Draft

Environmental Impact Statement on Future Dredging of Capron Shoal for the Fort Pierce Shore Protection Project St. Lucie County, Florida

11 September 2002

Prepared for
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ABSTRACT

U.S. Army Corps of Engineers, Jacksonville District

Draft Environmental Impact Statement

Dredging of Capron Shoal
Fort Pierce Shore Protection Project (SPP)
St. Lucie County, Florida

Abstract. This study is authorized by the River and Harbor Act of 1965 (79 Stat. 1089, 1092) in accordance with the recommendations of the Chief of Engineers in House Document 84, 89th Congress. The authorization provided for the restoration of 1.3 miles of shoreline south of Fort Pierce Inlet and for periodic nourishment as needed for a period of 10 years following initial construction of the project. This period was extended to fifty years under authority provided by Section 156 of the Water Resources Development Act of 1976 (PL 94-587), as amended by Section 934 of the 1986 Water Resource Development Act (PL 99-662). The authorized Fort Pierce, Florida, SPP provides for a 50-foot protective berm that extends 1.3 miles from the south Fort Pierce Inlet jetty to the southern terminus at Surfside Park. In 1999, a lawsuit was filed (Judith Winston, et al., v. Lt. Gen. Joe. N. Ballard, Docket No. CA 99-0533) which sought a Temporary Restraining Order (TRO) against the U.S. Army Corps of Engineers (USACE) dredging project, which alleged that the USACE did not conduct a thorough National Environmental Policy Act (NEPA) analysis, and further alleged that immediate and irreparable harm would result if dredging went forward. The Court ruled in favor of the petitioners and issued a TRO on March 5, 1999. Subsequently, the USACE and the petitioners reached a Settlement Agreement, which committed the USACE to conduct additional NEPA analysis before beginning the next phases, and to conduct additional studies. This Environmental Impact Statement evaluates two action alternatives and the No-Action Alternative for this next project phase. The Preferred Alternative uses Capron Shoal sand for the beach renourishment. The removal of borrow area sediment would affect the habitat of recently discovered organisms of the phylum bryozoa originally thought to occur at no other location. Studies conducted since the Settlement Agreement revealed that these organisms either do, or are likely to occur on other area shoals (Appendix C). Temporary impacts to about 7.8 acres of exposed limerock (hardbottom) by sand coverage and increased turbidity are unavoidable. These ephemeral effects will be mitigated by a Florida Department of Environmental Protection (FDEP) approved plan which includes 5 acres of hardbottom habitat creation in the vicinity of, but which should not be affected by, the current and future beach renourishments.

Send your comments to the District Engineer by:

_____

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EXECUTIVE SUMMARY

Background. As described in the Abstract, the USACE and the petitioners reached a Settlement Agreement which committed the USACE to fund bryozoan studies of Capron and nearby shoals ($200,000), dredge only in the southern portion of the currently authorized borrow area at Capron Shoal during the first phase of the beach renourishment project, conduct a survey of the effect of beach nourishment on the nearshore hardbottom, and conduct additional NEPA analysis before beginning the next project phases. These studies have been completed and are respectively contained in Appendices C and D. This DEIS represents the required NEPA documentation to be completed prior to initiation of the next beach renourishment using Capron Shoals sand.

Alternatives. The use of various sand sources and the No-Action Alternative are evaluated in this document. The recommended plan uses Capron Shoal as the sand source for beach renourishment. Several shoals offshore of Fort Pierce contain appreciable quantities of beach-compatible sand which could be used for beach renourishment. However, Capron Shoal's estimated 23 million cubic yards of high quality sand is the largest source near the project and can readily supply the projected 3.2 million cubic yards needed for this project's authorized duration. The Section 934 Study completed in 1993 included an evaluation of potential sand sources available for Fort Pierce South Beach. Based on available data, Capron Shoals was selected as an excellent long-term source of beach quality sediments for renourishment. Shoal "A" was also considered as a source, but did not contain sufficient quantities of beach compatible sand for the life of the project. Three additional shoals (Indian River Shoal, Unnamed Shoal #1, and Unnamed Shoal #2) were removed from consideration due to their much greater distance from the project area.

