed SIDA project from 2008 are also applicable (USACE 2008a). In 2008, when dredged material was proposed to be placed at the Port Royal ODMDS, the USACE determined that the project may have individual or cumulative adverse impacts on Essential Fish Habitat (EFH) or fisheries managed by the South Atlantic Fishery Management Council (SAFMC) and NMFS. The USACE determined that the project would have no effect on any federally endangered, threatened, or proposed species and would not result in the destruction or adverse modification of any critical habitat (USACE 2008a).

2.3 Federally Listed Species

The immediate dredging areas are developed, with residential and commercial activities throughout the area. Few biological studies have been performed on these areas. The SCDNR Heritage Database was queried on April 6, 2012, and listed species of Beaufort County were gained from US Fish and Wildlife Service (USFWS) website on April 6, 2012. Figures 2-1, 2-2, and 2-3 depict the results of the Heritage

As shown in Figure 2-1, the project is located within the Tybee Island North quadrangle. Listed species observations include site 4, the location of bald eagle (*Haliaeetus leucocephalus*) nests on Daufuskie Island that have been active since 2001. Site 1 is a colonial waterbird colony noted in 1995; site 2 noted an immature harbor seal (*Phoca vitulina*) washed up on the beach at the mouth of Braddock Cove Creek in 1960; and site 3 is a state listed species, the marsh flatsedge (*Cyperus distinctus*), which was found on Daufuskie Island in 1982.

Figure 2-1 also shows the Bluffton quadrangle, which is the area to the east of the project. It includes the Sea Pines Forest Preserve, which has been discussed as an alternative location for dredged spoil placement. Observations of federally listed species in this quadrangle include site 2, a bald eagle nest found in 2003 within the Highway 278 loop, southeast of Broad Creek; site 16, a wood stork (*Mycteria americana*) nesting on Little Bull Island observed in 2002 and 2003; and sites 20 and 21, also on Little Bull Island, where a bald eagle pair nested from 1995-2003 at site 20, then moved to site 21, where they nested in 2004. The majority of the remainder of sites pin-point locations of colonial waterbirds: sites 3-8, 16-18, 22, 24, 25, 28, 29, 32, and 35. The rest of the sites on Hilton Head are rare plants that are not federally listed: site 1, cupgrass (*Eriochloa michauxii*); site 10, marsh flatsedge (*Cyperus distinctus*); site 11, powdery thalia (*Thalia dealbata*), which was observed in the Forest Preserve in 1980; and site 15, leafless swallow-wort (*Cyanchum scoparium*), which was last observed in 1880 on Buck Island.

Figure 2-2 shows the Pritchardville Quadrangle, to the northwest, up the May and Cooper Rivers. There are three bald eagle nests in this quadrangle: Site 3, observed from 2000-2003, and site 9, also from 2000-2003. No data on monitoring since 2003 was provided, but the sites may still be active. Sites 1, 2, and 8 are colonial waterbird nesting areas.

Figure 2-3 shows the Hilton Head Quadrangle, east of the proposed project. Federally listed species observed in this quadrangle include site 7, a loggerhead turtle (*Caretta caretta*) nest, and site 15, where a manatee (*Trichechus manatus*) was observed at Broad Creek Marina in August of 2000.

Based on the SCDNR Heritage Database, Hilton Head Sea Turtle Monitoring, SCDNR sea turtle monitoring, and other studies, the only federally listed species known to occur in the immediate project area is the loggerhead sea turtle. Nests have been found along the beach south of the groin that is south of the entrance to Braddock Cove Creek, but not north of the groin (SCDNR 2012).

The biological assessment for stabilizing the Port Royal Sound (northeast) shoreline of Hilton Head Island (Coastal Eco-Group 2009) was also reviewed to gain information on potential effects to federally listed species. The project included beach fill, sand borrowed from Joiner Banks, and groins placed along the front beach and Port Royal Sound inlet. This area is designated as Critical Habitat for piping plovers. The

study found that the proposed project: may affect, but should not jeopardize the continued existence of loggerhead and leatherback (*Dermochelys coriacea*) sea turtles and piping plover; may adversely affect designated critical wintering habitat for piping plover in Critical Habitat Unit SC-1; and may affect, but is not likely to adversely affect green and Kemp's ridley sea turtles (*Chelonia mydas* and *Lepidochelys kempii*, respectively) and West Indian manatee (*Trichechus manatus*). They found the proposed project will have no effect on shortnose sturgeon (*Acipenser brevirostrum*), and the North Atlantic right whale (*Eubalaena glacialis*), blue whale (*Balaenoptera musculus*), finback whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), sei whale (*Balaenoptera borealis*), and sperm whale (*Physeter macrocephalus*) (Coastal Eco-Group 2009).

In 2005, another study conducted by the USACE during the permitting of the Hilton Head Island Renourishment Project assessed the area of Barrett Shoals likely to be affected by inshore open water placement (dumping sand in the shallow water along the beach). The project used Barrett Shoals as a sand source for beach fill that affected 670 acres of estuarine substrates and emergent wetlands utilized by several managed fisheries. The area around South Beach was renourished during this project and is immediately east of the proposed placement area. The contours and bathymetry collected for this project updated those that were used for the previous studies in 1999 and 2000 by ATM. For this project, the determination by the USACE was that the proposed renourishment project was likely to have an adverse effect on loggerhead sea turtle as well as piping plover (*Charadrius melodus*) critical habitat due to the beach fill (USACE 2005).

2.4 Fisheries in Calibogue Sound

Efforts also were made to gather available listed species information for Calibogue Sound through personal communications with researchers at SCDNR, University of South Carolina, Beaufort, Coastal Carolina University, College of Charleston, and among the fishing charter captains at Broad Creek Marina. The finding was that hydroacoustic studies of spawning fish and bottlenose dolphin communications are underway by the University of South Carolina, Beaufort (Montie, personal communication, 2012), and there are as many as ten boats operating as dolphin-watches. However, no project work was underway in the areas affected by the proposed dredging project. Adjacent to Barrett Shoals, fishing captains indicated that the area is used for charter boats to fish for various species, including sharks, rays, and other fishes (Roth, Majers and Hughes, personal communications, 2012).

The Port Royal ODMDS Environmental Impact Statement (EIS) (USACE 2004) contains details that are relevant to this project. The permitting of the one and a half square mile ODMDS site included solicitations from resource agencies and the general public. Implementation of the Port Royal project impacted approximately 1.5 square miles (960 acres) of marine water column (average depth 36 feet) and non-vegetated bottoms utilized by various life stages of species comprising the red drum (*Sciaenops ocellatus*), spiny lobster (*Panulirus argus*), shrimp (*Penaeus* spp.), calico scallop (*Argopecten gibbus*), snapper-grouper management complexes, and coastal migratory pelagic fishes.

The EIS synthesized previous studies to describe the ocean waters affected by the placement site selection. The common finfish observed in ocean waters for the Port Royal project included all life stages

of the following families: Clupeidae (herring, shads, sardines, or menhaden), Sciaenidae (drums or croakers), Bothidae (flounders), Gadidae (cod, haddock, whiting, or pollock), Carangidae (jacks, pompanos, jack mackerels, or scads), Mugilidae (mullet), and Triglidae (sea robins). Commercially important species of shellfish in the Port Royal Sound area included shrimps, crabs, whelks, and oysters. The area was identified as important for whelk fisheries. The studies did not address commercial shrimping, which occurs primarily within three miles of shore in South Carolina. With the absence of structures such as piers and reefs in the proposed placement area for the Port Royal ODMDS project, no threat was identified to finfish, either. The project was determined by the Protected Species Division of NMFS to have no effect on listed species or critical habitat protected by the ESA under NOAA Fisheries purview (p. 101 citing letter dated December 10, 2003 by NMFS).

Documents for the permit application for Calibogue Cay to dredge its creek and place the material in an upland disposal site were also reviewed. In its Joint Public Notice on this project, the USACE noted that the proposed project would impact 13.77 acres of estuarine substrates and emergent wetlands utilized by red drum, shrimp, and the snapper-grouper management complexes. Their determination was that the proposed project would not have a substantial individual or cumulative adverse impact on EFH or federally managed fisheries (USACE 2008b).

2.5 Water Quality

Calibogue Sound has been investigated in the greatest level of detail for the upper reaches, which are Outstanding Resource Waters. Therefore, water quality monitoring data from SC Department of Health and Environmental Control's (SCDHEC) four sampling stations in Calibogue Sound were reviewed for this report. The study found that "aquatic life and recreational uses are fully supported at all sites and a significant decreasing trend in fecal coliform bacteria suggests improving conditions for this parameter."

2.6 Sediment Quality

ATM (2000b) evaluated quality of the sediments to be dredged. The sediments were sampled according to the procedures set forth in the Inland Testing Manual (USEPA/USACE, 1998) and the local USACE Charleston District testing protocols set forth in the 17 June 1998 Draft Sampling and Analysis Plan (CESAC, 1998). The assessment concludes that the proposed dredged material is acceptable for open water placement with no special management provisions.

Sediment quality testing by GEL Engineering (2008) found that the bulk sediment chemistry was very similar to the samples collected for the ATM study (2000b), demonstrating that there has been no potentially significant change in sediment quality. GEL Engineering (2008) concluded that the sediment quality remains acceptable for placement in the Port Royal ODMDS.

Based on the above literature and data review, there is sufficient information to characterize and determine the likely presence of federally listed species in the proposed project area, as well as describe existing conditions in the area proposed for dredged material placement (Site 5). Additional information on the proposed areas to be dredged was obtained during a field visit in March 2012. Descriptions of these sites are provided in the following section.

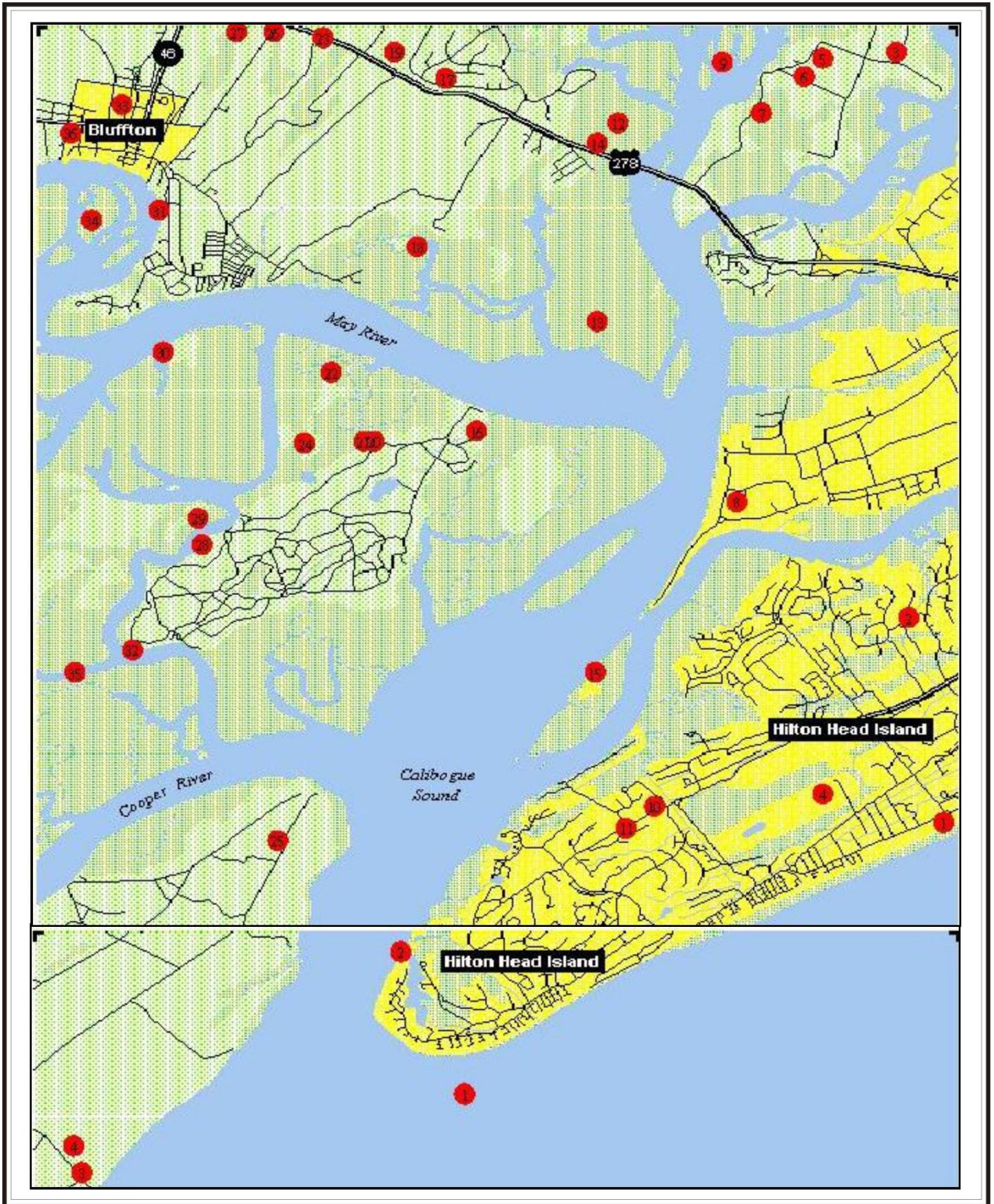


Figure 2-1. Tybee Island North and Bluffton Quadrangles from SCDNR Heritage Database.

