MARCH 2002

BEACH EROSION CONTROL AND HURRICANE PROTECTION PROJECT DADE COUNTY, FLORIDA

SECOND PERIODIC RENOURISHMENT AT HAULOVER BEACH PARK

DRAFT ENVIRONMENTAL ASSESSMENT

U.S. Army Corps
of Engineers
Jacksonville District

PRELIMINARY
FINDING OF NO SIGNIFICANT IMPACT

SECOND PERIODIC RENOURISHMENT
AT HAULOVER BEACH PARK

BEACH EROSION CONTROL AND
HURRICANE PROTECTION PROJECT
DADE COUNTY, FLORIDA

I have reviewed the Environmental Assessment (EA) for the proposed action. This Finding incorporates by reference all discussions and conclusions contained in the Environmental Assessment enclosed hereto. Based on information analyzed in the EA, reflecting pertinent information obtained from agencies having jurisdiction by law and/or special expertise, I conclude that the proposed action will not significantly impact the quality of the human environment and does not require an Environmental Impact Statement. Reasons for this conclusion are in summary:

a. The proposed action would restore a section of severely eroded beach at Haulover Beach Park in Dade County, Florida thus preventing or reducing loss of public beachfront to continuing erosional forces and preventing or reducing periodic damages and potential risk to life, health and property in the developed lands adjacent to the beach.

b. Measures to prevent or minimize impacts to sea turtles in accordance with Biological Opinions from the U.S. Fish and Wildlife Service and the National Marine Fisheries Service will be implemented during and after project construction. To protect the manatee, all water-based activities would follow standard manatee protection measures. There would be no adverse impacts to other Federally listed endangered or threatened species.

c. Based on historic property field investigations, no potentially significant cultural resources are located in the proposed offshore borrow area. No significant historical properties have been identified on the segment of beach proposed for renourishment.

d. The Florida Department of Environmental Protection on July 27, 2001 issued Water Quality Certification (Permit No. 0128781-00-JC), pursuant to Section 401 of the Clean Water Act.

e. Measures to eliminate, reduce, or avoid potential impacts to fish and wildlife resources include the following: (1) A buffer zone with a minimum distance from any hardbottom has been established for the proposed borrow area, (2) Visual inspections of hardbottom in proximity to the dredging area would be routinely conducted to look for any indicators of turbidity, sedimentation or mechanical impacts, (3) Extensive turbidity monitoring would be performed at the beach fill and dredging

sites during construction to ensure turbidity levels do not exceed the State water quality standard, (4) To avoid mechanical damage to hardbottom habitat associated with dredging, precision electronic positioning equipment would be used to ensure the dredge remains in the borrow area during dredging operations.

_____ _____

James G. May
Colonel, U.S. Army
District Engineer

Date

DRAFT
ENVIRONMENTAL ASSESSMENT
ON
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1. PROJECT PURPOSE AND NEED

1.1 PROJECT AUTHORITY.

1.1.1 INITIAL AUTHORIZATION.
The Beach Erosion Control and Hurricane Protection (BEC & HP) Project for Dade County, Florida was authorized by the Flood Control Act of 1968. In addition, Section 69 of the 1974 Water Resources Act (P. L. 93-251 dated 7 march 1974) included the initial construction by non-federal interests of the 0.85 mile segment along Bal Harbour Village, immediately south of Bakers Haulover Inlet. The authorized project, as described in HD 335/90/2, provided for the construction of a protective/recreational beach and a protective dune for 9.3 miles of shoreline between Government Cut and Baker's Haulover Inlet (encompassing Miami Beach, Surfside and Bal Harbour) and for the construction of a protective/recreational beach along the 1.2 miles of shoreline at Haulover Beach Park.

1.1.2 SUPPLEMENTAL APPROPRIATION.
The Supplemental Appropriations Act of 1985 and the Water Resources Development Act of 1986 (Public Law 99-662) provided authority for extending the northern limit of the authorized project to include the construction of a protective beach along the 2.5 mile reach of shoreline north of Haulover Beach Park (Sunny Isles) and for periodic nourishment of the new beach. This authority also provided for the extension of the period of Federal participation in the cost of nourishing the authorized 1968 BEC & HP Project for Dade County, which covered 10.5 miles of shoreline extending from Government Cut north to the northern boundary of Haulover Beach Park, from 10 years to the 50-year life of the project.

1.2 PROJECT LOCATION.
The project is located on the southeast Florida coast within Dade County. Haulover Beach Park is a public park located immediately north of Bakers Haulover Inlet (see figure 1, project location map).

1.3 PROJECT NEED OR OPPORTUNITY.
Nourishment of Dade County Beaches has become a necessity to provide storm protection. The purpose of the project is to reduce loss of public beach front to continuing erosional forces and to prevent or reduce periodic damages and potential risk to life, health, and property in the developed lands adjacent to the beach. Continual erosion of the beach has resulted in the loss of nesting habitat for threatened and endangered sea turtles loss of protection from storm and hurricane damage and potential risk to life, health, and property. Recent storm impacts to the project (Hurricane Andrew in 1992, Hurricane Gordon in 1994, and the winter storms in 1996) have severely increased the need for the project.

1.4 DESCRIPTION OF PROPOSED ACTION
The placement of about 114,000 cubic yards of material will be required along the beach at Haulover Beach Park, Dade County, Florida. The beach fill would extend southward from the border with Sunny Isles, approximately 2,600 feet. Refer to figure 2 for a plan view of the fill area. The construction berm width is 120 feet from the ECL at an elevation of +9 feet mean low water (MLW), with a construction tolerance of +/- 0.5 feet. The front slope of the fill will be 1 vertical on 10 horizontal. Refer to figure 3 for a typical profile view. The proposed borrow area is located within the ebb shoal northeast of Bakers Haulover Inlet in 10 to 20 feet of water (figures 1 & 4).

1.5 RELATED ENVIRONMENTAL DOCUMENTS.
The following is a list of related documents:

a. Dade County Beaches, Florida, Beach Erosion Control and Hurricane Surge Protection, General Design Memorandum, Phase I. U.S. Army Corps of Engineers, Jacksonville District, 1974.

b. Final Environmental Impact Statement, Beach Erosion Control and Hurricane Surge Protection Project, Dade County, Florida. U.S. Army Corps of Engineers, Jacksonville District, April 1975.

c. Beach Erosion Control and Hurricane Protection Study for Dade County, Florida, North of Haulover Beach Park, Survey Report and EIS Supplement.

U.S. Army Corps of Engineers, Jacksonville District, June 1984.

d. Final Environmental Assessment, Second Periodic Nourishment, Sunny Isles and Miami Beach Segments, Beach Erosion Control and Hurricane Protection Project, Dade County, Florida. U.S. Army Corps of Engineers, Jacksonville District, May 1995.

e. Coast of Florida Erosion and Storm Effects Study, Region III, Feasibility Report with Final Environmental Impact Statement. U.S. Army Corps of Engineers, Jacksonville District, October 1996.

f. Final Environmental Assessment, Beach Erosion Control and Hurricane Protection Project Dade County, Florida, Second Periodic Nourishment, Surfside and South Miami Beach Segments. U.S. Army Corps of Engineers, Jacksonville District, April 1997.

g. Dade County, Florida, Shore Protection Project, Design Memorandum, Addendum III, North of Haulover Park (Sunny Isles) Segment, U.S. Army Corps of Engineers, Jacksonville District, January 1995.

h. Final Environmental Assessment Beach Erosion Control and Hurricane Protection Project Dade County, Florida, Second Periodic Nourishment, at Bal Harbour. U.S. Army Corps of Engineers, Jacksonville District, May 1998.

i. Final Environmental Impact Statement, Beach Erosion Control and Hurricane Protection Project Dade County, Florida, Modifications at Sunny Isles. U.S. Army Corps of Engineers, Jacksonville District, May 1998.

j. Final Environmental Assessment, Beach Erosion Control and Hurricane Protection Project Dade County, Florida, Renourishment at Miami Beach in the Vicinity of 63rd Street. U.S. Army Corps of Engineers, Jacksonville District, November 2000.

1.6 DECISIONS TO BE MADE.
The alternatives to provide shore protection for Dade County beaches, from Government Cut north to Bakers Haulover Inlet (including Haulover Beach Park), were evaluated in references 1.5a and 1.5b above. The plan recommended and approved for implementation was beach restoration with periodic renourishment. This Environmental Assessment will not re-evaluate the alternatives to beach renourishment but, will evaluate alternative sand sources to accomplish the renourishment at Haulover Beach Park.

1.7 SCOPING AND ISSUES.
Scoping for the proposed action was initiated by a Public Notice dated February 3, 2000. The Public Notice was distributed to the appropriate Federal, State and Local agencies, appropriate city and county officials, and other parties known to be interested in the project. Copies of the Public Notice, the list of addressees used to distribute the notice, and letters of response are included in Appendix C, Pertinent Correspondence.

1.7.1 ISSUES EVALUATED IN DETAIL.
The following issues were identified during scoping and by the preparers of this Environmental Assessment to be relevant to the proposed action and appropriate for detailed evaluation:

a. Turbidity and sedimentation impacts to hardground/reef communities.
b. Monitoring of reefs adjacent to the borrow area for turbidity and sedimentation impacts.
c. Impacts on nesting sea turtles, nests, and hatchlings.
d. Mitigation.
e. Impacts on historic properties (i.e. historic shipwrecks).
f. Water quality.
g. Recreation.
h. Endangered Species

1.7.2 IMPACT MEASUREMENT.
The following provides the means and rationale for measurement and comparison of impacts of the proposed action and alternatives.

