SOUTHERN PALM BEACH ISLAND COMPREHENSIVE SHORELINE STABILIZATION PROJECT

Draft Essential Fish Habitat

U.S. Army Corps of Engineers
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COMPREHENSIVE SHORELINE STABILIZATION PROJECT
DRAFT ESSENTIAL FISH HABITAT ASSESSMENT

TABLE OF CONTENTS

LIST OF FIGURES

Figure No.

LIST OF TABLES

Table No.

LIST OF PHOTOGRAPHS

Photograph No.

1.0. INTRODUCTION

The Magnuson Fishery Conservation and Management Act of 1976, amended Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act, MSFCMA) by the Sustainable Fisheries Act of 1996, set forth a mandate to identify and protect important marine and estuarine fish and their habitat. The U.S. Congress enacted the Magnuson-Stevens Act to support the government's goal of sustainable fisheries. Crucial to achieving this goal is the maintenance of suitable marine fishery habitat quality and quantity. This goal is achieved through identifying and describing Essential Fish Habitat (EFH), describing non-fishing and fishing threats, and suggesting measures to conserve and enhance EFH. The Magnuson-Stevens Act defines EFH as "...those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (16. U.S.C. 1802 (10))."

Rules promulgated by the National Marine Fisheries Service (NMFS) in 2002 further clarify EFH with the following definitions: **waters** - aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; **substrate** - sediment, hardbottom, structures underlying the waters, and associated biological communities; **necessary** - the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and **spawning, breeding, feeding, or growth to maturity** - stages representing a species' full life cycle. EFH may be a subset of all areas occupied by a species. The 1996 amendments to the Magnuson-Stevens Act require regional fishery management councils and federal agencies to promote protection, conservation, and enhancement of EFH. The EFH provisions of the Magnuson-Stevens Act support one of the Nation's overall marine resource management goals -maintaining sustainable fisheries. Achieving this goal requires maintenance of the quality and quantity of habitats necessary for fishery resources.

> **EFH** is defined in the **MSFCMA** as *"...those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity."*

The EFH mandates of the Magnuson-Stevens Act represent an effort to integrate fishery management, and habitat management by stressing the dependency of healthy, productive fisheries on the maintenance of viable and diverse estuarine and marine ecosystems. The consultation requirements in the Magnuson-Stevens Act direct federal agencies to consult with the National Oceanic and Atmospheric Administration's (NOAA) NMFS when any of their activities may have an adverse effect on EFH. An adverse effect is defined by EFH rules as "any impact which reduces quality and/or quantity of EFH… [and] may include direct, indirect, site-specific, or habitat wide impacts, including individual, cumulative, or synergistic consequences of actions" (50 CFR 600.810). The purpose of this EFH Assessment, as required by the Magnuson-Stevens Act, is to identify all EFH and managed species that may occur within the proposed Project Area for the Southern Palm Beach Island Comprehensive Shoreline Stabilization Project (the Project), and to examine potential adverse effects to these resources.

The South Atlantic Fisheries Management Council (SAFMC), one of eight regional fishery management councils in the United States, currently manages eight fisheries, including: penaeid shrimp, snapper grouper complex, Coastal Migratory Pelagic (CMP) species, golden crabs, spiny lobsters, coral and live bottom habitat, dolphin and wahoo, and sargassum (SAFMC, 2014a; Iverson, pers. comm., 2010). Red drum were jointly managed in state and federal waters by the SAFMC and the Atlantic States Marine Fisheries Commission (ASMFC) for nearly two decades, but the management of red drum was transferred to the ASMFC in 2008 and so this species is not assessed in this document (Arnott et al., 2013; Sramek, pers. comm., 2014; Karazsia, pers. comm., 2014). In addition to the fishery management plans (FMP) prepared by SAFMC, NMFS (Highly Migratory Species Management Unit, Office of Sustainable Fisheries) manages highly migratory species (HMS) such as tunas, billfishes, sharks, and swordfish. Some of the species managed by SAFMC and NMFS also fall under the jurisdiction of the ASMFC, which manages fishery resources from Maine through Florida.

During consultation, consideration must also be given to Habitats of Particular Concern (HAPC), which are described as subsets of EFH which are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area (NMFS, 2010). SAFMC has determined that the nearshore hardbottom resources from Cape Canaveral to Broward County, Florida, including the resources located adjacent to the Project Area, meet the criteria as HAPC for coral, coral reefs and live/hardbottom (SAFMC, 2009a, 2011).

The Town of Palm Beach and Palm Beach County have both proposed shoreline stabilization projects that are adjacent to one another. The U.S. Army Corps of Engineers (USACE) determined that the proposed projects are similar actions, and is therefore evaluating the environmental effects of these projects together (78 FR 40128). The comprehensive project has been named the Southern Palm Beach Island Comprehensive Shoreline Stabilization Project (the Project) and the Project Area comprises approximately 2.07 miles of shoreline and nearshore environment from Florida Department of Environmental Protection (FDEP) R-monuments R-129-210 to R-138+551 (Figure 1-1).

The USACE serves as the lead federal agency for Endangered Species Act (ESA) Section 7 and EFH consultations for this Project, and determined that an Environmental Impact Statement (EIS) was required - this EFH Assessment will supplement the EIS. The two projects that make up the Southern Palm Beach Island Comprehensive Shoreline Stabilization Project will each be constructed by the separate Applicants: the Town of Palm Beach and Palm Beach County. While the USACE is evaluating the environmental effects of these projects together, the USACE will complete EFH consultation for the Town of Palm Beach and Palm Beach County projects separately in association with their respective permit applications. This EFH assessment will assist NMFS Habitat Conservation Division with EFH consultation for both permit applications.

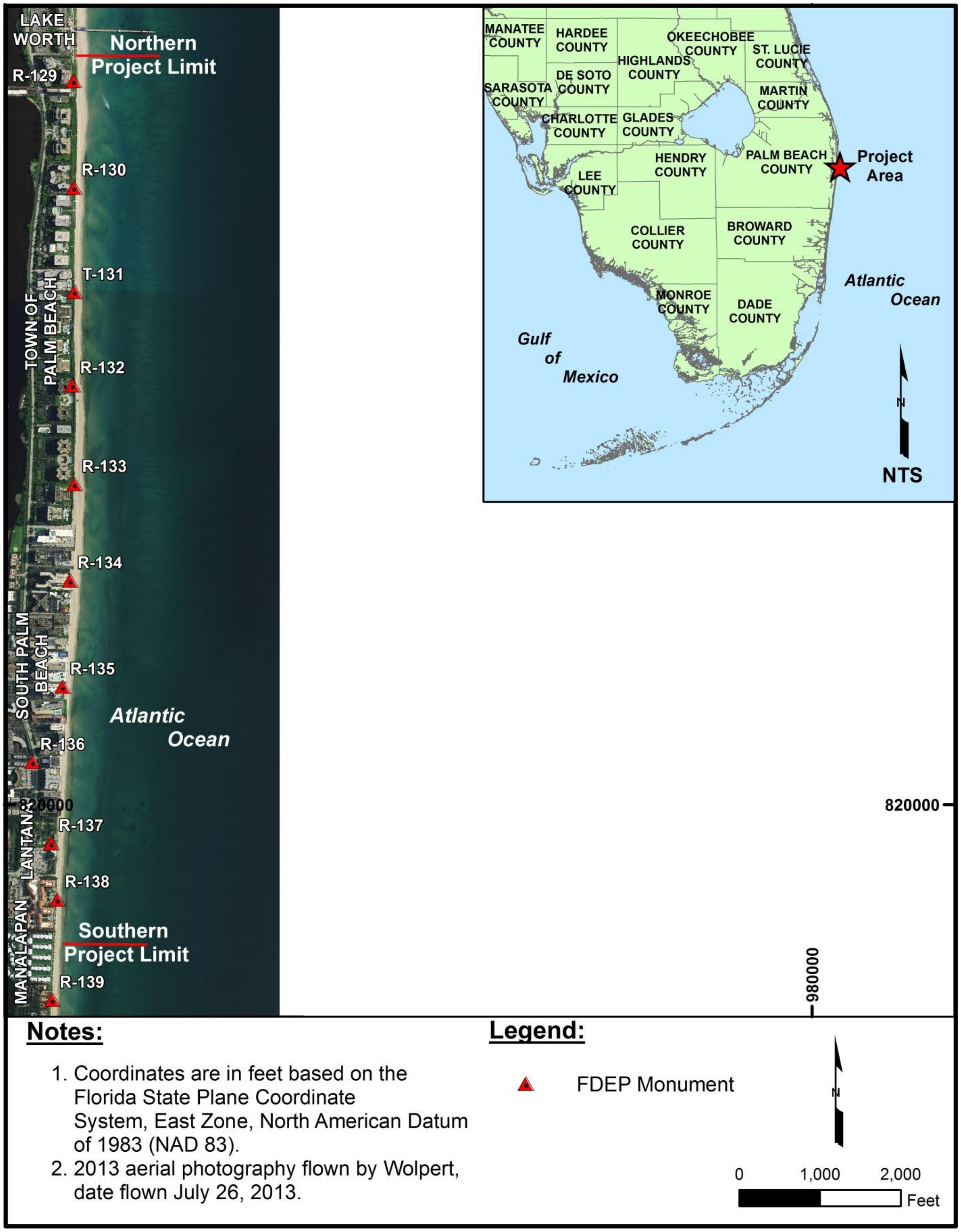

Figure 1-1. Location map of the Project Area.

This EFH Assessment includes: 1) a description of the proposed Project; 2) a description of EFH in the Project Area; 3) a description of managed species and life stages within the EFH and the HAPC located within the Project Area; 4) an assessment of anticipated impacts to the EFH; and 5) a discussion of proposed mitigation measures to minimize impacts to EFH.

The Project Area falls under the jurisdiction of the SAFMC, which is responsible for the conservation and management of fish stocks within the federal 200-mile limit of the Atlantic Ocean off the coasts of North Carolina, South Carolina, Georgia, and east Florida to Key West. Table 1-1 lists the important habitats within estuarine and marine areas of the South Atlantic region as designated by the comprehensive EFH amendment (SAFMC, 1998) and Fishery Ecosystem Plan (SAFMC, 2008). Although unconsolidated (soft) bottom is not defined as an EFH category in FMP Amendments by the SAFMC, it has been listed as EFH for certain life stages of snapper grouper, spiny lobster and shrimp FMPs (SAFMC, 2014b), and is therefore also included in Table 1-1. The Project Area encompasses only marine areas, specifically nearshore hardbottom and coral habitat, water column, and unconsolidated (soft) bottom.

