APPENDIX J

DRAFT CUMULATIVE IMPACT ANALYSIS

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SOUTHERN PALM BEACH ISLAND COMPREHENSIVE SHORELINE STABILIZATION PROJECT DRAFT CUMULATIVE IMPACT ANALYSIS

TABLE OF CONTENTS

LIST OF FIGURES

Figure No.

LIST OF TABLES

Table No.

1.0 INTRODUCTION

This Cumulative Impact Analysis (CIA) has been prepared to support the Southern Palm Beach Island Comprehensive Shoreline Stabilization Project (the Project) Draft Environmental Impact Statement (EIS). The combined, incremental effects of human activity, referred to as cumulative impacts, may pose a serious threat to the environment. While they may be insignificant by themselves, cumulative impacts accumulate over time, from one or more sources, and can result in the degradation of important resources. Because federal projects cause or are affected by cumulative impacts, this type of impact must be assessed in documents prepared under the National Environmental Policy Act (NEPA). The NEPA definition of a cumulative impact comes from the Council on Environmental Quality (CEQ), which defines a cumulative impact as:

> …the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR §1508.7.).

Cumulative effects analysis is an iterative process in which consequences are assessed repeatedly following incorporation of avoidance, minimization, and mitigation measures into the alternatives. Monitoring is the last step in determining the cumulative effects that ultimately result from the action. The significance of cumulative effects depends upon the ecosystem, resource baseline conditions, and relevant resource stress thresholds (CEQ, 1997). CEQ regulations require all federal agencies to consider the cumulative effects of all proposed agency actions. A cumulative impact analysis is required whenever an environmental document is prepared (i.e., an Environmental Assessment or Environmental Impact Statement). A cumulative impact is defined in both spatial (geographic) and temporal terms (i.e., timeframes in which to identify past, present, and reasonably foreseeable actions) and results from spatial and temporal

crowding of environmental perturbations. “The effects of human activities will accumulate when a second perturbation occurs at a site before the ecosystem can fully rebound from the effect of the first perturbation” (CEQ, 1997). Chapter 4 of the EIS – Environmental Consequences considers direct, indirect and cumulative effects anticipated to result from construction of each of the alternatives and construction of the mitigative artificial reefs which will be required to offset impacts to nearshore hardbottom resources. The Biological Assessment (provided as Appendix E to the EIS), prepared in accordance with Section 7 of the Endangered Species Act, also considers direct effects, indirect effects, interrelated or interdependent actions, and cumulative effects to listed and proposed species and critical habitat.

While the EIS is assessing the proposed Town of Palm Beach and Palm Beach County projects (and alternatives) as similar actions under the combined project name of “Southern Palm Beach Island Comprehensive Shoreline Stabilization Project”, it is understood that these projects are located within the same coastal cell as other past, present and future coastal projects, and that these are all cumulative actions. Therefore, this CIA has been prepared to assess the scope of impact from the Southern Palm Beach Island Comprehensive Shoreline Stabilization Project as well as from other coastal projects on Palm Beach Island which have occurred, and which are expected to be constructed again, in the vicinity of the Project Area.

The principal goal of this assessment is to identify, avoid, minimize, and mitigate adverse environmental impacts associated with the project objectives of providing storm protection along the project shoreline, with particular emphasis upon potential cumulative impacts to the nearshore hardbottom resources and the sand beach habitat along the projects and adjacent shorelines.

1.1. PROJECT DESCRIPTION

The proposed Southern Palm Beach Island Comprehensive Shoreline Stabilization Project (the Project) (designated as Alternative 2 - the Applicants’ Preferred Project Alternative) would use a combination of beach nourishment, dune reconstruction and coastal structures between R-129-210 and R-138+551 on Palm Beach Island, Palm

Beach County, Florida (Figure 1-1). The Project includes two projects which will be constructed by two separate Applicants: the Town of Palm Beach (project area extending from R-129-210 to R-134+135) and Palm Beach County (County) (project area extending from R-134+135 to R-138+551).

The proposed Project has been designed to enhance stability to existing seawalls and to enhance the existing beach and dune system for storm protection to upland property. Approximately 150,000 cubic yards (cy) of fill will be placed along the shoreline within the Project Area from R-129-210 to R-138+551 (approximately 3.33 km [2.07 mi]). The fill volume will be split between the two Applicants' separate project areas – 75,000 cy of sand in the Town of Palm Beach and 75,000 cy in the County project area within South Palm Beach, Lantana and Manalapan. From north to south, the Project would place dune nourishment only from R-129-210 to R-129+150, dune and beach nourishment from R-129+150 to R-131, dune nourishment only from R-131 to R-134+135 (Town of Palm Beach southern limit), and beach nourishment with seven low-profile groins from R-134+135 to R-138+551 (Figure 1-2).

The two separate public entities proposing projects may utilize sand originating from different sources. The proposal by the Town of Palm Beach includes transportation of dredged fill material originating from the Reach 7 Phipps Ocean Park Beach Restoration Project (Phipps) and/or the Mid-Town Beach Nourishment Project (Mid-Town) or an upland sand mine. The material would be delivered by truck using the local network of roadways and placed within the Town of Palm Beach project limits (R-129-210 to R-134+135). The County has proposed to utilize sand originating from an upland sand mine to be placed within the County project limits along South Palm Beach, Lantana and Manalapan (R-134+135 to R-138+551) (Figure 1-2). The Town of Palm Beach plans to time future beach nourishment projects so that the sand source alternates between stockpiled sand excavated in excess during dredging for Phipps and Mid-Town projects. If the project schedules do not coincide, the Town of Palm Beach may truck in sand from upland mines. The County only proposes upland sand for construction of its portion of the Project.

This Project has been designed to avoid and minimize impacts to nearshore hardbottom to the maximum extent practicable, including reducing the volume of sand placed below mean high water (MHW) and by avoiding mobilization of a separate dredging operation offshore and hydraulic pumping of sand through a pipeline to the Project Area. However, the Project is anticipated to result in adverse effects on nearshore hardbottom through direct placement of sand during construction and beach profile equilibration (spreading) following construction. 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 equilibration (Figure 1-3). Impacts to hardbottom were based on a time average of exposed hardbottom delineated from aerial images between 2003 and 2013, which represents the most current dataset. 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.

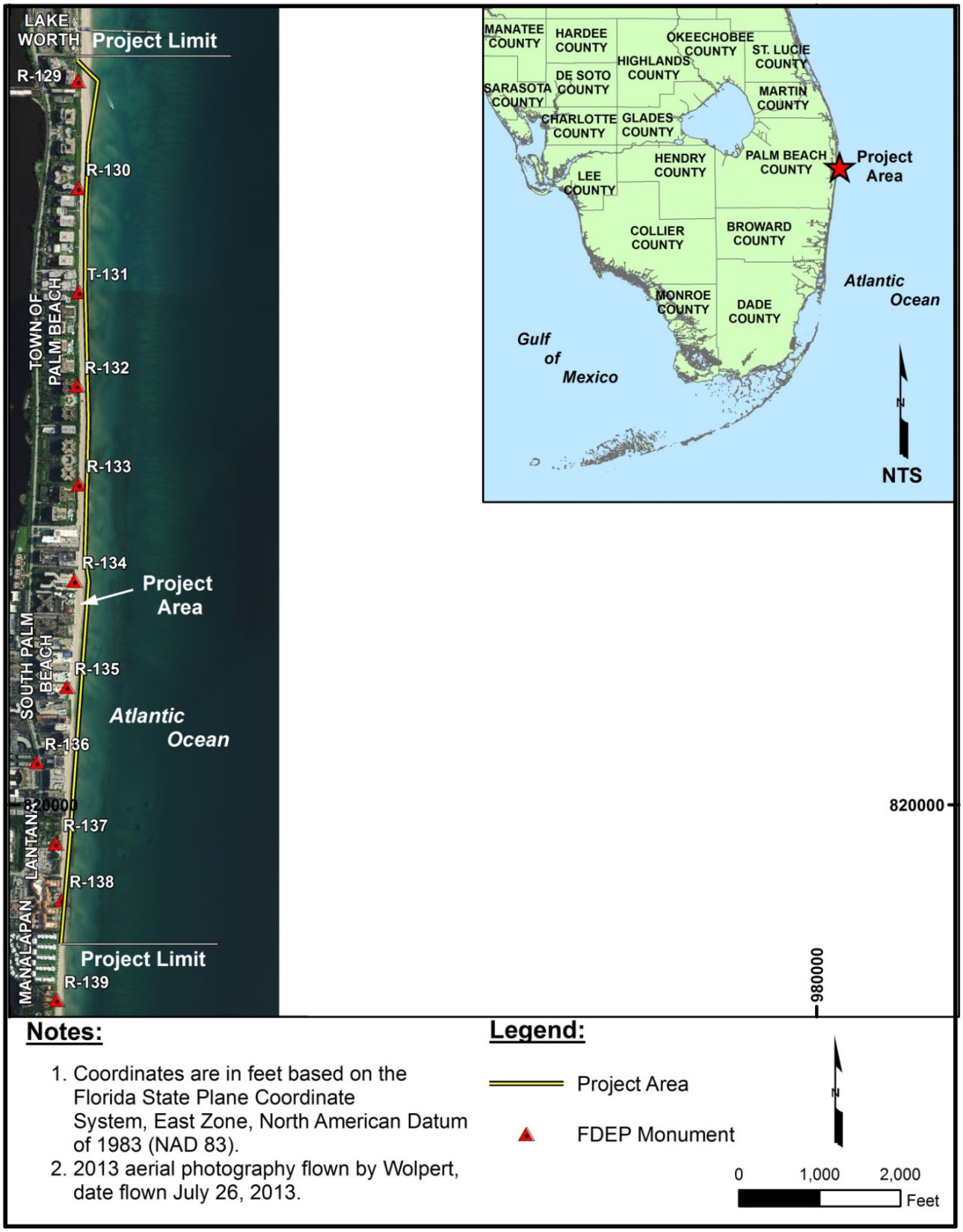


Figure 1-1. Southern Palm Beach Island Comprehensive Shoreline Stabilization Project location map.

