BIOLOGICAL ASSESSMENT
FOR THE
OPERATIONS AND MAINTENANCE DREDGING AND DISPOSAL

FOR THE
FOLLY RIVER DREDGING PROJECT
CHARLESTON COUNTY, SOUTH CAROLINA

NOVEMBER 2001

1.00 BACKGROUND AND AUTHORIZATION

The Folly River Dredging Project is located southwest of Charleston, S.C., encompassing the Stono Inlet Entrance Channel and the Folly River Channel from Highway 171 to the confluence of Folly and Stono Rivers, a distance of approximately three nautical miles. The project was authorized on 23 December 1977, under Section 107 of the 1960 River and Harbor Act, as amended. The project provided for shallow draft navigation as follows:

a. Stono Inlet Entrance Channel. An entrance channel 11 feet deep by 100 feet wide extending from the 11-foot contour in the Stono River through the shoal lying off the river mouth to buoy "1S" in the ocean; a distance of approximately three nautical miles.

b. Folly River Channel. A channel within the Folly River 9 feet deep and 80 feet wide, extending downstream fro Highway 171 to the confluence of Folly and Stono Rivers; a distance of approximately three nautical miles.

c. Folly Creek Channel. A channel within Folly Creek 9 feet deep by 80 feet wide extending downstream from Highway 171 to the confluence with Folly River; a distance of approximately three nautical miles.

Project construction was physically completed in September 1979.

2.00 PROPOSED PROJECT

The Corps proposes to perform O&M dredging of the Project as described in this Biological Assessment (BA). In previous years, material was placed on an island known as Bird Key. The shifting sands and currents in this area eroded Bird Key and built an adjacent island known as Skimmer Flats. This area is now known as the Bird Key Stono Complex (BKSC). The project involves hydraulically dredging (using a hydraulic pipeline cutterhead dredge) beach compatible material (sand) from the federal navigation channel behind the BKSC and Folly Beach County Park (FBCP) (see Figure 1). During

the 2002 dredging cycle, there are two shoals that will be dredged. Shoal number one is located southwest of the BKSC at the mouth of the Stono River. Approximately 11,000 cubic yards will be dredged from this shoal and placed on the BKSC during the FY 2002 dredging cycle. Shoal number two is located behind FBCP at the confluence of the Folly River and the Stono River. Approximately 47,000 cubic yards will be dredged from this shoal and placed on the beach at FBCP from station 79+65 to station 92+00 during the FY 2002 dredging cycle.

The maintenance dredging of the channel in addition to the disposal of material is repeated biannually to maintain the required depths for the Project as authorized. Quantities dredged from the navigation channel will vary from dredging cycle to dredging cycle; however, shoal number one will continue to be placed at the BKSC and shoal number two will be placed at FBCP.

3.00 PRIOR CONSULTATIONS

Formal section 7 consultation was conducted in 1997 regarding deepening the Folly River Channel and placing the material on Skimmer Flats (now known as BKSC) and on the FBCP. The conclusion of the biological opinion rendered by the U.S. Fish and Wildlife Service (FWS) at that time determined that the beach nourishment project, as proposed, was not likely to jeopardize the continued existence of the loggerhead sea turtle species. No critical habitat would be affected since none had been designated.

4.00 LIST OF SPECIES

4.01 U.S. Department of Interior

The following species have been listed by the U.S. Department of Interior as occurring or possibly occurring in Charleston County, South Carolina (from list dated July 24, 2001).

Key

E = Federally endangered
T = Federally threatened
PCH = Proposed Critical Habitat
C = The US Fish and Wildlife Service (FWS) or the National Marine Fisheries Service (NMFS) has on file sufficient information on biological vulnerability and threat(s) to support proposals to list these species
S/A = Federally protected due to similarity of appearance to a listed species
SC = Species of concern. These species are rare or listed in distribution but are not currently legally protected under the Endangered Species Act.
* = Contact NMFS for more information on this species

Common Name	Scientific Name	Status	Occurrences
West Indian manatee	*Trichechus manatus*	E	Known
Finback whale	*Balaenoptera physalus**	E	Known
Humpback whale	*Megaptera novaeanqliae**	E	Known
Northern right whale	*Eubaleana glacialis**	E	Known
Sei whale	*Balaenoptera borealis**	E	Known
Sperm whale	*Physeter catodon**	E	Known
Bald eagle	*Haliaeetus leucocephalus*	T	Known
Bachman's warbler	*Vermivora bachminii*	E	Known
Wood stork	*Mycteria americana*	E	Known
Red-cockaded woodpecker	*Picoides borealis*	E	Known
Piping plover	*Charadrius melodus*	T/CH	Known
Kemp's ridley sea turtle	*Lepidochelys kempii**	E	Known
Leatherback sea turtle	*Dermochelys coriacea**	E	Known
Loggerhead sea turtle	*Caretta caretta*	T	Known
Green sea turtle	*Chelonia mydas**	T	Known
Flatwoods salamander	*Ambystoma cingulatum*	T	Known
Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
Sea-beach amaranth	*Amaranthus pumilus*	T	Known
Canby's dropwort	*Oxypolis canbyi*	E	Possible
Pondberry	*Lindera melissifolia*	E	Possible
Chaff-seed	*Schwalbea americana*	E	Known
Dusky shark	*Carcharhinus obscurus**	C	Possible
Sand tiger shark	*Odontaspis taurus**	C	Possible
Night shark	*Carcharinus signatus**	C	Possible
Speckled hind	*Epinephelus drummondhayi**	C	Possible
Jewfish	*E. itijara**	C	Possible
Warsaw grouper	*E. nigritus**	C	Possible
Nassau grouper	*E. striatus**	C	Possible
Bachman's sparrow	*Aimophila aestivalis*	SC	Known
Boykin's lobelia	*Lobelia boykinii*	SC	Known
Gopher frog	*Rana capito*	SC	Known
Island glass lizard	*Ophisaurus compressus*	SC	Known
Incised groovebur	*Agrimonia incisa*	SC	Known
Pondspice	*Litsea aestivalis*	SC	Known
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	SC	Known
Southeastern myotis	*Myotis austroriparius*	SC	Known
Sweet pinesap	*Monotropsis odorata*	SC	Known
Venus' fly-trap	*Dionaea muscipula*	SC	Known