1.7.2.1 Hardground and Reef Impacts.
Based on extensive experience with beach renourishment and use of off-shore borrow in Dade County and other Florida beaches, impacts to hardground and reefs can be predicted based on proximity, currents, nature of borrow material, buffer zones and other factors. Our desire in selecting an alternative is to keep impacts to these resources to the minimum practicable in consideration of other project requirements.

1.7.2.2 Sea Turtles.
Sea Turtle nesting is closely monitored along Dade County's public beaches, including Haulover Beach Park. Detected nests are relocated to a safe hatchery. Impacts of compaction and scarps are fairly well established. In addition, continued beach erosion would reduce available nesting habitat. Corrective and mitigative protocols have been established. It is our goal to minimize impacts to sea turtles and to comply with the requirements of the Endangered Species Act.

1.7.2.3 Other Impacts.
Bases for impact measurement and comparison are stated more specifically in section 4.0 on ENVIRONMENTAL EFFECTS and other sections of this document and its appendices.

1.7.3 ISSUES ELIMINATED FROM DETAIL ANALYSIS.
No issues were specifically identified for elimination.

1.8 PERMITS, LICENSES, AND ENTITLEMENTS.
The proposed beach renourishment is subject to the Coastal Zone Management Act. Consultation with the State Historic Preservation Officer is also required. Since there would be a discharge of dredged or fill material into waters of the United States, the proposed Action is subject to Section 404 of the Clean Water Act. In addition the proposed

action is subject to Section 401 of the Act for certification of water quality by the state. The Florida Department of Environmental Protection (FDEP) has issue a Water Quality Certification (Permit No. 0128781-00-JC) for this project.

If conducted during the sea turtle nesting and hatching season, the proposed action will require daily sea turtle nest surveys and nest relocations. A permit from the Florida Fish and Wildlife Conservation Commission (FWC) to handle sea turtles and relocate nests will be required for the person(s) performing the surveys and nest relocations associated with the proposed action. For the proposed renourishment at Haulover Beach Park, personnel from the Dade County Department of Parks and Recreation will be conducting the surveys and nest relocations.

The project sponsor, Dade County Department of Environmental Resources Management (DERM), is responsible for obtaining any real estate easements and rights of way required for this project.

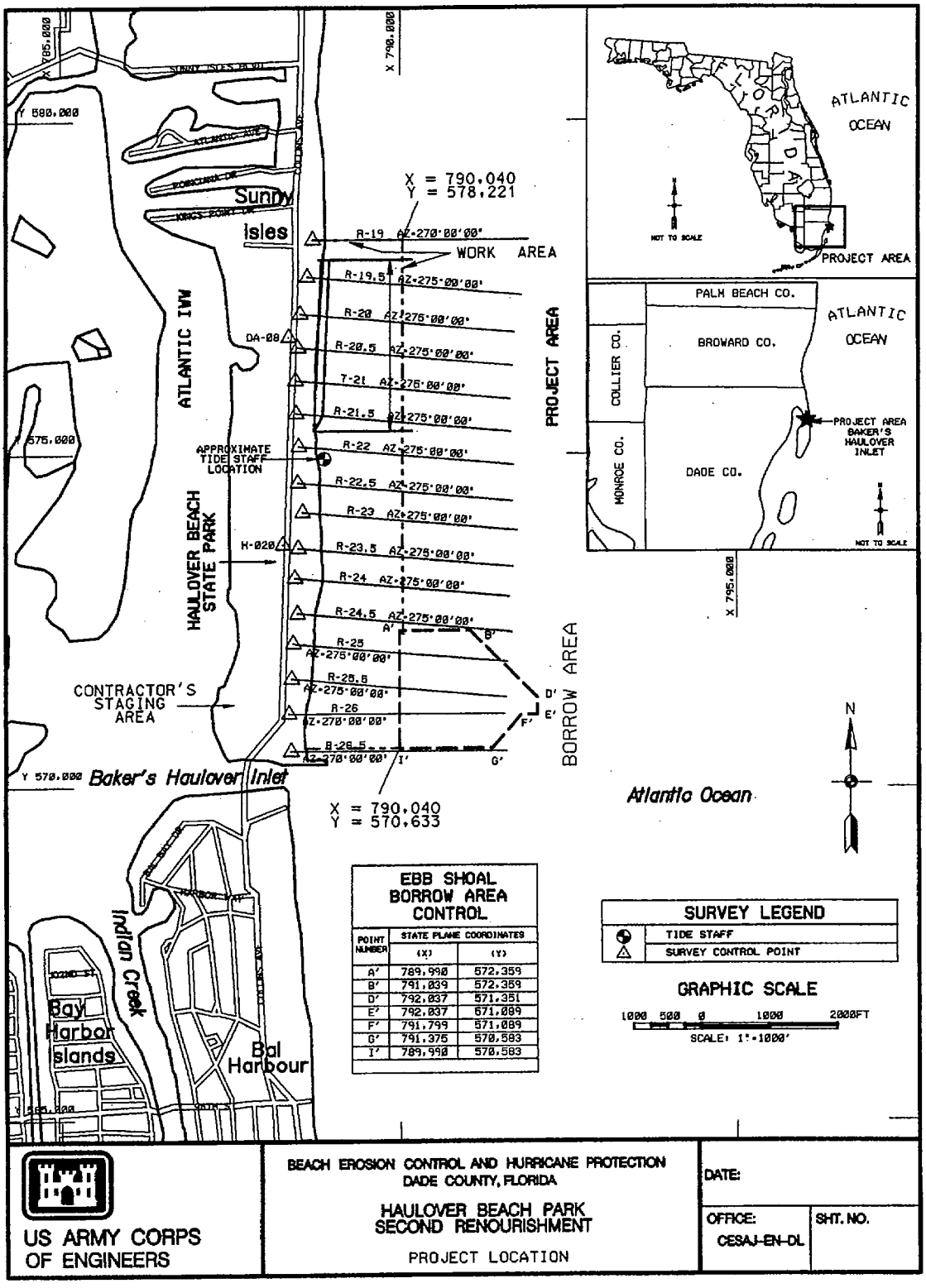

Figure 1. Project Location Map

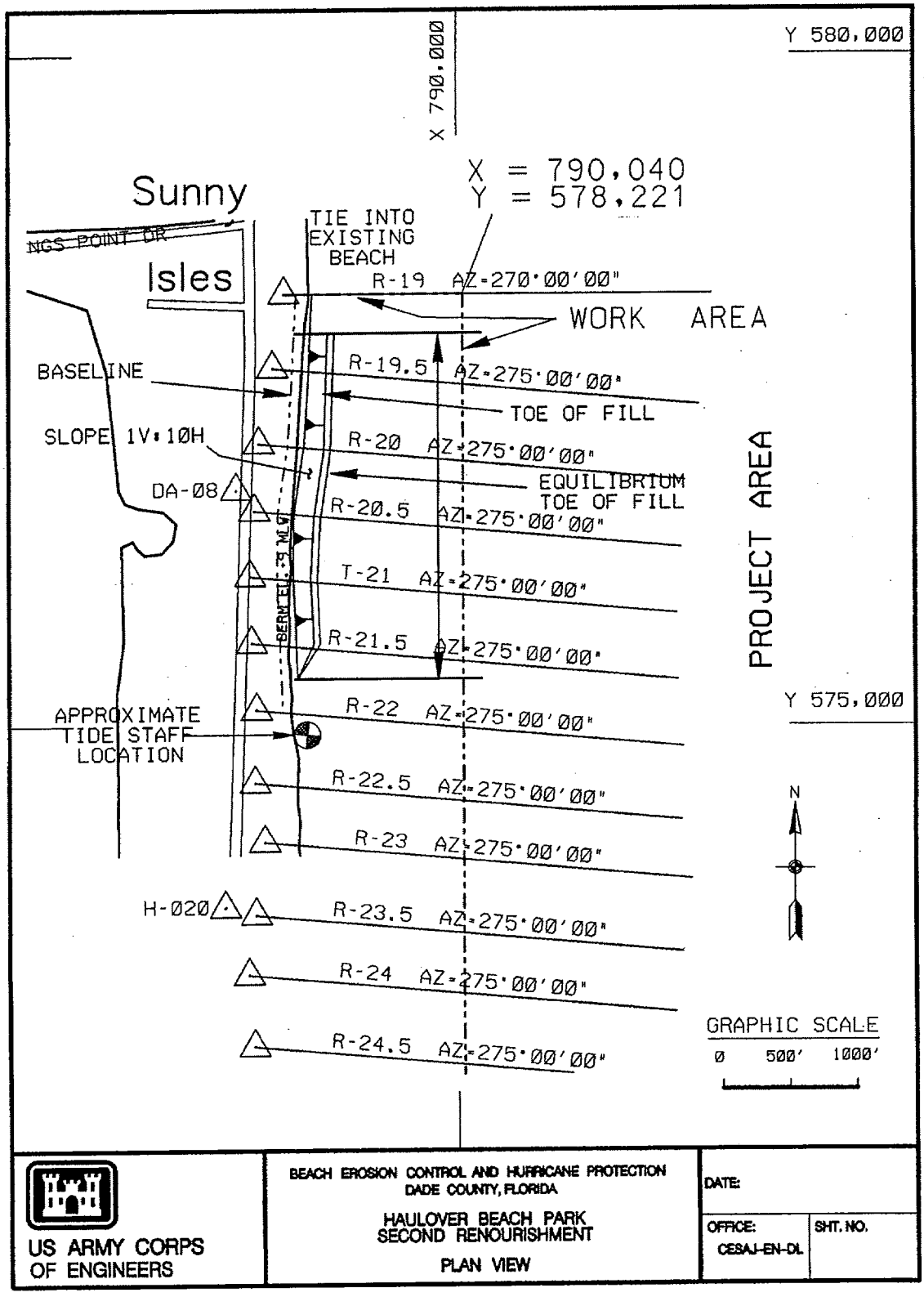

Figure 2. Plan view of the beach fill area.