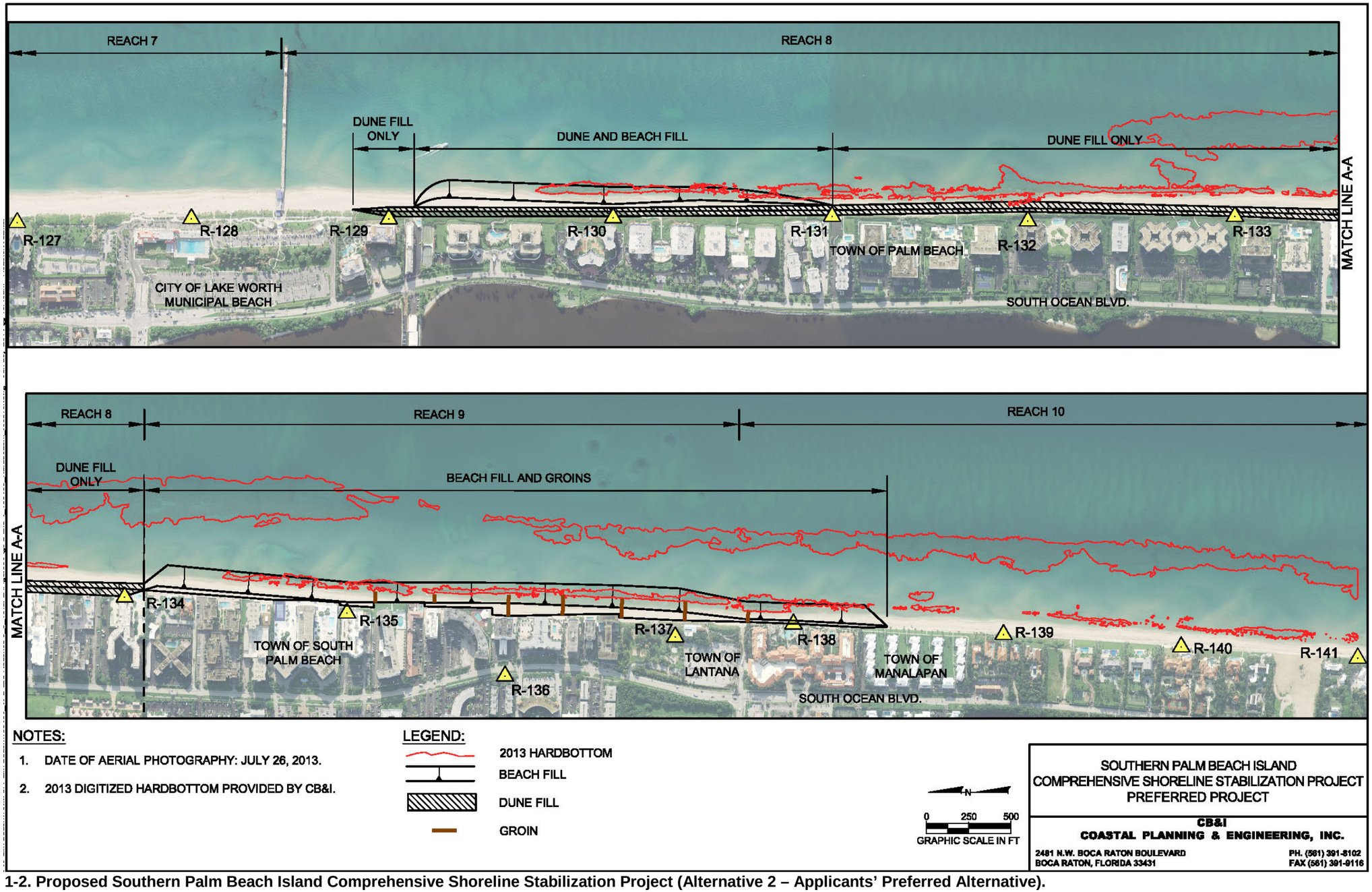


Figure 1-2. Proposed Southern Palm Beach Island Comprehensive Shoreline Stabilization Project (Alternative 2 – Applicants' Preferred Alternative).

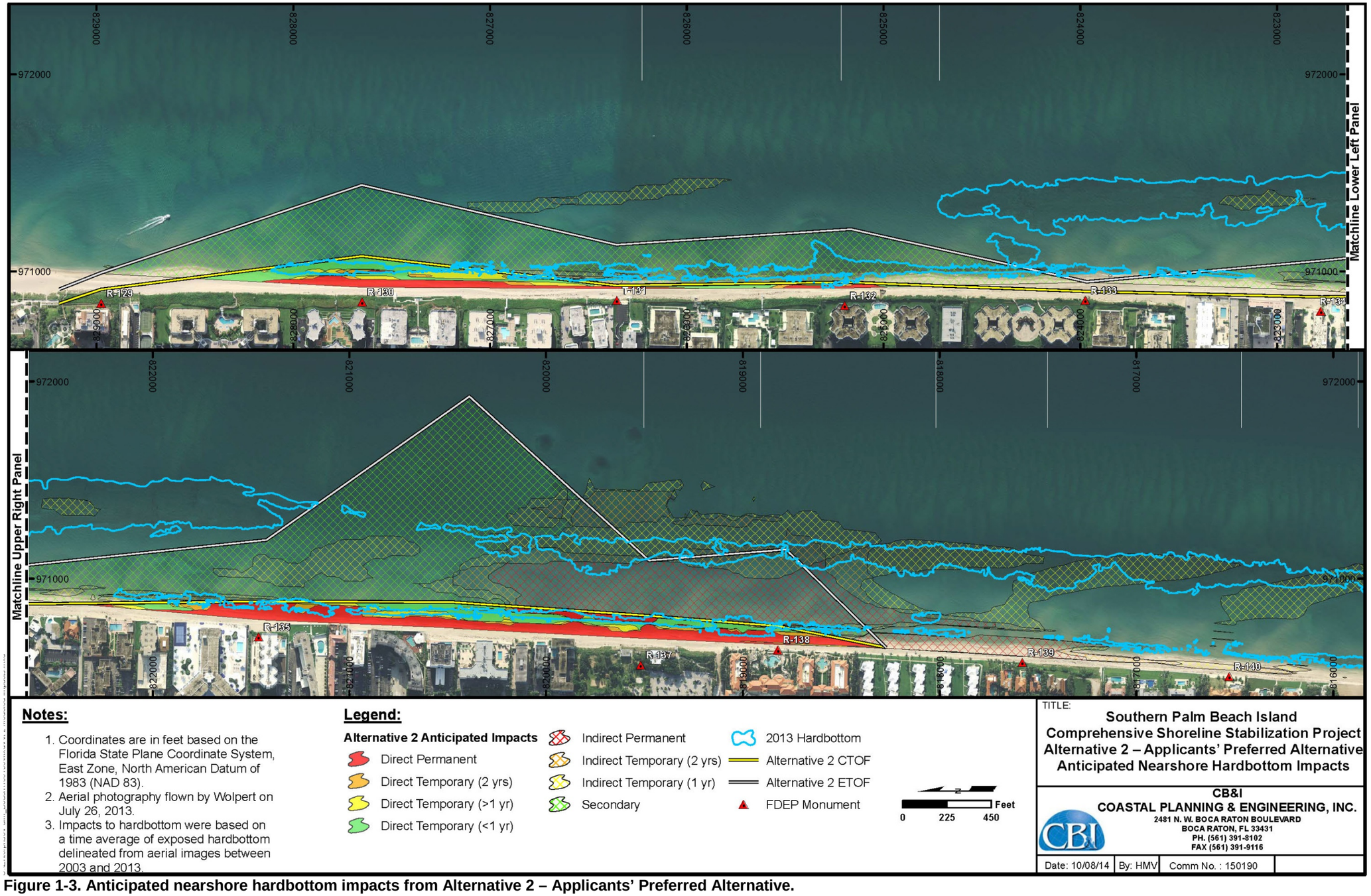


Figure 1-3. Anticipated nearshore hardbottom impacts from Alternative 2 – Applicants' Preferred Alternative.

1.1.1. SAND SOURCES FOR PROPOSED PROJECT

Offshore sand source. A stockpile of dredged material from the Phipps Project and/or the Mid-Town Project is the preferred sand source for the Project Area within the Town of Palm Beach limits. Phipps and Mid-Town projects may dredge sand from North Borrow Area 1 (NBA1), South Borrow Area 2 (SBA2), or South Borrow Area 3 (SBA3) (Figure 1-4), or any offshore sand source that may provide appropriate beach compatible sand consistent with sediment quality specifications (FDEP, 2013). The stockpile area will be active so that sand is removed for transport to the Project Area soon after it is pumped to the beach. 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. If timing of the Phipps and Mid-Town projects does not allow for use of dredged sand for the Applicant's Preferred Project, the Town of Palm Beach would consider using sand from an upland source. Additional information about the offshore borrow areas is provided in Section 6.0.

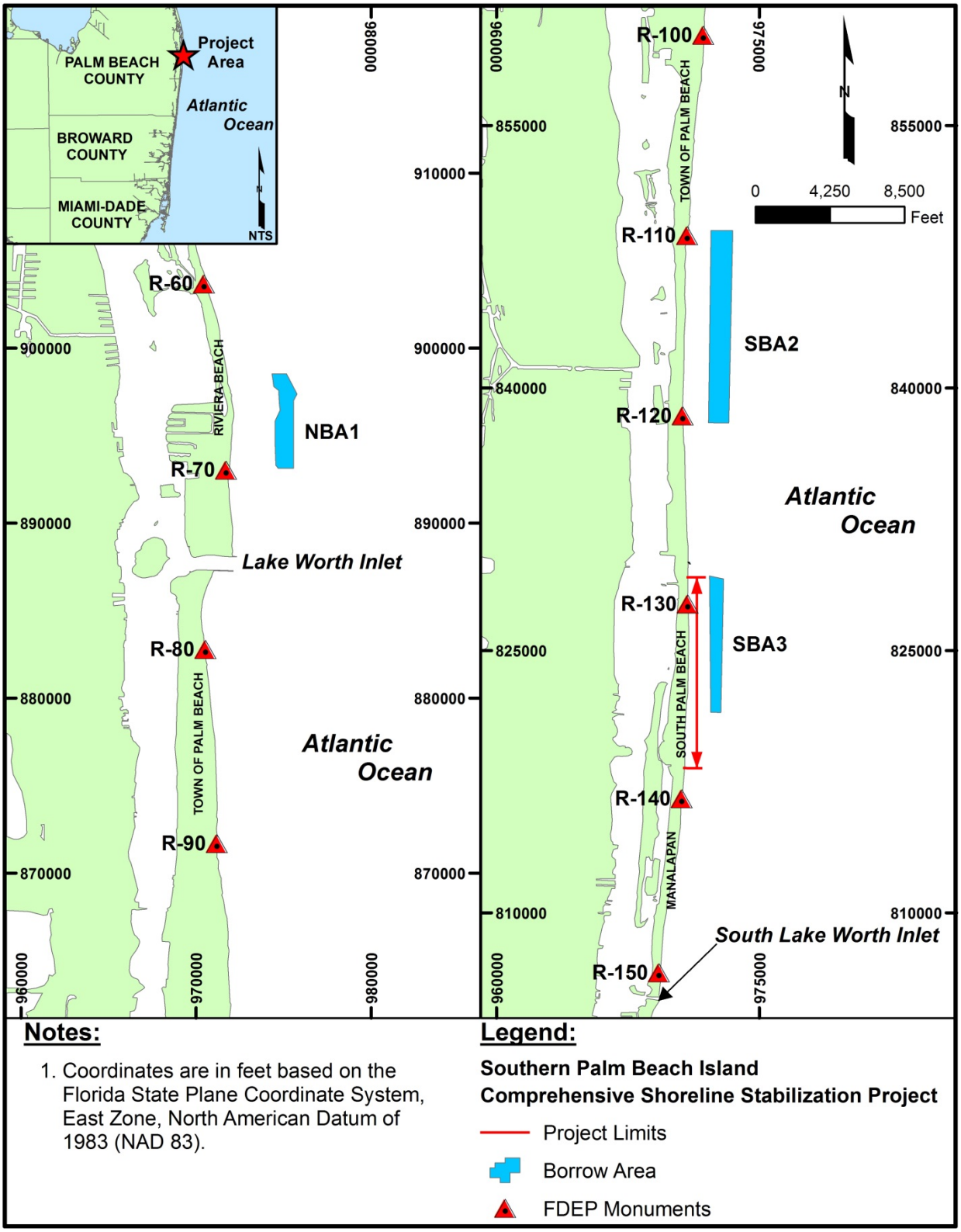


Figure 1-4. Potential borrow areas to be used during Phipps and Mid-Town projects that may supply the sand for the proposed Project within the Town of Palm Beach limits (R-129-210 to R-134+135).