Designated Critical Habitat: The FWS has designated 137 areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas as critical habitat of the wintering population of the piping plover. Fifteen of these sites are located along the coast of South Carolina. Unit SC-9 consists of 1223 acres located in Stono Inlet in Charleston County (see Figure 2). Most of this unit is privately

owned and includes the eastern end of Kiawah Island from the MLLW (mean low low water) on the Atlantic Ocean extending north to MLLW on the first large tributary connecting east of Bass Creek running northeast into the Stono River. It includes MLLW up to a point where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur along Stono Inlet and river. All of Bird Key-Stono Heritage Preserve and all of Skimmer Flats to MLLW are included. The Golf course and densely vegetated areas are not included (Federal Register, July 2001).

4.02 The National Marine Fisheries Service

The NMFS provided a list indicating the following threatened (T) and endangered (E) species and critical habitats that are listed under that agency's jurisdiction of the South Atlantic area of South Carolina.

Listed Species	Scientific Name	Status	Date Listed
Marine Mammals			
Blue whale	*Balaenoptera musculus*	E	12/02/70
Finback whale	*Balaenoptera physalus*	E	12/02/70
Humpback whale	*Megaptera novaeangliae*	E	12/02/70
Right whale	*Eubaleana glacialis*	E	12/02/70
Sei whale	*Balaenotera borealis*	E	12/02/70
Sperm whale	*Physeter macrocephalus*	E	12/02/70
Turtles			
Green sea turtle	*Chelonia mydas*	T*	07/28/78
Hawksbill sea turtle	*Eretmochelys imbricata*	E	06/02/70
Kemp's ridley sea turtle	*Lepidochelys kempii*	E	12/02/70
Leatherback sea turtle	*Dermochelys coriacea*	E	06/02/70
Loggerhead sea turtle	*Caretta caretta*	T	07/28/78
Fish			
Shortnose sturgeon	*Acipenser brevirostrum*	E	03/11/67

Species Proposed for Listing: None
Designated Critical Habitat: None
Proposed Critical Habitat: None

Candidate Species**

Fish	
Dusky shark	*Carcharhinus obscurus*
Sand tiger shark	*Odontaspis Taurus*

Night shark	*Carcharinus signatus*
Atlantic sturgeon	*Acipenser oxyrhynchus oxyrhynchus*
Speckled hind	*Epinephelus drummondhayi*
Warsaw grouper	*Epinephelus nigritus*

* Green turtles are listed as threatened, except for breeding populations of green turtles in Florida and on the Pacific Coast of Mexico, which are listed as endangered.

** Candidate species are not protected under the Endangered Species Act, but concerns about their status indicate that they may warrant listing in the future. Federal agencies and the public are encouraged to consider these species during project planning so that future listings may be avoided.

5.00 GENERAL EFFECTS ON LISTED SPECIES/CRITICAL HABITAT

Since all aspects of the proposed work will occur on the ocean beach or on a marine shoal, the project will not affect any listed species occurring in forested or freshwater habitats. Thus, the bald eagle, red-cockaded woodpecker, wood stork, Canby's dropwort, Pondberry, chaffseed, and the blue, finback, humpback, right, sei and sperm whales will not be affected by the proposed action. Further, there are no known populations of seabeach amaranth in the project area.

Species that could be present in the project area during the proposed action are the shortnose and Atlantic sturgeons, and the hawksbill (NMFS list), Kemp's ridley, leatherback, loggerhead, and green sea turtles. However, loggerheads are the primary sea turtle nesters in this area. The Florida manatee rarely visits the area, however, some sightings have been recorded over the years. The piping plover winters in this area and as mentioned previously, critical habitat has been designated within the project area (see Section 4.01).

6.00 SPECIES ASSESSMENTS

6.01 Manatee

West Indian manatees are massive fusiform-shaped animals with skin that is uniformly dark grey, wrinkled, sparsely haired, and rubber-like. Manatees possess paddle-like forelimbs, no hind limbs, and a spatulate, horizontally flattened tail. Females have two maxillary mammae, one at the base of each forelimb. Their bones are massive and heavy with no marrow cavities in the ribs or long bones of the forearms (COE, 2001). Adults average about 11.5 feet in length and 2,200 pounds in weight, but may reach lengths of up to 15 feet (COE, 2001) and weigh as much as 3,570 pounds (COE, 2001). Newborns average 4 to 4.5 feet in length and about 66 pounds (COE, 2001).

The West Indian manatee (*Trichechus manatus*) was listed as endangered on March 11, 1967, under a law that preceded the Endangered Species Act of 1973, as amended (16 USC 1531 et seq.). Additional Federal protection is provided for this species under the Marine Mammal Protection Act of 1972, as amended (16 USC 1461 et

seq.) The manatee population in the United States is confined during the winter months to the coastal waters of the southern half of peninsular Florida and to springs and warm water outfalls as far north as southeast Georgia (COE, 2001). However, during the summer months, they may migrate as far north as coastal Virginia on the East Coast and Louisiana on the Gulf of Mexico (COE, 2001). The manatee is an uncommon summer resident of the South Carolina coast with occasional visual reports. There is no designation of critical habitat for the West Indian manatee in South Carolina.