Table 1-1. Essential Fish Habitat Identified in Fishery Management Plan Amendments of the South Atlantic Fisheries Management Council (SAFMC, 1998, 2008, 2014b; NMFS, 2010).

ESTUARINE AREAS	MARINE AREAS
Estuarine Emergent Wetlands	Live / Hardbottom
Estuarine Scrub/Shrub Mangroves	Coral & Coral reefs
Submerged Aquatic Vegetation	Artificial / Manmade reefs
Oyster Reefs & Shell Banks	Sargassum
Intertidal Flats	Water Column
Palustrine Emergent & Forested Wetlands	Unconsolidated bottom (soft sediments)
Aquatic Beds	
Estuarine Water Column	

2.0. PROJECT DESCRIPTION

2.1. PROPOSED PROJECT

The Project proposes to use beach fill placement and coastal protection structures to enhance the existing beach and dune system for storm protection to upland property and to improve recreation and enhance the habitat. The Project would place approximately 150,000 cy of sand between R-129-210 and R-138+551 along the shorelines of the Towns of Palm Beach, South Palm Beach, Lantana and Manalapan (Figure 2-1). The sand volume will be split between the two Applicants' project areas – 75,000 cy of sand in the Town of Palm Beach and 75,000 cy in the County project area (Towns of South Palm Beach, Lantana and Manalapan). From north to south, the Project would place dune sand only from R-129-210 to R-129+150, dune and beach sand from R-129+150 to R-131, dune sand only from R-131 to R-134+135 (Town of Palm Beach southern limit), and beach sand with seven (7) low-profile groins from R-134+135 to R-138+551. The groins would be placed perpendicular to the shoreline extending from the existing seawalls to the post-construction (beach fill) waterline.

It is anticipated that the mechanism for sand placement would involve use of a truck-haul approach. The sand source would be a combination of stockpiled dredge material from the Reach 7 Phipps Ocean Park Beach Restoration Project (Phipps) (SAJ-2000-00380) or the Mid-Town Beach Restoration Project (Mid-Town) (SAJ-1995-03779) for placement within the Town of Palm Beach project limits, and upland sand for placement within the County project limits. The Phipps and Mid-Town Projects would utilize either a hopper or cutterhead dredge to obtain beach quality sand from an offshore borrow area. If the project schedules do not coincide, the Town of Palm Beach may truck in sand from upland mines. The Project has been designed to provide approximately 2-4 years of protection, depending on the rate of erosion. A shorter frequency between sand placement events would be expected if the erosion rate is accelerated due to hurricanes, tropical storms, swell events, nor'easters or other shoreline eroding events. Future beach nourishment projects can be expected to match the currently proposed beach and dune profile, and require a similar volume of sand. The groin construction would only occur during the first construction event, but may require future operations and maintenance.

2.1.1. TRUCK HAUL OPERATIONS

Utilizing a truck-haul approach for a beach nourishment project involves several stages of transport: loading of material at the mine site, road transport via dump trucks, beachside delivery and stockpiling, transfer from stockpile to off-road vehicles, beach transport, placement, and finally, spreading of material and grooming to the design shape; however, if the project schedules do not coincide, the Town of Palm Beach may truck in sand from upland mines. The County prefers to utilize sand only from an upland mine.

Sand from either source must meet FDEP requirements for beach sand compatibility as per Florida Administrative Code, Rule 62B-41.007(2)(j). These criteria apply to all beaches in Florida so that the sand closely resembles the “native” sand for biological, physical and aesthetic purposes. For the specific Project Area, any sand source must be consistent with the BMA cell-wide sediment quality specifications (Table 2-1) (FDEP, 2013a). The sand source used for the County project must also meet the County's technical sand specifications (provided as Appendix B to the EIS). According to the County’s technical standards, sand must be obtained from a source further than 800 ft landward of the coastal construction control line, must be similar in color to the native beach material, must be free of construction debris, rocks, clay, or other foreign matter, must have less than 1% organic material, must be free of coarse gravel or cobbles, must have a particle size distribution ranging predominantly between 0.074 mm and 4.76 mm, and must be well-drained and free of excess water and have a moisture content of less than 10%. By adhering to the above standards and regulations, no foreign matter or unacceptable material as a component of the fill material is anticipated.

Table 2-1. Sediment compliance specifications (FDEP, 2013).

Sediment Parameter	Parameter Definition	Compliance Value
Mean Grain Size	Min and max values (using moment method calculation)	0.25 mm to 0.60 mm
Maximum Silt Content	Passing #230 sieve	2%
Maximum Fine Gravel Content*	Retained on #4 sieve	5%
Munsell Color Value	Moist value (chroma = 1)	6 or lighter

Note: the beach material shall not contain construction debris, toxic material, other foreign matter, coarse gravel or rocks.
***Shell content is used as the indicator of fine gravel content for the implementation of quality control/quality assurance procedures.**

Offshore sand source. A stockpile of dredged material from either the Phipps or Mid-Town Project is the preferred sand source for placement in the Town of Palm Beach limits. This material will be dredged under authorization of the Palm Beach Island Beach Management Agreement (BMA) (FDEP, 2013) and the USACE permit Number SAJ-2000-00380 (Phipps) or SAJ-1995-03779 (Mid-Town), and may include sand from North Borrow Area 1 (NBA1), South Borrow Area 2 (SBA2), South Borrow Area 3 (SBA3) (Figure 2-2) or any offshore sand source that is consistent with the BMA cell-wide sediment quality specifications (Table 2-1) (FDEP, 2013). The total proposed volume for placement within the Town of Palm Beach is approximately 75,000 cy, 12,000 cy of which will be placed below mean high water.

Upland sand source. The sand source for the County project area is sand from domestic upland sand quarries within the state of Florida. The sand would be placed on the beach mechanically, rather than hydraulically. There are known sand mines within 160 km (100 mi) of the Project shoreline that have provided clean, quality material for past nourishment projects in southeast Florida. Due to a larger mean grain size and smaller fines content, upland sand is expected to be more stable and produce less turbidity in the nearshore environment than sand obtained from offshore borrow areas in Broward County (OAI, 2012). In-water work may occur if vessels are required during turbidity monitoring and for groin construction.

2.1.2. GROIN CONSTRUCTION

The County portion of this Project also includes the construction of seven (7) groins placed perpendicular to the shoreline extending from the existing seawalls to the post-construction (beach fill) shoreline in South Palm Beach, Lantana and Manalapan (R-134+135 to R-138+551) (Figure 2-1). The groins will be low-profile, meaning that they are designed to be level with the berm and are intended to blend in with the beach. They will be concrete king pile and panel groins with 18 inch (+/-) wide H-piles spaced every 8 to 10 ft (similar to structure shown in Photograph 2-1). Exact location and length of the groins will depend on the presence of nearshore hardbottom resources at the time of construction, but it is currently estimated that they will be approximately 90 ft long and spaced approximately 300 ft apart. As the sand naturally erodes from the beach, the groins would gradually become partially exposed until the next nourishment. The result will be a disruption of the natural littoral sand transport system along the beach in this area, with sand accretion/sediment deposition occurring on the updrift side and erosion on the downdrift side of the groin field. The construction of the groins may occur from either land-based operations or using in-water construction, or a combination of the two methods.

Photograph 2-1. Shoreward view of a concrete king pile and panel groin.

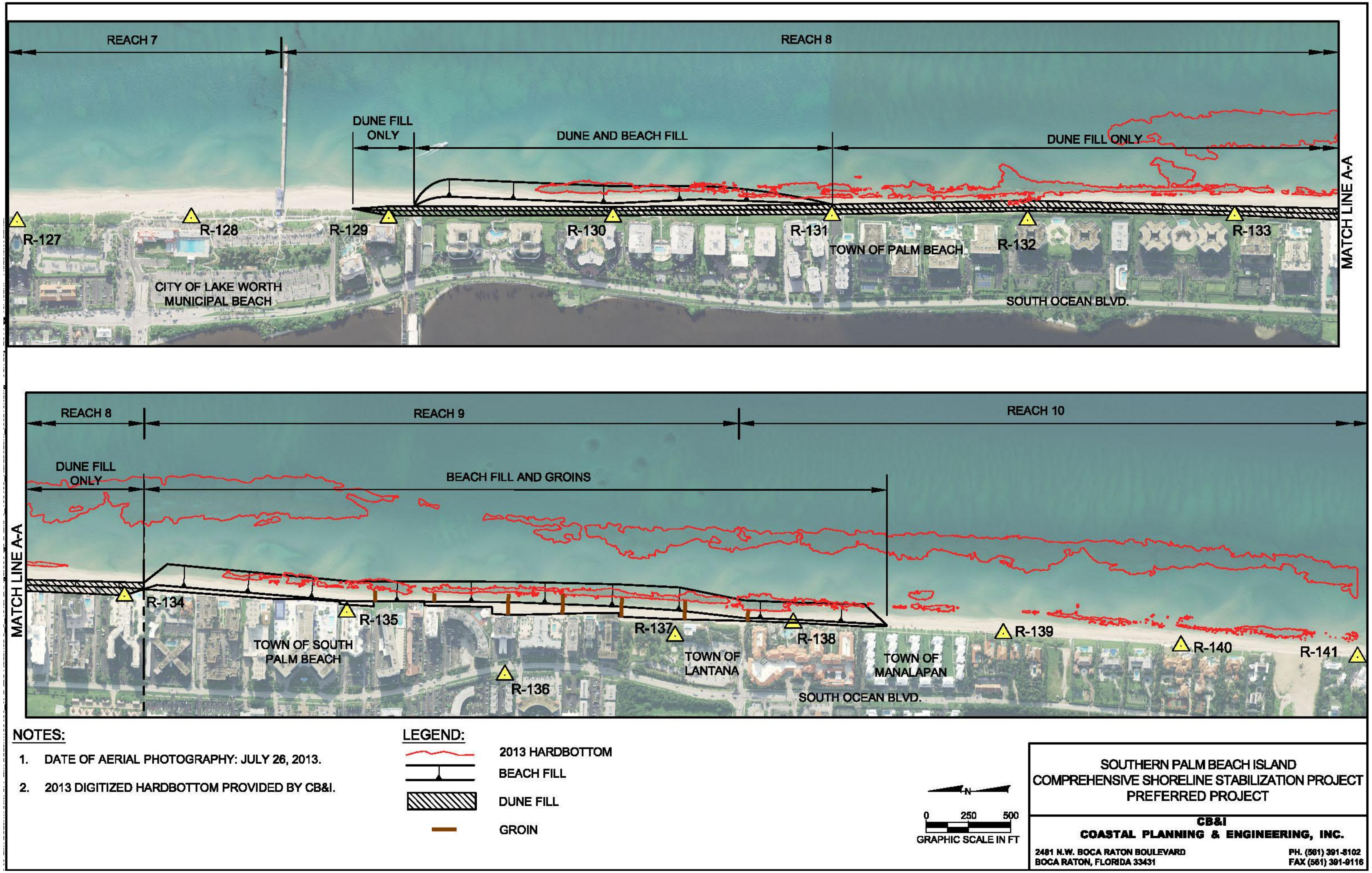

Figure 2-1. Proposed Southern Palm Beach Island Comprehensive Shoreline Stabilization Project.