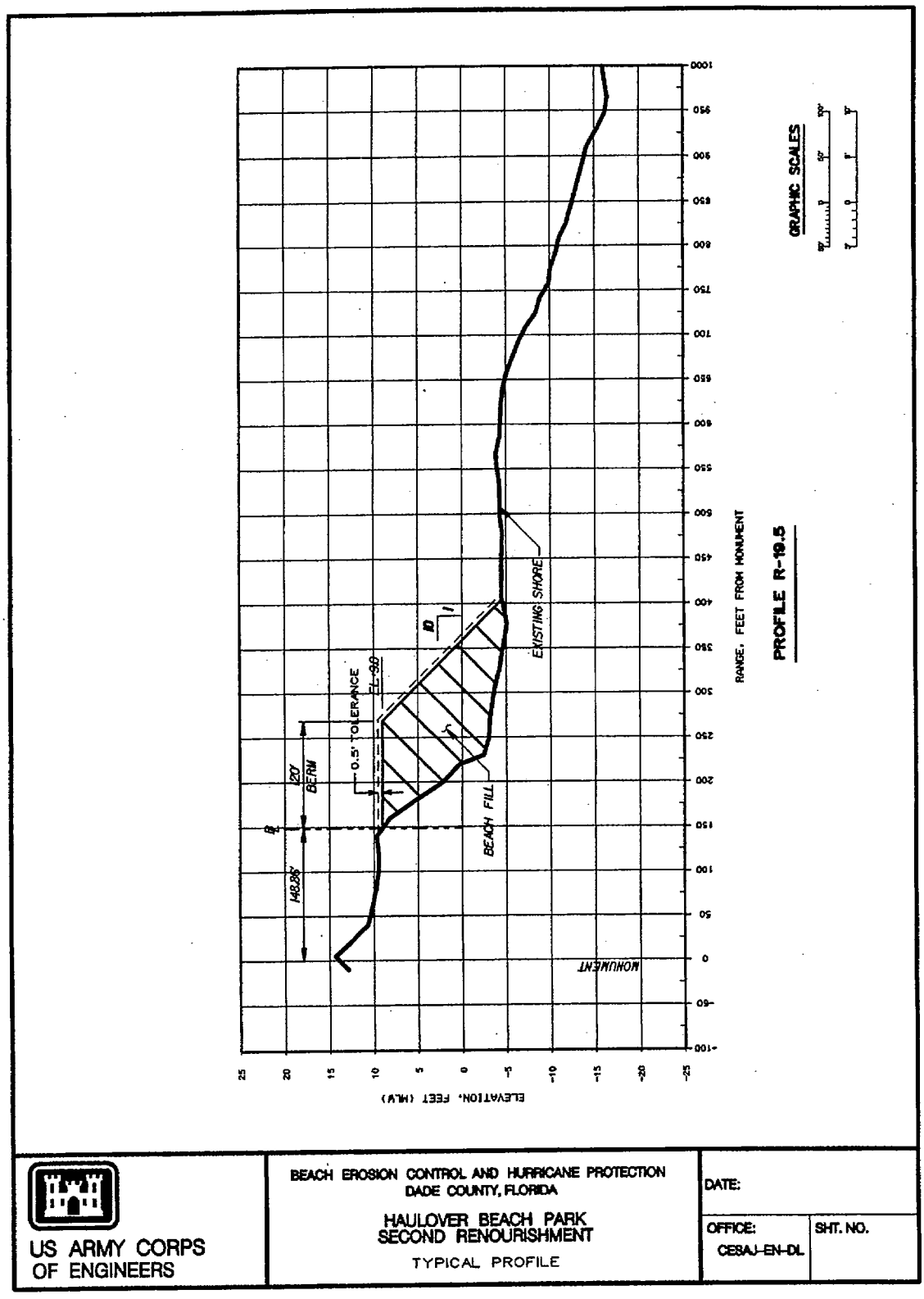

Figure 3. Typical beach fill profile view.

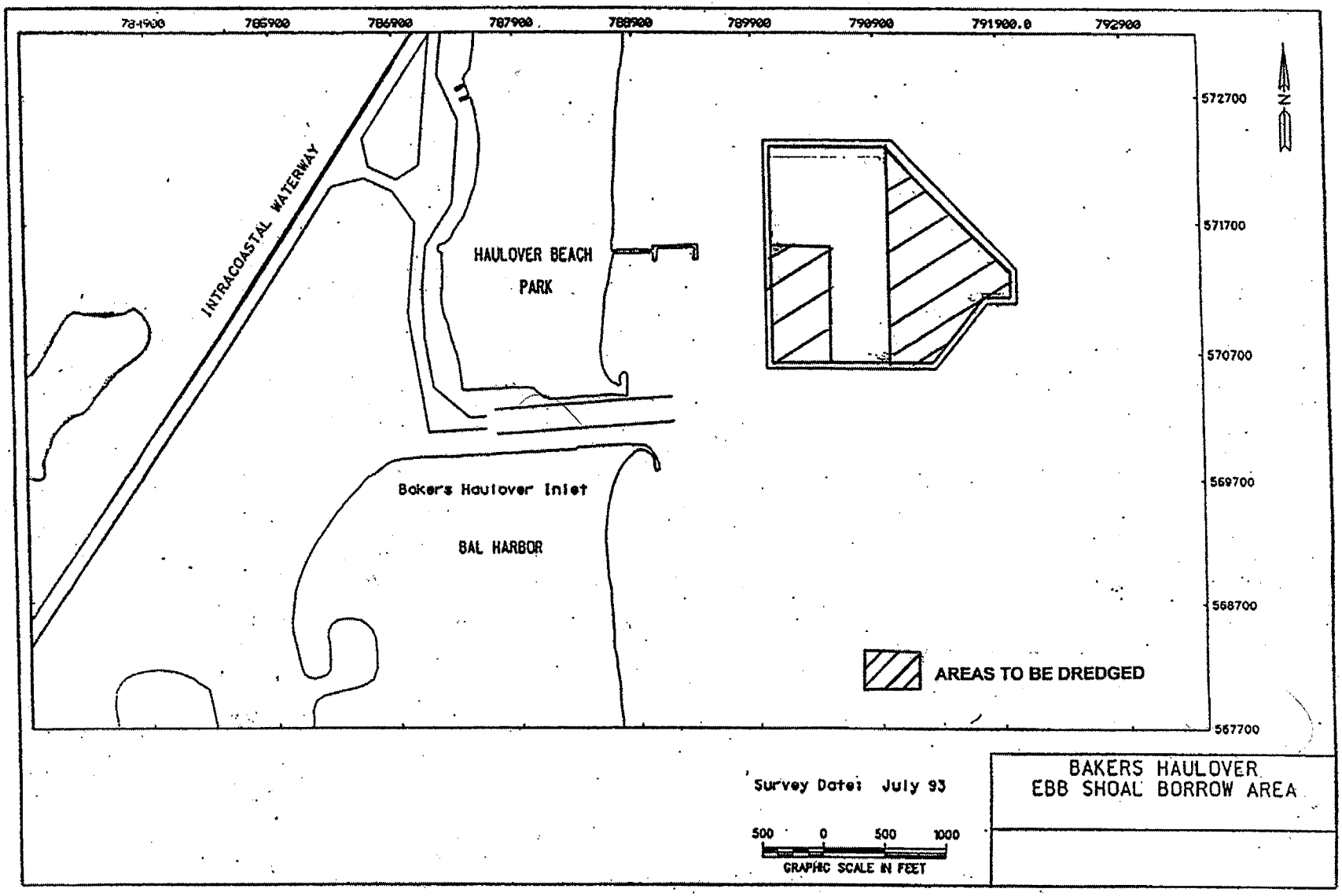

Figure 4. Proposed Borrow Area, Ebb Shoal at Bakers Haulover Inlet

2. ALTERNATIVES

The alternatives section is the heart of this EA. This section describes in detail the no-action alternative, the proposed action, and other reasonable alternatives that were studied in detail. Then based on the information and analysis presented in the sections on the Affected Environment and the Probable Impacts, this section presents the beneficial and adverse environmental effects of all alternatives in comparative form, providing a clear basis for choice among the options for the decisionmaker and the public.

As previously mentioned in Section 1.6, the alternatives to provide shore protection for Dade County beaches were evaluated in prior reports. The plan recommended and approved for implementation was beach restoration with periodic renourishment. This Environmental Assessment will not re-evaluate alternatives to beach renourishment but, will evaluate alternatives to accomplish renourishment at Haulover Beach Park.