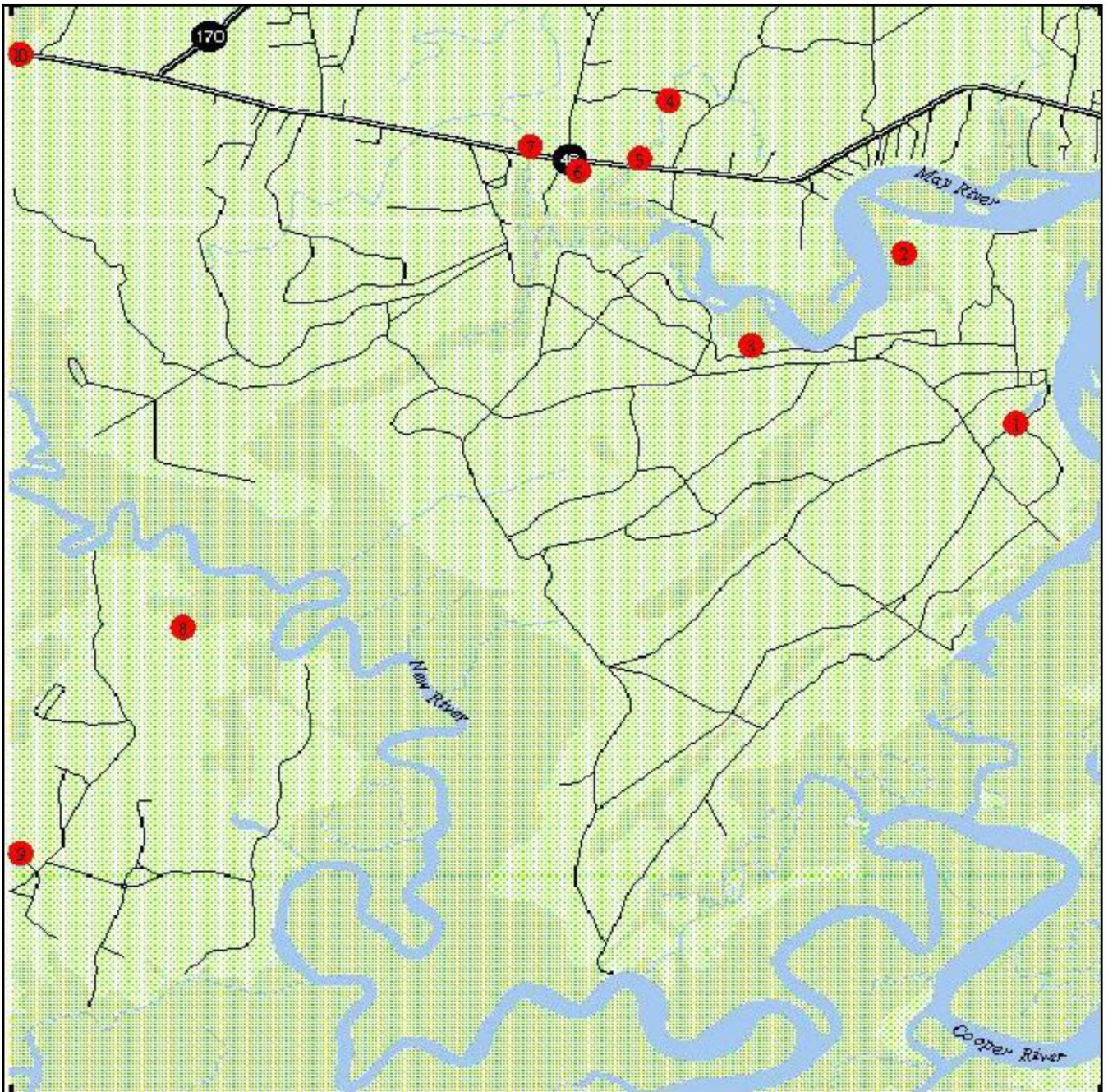


Figure 2-2. Pritchardville Quadrangle from SCDNR Heritage Database.

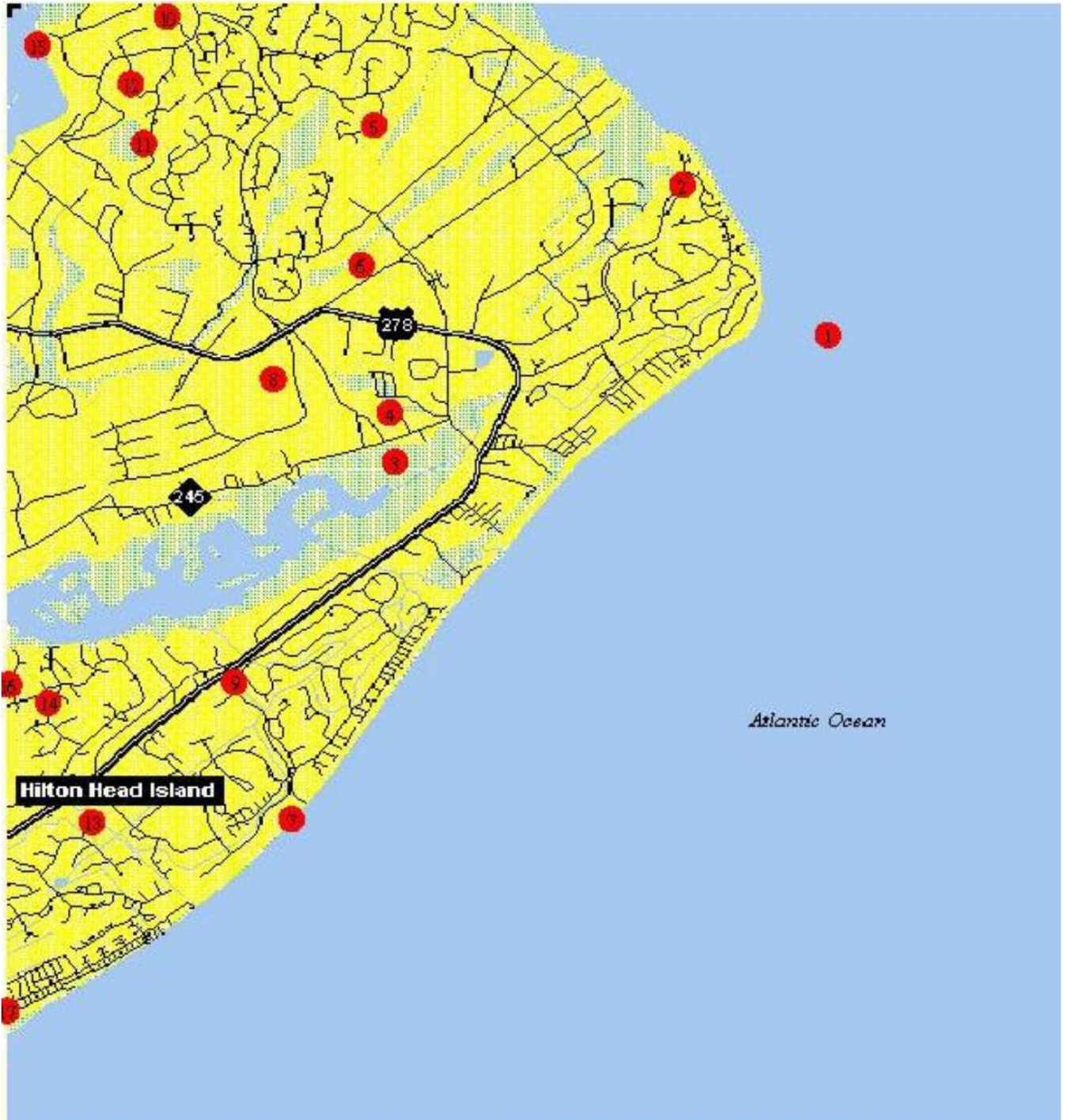


Figure 2-3. Hilton Head Quadrangle from SCDNR Heritage Database.

3 Existing Conditions in Dredging Action Area

The area proposed for dredging was reviewed during field visits on March 23 and August 24, 2012. Prior to field deployment, the following information was reviewed: detailed recent aerial photographs, proposed project plans overlain on the aerials, defined area of influence, list of protected species and species of concern known to inhabit the site, agency comments on the proposed scope of work, and the outline of information for the EFH Assessment and BA.

During the site visits, the project impact areas and adjacent areas were documented. The dredged material placement areas were not investigated. The sites were viewed at high tide in the morning (8:55) and low tide (2:35) in the afternoon. The overall habitat quality of the proposed dredging areas was evaluated during and following the site visits. The proposed areas to be dredged have been previously dredged, and no pristine or undisturbed habitats will be affected.

The following sections describe each site from the north end of the project area to south, and individual sites are described from Calibogue Sound to the upper reaches.

3.1 Harbour Town Marina

Harbour Town Marina is located at the northeastern end of the Action Area. Harbour Town is economically important to the marine, sport-fishing, tourism, and golf industries of Hilton Head, particularly for the Heritage Golf Tournament. Shallow-draft vessels that are docked in the neck area of the marina, which is in most need of dredging, are commercial charter vessels. The basin was last dredged in 2003. Figure 3-1 shows the proposed dredge footprint at Harbour Town. Site photographs 1-6 illustrate the conditions during the March 23, 2012 site visit.

The inner basin is bulk-headed with steep sides all around and no natural intertidal habitat, except from fouling communities on the bulkhead and docks. In the neck of the harbor, toward the mouth, there are two areas of tidal flats. These areas have shoaled just inside of the entrance channel east of the mouth and are proposed to be dredged. The southern tidal flat is wedge-shaped and approximately 45 feet long on each side. The northern one is also wedge-shaped, and approximately 25 feet long on either side. The entrance channel in Calibogue Sound is also proposed to be dredged. The substrate throughout the action area is a combination of sand, silt and clay.

The area was viewed within an hour and a half of low tide and no oyster reefs, salt marsh, or emergent habitats – other than small areas of tidal flat noted above – were identified. A salt marsh restoration project was noted to the south of the seawall in the golf course area. However, this project is outside of the area of influence and would not be affected by the proposed dredging.

The pipe conveying dredged material from the harbor will run along the shallow subtidal area of the shoreline, off the bottom of the Sound and away from intertidal and subtidal habitats. There are beaches to the north of the seawall, but they are not expected to be affected by the proposed dredging. The pipeline will be submerged where necessary to avoid blocking navigation.

Marine birds that were observed during the visit included brown pelicans (*Pelecanus occidentalis*), herring gulls (*Larus argentatus*), and laughing gulls (*Larus atricilla*). Apart from cannonball jellies (*Stomolophus meleagris*), no other marine life was observed.

3.2 Baynard Cove Creek

Baynard Cove Creek (Baynard) is a tidal creek of approximately 125 feet in width that extends from Calibogue Sound southeast to a culvert along the road. Approximately 1,500 linear feet upstream from its mouth is a side channel that forks to the north, and at the head of that is the Community Dock. The area at the head of the creek, dock, and the approaches were viewed during the site visit at high and low tide. Figure 4-2 shows the proposed dredging area for Baynard Cove Creek's mouth and the Community Dock. Site photographs 7 through 17 portray the area proposed for dredging, as well as upper Baynard areas that are no longer under consideration for the proposed project.

The creek banks from the mouth to the northern side channel consist of salt marsh and maritime scrub wetlands. The existing channel contains intertidal and subtidal unconsolidated substrates of clay, silt and sand. From the aerial photographs, it appeared that the channel dredging would primarily affect subtidal and intertidal mudflat; however, some areas of oyster reef are present, particularly upstream of the north channel where the Community Dock is located. Field surveys confirmed that the middle and upper reaches of Baynard have oyster reefs near the proposed impact areas. The proposed project design will provide a 10 foot buffer from oyster reefs or emergent marsh when the proposed channel is dredged such that these resources will not be affected.

The previously permitted project included dredging the upper reaches of Baynard beyond the north channel leading to the Community Dock. The upper reach of Baynard has not been dredged for approximately 40 years. During this time, substantial oyster reefs have developed along the creek's banks. After noting the presence of this established tidal creek habitat, the project extent was reduced to avoid the upper reaches of Baynard, so that a 10-foot buffer between oyster reefs and the area affected by dredging could be maintained. Thus the upper two-thirds of Baynard are no longer proposed for dredging under this project. The new extent of dredging will be to the second dock upstream from the northern side creek where the Community Dock is located. By extending just past the side creek, the mouth of that creek will not refill after dredging as quickly. Further, the width of the creek in this area is adequate to protect oyster reef resources along the banks.

Wildlife noted during the survey included two tri-colored herons (*Egretta tricolor*) and a great egret (*Ardea alba*) at the Community Dock, a snowy egret (*Egretta thula*) at the head of the creek, unidentified fish under 1 inch long in the shallow waters of the creek, and numerous cannonball jellies (*Stomolophus meleagris*).

The dredge pipe will be floated along the creek and will be submerged at the mouth of the creek to allow boat access. No resource uses were noted during the survey; however, all docks observed had small motor vessels and many had kayaks. The Community Dock had a kayak rack as well. Existing impacts noted included the docks, most of which rested on the mud during the low tide portion of the survey.

3.3 Braddock Cove Creek

Braddock Cove Creek (Braddock) is a much larger tidal system than Baynard Creek, with a narrow entrance (approximately 100 feet wide) opening to an approximate bank width of 250-350 feet. The proposed dredge area in the mouth of Braddock Cove Creek to just from Gull Point Marina is shown in Figure 3-3. As shown, there is a small area of accreting sand spit at the inlet which is proposed for removal. Site photographs 18-27 illustrate conditions in the mouth of Braddock Creek during the March 23, 2012 site visit.

Travelling from the mouth, Gull Point Marina is positioned first in a side channel on the east bank, then a large cut basin holds the South Beach Marina on the west bank, followed by five small docks along both banks. Three of these docks are on the west bank are community docks: one set of docks for the six Portside homes and two sets for the Port Villas condominiums. There is also one dock each for two individual homes on the east bank. Most of the west bank is bulk-headed and much of it has a rock revetment. Along the east bank, most of the shoreline is not reinforced and is densely vegetated by *Spartina alterniflora*, *S. cynosuroides*, and *S. patens*, depending on the elevation.

The greatest diversity of fauna was noted at the mouth of the creek, where wildlife observed included two bottlenose dolphin (*Tursiops truncatus*), two osprey (*Pandion haliaetus*), cormorants (*Phalacrocorax auritus*), and laughing gulls (*Larus atricilla*). The following marine species were found washed up on the sandy beach or seen in the water: spider crab (*Libinia emarginata*), polychaetes (*Nereis* spp.) in a spawning swarm, ghost crab holes (*Ocypode quadrata*), stone crab (*Menippe mercenaria*), fragments of sand dollar (*Mellita isometra*), channeled whelk (*Busycotpus canaliculatus*), pen shell (*Atrina seminuda*), oyster (*Crassostrea virginica*), numerous sea whips (*Leptogorgia virgulata*), and unidentified calcareous alga (*Penicillis* spp.) On the accreting spit, vegetation included sea rocket (*Cakile harkeri*), dune grass (*Distycklis spicata*), sandspurs (*Cenchrus tribuloides*), pennywort (*Hydrocotyle bonariensis*), beach croton (*Croton punctatus*), and dried *Sargassum* spp. In the high dune above the area proposed for removal, dense sea oats (*Uniola paniculata*), sea oxeye daisy (*Borrchia frutescens*), marsh elder (*Iva frutescens*), beach croton, occasional yucca (*Yucca aloifolia*), prickly pear (*Opuntia compressa*), and sandspurs were noted. A bulkhead separates the residential properties from the dune.

The area is frequented by boaters, including commercial kayak charters and small private and charter vessels. Existing impacts included erosion along the beach and a 1-2 foot beach scarp created by wave action. A long rock revetment was built in 2010 to prevent erosion and has caused considerable shoreline accretion to the south of the project area. This groin will likely help reduce additional sediment accretion in the mouth of the creek, once the dredging project has been conducted.

Careful inspection of the sand spit and dune was conducted in August 2012 to check for the presence of seabeach amaranth (*Amaranthus pumilus*), a federally threatened species that can be found on sand spit habitats and is a dune pioneer species. No amaranth was noted, and because it has difficulty competing with other beach plants, it is unlikely to occur here. This species is discussed further in Section 5.1.5.