Upland sand source. Upland sand mines and other upland sources (such as publicly owned land with available sand resources) have provided sand for beach and dune restoration projects in Florida for over a decade. Upland sand has historically been used for small projects (less than 50,000 cy) (USACE, 2001), but upland sand has recently been utilized for larger projects in Indian River County, Broward County, and Brevard County. Within Palm Beach County, upland sand has been used for restoration efforts in Coral Cove Park in Tequesta, Singer Island, Town of Palm Beach, South Palm Beach, Lantana, and Delray Beach. Specifically within the Project Area, the Towns of Palm Beach, South Palm Beach, and Lantana have utilized upland sand to maintain dune habitat and protect upland infrastructure.

The sand source for the County project area within the limits of the Towns of South Palm Beach, Lantana, and Manalapan (R-134+135 to R-138+551) is sand from domestic upland sand quarries within the State of Florida. The sand would be transported to the beach and placed on the beach mechanically, rather than hydraulically. There are several known sand mines within 100 miles of the project shoreline that can provide clean, quality material for projects in southeast Florida. A study conducted in Broward County found that 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 (OAI and CPE, 2013).

To identify potential upland sand sources for this Project, the Town of Palm Beach or the County would evaluate several mines based on successful usage for past projects or by the mines responding to Requests for Proposal associated with either the Town of Palm Beach or County’s procurement process. Each mine would be evaluated based on compliance with the FDEP and the County's technical sand specifications, sediment characteristics, location relative to the Project Area, compliance with state and federal laws and method of transport available. The County did not specifically identify a preferred upland mine; contractors may propose to use any mine as long as the material meets the technical sand specifications (Appendix B to the EIS). Previous

County projects have utilized sand from E.R. Jahna Industries, Inc. Ortona Sand Mine (Ortona) and Stewart Mining Industries in Ft. Pierce, as well as from local County preserves. The Town of Palm Beach identified Ortona as their preferred upland sand mine, which has been previously utilized within the Town of Palm Beach. Thirteen upland mines located in Florida, which have the potential to be evaluated for use for this Project, are listed in Table 1-1 and their locations are shown on Figure 1-5. The identified mines do not constitute a complete list and the sand at these upland mines has not yet been specifically evaluated for use in this Project.

Table 1-1. Potential upland sand sources.

Company	Mine Name	Distance from Project Area (mi)*
E.R. Jahna Industries, Inc.	Ortona	96
Stewart Mining Industries	Ft. Pierce	79
Stewart Mining Industries	Immokalee	138
Vulcan Materials Co.	Witherspoon	93
Cemex	Davenport	175
Cemex	Palmdale	101
Henry Fischer & Sons Leasing, Inc.	17th St. SW	88
Henry Fischer & Sons Leasing, Inc.	Ranch Road	91
Florida Shell & Fill Company	Diner Ranch	132
JJJ Enterprises	Farabee	135
Cemex	Lake Wales	155
CC Calhoun	Pit 1	154
E.R. Jahna Industries, Inc.	Greenbay	183

*Distance is the shortest driving distance (miles) between each mine and Lantana Municipal Beach Park; actual distance will depend on routes selected by contractor.

Figure 1-5. Upland sand mines with potentially feasible sources of material that could be considered for a truck-haul project for placement in the proposed Project Area.

One consideration involved with selecting upland sand sources is the availability of sand resources within the mines, as this can affect overall construction rate of the project. The mine(s) selected must have sufficient total and daily production capacity to meet the project needs. Sand mines can stockpile some of the material to ensure that they can keep pace with required delivery rates. Other considerations that affect project efficiency include the distance from the mine to the project, the number of trucks and other machinery at the staging and beach nourishment areas, as well as the number of active access points. In the event that delivery rate exceeds handling time on the beach, the utilization of offsite truck waiting areas may be required in order to avoid congestion at the access points. The Town of Palm Beach and the County would consider mines that can provide suitable sand material based on the state and county sediment guidelines, the cost per cubic yard, as well as having sufficient production capacity and a reasonable trucking distance from the Project Area.

1.1.2. GROIN CONSTRUCTION

The County portion of this Project 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 1-2). The groins are proposed to be low-profile, meaning that they are designed to be level with the height of the existing berm and are intended to be concealed by sand most of the time. The construction materials potentially include concrete king pile and panel groins with 18 inch (+/-) wide H-piles spaced every 8 to 10 ft. Exact location and length of the groins would depend on the presence of nearshore hardbottom resources at the time of construction. The proposed Project includes a series of approximately 90 ft long walls spaced approximately 300 ft apart. As the sand naturally erodes from the beach, the groins would gradually become exposed until the next nourishment. The groins act to hold the sand within the littoral system which results in a disruption of the natural littoral sand transport system along the beach. Typically sand accretion/sediment deposition occurs on the updrift side and erosion would be expected on the downdrift side. The construction of the groins may

occur from either land-based operations or using in-water construction, or a combination of the two methods.

2.0 SCOPE OF ANALYSIS

The "Scope of Analysis" was discussed in Section 1.7.1 in Chapter 1 of the EIS. For the proposed Project, the regulated activities include placement of sand below mean high water and construction of seven low-profile groins that extend perpendicular to shore into the Atlantic Ocean.

Historically, beach erosion control and inlet management activities have been regulated by the FDEP and USACE on a project-by-project basis. In an effort to adopt a more holistic approach to ecosystem management that could address the full scope of Palm Beach Island's shoreline erosion problems, the Town of Palm Beach and the County requested that FDEP enter into a binding Beach Management Agreement (BMA) for beach nourishment, inlet sand bypassing, and dune restoration projects along the Palm Beach Island shoreline in 2012. A primary goal of the BMA is to develop a coordinated, long-term process that facilitates predictable approval of qualifying coastal erosion control and inlet management activities within the Palm Beach Island coastal cell (Lake Worth Inlet to the South Lake Worth Inlet),

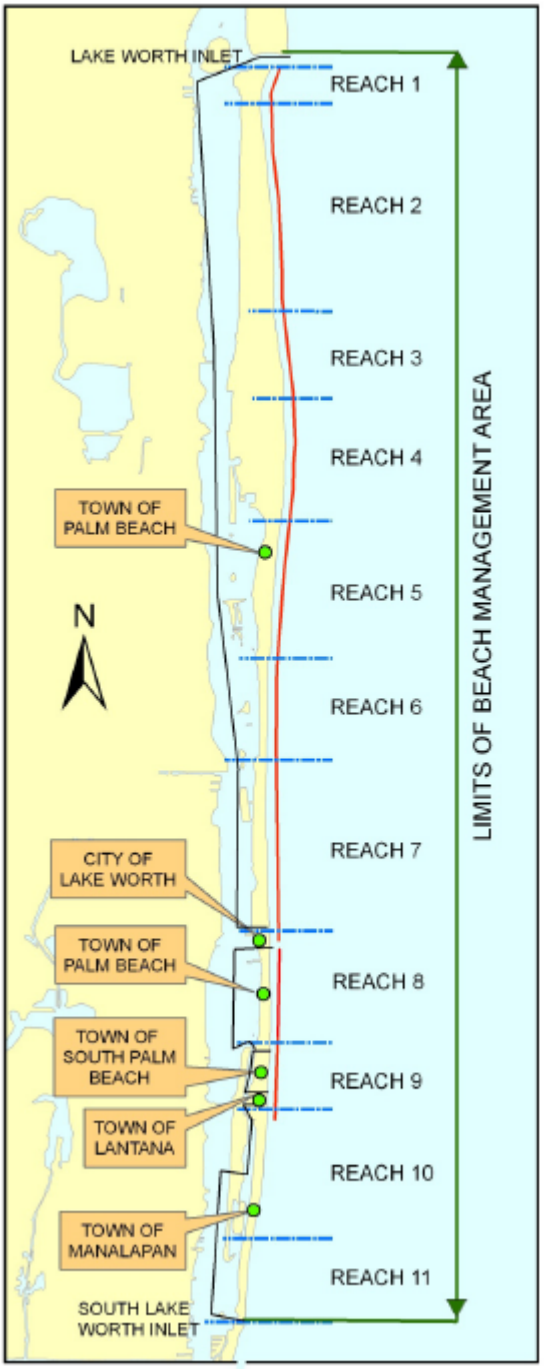


Figure 2-1. Limits of Beach Management Agreement Area (FDEP, 2013).

encompassing 15.7 miles of Atlantic Ocean shoreline, and covering 34.5% of the Palm Beach County Shoreline (Figure 2-1) (FDEP, 2013).

The final BMA, executed on September 26, 2013, includes authorization from FDEP for maintenance dredging of the Lake Worth Inlet with placement on downdrift beaches, construction of an improved sand transfer plant at Lake Worth Inlet, repair and removal of groins throughout the cell, nourishment of the Mid-Town Project, nourishment of the Phipps Ocean Park Project, and dune restoration (FDEP, 2013).

The BMA's approach to authorizing projects and activities is centered on regional management of the coastal system rather than the conventional project-by-project permitting process. In addition, the BMA is expected to generate a more cost-effective and efficient permitting process that will reduce the BMA Participants' costs, time delays, and permitting uncertainty.