2.1 DESCRIPTION OF ALTERNATIVES.

2.1.1 PROPOSED BORROW AREA - EBB SHOAL AT BAKERS HAULOVER

The proposed borrow area for this renourishment is the ebb shoal at Bakers Haulover Inlet. The area is located approximately 2,000 feet offshore, and just northeast of the inlet in 10 to 20 feet of water (figure 4). The borrow area occupies about half of the ebb shoal. The final design was selected to leave a shoal and resulting wave refraction to minimize the impact to the adjacent shore processes.

The material to be excavated is generally light gray to tan, poorly graded shelly sand with a trace of silt and gravel sized shell fragments. The composite mean grain size of the borrow area is 0.54 mm with an average silt content of 2.7 percent. Large carbonate rock fragments do not occur in the borrow area; therefore, rock removal will not be required. No hardgrounds are located within the borrow area, and no hardgrounds occur within 200 feet of the eastern tip of the borrow area.

The water depth within the proposed ebb shoal borrow area is too shallow for a hopper dredge. The most likely piece of equipment to be used would be a hydraulic pipeline dredge. A submerged pipeline would be placed from the borrow area to the shore to transfer material from the dredge to the beach.

2.1.2 BORROW AREAS SOUTH OF GOVERNMENT CUT

Several borrow areas south of Government Cut have been developed for the renourishment of the Dade County BEC&HP Project. All but one of these borrow areas have been used for previous renourishments of the project. The remaining borrow area has been designated as SGC-EXT-2 and is located about 2 miles east of Key Biscayne. The borrow area is in 35 to 45 feet of water and is situated between two hardground/reef communities. To protect reef communities the borrow area has been designed to have a buffer zone of at least 400 feet from any hardground area. The borrow area has also been designed to avoid potentially significant cultural resources identified in the vicinity. Sand from this area is generally light gray, poorly graded carbonate sand with a trace of silt and gravel sized shell fragments. Silt content in the borrow area ranges from 0.8 to 9.2 percent with an average of 3.7 percent. The composite mean grain size is 0.62 mm. Carbonate rock fragments occur within the borrow area and it is estimated that up to 5 percent of the borrow area may be rock fragments from 1 inch to 3 feet in diameter. The use of this borrow area will require that all rock fragments larger than 1 inch be separated from the sand and disposed of in an approved area offshore. The borrow area is a high quality beach nourishment sand source that contains a low amount of silt.

One disadvantage of using the SGC-EXT-2 borrow area when compared to the proposed borrow area is the hauling distance. The distance from the SGC-EXT-2 borrow area to Haulover Beach Park ranges from 12 to 16 miles. This is considerably greater than the distance to the ebb shoal borrow area, which is about 2,000 feet.

2.1.3 DISTANT DOMESTIC SAND SOURCES

Non-local offshore sources of sand (sand located outside the immediate Dade County area) are discussed here as an alternative to the proposed borrow area. This sand could come from other areas within Florida or perhaps outside the state. According to investigations conducted during of the Coast of Florida Erosion and Storm Effects Study, Region III, a substantial amount of sand lies off the coast of Palm Beach County (estimated at 655,025,947 cubic yards). The renourishment needs of the Palm Beach County Shore Protection Project is estimated at 26,253,000 cubic yards of material over the next 50 years [except the Delray segment (28 years) and Boca Raton segment (43 years)]. Although the use of distant sources causes an increase to project costs, the inadequate supply of sand in Dade County will result in the use of alternate sources in the future. However, Palm Beach County has objected to the use of sediment deposits offshore of Palm Beach County for beach nourishment projects in Dade County. Refer to letter dated 25 April 1995, from the Director of the Department of Environmental Resources Management for Palm Beach County in Appendix C.

2.1.4 UPLAND SAND SOURCE

Test results on native beach materials and sands available from commercial upland sand quarries indicate that, in most cases, the upland sand sources are texturally very compatible with little or no overfill required. Upland sand quarries are located on the Lake Wales Ridge of the Central Highlands physiographic region of south Florida. One upland source area is located southwest of Lake Okeechobee, at Ortona, Florida. There are presently two quarries at Ortona, and barge canal access to the Okeechobee Waterway is accessible to both quarries. The material from these two quarries consists of clean, medium to fine grained quartz sand that have a mean grain size range of 0.48 mm to 0.55 mm with generally less than 5 percent silt content. This alternative would involve the transporting sand from a quarry site, by either barge or railroad cars, to an appropriate offloading site near the project location. The sand would then be loaded onto dump trucks and then hauled to the beach and dumped at beach access points along the fill site. From these beach stockpiles, the material would be distributed along the beach by earthmoving equipment. Because of the potential to damage bridges, the dump trucks would most likely be limited to a maximum capacity of 12 cubic yards. With an estimated volume of 114,000 cubic yards of sand needed to complete the project, this would require over 9,500 truckloads. The use of larger dump trucks (i.e. 16 to 18 cubic yards), if allowed, would reduce the number of loads but would still be substantial. This would have a significant adverse impact on the traffic within the project area and areas adjacent to the project. There would also be an increase in the noise levels associated with trucking sand to the project site. In addition, vibrations caused by the trucks could damage structures that are located close to the roadways being used. The use of large numbers of trucks would also cause extensive damage to the roads used. This would require that the roads be repaired after construction has been completed.

2.1.5 NO ACTION ALTERNATIVE (STATUS QUO)

If the no action alternative is implemented, the present condition of erosion along the shoreline at Haulover Beach Park would continue at its present rate. The no action alternative does not provide the benefits needed to protect the coast from the effects of erosion and storm damage.

2.2 COMPARISON OF ALTERNATIVES

Table 1 lists the alternatives considered and summarizes the major features and consequences of the proposed action and alternatives. See section 4.0 Environmental Effects for a more detailed discussion of impacts of alternatives.

2.3 MITIGATION

Borrow area design will ensure sufficient buffer areas to minimize impacts from turbidity, sedimentation and mechanical damage on nearshore hardground communities. Precision positioning of equipment, with a Geographic Positioning System (GPS), will aid in avoiding sensitive areas. Section 5.0 Environmental Commitments, discusses other procedures that will be implemented to avoid or minimize potentially adverse environmental impacts.

Table 1: Summary of Direct and Indirect Impacts for Alternatives Considered.

ALTERNATIVE ENVIRONMENTAL FACTOR	PROPOSED EBB SHOAL BORROW AREA	BORROW AREAS SOUTH OF GOVERNMENT CUT	DISTANT DOMESTIC SAND SOURCES	UPLAND SAND SOURCES	NO ACTION
PROTECTED SPECIES	no impact on manatees , whales, or sea turtles at borrow area; beach fill could impact sea turtle nesting or hatching.	no impact on manatees , whales, or sea turtles at borrow area; beach fill could impact sea turtle nesting or hatching.	no impact on manatees , whales, or sea turtles at borrow area; beach fill could impact sea turtle nesting or hatching.	potential impact to sea turtle nesting and hatching; potential to effect scrub jay and gopher tortoise habitat.	continued erosion could affect sea turtle nesting habitat.
HARD GROUND	no impact to hardground communities expected.	potential sedimentation, turbidity and mechanical effects near borrow areas; impacts to hardgrounds from pipeline placement.	potential sedimentation, turbidity and mechanical effects near borrow areas; impacts to hardgrounds from pipeline placement.	no impact if sand is truck hauled to beach; if trans- ported by barge and pumped to beach, potential impact from pipeline placement.	no impact
EFFECTS ON ADJACENT SHORELINE EROSION	use of borrow area is not expected to increase erosion on adjacent shoreline.	no effect expected	no effect	no effect	continued erosion of the project beach.
FISH AND WILDLIFE RESOURCES	minor affect on benthic organisms at beach and borrow sites - beach habitat improved.	minor affect on benthic organisms at beach and borrow sites - beach habitat improved.	minor affect on benthic organisms at beach and borrow sites - beach habitat improved.	depends on wildlife present at quarry - minimal impact is expected; beach habitat improved.	continued loss of beach habitat
VEGETATION	no seagrass beds present in borrow area; no impact.	no seagrass beds present in borrow area; no impact.	unknown at this time; could impact seagrasses if present in vicinity of borrow area.	no impact to seagrasses; upland vegetation may be affected - extent unknown.	continued erosion could impact dune vegetation.
WATER QUALITY	temporary increase in turbidity and suspended sediments at borrow and beach fill sites.	temporary increase in turbidity and suspended sediments at borrow and beach fill sites.	temporary increase in turbidity and suspended sediments at borrow and beach fill sites.	temporary increase in turbidity and suspended sediments at beach site.	no impact
HISTORIC PROPERTIES	no impact expected	no impact expected	not determined	no impact expected	no impact
ECONOMICS	uses nearby economical sand source	higher costs in comparison due to mobilization of hopper dredge and longer transporting distances.	higher costs in comparison due to mobilization of hopper dredge and longer transporting distances.	higher transportation costs; increased maintenance costs on roads used to transport sand.	beach degradation with potential decrease in tourism.

ALTERNATIVE ENVIRONMENTAL FACTOR	PROPOSED EBB SHOAL BORROW AREA	BORROW AREAS SOUTH OF GOVERNMENT CUT	DISTANT DOMESTIC SAND SOURCES	UPLAND SAND SOURCES	NO ACTION
ENERGY REQUIREMENTS & CONSERVATION	smaller energy use in comparison with other alternatives.	higher in comparison to proposed borrow area due to longer transporting distances.	higher in comparison to proposed borrow area due to longer transporting distances.	higher in comparison to proposed borrow area due to longer transporting distances.	potentially higher energy usage during storm damage clean up.