Effect Determination

The proposed work is currently scheduled to occur during the cooler months of the year when manatees would not be present. However, to ensure the protection of manatees, all Federal and contract personnel associated with this project shall be instructed on the potential presence of manatees and the need to avoid vessel or plant collisions with manatees. Since the proposed work is to be performed with a pipeline dredge, a dredge plant that is essentially stationary, no direct impacts to the manatee are anticipated. For these reasons, it has been determined that the proposed project is not likely to adversely affect the manatee.

6.02 Kemp's ridley, leatherback, loggerhead, green, and hawksbill sea turtles

There are five species of sea turtles on the Atlantic Coast, Kemp's ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas)*, and the hawksbill sea turtle (*Eretmochelys imbricata*). These five species of sea turtles are protected by the Convention on International Trade in Endangered Species (CITES). They are also listed as endangered or vulnerable in the Red Data Book by the International Union for the Conservation of Nature (IUCN). The hawksbill, Kemp's ridley and leatherback were listed as endangered by the U. S. Endangered Species Act in 1973. The green turtle and the loggerhead were added to the list as threatened in 1978. All species that appear on the United States list are also on the South Carolina list.

Sea turtles vary in size from an average of 75 pounds for the Kemp's ridley (does not occur in the project area) to the giant leatherback, which may exceed 800 pounds. Modified for living in the open ocean, they have paddle-like front limbs for swimming. The thick neck and head cannot be drawn back into the body. Sea turtles also have special respiratory mechanisms and organs to excrete excess salt taken in with seawater when they feed.

The leatherback is very different from the six other sea turtle species. Instead of plates (scutes) on the shell, the leatherback's carapace has seven hard longitudinal ridges along the length of the back. Its rubber-like covering is black with white spots and a pinkish-white underside. The average length of its shell is 5 feet. The green turtle is the second largest sea turtle and the loggerhead the third. Green turtles get their name from the color of their fat, not their shells, which are grayish in older animals. The smallest sea turtle is the Kemp's ridley; it has a drab olive to grayish-black shell. Loggerheads

have rich reddish-brown shells and yellow on their undersides. The loggerhead's large skull provides for the attachment of strong jaw muscles for crushing conchs and crabs. The hawskbill has a patterned shell of brown and yellow with scutes that overlap like shingles on a roof. Its long, narrow head and beak enable it to feed among coral reefs.

Sea turtles occupy different habitats, depending upon their species, sex and age (size). Hatchlings and smaller juvenile loggerheads appear to live in floating mats of sargassum in the open ocean. This seaweed offers cover, protection from predators and a source of food. Larger juveniles are generally seen in the same coastal habitat as the adults, especially during the summer.

Leatherbacks feed entirely on jellyfish, and they must often travel long distances to keep up with large concentrations of this food source drifting in the ocean currents. Green turtles are herbivorous and remain near pastures of turtle-preferred grasses. Often these pastures are not near their nesting beaches, so these turtles migrate hundreds of miles to nest. Loggerheads usually leave the cold, coastal waters in the winter and are often seen along the edge of the Gulf Stream. Hawksbills live on coral reefs almost year-round, feeding on sponges, sea squirts and other bottom organisms. Although the Kemp's ridley nests only on Mexico's Gulf Coast, small juveniles of this species and the green turtle occur along the South Carolina coast during the summer.

Very little is known about male sea turtles since they almost never come ashore. Male loggerheads are seen in near-shore waters during the spring and early summer breeding season but apparently move back offshore once breeding is completed. Since the reproductive cycles of all sea turtles are similar, a generalized version encompasses all. Mating takes place offshore, and the turtles must only mate once to fertilize all eggs laid during the nesting season. When nesting, the female crawls onto the beach, usually at night, and digs a hole in the sand with her hind flippers. After laying about 100 (number of eggs vary among species) white, leathery eggs, she covers them and returns to the sea. A single female may nest several times a season, usually at 2-week intervals. The eggs incubate about 60 days, depending on the weather. Hatchlings dig out of the sand at night and make their way to the sea using light cues for guidance. Destruction of nests and hatchling mortality at sea are usually high. It appears sea turtles' high number of eggs per clutch and several nestings per season have evolved to offset this high mortality rate. Nesting habits of the Kemp's ridley deviate from those of other sea turtles. The Kemp's ridley is the only species that nests during the day. Most sea turtles do not nest every year. They return on either a 2- or 3-year cycle to the same general area or beach. Of these six species, only the loggerhead is considered to be a regular nester in SC. There is no critical habitat designation for sea turtles in SC. For purposes of this assessment, the loggerhead is considered to be the only species likely to nest in the project area.

Loggerhead Sea Turtle. The loggerhead sea turtle has a worldwide distribution and is found in temperate and subtropical waters. Major nesting areas in North America occur along the Southeast Coast from North Carolina to Florida. Loggerhead sea turtles regularly nest along the southern coast of South Carolina from Georgetown south, usually