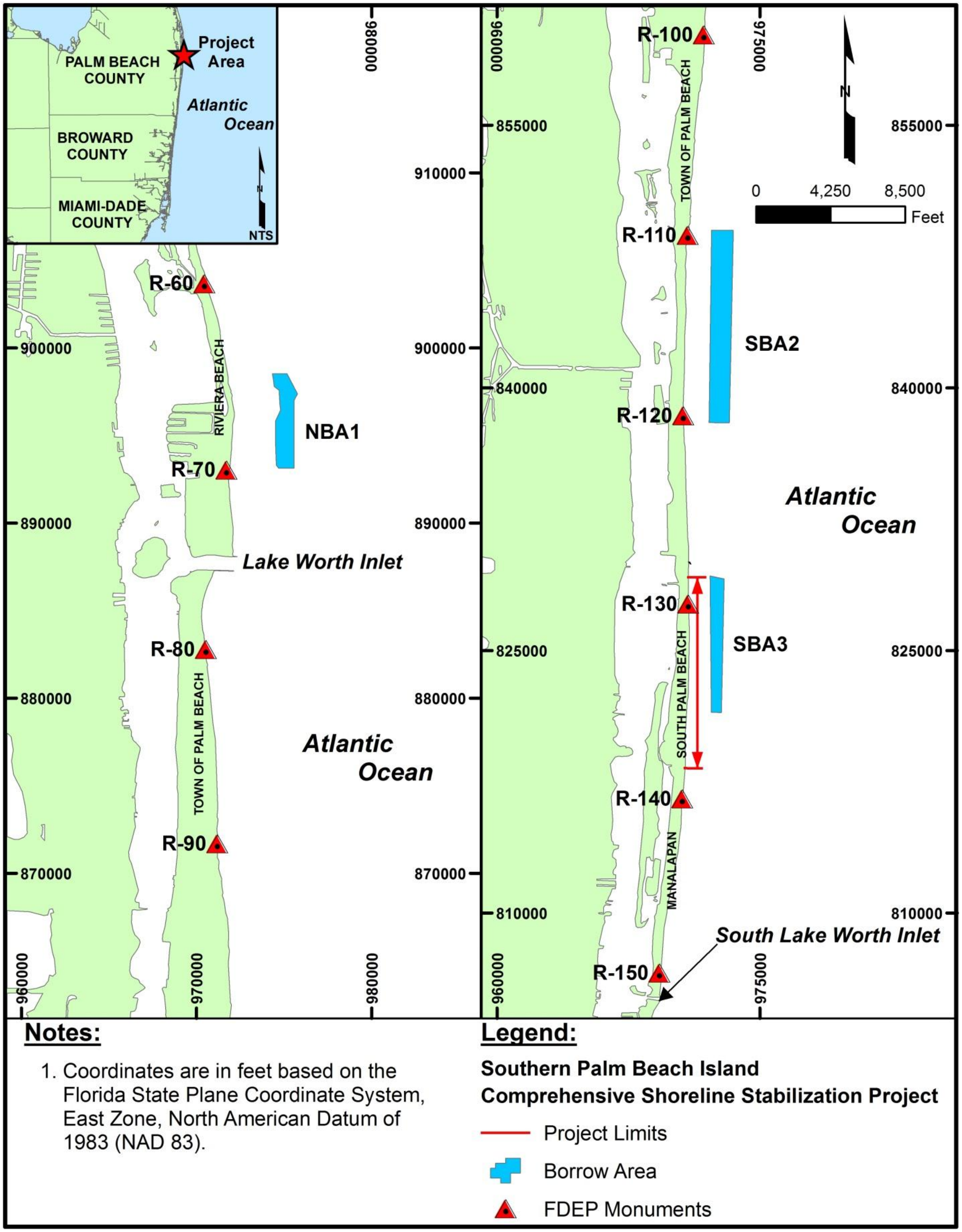

Figure 2-2. Potential borrow areas to be used during the Phipps and/or Mid-Town projects that may supply the fill for the Project within the Town of Palm Beach limits (R-129-210 to R-134+135).

3.0. EFH IN THE PROJECT AREA AND MANAGED SPECIES

3.1. EFH IN THE PROJECT AREA

Of the EFH areas designated by the SAFMC, the Southern Palm Beach Island Comprehensive Shoreline Stabilization Project Area (R-129-210 to R-138+551) encompasses only marine areas, specifically nearshore coral/live hardbottom, water column, and unconsolidated (soft) bottom. The following sections address the EFH in and near the Project Area. This EFH assessment includes analysis of potential direct and indirect impacts to EFH and managed species from sand placement and groin construction; this assessment does not include the effects associated with dredging offshore borrow areas or the activities associated with stockpiling the dredged material since EFH consultation will occur separately for these activities under the permitting processes for the Phipps and/or Mid-Town projects.

3.1.1. CORAL/LIVE HARDBOTTOM

The SAFMC classifies coral and live/hardbottom habitats as EFH. The Fishery Management Plan for Coral, Coral Reefs and Live/Hard Bottom Habitat of the South Atlantic Region (Coral FMP) defines coral reefs as nearshore hardbottoms, deepwater hardbottoms (including deepwater banks), patch reefs, and outer bank reefs. SAFMC has determined that the nearshore hardbottom resources from Cape Canaveral to Broward County, Florida, including the resources located adjacent to the Project Area, meet the criteria as HAPC for coral, coral reefs and live/hardbottom (SAFMC, 2009a, 2011). According to the SAFMC Final Habitat Plan for the South Atlantic Region (1998), hardbottom habitats in this area are generally low relief areas on continental shelves. They constitute a group of communities characterized by a thin veneer of corals and other biota overlying assorted sediment types.

The SAFMC designates coral, coral reef, and hardbottom habitats as EFH-HAPC for species managed under the snapper-grouper, spiny lobster, and coral, coral reef, and live/hardbottom FMPs. Additionally, sponge habitats are designated EFH-HAPC for the spiny lobster FMP. All demersal fish species under SAFMC management that associate with coral habitats are contained within the FMP for snapper-grouper species and include some of the more commercially and recreationally valuable fish of the region. All of these species show an association with coral or hardbottom habitat during their life history. In groupers, the demersal life history of almost all *Epinephelus* species, several *Mycteroperca* species, and all *Centropristis* species, takes place in association with coral habitat (SAFMC 2009b). Coral, coral reef, and hardbottom habitats benefit fishery resources by providing food or shelter (SAFMC 1983).

Nearshore, shallow hardbottom, defined by FDEP (2013) as the 200-400 meter-wide strip from the shoreline, ranging from the supralittoral zone to the depth of -4 meters (0-13 ft), is found in much of southeast and central Florida, including portions of Broward, Palm Beach, Martin, St. Lucie, Indian River and Brevard Counties. Along most of the East Coast of Florida, the Pleistocene Anastasia Formation forms the main coastal bedrock outcrop (Finkl 1993; Esteves and Finkl, 1999). Anastasia limestone is comprised of sediments and mollusk shells (primarily the coquina clam *Donax)* that accumulated on shorelines 80,000-120,000 years ago (CSA, 2009). Formations that are exposed in the surf zone tend to have smooth surfaces that are abraded by wave and current action. In Palm Beach County, shoreline occurrences of the Anastasia Formation can be found between the Lake Worth Inlet and the South Lake Worth Inlet (also called Boynton Inlet) and occur in a range of morphological expressions of coquina, including inshore and offshore rock reefs (Finkl and Warner, 2005). The nearshore hardbottom within Palm Beach County, including within the Project Area, includes areas of wormrock (Photograph 3-1), formed by tube building sabellariid tubeworms (*Phragmatopoma* spp.) (USACE, 2012). Wormrock reefs provide a nursery for a variety of coastal fish and invertebrate species (FWC, 2014) and support associated assemblages of organisms, such as decapod crustaceans (Gore et al., 1978), which attract fish species.

Photograph 3-1. Wormrock, formed by tube building sabellariid tubeworms (*Phragmatopoma caudata*) as shown in the nearshore community adjacent to R-132 on October 21, 2013.

Field investigations determined that exposure of natural intertidal hardbottom formations located in the Project Area (Photograph 3-2) fluctuate with seasonal variations and storm events (CPE, 2007). These formations are ephemeral in nature and the quantity and quality of intertidal hardbottom changes drastically over short time periods (i.e. six months to one year, or less). Aerial delineations of exposed hardbottom between 2003 and 2013 within and adjacent to the Project Area show that not only does the actual location of exposed hardbottom change, but the total area of exposure has also varied drastically over time (Table 3-1).

Table 3-1. Exposed hardbottom acreage delineated from aerial imagery between 2003 and 2013 from R-127 to R-141+586.

Year of Delineation	Area (ac)
2003	5.22
2004	27.18
2005	37.92
2006	51.20
2007	41.69
2008	29.17
2009	3.06
2010 (June)	18.76
2010 (October)	8.64
2011	15.71
2012	16.62
2013	39.26

Photograph 3-2. Intertidal hardbottom formation located in the Project Area adjacent to R-132 on October 21, 2013.