Table 1 (Continued): Summary of Direct and Indirect Impacts for Alternatives Considered.

3. AFFECTED ENVIRONMENT

The Affected Environment section succinctly describes the existing environmental resources of the areas that would be affected if any of the alternatives were implemented. This section describes only those environmental resources that are relevant to the decision to be made. It does not describe the entire existing environment, but only those environmental resources that would affect or that would be affected by the alternatives if they were implemented. This section, in conjunction with the description of the "no-action" alternative forms the base line conditions for determining the environmental impacts of the proposed action and reasonable alternatives.

3.1 VEGETATION

The dominant plant species within the dune system at Haulover Beach Park include sea grapes, *Coccoloba uvifera*; the beach morning glory, *Ipomoea pes-caprea*; beach bean, *Canavalia rosea*; sea oats, *Uniola paniculata*; dune panic grass, *Panicum amarulum*; bay bean, *Canavalia maritima*. The beach berry or inkberry, *Scaevola plumieri;* sea lavender, *Mallotonia gnaphalodes*; spider lily, *Hymenocalis latifolia*; beach star, *Remirea maritima*; and coconut palm, *Coco nucifera* are also present

Algal coverage on the offshore hardground areas fluctuates seasonally. The most common algal species observed within southeast Florida offshore hardground areas are *Caulerpa prolifera*, *Codium isthmocladum*, *Gracillaria* sp., *Udotea* sp., *Halimeda* sp., and various members of the crustose coralline algae of the family Corallinaceae. Algal growth is most luxuriant from late July through late October or early November, and there seems to be a particular burst or bloom in the macroalgal population in conjunction with the seasonal upwelling that occurs in late July or early August (Smith, 1981, 1983; Florida Atlantic University and Continental Shelf Associates, Inc., 1994).

Seasonally, there is extensive macroalgal growth in the offshore soft bottom areas, with species of green algae (*Caulerpa* sp., *Halimeda* sp., and *Codium* sp.) being particularly abundant in the summer and the brown algal species (*Dictyota* sp. and *Sargassum* sp.) being more abundant in the winter (Courtenay *et al.*, 1974; Florida Atlantic University and Continental Shelf Associates, Inc., 1994). The sea grass *Halophila decipiens* has been observed offshore of Dade County, but is considered seasonal (April through November) in these offshore soft bottom areas.

3.2 THREATENED AND ENDANGERED SPECIES

3.2.1 SEA TURTLES

Sea turtles are present in the open ocean year-round offshore of Dade County because of warm water temperatures and hardbottom habitat used for both foraging and shelter. The predominant species is the loggerhead sea turtle, *Caretta caretta*, although green turtles, *Chelonia mydas*; leatherback turtles, *Dermochelys coriacea*; hawksbill turtles, *Eretmochelys imbricata*; and Kemp's ridleys, *Lepidochelys kempii* are also known to exist in the area. All the sea turtles except for the loggerhead are listed as endangered. The loggerhead is listed as threatened.

Sea turtle nesting in Dade County occurs from May through September (Meylan et. al., 1995). The density of nesting along the Dade County shoreline north of Government Cut is relatively low. The loggerhead accounts for the majority of the nesting in the county with occasional nesting by green and leatherback turtles. Leatherback turtles may start nesting earlier than loggerheads. In Dade County the earliest nest documented by Meylan et. al., 1995 was on April 11, 1992. During the sea turtle nesting season, the Dade County Park and Recreation Department conducts daily surveys and relocates nests found along the beach from Sunny Isles south to Government Cut. This is done to prevent poaching or nest destruction due to beach maintenance, emergency vehicles which access the beach and other human related causes (Flynn 1992). All nests found during the surveys are relocated to a central hatchery on Miami Beach (pers. comm., B. Flynn, Dade Co. Dept. of Env. Res. Mgmt., 1993).

3.2.2 WEST INDIAN MANATEE

The estuarine waters around the inlets and bays within Dade County provide year-round habitat for the West Indian manatee, *Trichecus manatus*. Although manatees have been observed in the open ocean, they feed and reside mainly in the estuarine areas and around inlets. No significant foraging habitat is known to exist in the areas around the project sites, nor have manatees been known to congregate in the nearshore environment within the project area.

3.2.3 OTHER THREATENED ENDANGERED SPECIES

Other threatened or endangered species that may be found in the in the coastal waters off of Dade County during certain times of the year are the finback whale, *Balaenoptera physalus*; humpback whale, *Megaptera novaeangliae*; right whale *Eubalaena glacialis*; sei whale, *Balaenoptera borealis*; and the sperm whale *Physeter macrocephalus catodon.* These are infrequent visitors to the area and are not likely to be impacted by project activities.

3.3 FISH AND WILDLIFE RESOURCES

3.3.1 BEACH AND OFFSHORE SAND BOTTOM COMMUNITIES

The beaches of southeast Florida are exposed beaches and receive the full impact of wind and wave

action. Intertidal beaches usually have low species richness, but the species that can survive in this high energy environment are abundant. The upper portion of the beach, or subterrestrial fringe, is dominated by various talitrid amphipods and the ghost crab *Ocypode quadrata*. In the midlittoral zone (beach face of the foreshore), polychaetes, isopods, and haustoriid amphipods become dominant forms. In the swash or surf zone, beach fauna is typically dominated by coquina clams of the genus *Donax*, the mole crab *Emerita talpoida*. All these invertebrates are highly specialized for life in this type of environment (Spring, 1981; Nelson, 1985; and U.S. Fish and Wildlife Service [USFWS], 1997).

Shallow subtidal soft bottom habitats (0 to 1 meters [0 to 3 feet] depth) show an increasing species richness and are dominated by a relatively even mix of polychaetes (primarily spionids), gastropods (*Oliva* sp., *Terebra* sp.), portunid crabs (*Arenaeus* sp., *Callinectes* sp., *Ovalipes* sp.), and burrowing shrimp (*Callianassa* sp.). In slightly deeper water (1 to 3 meters [3 to 10 feet] depth) the fauna is dominated by polychaetes, haustoid and other amphipod groups, bivalves such as *Donax* sp. and *Tellina* sp. (Marsh *et al.*, 1980; Goldberg *et al.*, 1985; Gorzelany and Nelson, 1987; Nelson, 1985; Dodge *et al.*, 1991.

Offshore soft bottom communities are less subject to wave-related stress than are nearshore soft bottom communities. They exhibit a greater numerical dominance by polychaetes as well as an overall greater species richness than their nearshore counterparts. Barry A. Vittor & Associates, Inc. (1984) reported polychaetes made up 68.9 percent of the macrobenthic community off Port Everglades, followed by mollusca (13.2 percent), arthropods (10.7 percent), echinoderms (1.2 percent), and miscellaneous other groups (6.0 percent). Goldberg (1985) reported polychaetes as the dominant taxon from his infaunal survey off northern Broward County. Dodge *et al.* (1991) found polychaetes to be the most abundant group in 18 meters (60 feet) of water off Hollywood, Florida. In March 1989, polychaetes made up 51.7 percent of the macrofaunal community at that location followed by nematodes (14.3 percent), smaller species of crustaceans (9.0 percent), oligochaetes (4.3 percent), nemerteans (3.6 percent), and bivalves (2.9 percent).

Larger members of the invertebrate macrofauna seen occasionally in these offshore soft bottom areas between the second and third reef lines include the queen helmet, *Cassia madagascariensis*; the king helmet, *Cassia tuberosa*; Florida fighting conch, *Strombus alatus*; milk conch, *Strombus costatus*; Florida spiny jewel box, *Arcinella cornuta*; decussate bittersweet, *Glycymeris decussata*; calico clam, *Macrocallista maculata*; tellin, *Tellina* sp.; and cushion star, *Oreaster reticulatus*. Commercially valuable species, such as the Florida lobster, *Panulirus argus* move through this area as they migrate from offshore to nearshore areas (Courtenay *et al.*, 1974).

Surf zone fish communities are typically dominated by relatively few species (Modde and Ross, 1981; Peters and Nelson, 1987). Fish species that can be found in the surf zone include, Atlantic threadfin herring, *Opisthonema oglinum*; blue runner, *Caranx crysos*; spotfin mojarra, *Eucinostomus argenteus*; southern stingray, *Dasyatis americana*; greater barracuda, *Sphyraena barracuda*; yellow jack, *Caranx bartholomaei*; and the ocean triggerfish, *Canthidermis sufflamen*, none of which are of local commercial value. Most of the fish making up the inshore surf community tend to be either small species or juveniles (Modde, 1980).

Fish species specifically associated with the sand flats and soft bottom areas between the first and second reefs off Dade countie include lizardfish, *Synodus* sp.; sand tilefish, *Malacanthus plumieri*; yellow goatfish, *Mulloidichthys martinicus*; spotted goatfish, *Pseudupeneus maculatus*; jawfish, *Opistognathus* sp.; stargazer, *Platygillellus (Gillellus) rubrocinctus*; flounder, *Bothus* sp.; and various species of gobies and blennies, none of which have significant local commercial value.

3.3.2 REEF/HARDGROUND COMMUNITIES

The classic reef distribution pattern described for southeast Florida reefs north of Key Biscayne consists of an inner reef in approximately 15 to 25 foot (5 to 8 meters) of water, a middle patch reef zone in about 30 to 50 foot (9 to 15 meters) of water, and an outer reef in approximately 60 to 100 foot (18 to 30 meters) of water. This general description was first published by Duane and Meisburger (1969) and has been the basis for most descriptions of hardground areas north of Government Cut, Miami since that time (Goldberg, 1973; Courtenay *et al.*, 1974; Lighty *et al.*, 1978; Jaap, 1984). Development of these three reef terraces into their present form is thought to be related to fluctuations in sea level stands associated with the Holocene sea level transgression that began about 10,000 years ago. An extensive sand zone lies between the middle and outer reef communities. It is in this sand area that the offshore borrow areas are located.