3.4 Gull Point Marina

Gull Point Marina is located approximately 1,000 feet from the mouth of Braddock, in a cut side channel on the east bank. The sides of the channel are natural and consist of *Spartina alterniflora* and intertidal mudflat. Along the south shore of the channel there are some oyster reefs that have developed outside of the proposed dredge footprint. The marina is completely intertidal as shown by the site photographs. During mid-tide conditions (not shown), 20 snowy egrets (*Egretta thula*) and a great blue heron (*Ardea herodias*) were observed foraging for small fish in the shallows. Dense concentrations of mud snails and hermit crabs occupy the shallow intertidal mudflats. Site photographs 28-32 portray the Gull Point Marina conditions.

The marina includes 36 slips and serves the property owners of Gull Point. All the vessels at the marina are shallow draft and can only access Braddock Creek within 2 hours of high tide.

3.5 South Beach Marina and Upper Braddock Cove Creek

South Beach Marina is located approximately 2,000 feet from the mouth of Braddock, on the west bank. It is a cut basin from the creek and contains a large number of docks as well as a busy commercial center of restaurants and gift shops. The entire basin is bulk-headed and much of it also has a rock revetment. Along the southwestern side of the bulkhead, the slope has oyster reef with approximately 30 percent cover. This area is outside of the dredge footprint and will not be affected by the proposed project. Wildlife noted during the South Beach Marina survey included laughing gulls, herring gulls, and brown pelicans at the marina.

The proposed dredge footprint includes the existing marina and access channels, as well as the channel up to the head of the creek, as shown on Figure 3-4. Site photographs 33-27 portray South Beach Marina. Above South Beach Marina, Braddock Creek continues for an additional approximate 1,000 feet in a predominantly bulk-headed channel. On the west side of the channel are Portside homes and Port Villas condominiums. On the east side is Wren Point. There are three community docks on the west side that would be served by the proposed dredging project: one for the Portside homes and two dock trees for the Port Villas condominiums. There are two docks on Wren Point that will benefit from the proposed dredging. On the west side, the channel is bulk-headed for its entire length, while on the east side, it appears to be more natural without reinforcement. Site photographs 38-42 portray upper Braddock Cove Creek above South Beach Marina.

Four snowy egrets were observed perched on a log on the east shore of Braddock Creek and slightly upstream from the marina. Brown pelicans were observed on docks. Mullet (*Mugil* sp.) were observed jumping in the creek during high tide. In some areas, there are oyster mounds near shore as well as oyster reefs along the shore. These habitats will be avoided by dredging ten feet or more away from any marsh grass or oyster reefs.

3.6 Open Water Placement Area

The proposed open water placement area is located in waters of the United States as regulated by the Clean Water Act, or simply Calibogue Sound. This discharge point in the placement area is approximately 4,600 feet south southwest of Hilton Head Island. The estuarine bottom at the site is relatively flat, and

most of the area has depths ranging between 26 and 28 feet Mean Lower Low Water (MLLW). The project will affect areas as shallow as 22 feet MLLW in areas close to Barrett Shoals.

The bottom habitat at the proposed placement area is characterized by BVA's 2000 study. In this study, habitat maps were created using a combination of techniques. Side-scan sonar conducted by ATM (2000) was complemented by a rigorous collection effort using dredge and grab methods to confirm mapped bottom types and characterize the benthic and epibenthic communities. Grab and dredge samples were collected and species were identified and enumerated. The resulting combination of species richness for a given location and habitat mapping throughout the mouth of Calibogue Sound was used to characterize the benthic habitats and avoid impacts due to dredged material placement. A summary of the habitat map and sediment composition findings is shown in Figure 3-5.

Trawls conducted by BVA in 2000 were not performed in a discrete area, but ran along an escarpment in the northern sites and ended at Placement Site 5. Figure 3-6 shows the location of the trawls. Figure 3-7 presents the catch of Trawl 6. In general, the trawls yielded Hauff's Alcyonidium (*Alcyonidium hauffi*), sponges (*Porifera*), and whelks (*Busycon* sp.). While sea whips are not listed in the trawl catch, they are shown in the photographs and preliminarily identified as *Leptogorgia* sp. Therefore, it appears that there are sea whip and sponge communities in adjacent hard bottom areas to the north of Site 5.

In total, BVA identified 6,702 organisms representing 243 taxa. The project report emphasized that the results show presence and absence, not abundance, as the methods used (trawl and grab) can miss concentrations of organisms. The dominant taxa are shown in BVA's report for each station. In the report's detailed species list, the catch for all stations was composited, rather than listed separately.

The proposed placement area at Site 5 was characterized as containing a rippled sand bottom. Species observed within the area include those collected at stations 7-17, 18, 45, 65, 67, 82, and 83. The sediment and faunal characteristics for Site 5 are presented in Table 3-1 below.

Grab samples yielded primarily annelids, with polychaetes dominating the catch, as well as molluscs, arthropods, echinoderms, and unidentified taxa. Of the species listed in BVA's report (2000), unidentified penaeid shrimp, which includes the federally managed species of brown (*Penaeus aztecus*), pink (*P. duorarum*), and white shrimp (*P. setiferus*), were found at one station and represented 0.01 percent of the catch.

Based on the species list composited by BVA (2000), no golden crab (*Chaceon fenneri*), calico scallop (*Argopecten gibbus*), spiny lobster (*Panulirus argus*), or other species of managed shrimp (royal red [*Pleoticus robustus*], rock [*Sicyonia brevirostris*], or seabob [*Xiphopenaeus kroyeri*]) were observed. The bryozoan, *Alcyonidium*, noted above as being found during trawls is listed as a species of conservation concern by the South Carolina Department of Natural Resources (SCDNR). However, no federal or state protection is conferred by this distinction.

Table 3-1. Site 5 sediment and faunal characteristics (from BVA, 2000)

Station	Percent Gravel /Sand/Clay	Dominant Taxa	Subdominant Taxa
7-17	16/84/0.3	70 percent Annelida	Mollusca, Arthropoda, Echinodermata
7-18	11/88/0.6	88 percent Annelida	Arthropoda
7-45	12/88/0.3	66 percent Annelida	Mollusca, Arthropoda, Echinodermata
7-65	33/50/17	59 percent Annelida	Mollusca, Echinodermata, Arthropoda
7-82	34/53/13	53 percent Annelida	Mollusca, Arthropoda, Echinodermata
7-83	13/86/0.7	60 percent Annelida	Arthropoda, Mollusca, Echinodermata

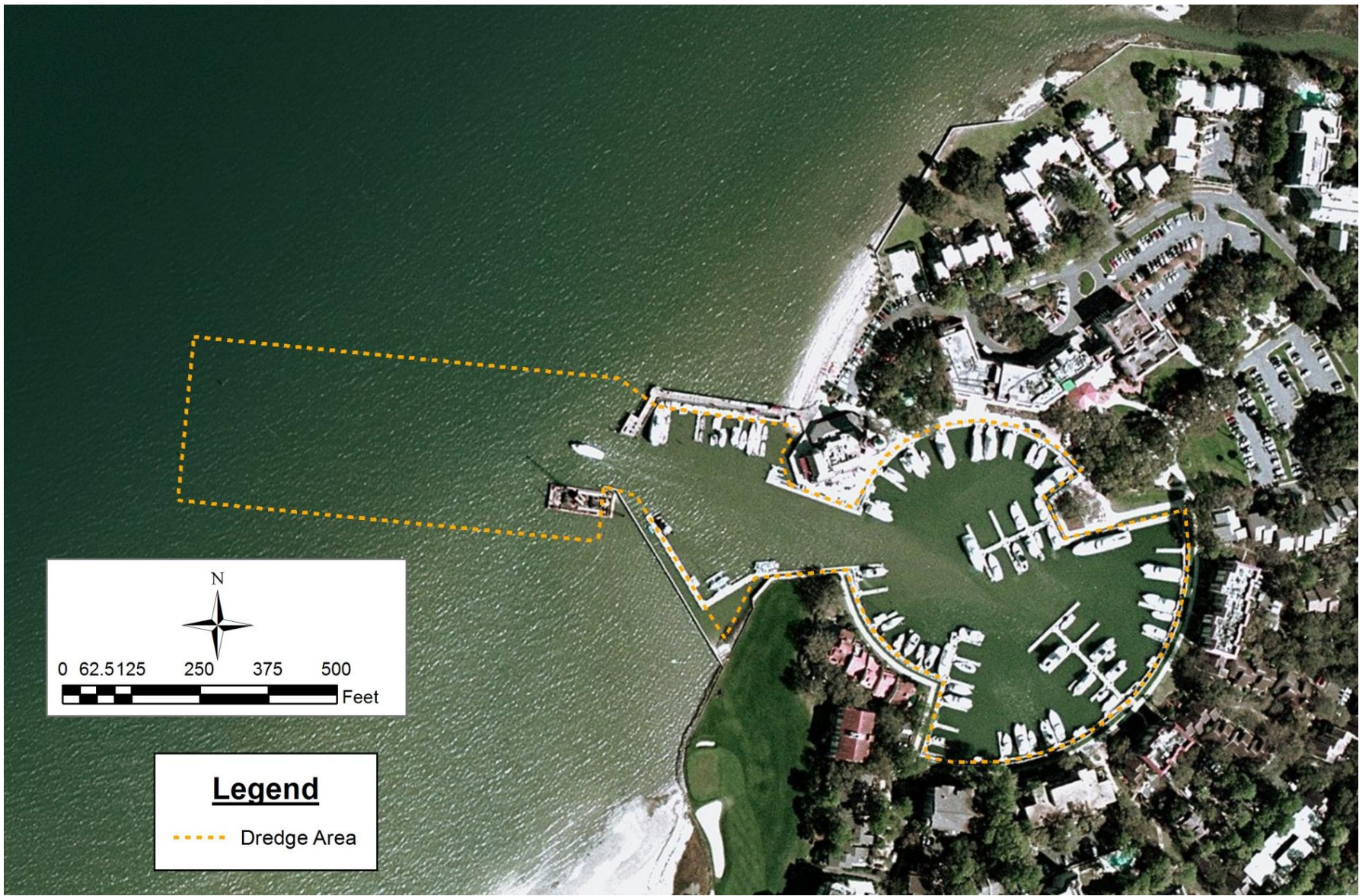


Figure 3-1. Harbour Town Marina Dredge Area

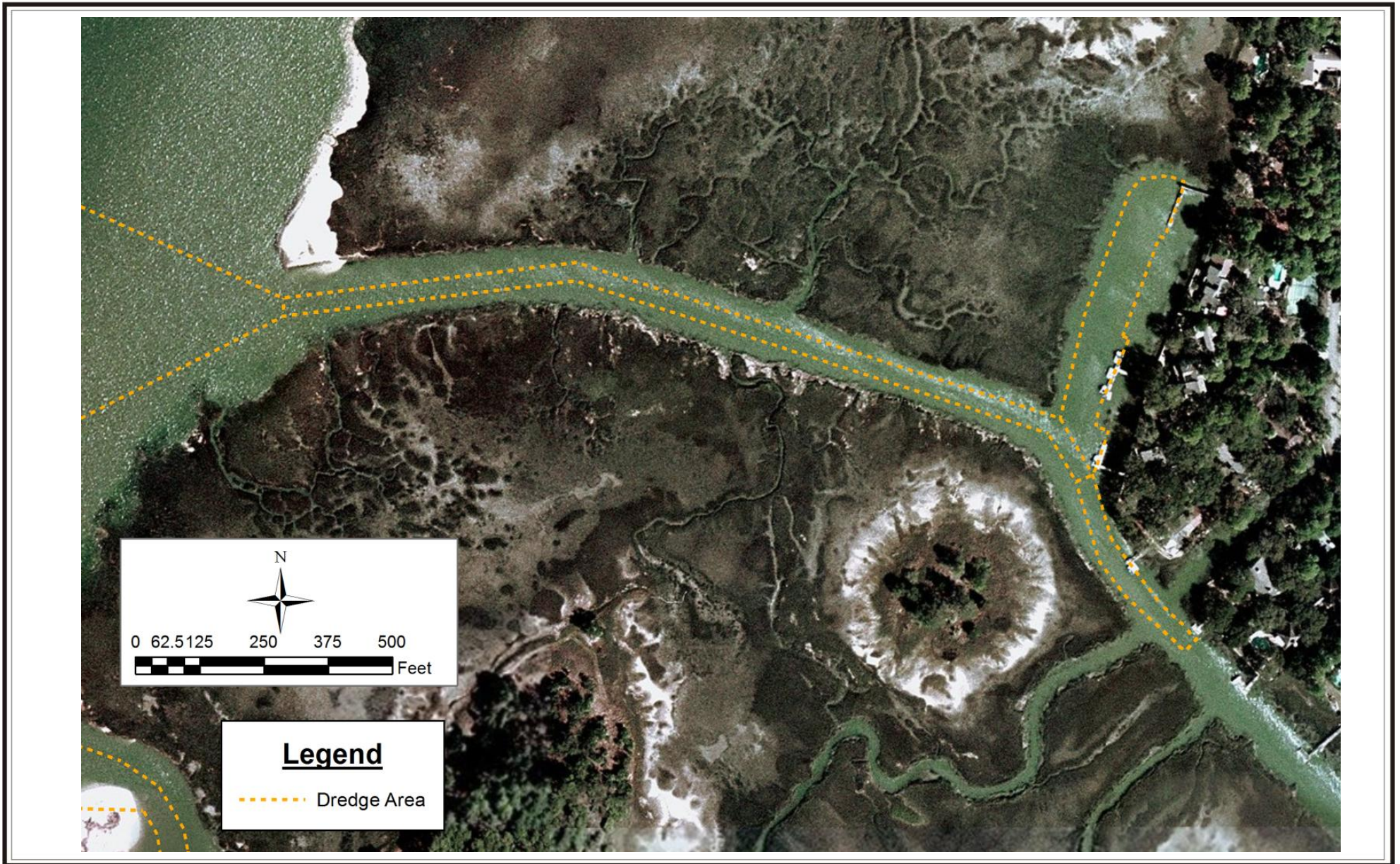


Figure 3-2. Baynard Cove Creek Mouth and Community Dock Dredge Area.



Figure 3-3 Braddock Cove Creek Mouth and Gull Point Marina areas to be dredged.