In situ assessments have been conducted on the nearshore intertidal and subtidal hardbottom formations in the Project Area within the last decade in association with several feasibility studies for coastal construction. Quantitative benthic assessments were conducted in 2006 and 2008 (CPE, 2007; CPE, 2009), hardbottom relief measurements were documented in 2009 and 2010 (CPE, 2010), aerial delineations of hardbottom have been analyzed between 2003 and 2013 (CB&I, 2014), and investigations for listed coral species have been conducted (PBC-ERM, 2013). The most recent survey was conducted in October 2013 to provide updated data of the nearshore habitat for planning and permitting of the proposed Project (CB&I, 2014; PBC-ERM, 2013). Previous surveys are consistent with the findings of the 2013 survey, which documented a benthic community (intertidal and nearshore subtidal hardbottom) dominated by turf algae, sediment, bare hard substrate and macroalgae. Common macroalgae genera have included *Padina, Dictyota, Hypnea, Dasycladus, Laurencia* and *Halimeda*. Wormrock (*Phragmatopoma* caudate) was also observed along with tunicates, sponges, zoanthids, bryozoans, scleractinian (stony) corals and octocorals. Photograph 3-3 shows the subtidal hardbottom offshore of R-135 that was dominated by small (mean < 6 cm) octocorals. The scleractinian species most frequently observed on the intertidal and subtidal hardbottom were *Siderastrea* spp. and *Solenastrea bournoni*. The most common genus of octocoral observed was *Pseudopterogorgia*, with colonies of *Pterogorgia, Muricea* and *Eunicea* documented, as well (CPE, 2005, 2006a, 2007; CB&I, 2014; CPE and CSI, 2011).

Managed species that may utilize the nearshore hardbottom habitat include species of the snapper-grouper complex, coastal inshore shark species, spiny lobster, and coral. Fish reported utilizing this habitat in the nearshore waters of the Project Area are included in Table 3-2 (CPE, 2005, 2007; CB&I, 2014).

Due to the ephemeral nature of the hardbottom in this area, a time-average of exposed hardbottom within the impact area was determined based on aerial delineations between 2003 and 2013. This time-averaged hardbottom was used to estimate impacts and associated mitigation. Based on engineering and modeling results (Appendix G to the EIS), it is anticipated that the Project may result in permanent impacts to 4.03 ac of hardbottom as well as temporary and secondary impacts to 8.13 ac of hardbottom due to direct sand placement and subsequent spreading (equilibration) of sand (Figure 4-1). Impacts to hardbottom were based on a time average of exposed hardbottom delineated from aerial images between 2003 and 2013. Using the engineering and modeling results, historic exposed hardbottom acreage, and recent benthic characterization data, a preliminary Uniform Mitigation Assessment Method (UMAM) evaluation was conducted (provided as Appendix H to the EIS). This draft UMAM analysis determined that 6.39 acres of mitigation may be required to offset these impacts to intertidal and subtidal hardbottom. There are no offshore coral reefs that would be directly affected by the Project. When offshore borrow areas are utilized for the Phipps and Mid-Town projects (permitted separately), coral reefs will be avoided by requiring vessel transit areas and pipeline corridors free of hardbottom.

Photograph 3-3. Benthic community dominated by small octocoral colonies adjacent to R-135 on October 23, 2013 (CB&I, 2014).

Table 3-2. Fish observed over hardbottom resources in or adjacent to the Project Area (CPE, 2005, 2007; CB&I, 2014).

Common Name	Scientific Name	Common Name	Scientific Name
Sergeant-major	*Abudefduf saxatilis*	Spottail pinfish	*Diplodus holbrookii*
Honeycomb cowfish	*Acanthostracion polygonius*	Neon goby	*Elacatinus oceanops*
Scrawled cowfish	*Acanthostracion quadricornis*	Rock hind	*Epinephelus adscensionis*
Ocean surgeonfish	*Acanthurus bahianus*	Silver mojarra	*Eucinostomus aregenteus*
Doctorfish	*Acanthurus chirurgus*	Silver jenny	*Eucinostomus gula*
Blue tang	*Acanthurus coeruleus*	Mojarra sp.	*Eucinostomus* sp.
Black margate	*Anisotremus surinamensis*	Yellowfin mojarra	*Gerres cinereus*
Porkfish	*Anisotremus virginicus*	Nurse shark	*Ginglymostoma cirratum*
Sheepshead	*Archosargus probatocephalus*	Green moray	*Gymnothorax funebris*
Gray triggerfish	*Balistes capriscus*	Spotted moray	*Gymnothorax moringa*
Spotfin hogfish	*Bodianus pulchellus*	Purplemouth moray	*Gymnothorax vicinus*
Spanish hogfish	*Bodianus rufus*	White margate	*Haemulon album*
Eyed flounder	*Bothus ocellatus*	Tomtate	*Haemulon aurolineatum*
Saucereye Porgy	*Calamus calamus*	Caesar grunt	*Haemulon carbonarium*
Sheepshead porgy	*Calamus penna*	Smallmouth grunt	*Haemulon chrysargyreum*
Orangespotted filefish	*Cantherhines pullus*	French grunt	*Haemulon flavolineatum*
Sharpnose puffer	*Canthigaster rostrata*	Spanish grunt	*Haemulon macrostomum*
Yellow jack	*Carangoides bartholomaei*	Cottonwick	*Haemulon melanurum*
Bar jack	*Caranx ruber*	Sailor's choice	*Haemulon parra*
Blue runner	*Caranx crysos*	White grunt	*Haemulon plumierii*
Black seabass	*Centropristis striata*	Bluestriped grunt	*Haemulon sciurus*
Atlantic spadefish	*Chaetodipterus faber*	Grunt sp.	*Haemulon* sp.
Foureye butterflyfish	*Chaetodon capistratus*	Slippery dick	*Halichoeres bivittatus*
Spotfin butterflyfish	*Chaetodon ocellatus*	Clown wrasse	*Halichoeres maculipinna*
Banded butterflyfish	*Chaetodon striatus*	Blackear wrasse	*Halichoeres poeyi*
Atlantic bumper	*Chloroscombrus chrysurus*	Puddingwife	*Halichoeres radiatus*
Colon goby	*Coryphopterus dicrus*	Ballyhoo	*Hemiramphus brasiliensis*

Table 3-2 (cont'd). Fish observed over hardbottom resources in or adjacent to the Project Area.

Common Name	Scientific Name	Common Name	Scientific Name
Bridled goby	*Coryphopterus glaucofraenum*	Halfbeak / Flyingfish	*Hemiramphus* sp.
Longspined porcupinefish	*Diodon holocanthus*	Rock beauty	*Holacanthus tricolor*
Spot-fin porcupinefish	*Diodon hystrix*	Blue angelfish	*Holocanthus bermudensis*
Sand perch	*Diplectrum formosum*	Chub	*Kyphosus sectatrix*
Silver porgy	*Diplodus argenteus*	Hairy blenny	*Labrisomus nuchipinnis*
Mutton snapper	*Lutjanus analis*	Greater soapfish	*Rypticus saponaceus*
Gray snapper	*Lutjanus griseus*	Rainbow parrotfish	*Scarus guacamaia*
Mahogany snapper	*Lutjanus mahogoni*	Pacific spotted scorpionfish	*Scorpaena plumieri*
Lane snapper	*Lutjanus synagris*	Greater amberjack	*Seriola dumerili*
Saddled blenny	*Malacoctenus triangulatus*	Banded rudderfish	*Seriola zonata*
Yellow goatfish	*Mulloidichthys martinicus*	Belted sandfish	*Serranus subligarius*
Black grouper	*Mycteroperca bonaci*	Redband parrotfish	*Sparisoma aurofrenatum*
Gag	*Mycteroperca microlepis*	Redfin parrotfish	*Sparisoma rubripinne*
Yellowtail snapper	*Ocyurus chrysurus*	Stoplight parrotfish	*Sparisoma viride*
Reef croaker	*Odontoscion dentex*	Bandtail puffer	*Sphoeroides spengleri*
Banded jawfish	*Opistognathus macrognathus*	Dusky damselfish	*Stegastes adustus*
Pigfish	*Orthopristis chrysoptera*	Longfin damselfish	*Stegastes diencaeus*
Seaweed blenny	*Parablennius marmoreus*	Beaugregory	*Stegastes leucostictus*
Gulf flounder	*Paralichthys albigutta*	Bicolor damselfish	*Stegastes partitus*
Highhat	*Pareques acuminatus*	Cocoa damselfish	*Stegastes variablilis*
Glassy sweeper	*Pempheris schomburgki*	Needlefish	*Strongylura marina*
Gray angelfish	*Pomacanthus arcuatus*	Channel flounder	*Syacium micrurum*
French angelfish	*Pomacanthus paru*	Pipefish/Seahorse sp.	*Sygnathus* sp.
Spotted goatfish	*Pseudupeneus maculatus*	Sand diver	*Synodus intermedius*
Blue goby	*Ptereleotris calliurus*	Bluehead wrasse	*Thalassoma bifasciatum*
Lionfish	*Pterois volitans*	Great pompano	*Trachinotus goodei*
Smooth trunkfish	*Rhinesomus triqueter*	Yellow stingray	*Urobatis jamaicensis*
Atlantic guitarfish	*Rhinobatos lentiginosus*	Green razorfish	*Xyrichtys splendens*

3.1.2. UNCONSOLIDATED (SOFT) BOTTOM

Unconsolidated bottom is EFH for certain life stages of snapper grouper, spiny lobster, reef fish, stone crab, spiny lobster, corals and reefs, and penaeid shrimp FMPs (SAFMC, 2014b). This habitat type is also used to some extent by many coastal fish species. However, certain species are better adapted to, characteristic of, or dependent on shallow non-vegetated bottom. Flatfish, rays, and skates are well suited for utilization of unconsolidated bottom. Juvenile and adult fish species that forage on the rich abundance of microalgae, detritus, and small invertebrates are highly dependent on the condition of softbottom (SAFMC, 2008).

Two ridges of hardbottom (intertidal and subtidal) are present almost continuously along the proposed Project Area. Due to the ephemeral nature of the hardbottom in this area, one or both may be buried at any given time. Unconsolidated bottom occurs between these nearshore ridges (see Figure 4-1) and sometimes on top of them. The direct placement and equilibration (offshore spreading) of sand from the Proposed Action will permanently bury and/or asphyxiate most infaunal and epifaunal organisms that inhabit the sand. A review of infaunal studies revealed that invertebrate recovery following placement of dredged material in relatively stable, unstressed marine environments generally takes between one and four years, while recovery in more naturally stressed areas is faster, often achieved within nine months (Bolam and Rees, 2003). The quality of the material which will be obtained from upland or offshore sources for use in the Project will meet strict sediment criteria. The similarity of the sand material to the native sediment will aid in the recovery of the benthic communities impacted by the placement of the fill material.