Environmental Consequences of the Preferred Alternative. Environmental consequences of the Preferred Alternative include impacts to communities inhabiting both sand (softbottom) and exposed limerock (hardbottom). Sediment removal from the proposed borrow area will directly impact softbottom habitat and resident infauna and epibenthos. Initially, this will result in a localized reduction in the abundance, diversity, and biomass of fauna within the dredged area. However, due to the relatively small area that will be directly or indirectly affected, the impacts to the surrounding benthic community will be minimal, if present at all, due to the relatively short period of recovery for infaunal communities following dredging activities (Culter and Mahadevan 1982; Saloman et al., 1982). Other benthic organisms will likely migrate into the dredge area to recolonize it within weeks or months of the activity.

Impacts to the nearshore hardbottom habitat and associated biological communities include both direct and indirect impacts. Nearshore reefs will be covered by beach-fill. Furthermore, nearshore reefs, adjacent to areas directly affected, may also be slowly covered by sand after renourishment when the beach fill seeks equilibrium in the nearshore zone. This situation will be temporary as physical forces continually resuspend/redistribute littoral sediment. An accurate estimate of impact on the nearshore hardbottom community is difficult, if not

impossible to predict, due to natural reef exposure fluctuations caused by continuous shifting sand in this highly dynamic area. However, the nearshore habitat to be most acutely affected is already stressed by heavy surf, high turbidities and biological factors which select for biological communities populated with hardy, highly fecund individuals with short reproductive cycles. Sedimentation of beach fill on nearshore hardbottom is not expected to have any long-term adverse impact to photosynthetic, filter-feeding, forage or predator species which frequent the dynamic conditions of the surf zone. These species are well adapted to survive resuspension/redistribution of material, any long-term adverse impact to biological communities is not expected and unlikely. Short-term effects to an estimated 7.8 acres of hardbottom habitat are unavoidable.

Mitigation. Although long-term adverse impacts to biological communities are not expected, the USACE will mitigate based on the short-term effects the project will have on unavoidable hardbottom habitat. The Florida Department of Environmental Protection (FDEP) approved plan requires 5 acres of hardbottom habitat creation in the nearshore environment outside the area of beach renourishment effects.

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1.0 PROJECT PURPOSE AND NEED

1.1 Project Authority

This study is authorized by the River and Harbor Act of 1965 (79 Stat. 1089, 1092) in accordance with the recommendations of the Chief of Engineers in House Document 84, 89th Congress. This authorization provided for the restoration of 1.3 miles of shoreline south of Fort Pierce Inlet and for periodic nourishment as needed for a period of 10 years following initial construction of the project. This period was extended to fifty years under authority provided by Section 156 of the Water Resources Development Act of 1976 (PL 94-587), as amended by Section 934 of the 1986 Water Resource Development Act (PL 99-662).