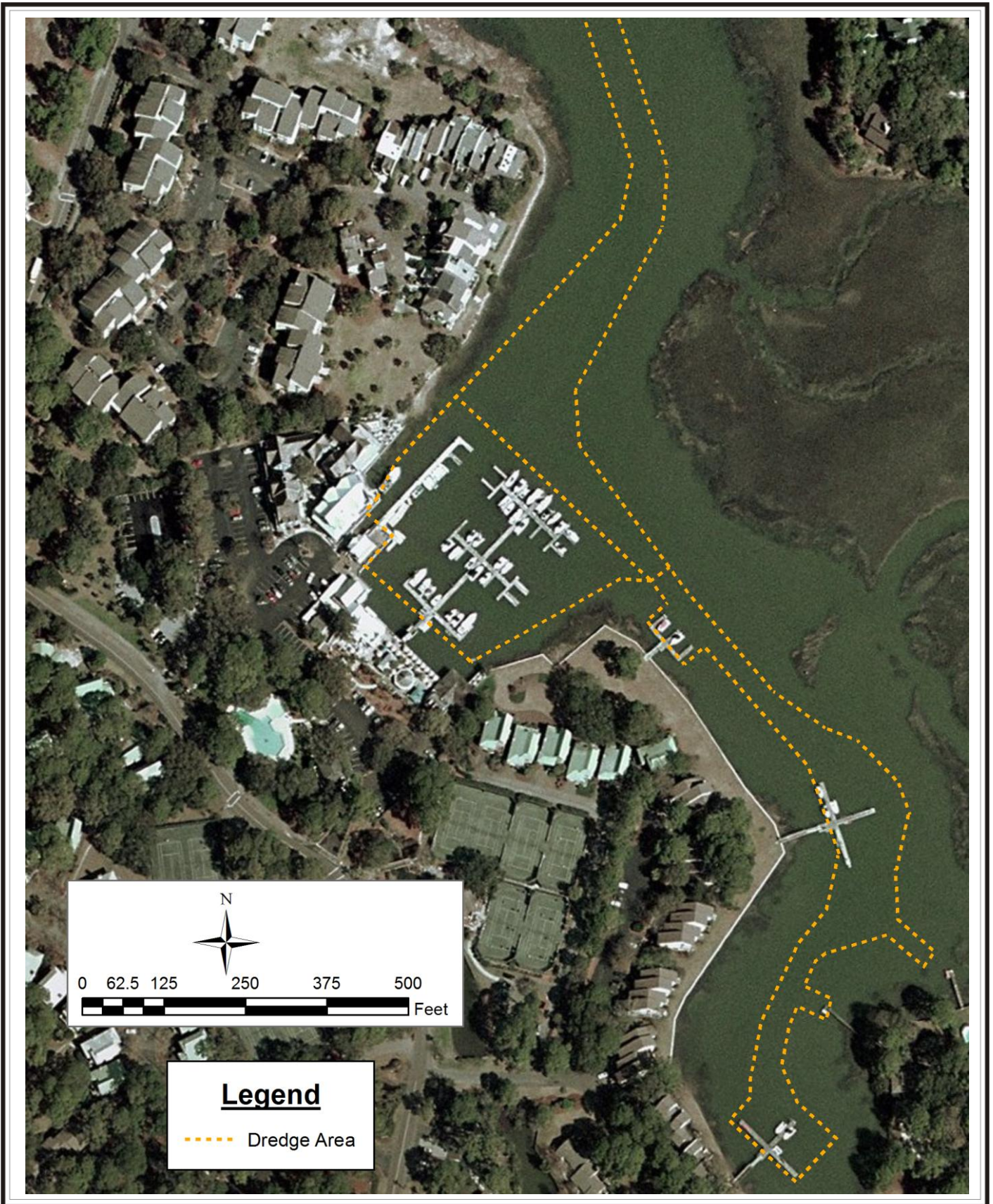


Figure 3-4 Braddock Cove Creek and South Beach Marina areas to be dredged.

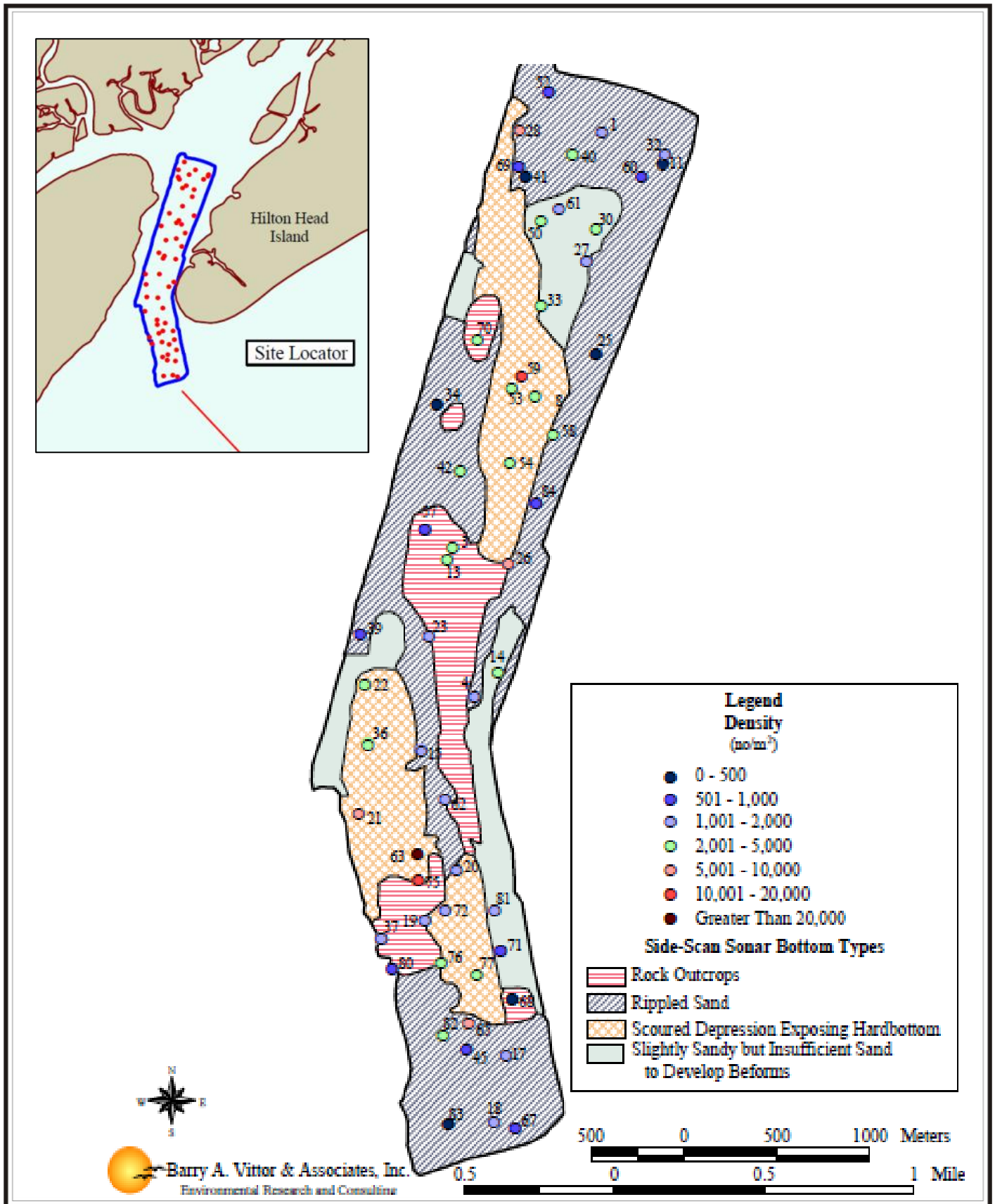


Figure 3-5. Benthic habitat map and sampling locations by BVA in July 2000.

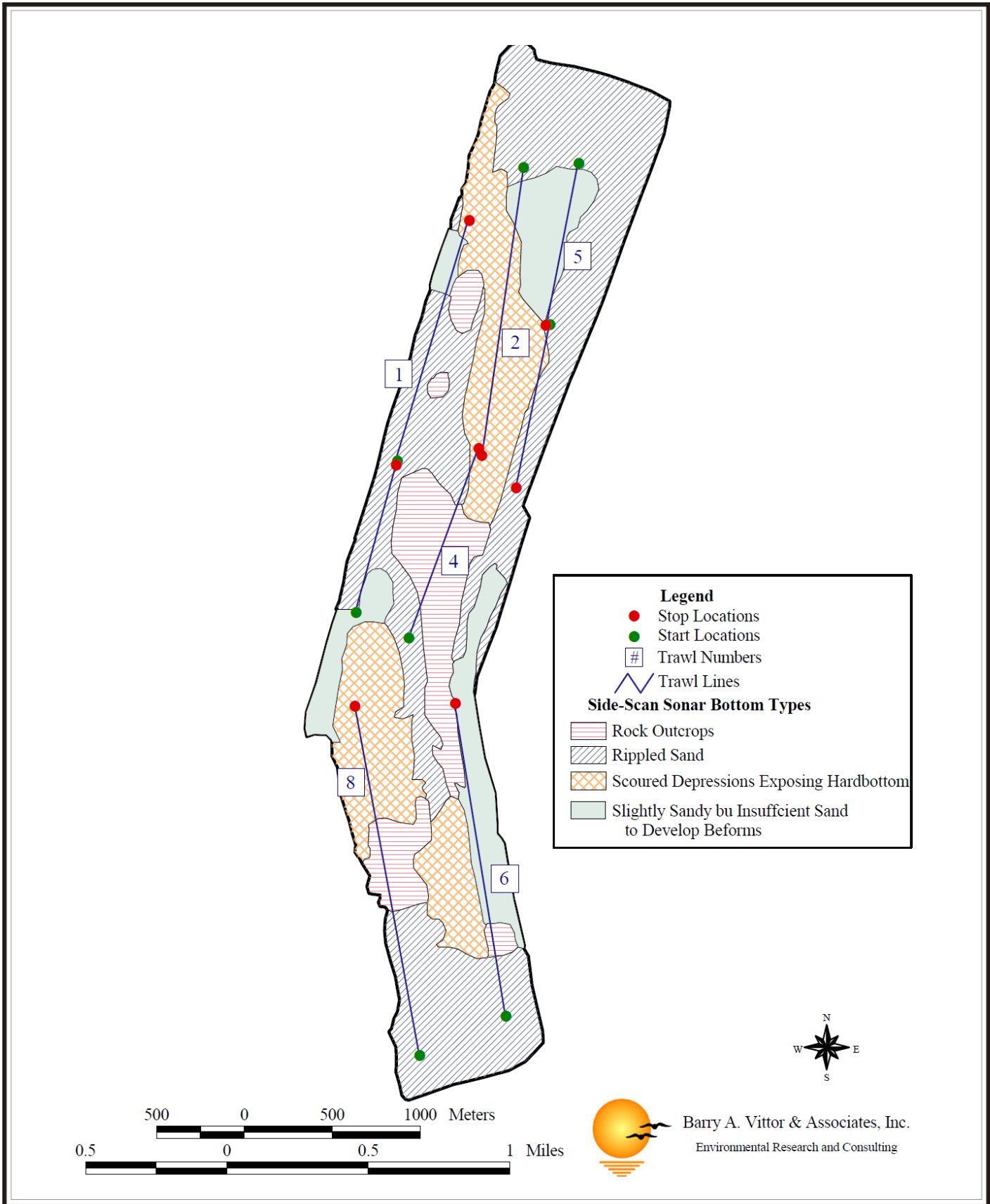


Figure 3-6. Trawl locations conducted by BVA in July 2000.



Figure 3-7. Echinoderms and shells (top) and whelks, sponges, and sea whips captured in Trawl 6 by BVA (2000).



Harbour Town Site Photographs 1-4 showing inner basin and shoaling in quiescent areas.



Harbour Town Site Photographs 5 & 6 (top) showing inner basin and entrance channel with pilings showing dredge channel width. Baynard Cove Site Photographs 7 & 8 (bottom) showing northwest above proposed upstream limit of dredging just upstream of north channel containing community dock. Photo on the left faces downstream, and the photo on the right faces upstream.



Site Photographs 9-12 of Baynard Cove Creek. Top pictures show the upper area not to be dredged, and the lower two photographs show the areas to be dredged, including the end of the dock downstream of the community dock.



Site Photographs 13-16 of the community dock area on Baynard Cove Creek. Top pictures show the north channel of this creek, including the community dock and the area between the main channel and north channel (top right). Lower pictures show the community dock.



Site Photograph 17 (top left)-of upper Baynard Cove Creek, which was removed from the proposed dredge area. Photograph 18 (top right) is the mouth of Braddock Cove Creek on Calibogue Sound. Lower left is Photograph 19 showing the accreted spit in the dredge footprint of the mouth of Braddock Cove Creek. The lower right (Photograph 20) shows the tidal flat at the mouth of Braddock Cove Creek, facing east.



Site Photographs 21-24 showing the mouth of Braddock Cove Creek from the rock groin (top left), facing west from the beach (top right), facing west (lower left), and facing southeast (lower right) with small patch of cordgrass in the background that is within the dredge footprint.



Site Photographs 25-27 of the mouth of Braddock Cove Creek (top) facing the mouth and facing upstream (right). Dune vegetation on the upper mouth of Braddock Cove Creek (bottom left). Photograph 28 of Gull Point Marina's north side, facing east (bottom right.)



Site Photographs 29 through 32 of Gull Point Marina: top left is the mouth, top right is the north side, bottom left is the south side, facing west, and the bottom right is the north side, facing west.



Site Photographs 33 through 36 of South Beach Marina. Top shows the outer marina facing the main channel of Braddock Cove Creek, and the top right and bottom photographs show the inner basin of South Beach Marina, including oyster habitat along the bulkhead which will be avoided during dredging.



Site Photograph 38 showing the west side of South Beach Marina to be dredged to the pilings at the left (top left). Site photographs 39-41 show Braddock Cove Creek upstream of South Beach Marina facing north (top right), facing southeast (bottom left) and facing east (bottom right.)



Site Photographs 42-45 showing upper Braddock Cove Creek at low tide (top photographs) and high tide (bottom photographs).

4 Listed Species and Habitat in Action Area

The biological assessment of the proposed project's effects on protected species considers the types of habitats affected and the known or potential presence of federally listed species. The following list of species was reviewed by USFWS and comments were provided to the USACE regarding any additional needs for the BA. Listed species that could potentially be affected by the proposed project include:

- West Indian manatee (*Trichechus manatus*)
- Bald eagle (*Haliaeetus leucocephalus*)
- Wood stork (*Mycteria Americana*)
- Piping plover (*Charadrius melodus*)
- Seabeach amaranth (*Amaranthus pumilus*)
- Finback whale (*Balaenoptera physalus*)
- Humpback whale (*Megaptera novaeangliae*)
- North Atlantic right whale (*Eubalaena glacialis*)
- Sei whale (*Balaenoptera borealis*)
- Sperm whale (*Physeter macrocephalus*)
- Blue whale (*Balaenoptera musculus*)
- Green sea turtle (*Chelonia mydas*)
- Kemp's ridley sea turtle (*Lepidochelys kempii*)
- Leatherback sea turtle (*Dermochelys coriacea*)
- Loggerhead sea turtle (*Caretta caretta*)
- Shortnose sturgeon (*Acipenser brevirostrum*)
- Atlantic sturgeon (*Acipenser oxyrhincus*)

Additional listed animal species that occur in South Carolina that are not expected to be found in the project area include: Carolina heelsplitter, (*Lasmigona decorate*), eastern puma (*Felis concolor*), flatwoods salamander (*Ambystoma cingulatum*), eastern indigo snake (*Drymarchon corais couperi*), Bachman's warbler (*Vermivora bachmanii*), and the red-cockaded woodpecker (*Picoides borealis*). Because no upland habitats are affected by the proposed project, a detailed evaluation of plant species was not conducted. However, the small area of sand spit that would be affected by the project led to the evaluation of potential impacts to seabeach amaranth and a survey for the presence of seabeach amaranth in August 2012.