3.1.3. MARINE WATER COLUMN

The SAFMC designates marine water column as EFH. It is the "medium of transport for nutrients and migrating organisms between river systems and the open ocean" (SAFMC, 1998). The water column from Dry Tortugas to Cape Hatteras serves as habitat for many marine fish and shellfish. Most marine fish and shellfish broadcast-spawn pelagic eggs and, thus utilize the water column during a portion of their early life history (e.g. egg, larval and juvenile stages). In general, snapper/grouper complex, penaeid shrimp, Sargassum, spiny lobster, coral and coral reefs, golden and stone crabs, and migratory/pelagic fishes utilize the water column (SAFMC, 1998). Important attributes of the water column include hydrodynamics, temperature, salinity, and dissolved oxygen.

3.2. MANAGED SPECIES

Of the fisheries managed by the SAFMC and NMFS, the following may occur within the Southern Palm Beach Island Comprehensive Shoreline Stabilization Project Area:

- Coral, Coral Reefs, and Live/Hardbottom
- Penaeid shrimp
- Snapper grouper complex
- Spiny lobster
- Coastal migratory pelagic species (including dolphin and wahoo)
- Coastal highly migratory species

Members of these groups occur in the Project Area for at least a portion of their life history. The following sections briefly summarize the EFH for these species and their respective life stages, as described in the relevant FMPs.

3.2.1. CORAL, CORAL REEFS, AND LIVE/HARDBOTTOM

The Fishery Management Plan for Coral, Coral Reefs and Live/Hardbottom Habitat of the South Atlantic Region (Coral FMP) defines coral reefs as nearshore hardbottoms, deepwater hardbottoms, patch reefs, and outer bank reefs. The Coral FMP includes hundreds of species found within coral reef and hardbottom communities. SAFMC has determined that the nearshore hardbottom resources from Cape Canaveral to Broward County, Florida, including the resources located adjacent to the Project Area, meet the criteria as HAPC for coral, coral reefs, and live/hardbottom (SAFMC, 2009a, 2011). Section 3.1.1 of this report summarizes the coral and live hardbottom habitat found within and adjacent to the Project Area, and the species of scleractinian corals, octocorals and fish which have been documented within this habitat.

3.2.2. PENAEID SHRIMP

The shrimp fishery in the South Atlantic includes five species: brown shrimp (*Farfantepeneaus aztecus*), pink shrimp (*Farfantepenaeus duorarum*), white shrimp (*Litopenaeus setiferus*), rock shrimp (*Sicyonia brevirostris*), and royal red shrimp (*Pleoticus robustus*) (SAFMC, 1998; NMFS, 1999a). The shrimp species of the southeastern U.S. occupy similar habitats with the greatest differences being in optimal substrate and salinity. In general, EFH is designated as varied inshore, pelagic, and benthic habitats from the Virginia/North Carolina border to southern Florida. Of these six managed species, pink shrimp are expected to occur within the Project Area as they are the only penaied species whose range includes south Florida (SAFMC, 1998).

Pink Shrimp (Farfantepenaeus duorarum)

Pink shrimp occur from southern Chesapeake Bay to the Florida Keys, and around the coast of the Gulf of Mexico to the Yucatan south of Cabo Catoche. Maximum abundance is reached off southwestern Florida and the southeastern Golfo de Campeche (SAFMC, 2010). Along the Atlantic Coast of the U.S., pink shrimp occurs in sufficient abundance to be of major commercial significance only in North Carolina. Pink shrimp spawn in water depths between 3.7 and 15.8 m (12 and 52 ft) and are most abundant in waters of 11-37 m (36-121 ft) although in some areas they may be abundant as deep as 65 m (213 ft). Pink shrimp are also common in the estuaries and shallow marine waters surrounding southern Florida and into deep waters (approximately 100 m) southeast of the Keys. Post-larval and juvenile pink shrimp are commonly found in seagrass habitats where they burrow into the substrate by day and emerge to feed at night. Shrimp that survive the winter grow rapidly in late winter and early spring before migrating to the ocean (SAFMC, 2010).

3.2.3. SNAPPER GROUPER COMPLEX

Essential fish habitat for snapper grouper species includes coral reefs, live/hardbottom, submerged aquatic vegetation, artificial reefs, and medium to high profile outcroppings on and around the shelf break zone from shore to at least 600 ft (183 m; but to at least 2000 ft/610 m for wreckfish). The annual water temperature range in this area is sufficiently warm to maintain adult populations of members of this largely tropical complex (SAMFC, 2013a).

Of the species managed by the SAFMC, 60 are included in the snapper-grouper complex (SAFMC, 2013a). Because of its mixed-species nature, this fishery is challenging to manage. Through the original FMP and subsequent amendments, the SAFMC has addressed overcapitalization, implemented measures to rebuild overfished species, and is moving forward with the use of Marine Protected Areas (MPA) as a management tool for deepwater species.

The SAFMC's FMP for the snapper grouper resource was first implemented in 1983. Strict management measures, including prohibition of harvest in some cases, have been implemented to rebuild overfished species in the snapper grouper complex. In addition, the SAFMC has used traditional management tools such as bag limits, size limits, trip limits, commercial quotas, and spawning season closures to help rebuild stocks. The SAFMC also approved Amendment 14 to create a system of eight deepwater marine protected areas to help further protect deepwater snapper grouper species and their associated habitat (SAFMC, 2010b). More recently, the SAFMC has explored the use of Limited Access Privilege (LAP) Programs for the snapper grouper fishery, including a program specific for the golden tilefish commercial fishery. There are no MPAs or LAPs in the Project Area.

The following species are managed species that have been observed utilizing live/hardbottom within and adjacent to the Project Area (Table 3-2):

Gray Snapper *(Lutjanus griseus)*

This species occurs in the western Atlantic from Florida to Rio de Janeiro. Young fish are sometimes found as far north as Massachusetts. Habitat can include coral reefs, rocky areas, and wrecks; inshore, gray snapper can be found over smooth bottom, usually near pilings, seagrass meadows and mangrove thickets. They feed mainly at night on small fishes, shrimps, crabs, gastropods, cephalopods, and some planktonic items. Spawning usually occurs in the summer at the dusk of a full moon and in shallow waters. The lifespan of a gray snapper may be up to 21 years and individuals may reach lengths of 89 cm (35 in) and weights of 11 kg (25 lbs) (SAFMC, 2013b). They are an important commercial and game fish species. Gray snapper have been observed in the nearshore hardbottom habitat adjacent to the Project Area (CPE, 2006b).

Greater Amberjack *(Seriola dumerili)*

The greater amberjack occurs in the western Atlantic from Nova Scotia and Bermuda to Brazil, including the West Indies and Gulf of Mexico. Individuals that are at least five years of age, or 85 cm (33.5 in) long, spawn from March through July. Spawning concentrations occur in southeast Florida and the Keys. They may reach a size of 1.8 m (6 ft) and weigh nearly 91 kg (200 lbs). Voracious predators, greater amberjacks eat mostly crab, squid, and other fishes found on reefs. They are often found in small groups and are approachable to divers (SAFMC, 2013c). Greater amberjack has a minor commercial fishery value and is a recreational gamefish. This species has been observed in the nearshore hardbottom habitat adjacent to the Project Area (CPE, 2006b).

Mutton Snapper *(Lujanus analis)*

The mutton snapper ranges from Florida and Bermuda to Brazil. They occur in continental shelf areas, as well as clear waters around islands. Large adults are usually found among rocks and coral, while juveniles occur over sandy, vegetated bottoms. They form small aggregations during the day. Adults may make migrations to spawning sites and spawning activity occurs offshore and may peak during the summer and fall.

Adults are generalized top predators on a variety of reef invertebrates and fishes, particularly slow moving or sedentary benthic and epibenthic prey species. Feeding predominately takes place near the bottom during the day or night (SAFMC, 1998). The mutton snapper is a highly valued commercial and gamefish species and is considered vulnerable due to fishing pressure. This species has been observed in the nearshore hardbottom habitat adjacent to the Project Area (CPE, 2006b; CB&I, 2014).

White Grunt *(Haemulon plumieri)*

White grunts occur in tropical and warm-temperature waters, inhabiting irregular bottom areas of the continental shelf from Virginia to Brazil, including Bermuda, the Caribbean, and the Gulf of Mexico. White grunts are sexually mature during their third year, or when they reach about 25 cm (10 inches) long. Spawning occurs in the late spring and summer. The species is reported to live as long as 13 years, attaining a length of 63.5 cm (25 inches) and weight of 3.6 kg (8 lbs). White grunts are carnivores that feed on bottom-dwelling invertebrates by rooting around in the sand and shell hash between rocky ledges and at the bases of coral formations (SAFMC, 2013d). They are a gamefish and a minor commercial fishery species. White grunts have been observed in the nearshore hardbottom habitat of the Project Area (CPE, 2006b; CB&I, 2014).

3.2.4. SPINY LOBSTER

Essential fish habitat for spiny lobster includes nearshore shelf/oceanic waters; shallow subtidal bottom; seagrass habitat; unconsolidated bottom (soft sediments); coral and live/hard bottom habitat; sponges; algal communities (*Laurencia*); and mangrove habitat (prop roots). In addition, the Gulf Stream is EFH because it provides a mechanism to disperse spiny lobster larvae (SAFMC, 1998). In Florida, HAPCs for spiny lobster include Florida Bay, Biscayne Bay, Card Sound, and coral/hardbottom habitat from Jupiter Inlet through the Dry Tortugas.

Caribbean Spiny Lobster (*Panulirus argus*)

The spiny lobster fishery is managed throughout its range from North Carolina through Texas. The commercial fishery and a large proportion of the recreational fishery occur in waters offshore of south Florida, primarily off Monroe County in the Florida Keys (Marx and Herrnkind, 1986). The principal habitat used by spiny lobster is offshore coral reefs and seagrass to depths of 80 m or more (Marx and Herrnkind, 1986). Areas of high relief on the continental shelf serve as spiny lobster habitat and include coral reefs, artificial reefs, rocky hardbottom substrates, ledges and caves, sloping softbottom areas, and limestone outcroppings. Spiny lobster spawn in offshore waters along the deeper reef fringes (Marx and Herrnkind, 1986). Adult males and females occasionally inhabit bays, lagoons, estuaries, and shallow banks; however, they are not known to spawn in these shallower areas.

3.2.5. COASTAL MIGRATORY PELAGIC SPECIES INCLUDING DOLPHIN AND WAHOO

Coastal migratory pelagic (CMP) species managed under the SAMFC, such as King mackerel, Spanish mackerel, cobia, common dolphinfish, and wahoo utilize the marine water column. EFH for these species includes sandy shoals of capes and offshore bars, high profile rocky bottom and barrier island ocean-side waters, from the surf to the shelf break zone. In addition, all coastal inlets and all state-designated nursery habitats of particular importance to CMPs are considered EFH (SAFMC, 1998). The Gulf Stream is also considered EFH because it provides a mechanism to disperse CMP larvae. Within the spawning area, eggs and larvae are concentrated in the surface waters.