Lighty *et al.* (1978) showed that active barrier reef development took place as far north as the Fort Lauderdale area as late as 8,000 years ago. It is possible that the reefs and hardground areas seen from Delray Beach southward are the result of active coral reef growth in the relatively recent past, whereas the hard bottom features seen north of Palm Beach Inlet may represent the outcropping of older, weathered portions on the Anastasia Formation. The reefs north of Palm Beach Inlet (Lake Worth Inlet) do not show the same orientation to shore as those to the south and the classical "three reef" hardgrounds description begins to differ north of that inlet (Continental Shelf Associates, Inc., 1993).

The composition of hardground biological assemblages along Florida's east coast has been detailed by Goldberg (1970, 1973), Marszalek and Taylor (1977), Raymond and Antonius (1977),

Marszalek (1978), Continental Shelf Associates, Inc. (1984; 1985; 1987; 1993), and Blair and Flynn (1989). Although there are a large variety of hard coral species growing on the reefs north of Government Cut, these corals are no longer actively producing the reef features seen there. The reef features seen north of Government Cut have been termed "gorgonid reefs" (Goldberg, 1970; Raymond and Antonius, 1977) because they support such an extensive and healthy assemblage of octocorals. Goldberg (1973) identified 39 species of octocorals from Palm Beach County waters. The U.S. Environmental Protection Agency (1992) lists 46 species of shallow water gorgonids as occurring along southeast Florida. Surveys by Continental Shelf Associates, Inc. (1984; 1985) identified 33 sponge, 21 octocoral, and 5 hard coral species on offshore reefs off Ocean Ridge and 40 sponge, 18 octocoral, and 14 hard coral species on the offshore reefs off Boca Raton. Blair and Flynn (1989) described the reefs and hard bottom communities off Dade County and compared them to the offshore reef communities from Broward and Palm Beach counties. They documented a decrease in the hard coral species density moving northward from Dade County to Palm Beach County. Despite this gradual decrease in the density of hard coral species present, the overall hardground assemblage of hard corals, soft corals, and sponges seen along southeast Florida's offshore reefs remains remarkably consistent throughout the counties of Dade, Broward, and Palm Beach. Commercially, the most important invertebrate species directly associated with these hardground areas is the Florida lobster, *Panulirus argus*.

Common fish species identified with the reef/hardground communities include grunts (Haemulidae), angelfish (Pomacanthidae), butterflyfish (Chaetodontidae), damselfish (Pomacentridae), wrasses (Labridae), drum (Sciaenidae), sea basses (Serranidae) snapper (Lutjanidae) and parrotfish (Scaridae). Important commercial and sport fish such as black margate (*Ansiotremus surinamensis*), gag (*Mycteroperca microlepis*), red grouper (*Epinephelus morio*), red snapper (*Lutjanus campechanus*), gray snapper (*L. griseus*) Hogfish (*Lachnolaimus maximus*) and snook (*Centropomus undecimalis*) are also associated with these reefs. The precise composition of the fish assemblage associated with any given location along these hardground areas is dependent upon the structural complexity of the reef at that location.

Herrema (1974) reported over 300 fish species as occurring off southeast Florida. Approximately 20 percent of these species were designated as "secondary" reef fish. Secondary reef fish are fish species that, although occurring on or near reefs, are equally likely to occur over open sand bottoms. Many of these species, such as the sharks, jacks, mullet, bluefish, sailfish, and marlin (none of which have significant local commercial value), are pelagic or open water species and are transient through all areas of their range.

3.4 ESSENTIAL FISH HABITAT

The Magnuson-Stevens Fishery Conservation and Management Act, 16 USC 1801 et seq. Public Law 104-208 reflects the Secretary of Commerce and Fishery Management Council authority and responsibilities for the protection of essential fish habitat (EFH). Federal agencies that fund, permit, or carry out activities that may adversely impact EFH are required to consult with the National Marine Fisheries Service (NMFS) regarding the potential effects of their actions on EFH. In conformance with the 1996 amendment to the Act, the information provided in this EA will comprise the required EFH assessment and will be coordinated with the NMFS.

The proposed project is within the jurisdiction of the South Atlantic Fishery Management Council (SAFMC) and is located in areas designated as EFH for coral. Coral reef and live bottom habitat, red drum, shrimp, spiny lobster, coastal migratory pelagic species and the snapper-grouper complex. In addition, the nearshore hardbottom habitat located in the vicinity of the proposed beach fill and the proposed ebb shoal borrow area are designated as Essential Fish Habitat-Habitat Areas of Particular Concern (EFH-HAPC) for the snapper-grouper complex.

3.5 COASTAL BARRIER RESOURCES

There are no designated Coastal Barrier Resource Act Units located in the project area that would be affected by this project.

3.6 WATER QUALITY

Waters off the coast of Dade counties are classified as Class III waters by the State of Florida. Class III category waters are suitable for recreation and the propagation of fish and wildlife. Turbidity is the major limiting factor in coastal water quality in South Florida. Turbidity is measured in Nephelometric Turbidity Units (NTU), which quantitatively measure light-scattering characteristics of the water. However, this measurement does not address the characteristics of the suspended material that creates turbid conditions. According to Dompe and Haynes (1993), the two major sources of turbidity in coastal areas are very fine organic particulate matter and sediments and sand-sized sediments that become resuspended around the seabed from local waves and currents. Florida state guidelines set to minimize turbidity impacts from beach restoration activities confine turbidity values to under 29 NTU above ambient levels outside the turbidity mixing zone for Class III waters.

Turbidity values are generally lowest in the summer months and highest in the winter months, corresponding with winter storm events and the rainy season (Dompe and Haynes, 1993; Coastal Planning & Engineering [CPE], 1989). Moreover, higher turbidity levels can generally be expected around inlet areas, and especially in estuarine areas, where nutrient and entrained sediment levels are higher. Although some colloidal material will remain suspended in the water column upon disturbance, high turbidity episodes usually return to background conditions within several days to several weeks,

depending on the duration of the perturbation (storm event or other) and on the amount of suspended fines.

3.7 HAZARDOUS, TOXIC AND RADIOACTIVE WASTE

The coastline within the project area is located adjacent to predominantly residential, commercial and recreational areas. The areas within the project are high energy littoral zones and the material used for nourishment are composed of particles with large grain sizes that do not normally have contaminants adsorbing to them. The nature of the work involved with the renourishment of beaches is such that contamination by hazardous and toxic wastes is very unlikely. No contamination due to hazardous and toxic waste spills is known to be in the study area.

3.8 AIR QUALITY

Air quality within the project area is good due to the presence of either on or offshore breezes. Dade County is in attainment with the Florida State Air Quality Implementation Plan for all parameters except for the air pollutant ozone. The county is designated as a moderate non-attainment area for ozone.

3.9 NOISE

Ambient noise around the project area is typical to that experienced in recreational environments. Noise levels range from low to moderate based on the density of development and recreational usage. The major noise producing sources include breaking surf, beach and nearshore water activities, adjacent residential and commercial areas, and boat and vehicular traffic. These sources are expected to remain at their present noise levels.

3.10 AESTHETIC RESOURCES

The project area consists of light sandy beige beaches that contrast strikingly with the deep hues of the panoramic Atlantic Ocean. The beach is located in a county park with a natural dune system and no large beachfront structures (i.e., condominiums, hotels, etc.) as in the rest of Dade County. The area consists of moderate to good aesthetic values with few exceptions throughout the entire project.

3.11 RECREATION RESOURCES

Dade County is a heavily populated county on Florida's Atlantic Coast that receives a tremendous volume of tourists, particularly during the winter months. Those beaches, which can be accessed by the general public, are heavily used year round. Those beaches which are associated with condominiums, apartments and hotels have more restricted access for the general public, but receive use from the many visitors who frequent these facilities as well as those members of the general public who walk or jog along the beachfront.

Haulover Beach Park is a public park and the beach receives heavy use by swimmers and sunbathers. Other water related activities within the project area include on-shore and offshore fishing, snorkeling, SCUBA diving, windsurfing and recreational boating. Most of the boating activity in the area originates from either Bakers Haulover Inlet or Government Cut. Both offshore fishing and diving utilize the natural and artificial reefs located within and adjacent to the project area. Commercial enterprises along the beach rent beach chairs, cushions, umbrellas, and jet skis. Food vendors can also be found along the beach areas. The revenue generated by beachgoers supports a resurgent Miami Beach business district in the project vicinity.

3.12 HISTORIC PROPERTIES

Documented transportation activities along the southeastern coast of Florida date from the second half of the 16th century. As a consequence of over 400 years of navigation in the Bahama Channel, several hundred shipwrecks have been documented in the waters off the southeast coast of the state. Remains of these and other unrecorded shipwrecks may be located in the vicinity of the proposed borrow areas.