The status of each of these species in the Hilton Head Island region, their habitat and range, likelihood of presence in the area, as well as project-related threats or impacts are discussed in the following sections. Because the protection of the listed species is managed by two separate agencies, the USFWS and the NMFS, the following discussion divides the animals and plants by regulatory oversight, beginning with the USFWS.

4.1 Species Managed by the US Fish and Wildlife Service

4.1.1 West Indian Manatee

West Indian manatees (*Trichechus manatus*) are endangered large marine mammals that swim beneath the surface of sluggish rivers, sheltered marine bays, sounds, and shallow estuaries. The majority of manatees live in Florida, but a small segment of the population migrates during the summer into Georgia and north as far as Rhode Island (Georgia Department of Natural Resources 1999). Water temperature partially controls their distribution, as they do not tolerate temperatures below 60°F without adverse effects.

Cold stress is a leading cause of death, such as in Florida when cold winters in 1977, 1981, 1984, and 1989 killed many manatees. For this reason, manatees are found in Georgia and South Carolina during the warmer months of the year. During the summer, they have been observed in marinas and near marinas, including near the Broad Creek Marina in Hilton Head in August of 2000 (SCDNR, 2012) and in Harbour Town Marina in the summer of 2010.

Manatees are sometimes called sea cows, in part because they are vegetarians, eating aquatic plants including smooth cordgrass (*Spartina alterniflora*), and any terrestrial plants they can reach. They spend five to eight hours a day eating since adults need about 4 to 9 percent of their body weight in nutritious vegetation each day (calves need up to 17 percent). The lack of submerged aquatic vegetation, such as seagrass, in Georgia and South Carolina may limit their distribution in these states.

Prior to their protection, manatees were slaughtered for their meat; oil and hides were also used. Today, threats to manatees include cold stress, red tide, disease, parasites, entanglement with shrimp trawls and other fishing gear, and boat collisions. Collision with small, fast-moving boats accounts for about 25% of human-related manatee deaths, so in areas where manatees are found, boater education programs and no-wake zones can help to protect them from propeller injuries and collisions. Manatees also suffer from habitat loss, particularly the loss and degradation of seagrass beds (GDNR 1999).

Dredging and dredged material placement in open water areas has the potential to affect manatees during warmer summer months, including April, when manatees may be present. The effects would be disturbance of habitat areas due to dredging and open water placement. The proposed project will be conducted during the colder months from November to the end of April in order to reduce potential effects to manatees. Further, it will employ a small hydraulic dredge which does not pose an entrainment risk to manatees. Temporary disturbance of the manatee's habitat may result from dredging and open water placement. Therefore, the project may affect, but is not likely to adversely affect manatees¹.

¹ A "may affect, but not likely to adversely affect" determination is appropriate if effects are insignificant (in size) or discountable (extremely unlikely).

4.1.2 Bald Eagle

Although they were removed from the Endangered Species List in 2007, bald eagles (*Haliaeetus leucocephalus*) are protected under other federal legislation (Lacey Act, Migratory Bird Act, Bald and Golden Eagle Protection Act), and it is still illegal to harm them or possess their parts. In an email to the USACE in March 2006, the USFWS Charleston office confirmed that they should be considered for biological assessment of this type.

Bald eagles need several features in their habitat for nesting, feeding, and roosting. They nest in large trees, often those that have bare branches or are dead but standing and in a sparsely forested area. Their nests are very large and often found along rivers, lakes, or marshes, near foraging areas for fish, waterfowl, or carrion. Eagles also need a good vantage point upon which to roost and scan the landscape for potential prey.

Nesting occurs in October and November, and eagles return to the same nest year after year. Although their initial decline was due to hunting and habitat loss, populations failed to recover at first because pesticides consumed through their food caused their eggs to be so frail as to be unviable. Cessation of DDT use helped the eagles to rebound. They still face threats from chemicals such as PCB's, mercury, and pesticides, as well as avian brain lesion syndrome (GDNR 1999).

As discussed in the literature review, there are numerous nesting pairs of eagles found within five miles of the project area. The nearest nests have been observed on Little Bull Island and on nearby Daufuskie Island. On Daufuskie, six active nest sites have been monitored. Wildlife surveys of the area did not detect any nests, feathers, or presence of bald eagles; however, they have been observed flying over Hilton Head Island and may be seen in and near the project area. The proposed project will not harm individual eagles or destroy or damage any critical habitat for this species; therefore, it will have no effect on bald eagles.

4.1.3 Wood Stork

Federally endangered wood storks (*Mycteria Americana*) are an unmistakable large wading bird that roosts in colonies. The primary threat to wood storks is loss of habitat, including foraging and nesting habitats, but they are also threatened by predation (on chicks), contamination, road kill, and electrocution. Through protection and conservation, wood stork populations appear to be rebounding, and in 2010, they were proposed to be down-listed to threatened based on this recovery. However, they remain on the endangered list at this time.

Wood stork rookeries are located in open water, often along the edges of the marsh behind the barrier islands, where they nest in large trees. A nesting tree will frequently have several nests in it, and it must be in a seasonally flooded area to prevent terrestrial predators from getting to the chicks.

This large bird can stand five feet tall, and needs a high concentration of food to survive and thrive, particularly during nesting season (late March through August). Wood storks eat fish that they catch in pooled water in freshwater and brackish wetlands, tidal creeks, or other depressions where fish can be trapped. They have an unusual feeding strategy compared to other wading birds that relies on a high

density of prey fish. They stick their open beaks in the water and when they feel movement in between, they slam their beak shut trapping the fish. Wood storks eat fish, as well as occasional amphibians and crustaceans in the water. Small tidal creeks are a preferred feeding habitat because as the water drains, the fish are concentrated (GDNR 1999).

Wood storks have been recorded nesting on Little Bull Island, just north of Hilton Head as shown on Figure 4-2. They also nest on the 4,055-acre Pinckney Island, which is in Port Royal Sound, and to the east of Hilton Head.

The March 2012 survey of the proposed project area did not record any wood storks at the site; however, suitable foraging habitats are present in the proposed project dredge areas and these areas would be deepened by the project. The conversion of shallow tidal flats and mudflats to deep water habitat for navigation could result in minimal loss of foraging habitat for the wood stork. However, the project represents a small fraction of available foraging habitat on Hilton Head and the surrounding islands. Therefore, the proposed project may affect, but is not likely to adversely affect wood storks.

4.1.4 Piping Plover

The preferred habitats of the federally threatened piping plovers (*Charadrius melodus*) are sandy beaches along the ocean and inland lakes, as well as alluvial bars in rivers. Beaches, mudflats, sandflats, and tidal ponds provide suitable habitats. Shorelines with little vegetation are preferred for both nesting and feeding because plovers feed primarily on small invertebrates that they pluck from the sand. The primary threats to the piping plover are modification and destruction of habitat and disturbance of nesting adults and chicks by vehicles, people, feral and domestic animals, including dogs roaming on nesting beaches, and disturbances which flush them from resting or nesting habitats (GDNR 1999).

Their breeding grounds are to the north of Hilton Head Island, from Newfoundland to North Carolina. While they do not nest on Hilton Head Island, piping plovers are known to winter on the northeast side of the island, in an area known as the “heel” or “elbow,” near Fish Haul Creek. Audubon records 15-20 piping plovers in this spot during their winter bird counts. Fish Haul Creek is known for its diversity of bird life and the plovers can be found there from mid-August through April. SC-15 is the official name of this critical habitat, which is approximately twelve miles from the proposed project site.

The proposed project will reduce the area of mudflats in the dredging area, which are foraging habitat for piping plover. The fraction of habitat lost will not be significant compared to the available habitat, nor will it destroy or modify any habitat deemed critical for the species survival. Therefore, the proposed project may affect, but is not likely to adversely affect piping plovers.

4.1.5 Seabeach Amaranth

Federally threatened seabeach amaranth (*Amaranthus pumilus*) grows on barrier islands, such as Hilton Head, primarily on undeveloped overwash flats on accreting sand spits. Because there is a small spit of sand at the mouth of Braddock Creek that will be affected by the proposed project, this species is included in this assessment. It is a dune building pioneer species and is usually found high on the beach in front of the foredune.

Primary threats to seabeach amaranth include coastal development, beach stabilization structures such as groins and jetties, severe storms, disturbance from vehicles, invasive species such as beach vitex, and predation. It does not compete readily with other plant species, and can be crowded out by sea oats, beach croton, and sea rocket. It generally does not occur in areas that have groins or other beach protection structures, such as at the site at the mouth of Braddock Cove Creek.

During the March and August 2012 site visits, no seabeach amaranth was observed. It appeared that the beach area was heavily vegetated to the reach of the tide making the habitat unsuitable for amaranth. All overwash areas were colonized by other dune species. Therefore, the proposed project will have no effect on seabeach amaranth or its habitats.

4.2 Species Managed by the National Marine Fisheries Service

4.2.1 Finback Whale

The endangered finback whale (*Balaenoptera physalus*) was once common in waters from Cape Hatteras northward (NMFS, 2005). Fin whales accounted for 46 percent of the large whales and 24 percent of all cetaceans sighted over the continental shelf during aerial surveys (CETAP 1982) between Cape Hatteras and Nova Scotia during 1978-82. A more recent estimate of 2,814 finback whales was derived from a 28 July to 31 August 1999 line-transect sighting survey conducted by a ship and airplane covering waters from Georges Bank to the mouth of the Gulf of St. Lawrence.

No nearby observations of living whales were found for finback whales, sei whales, or blue whales in this review. A dead finback whale was found in South Carolina that was determined to have been struck by a ship; however, it is unknown where it was struck and how far from shore it had been carried (McFee 2005). Because finback whales are rare visitors to South Carolina, the proposed project will have no effect on this species.

4.2.2 Sei Whale

The endangered sei whale (*Balaenoptera borealis*) is similar to the finback whale in appearance and range. It is typically found well north of South Carolina. The southern portion of the species' range during spring and summer includes the northern portions of the U.S. in the Gulf of Maine and Georges Bank. There are few if any data on fishery interactions or human impacts. There was no reported fishery-related mortality or serious injury to sei whales in fisheries observed by NMFS during 1991-1997. There are no reports of mortality, entanglement, or injury in the Northeast Fisheries Science Center (NEFSC) or NE Regional Office databases; however, there is a report of a ship strike. The New England Aquarium documented a sei whale carcass hung on the bow of a container ship as it docked in Boston in 1994. The crew estimated that the whale had been hung on the bow for approximately four days prior to the ship's arriving in port.

As with the finback whale, the proposed project will not increase risks to this species, affect its critical habitats, or have other negative effects to the sei whale.

4.2.3 Sperm Whale

The endangered sperm whale (*Physeter macrocephalus*) is another unlikely visitor to the Hilton Head coastal area where the project is proposed to occur. Sperm whales are not common in waters less than 300 feet deep, as their primary food sources are deep water species including giant squid. However, pygmy and dwarf sperm whales are the second and third most likely marine mammal, after bottlenose dolphin, to strand in South Carolina waters. The stranded animals often have some evidence of debris ingestion or entanglement, or other evidence of human interaction (South Carolina Marine Mammal Stranding Network 2011). The difference between the three is that the sperm whale grows to sixty feet, while the pygmy and the dwarf average ten feet at maturity.

Total numbers of sperm whales off the U.S. or Canadian Atlantic coast are unknown, although several estimates from selected regions of the habitat do exist for select time periods. The best abundance estimate for sperm whales is the sum of the 1998 estimates from both the northern and southern U.S. Atlantic surveys where the estimate for the northern U.S. Atlantic was 2,848 and the southern U.S. Atlantic was 1,181 (for a total of 4,029 whales). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.

During 1994-2000, eighteen sperm whale strandings have been documented along the U.S. Atlantic coast between Maine and Miami, Florida (NMFS, 2005). Two stranded whales in Florida, one in 1998 and another in 2000, showed signs of human interactions. The 1998 animal's head was severed, but it is unknown if it occurred pre- or post-mortem. The 2000 animal had fishing gear in its blowhole. In October 1999, a live sperm whale calf stranded on eastern Long Island and was subsequently euthanized. Also, a dead calf was found in the surf off Florida in 2000.

During 2001 to 2003, ten sperm whale strandings were documented along the U.S. Atlantic coast according to strandings databases. Except for the sperm whale struck by a naval vessel in the US Atlantic Exclusive Economic Zone (EEZ) in 2001, there were no confirmed documented signs of human interactions on the other nine animals. There were no sperm whale observations noted near or along the coast of Hilton Head. Because the species is not expected to occur in the area, the proposed project will have no effect on the sperm whale.

4.2.4 Blue Whale

The endangered blue whale (*Balaenoptera musculus*) is found mainly in the western North Atlantic from the Arctic to at least mid-latitude waters. Blue whales are most frequently sighted in the waters off eastern Canada, with the majority of recent records from the Gulf of St. Lawrence (Sears et al. 1987).

The blue whale is best considered as an occasional visitor in US Atlantic EEZ waters, which may represent the current southern limit of its feeding range (CETAP 1982; Wenzel et al. 1988). Five sightings that occurred in August by Yochem and Leatherwood (1985) suggest an occurrence of this species south to Florida and the Gulf of Mexico, although the actual southern limit of the species' range is unknown.

There are no confirmed records of mortality or serious injury to blue whales in the US Atlantic EEZ. However, in March 1998, a dead 66-foot male blue whale was brought into Rhode Island waters on the

bow of a tanker. The cause of death was determined to be ship strike. Although it appeared likely that the vessel concerned was responsible, the necropsy revealed some injuries that were difficult to explain in this context. The location of the strike was not determined; given the known rarity of blue whales in US Atlantic waters, and the vessel's port of origin (Antwerp), it seems reasonable to suppose that the whale died somewhere to the north of the US Atlantic EEZ.

There have been no blue whale observations near or along the coast of Hilton Head. Because the species is not expected to occur in the area, the proposed project will have no effect on the blue whale.