from mid-May to August. Nesting is preferred on remote beaches away from human disturbance. However, because of the high development along the coastline, many loggerheads nest on highly developed beaches. The loggerhead is considered a turtle of shallow water with juveniles preferring bays and estuaries. An omnivore, crustaceans, mollusks, squid, jellyfish, fish, and plant materials are desirable foods. Stranding data reveals that up to 70% of all stranded sea turtles are loggerheads with the majority of strandings occurring from May to August. Therefore, it can be surmised that the potential presence of loggerheads in the project area would most-likely occur at this time. In Georgia, South Carolina and North Carolina the nesting season generally begins in mid-May and ends by mid-August. Nesting activity is greatest, however, in June and July. Loggerheads are known to nest from one to seven times within a nesting season; the mean is approximately 4.1. The interesting interval varies around a mean of about 14 days. There is general agreement that females mate prior to the nesting season (and possibly only once) and then lay multiple clutches of fertile eggs throughout some portion of the nesting season. Mean clutch size varies from about 100 to 126 along the southeastern United States coast. Loggerheads are nocturnal nesters, but exceptions to the rule do occur infrequently. Multi-annual re-migration intervals of two and three years are most common in loggerheads, but the number can vary from one to six years. The length of the incubation period is related to nest temperature. Sex determination in loggerhead hatchlings is temperature dependent and the species apparently lacks sex chromosomes. Natural hatching success rates of 73.4 percent and 55.7 percent have been reported in South Carolina. Loggerhead hatchlings engage in a "swimming frenzy" for about 20 hours after they enter the sea and that frenzy takes them about 22 to 28 kilometers offshore. After leaving the beach, they become associated with *Sargassum* rafts/debris and ride these communities among ocean currents for a few years as juveniles. Upon reaching a mean straight carapace length (sCL) of 40 - 50 cm, they abandon the pelagic existence and migrate to near-shore and estuarine waters of the eastern United States, the Gulf of Mexico and the Bahamas and begin the subadult stage. As adults, loggerheads become migratory for the purpose of breeding. Reported tag recoveries suggest a "migratory path" from Georgia to Cape Hatteras, North Carolina with a single recovery of a Georgia tagged female on the Florida Gulf Coast (Tampa Bay). Little else is known of the scheduled travels of Georgia, South Carolina, and North Carolina nesters outside of the nesting season (NMFS, USFWS, 1991).

Affected sea turtle environment. The areas of affected environment for this proposed project in FY 2002 are the marine areas proposed for O&M dredging (see Figure 1**)** and the disposal area on FBCP. The depth of the channel will be –9 feet plus 2 feet of overdepth MLW with 4:1 side slopes.

Actual quantities computed from the condition survey of the shoals proposed for dredging include 11,000 cubic yards in shoal 1 which will be placed on BKSC. The location of the material placement on BKSC will be determined on-site just prior to dredging, and in coordination with SCDNR. The maximum elevation at this site will not exceed 9.0 NGVD.

Additionally, 47,000 cubic yards in shoal 2 which will placed on FBCP. It will be placed on FBCP parallel to the existing shoreline for a distance of approximately 1,250 feet with a width of approximately 150 feet. The total area encompasses approximately 4 acres. Only a portion of this total area between the toe of the eroded embankment and MHW may be considered suitable sea turtle nesting habitat.

As noted previously, actual quantities of material to be dredged will vary from year to year depending on the shoaling rate.

Current range wide conditions for sea turtles. It is not possible, at present, to estimate the size of the loggerhead population in United States territorial waters if one includes subadults. There is, however, general agreement that enumeration of nesting females provides a useful index to population size and stability. It is estimated that 14,150 females nest per year in the southeastern United States. This estimate was based on aerial survey data from 1983 and has been accepted as the best current approximation. Based on a mean of 4.1 nests per female, it is estimated that approximately 58,000 nests are deposited per year in the Southeast. Based on more extensive ground and aerial surveys throughout the Southeast in recent years (1987 to 1990), it is estimated that approximately 50,000-70,000 nests are deposited annually. These totals constitute about 35 to 40 percent of the loggerhead nesting known worldwide and clearly rank the southeastern United States aggregation as the second largest in the world. (NMFS, USFWS, 1991).

A recent review considered consequences of life tables and population models; mortality rates in the Southeast; population declines in South Carolina and Georgia; and estimates of annual mean clutch production per female. It was concluded that the stock of loggerheads represented by females that nest in the Southeast is continuing to decline (NMFS, USFWS, 1991).

Cumulative effects of actions in project area on sea turtles. Very little is known about sea turtle diseases or natural mortality, rates. However, it is believed that declines in populations are a direct result of human actions. Erosion of nesting beaches can result in partial or total loss of suitable nesting habitat. Dynamic coastal processes, including sea level rise, influence erosion rates. Man's interference with these natural processes through coastal development and associated activities has resulted in accelerated erosion rates and interruption of natural shoreline migration. Where beachfront development occurs as on Folly Beach, the site is often fortified to protect the property from erosion. Virtually all shoreline engineering is carried out to save structures, not dry sandy beaches, and ultimately, this results in environmental damage. One type of shoreline engineering, collectively referred to as beach armoring, includes sea walls, rock revetments, riprap, sandbag installations, groins and jetties. Beach armoring can result in permanent loss of a dry nesting beach through accelerated erosion and prevention of natural beach/dune accretion and can prevent or hamper nesting females from accessing suitable nesting sites. Clutches deposited seaward of these structures may be inundated at high tide or washed out entirely by increased wave action near the base of these structures. As these structures fail and break apart they spread

debris on the beach that may further impede access to suitable nesting sites (resulting in higher incidences of false crawls) and trap hatchlings and nesting turtles. Sandbags are particularly susceptible to rapid failure and result in extensive debris on nesting beaches. Rock revetments, riprap and sand bags can cause nesting turtles to abandon nesting attempts or to construct improperly sized and shaped egg cavities when inadequate amounts of sand cover these structures. Approximately 21 percent (234 km) of Florida's beaches, 10 percent (18 km) of Georgia's beaches and 10 percent (30 km) of South Carolina's beaches are armored (NMFS, USFWS, 1991).