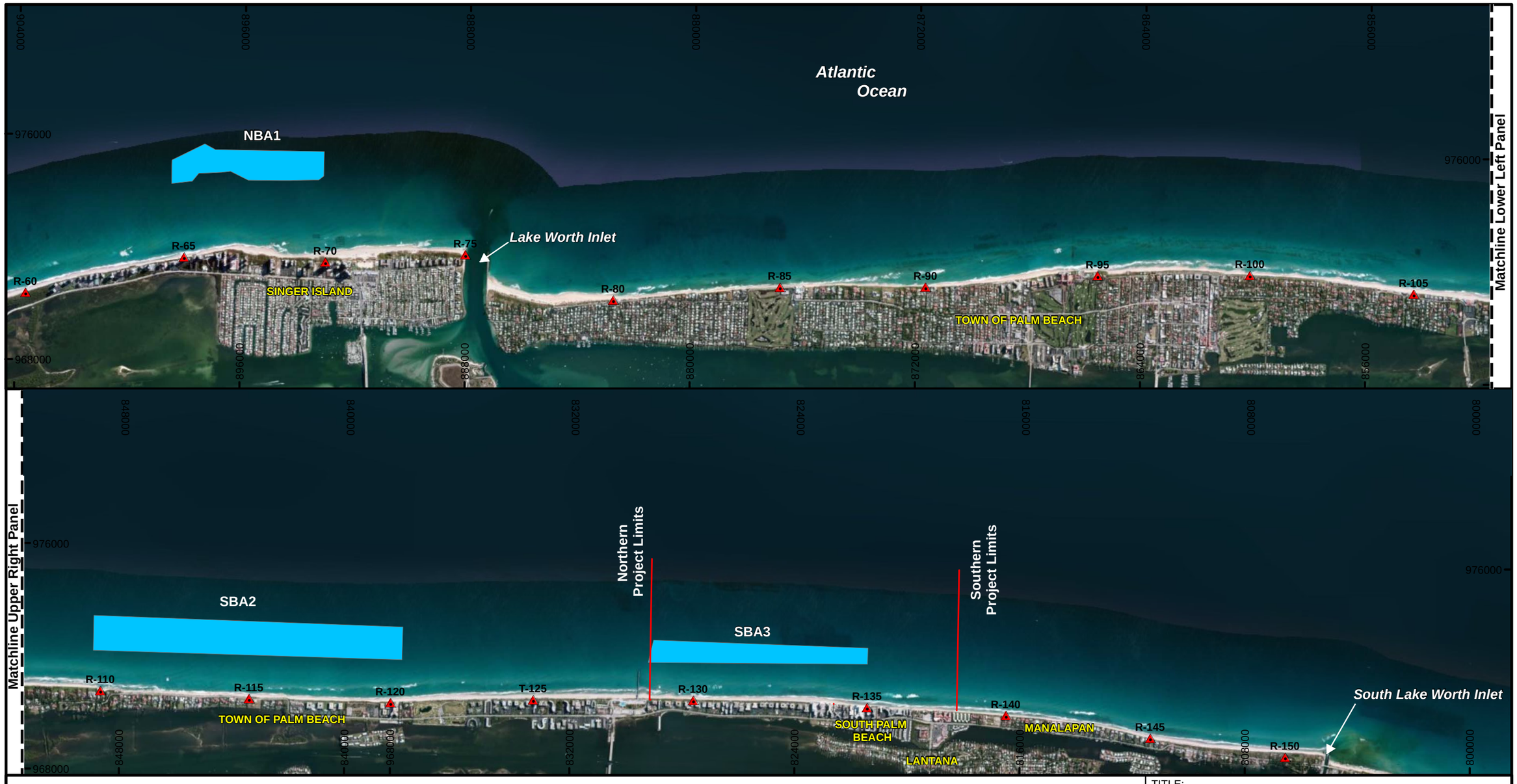
A summary of projects authorized under the BMA is provided in Section 5.0. These projects are located in the vicinity of the Southern Palm Beach Island Comprehensive Shoreline Stabilization Project; therefore, these actions and the proposed Project are considered cumulative actions, whose impacts should all be considered.

2.1. GEOGRAPHIC SCOPE

Palm Beach County is located on the southeastern coast of Florida and includes approximately 45 miles of Atlantic Ocean coastline. There are three ocean inlets within Palm Beach County. The geographic scope of the proposed Project is comprised of: 1) the northern limit of North Borrow Area 1 (NBA1), approximately 2 miles north of Lake Worth Inlet; 2) the eastern edge of NBA1, in water depths between 40 and 60 feet, approximately 2,500 feet offshore of Singer Island; 3) the South Lake Worth Inlet (R-151), located approximately 2.5 miles south of the Project Area, and 4) the westernmost boundary of the potential upland mines in order to encompass the truck routes to the Project Area (see Figures 1-5 and 2-2).

Nearshore hardbottom habitat is classified by FDEP to include the “200-400 meter-wide strip from the shoreline, ranging from the supralittoral zone to the depth of -4 meters”, intermediate hardbottom exists “from the depth of -4 meters to the depth of closure (approximately -8 meters)”, and offshore hardbottom is located in “water depths deeper than -8 meters, beyond the depth of closure to -12 meters” (FDEP, 2013). The nearshore habitat may be affected by direct, indirect and secondary impacts due to project construction. This area extends from just updrift of the Project Area to approximately 3000 feet south of the Project Area. It is not anticipated that intermediate or offshore hardbottom resources will be affected by the proposed Project. The nearshore environment of Palm Beach Island is characterized by a generally discontinuous swath of nearshore hardbottom resources along the entire 16-mile island, which is also present throughout most of the remaining shoreline in Palm Beach County. Other known exposed nearshore hardbottom resources are higher functioning reefs in deeper water (9 m or deeper) that have older classes of benthic species (e.g. corals, sponges, and algae) and tend to be persistent.

In addition to the Proposed Action, past, present and future actions on the island that would contribute to cumulative impacts principally include beach management activities (including beach nourishment) conducted within the littoral zone of the Town of Palm Beach and Palm Beach County, and other municipalities within Palm Beach County. Broadly, this includes the entire shoreline of Palm Beach County. Beach management activities within this zone include sand bypassing and inlet sand management at Lake Worth Inlet (Port of Palm Beach), South Lake Worth Inlet (Boynton) and Boca Raton Inlet, and beach nourishments projects. North of Palm Beach County, the nearshore dynamics change due to the natural contours of Florida where there are shallow protective reefs south of St. Lucie Inlet. Additionally, higher functioning reefs become more abundant within Broward County due to a reduced wave climate resulting from a change in the angle of the natural shoreline. Just north of the Project Area, the Lake Worth Pier provides an impediment, or littoral barrier, that interrupts sediment transport. At the south end of the Project Area, the natural shoreline has been stable with no requests to stabilize the beach.



Notes:

1. Coordinates are in feet based on the Florida State Plane Coordinate System, East Zone, North American Datum of 1983 (NAD 83).
2. Background imagery is from ESRI's Imagery Service.The data source is Microsoft, dated December 12, 2010.

Legend:

- Project Limits
- Borrow Area
- FDEP Monument

N

0 1,750 3,500 Feet

1 inch = 3,500 feet

TITLE:

Regional Location Map
Southern Palm Beach Island Comprehensive Shoreline Stabilization Project

CB&I
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Boca Raton, FL 33431
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Date: 12/2/2014	By: ALS	Comm No. : 150190	Figure 2-2

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2.2. TEMPORAL SCOPE

The anticipated project construction start date is 2016. Initial construction is anticipated to occur between November and April 30, and includes dredging and stockpiling of sand, transport and placement of initial fill material, and construction of mitigative artificial reefs. Temporal overlap of these activities is anticipated. Planning for the Project was formulated to include a 50-year horizon considering sand resource utilization and project life-spans of approximately 3-4 years. Assessment of the mitigation requirements for impacts to nearshore hardbottom was computed over an indefinite (perpetual) horizon, i.e., presuming perpetual impacts to resources. The Proposed Action includes periodic renourishment of the project beach fill in nominal three year intervals after initial construction.

Prior activities contributing to cumulative effects potentially include beach restoration activities in 1977 along the Town of Palm Beach. While there were beach restoration activities (mostly from upland sand sources) prior to 2000-01, these earlier activities were either of limited scale or physically distant from the Project impact area. Beach nourishment activities that principally affected the existing shorelines and resources are principally those beach and dune restoration projects commencing in and after the 1990's, and include the bypassing and jetty improvements at Lake Worth Inlet and South Lake Worth Inlet.

2.3. RESOURCES WITHIN THE CUMULATIVE IMPACT ANALYSIS AREA

Priority habitats within the project impact area subject to potential cumulative effects include: (1) nearshore hardbottom along the shoreline that are within the direct and/or indirect influence of beach nourishment (sand placement) activities; (2) benthic, fish and related resources within offshore sand borrow areas subject to dredging; and (3) benthic, fish and related biotic community along shoreline areas subject to periodic sand burial and/or turbidity associated with beach nourishment activities. The nearshore hardbottom habitat in particular is generally considered by the U.S. Fish and Wildlife Service as Resource Category 2, and no net loss of in-kind habitat value is

recommended. Resource Category 1 habitats include those that would be considered unique resources which cannot be replaced; however, these resources are not known to exist within this area.

The proposed Project, in addition to past projects and future actions, primarily affects those habitats or environmental factors related to the nearshore hardbottom, offshore sand borrow areas, upland sand stockpile area, and upland development.

Nearshore Hardbottom. The amount of exposed nearshore hardbottom along Palm Beach Island fluctuates annually. As the shorelines within the Town of Palm Beach and the County are eroded, hardbottom may, depending on the location, become exposed or buried. From 2000 to 2012, the total amount of exposed nearshore hardbottom along Palm Beach Island (Reaches 1-11), as determined by aerial analysis, ranged from 171 ac to 266 ac (FDEP, 2013). Based on FDEP's evaluation of the Palm Beach Island projects authorized by the BMA (see Section 5.0 below) it was determined that the Town of Palm Beach has avoided and minimized impacts to the nearshore hardbottom resulting from the projects to the greatest extent practicable. FDEP also does not anticipate direct or secondary impacts associated with the projects beyond those impacts that have occurred and have been or are being mitigated for in previously permitted projects. For example, in 2004 the Town of Palm Beach constructed a 3.1 ac artificial reef to mitigate for anticipated nearshore hardbottom impacts as part of the 2006 Phipps Ocean Park Beach Nourishment Project. The Town of Palm Beach also constructed a 0.8 artificial reef in 2007 to comply with the federal mitigation requirement even though FDEP determined that the 3.1 ac mitigative artificial reef completely offset nearshore hardbottom project impacts (FDEP, 2013).

For the proposed Project, it is predicted that the Applicants' Preferred Alternative may result in permanent impacts to 4.03 ac of hardbottom as well as temporary and secondary impacts to 8.13 ac of hardbottom. The anticipated permanent impacts would account for approximately 1.5%-2.4% of the historic range of exposed hardbottom acreage and the temporary and secondary impacts would account for approximately 3.1%-4.8% of the historic range. The impacts acreages were used to complete a UMAM

evaluation, which determined that 6.39 acres of mitigative artificial reef would be required to offset these impacts to intertidal and subtidal hardbottom. Future impacts to hardbottom are likely to require similar mitigation to avoid unacceptable cumulative losses attributable to shoreline stabilization projects along Palm Beach Island.

Offshore Sand Resources. There are three previously authorized borrow areas that have approximately 6 million cubic yards of beach compatible sand. The amount of sand is anticipated to provide approximately 23 years of sand for all of the Town of Palm Beach's future shoreline stabilization projects based on a consumption rate of approximately 270,000 cubic yards per year. The rate was calculated by dividing the anticipated amount of sand needed to build the Phipps, Mid-Town and the Preferred Alternative Project and dividing those volumes by the life expectancy of each project. Once the previously authorized borrow areas are depleted of beach compatible sand, the Town of Palm Beach would possibly seek other borrow areas or utilize upland sand sources.