4.2.5 Humpback Whale

Endangered humpback whales (*Megaptera novaeangliae*) could potentially be found near coastal areas while migrating; however, it would be unlikely that they would be found near Calibogue Sound and the proposed project area. No feeding, calving, or resting grounds have been identified in the proposed project area. The biggest risk to these whales is from ship or vessel strikes, as documented ship strikes to two humpback whales have occurred from 1995 to 2006 in South Carolina (McFee, 2005).

The majority of the western Atlantic humpback whale population spends most of its time in the Gulf of Maine region. Barco et al. (2002) did perform a study in the mid-Atlantic to catalogue whales from the Gulf of Maine (the closest feeding ground) and other areas in the North Atlantic. Although the population composition of the mid-Atlantic is apparently dominated by Gulf of Maine whales, Canadian populations of humpback whales also occur in the region. Barco et al. (2002) suggested that the mid-Atlantic region primarily represents a supplemental winter feeding ground that is used by humpbacks for more than one purpose. The population estimate of 11,570 is regarded as the best available estimate for the North Atlantic (NMFS, 2005).

An updated analysis of humpback whale mortalities from the Mid-Atlantic States region has been produced by Barco et al. (2002). Between 1990 and 2000, there were 52 known humpback whale mortalities in the waters of the U.S. Mid-Atlantic States. Length data from 48 of these whales (18 females, 22 males and 8 of unknown sex) suggested that 39 (81.2 percent) were first-year animals, 7 (14.6 percent) were immature and 2 (4.2 percent) were adults. However, sighting histories of five of the dead whales indicate that some were small for their age, and sighting histories of live whales further indicate that the population contains a greater percentage of mature animals than is suggested by the stranded sample.

Humpback whales that have been found on the South Carolina coast have died from ship strikes or fishing gear entanglement (Cupka and Murphy 2004). While small recreational vessel strikes do account for some injuries to humpback whales in southeastern Alaska, most or all of these incidents involve whales rising rapidly to the surface while bubble-net feeding, which strike anchored or otherwise silent vessels, rather than the other way around. Humpback whales do not feed in the Hilton Head area, but would be in transit between calving grounds in the Caribbean and feeding grounds in the Gulf of Maine. Recreational vessel strikes near the southeastern US that have been recorded are from cruise ships. For this coastal species, boater education can help avoid unintended impacts from vessels and debris.

The proposed project will not increase the likelihood of either of these risks to humpback whales and, therefore, will have no effect on this species. Furthermore, because the proposed project uses a hydraulic dredge pipeline for transport of the dredged material, there is less risk of ship strike to these whales as compared to other transport methods, such as a hopper dredge or a scow.

4.2.6 North Atlantic Right Whale

The North Atlantic right whale (*Eubalaena glacialis*) is of particular concern because it is occasionally found offshore as individuals transit the coast towards their winter calving grounds. Right whales are the world's most endangered large whale and scientists considered them extinct before an aerial survey spotted a pod in the early 1980s. Entanglement with fishing gear, ship collisions, and pollution are the leading causes of death since no commercial whaling occurs in their range.

Right whales calve to the south and feed to the north, so they transit the area along Hilton Head with their calves. Hitting a calf or a female would affect their population because there are only 250 to 300 left worldwide, and their reproductive ability is very limited (although 28 calves were spotted off Florida in 2005) (Peterson, 2005).

There are five well-known habitats used annually by western North Atlantic right whales: 1) coastal Florida and Georgia, 2) the Great South Channel, east of Cape Cod, 3) Cape Cod and Massachusetts Bays, 4) the Bay of Fundy, and 5) Browns and Baccaro Banks, south of Nova Scotia. The first three areas occur in U.S. waters and were designated by NMFS as critical habitat in June 1994 (59 FR 28793). South Carolina is not a critical habitat; however, the border of Georgia is near Hilton Head Island and right whales have been observed within five miles of the Hilton Head coast.

Right whales are most often spotted within 30 nautical miles of shore in shallow waters. It is possible that the shore-hugging habit is to avoid predation by large sharks which are often found in deeper waters. However, this habit also increases the vessel-strike and fishing gear entanglement injuries sustained by this species.

Injured and entangled right whales have been observed several miles off Hilton Head in 2006, 2010, and 2011. The proposed dredged material placement area is within the seasonal management area for the North Atlantic right whale. However, it is unlikely that the proposed project would have any negative effects on the right whale. The dredge pipe is less dangerous than a large vessel transporting dredged material to the placement site, and the whales do not approach the inlet entrance during their migration.

North Atlantic right whales can be expected to transit the area during the month of December for the fall migration, and for the spring migration to begin transit in mid-March. Despite the low odds of an encounter, an injured whale could conceivably come near the dredge pipe area. To ensure that the proposed work does not impact such a right whale, the applicant would abide by the conditions set by NMFS in its extant Biological Opinion. The applicant would also establish precautionary collision avoidance measures to be implemented during dredging operations that take place during the time right whales are present in waters off Hilton Head. This can be achieved by instructing all personnel

associated with the dredging project about the possible presence of right whales in the area and the need to avoid collisions and the stiff penalties for harming, harassing or killing species that are protected under the ESA and the Marine Mammal Protection Act (MMPA). Unlike many whales protected under the ESA that have showed signs of recovery (the humpback whale, for example), right whales do not effectively avoid marine traffic. Dredges and all other attendant vessels are required to stop, alter course, or otherwise maneuver to avoid approaching the known location of a right whale. Given these measures, the proposed project will have no effect on the North Atlantic right whale or its critical habitats.

4.2.7 Green Sea Turtle

The endangered green sea turtle (*Chelonia mydas*) typically nests in the Caribbean and southern Florida. It eats algae and sea grasses on flats and coral reefs. While juvenile and stranded green sea turtles are found at times in Georgia, there was only one record of this species on Hilton Head. It is likely that the lack of submerged aquatic vegetation in turbid coastal South Carolina limits this species range in the area. Green sea turtles may transit the area during its annual migrations; however, it would be rarely found in the proposed project area. There was one recorded nesting event in 2003 (Coastal Eco-Group 2009). Because it was so rare, Hilton Head's Coastal Discovery Museum staff gathered and incubated the eggs and gave the surviving hatchling to the South Carolina Aquarium. Also, in 2010, a cold-stunned juvenile green sea turtle was found on the beach in Hilton Head and was transported to the South Carolina Aquarium (SC Aquarium 2010). This turtle was released from the Isle of Palms in June 2011 (Post and Courier 2011). Because the green sea turtle is rarely found in the project area, the proposed project will have no effect on this species.

4.2.8 Kemp's Ridley Sea Turtle

The endangered Kemp's ridley sea turtle (*Lepidochelys kempii*) is the smallest of the sea turtles and is typically found in the Gulf of Mexico. However, it may be present in the waters off shore of the project site from April through October (GDNR 1999.) It is extremely rare, however. While nesting of this species has not been recorded on Hilton Head, three injured or hooked Kemp's ridley sea turtles have been found in the Hilton Head area since 2000. All of them were taken to turtle hospitals in Charleston and North Carolina for recovery and release. As this species is not likely to be in the project area, the proposed project will have no effect on the Kemp's ridley sea turtle.

4.2.9 Leatherback Sea Turtle

The endangered leatherback sea turtle (*Dermochelys coriacea*) is the largest of the sea turtles, and the largest marine reptile in North America. It is also the only sea turtle that can regulate its body temperature, a feat which allows it to forage and migrate into colder waters than any of the other sea turtles. This species feeds extensively on cannonball jellyfish. While it is primarily pelagic, the females come to shore to nest. While leatherbacks were unknown to South Carolina beaches prior to 1980, since that time, there has been an increase in observations as well as nesting (Murphy et al. 2006). On Hilton Head, there were three confirmed leatherback nests in 2011, and nesting is recorded from 2006 as well.

While they have not been observed in Calibogue Sound, leatherbacks have been observed in estuaries near Wassabaw, Ossabaw, and St. Catherine's islands (GDNR 1999). There have also been three

leatherbacks found off Hilton Head Island in the winter and spring of 2004. Two were entangled in crab pot lines, and one was found in April in the marsh, badly decomposed, with evidence of a ship-strike (Beaufort Gazette 2004.) Although they are a wide-ranging pelagic species, their preferred food, cannonball jellyfish, is found in great concentrations near the shore. Seeking their preferred food, the leatherback sea turtle can become entangled in nearshore fishing equipment or be hit by coastal vessels.

Because this species can be found near Hilton Head in the winter and spring, it is important to ensure that no impacts occur from the proposed project. The proposed project will not affect the nesting beaches. Additionally, the dredge pipe anchoring or floating system will be constructed of materials that do not present a risk of entanglement for leatherback sea turtles. Furthermore, because the proposed project uses a hydraulic dredge pipeline for transport of the dredged material, there is less risk of ship strike to these animals as compared to other transport methods, such as a hopper dredge or a scow. Given the potential presence of the species in the project action area, the proposed project may affect, but is not likely to adversely affect leatherback sea turtles.

4.2.10 Loggerhead Sea Turtle

The endangered loggerhead sea turtle (*Caretta caretta*) nests from May through August on Hilton Head Island. They eat a variety of organisms from sponges to marine invertebrates, including whelks (*Busycotpus canaliculatus*), moon snails (*Lunatia heros*), blue crabs (*Callinectes sapidus*), spider crabs (*Libinia emarginata*), and calico crabs (*Ovalipes ocellatus*). They also use sounds and estuaries to a greater extent than the other sea turtle species, and can be found in Calibogue Sound as well as in ocean waters. Threats to loggerheads include entanglement in shrimp trawls, which have been greatly reduced since the advent of the Turtle Excluder Device (TED) in 1992. Boat strikes, predation of nestlings and eggs, and entanglement with fishing gear are among the other leading threats. Beach lighting, beach renourishment, and other coastal development related pressures have reduced the quality and quantity of their available nesting habitat. Marine debris and pollution continues to be a threat, with ingestion of plastics a particular concern (GDNR 1999).

Hilton Head Island is the largest barrier island in South Carolina and the fourth most important loggerhead nesting island in the state. The Sea Turtle Monitoring Program through the Coastal Discovery Museum found 239 nests in 2010, and more in 2011. While most of the nesting occurs on the oceanward side of the island, some nesting has been observed near, but not on, the sand spit that would be affected by the proposed project. Since the placement of the groin in 2008 just north of this spit, the beach profile has been lowered. The resulting elevations are not suitable for sea turtle nesting, as the tide reaches to the dune vegetation and there is little dry beach. As shown on Figure 4-1, records from 2010 and 2011 do not show the affected area as having been used for nesting (SCDNR 2012.). Surveys for seabeach amaranth in August 2012 confirmed that the dry beach area above the high tide line is completely colonized by dune plants, leaving no area suitable for sea turtle nesting.

Because the project will affect a very small portion of beach that is unlikely to serve as nesting habitat, and will not result in increased entanglement or ship strike risk to loggerhead sea turtles, the proposed project may affect, but is not likely to adversely affect loggerhead sea turtles.

4.2.11 Shortnose Sturgeon

The endangered shortnose sturgeon (*Acipenser brevirostrum*) is an anadromous fish which lives most of its life in the freshwater portion of the large estuaries. Although historically this fish lived in most coastal plain and piedmont rivers, it is now restricted to eighteen east coast rivers from the Saint John River in Canada to the Saint Johns River in Florida. Known habitats include the Altamaha, Ogeechee, and Savannah Rivers in Georgia, and the Cooper River, Santee-Cooper Lakes, and Winyah Bay (Collins et al. 2000), as well as the Great and Little Pee Dee, Congaree, Wateree, Ashepoo, Edisto, Black, and Waccamaw River systems in South Carolina.

After an initial population collapse brought on by unrestricted fishing, continued threats include: poaching, loss of habitat, installation of dams on spawning rivers, dredging, and degradation of spawning areas (NMFS 1998). Habitat degradation and bycatch are thought to be the cause of their continued decline, rather than prey availability.

The shortnose sturgeon spends most of its adult life in fresh and brackish water. However, they do venture into the lower coastal reaches and ocean on rare occasions (Collins et al. 2001). They spawn well upstream, and the eggs, larvae, and juveniles remain in fresh water until they approach adulthood. Juveniles spend their first year in upper freshwater reaches, and then adopt a migratory lifestyle traveling upriver in the summer and downriver in the winter (Collins et al. 2002). In the winter, sturgeon move downstream to the estuarine-freshwater interface, possibly to feed or escape cold (Hall et al. 1991). Sturgeons primarily eat polychaetes, amphipods, as well as isopods, insects, and possibly bivalves and crustaceans (Collins et al. 2008).

In early February and late March, sturgeon spawn in the upper reaches of their natal rivers in deep water (Crance 1986). For example, in the Savannah River, they spawn at river mile 111 to river mile 173 in late winter (Hall et al. 1991, Collins and Smith 1993). Spawning sites tend to be located on gravel bars, channels and curves, and riffles on or near limestone bluffs with gravel to boulder sized substrate are ideal (Rogers and Weber 1994). The spawning habitats of shortnose sturgeon are not available in the Calibogue Sound system.

Although Smith et al. (2002) found that wild shortnose sturgeon rarely leave their natal river, hatchery fish may colonize nearby river systems. As an example, two hatchery raised shortnose sturgeon that were released in the Savannah and Edisto Rivers were later caught in the Cooper River (Palmer et al., 2001). Jenkins et al. (1993) also found that adult shortnose sturgeon of southern populations rarely enter the open ocean although they can tolerate full-strength seawater. Therefore, shortnose sturgeon are listed as occurring in Calibogue Sound because it is possible (although not likely). They are listed as a possible occurrence because of the adjacent major estuaries of Port Royal Sound and the Savannah River. No spawning habitats exist in the Calibogue watershed, and the salinity levels are higher than the brackish habitats preferred by the shortnose sturgeon.

Because shortnose sturgeon rarely enter Calibogue Sound, it is very unlikely that the proposed project will affect them or their critical habitats. Therefore, the proposed project may affect, but is not likely to adversely affect the shortnose sturgeon.