Archival research and field investigations have been conducted for the study area and coordinated with the Florida State Historic Preservation Officer (SHPO). Results of the investigations for the borrow areas south of Government Cut (including SGC-EXT-2) are discussed in the reports, *A Submerged Cultural Resource Magnetometer Survey for Two Borrow Areas, Second Beach Renourishment, Dade County, Florida*, May 1993 and *A Magnetometer and Side Scan Survey, Borrow Area Extension, Dade County, Florida*, October 1996. Both reports were prepared by Tidewater Atlantic Research. Five magnetic anomalies were identified in the areas surveyed during the field investigations described in the above referenced reports. One target was confirmed to be the remains of a modern steel hull vessel sunk as an artificial reef. The other four targets are considered to be potentially significant as their signatures correspond with those of previously identified National Register eligible submerged cultural resources.

Results of the field investigation of the ebb shoal borrow area are discussed in the report *Submerged Historic Properties Survey of Proposed Borrow Area for Dade County Shore Protection Project, Second Periodic Beach Renourishment at Bal Harbour* prepared by Tidewater Atlantic Research. Five magnetic anomalies were identified during the survey. Each signature was determined to be suggestive of modern debris and not a potentially significant submerged cultural resource. No additional investigation of the targets was recommended in the report.

No significant historic properties have been identified on the beach segment proposed for renourishment.

4. ENVIRONMENTAL EFFECTS

This section is the scientific and analytic basis for the comparisons of the alternatives. See table 1 in section 2.0 Alternatives, for summary of impacts. The following includes anticipated changes to the existing environment including direct, indirect, and cumulative effects.

4.1 GENERAL ENVIRONMENTAL EFFECTS

The placement of sand on the beach would restore some of the beach's ability to provide protection against storms and flooding. It would also enhance the appearance and suitability for recreation along the beach and would provide additional nesting habitat for threatened an endangered species of sea turtles. If no action is taken, the project beach would continue to erode and shoreline recession would continue. Dredging in the proposed borrow area would cause a depletion of sand, however the area does not currently support seagrass, reefs, hard bottom, or other particularly productive habitat that would be altered within the borrow area. Although hardgrounds are located outside of the borrow area, a buffer zone will be used to minimize or eliminate potential impacts due to dredging.

4.2 VEGETATION

4.2.1 BEACH RENOURISHMENT ACTIVITIES

There are no sea grasses algal communities present in the footprint of the beach fill or the adjacent nearshore areas. No work would be performed on vegetated upland areas. No adverse impacts to either marine or terrestrial vegetation are expected.

4.2.2 PROPOSED BORROW AREA: EBB SHOAL AT BAKERS HAULOVER INLET

There are no seagrass beds present in the proposed ebb shoal borrow area. Depending on the season when dredging would occur, some ephemeral algal communities could be present in the borrow areas. Any algal communities present within the areas dredged would be affected. This impact would be short-term as the algal communities would be expected to regrow after dredging is completed.

4.2.3 BORROW AREA SOUTH OF GOVERNMENT CUT

Dredging impacts on vegetation in this borrow area would be similar to those discussed for the proposed borrow area.

4.2.4 DISTANT DOMESTIC SAND SOURCES

No distant offshore sources of sand have been identified or evaluated for this renourishment activity. Impacts associated with using distant offshore sources cannot be predicted at this time. It is possible that distant offshore sand sources may be identified in the future. The assessment of impacts on vegetation would occur at that time.

4.2.5 UPLAND SAND SOURCE

Sand from an upland source would be obtained from a commercial quarry. There would likely be some loss of terrestrial vegetation at the quarry site in association with the excavation of sand.

4.2.6 NO ACTION ALTERNATIVE (STATUS QUO)

This alternative would have no effect on marine vegetation. However, continued erosion could eventually result in the loss upland vegetation adjacent to the beach.

4.3 THREATENED AND ENDANGERED SPECIES

4.3.1 BEACH RENOURISHMENT ACTIVITIES

Beach nourishment and associated activities have the potential to impact sea turtles and may have the following effects. These potential effects would apply to any of the alternative sand sources discussed including the preferred borrow area.

a. Scarp development leading to hindrance or blockage of accessibility to nesting habitat.

b. Adverse alteration of moisture levels or temperature in beach due to modified nesting material.

c. Compaction and cementation of beach sediments that cause reduced nesting success and aberrant nest cavity construction resulting in reduced nesting and/or hatching success.

d. If carried out during the nesting season, there is a potential for the destruction of nests that are not identified during the daily nest survey and relocation program.

e. Disruption of nesting activities that could lead to poor nest site selection and energetic cost diminishing egg production.

f. Disorientation or misorientation of hatchlings from adjacent beaches by artificial lights on dredge equipment or construction equipment on the beach.

Important physical characteristics of beaches include sand grain size, grain shape, silt-clay content, sand color, beach hardness, moisture content, mineral content, substrate water potential, and porosity/gas diffusion. By using proper management techniques such as nest relocation, tilling of compacted beaches, use of compatible sand, and smoothing of scarp formations, most of the negative effects can be avoided or corrected (Nelson and Dickerson, 1989a).

Artificial lighting along the beach is known to effect the orientation of hatchlings (Dickerson and Nelson, 1989; Witherington, 1991) and to effect the emergence of nesting females onto the beach

(Witherington, 1992). If beach nourishment occurs during the sea turtle nesting season, lighting associated with construction activities on the beach may effect hatchlings and nesting females. Research has shown that low-pressure sodium (LPS) lights that emit only yellow wavelengths do not attract hatchlings (Dickerson and Nelson 1989; Nelson and Dickerson, 1989b). Witherington (1992) demonstrated that LPS lights on the beach did not significantly effect the nesting behavior of green or loggerhead sea turtles. The use of LPS lighting at the beach nourishment site and on the dredge can reduce the potential for lighting effects on sea turtles. However, the Corps is currently evaluating the appropriateness of using LPS lights in a marine construction environment for safety reasons. If, in consultation with the USFWS and FDEP, it is found not to be appropriate to use in this situation, LPS lights would not be required.

4.3.2 PROPOSED BORROW AREA: EBB SHOAL AT BAKERS HAULOVER INLET

The material within the proposed borrow areas that will be dredged and placed on the beach is similar to the existing beach sand, is low in silt content and therefore, would be compatible with sea turtle nesting. As previously mentioned in Section 2.1.1, the water depth within the proposed borrow area is too shallow for a hopper dredge. Therefore, none of the potential impacts to sea turtles that can be associated with hopper dredging would occur. It is anticipated that a hydraulic pipeline dredge would be used to perform the work. No impacts are expected on sea turtles from using this type of dredge (NMFS Regional Biological Opinions dated August 25, 1995, amended September 25, 1997).

4.3.3 BORROW AREA SOUTH OF GOVERNMENT CUT

Hopper dredging in harbors and entrance channels is known to adversely effect sea turtles by entrainment. These incidents occur because sea turtles utilize and are concentrated in these channels during certain times of the year. Sea turtles utilize hardground and reef areas for foraging and resting and may be present on the hardground areas adjacent to the proposed borrow areas during dredging. It is not expected that sea turtles will concentrate in the sandy borrow area as they do in navigation channels; therefore it is unlikely that the dredge draghead will come into direct contact with a sea turtle. Since the boundary of the borrow area is designed to avoid hardgrounds, it is not expected that the hopper dredge will have a direct impact on any sea turtles utilizing the hardgrounds for resting or foraging. To further ensure that sea turtles are not entrained by the dredge, the use of a draghead designed to deflect sea turtles would be required on the dredge. The deflector draghead is designed to form a sand wedge in front of it that will push out of the way any sea turtle that it comes in contact with. The deflector draghead has been successfully used in the maintenance dredging of navigation channels along the Southeastern United States. During past beach nourishment projects there has been no evidence of sea turtles being entrained by a hopper dredge dredging sand material from an offshore borrow area. The material within this borrow area is similar to the existing beach sand, is low in silt content and therefore, would be compatible with sea turtle nesting.

4.3.4 UPLAND SAND SOURCE

The material obtained from an upland source would be predominantly quartz which would replace a predominantly calcium carbonate beach. It is not expected that the quartz sand itself would significantly effect nesting sea turtles or hatching success since the majority of the high density nesting beaches in Florida are comprised of predominantly quartz sand (i.e., Brevard County). However, some of the other negative impacts previously discussed (sand compaction, potential for scarp formation, artificial lighting effects, etc.) would still apply.

4.3.5 NO ACTION ALTERNATIVE (STATUS QUO)

If no action is taken, the beach would continue to erode. If left to erode, this could ultimately result in the loss of sea turtle nesting habitat and/or poor nest site selection. No adverse impacts are expected on other listed species.

4.4 FISH AND WILDLIFE RESOURCES

4.4.1 BEACH RENOURISHMENT ACTIVITIES

During the placement of sand on the beach there may be some interruption of foraging and resting activities for shorebirds that utilize the project area. This impact would be short-term and limited to the immediate area of disposal and time of construction. There would be sufficient beach area north and south of the renourishment sites that can be used by displaced birds while construction takes place. Increased foraging opportunities for some species, such as sea gulls, can also occur as a result of the discharge activity. Elevated turbidity levels within the immediate vicinity of the discharge site may interfere with foraging by sight feeders such as the brown pelican (*Pelecanus occidentalis*). However, increased turbidity levels would be limited to a small portion of the shoreline and should not result in significant impacts to foraging activities.