Groins and jetties are designed to trap sand during transport in longshore currents or to keep sand from flowing into channels in the case of the latter. These structures prevent normal sand transport and accrete beaches on one side of the structure while starving neighboring beaches on the other side thereby resulting in severe beach erosion and corresponding degradation of suitable nesting habitat. Beach nourishment consists of pumping, trucking or scraping sand onto the beach to rebuild what has been lost to erosion. Beach nourishment can impact turtles through direct burial of nests and by disturbance to nesting turtles if conducted during the nesting season. Sand sources may be dissimilar from native beach sediments and can affect nest site selection, digging behavior, incubation temperature (and hence sex ratios), gas exchange parameters within incubating nests, hydric environment of the nest, hatching success and hatchling emergence success. Beach nourishment can result in severe compaction or concretion of the beach. Trucking of sand onto project beaches may increase the level of compaction (NMFS, USFWS, 1991).

Significant reductions in nesting success have been documented on severely compacted nourished beaches. Compaction levels that have been evaluated at ten renourished east coast Florida beaches concluded that 50 percent were hard enough to inhibit nest digging, 30 percent were questionable as to whether their hardness affected nest digging and 20 percent were probably not hard enough to affect nest digging. They further concluded that, in general, beaches nourished from offshore borrow sites are harder than natural beaches, and, while some may soften over time through erosion and accretion of sand, others may remain hard for 10 years or more. Nourished beaches often result in severe escarpments along the mid-beach and can hamper or prevent access to nesting sites. Nourishment projects result in heavy machinery, pipelines, increased human activity and artificial lighting on the project beach. These activities are normally conducted on a 24-hour basis and can adversely affect nesting and hatching activities. Pipelines and heavy machinery can create barriers to nesting females emerging from the surf and crawling up the beach, causing a higher incidence of false crawls (non-nesting emergences). Increased human activity on the project beach at night may cause further disturbance to nesting females. Artificial lights along the project beach and in the nearshore area of the borrow site may deter nesting females and disorient or misorient emergent hatchlings from adjacent non-project beaches (NMFS, USFWS, 1991).

Beach nourishment projects require continual maintenance (subsequent nourishment) as beaches erode and hence their negative impacts to turtles are repeated on a regular basis. Beach nourishment projects conducted during the nesting season can

result in the loss of some nests which may be inadvertently missed or misidentified as false crawls during daily patrols conducted to identify and relocate nests deposited on the project beach. Nourishment of highly eroded beaches (especially those with a complete absence of dry beach) can be beneficial to nesting turtles if conducted properly. Careful consideration and advance planning and coordination must be carried out to ensure timing, methodology and sand sources are compatible with nesting and hatching requirements (NMFS, USFWS, 1991).

Extensive research has demonstrated that the principal component of the sea-finding behavior of emergent hatchlings is a visual response to light. Artificial beachfront lighting from buildings, streetlights, dune crossovers, vehicles and other types of beachfront lights has been documented in the disorientation (loss of bearings) and misorientation (incorrect orientation) of hatchling turtles. The results of disorientation or misorientation are often fatal. As hatchlings head toward lights or meander along the beach their exposure to predators and likelihood of desiccation is greatly increased. Misoriented hatchlings can become entrapped in vegetation or debris, and many hatchlings are found dead on nearby roadways and in parking lots after being struck by vehicles. Hatchlings that successfully find the water may be misoriented after entering the surf zone or while in nearshore waters. Intense artificial lighting can even draw hatchlings back out of the surf (NMFS, USFWS, 1991).

The problem of artificial beachfront lighting is not restricted to hatchlings. It has been indicated that adult loggerhead emergence patterns were correlated with variations in beachfront lighting in south Brevard County, Florida, and that nesting females avoided areas where beachfront lights were the most intense. It has also been noted that loggerheads aborted nesting attempts at a greater frequency in lighted areas. Problem lights may not be restricted to those placed directly on or in close proximity to nesting beaches. The background glow associated with intensive inland lighting, such as that emanating from nearby large metropolitan areas, may deter nesting females and disorient or misorient hatchlings navigating the nearshore waters. Cumulatively, along the heavily developed beaches of the southeastern United States, the negative effects of artificial lights are profound (NMFS, USFWS, 1991).

Residential and tourist use of developed (and developing) nesting beaches can result in negative impacts to nesting turtles, incubating egg clutches and hatchlings. The most serious threat caused by increased human presence on the beach is the disturbance to nesting females. Night-time human activity can cause nesting females to abort nesting attempts at all stages of the behavioral process. It has been reported that disturbance can cause turtles to shift their nesting beaches, delay egg laying, and select poor nesting sites. Heavy utilization of nesting beaches by humans (pedestrian traffic) may result in lowered hatchling emergence success rates due to compaction of sand above nests and pedestrian tracks can interfere with the ability of hatchlings to reach the ocean. Campfires and the use of flashlights on nesting beaches misorient hatchlings and can deter nesting females (NMFS, USFWS, 1991).

A variety of natural and introduced predators such as raccoons, foxes, ghost crabs and ants prey on incubating eggs and hatchling sea turtles. The principal predator is the raccoon (*Procyon lotor).* Raccoons are particularly destructive and may take up to 96 percent of all nests deposited on a beach. In addition to the destruction of eggs, certain predators may take considerable numbers of hatchlings just prior to or upon emergence from the sand (NMFS, USFWS, 1991).