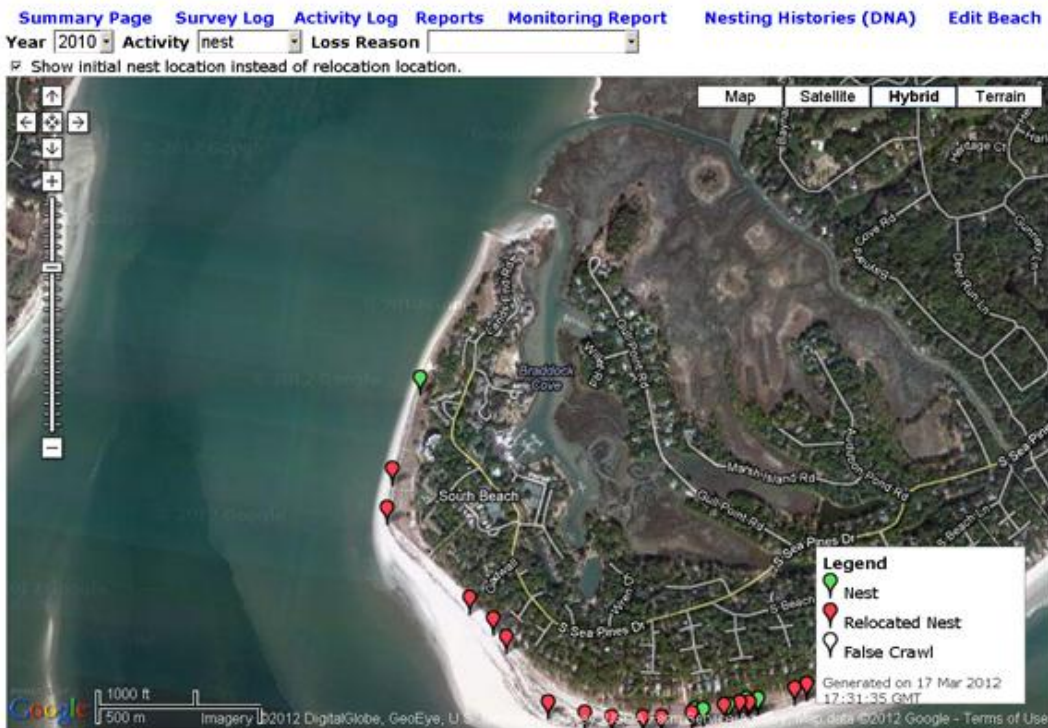
4.2.12 Atlantic Sturgeon

The Atlantic sturgeon (*Acipenser oxyrhyncus*) was listed as endangered during the preparation of this biological assessment on April 6, 2012. Although it spawns in the upper reaches of major rivers like the shortnose sturgeon, unlike the shortnose, the Atlantic enters salt water and is truly anadromous. Like the shortnose sturgeon, the Atlantic sturgeon's decline was driven by overfishing, and the failure to recover is attributed to loss of spawning habitat, dam construction and operation, dredging and material placement, water quality modifications, ship strikes, fisheries bycatch, and poaching.

Strongholds of the Atlantic sturgeon population in South Carolina are the Edisto and Waccamaw-PeeDee River Basins (Atlantic Sturgeon Status Review Team 2007). Little is known about Atlantic sturgeon from the minor river systems like Calibogue Sound. Nearby, one Atlantic sturgeon was caught in a directed fishery in the Coosawatchie River in 1982 (Smith and Dingley 1984), which is north of Calibogue Sound. South Carolina enacted a moratorium on fishing for Atlantic sturgeon in 1985, but poaching has been reported as recently as 2006 (ASSRT 2007).

The only records from the Calibogue Sound are anecdotal observations in June 2007, July 2010, and June 2011, when Atlantic sturgeon were observed jumping by recreational boaters in Calibogue Sound. Breaching, jumping, and leaping is most often observed in the early summer in the Southeastern US, and it may be a form of communication (Sulak et al. 2002). The population size, distribution, and other details on the sturgeon in Calibogue Sound are unknown (Shotts, personal communication, 2012.)

Efforts to protect sturgeon from dredging's effects include using the least-risky method, which is hydraulic cutterhead, with a small intake. With the use of a 16-inch or less intake, entrainment would be unlikely in the dredge proposed to be used for this project. However, as winter is the period of least activity and sturgeon may be lethargic from cold temperatures, if they are present, there is a possibility of an effect. Additional minor threats related to the proposed project include burial of prey organisms in the marine environment, and turbidity and suspended sediment effects in the Sound when the project is underway. This project may have indirect effects on the quantity of foraging habitat for Atlantic sturgeon, but the fraction of habitat affected is insignificant compared to the available habitat, and it will not destroy or modify any habitat deemed critical for the species survival. Therefore, it is determined that the proposed project is unlikely to adversely affect Atlantic sturgeon.



South Carolina DNR Sea Turtle Conservation Program

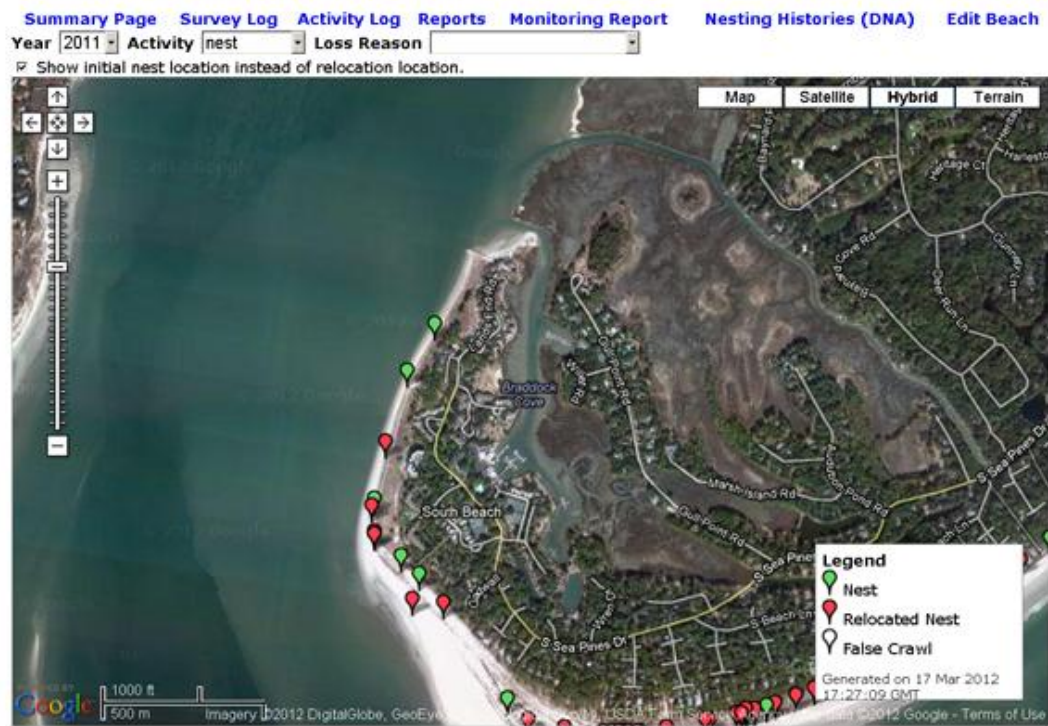


Figure 4-1. Sea Turtle Nesting Data from 2010 and 2011 from SCDNR, 2012.

5 Effects on Listed Species and Habitats

The majority of project impacts will result from deepening shallow tidal flats which have shoaled in the last decade that are part of a marina basin or entrance channel. As the goal of the project is to increase depths to allow navigation, and the areas to be deepened contain tidal flats, the areas within Baynard and Braddock Cove Creeks, and a small area described above in Harbour Town Marina's entrance will be converted from tidal flat to subtidal habitat.

The previously approved SIDA dredging project with placement at the Port Royal ODMS (USACE 2008a) included dredging the upper portion of Baynard Cove Creek. The total area of tidal flat habitat to be affected by the currently proposed project has been reduced by a large amount by removing the upper portion of Baynard Cove Creek from the proposed dredging area. This reduced the project excavation of tidal creek habitat in Baynard Cove Creek by approximately 66 percent, as compared to the previously proposed dredge area. The narrow channel did not allow for a ten foot buffer between oyster reef and salt marsh habitats, and therefore the reach of the creek was removed from the proposed dredging project.

Conversion of intertidal to subtidal habitat may reduce the foraging area for shorebirds and wading birds. Estuarine subtidal unconsolidated substrate ranges in grain size from sand to fine mud. Unconsolidated substrates support many benthic and epibenthic fauna, including but not limited to hermit crabs, blue crabs, spider crabs, penaeid shrimp, grass shrimp, mantis shrimp, snapping shrimp, ghost shrimp, mud shrimp, and many species of amphipods, polychaetes, and other invertebrates. These species reside within the sediments of the estuarine intertidal and subtidal unconsolidated substrates.

Temporary burial of sand substrates in the placement area may reduce foraging habitat for benthic fish species. However, the placement site is dispersive, and the deposited sediments in the placement area will be completely eroded from site within weeks. As a result, the project will not cause any permanent or long term change to the bottom sediments. Also, species will recolonize disturbed sediment in areas affected by the dredging. The recovery speed of the benthic community in dredged areas varies between a few weeks to 6 months (Clarke, D., and Miller-Way, T., 1992, Van Dolah et al., 1984).

In the proposed placement area, the depth of the affected areas range from 22-28 feet. The affected area is turbid due to the naturally-occurring suspended material in Calibogue Sound. Suspended sediment in the area of Calibogue Sound proposed for use as the placement site were measured in December 1999 for the previous permit and found to be 68 mg/L at mid-depth application. While the water column is turbid, the placement of dredged material at the placement site will temporarily reduce foraging habitat for certain fish species, which may include Atlantic sturgeon. It is unknown if Atlantic sturgeon are present in the affected area, however. As described above, there will be no project-related impacts to the following species because they are not expected to be present during the proposed project or their habitats will not be affected: bald eagle, finback whale, humpback whale, North Atlantic right whale, sei whale, sperm whale, green sea turtle, Kemp's ridley sea turtle, and shortnose sturgeon.

Use of a hydraulic cutterhead dredge will reduce the turbidity experienced in the creek habitats. However, despite using the best available methods to reduce impacts, some impacts will occur. The tidal creek water column and the water column in the dredged material placement areas will be impacted by turbidity and increased suspended sediment load during dredging and placement. However, the magnitude of these effects will be minor for the tidal creeks and open water areas proposed for placement. The duration of the impact for the tidal creeks will be weeks for the creeks, and months for the open water areas which will be affected for the duration of the project. As a result, there may be some loss of foraging habitat for wood stork and piping plover, but it would be insignificant compared to the available habitat.

No seabeach amaranth colonies were located at the proposed project site and no impacts to this species will occur. Leatherback sea turtle, loggerhead sea turtle, and Atlantic sturgeon may forage in areas that are affected by an increase in turbidity during dredged material placement. The turbidity impacts will be temporary and are not expected to result in permanent direct or indirect effects on these species.

6 Avoidance, Minimization, and Mitigation Measures

Maintenance dredging of harbors, marinas and entrance channels is necessary to allow for navigation. However, during dredging and placement operations, there is potential for unacceptable environmental impacts to coastal resources. During the process of planning the proposed dredging and placement operations, the applicant has sought means to reduce identified impacts and preserve the abundant aquatic life in Calibogue Sound, its watershed, and the adjacent coastal waters. In a recent study comparing dredged and un-dredged creeks, it was determined that preserving marshes, reducing dredge depth, and restricting dredging to the winter period moderated the impacts of dredging and development (Bilkovic 2010). Timing, duration, design, methodology, and monitoring approaches have been proven to reduce the negative impacts associated with dredging. To further avoid, minimize, and mitigate the unavoidable impacts of the proposed project, the applicant will commit to the measures discussed in the following paragraphs.

Permit conditions typically restrict project dredging to the period from November 1 to March 31. Because of the quantity of material to be dredged (300,000 CY), and the fact that only a small dredge can navigate the creeks to excavate the material, the project will require up to 6 months to complete. Therefore, the project will require up to 6 months duration during late fall, winter and early spring seasonal conditions. This project timing will avoid summer season impacts to many species, including those that are federally protected. Dedicated observers and a monitoring program will be in place to ensure no impacts to protected species, such as manatees, which may be present in the spring.

The primary potential impacts to wildlife are the conversion of tidal flat foraging habitat to subtidal habitat in the dredged creek areas. Site specific modification of the dredge footprint has been used to minimize aquatic impacts. The extent of the dredge area has changed since the previously approved application in 2008, which included the full length of Baynard Cove Creek. Site surveys of the area noted that the narrow channel of upper Baynard would not allow for avoidance of sensitive habitats, including oyster reefs and salt marsh. As a result, the area to be dredged has been minimized and no dredging will occur in upper Baynard Cove Creek. Furthermore, this loss of tidal flat foraging habitat is insignificant compared to the available habitat, and the project will not affect any habitat deemed critical for the survival of any listed species.

To further reduce impacts to prey populations and foraging habitat, the applicant and their contractors will maintain a ten foot wide buffer from salt marsh and oyster reefs and mounds during the dredging effort. To ensure this buffer is maintained, the applicant will mark the dredge corridor with PVC stakes in areas where oyster reefs may be obscured by water.

To further avoid impacts to the creeks, the applicant minimized the channel width to 35 feet in most areas with a maximum width of 50 feet. The narrow width will allow for 3:1 side slopes which will maximize channel stability and reduce slumping and erosion of the adjacent banks. To accommodate the gentle side slopes, the areas will be dredged to the minimum depth necessary to allow navigation for relatively small recreational craft in most areas, except South Beach and Harbour Town Marinas,

which serve commercial vessels with deeper draft requirements. To meet these requirements, the project includes maximum depths of 6-8 feet MLW plus 1 foot allowable over-dredge.

Selecting the least-damaging methodology will reduce impacts to all aquatic life. There are several dredge methodologies available for this site, and the chosen hydraulic cutterhead dredge method results in less sedimentation lost to creek habitats and less suspension, also less entrainment than from using a hopper or clamshell dredge. The reduced risk of entrainment will protect more aquatic life than if other methodologies were employed.

Because hydraulic dredging will be used, materials will be removed by pipeline, which will have fewer impacts than multiple barge or scow trips through the estuary. No ship strike or collision risks are present that could result in mortality to whales or turtles. The footprint of the conveyance and outfall pipe will be along the shoreline, but in adequate depth to avoid impacts to the benthic environment. The applicant will place the pipeline over unconsolidated surfaces that will not suffer shading effects, thus avoiding impacts to intertidal or subtidal resources. To avoid impacts to the bottom-dwelling prey species and habitats, the applicant will suspend the dredge pipe above the bottom rather than anchor it directly on the bottom as proposed in previous applications. The pipeline will be anchored with heavy chains with weights on the ends that do not pose an entanglement risk to sea turtles, and the project will not include use of any ropes or cables that are light enough to pose a potential entanglement risk.

The site chosen during the prior 2000 application process for dredged material placement (Placement Site 2) consists of sand; however, hard bottom resources were located with the potential area of turbidity effects. To avoid turbidity effects or migration of sediments to hard bottom communities, the dredged material placement site was relocated further south (to Placement Site 5). This measure helps ensure that the project avoids hard bottom habitats. Furthermore, sea turtles consume sponges, which grow on hard bottom habitat. Moving the proposed placement area away from hard bottom habitat will therefore eliminate the potential for loss of foraging habitat for sea turtles at the placement site.