The Gulf Stream, Charleston Gyre, Florida Current, and pelagic *Sargassum* are considered EFH for dolphin and wahoo (SAFMC, 2003). EFH-HAPC for dolphin and wahoo in the Atlantic include: The Point, The Ten-Fathom Ledge and Big Rock (North Carolina); The Charleston Bump and The Georgetown Hole (South Carolina); The Point off Jupiter Inlet (Florida); The Hump off Islamorada (Florida), The Marathon Hump off Marathon (Florida); The “Wall” off the Florida Keys, and Pelagic *Sargassum* (SAFMC, 2003).

Dolphin *(Coryphaena* spp.)

Dolphinfishes, including the common dolphin *(Coryphaena hippurus)* and pompano dolphin (*Coryphaena equiselis),* are highly prized commercial and recreational fish species found in tropical and subtropical seas. Both species may breed year-round. Dolphin is an oceanic species that may be found on the continental shelf. The maximum life span of dolphin is estimated at four years. Adult dolphins are opportunistic, top level predators, feeding upon a variety of fish and crustaceans (Palko et al., 1982).

Wahoo (*Acanthocybium solandri)*

Wahoo are circumtropical and subtropical, including the waters of the Caribbean and Mediterranean seas. They are an oceanic, epipelagic species frequently solitary or forming small loose aggregations rather than compact schools. Wahoo feed primarily on fish and squid. They are an important sport fish in some areas, although there have been reports of ciguatera poisoning in wahoo (Lewis, 1986).

King Mackerel (*Scomberomorus cavalla)*

EFH for king mackerel includes sandy shoals of capes and offshore bars, rocky bottom and barrier island oceanside waters from the surf to the shelf break zone (SAFMC, 1998). King mackerel are reef-associated fish, often occurring in clear waters over outer reef areas and inshore and continental shelf waters (Collette and Nauen, 1983). They are “coastal pelagic” species that inhabit open waters near the coast. King mackerel prefer warm waters, and seldom enter waters below 68° F (20° C). Their affinity for warm water and the availability of food result in extensive migrations along the southeastern United States, as the fish venture south in the fall and north in the spring. As the largest of the mackerels, the king mackerel may reach a length of 1.7 m (5.5 ft) and weigh 45.4 kg (100 lbs). They feed on other migratory fishes, squid and shrimp, and may be seen leaping out of the water in pursuit of prey.

Adults spawn over the outer continental shelf from May to October. The pelagic eggs are found offshore over depths of 35-180 m (115-590 ft) in spring and summer. Larvae occur over the middle and outer continental shelf, principally in the north-central and northwestern Gulf of Mexico. Juveniles are found from inshore to the middle shelf waters (Fishwatch, 2013a).

King mackerel is an important species for recreational and commercial fisheries throughout its range and is valued as a sport fish year-round in Florida. They are caught as far north as the Gulf of Maine, but are more often found from Virginia south to Brazil, including the Caribbean and the Gulf of Mexico.

Spanish mackerel (*Scomberomorus maculata)*

Similar to king mackerel, Spanish mackerel are reef associated fishes feeding primarily on fishes, shrimp, and squid. Spanish mackerel are found in the waters of the Atlantic ocean from Cape Cod to Miami and migrate in large schools over great distances along the shoreline. EFH for the Spanish mackerel includes sandy shoals of capes and offshore bars, rocky bottom and barrier island ocean-side waters including the Project Area (SAFMC, 1998).

Spanish mackerel are found off the U.S. Atlantic coast and in the Gulf of Mexico. Although they mostly inhabit open waters, they are sometimes found over deep grass beds and reefs, or shallow estuaries (SAFMC, 2013f). The pelagic eggs are found over the inner continental shelf at depths greater than 50 m (164 ft) in spring and summer. Larvae occur over the inner continental shelf, mainly in the northern Gulf of Mexico. Juveniles occur in estuarine and coastal waters. Adults are found in inshore coastal waters (greater than 75 m; 246 ft) and may enter estuaries in pursuit of baitfish.

While the king mackerel is valued in sport fishing all year long, the Spanish mackerel is fished primarily in the winter months (SAFMC, 2013e).

Cobia (*Rachycentron canadum)*

Cobia EFH includes high salinity bays, estuaries, and seagrass habitat, in addition to the aforementioned EFH for coastal pelagic species. The cobia is a highly prized recreational fish that can be found worldwide in tropical, subtropical, and warm temperate waters (Fishwatch, 2013b). Adults are a highly migratory species that range from the South Atlantic to Mid-Atlantic Bights. Cobia are generally found on sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island/ocean side waters from the surf zone to the shelf break, but from the Gulf Stream shoreward (SAFMC, 2013f). They are generally found over reef and often associate with structures such as pilings and wrecks, and favor the shade of these structures. Cobia prefer water temperatures in excess of 68° F (20^{o} C) and salinities greater than 25 ppt (SAFMC, 2013f).

Cobia are known to live up to 10 years and reach a length of 1.8 m (6 ft) and a weight exceeding 45 kg (100 lbs) (SAFMC, 2013b). Females are usually larger than males, and reach sexual maturity when they are 91 cm (36 in) long. A male will reach sexual maturity at 61 cm (24 in) (SAFMC, 2013b). Cobia spawn in both estuarine and coastal bays (Fishwatch, 2013b). The spawning season extends from late June to mid-August along the southeastern United States and from late summer to early fall in the Gulf of Mexico.

They are adaptable to their environment and are voracious predators that forage primarily near the bottom. Cobia feed primarily on crabs and to a lesser extent, other benthic invertebrates and fishes. Adults may be found solitary or in small groups and are known to associate with rays, sharks, and other large fish (Fishwatch, 2013b). Cobia are fished both commercially and recreationally and have been observed in the nearshore waters adjacent to the Project Area (Baron, pers. obs., 2003).

Little Tunny *(Euthynnus allettaratus)*

The little tunny is found in tropical and subtropical waters including the inshore habitat within the Mediterranean, Caribbean, Atlantic Ocean and Gulf of Mexico, and often forms large, elliptical schools that extend up to two miles on the long axis. Life expectancy is around five years. Spawning season occurs throughout most of the year, except December. When females are approximately 79 cm (31 in), or 6 kg (14 lbs), they will lay up to 1.8 million eggs. The Little Tunny feeds mainly on small crustaceans, squid and small fishes (SAFMC, 2013g).

Cero *(Scomberomorus regalis)*

Also referred to as gray tilefish, this species is very similar to the mackerel. It is common only off the coast of Florida, although federal regulations for this species include areas 3 to 200 miles off the coasts of North Carolina, South Carolina, Georgia and east Florida (SAFMC, 2013h).

3.2.6. COASTAL HIGHLY MIGRATORY SPECIES

Coastal highly migratory species (HMS) managed by NMFS, such as tuna and coastal sharks, may also utilize the marine water column in or near the Project Area. Several pelagic HMS species may occur in the waters extending out to the western edge of the Gulf Stream, but are more commonly found in water depths greater than 100 m. Table 3-3 lists coastal HMS species with the potential to occur within or adjacent to the Project Area. Pelagic HMS are not listed, as they generally occur in water depths greater than 25 m (82 ft), which is outside of this Project's influence.

Most species found in federal waters are managed by Fishery Management Councils (FMCs). These Councils, through NMFS, implement regulations for species in their area. However, HMS such as Atlantic tunas, swordfish, sharks, and billfish are different in that they are found throughout the Atlantic Ocean and must be managed on domestic and international levels. Due to these concerns, on November 28, 1990, the President of the United States signed into law the Fishery Conservation Amendments of 1990 (Pub. L. 101-627) (NMFS, 2010). According to NMFS, identifying EFH for tuna, swordfish, and many pelagic shark species is challenging because, although some HMS may frequent the neritic waters of the continental shelf as well as inshore areas, they are primarily blue-water (i.e., open-ocean) species. Most of these species frequent coastal and estuarine habitats during various life stages and travel over great horizontal distances, commonly migrating vertically within the water column (NMFS, 1999b).

Table 3-3. Coastal highly migratory species (HMS) that have the potential to occur adjacent to the Project Area (J=juvenile; A=adult) (NMFS, 1999b). Measurements (m) represent isobath.

Common Name	Scientific Name	EFH
Coastal HMS		
Atlantic bluefin tuna	*Thunnus thynnus*	Nearshore to 200 m
Great hammerhead	*Sphyrna mokarran*	J, A = coastal waters to 100 m
Nurse shark	*Ginglymostoma cirratum*	J, A = shoreline to 25 m
Bull shark	*Carcharhinus leucas*	J = inlets, estuaries, < 25 m
Lemon shark	*Negaprion brevirostris*	A = inlets, estuaries, < 25 m
Scalloped hammerhead shark	*Sphyrna lewini*	J = shoreline to 200 m
Dusky shark	*Carcharhinus obscurus*	J = inlets, estuaries, < 200 m
Spinner shark	*Carcharhinus brevipinna*	Early J = coastal waters to 25 m
Tiger shark	*Galeocerdo cuvieri*	A = coastal to Gulf Stream
Bonnethead shark	*Sphyrna tiburo*	J = inlets, estuaries, < 25 m

Due to the variety of habitats utilized by most HMS during various life stages, most HMS have the potential to occur somewhere in the Project Area. EFH for HMS was updated in the Final Amendment 1 to the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2009). Table 3-3 lists HMS with life stages in designated EFH located in the Project Area.

Atlantic Bluefin Tuna *(Thunnus thynnus)*

Although not likely to be found within the Project Area, the range of Atlantic bluefin includes nearshore marine waters of the Western Atlantic (Fishbase, 2013). Atlantic bluefin tuna exhibit a seasonal migratory behavior by moving from spring spawning grounds within the Gulf of Mexico through the Straits of Florida to feeding grounds off the northeast U.S. coast. The western Atlantic stock has a range from Newfoundland south into the Gulf of Mexico and the Caribbean and was once believed to be separated from the east Atlantic stock by the Labrador Current. However, the May 2011 Status Review Report of the Atlantic Bluefin Tuna (NMFS, 2011a) cites studies that note that bluefin tuna are moving across the Atlantic but return to their original spawning grounds. Western north Atlantic bluefin tuna inhabit spawning grounds within the Gulf of Mexico and the Florida Straits from mid-April to mid-June. Even though individual bluefin tuna may spawn more than once a year, a single annual spawning period has been recognized for the western Atlantic stock (NMFS, 1999b). Bluefin tuna can grow to more than 650 kg (1,400 lbs) in weight and 3 m (10 ft) in length. Maximum age is estimated to be more than 20 years. Adult bluefin tuna feed on squid, pelagic crustaceans, and schooling fishes such as anchovies, and hakes (NMFS, 2005). The bluefin tuna is an important commercial species and is becoming rare due to massive overfishing (NMFS, 2005).