Water Quality. As of September 2013, the Town of Palm Beach has identified 67 public and 103 private outfalls/discharges that currently direct stormwater onto the beach and dune system. Water discharges can cause scour/erosion of the adjacent beach and dune system, and may affect water quality and negatively influence sea turtle nests on the beach or natural resources in the nearshore area. The Town of Palm Beach plans to implement a ten-year program (starting at the effective date of the BMA) to remove or divert all 67 of the public outfalls/discharges. It also plans to implement an annual education campaign targeting all residents with outfalls/discharges on the beach and dune system to consider actions to reduce or eliminate any influences. Improvements in this regard are typically required by the State of Florida as part of its issuance of permits for the proposed action. As such, the Proposed Action represents a stimulus for the non-federal interests to improve urban storm water runoff.

Water quality associated with the Project may be influenced by placement of both upland sand and stockpiled dredged sand. The placement of fill would produce a temporary increase in turbidity at the fill site and adjacent waters; however, the use of a

truck haul approach minimizes these impacts. Additionally, turbidity monitoring will be required throughout construction activities, and implementation of proper design and best management practices (BMPs) can minimize impacts due to the potential for elevated turbidity. The grain size of the sand material determines the amount of impact on organisms; elevated amounts of fine grained material can lead to long term effects, whereas smaller amounts will diminish quickly. Sand from either source must meet FDEP requirements for beach sand compatibility as per Florida Administrative Code, Rule 62B-41.007(2)(j). For the specific Project Area, any sand source must be consistent with the BMA cell-wide sediment quality specifications (FDEP, 2013). The sand source used for the County project must also meet the County's technical sand specifications outlined in the County's Annual Dune and Wetlands Restoration contract. Utilizing fill material that meets the above specifications will minimize the potential project impacts to water quality.

Upland Sand Stockpile Area. The upland stockpile areas within the limits of the Mid-Town Project and the Phipps Project proposed for interim staging of the dredged material are already developed and designated as dredged-material temporary staging areas and their boundaries and function will remain unchanged. With monitoring for, nesting sea turtles, shorebirds, and other species of concern proximate to the stockpile areas, no singular or cumulative significant adverse environmental impacts are anticipated from the stockpile activity. The transport of sand from the borrow area to the temporary staging area (within Mid-Town and/or Phipps) will increase vessel traffic near the Lake Worth Inlet. Transport of fill sand from the Mid-Town and/or Phipps stockpile areas to the beach site will increase truck traffic within local upland roadways during the construction period. These activities are not continuous but would occur for several months every few years. Both activities increase air pollution and carbon emissions, Equivalent activities have occurred in the past, and will continue through the present and future. Vessel and truck activities at the Inlet and stockpile area are all within existing, developed areas with similar purposes. Transport of the sand on the public roads cumulatively increases traffic and related impacts on these roads. Thus, there are no significant cumulative impacts associated with these factors.

Upland Development. The proposed Project will increase the length of shoreline where sand is placed to mitigate beach erosion and decrease the potential for public and private property losses. Because the upland shorefront property along the Project Area and adjacent shores is more or less fully developed, and because the proposed beach fill and level of storm protection is relatively small, the action is not anticipated to significantly alter (increase) the density of nature of upland development – when viewed in the cumulative context of past, present and future related activities. In the absence of the Proposed Action, and/or the absence of continued or future, similar beach fill actions in the overall area, it is not reasonably anticipated that development will decrease. Instead, in the absence of the Proposed Action and other beach fill actions, it is likely that property values may decrease and maintenance of the existing properties could increase, and seawalls and shoreline armoring may increase. Thus, in regard to upland development and related trends, there are no significant adverse cumulative effects anticipated with implementation of the project. Instead, adverse impacts are more likely associated with the No Action Alternative and/or the cumulative effects of discontinuing existing and future active beach management activities.

See Table 7-1 for a summary of the cumulative impacts to resources expected from future Palm Beach Island projects and project-related activities.

2.4 ACTIONS AFFECTING THE RESOURCES, ECOSYSTEMS, AND HUMAN COMMUNITIES OF CONCERN

Other significant actions that could potentially affect the resources of concern identified in this analysis (nearshore hardbottom and sand beach habitat) principally include adjacent beach restoration and related activities, beach lighting and urban storm water runoff (outfalls).

There are no other direct mechanical (e.g., pipeline) impacts to the hardbottom associated with the Proposed Action or other, adjacent actions. Beach fill placement along the Project Area shall be from the upland (truck-haul) originating from the Phipps or Mid-Town project areas. Elsewhere in the region, where pipeline (hydraulic)

delivery of beach fill material is implemented, there are no anticipated new hardbottom resource impacts. There are no other regional beach restoration activities that result in direct impact to hardbottom that have not or will not be reviewed by the USACE.

Sand fill placement within the project impact area has previously included dune restoration to partially restore sand eroded from the dune, above the high water line. These activities have not advanced the beach or shoreline relative to pre-storm conditions. The sand fill for the previous activities has been from permitted upland sources or as a result of dredging offshore borrow areas. No adverse environmental effects have been identified from these activities. The Proposed Action would serve to enhance and partially replace ongoing non-federal actions for post-storm dune restoration. It would fulfill future requirements for dune restoration (in terms of both maintenance and storm protection) using high-quality, beach compatible sand from offshore sources.

The historical and future placement of beach nourishment material adjacent to the project impact area can potentially result in cumulative impacts to the nearshore hardbottom and beach habitat.

Artificial lighting, coupled with loss of dune/coastal hammock vegetation and increased elevation of the beach berm, exposes the marine turtle nesting beach to increased artificial lighting. This lighting can lead to disorientation of marine turtles (hatchlings), impeding their timely entry from nest to sea. To address this impact, to date, all beach nourishment activities along the Palm Beach County shoreline have incorporated (1) beach lighting surveys and follow-up measures to reduce lighting impacts and (2) sloping “turtle friendly” berm elevations. The slopes, elevations and widths of the beach fill placement in the Project Area are likewise designed to minimize impacts to marine turtles. Beach lighting will be in accordance with local ordinances.

3.0 AFFECTED ENVIRONMENT

3.1. RESPONSES BY RESOURCES, ECOSYSTEMS, AND HUMAN COMMUNITIES TO CHANGE AND THEIR CAPACITY TO WITHSTAND STRESSES

The nearshore hardbottom adjacent to the Project Area exists in a shallow, turbulent, highly dynamic, energetic and sedimentary environment. The hardbottom resources are subject to frequent burial and exposure by sand, turbidity, and abrasion. The nearshore environment where direct, indirect and secondary impacts are anticipated is defined as the Study Area and extends from R-127 to R-141+586. Within the Study Area, aerial delineation of hardbottom resources between 2003 and 2013 revealed a highly variable range of exposed hardbottom acreage between 3.06 acres (2009) and 51.20 acres (2006). The time average amount of exposed hardbottom in this time period is 25.37 acres. The most recent delineation from 2013 aerials revealed approximately 39.26 acres of hardbottom in this area.

The physical stresses of the nearshore habitat limit the biodiversity and survivability of epibenthic species. Due to these conditions, some of the nearshore hardbottom within the intertidal zone is bare scoured rock or may be colonized primarily by turf algae. However, several sessile organisms are well adapted to the prevailing conditions and often cover high portions of the exposed rock. One such organism is the sabellarid polychaete *Phragmatopoma lapidosa*, which forms large gregarious colonies commonly referred to as worm rock or worm reefs (Kirtley and Tanner, 1968; McCarthy et al., 2003). The worm reef colonies are composed of sand grains cemented together to form rugose structures that add relief and structural complexity to existing natural and artificial hard bottom. The growth of worm reef depends on a combination of available hard substrate, wave energy, sediment availability, and larval supply (McCarthy et al., 2003). Wave impacts from fairly frequent to severe storms can dislodge and destroy much or almost all of the worm reef colonies that have formed upon the nearshore coquina rock outcrops. The colonies are typically reformed within a few summers

thereafter (McCarthy et al., 2003). Worm reefs support fish species and associated assemblages of organisms, such as decapod crustaceans (Gore et al., 1978); however, the 2013 characterization of the Study Area documented average wormrock cover of less than 1%. This survey did document 56 species of fish, 2 species of scleractinian corals, 4 genera of octocorals, 14 genera of macroalgae and other functional group organisms such as sponges, tunicates, hydroids, bivalves, barnacles, turf algae, anemones, bryozoans, and zoanthids.

Beach nourishment and construction of shore protection structures can introduce increased turbidity and sedimentation to the nearshore habitat. Turbidity can affect feeding, movements and respiration in fishes. High concentrations of suspended or fine sediments can clog or abrade gills. The ability of these biota specific to the existing hardbottom resources to survive within this dynamic and turbulent environment indicates their tolerance to high levels of sedimentation, turbidity and periodic burial. Additional sediment may directly or indirectly affect the nearshore hardbottom resources. The degree to which this sediment will impart change or stress to the system is in large part associated with the amount and quality (grain size, compatibility) of the sediment, and the lines, grades and slopes to which the sediment is placed. As previously mentioned, it is anticipated that the mechanical placement of beach compatible sand will minimize these impacts.

While nesting marine turtles are adapted to a dynamic, energetic, sandy environment, non-nesting emergences may result on beaches that are overly compact due to recent beach nourishment activities. Additionally, hatching success may be adversely impacted by nests established on sand beaches with poor gas exchange, or which are subject to physical erosion or frequent inundation.

3.2. STRESSES AFFECTING RESOURCES, ECOSYSTEMS, AND HUMAN COMMUNITIES AND THEIR RELATION TO REGULATORY THRESHOLDS

Critical levels of sedimentation (in terms of thickness and temporal length of sand burial) and sedimentary abrasion affecting the survival or growth of macroalgae, worm rock, infauna and other biota associated with the nearshore hardbottom are likely cross-dependent on numerous other factors and vary with the biota, and are otherwise not definitive. Levels of sedimentation associated with the nearshore habitat along the Project Area cannot be pragmatically measured (as is done for coral reef monitoring, for example).

Relevant State of Florida turbidity thresholds require that activities create less than 29 NTU above background levels. It is not anticipated that the Proposed Action will result in turbidity that reaches or approaches this level due to the nature of the proposed beach fill sediment with low (<2%-3%) fines fraction, and a truck haul approach will be utilized where the sand will be placed mechanically rather than hydraulically.

Standards developed by the USFWS require that measured beach compaction be less than 500 cone penetrometer units at 6 inches, 12 inches, and 18 inches below beach grade, in order that the beach be compliant with marine turtle nesting activity (else, the beach must be tilled). Monitoring for beach compaction, and subsequent tilling when required, is undertaken for all beach restoration activities in Palm Beach County. The standards developed and followed in this regard have thus far appeared to be appropriate relative to their objectives.