Listed species receive focused attention due to their dangerously low population levels. However, they depend upon the same high quality habitat that all organisms do, and their prey and refuge habitats will be protected to the utmost possible level by this project. To demonstrate that the project has a minimum effect on the listed species, the applicant will conduct monitoring in association with the dredging and placement. A specific dredge monitoring plan will be submitted for review and approval prior to dredging. The monitoring program includes biological monitoring of both dredging and placement areas, as well as a manatee observer during any dredging conducted in April. To quantify the effects of turbidity, suspended sediment, and dissolved oxygen changes due to dredging and material placement, the applicant will monitor benthic habitat and water quality parameters before, during, immediately after, and periodically after dredging. Parameters include salinity, temperature, dissolved oxygen, turbidity, suspended sediment concentration, pH, as well as sediment grain size, benthic community sampling, and other factors described in the Monitoring Plan. The outcome of each monitoring event will be reported to permitting and commenting natural resource agencies. These measures will help to determine the level and duration of impacts from the project and compare or confirm them to the predicted effects.

7 Conclusions

Table 7-1 summarizes the potential effects of the proposed project. In this table a “may affect, but not likely to adversely affect” determination is presented as “not likely to adversely affect.”

The proposed project will have no effect on the following because they are not present during the season or in the area in which the project would be conducted: bald eagle, finback whale, humpback whale, North Atlantic right whale, sei whale, sperm whale, green sea turtle, Kemp’s ridley sea turtle, and shortnose sturgeon.

No Critical Habitat Areas exist in the action area, and no listed species records were found, except for a manatee in Harbour Town Marina during the summer. The West Indian manatee is unlikely to be affected despite the temporary disturbance to habitat. Leatherback sea turtles may be present in the placement area; however, they are not expected to be affected by the proposed project.

The wood stork and piping plover are unlikely to be affected by the project despite a minor loss of potential foraging habitat in the dredged areas, which is considered insignificant as compared to the available foraging habitat. The applicant will apply every practicable measure to avoid and minimize this habitat loss and disturbance. The Atlantic sturgeon is unlikely to be affected by the project despite the loss of potential foraging habitat in the dredged material placement area. The location of the placement area was chosen based on the minimum harm to all species of concern, listed and managed species, and the higher vulnerability of hard bottom habitats as compared to unconsolidated bottom habitats.

Table 7-1. Summary of Potential Project Effects on Listed Species

Listed Species	Effects	Summary
West Indian manatee	Unlikely to adversely affect	Temporary habitat disturbance
Bald eagle	No effect	No individual or habitat impacts
Wood stork	Unlikely to adversely affect	Minor loss of foraging habitat (shallow tidal creek)
Piping plover	Unlikely to adversely affect	Minor loss of foraging habitat (shallow tidal creek)
Seabeach amaranth	No effect	Not present in project area
Finback whale	No effect	Not present in project area
Humpback whale	No effect	Not present in project area
North Atlantic right whale	No effect	Not threatened by project actions or methods
Sei whale	No effect	Not present in project area
Sperm whale	No effect	Not present in project area
Green sea turtle	No effect	Extremely rare in proposed project area
Kemp's ridley sea turtle	No effect	Extremely rare in proposed project area
Leatherback sea turtle	Unlikely to adversely affect	Very small loss of beach at inlet area that is unlikely nesting habitat
Loggerhead sea turtle	Unlikely to adversely affect	Very small loss of beach at inlet area that is unlikely nesting habitat
Shortnose sturgeon	Unlikely to adversely affect	Unlikely to be present in project area
Atlantic sturgeon	Unlikely to adversely affect	Disturbance of marine foraging habitat

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**APPENDIX A – SOUTH CAROLINA DREDGING
ADVISORY (VAN DOLAH AND BERQUIST,
2009)**

South Carolina Department of Natural Resources

Advisory Regarding Dredging and Natural Resources

Problem: Many estuarine and marine water bodies are routinely dredged in order to ensure safe and efficient transportation between the open ocean and land-based infrastructure. Estuaries also provide habitat and nursery grounds for a wide range of commercially and recreationally important invertebrates (shrimp, crabs, oysters, etc.) and finfish (flounder, red drum, etc) as well as threatened and endangered species (sturgeon, sea turtles, etc.). Many of these species have both inshore and offshore life stages involving ingress and egress through channels, either as post-larval or juvenile organisms, or as adults. As a result, resource managers are placed in the position of balancing navigation channel maintenance with the potential impact of those activities on these natural resources. Central to this decision-making process is a clear identification of the resources potentially at risk as well as when and where those resources and dredging are likely to coincide.



Development of Ranking System: In order to provide guidance on these issues, a panel of SCDNR resource specialists was assembled and asked to develop spatially and temporally explicit distributions of important estuarine, diadromous, and marine species. This list included various crustacean, finfish, mollusk and sea turtle species that are either of commercial-recreational value and/or that are protected by state or federal law (Table 1). The estuarine/marine environment was divided into eight

habitats, based on ocean proximity, water body size, and salinity, that could be dredged (Table 2). The likelihood of each species coinciding with dredging in each habitat was then ranked for each half-month

increment throughout the calendar year. The ranking system had four levels describing the probability of a species' presence in an area impacted by dredging:

- white—little if any probability of occurrence,
- yellow—low probability of occurrence,
- orange—moderate probability of occurrence,
- red—high probability of occurrence.

In addition to the species rankings, hopper dredging is restricted in state waters to the period of December through March. As a result, the April through November period was given a "red" ranking for hopper dredging in those environments where it could be used. The rankings were compiled into spreadsheets (Tables 3-10) that allow rapid identification of time periods during which few or many species may be affected by dredging.

Table 1. Species ranked for occurrence in estuarine habitats.

Crustaceans
Brown Shrimp, White Shrimp, Blue Crab
Finfish
Red Drum, Spotted Sea Trout, Flounder, Shad, Shortnose Sturgeon, Atlantic Sturgeon, American Eel
Molluscs
American Oyster, Hard Clam
Sea Turtles
Loggerhead, Kemp's Ridley, Green, Leatherback

Habitat	Definition
Major Estuary Entrance Channel	Connection of major bays and sounds to open ocean
Smaller Inlet Entrances	Connection of tidal rivers and creeks to open ocean.
High Salinity Bay/Sound	Open water body with salinity > 18 ppt
Mesohaline River	Channelized water body > 100 m bank to bank and salinity 5-18 ppt
Oligohaline River	Channelized water body > 100 m bank to bank and salinity 0-5 ppt
High Salinity Creek	Channelized water body < 100 m bank to bank and salinity > 18 ppt
Mesohaline Creek	Channelized water body < 100 m bank to bank and salinity 5-18 ppt
Oligohaline Creek	Channelized water body < 100 m bank to bank and salinity 0-5 ppt

The decision to base the rankings on occurrence rather than risk reflected a need to provide an objective tool for resource managers, whereas to adequately assess risk for the various species typically requires detailed information about a particular project. More specifically, the time-specific rankings were not developed to measure the risk of dredging to individual species' populations (for example: will entrainment of larvae by a dredge negatively impact shrimp populations?) or the relative risk among different species (for example: will the loss of one sturgeon have more impact than the loss of one flounder). Drawing these kinds of conclusions without the needed information would have resulted in an overly subjective series of rankings that force trading impacts to one species against another. The goal with the ranking spreadsheets was to provide additional critical information and to leave decision-making to the experience and judgment of resource managers.

Reading the Rankings Spreadsheets: Each spreadsheet shows the occurrence rankings for the target species for each half-month time period in one of the estuarine/marine habitats. The temporal patterns of occurrence generally reflect the life cycles of the species in South Carolina. For example, brown shrimp, *Farfantepenaeus aztecus*, spawn offshore and larvae enter estuaries during spring, take up residence in mesohaline tidal creeks and rivers, and then exit to the ocean during the summer. The ranking tables for probability of their occurrence in major estuary entrance channels (Table 3) and smaller inlet entrances (Table 4) during February and March (larval ingress) and May through mid-August (adult egress) and high probabilities of occurrence in mesohaline rivers and creeks (Tables 6 and 9) and bays and sounds (Table 5) in between ingress and egress (nursery stage). This species may also take up residence in oligohaline environments and higher salinity creeks, but less often and in lower numbers, thus their probability of occurrence in these environments are shown as low to moderate (Tables 7, 8 and 10).

Example Applications of Spreadsheets:

Example 1—Proposed Dredging of a Major Estuary Entrance Channel (Table 3). Dredging in this habitat illustrates decisions that may be made among the conflicting needs of various protected species. Hopper dredging is only allowed from December 1 through March 31 due to dangers of this form of dredging to sea turtles. However, the threatened shortnose and Atlantic sturgeon have a high probability of occurrence in entrance channels and numerous other species are also entering and exiting the estuary during that period. To minimize the chances of impacts to estuarine/marine resources, hydraulic dredging between April 1 and August 31 would be recommended. If this is not enough time, that window could be expanded through September when the likelihood of sturgeon occurrence is low (yellow). If still more time is needed, the window could be extended into March and October when occurrence probabilities are moderate. Dredging would likely not be permitted in this habitat between November and February.

Example 2—Proposed Dredging of a Mesohaline Creek (Table 9). Dredging in this habitat illustrates decisions that may be made in a weight-of-evidence manner. These habitats are most heavily used by crustaceans, mollusks and finfish of commercial and/or recreational value with peak occurrences between February and October. Dredging may be recommended between November 1 and January 31 to avoid that time period. If more time is needed for the project, that window may be expanded into spring and early fall in such a way as to affect the fewest species possible. Although oysters will be present year-round, they occur almost exclusively in the intertidal zone in South Carolina. If significant oyster resources are present in a creek, dredging will likely be restricted to subtidal areas and to a design not likely to cause the loss of oyster habitat due to slumping.



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Table 3. Major estuary entrances channels

Species	January		February		March		April		May		June		July		August		September		October		November		December		
	1-15	16-31	1-15	16-28	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	
Crustaceans																									
Brown Shrimp																									
White Shrimp																									
Blue Crab																									
Finfish																									
Red Drum																									
Spotted Trout																									
Flounder																									
Shad																									
Shortnose Sturgeon																									
Atlantic Sturgeon																									
American Eel																									
Mollusks																									
Oysters																									
Hard Clams																									
Turtles																									
Loggerhead																									
Kemp's ridley																									
Green																									
Leatherback																									
OCRM Reqs For Hopper Dredges																									

Table 4. Smaller inlet entrances

Species	January		February		March		April		May		June		July		August		September		October		November		December		
	1-15	16-31	1-15	16-28	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	
Crustaceans																									
Brown Shrimp																									
White Shrimp																									
Blue Crab																									
Finfish																									
Red Drum																									
Spotted Trout																									
Flounder																									
Shad																									
Shortnose Sturgeon																									
Atlantic Sturgeon																									
American Eel																									
Mollusks																									
Oysters																									
Hard Clams																									
Turtles																									
Loggerhead																									
Kemp's ridley																									
Green																									
Leatherback																									
OCRM Reqs For Hopper Dredges																									

- little if any probability of occurrence
- moderate probability of occurrence
- low probability of occurrence
- high probability of occurrence

Table 5. High salinity bay or sound

Species	January		February		March		April		May		June		July		August		September		October		November		December		
	1-15	16-31	1-15	16-28	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	
Crustaceans																									
Brown Shrimp																									
White Shrimp																									
Blue Crab																									
Finfish																									
Red Drum																									
Spotted Trout																									
Flounder																									
Shad																									
Shortnose Sturgeon																									
Atlantic Sturgeon																									
American Eel																									
Mollusks																									
Oysters																									
Hard Clams																									
Turtles																									
Loggerhead																									
Kemp's ridley																									
Green																									
Leatherback																									
OCCM Regs for Hopper Dredges																									

Table 6. Mesohaline rivers

Species	January		February		March		April		May		June		July		August		September		October		November		December		
	1-15	16-31	1-15	16-28	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	
Crustaceans																									
Brown Shrimp																									
White Shrimp																									
Blue Crab																									
Finfish																									
Red Drum																									
Spotted Trout																									
Flounder																									
Shad																									
Shortnose Sturgeon																									
Atlantic Sturgeon																									
American Eel (Evers)																									
Mollusks																									
Oysters																									
Hard Clams																									
Turtles																									
Loggerhead																									
Kemp's ridley																									
Green																									
Leatherback																									
OCCM Regs for Hopper Dredges																									

little if any probability of occurrence moderate probability of occurrence
 low probability of occurrence high probability of occurrence

Table 7. Oligohaline rivers

Species	January		February		March		April		May		June		July		August		September		October		November		December		
	1-15	16-31	1-15	16-28	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	
Crustaceans																									
Brown Shrimp																									
White Shrimp																									
Blue Crab																									
Finfish																									
Red Drum																									
Spotted Trout																									
Flounder																									
Shad																									
Shortnose Sturgeon																									
Atlantic Sturgeon																									
American Eel (Evers)																									
Mollusks																									
Oysters																									
Hard Clams																									
Turtles																									
Loggerhead																									
Kemp's ridley																									
Green																									
Leatherback																									
OCRM Reqs For Hopper Dredges																									

Table 8. High salinity creeks

Species	January		February		March		April		May		June		July		August		September		October		November		December		
	1-15	16-31	1-15	16-28	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	
Crustaceans																									
Brown Shrimp																									
White Shrimp																									
Blue Crab																									
Finfish																									
Red Drum																									
Spotted Trout																									
Flounder																									
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Shortnose Sturgeon																									
Atlantic Sturgeon																									
American Eel																									
Mollusks																									
Oysters																									
Hard Clams																									
Turtles																									
Loggerhead																									
Kemp's ridley																									
Green																									
Leatherback																									
OCRM Reqs For Hopper Dredges																									

- little if any probability of occurrence
- moderate probability of occurrence
- low probability of occurrence
- high probability of occurrence

Table 9. Mesohaline creeks

Species	January		February		March		April		May		June		July		August		September		October		November		December		
	1-15	16-31	1-15	16-28	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	
Crustaceans																									
Brown Shrimp																									
White Shrimp																									
Blue Crab																									
Finfish																									
Red Drum																									
Spotted Trout																									
Flounder																									
Shad																									
Shortnose Sturgeon																									
American Eel (Evers)																									
Mollusks																									
Oysters																									
Hard Clams																									
Turtles																									
Loggerhead																									
Kemp's ridley																									
Green																									
Leatherback																									
OCRM Regs For Hopper Dredges																									

Table 10. Oligohaline creeks

Species	January		February		March		April		May		June		July		August		September		October		November		December		
	1-15	16-31	1-15	16-28	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	
Crustaceans																									
Brown Shrimp																									
White Shrimp																									
Blue Crab																									
Finfish																									
Red Drum																									
Spotted Trout																									
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Hard Clams																									
Turtles																									
Loggerhead																									
Kemp's ridley																									
Green																									
Leatherback																									
OCRM Regs For Hopper Dredges																									

little if any probability of occurrence moderate probability of occurrence
 low probability of occurrence high probability of occurrence