Nest loss due to erosion or inundation and accretion of sand above incubating nests appear to be the principal abiotic factors that may negatively affect incubating egg clutches. While these factors are often widely perceived as contributing significantly to nest mortality or lowered hatching success, few quantitative studies have been conducted. Studies on a relatively undisturbed nesting beach indicated that excepting a late season severe storm event, erosion and inundation played a relatively minor role in destruction of incubating nests. Inundation of nests and accretion of sand above incubating nests as a result of the late season storm played a major role in destroying nests from which hatchlings had not yet emerged. Severe storm events (e.g., tropical storms and hurricanes) may result in significant nest loss, but these events are typically aperiodic rather than annual occurrences. In the southeastern United States, severe storm events are generally experienced after the peak of the hatching season and hence would not be expected to affect the majority of incubating nests. Erosion and inundation of nests are exacerbated through coastal development and shoreline engineering (NMFS, USFWS, 1991).

The effects of dredging are evidenced through degradation of habitat and/or incidental take of marine turtles. Channelization of inshore and nearshore habitat and the disposal of dredged material in the marine environment can destroy or disrupt resting or foraging grounds (including grass beds and coral reefs) and may affect nesting distribution through the alteration of physical features in the marine environment. Hopper dredges are responsible for incidental take and mortality of marine turtles during dredging operations. Other types of dredges (clamshell and pipeline) have not been implicated in incidental take (NMFS, USFWS, 1991).

Of all commercial and recreational fisheries conducted in the United States, shrimp trawling is the most damaging to the recovery of marine turtles. The estimated number of loggerheads killed annually by the offshore shrimping fleet in the southeastern United States Atlantic and Gulf of Mexico is 5,000 to 50,000. Incidental capture and drowning in shrimp trawls is believed to be the largest single source of mortality on juvenile through adult stage marine turtles in the southeastern United States. Most of these turtles are juveniles and subadults, the age and size classes most critical to the stability and recovery of marine turtle populations. Quantitative estimates of turtle take by shrimp trawlers in inshore waters have not been developed, but the level of trawling effort expended in inshore waters along with increasing documentation of the utilization of inshore habitat by loggerhead turtles suggest that capture and mortality may be significant. Trawlers targeting species other than shrimp tend to use larger nets than shrimp trawlers and probably also take sea turtles, although capture levels have not been developed. These fisheries include, but are not limited to bluefish, croaker, flounder,

calico scallops, blue crab and whelk. Of these, the bluefish, croaker and flounder trawl fisheries likely pose the most serious threats. The harvest of sargassum by trawlers can result in incidental capture of post hatchlings and habitat destruction (NMFS, USFWS, 1991).

Effect Determination

Loggerhead sea turtle nesting activities have been recorded within the project area at FBCP. Folly Beach has a very active volunteer turtle monitoring task force. Data collected from the last four turtle nesting seasons is summarized and provided at website http://www.Follyturtles.com. Review of data on this web site indicated that there were six turtle nests on the beach at FBCP during the nesting season of 2001. Of those six, five were relocated due to the potential of adverse conditions, particularly flooding, of the nest site. The sixth nest was a wild nest that was not identified until after hatching. All of the nests (wild and relocated) had good nesting success, averaging 93%. From 1998 through the 2000-nesting season, 11 nests were laid, and 12 false crawls or aborted nest sites were identified on the FBCP beach. Of the six nests laid during the 1999 and 2000 seasons, two nests were relocated, two were impacted by high tides, and two hatched from the original nest location (one with poor survival rates - 3%, and one successfully). Data for 1998 does not include this information. Review of these numbers supports the conclusion that conditions at the FBCP and at the proposed disposal site are not conducive to successful nesting without human intervention (i.e. relocation of nests).

The placement of sand and construction activities associated with the placement of that sand on these beaches could adversely affect any existing sea turtle nests and sea turtles attempting to nest. The extent of nesting on FBCP is considered to be minor and irregular when compared with other beaches along the coast. The construction work is expected to be completed prior to the nesting season. Therefore, a standardized nest monitoring and relocation plan will not be implemented unless the project is delayed and extends into the turtle-nesting season.

Usually, the Charleston District implements a standard beach monitoring protocol to measure beach hardness/compaction after placement of disposal material on the beach. After the material is disposed of on the beach, any areas that are determined to have an in situ hardness greater than 500 Cone Penetrometer Units (CPU) is tilled in order to make it suitable for sea turtle nesting. However, the proposed beach disposal area at FBCP is only approximately 1200 feet long and the material will be placed on a slope without forming a dune system. Since this distance is relatively short compared to the rest of the beach, erodes severely within a few months, is utilized very little by turtles for nesting purposes, and is not an area where the turtles nest with a high success rate without human intervention, tilling is not recommended. The District does, however, recommend conducting cone penetrometer testing before and after the dredging in an effort to collect data, which can be correlated with the turtle nesting during the summer, and which may provide useful information for other beach renourishment projects.

All of the dredging for the proposed project will be accomplished with a hydraulic pipeline cutterhead dredge in the specified areas. Visual surveys for

escarpments along the project area will be made during construction and immediately after completion of the O&M Project and prior to May 1. Escarpments exceeding 18 inches in height for a distance of 100 feet or more will be graded down.

This project is not being designed to enhance turtle habitat and is planned to be completed prior to turtle nesting season. However, because turtles may attempt to nest here and false crawls may occur due to the lack of suitable habitat, it has been determined that the project may adversely affect the loggerhead sea turtle.

6.03 Shortnose sturgeon

The Shortnose Sturgeon occurs in Atlantic Seaboard Rivers from southern New Brunswick to northeastern Florida. Department of Commerce studies have shown that the shortnose sturgeon exists in many of the large coastal river systems in South Carolina including the Waccamaw, Pee Dee, Black, Santee, Cooper, Ashepoo, Combahee and Edisto Rivers. Little is known about the shortnose sturgeon population level, life history or ecology. Their status is probably due to exploitation, damming of rivers and deterioration of water quality. Because there is not a large coastal river associated with this project, there is a lack of suitable freshwater spawning areas for the sturgeon in the immediate project area.