3.3. BASELINE CONDITIONS FOR RESOURCES, ECOSYSTEMS, AND HUMAN COMMUNITIES

The general occurrence of nearshore hardbottom along the project impact area was described during the baseline characterization (CB&I, 2014). Aerial delineation of the

nearshore hardbottom identified 39.26 acres along the Study Area shoreline (R-127 to R-141+586) in 2013.

A collection of aerial photography with sufficient clarity (in terms of water clarity, surf and turbulence, cloud cover, etc.) can assist with accurately identifying and quantifying the amount of exposed nearshore hardbottom along this coastline, and is included in the analysis. The 2013 results represent the most recent, ecological characterization of the hardbottom. However, a 10-year time-averaged series of aerial photographs from 2003 to 2013 were used to identify and assess impacts since there is a substantial disparity among multiple years, ranging from a high of 51.20 acres of exposed hardbottom in 2006 to a low of 3.06 acres in 2009. Persistent hardbottom is that which is constantly exposed over a given timeframe. A very small area (0.000392 acres [17.1 ft^2]) of hardbottom was identified between 2003 and 2013 located approximately 350 feet north of R-133.

Pre-project, baseline conditions that characterize the biota and physical exposure (and natural variation) of the nearshore hardbottom and beach profile shall be measured as part of the Project's Mitigation and Monitoring Plan. Details of the mitigation plan are presented in Appendix I of the EIS and the monitoring currently follows that outlined in the BMA.

Baseline conditions for marine turtle nesting activities have been previously established through mostly annual monitoring conducted in Palm Beach County since before 1980. Palm Beach County beaches serve as important nesting habitat for threatened and endangered sea turtle species. Although Palm Beach County beaches comprise only 3% of the State's ocean shore length, the County accounted for 22.4% of the nesting in the State in 2013 (FWC, 2013; Palm Beach County, 2014; U.S. Census Bureau, 2012). In the same year, loggerhead, green and leatherback sea turtles accounted for 65.8%, 33.2% and 1.0%, respectively, of the nesting in the County (FWC, 2013). These three species are known to regularly nest on Palm Beach County beaches.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1. CAUSE-AND-EFFECT RELATIONSHIPS BETWEEN HUMAN ACTIVITIES AND RESOURCES, ECOSYSTEMS, AND HUMAN COMMUNITIES

Anthropogenic factors that may principally, and potentially, result in substantial effects to the nearshore hardbottom communities in the project impact area would be shore protection, pollution, mechanical destruction, and overfishing. Of these, only shore protection activities are pragmatically relevant. Pollution would adversely affect the hardbottom biota. A source of pollution may be stormwater outfalls upon the beaches, and these outfalls could be modified by non-federal actions in the future, particularly as the Proposed Action may be implemented. Mechanical destruction of the hardbottom (by dredging or displacement, etc.) is not known to occur or likely to occur at this location. Recreational (surf) fishing occurs along the nearshore hardbottom, from the beach, but is not known to be unusually frequent or abundant in the quantity of catch.

Shore protection activities can affect the nearshore hardbottom by: (1) direct burial/sedimentation by sand placement: (2) indirect burial/sedimentation by alongshore or cross-shore diffusion (transport) of sand across the hardbottom; (3) increased turbidity; (4) accumulation of sand by the construction of groins, breakwaters, or similar structures intended to entrap or stabilize sand movement; and (5) beach erosion and burial of the nearshore rock, such as induced by seawalls and armoring.

Mechanical and beach lighting activities along the beach can adversely impact marine turtle nesting by; (1) physical impact; (2) burial, inundation and/or exposure of nests; (3) establishment of beach sediment that is not compatible with nesting; and (4) disorientation.

Direct burial of nearshore hardbottom may result in mortality of macroalgae and faunal epibenthic species, as well direct burial of newly settled life stages of fishes. Suspension of sediment may cause mortality to eggs and larvae of marine and

estuarine fish, and a reduction in feeding in juvenile and adult fish. Settlement and shelter of juvenile fish may be reduced by the gradual burial of 4.03 acres of nearshore hardbottom habitat. Foraging sea turtles and fish could be displaced to adjacent areas of hardbottom. It is anticipated that reduced feeding success may influence survival, year-class strength, and recruitment of juvenile fish that inhabit nearshore hardbottom. For these reasons, the Proposed Action includes compensatory mitigation to serve towards replacing ecological functions potentially lost with the partial or total burial of about 4.03 acres of existing nearshore hardbottom in the Project Area.

4.2. MAGNITUDE AND SIGNIFICANCE OF CUMULATIVE EFFECTS

The Proposed Action is anticipated to impact on the order of 4.03 acres of existing nearshore hardbottom, or about 15.9% of the total exposed hardbottom resource along the Study Area, based upon a 10-year time-average analysis.

Through a detailed assessment based upon field prototype investigations and related analysis, the proposed mitigation in the form of an artificial reef has been evaluated and developed in terms of its likely ability to replace ecological functions lost due to implementation of the Proposed Action. Mitigation reefs cannot be assumed to replace all ecological functions for the same suite of species or life stages that exist on natural reefs in shallower water. There are likely species-specific differences in sensory perception to water depth, wave energy, light penetration, turbidity, and other factors that may be different at the proposed mitigation site. In addition to these deterministic factors, there is an element of uncertainty associated with the colonization of newly available substrate by marine organisms that leads to variability and unpredictability. Nevertheless, over time the mitigative artificial reefs will lessen the significance of the initial adverse impact affected by direct burial of the landward edge of the nearshore hardbottom. Detailed discussion of the anticipated functional loss and functional gain associated with the biotic community and habitat at the impacted (nearshore hardbottom) and mitigation reef features is presented in the UMAM analysis in Appendix H of the EIS and details of the mitigation plan are provided in Appendix I of the EIS.

Annual monitoring of marine turtle nesting success on Palm Beach County beaches have indicated no significant adverse impacts associated with prior or ongoing re-nourishment activities. The Proposed Action will utilize sand from the same sources utilized for these other activities, and shall adopt similar “turtle friendly” fill placement geometries, construction restrictions and monitoring protocols.

The Proposed Action will not result in a cumulative increase in sand placement along the project impact area, as it will replace dune restoration that has been periodically required by the Applicants in response to dune erosion effected by severe storms. Instead, the Proposed Action should act to better ensure the beach-compatible quality of the placed sand through the placement of high-quality sand from offshore sand sources that has been successfully used on the adjacent shorelines.

The results of the environmental monitoring of the beach/seabed, nearshore hardbottom and mitigation reef structures will provide the information necessary to assess the overall cumulative impacts of the Proposed Action upon the affected environmental resources in and offshore of Palm Beach County.

4.3. MODIFICATION OR ADDITION OF ALTERNATIVES TO AVOID, MINIMIZE, OR MITIGATE SIGNIFICANT CUMULATIVE EFFECTS

Special conditions of any authorization for the proposed projects would reduce the potential for significant cumulative effects to environmentally sensitive nearshore resources from turbidity and sedimentation through turbidity monitoring and protocols to stop all activities if the limits are exceeded.

This EIS considered six beach-fill project alternatives, which includes the No Action Alternative. The proposed projects sought to avoid and minimize project-related impacts to the greatest extent possible while maintaining the project objectives and to likewise implement mitigation for unavoidable impacts. Development of the Projects’ mitigation reef structures has been proposed and should provide probable success of the reef in replicating displaced ecological function of the impacted nearshore hardbottom, by

better emulating the physical nature of the impacted resource and decreasing the possibility of subsidence of the structure.

4.4. MONITORING OF THE CUMULATIVE EFFECTS OF THE SELECTED ALTERNATIVE AND ADAPTIVE MANAGEMENT

A physical and biological monitoring program will be implemented to evaluate the pre- and post-construction conditions, performance and effects of the proposed beach fill placement, nearshore hardbottom, and mitigation reef. Details of this program are described in Chapter 5 (Mitigation) of the EIS. This use of adaptive management actions shall be taken based on the results of pre- and post-construction monitoring efforts.

In the present instance, the Proposed Action and its predicted effects are relatively small and reversible. The resources of the nearshore hardbottom that will be affected by the proposed sand placement exist in a dynamic environment and are adapted to naturally high sedimentation, sand abrasion, turbidity, and cyclical sand burial and exposure. The physical and temporal scales of the sand placement and resultant impacts to the beach and nearshore hardbottom are relatively small. The scale of the Project can be readily adapted to respond to the monitored effects of the Project's action, relative to the predicted effects described herein.

The project shall likewise implement monitoring during construction attendant to threatened and endangered species protection, turbidity, cultural resources, beach compaction, beach lighting and marine turtle nesting and success, and sediment-quality assurance. These monitoring activities are described in Section 5.1 of the EIS (Environmental Commitments). Each activity includes prescribed measures for monitoring and real-time response (adaptive management) to the monitoring observations. Identical or analogous monitoring protocols and measures have been successfully utilized in the past for projects constructed within the affected region and elsewhere throughout the State of Florida.

5.0 PALM BEACH ISLAND PROJECTS AUTHORIZED BY THE BMA

The following sections describe the Palm Beach Island projects currently authorized by the Beach Management Agreement (BMA) (FDEP, 2013).

5.1. LAKE WORTH INLET MAINTENANCE DREDGING

The permitted activity is periodic maintenance dredging by USACE Permit No. 0216012-001-JC of the entire navigation-related complex at Palm Beach Harbor/Lake Worth Inlet. The BMA authorizes the Town of Palm Beach to become a co-applicant with the Army Corps of Engineers for the placement of beach quality sand from the dredging activity and to use the sand placement sites identified below. Dredged material will be placed within the beach-nearshore template. The berm will have an elevation of approximately +8.7 feet (MLW), with a 1V:20H seaward slope. Placement of material may begin immediately south of the south jetty, and proceed in a southerly direction approximately 3,450 feet near FDEP reference monument R-79. If the authorized beach placement area immediately south of the Lake Worth Inlet is filled, then beach-quality sand may be placed within the Mid-Town Beach or the Phipps Ocean Park nourishment template. Within the entrance channel (between USACE Stations 25.0 and 56.0), shoals of less than 5,000 cubic yards may be transferred to deeper parts of the channel to temporarily alleviate navigational hazards. The construction activity will adhere to a Sediment Quality Control/Quality Assurance Plan that was approved by the Department on July 20, 2006.

5.2. LAKE WORTH INLET SAND TRANSFER PLANT

Under the BMA, the FDEP authorizes improvements to the sand transfer plant owned by the Town of Palm Beach at Lake Worth Inlet and authorizes the operation and maintenance of the sand transfer plant. Construction improvements include a new pump house facility immediately adjacent to the existing bypass plant on the north jetty of the Lake Worth Inlet and the construction of an additional discharge pipeline. The new facility will house a booster pump for an additional pipeline to transport material from the

north jetty approximately 4,500 feet south to an alternate discharge point near R-79 within Reach 2 in the Town of Palm Beach. The BMA authorizes the new pipeline to be directionally drilled beneath the inlet channel and remain below the sea bottom until it reaches a beach discharge structure anchored to pilings and enclosed in architectural formwork on the beach.