The disposal of sand on the beach would have temporary impacts to the macroinfaunal community. Some organisms may be buried and lost, but many organisms inhabiting the intertidal zone are well adapted for burrowing and would be able to burrow up through the fill material and survive. Turbidity levels along the disposal site would temporarily increase, but would return to normal after beach equilibrium is achieved. Organisms inhabiting this zone would be impacted by the run off from the disposal area but are adapted for survival in such conditions and impacts should be minor. Dominant infaunal inhabitants of the intertidal zone, such as amphipods, isopods and polychaetes typically possess high fecundity and rapid turnover rates

during their breeding season. Because of this, any losses due to construction activities would be replaced within a short time. No long-term adverse effects are anticipated to the intertidal macroinfaunal community due to nourishment activities (Deis, et al. 1992, Nelson 1985, Gorzelany & Nelson 1987, USFWS 1997).

Minimal impacts to nearshore hardbottom communities are expected by sand placement (i.e., disposal) on the beach due to the distance of the reefs to the shore. In conjunction with the Coast of Florida Erosion and Storm Effects Study, the hardground areas offshore of Dade County were mapped using side scan sonar. In addition, aerial photography flown in July 1997 has also been used to map the nearshore hardground. The closest hardground community in the vicinity of the proposed beach fill at Haulover Beach Park is in excess of 800 feet offshore.

4.4.2 PROPOSED BORROW AREA: EBB SHOAL AT BAKERS HAULOVER INLET

Organisms similar to the beach macroinfaunal community can be found in the proposed borrow area. Dredging would result in the loss of these organisms; however, recolonization is expected to be fairly rapid. In a study of a borrow area located offshore of Delray Beach, Florida, Bowen and Marsh (1988) concluded that recovery of the infaunal community occurred within 1 year. Cutler and Mahadevan (1982) found no significant differences in biotic communities between borrow sites and surrounding areas off Panama City, Florida, some 3-4 years after a beach nourishment project. No long-term adverse impacts are expected to macroinfaunal communities that inhabit the proposed borrow site.

There are no hardground communities present within the proposed borrow area. The western edge of the first reef comes within approximately 200 feet of the eastern tip of the borrow area. The reef edge would be marked with buoys to prevent encroachment by the dredge, and no anchoring would be permitted in hardground areas.

4.4.3 BORROW AREA SOUTH OF GOVERNMENT CUT

Dredging impacts to the macrofaunal communities within the SGC-EXT-2 borrow area would be similar to that discussed for the proposed ebb shoal borrow area.

The borrow area is located between the second and third reef hardbottom communities. Sessile organisms associated with the hardbottom community may be susceptible to some degree of negative impact due to dredging. Potential adverse impacts to the these communities may occur due to suspended sediments settling onto the reef, mechanical damage from contact by the dredge drag arm with the reef, or turbidity. As a group, scleractinian corals are the most sensitive to potential impacts. Gorgonian corals, sponges, and some other sessile organisms are more tolerant of increased turbidity and sedimentation. Past occurrences of mechanical and/or sedimentation damage to reef communities have been documented for the renourishments at Sunny Isles in 1988 and at Bal Harbour in 1990. Mechanical damages in 1988 and 1990 to reefs were from contact with the dredge drag-arm. In the 1988 incident, the dredge damaged hardbottom outside the designated dredging area. In the 1990 incident the dredge caused damage to previously undiscovered hardbottom within the designated dredging area. Sediment impacts to the reef during the 1990 incident was caused by the dredge spending a significant amount of time dredging a in one confined area between reefs located immediately north and south of the area dredged. Blair and Flynn (1988) and Blair et al. (1990) discuss factors believed to have contributed to the impacts documented, and recommended modifications to project specifications to reduce or eliminate the impacts. If any of these borrow areas were to be used for this project special considerations would be incorporated to avoid or minimize the potential for impacts to the hardbottom communities.

A buffer zone with a minimum distance of 400 ft from any hardground area would be established. Extensive turbidity monitoring would be performed at the dredging sites, throughout the construction phase of the project to ensure levels of turbidity are maintained below the State water quality standard. Visual inspections of the hardbottoms adjacent to the borrow area would be performed. The regions of hardbottom in proximity to the dredging area would be surveyed routinely to look for any indicators of turbidity or sediment impacts. Marine biologists with experience in impact assessment would conduct the surveys and examine the benthic organisms for pre-defined indicators of stress or imminent impact. Findings of such indicators would cause actions ranging from consultation to halting of the dredge operations until a determination can be made as to the cause and rectification of the factors creating the stress or imminent impact. The established buffer zones, borrow area usage restrictions and visual inspections of the reef would minimize or eliminate turbidity and sedimentation impacts.

Proper controls and procedures would be utilized to avoid the mechanical damage, which could result from the dredge or associated equipment coming in contact with the hardbottom. Project and construction specifications that would prevent such damage are: (a) Recording and displaying, real-time precision electronic location equipment must be in use during dredging operations. This equipment would provide the precision equivalent to that of a differential GPS system, provide records of the exact position of the dredge to the operator and allow continuous monitoring of the dredge location during operations. Daily reports would include a plot indicating the dredge location while operating in or

within a quarter of a mile of the borrow area, keyed to a printout listing coordinates at specified time intervals. (b) Pipelines would be placed only in approved locations and anchoring would be permitted in sandy areas only. (c) The borrow area perimeter will be marked by placement of Coast Guard approved lighted buoys. The buoys will be placed at an interval no greater than 400 ft apart, at every change of direction of the borrow area, and no closer than 400 feet from any hardground area. The distance of all borrow area buoys from the hardgrounds will be verified by divers and their positions recorded. (d) The edge of the hardbottoms adjacent to the borrow area will be marked by buoys at a sufficient frequency to visually discern the line of hardground edge. All buoys (borrow area and hardground) will be checked regularly, and replaced or repositioned as necessary, throughout the period of construction. (e) The Corps and Dade County DERM have developed a procedure that would allow suspension or alteration of the dredging operation if monitoring by DERM indicates a problem.

Additional measures to protect the reefs in the vicinity of the borrow area would include an intensive reef monitoring program. The program would monitor and evaluate numerous biological and physical characteristics and indicators for signs of stress or impact related to construction activities. This comprehensive program is designed to identify factors that may contribute to or cause stress and minor impacts, before they cause non-reversible impacts. Among the parameters assessed in the monitoring program are: benthic community structure, including hard coral, sponge and algal populations; fish populations of the hardbottom areas; infaunal assemblages of the beach area and borrow area; water quality, including nutrients, light penetration, turbidity and physical characteristics. These factors will be surveyed prior to and after project construction, and will be monitored regularly during project construction.

Rock, shell and coral rubble material that would be dredged up with the sand, but unsuitable for placement on the beach (i.e., >1 in. diam.), would be placed in a permitted artificial reef site. The habitat in the area where the rock is deposited, would change from what is now a predominantly sand benthic macroinfaunal community to a hardbottom benthic community. The rock would provide a concentrated hard substrate suitable for colonization by sessile benthic organisms. This would allow for the development of coral, plant, invertebrate and vertebrate communities and would provide a viable habitat with refuge, food resources, and a potential breeding ground for a wide variety of marine organisms. This would be the best use of this material, as the rock separated from the sand would be, and have been, devoid of external epibiotic growth (algae, sponges, coral, encrusting organisms) at the time of removal. The rock material that would be disposed in the artificial reef site is clean natural material.

To use the SGC-EXT-2 borrow area would most likely require using a hopper dredge. Because of the water depth required for a hopper dredge, it must remain seaward of the first reef tract to pump material to the beach. It therefore, would be necessary to place a discharge pipeline across the reef from an offshore pump-out platform to the beach fill site. The placement a pipeline across the reef would have an impact on the benthic community. Potential impacts include: physical crushing, abrasion and shading of benthos (algae, sponges, soft coral and hard coral). It is expected that the major impact would occur to sponges, algae and soft corals, with some loss to hard corals. The actual level and extent of impact would be determined through post-construction surveys.

The substrate located within the footprint of the pipeline will be temporarily impacted by the placement of the pipeline. However, when the pipeline is removed the area will be re-exposed and new benthic populations will begin to quickly establish. Past observations during previous renourishments (Miami Beach 1994; Sunny Isles and Miami Beach 1997; Surfside and South Miami Beach 1999) have shown that the pipeline made only occasional contact with the bottom, minimizing the impact by reducing the amount of substrate and number of benthic organisms contacting the pipeline. Post-placement inspection of the pipelines found them to be in contact with the reef only sporadically. Irregularities of the reef and the connector collars (or rings) used to connect the pipe segments, held the pipeline off the reef surface for considerable distances. In general, impacts to the bottom were much less than expected. The most severe impacts noted were to large hard coral heads having a colony diameter up to 2.0 m. The most common impact was to erect, dendroid soft corals that bordered the pipeline. These corals were abraded by the constant wave surge moving their branches against the pipeline. The actual impact was considerably less than the pre-project estimated impact. This was the result of several factors. The pre-project evaluation of the reef area over which the pipeline was to be placed provided a 'minimal impact" path for the corridor. In addition, the connector rings for the pipeline segments raised substantial lengths of the pipe off the bottom (between 50 and 100 feet, dependent on localized relief). Finally, the irregularities of the reef itself served as point supports for the pipe, allowing substantial lengths of the pipeline (up to 150 to 200 feet) to remain off the bottom. Although organisms in contact with the pipe (soft corals, sponges and hard corals) were impacted, many of these were saved by the "suspended" pipeline. For the 1999 Surfside and South Miami Beach renourishment, the Corps included a requirement in the contract plan and specifications for "collars" to be placed along the pipeline at 100-foot