Effect Determination

It is unlikely that the shortnose sturgeon occurs in the project area, however, should it occur, its habitat would be only minimally altered by the proposed project. Any shortnose sturgeons in the area should be able to avoid being taken by a slow moving pipeline dredge. For these reasons, it has been determined that the proposed project is not likely to adversely affect the shortnose sturgeon.

6.04 Seabeach Amaranth

Seabeach amaranth (*Amaranthus pumilus*) is an annual plant historically native to the barrier island beaches of the Atlantic coast from Massachusetts to South Carolina. No other vascular plant occurs closer to the ocean. The species was Federally listed as threatened by the U.S. Fish and Wildlife Service in 1993 (COE, 2001). Seabeach amaranth is listed as threatened and of national concern in South Carolina.

Germination takes place over a relatively long period of time, generally beginning in April and continuing at least through July. Upon germinating, this plant initially forms a small-unbranched sprig but soon begins to branch profusely into a clump, often reaching a foot in diameter and consisting of 5 to 20 branches. Occasionally a clump may get as large as a yard of more across, with hundreds of branches. The stems are fleshy and pink-red or reddish, with small rounded leaves that are 1.3 to 2.5 centimeters in diameter. The leaves are clustered toward the tip of the stem, are normally a somewhat shiny, spinach-green color, and have a small notch at the rounded tip. Flowers and fruits are relatively inconspicuous and are borne in clusters along the stems. Flowering begins as soon as plants have reached sufficient size, sometimes as early as June in the Carolinas but more typically commencing in July and continuing until their death in late fall or

early winter. Seed production begins in July or August and reaches a peak in most years in September; it likewise continues until the plant dies (COE, 2001).

Seabeach amaranth occurs on barrier island beaches, where its primary habitat consists of overwash flats at accreting ends of islands and lower foredunes and upper strands of non-eroding beaches. It occasionally establishes small temporary populations in other habitats, including sound side beaches, blowouts in foredunes, and in dredged material placed for beach renourishment or disposal. Seabeach amaranth appears to be intolerant of competition and does not occur on well-vegetated sites. The species appears to need extensive areas of barrier island beaches and inlets, functioning in a relatively natural and dynamic manner. These characteristics allow it to move around in the landscape as a fugitive species, occupying suitable habitat as it becomes available (COE, 2001).

Seabeach amaranth is a "fugitive" species that cannot compete with dense perennial beach vegetation and only occurs in the newly-disturbed habitat of a high-energy beach. It occurs on barren or sparsely-vegetated sand above the high water line, an area classified as marine wetland. This habitat usually disappears completely when seawalls or other hard structures are built along the shoreline. This loss of habitat from seawall construction and global sea level rise are thought to be major factors in the species' extirpation throughout parts of its historic range. It has been postulated that estuarine and coastal shore plants will suffer some of the most significant impacts as a result of global climate changes. Coastal development will prevent these species from migrating up slope to slightly higher ground if sea levels rise. To a large extent, this is already occurring as beaches are being fortified to prevent erosion. Beach renourishment projects eliminate existing plants if conducted during the summer and may bury the seed needed to reestablish the plant the following year if conducted during the winter. However, beach renourishment projects often rebuild the habitat this species requires. Fortification with seawalls and other stabilization structures or heavy vehicular traffic may eliminate seabeach amaranth populations locally. Any given site will become unsuitable at some time because of natural forces. However, if a seed source is no longer available in adjacent areas, seabeach amaranth will be unable to reestablish itself when the site is once again suitable or new favorable habitat is created. In this way, it can be progressively eliminated even from generally favorable stretches of habitat surrounded by permanently unfavorable areas (COE, 2001).

Historically, seabeach amaranth occurred in 31 counties in 9 states from Massachusetts to South Carolina. It has been eliminated from six of the States in its historic range. The only remaining large populations are in North Carolina. Surveys in South Carolina found that the number of plants along our coast dropped by 90% (from 1,800 to 188) as a result of Hurricane Hugo, subsequent winter storms and beach rebuilding projects that occurred in its wake. South Carolina populations are still very low and exhibit a further downward trend although 1998 was a better year than most with 279 plants identified along the coast. It is possible that the abundant rainfall associated with El Nino in the spring of 1998 produced a larger than normal population. The remaining populations in areas with suitable habitat are in constant danger of extirpation

from hurricanes, webworm predation, and other natural and anthropogenic factors (COE, 2001). At the present time, there are no known populations of seabeach amaranth in the project area.

Effect Determination

Because there are no know populations of seabeach amaranth in the project area, there is also no viable seed source. As such, the proposed project is not likely to adversely effect seabeach amaranth.

6.05 Piping plover and designated piping plover critical habitat

Piping plovers are small shorebirds approximately six inches long with sand-colored plumage on their backs and crown and white under parts. Breeding birds have a single black breast band, a black bar across the forehead, bright orange legs and bill, and a black tip on the bill. During the winter, the birds lose the black bands, the legs fade to pale yellow, and the bill becomes mostly black.

The piping plover breeds on the northern Great Plains, in the Great Lakes region, and along the Atlantic coast (Newfoundland to North Carolina); and winters on the Atlantic and Gulf of Mexico coasts from North Carolina to Mexico, and in the Bahamas West Indies.