During the operation phase, the FDEP authorizes the bypassing of approximately 162,000 cubic yards of beach-quality sand per year to the beach on the south side of the inlet. Material discharge rates from the bypassing plant will be less than 5,000 cubic yards per day and on an intermittent basis as coastal littoral transport processes move sand to the intake pipe of the bypassing plant on the north jetty. The Town of Palm Beach will utilize the two discharge pipelines as needed to maintain the beach in Reach 1 and Reach 2, and protect the shore-based discharge pipeline structure located immediately south of the inlet.

5.3. MID-TOWN BEACH NOURISHMENT PROJECT

The BMA authorizes periodic beach nourishment to maintain the beach restoration project located in the central portion of the Town of Palm Beach between R-89 and R-102 (Reaches 3 and 4), and maintenance repairs to the eleven existing groins. In conjunction with this activity, the FDEP authorizes the construction and maintenance of one additional groin located at R-99.3.

The beach fill design consists of a 25-foot wide design berm plus advance beach nourishment placed seaward of the design berm at an elevation of +9 feet NGVD for an average construction berm width of 180 feet. The beach construction berm is designed to a 1V:10H (vertical; horizontal) slope. The volumetric amount will be based on existing site conditions at the time of construction, but will not exceed the permitted template. The Department authorizes the Town of Palm Beach to obtain beach compatible sand from offshore borrow areas (see Section 6.0). Alternatively, the Town of Palm Beach may obtain beach compatible sand from an approved upland source consistent with the cell-wide sand specifications outlined in Article D-2 and truck-hauled to the beach

through designated beach maintenance access sites. If beach compatible sand becomes available from the maintenance dredging of Lake Worth Inlet by the USACE, it may also be used as fill material for the portion of this beach template located between reference monuments R-95+108 feet and R-101.4.

The Department authorizes repairs and maintenance to the eleven groins constructed in conjunction with the 1995 beach restoration (FDEP File No. 50-273953-9 and DBS9A0352-PB) not to exceed the parameters of the original design as shown in the approved plans and specifications. The groins are spaced approximately 325 feet apart on average and vary in length from 88 feet to 167 feet with a crest elevation at +6.0 feet NGVD, toe at approximately -1.0 feet NGVD at the landward end and approximately -4.0 feet at the seaward end. In addition, the construction and maintenance of one additional groin is authorized near the south limits of the project area at R-99.3. The authorized groin will be 98 feet long in the shore-normal direction and 12 feet wide at the crest. The sand placement described above will completely cover the groin.

As described in Section 1.1.1., the Town of Palm Beach proposes to use sand stockpiled during the Phipps Project and/or Mid-Town Project as the preferred sand source for the Project Area within the Town of Palm Beach limits. The proposed Project and the Phipps and Mid-Town projects are, therefore, considered cumulative actions under NEPA.

5.4. PHIPPS OCEAN PARK BEACH RESTORATION PROJECT

The BMA authorizes periodic beach nourishment to maintain the beach restoration project located in the south portion of the Town of Palm Beach (Reach 7) between R-119 and R-125 and periodic placement of sand to maintain the restored dune in the northern portion of Reach 7, from R-116 to R-119. In addition, the FDEP authorizes beach restoration and periodic beach nourishment between monument R-125 and the northern boundary of the Lake Worth Municipal Park at monument R-127 (northern segment of Reach 8). Construction and maintenance of these three contiguous

segments may be conducted separately or together and material may be stockpiled on the berm between R-119 and R-126 to replenish the restored dune.

The beach fill design from R-119 to R-127, consists of a +9 feet NGVD berm elevation with an average construction berm width varying from 190 feet to 455 feet. The restored dune has a typical crest width of 25 feet at an elevation of +16 feet NGVD, with a 1V:3H slope down to the beach berm, except north of R-119 where the dune crest is +10 feet. The volumetric amount will be based on existing site conditions at the time of construction, but will not exceed the permitted template.

The BMA authorizes the Town of Palm Beach to obtain beach compatible sand from offshore borrow areas (see Section 6.0), or any offshore source consistent with the cell-wide sand specifications in Article D-2 of the BMA. Alternatively, the Town of Palm Beach may obtain beach compatible sand from an approved upland source consistent with the cell-wide sand specifications and truck-hauled to the beach through designated beach maintenance access sites.

The Phipps Ocean Park beach Restoration Project includes periodic dune restoration south of the Lake Worth Pier in Reach 8. The dune-only portion, from R-129 to R-134 (within Reach 8), will be constructed to an elevation of +10 feet NAVD with a 1V:3H slope.

As described in Section 1.1.1., the Town of Palm Beach proposes to use sand stockpiled during the Phipps Project and/or Mid-Town Project as the preferred sand source for the Project Area within the Town of Palm Beach limits. The proposed Project and the Phipps and Mid-Town projects are, therefore, considered cumulative actions under NEPA.

5.5. PALM BEACH GROIN REHABILITATION

The BMA authorizes repair, rehabilitation, or removal of existing groins within the Reaches 2, 4, 5, and 6, as described in the 2011 Coastal Structures Plan for the Town of Palm Beach. The adaptive management strategy for this authorization includes

revising the list of groins needing repair, rehabilitation, or removal, and updating the table below (Table 5-1).

Table 5-1. List of groins that have been repaired, rehabilitated, or removed (FDEP, 2013).

Location		Structure ID	Activity
Reach 2	R-88	G73655	Retain and Repair
Reach 2	R-88+875	G72800	Retain and Repair
Reach 2	R-89+325	G72426	Retain and Repair
Reach 2	R-89+850	G71894	Remove
Reach 2	R-90+50	G71633	Retain and Repair
Reach 4 “North”	R-100+225	G59940	Retain and Repair
Reach 4 “North”	R-100+1150	G59002	Retain and Repair
Reach 5 “South”	R-108+650	G50601	Retain and Repair
Reach 5 “South”	R-108+1000	G50249	Retain and Repair
Reach 5 “South”	R-109+175	G49866	Retain and Repair
Reach 6	R-114+150	A44411	Remove

5.6. DUNE AND BACKSHORE BERM RESTORATION AND MAINTENANCE

The BMA authorizes the BMA Participants to construct artificial dunes within the Agreement Area as described below. Artificial dunes constructed in the Agreement Area are intended to protect upland properties and to protect and enhance habitat. The FDEP identified segments of shoreline within the Agreement Area with conditions suitable for the construction of sustainable dune features and developed procedures the BMA Participants must follow to construct dunes on those shorelines. Implementation of this Article will not only meet the goals stated above, but also provide more efficient and predictable permitting of artificial dunes in the Agreement Area.

The FDEP identified four dune conditions, permittable by the BMA, based on aerial and visual inspection of existing dunes, armoring, beach widths and elevations within the Agreement Area. These areas are identified in BMA Appendix A-4. Condition 1 is excellent for dune restoration projects, having a wide and elevated back beach berm. Condition 1 shorelines contain the island’s best existing dune features. Condition 2 is good or appropriate for dune projects, having a sufficiently wide back beach berm on which fill can be placed. These shorelines are often steep and armored and, for this reason, the sustainability of the dune feature is lower. Condition 2 dunes could be

considered sacrificial, meaning dunes constructed in these locations will likely provide temporary relief from coastal erosion until persistent wave activity transports material from the template. Condition 3 is poor for dunes, as constructed dunes are likely not sustainable and are subject to erosion from high frequency storms. Condition 4 includes the dune and backshore berm designs for the Mid-Town and Phipps Ocean Park beach nourishment projects.

The BMA Participant may use an offshore borrow area to obtain beach compatible sand that is stockpiled during beach nourishment and then transported to the dune restoration site. Alternatively, beach compatible sand may be obtained from an approved upland sand source consistent with Article D-2 of the BMA. This would allow the placement of artificial dunes in new locations or the restriction of dune placement in others. Changes in areas authorized for dune placement will require a formal amendment of the Agreement. BMA Participants wishing to construct a dune must meet the criteria set forth in Appendix D of BMA, and submit the information required in Appendix F-1. Before constructing a dune, the BMA Participant must follow the authorization procedures in Article I.

6.0 PREVIOUSLY AUTHORIZED OFFSHORE BORROW AREAS

Based upon the information and analysis provided by the applicant, the material to be excavated from the proposed borrow areas for placement in the beach project areas is expected to maintain the general character and functionality of the material occurring on the beach and in the adjacent dune and coastal system pursuant to Rule 62B41.007(2)(j), F.A.C. The proposed borrow areas include at least a 1000-foot buffer between the borrow area and any adjacent hardbottom. Potential borrow areas are shown in Figure 1-4.

6.1. OFFSHORE BORROW AREAS NBA1, NBA2 AND NBA3

6.1.1. NORTH BORROW AREA 1 (NBA1)

North Borrow Area 1 is a southward extension of the borrow area used for the 2009 Juno Beach Restoration Project and is located 1 to 2 miles north of Lake Worth Inlet in water depths between 40 and 60 feet approximately 2,500 feet offshore of Singer Island (Figure 1-4). The coarsest material within this borrow area occurs along the offshore boundary. In general, the coarser material is a subsurface layer 5-10 feet thick under several feet of fine sand. The estimated 2.8 million cubic yards of material within NBA1 is based on a nominal cut thickness of 15 feet. Core composite values range from 0.25 to 0.31 mm with a composite value for NBA1 of 0.276 mm and silt content of less than 2%. Based on the data provided, the selected regions of the North Borrow Area 1 contain beach compatible material.

6.1.2. SOUTH BORROW AREA 2 (SBA2)

South Borrow Area 2 is adjacent to Reach 7 and Phipps Ocean Park between R-110 and R-120 in water depths of 24-36 feet between the first and second reef (Figure 1-4). The estimated volume of 1.68 million cubic yards is based on a nominal cut thickness of 10 feet. The cores collected show a mix of fine sand and shell fragments. Some of the cores contain coral or rock fragments. Although a few scattered rock fragments were found in the cores, the occurrence of the rock fragments was not extensive enough to identify continuous lenses or layers of rock rubble. Core composite values range from 0.21 to 0.36 mm with a composite value for SBA2 of 0.29 mm and silt content of approximately 1%.

6.1.3. SOUTH BORROW AREA 3 (SBA3)

South Borrow Area 3 is adjacent to Reach 8 from Lake Worth Pier (South of R-128) to the city limits of the Town of Palm Beach (R-134) in water depths of 20-35 feet (Figure 1-4). SBA3 is located landward of Borrow Area III (R-127 to R-130) and immediately adjacent to Borrow Area IV (R-132 to S of R-134) used for Phipps Ocean Park permit.

SBA3 is same location as Borrow Area V proposed for Reach 8, only with slightly modified boundaries. The estimated volume of 1.83 million cubic yards is based on a nominal cut depth of greater than 10 feet. The cores show a mix of fine sand and shell fragments, and some contain rock and coral fragments. Core composite values range from 0.17 to 0.33 mm with a composite value for SBA3 of 0.25 mm and silt content of approximately 1%. Based on the data provided, the majority of the South Borrow Area 3 study area contains beach compatible material.