Great Hammerhead shark *(Sphyrna mokarran)*

Although not likely to be found within the Project Area, great hammerhead sharks are circumtropical, solitary fish found in both the open ocean and in shallow coastal waters (NMFS, 2013). Little information is available on early juvenile stages. Adults are caught in coastal longline shark fisheries, as well as in pelagic tuna and swordfish longlines fisheries. Great hammerheads are vulnerable to overfishing because of their biennial reproductive cycle and because they are caught both in directed fisheries and as bycatch in tuna and swordfish fisheries (NMFS, 1999b).

Nurse shark *(Ginglymostoma cirratum)*

The nurse shark inhabits littoral waters in both sides of the tropical and subtropical Atlantic, ranging from tropical West Africa and the Cape Verde Islands in the east, and from Cape Hatteras, North Carolina to Brazil in the west. They are also found in the eastern Pacific, ranging from the Gulf of California to Panama and Ecuador (Bigelow and Schroeder, 1948). Nurse sharks are a shallow water species, often found lying motionless on the bottom under coral reefs or rocks. They often congregate in large numbers in shallow water (FLMNH, 2010a) and have been observed on the nearshore hardbottom adjacent to the Project Area (Table 3-3).

Juveniles are also found around mangrove islands in south Florida. Large numbers of nurse sharks often congregate in shallow waters off the Florida Keys and the Bahamas at mating time in June and July (Fowler, 1906; FLNMH, 2010a).

Bull shark *(Carcharinus leucas)*

Bull sharks are large, shallow water sharks that are cosmopolitan in warm seas and estuaries and may be present within the Project Area. In the Gulf of Mexico, bull sharks constitute 3% of the shark catch in the directed shark fishery and are vulnerable to overfishing because of their slow growth and limited reproductive potential. Neonates are found in temperatures of 28.2°C to 32.2°C (82.8°F to 90.0°F)and in salinities between 18.5 and 28.5 ppt. Juveniles are found in temperatures of 21.0°C to 34.0°C (69.8°F to 93.2°F) and in salinities between 3.0 and 28.3 ppt (NMFS, 1999b).

Lemon shark *(Negaprion brevirostris)*

The lemon shark is a common tropical shallow water shark, inhabiting coral reefs and shallow coastal areas and may be present within the Project Area. The primary population in U.S. waters is found off south Florida and uses coastal mangroves as some of its nursery habitat. Although the lemon shark is caught throughout its range, it is not a commercially important species along the Atlantic coast (NMFS, 1999b).

Scalloped hammerhead *(Sphyrna lewini)*

The scalloped hammerhead is the most common hammerhead in the tropics and can be found schooling in large numbers (Compagno, 1984). It migrates seasonally along the eastern United States and may be present within the Project Area. The scalloped hammerhead is considered overfished because it forms very large schools that make it vulnerable to the gillnet fishery (NMFS, 1999b).

Dusky shark *(Carcharhinus obscurus)*

The dusky shark is a large (about 3.7 m/12 ft) shark species that is common in warm and temperate continental waters throughout the world (NMFS, 1999b) including the Project Area. It occurs from the surf zone to well offshore and from the surface to depths of 400 m (1,300 ft). Long migrations associated with seasonal temperature changes have been observed. Currently, factors for decline include illegal landings in both commercial and recreational shark fisheries, as well as bycatch from longlining fisheries (NMFS, 2011b). It is also commonly taken as bycatch in the swordfish and tuna longline fisheries (NMFS, 1999b).

Spinner shark *(Carcharhinus brevipinna)*

The spinner shark is a common coastal pelagic occupying warm-temperate and tropical waters. This shark is often seen in schools and gets its name due to its habit of leaping out of the water and spinning (FLMNH, 2010b). The impacts of fisheries to this species are unknown, although its habits are similar to those of the blacktip and its vulnerability to fishing pressure is also likely similar (NMFS, 1999b).

Tiger shark *(Galeocerdo cuvier)*

The tiger shark is one of the larger species of sharks with characteristic tiger-like markings and unique teeth that make it easy to identify. They inhabit warm waters in both deep oceanic and shallow coastal regions, potentially within the Project Area, and is considered one of the most dangerous species of sharks, responsible for many attacks on humans (FLMNH, 2010c). The nursery areas for tiger sharks appear to be offshore, though they have not been described. The tiger shark is frequently caught in coastal shark fisheries but is usually discarded due to low fin and meat value (NMFS, 1999b).

Bonnethead shark (*Sphyrna tiburo)*

The bonnethead is a small shark species (< 1 m/3.3 ft) that inhabits shallow coastal waters where it frequents sandy or muddy bottoms (NMFS, 1999a) and may be present within the Project Area. Juveniles are often found on the west coast of Florida. This species is at a low risk of overfishing because it is fast growing, reproduces annually, and is not targeted by fisheries due to its small size.

4.0. ASSESSMENT OF IMPACTS AND MITIGATION MEASURES

Sand placement and groin construction activities associated with the Southern Palm Beach Island Comprehensive Shoreline Stabilization Project each have the potential for direct effects (proposed action occurs at the same time and place as the effect), indirect effects (reasonably foreseeable effects caused by the action that occur later in time or farther from the action), or cumulative effects (which are those that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions). The affected EFH adjacent to the Project Area include nearshore hardbottom, un-vegetated bottom, and water column. This section assesses potential impacts to EFH and managed species that may occur as a result of the Project.

4.1. IMPACTS TO EFH

4.1.1. IMPACTS TO CORAL/LIVE HARDBOTTOM

Burial/Sedimentation. Placement and equilibration of beach sand will impact nearshore hardbottom resources. Hardbottom closest to shore will be directly buried by placement of beach sand immediately following construction, while equilibration will impact additional hardbottom after construction is complete. Based on engineering and modeling results (Appendix G to the EIS), it is anticipated that the Project may result in permanent impacts to 4.03 ac of hardbottom as well as temporary and secondary impacts to 8.13 ac of hardbottom due to direct sand placement and subsequent spreading (equilibration) of sand (Figure 4-1). Impacts to hardbottom were based on a time average of exposed hardbottom delineated from aerial images between 2003 and 2013. Using the engineering and modeling results, historic exposed hardbottom acreage, and recent benthic characterization data, a preliminary Uniform Mitigation Assessment Method (UMAM) evaluation was conducted (provided as Appendix H to the

EIS). This draft UMAM analysis determined that 6.39 acres of mitigation may be required to offset these impacts to intertidal and subtidal hardbottom.

Managed species/groups that have been observed utilizing or may potentially utilize the nearshore hardbottom habitat within the Project Area include coral, shrimp, spiny lobster, species of the snapper grouper complex, and some coastal pelagic species. Although the Project is anticipated to result in permanent impacts to 4.03 ac of hardbottom EFH as well as temporary and secondary impacts to 8.13 ac of hardbottom EFH, mobile species utilizing this habitat are unlikely to be adversely affected. Juvenile penaeid shrimp are generally confined to estuarine waters and will not be affected by construction activities along the coast. Adult shrimp and lobsters have adaptations to escape adverse conditions. White shrimp are very powerful swimmers, capable of actively swimming great distances, while both brown and pink shrimp can bury in the substrate (SAFMC, 1998). The high mobility of the managed finfish species will allow these fish to move to other undisturbed areas outside of any Project effects. Species which are temporarily displaced from the Project Area may find suitable hardbottom habitat north, south, or east of the Project Area. Once Project construction is completed, finfish are expected to return to the Project Area.

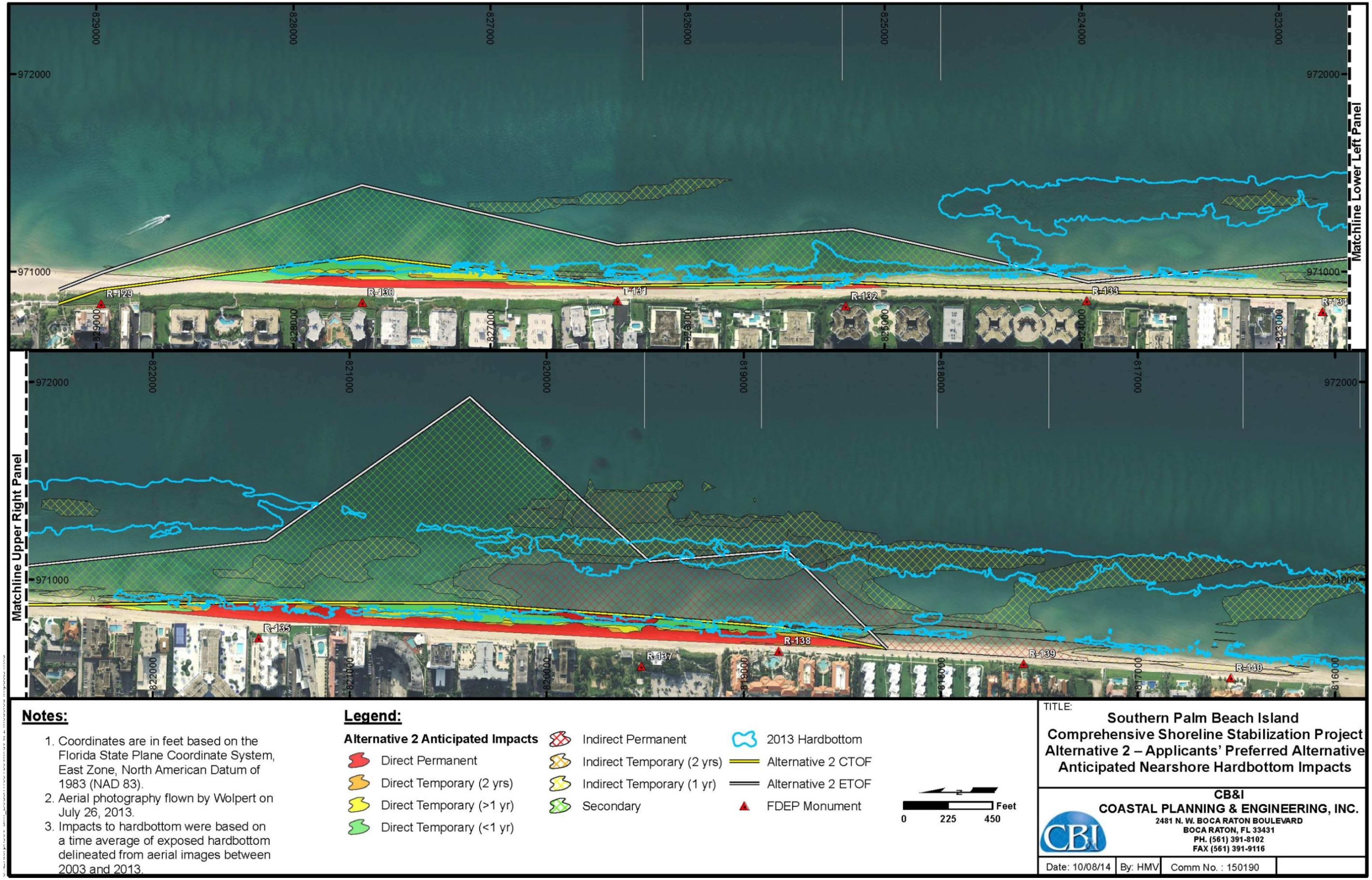

Figure 4-1. Anticipated impacts to nearshore hardbottom resources from Alternative 2 – Applicants' Preferred Project.