Piping plovers nest along the sandy beaches of the Atlantic Coast from Newfoundland to North Carolina, the gravelly shorelines of the Great Lakes, and on river sandbars and alkali wetlands throughout the Great Plains region. They prefer to nest in sparsely vegetated areas that are slightly raised in elevation (like a beach berm). Piping plover breeding territories generally include a feeding area, such as a dune pond or slough, or near the lakeshore or ocean edge. The piping plover winters along the coast, preferring areas with expansive sand or mudflats (feeding) in close proximity to a sandy beach (roosting). The primary threats to the piping plover are habitat modification and destruction, and human disturbance to nesting adults and flightless chicks. A lack of undisturbed habitat has been cited as a reason for the decline of other shorebirds such as the black skimmer and least tern (COE, 2001).

The piping plover is an occasional visitor along the South Carolina coast during the winter months and individuals are occasionally sighted in the project area. However, there are no large wintering concentrations in the state. Piping plovers are considered a threatened species under the Endangered Species Act of 1973, as amended, when on their wintering grounds. The species is not known to nest in the project area; however, it may winter in the area, particularly on the BKSC. The USFWS has designated 15 areas along the South Carolina (SC) coast as critical habitat for the wintering populations of the piping plover. This includes approximately 138 miles of shoreline along the SC coast along margins of interior bays, inlets, and lagoons. Figure 2 which delineates Unit SC-9, the designated critical habitat in the project area, was obtained from the FWS website.

Effect Determination

Disposal of the dredged material is currently scheduled to occur during early Spring 2002 for this dredging cycle. Direct loss of nests from the disposal of the dredged material will not occur, as the species is not known to nest in the project area. Piping plover foraging distribution on the beach during the winter months may be altered as beach food resources may be affected by disposal of material. Such disruptions will be temporary and of minor significance since the birds can easily fly to other loafing and foraging locations. In addition, both FBCP and the southeast side of BKSC have experienced erosion. As a result of the low quantity of material (11,000 cubic yards), the material is planned for placement on the northwest side of BKSC in an effort to provide stabilization of that low area. Placement of material on FBCP and BKSC may provide additional foraging habitat for the piping plover. For these reasons, it has been determined that the proposed project is not likely to adversely affect the piping plover. It has also been determined that the proposed project is not likely to adversely modify designated critical habitat for wintering piping plovers.

7.0 SUMMARY OF PROTECTIVE MEASURES

If construction is delayed and extends into the summer months (June through September), contract personnel will be advised that there are civil and criminal penalties for harming, harassing, or killing manatees. The Contractor may be held responsible for any manatee harmed, harassed, or killed as a result of vessel collisions or construction activities. Failure of the Contractor to follow these specifications is a violation of the Endangered Species Act and could result in prosecution of the Contractor under the Endangered Species Act or the Marine Mammals Protection Act. The standard manatee conditions apply annually from 1 June to 30 September. It is the responsibility of the Contractor to take necessary precautions to avoid any contact with manatees. If manatees are sighted within 100 yards of the dredging area, all appropriate precautions shall be implemented to insure protection of the manatee. The Contractor will stop, alter course, or maneuver as necessary to avoid operating moving equipment (including watercraft) any closer than 50 feet of the manatee. Operation of equipment closer than 50 feet to a manatee shall necessitate immediate shutdown of that equipment.

A nest relocation program for sea turtles will be implemented to minimize impacts to nesting sea turtles only if the dredging activity extends into the nesting season. This program will include daily patrols of disposal areas at sunrise, relocation of any nests laid in areas to be impacted by disposal of dredged material, and monitoring of hatching success of the relocated nests. If nest relocation is required, sea turtle nests will be relocated to an area suitable to both the USFWS and the SCDNR. A beach monitoring program (for hardness/escarpment formation) will be implanted. The Corps will perform any necessary maintenance of beach profile (tilling and shaping or knocking down escarpments) during construction and prior to the nesting season. Monitoring in follow-up years is unnecessary as the project area erodes severely each year

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

Further, if construction is delayed and extends into the nesting season, all on-beach lighting associated with the project will be limited to the immediate area of active construction during construction of this project. Such lighting will be shielded, low-pressure sodium vapor lights to minimize illumination of the nesting beach and nearshore waters. Red filters will be placed over vehicle headlights (i.e., bulldozers, front end loaders). No offshore equipment will be required to construct this project as proposed. However, if required, lighting on offshore equipment will be similarly minimized through reduction, shielding, lowering, and appropriate placement of lights to avoid excessive illumination of the water, while meeting all U.S. Coast Guard and OSHA requirements. Shielded, low pressure sodium vapor lights will be highly recommended for lights on any offshore equipment that cannot be eliminated.

8.0 SUMMARY EFFECT DETERMINATION

This assessment has examined the potential impacts of the proposed project on designated habitat and listed species of plants and animals that are, or have been, present in the project area. Both primary and secondary impacts to habitat have been considered. Critical habitat has not been designated for whales, manatees, sea turtles, sturgeon, or seabeach amaranth in South Carolina; therefore, none would be affected. The USFWS designated critical habitat for the wintering piping plover in July 2001. Based on the analysis provided by this document, the following determinations have been made.

- It has been determined that the proposed project is not likely to adversely affect the manatee.
- It has been determined that the proposed project is not likely to adversely affect Kemp's ridley, leatherback, green, or hawksbill sea turtles.
- It has been determined that the proposed project is not likely to adversely affect the shortnose sturgeon.
- It has been determined that the proposed project is not likely to adversely affect the piping plover.
- It has been determined that the proposed project is not likely to adversely affect seabeach amaranth.
- It has been determined that the proposed project is not likely to adversely modify designated critical habitat for the wintering piping plover.
- It has been determined that the proposed project may affect- is likely to adversely affect the nesting loggerhead sea turtle.

LITERATURE CITED

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