6.2. APPROVED MIXING ZONES

Temporary mixing zones for each of the two beach nourishment projects (Mid-Town and Phipps) would be implemented in order to construct the projects. A mixing zone of 150 meters offshore and downdrift would be implemented in accordance with state water quality standards for the Mid-Town beach nourishment activities. A mixing zone of 1000 meters downdrift and 300 meters offshore for the nearshore and beach placement site for the Phipps Ocean Park Project beach nourishment activity would be implemented in accordance with state water quality standards. This mixing zone shall only be valid during the construction period of the proposed activities. The Applicants would be required to monitor the waters within the Project Area to avoid water quality degradation (FDEP, 2013).

7.0 CUMULATIVE IMPACTS TO RESOURCES

Table 7-1 summarizes cumulative impacts, both positive and negative, that are expected to result from continued construction of coastal projects on Palm Beach Island, including all activities associated with those projects authorized by the BMA (see Section 5.0) and with the proposed Southern Palm Beach Island Comprehensive Shoreline Stabilization Project. Impacts to wildlife, habitat, and the human environment are considered. These resources were identified during the scoping process and EIS preparation. As stated in Section 2.2, the temporal scope of this analysis is 50 years, even though the current proposals are for one-time authorizations. However, during this timeframe, it is anticipated that the projects may require re-authorization since the

project life was designed for a three to four year duration. If the projects were constructed on a regular basis, the anticipated impacts summarized in Table 7-1 assume that the actions presented will be repeated for a period of at least 50 years.

Table 7-1. Cumulative impacts expected from Palm Beach Island projects and project-related activities.

Impacts to Resources	Dredging of Borrow Areas and Inlets	Transport of Sand from Mines	Placement of Sand on Beach and Dune (Above MHW)	Placement of Sand in Nearshore Marine Habitat (Below MHW)	Groin Construction/Rehabilitation	Construction of Artificial Reefs
Nesting Sea Turtles and Loggerhead Terrestrial Critical Habitat Unit LOGG-T-FL-12	NA	NA	Construction will avoid peak nesting season and will use compatible sand. However, compaction or other physical and chemical changes may impact nesting. Continued projects mean repeated disturbance to the habitat, but also maintain the stability of nesting beaches on Palm Beach Island.	If construction occurs during nesting season, the path of nesting and hatchling sea turtles may be impeded by construction activities.	Construction will avoid peak nesting season. Post-construction, groins may impede access to/from the beach for nesting/hatchling sea turtles. Groins may also cause downdrift erosion to sea turtle nesting habitat. However, the structures also help to stabilize beach habitat.	NA
Swimming Sea Turtles and Loggerhead Marine Critical Habitat Unit LOGG-N-19	Hopper dredging, and sometimes cutterhead dredging, occasionally results in sea turtle entrainment and death. The noise generated during dredging may also deter swimming sea turtles from the area.	NA	NA	Burial of nearshore hardbottom could prove to have detrimental effects for juvenile green sea turtles. However, it is estimated that this will be only a minor adverse effect. Sea turtles may also be negatively impacted by turbidity and/or noise during the construction period.	In water construction is unlikely due to the location of the nearshore hardbottom formations which will prevent barges from approaching the shoreline. However, all vessels will comply with NMFS Sea Turtle and Smalltooth Sawfish Construction Conditions (NMFS, 2006) in order to minimize direct impacts to swimming sea turtles during construction or maintenance of groins.	All vessels will comply with NMFS Sea Turtle and Smalltooth Sawfish Construction Conditions (NMFS, 2006) in order to minimize direct impacts to swimming sea turtles during construction of artificial reefs. Noise during construction may deter sea turtles from the area.
Florida Manatee	Manatees are rarely observed in water depths associated with the offshore borrow areas, so impacts from dredging the borrow areas are negligible. Dredging in the authorized channel may increase the potential for impacts to manatees. All vessels will comply with Standard Manatee Construction Conditions for In-Water Work (FWC, 2011) to reduce the potential for manatee impacts.	NA	Seagrass is not located within the Action Area, but manatees may use the Action Area as a travel corridor.	There exists the possibility of increased turbidity and noise disturbing the animals during construction. These small disturbances are not anticipated to have major impacts. However more frequent nourishment projects may result in larger impacts.	If the groins are installed or repaired using in-water methods, direct impacts to manatees include the possibility of vessel strike. However, all vessels will comply with Standard Manatee Construction Conditions for In-Water Work (FWC, 2011) to reduce the potential for manatee impacts.	During construction of artificial reefs, direct impacts to manatees include the possibility of vessel strike. However, all vessels will comply with Standard Manatee Construction Conditions for In-Water Work (FWC, 2011) to reduce the potential for manatee impacts.

Table 7-1 (cont.). Cumulative impacts expected from Palm Beach Island projects and project-related activities.

Impacts to Resources	Dredging of Borrow Areas and Inlets	Transport of Sand from Mines	Placement of Sand on Beach and Dune (Above MHW)	Placement of Sand in Nearshore Marine Habitat (Below MHW)	Groin Construction/Rehabilitation	Construction of Artificfial Reefs
Smalltooth Sawfish	Dredging an offshore borrow or inlet increases potential for impacts with smalltooth sawfish, however NMFS has determined that there has never been a reported take of a smalltooth sawfish by a hopper dredge (NMFS, 1997). All vessels will comply with NMFS Sea Turtle and Smalltooth Sawfish Construction Conditions (NMFS, 2006).	NA	Increased turbidity during construction and anticipated burial of hardbottom resources are unlikely to impact sawfish, due to the rarity of their occurrence over nearshore hardbottom adjacent to Palm Beach Island.	Construction related turbidity and noise may disturb the smalltooth sawfish. With mitigation measures in place, however, it is believed that the potential for smalltooth sawfish "take" will be greatly reduced. Smalltooth sawfish are expected to avoid the small habitat area used during construction. However more frequent nourishment projects may result in larger impacts.	If the groins are constructed or rehabilitated using in-water methods, direct impacts to smalltooth sawfish include the possibility of vessel strike. However, all vessels will comply with NMFS Sea Turtle and Smalltooth Sawfish Construction Conditions (NMFS, 2006) in order to minimize impacts.	All vessels will comply with NMFS Sea Turtle and Smalltooth Sawfish Construction Conditions (NMFS, 2006) in order to minimize direct impacts to swimming sea turtles during construction of artificial reefs. Noise during construction may deter sea turtles from the area.
Coral and Hardbottom	A 1000 ft buffer between offshore borrow areas and hardbottom habitat. Turbidity and biological monitoring will also be conducted as required.	NA	Sand placed above MHW may be transported into the marine environment.	With each nourishment project, sand is repeatedly placed on areas of intertidal and nearshore habitat, and spreading impacts areas farther offshore. Mitigative artificial reefs have been constructed for previous BMA projects, and will be constructed to offset hardbottom impacts from the proposed Project.	Groins will be placed with a buffer between the structures and hardbottom to the maximum extent practicable. If impacts are caused, mitigation will be required.	Artificial reef sites have been/will be determined to avoid placement over hardbottom and will maintain at least a 25 ft buffer from adjacent hardbottom. Artificial reefs replace ecological function lost when hardbottom is buried.
Shorebirds	NA	NA	Construction causes temporary disturbance and disruption of normal activities such as roosting and feeding, and possibly forcing birds to expend additional energy reserves to seek available habitat elsewhere.	Burial of infauna temporarily decreases the available food source for some shorebirds, forcing them to move to another area.	Construction causes temporary disturbance and disruption of normal activities such as roosting and feeding, and possibly forcing birds to expend additional energy reserves to seek available habitat elsewhere.	NA
Florida Panther	NA	Increased traffic and noise disturbance may impact the Florida panther along the truck routes (FWC, 2012). As offshore sand is depleted, upland mines will be used more often, leading to greater cumulative impacts.	NA	NA	NA	NA

Table 7-1 (cont.). Cumulative impacts expected from Palm Beach Island projects and project-related activities.

Impacts to Resources	Dredging of Borrow Areas and Inlets	Transport of Sand from Mines	Placement of Sand on Beach and Dune (Above MHW)	Placement of Sand in Nearshore Marine Habitat (Below MHW)	Groin Construction/Rehabilitation	Construction of Artificfial Reefs
Dune Vegetation	NA	NA	Construction of beach and dune projects will aim to enhance dune habitat with minimum impacts to existing dune vegetation. Dune vegetation plans may be implemented to enhance dune projects.	NA	NA	NA
Recreation	Potential for decreased water clarity due to elevated turbidity during construction; potential to affect fishing conditions.	NA	Increased area for recreational use; temporary disturbance during construction activities due to limited site access.	Potential for decreased water clarity due to elevated turbidity during construction; potential to affect fishing conditions.	Increased area for recreational use of the beach; temporary disturbance during construction activities due to limited site access.	Potential for decreased water clarity due to elevated turbidity during construction; potential to affect fishing conditions. Artificial reefs provide recreational opportunities for diving, snorkeling and fishing.
Aesthetics	Temporary impact due to presence of offshore dredge and support vessels and pipelines to shore.	Increased traffic and noise disturbance may impact aesthetics located along truck routes.	Temporary impact due to construction equipment on the beach; long-term improvement due to wider beach.	Temporary impact due to construction equipment on the beach; long-term improvement due to wider beach.	Temporary impact due to construction equipment on the beach; long-term improvement due to wider beach.	Temporary impact due to presence of offshore vessels.
Water Quality	Temporary, localized increase in turbidity during dredging activities; turbidity monitoring will ensure water quality standards are maintained.	NA	NA	Temporary, localized increase in turbidity during sand placement; turbidity monitoring will ensure water quality standards are maintained.	Temporary, localized increase in turbidity during groin construction; turbidity monitoring will ensure water quality standards are maintained.	Temporary, localized increase in turbidity during groin construction; turbidity monitoring will ensure water quality standards are maintained.

8.0 CONCLUSION

The impacts presented in Table 7-1 include either temporary impacts or permanent hardbottom impacts for which compensatory mitigation has been or will be provided. However, when considering cumulative impacts from all Palm Beach Island projects for the next fifty years, these temporary impacts will be repeated regularly within the system. The Town of Palm Beach and Palm Beach County have already taken the forward thinking approach of managing and planning their coastal projects with a more holistic approach, rather than treat their projects on a separate standalone basis. The Beach Management Agreement (BMA) was implemented to develop a coordinated, long-term process that facilitates predictable approval of qualifying coastal erosion control and inlet management activities within the Palm Beach Island coastal cell (Lake Worth Inlet to the South Lake Worth Inlet). The BMA is enabling the Town of Palm Beach, Palm Beach County, and state and federal agencies to plan, authorize and monitor coastal projects in this area with a regional approach. This will result in a better understanding of the cumulative impacts from these projects, and may improve the way these projects (or similar ones in the state) are implemented in the future.

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