4.1.2. IMPACTS TO UNCONSOLIDATED (SOFT) BOTTOM

Burial/Sedimentation. Sand placement impacts to unconsolidated bottom include direct burial of benthic organisms as the beach is widened. Effects of burial are dependent on sediment type, depth of sediment, and the size and behavior of infaunal or epifaunal organisms (including the species' ability to burrow and species' mobility) (SCDNR, 1995). Direct burial results in mortality to sessile or attached animals, while some motile species can survive by moving either horizontally outside the placement area, or vertically to the surface of the sand placement (NRC, 1995). Mortality during sedimentation has been found to depend on a species' ability to burrow through redeposited sediments and the rate at which sediment is deposited (IMG, 2004). Maurer et al. (1978) found that nearshore infaunal species are capable of burrowing through sand up to 40 cm (15.7 in). Generally, deposits greater than 20-30 cm (8-12 in) eliminate all but the largest and most vigorous burrowers (Maurer et al., 1978). If the bottom is covered with greater than 50 cm (20 in) of sand, most of the benthic fauna will be unable to move up through the placed sand (Maurer et al., 1978). Although the wet beach infauna can adapt to fluctuations in the natural environment, the addition of sediment to the wet beach would have immediate, short-term negative impacts, specifically in areas where beach sand will exceed 40 cm (15.7 in) in depth.

However, infauna inhabiting the shallow nearshore marine habitat in the Project Area are adapted to a dynamic environment and, therefore, the recovery of these communities can take place relatively quickly (Nelson, 1993). Nelson (1993) indicates that many organisms that reside in intertidal zones are more adaptable to fluctuations in their environment, including high sediment transport and turbidity levels. A review of infaunal studies revealed that invertebrate recovery following placement of dredged material in relatively stable, unstressed marine environments generally takes between one and four years, while recovery in more naturally stressed areas is faster, often achieved within nine months (Bolam and Rees, 2003). A study conducted in Brevard County, Florida, found that distribution, abundance and diversity of nearshore benthic fauna did not experience significant negative effects following beach nourishment (Gorzelany and Nelson, 1987). Most studies that did find impacts to nearshore infaunal communities generally found only limited or short-term alterations in the abundance, diversity and species composition (NRC, 1995).

Groin Construction. The Palm Beach County portion of this Project also includes the construction of seven low-profile groins placed perpendicular to the shoreline extending from the existing seawalls to the post-construction (beach fill) shoreline in South Palm Beach, Lantana and Manalapan (R-134+135 to R-138+551). If groin construction follows placement of the beach nourishment project, impacts would occur to dry beach habitat. If the groins are constructed before the nourishment project, narrow trenches will be excavated for each groin and piles will be driven into the dry beach and intertidal softbottom habitat; this construction would result in minimal impacts to a small area of intertidal softbottom. Infauna within the softbottom resources would only be temporarily displaced, therefore allowing recovery following disturbance.

4.1.3. IMPACTS TO WATER COLUMN

Turbidity. Turbidity is caused by the suspension or resuspension of sediments into the water column. Turbidity can affect fish feeding activities, movement, and respiration. Placement of sand along the shoreline will cause temporary increased turbidity in the nearshore marine environment, which will temporarily impact marine water column. These impacts are not anticipated to extend beyond the duration of construction activities. During construction of the Project, fish and other motile species can avoid most of the direct effects of beach nourishment by temporarily leaving impacted areas and traveling to other suitable areas. These species can return to these areas following conclusion of construction activity. Surveys of nearshore fish populations conducted in Florida before and after beach nourishment showed no evidence of any adverse impacts on the abundance and composition of the fishes sampled (NRC, 1995).

Noise. Disturbance caused by the construction operations necessary for placement of sand in the nearshore marine environment will temporarily impact those species which typically utilize the water column in that area. Noise has been documented to influence fish behavior. Fish detect and respond to sound utilizing its cues to hunt for prey, avoid predators, and for social interaction (LFR, 2004). Some reef fish larvae have been shown to respond to sound stimuli as a sensory queue to settlement sites (Stobutzki and Bellwood, 1998). Alterations of background noise may impair the ability of newly settled fishes to locate preferred substrate. Changes in noise levels also may affect feeding or reproductive activities of reef fishes that depend on sound for these activities (Myrberg and Fuiman, 2002). Due to the short duration of this Project, the impacts of underwater noise on fish populations are expected to be temporary and localized.

4.1.4. CUMULATIVE EFFECTS

The Project as proposed includes a relatively modest amount of fill, and smaller-scale coastal structures to minimize the effects of the Project on the environment. However, within the next 50-years, the Town of Palm Beach anticipates nourishing the Project Area every four years and the County anticipates a 3-year nourishment interval. Based on placement of approximately 75,000 cy every four years, the Town of Palm Beach project would be nourished 12 times over the next 50 years. It is assumed that there may be two storm events that require additional nourishments during this timeframe; therefore, approximately 14 nourishments requiring 1,050,000 m cy of sand would occur within the Town of Palm Beach portion of the Project Area. The County project would require approximately 18 nourishments (16 plus two storm nourishments), requiring about 1,350,000 cy. The Phipps Project may dredge approximately 1 million cy of sand in order to restore the beach between R-119-300 and R-126. The Mid-Town Project is currently permitted by FDEP (0164713-001-JC) to dredge approximately 1.4 million cy of sand in order to restore the beach in Reaches 3 and 4 between R-90.4 and R-101.4. Both of these projects anticipate an 8-year nourishment cycle. The anticipated effects associated with the proposed Project and the long-term and cumulative effects associated with the reasonably foreseeable actions are not anticipated to result in any measurable cumulative losses of ecological functions and services, or cumulative impacts on EFH or managed species. However, if unanticipated effects are identified during the monitoring period, or for any future beach project, the Corps will evaluate the project’s effects, and as appropriate, initiate consultation with NMFS for EFH.

4.2. MITIGATION MEASURES

The Project has been designed to maximize coastal protection while minimizing impacts to nearshore hardbottom. For example, the Project includes placement of dune sand only from R129-210 to R-129+150 and from R-131 to R-134+135, both of which are adjacent to nearshore hardbottom. Of the 150,000 cy of sand volume proposed for the Project, only 36,500 cy will be placed below MHW. The proposed Project will use beach compatible sand (meeting FDEP requirements for beach sand compatibility as per Florida Administrative Code, Rule 62B-41.007(2)(j)), similar to the existing beach sand, which will reduce impacts to infauna and increase recovery time.

Although measures have been incorporated into the Project design to minimize impacts to EFH, it is anticipated that construction of the proposed Project will result permanent impacts to 4.03 ac of hardbottom as well as temporary and secondary impacts to 8.13 ac of hardbottom due to direct sand placement and subsequent spreading (equilibration) of sand (Figure 4-1). Construction of mitigative artificial reefs will likely be required by federal and state agencies to offset impacts to hardbottom resources. Based on a preliminary UMAM evaluation (provided as Appendix H to EIS), 6.39 acres of mitigative artificial reef would be required to offset these permanent and temporary impacts to intertidal and subtidal hardbottom habitat. Biological and physical monitoring will assess project performance and success of the mitigative artificial reef.

Appendix I to the EIS provides the Applicants' draft mitigation plans, including potential locations of the artificial reef sites. The location of the mitigation reefs will be within the nearshore environment, in relatively close proximity to the Project Area to ensure it will have similar ecological functions and services for the affected fisheries. In general, nearshore mitigative artificial reefs are located in subtidal areas where there is a thin veneer of sand overlying a consolidated rock layer to avoid reef subsidence, but not located where permanent or ephemeral hardbottom resources have been documented to avoid indirect impacts or construction-related impacts.

Typical issues related to mitigation reefs include:

- Reef subsidence if there is no underlying rock to serve as a foundation.
- Located within appropriate water depth range: if placed in water depths that are too deep, target species normally associated with nearshore hardbottom will likely not utilize the reef.
- Structural differences between impacted resources, i.e. rugosity (natural flat pavement type hardbottom vs. rubble rip-rap boulders).
- Performance and success criteria of mitigation reefs.
- Material used for reef construction.

During construction of the proposed Project, water quality monitoring will be conducted at the sand placement sites to ensure turbidity levels comply with permit requirements.

5.0. CONCLUSION

It is anticipated that the proposed Southern Palm Beach Island Comprehensive Shoreline Stabilization Project may adversely impact hardbottom and softbottom, and will temporarily impact the marine water column for various life stages of managed species. Effects that will result from the Project include: direct burial of hardbottom and infauna from beach nourishment, potential localized displacement of infauna through groin construction, noise disturbance, and elevated turbidity. Construction of a mitigative artificial reef will likely be required by federal and state agencies to offset permanent impacts to 4.03 ac of hardbottom as well as temporary and secondary impacts to 8.13 ac of hardbottom due to direct sand placement and subsequent spreading (equilibration) of sand. Based upon the Project design, avoidance and minimization measures, and the proposed compensatory mitigation, it is anticipated no substantial adverse effect on EFH or managed species will occur from this Project.

6.0. LITERATURE CITED

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