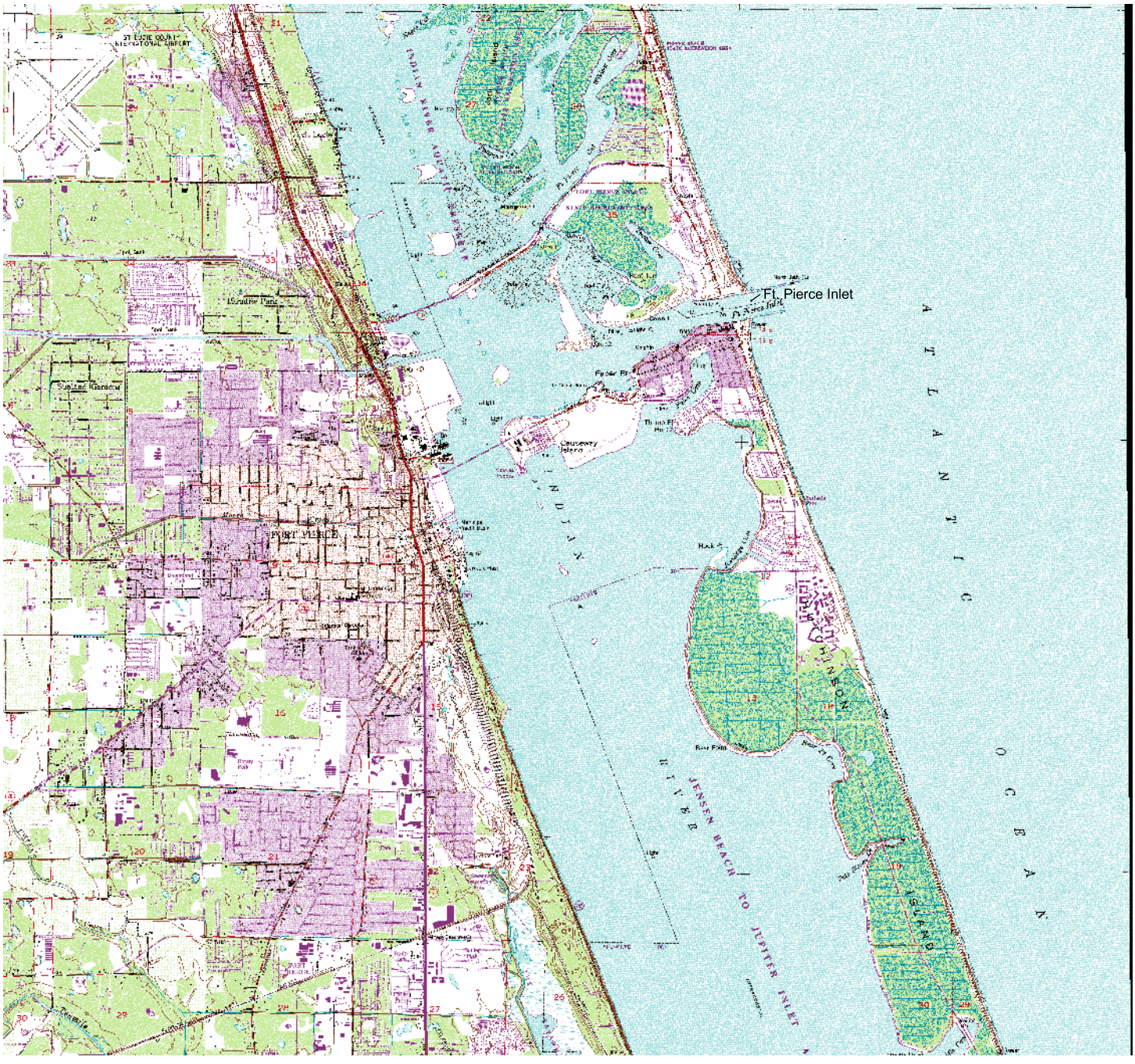
1.2 Project Location

The study area is located along 1.3 miles of shoreline in Fort Pierce, Florida (Figure 1). The northern and southern limits of the study area are the south jetty at Fort Pierce Inlet and the south boundary of Surfside Park, respectively. The project area extends from Florida Department of Environmental Protection (FDEP) Monument R-34 southward to FDEP Monument R-41 (Figure 2).

1.3 Need and Description of Proposed Action

The authorized Fort Pierce Shore Protection Project (SPP) provides for a 50-foot protective berm that extends 1.3 miles from the south Fort Pierce Inlet jetty at FDEP Monument R-34 to the southern terminus of the authorized project at Surfside Park, Monument R-41. Shoreline change data indicate that materials in the 1.3-mile authorized project are eroding at approximately 6 feet/year. Approximately 1,250,000 cubic yards (cy) of material (650,000 cy design volume + 600,000 cy advance nourishment) will be required to complete the 1.3-mile shore protection project. Advance nourishment material would be placed at the time of construction to offset anticipated erosion losses between nourishments.

In 1999, a lawsuit was filed (Judith Winston, et al., v. Lt. Gen. Joe. N. Ballard, Docket No. CA 99-0533) seeking a Temporary Restraining Order (TRO) against the U.S. Army Corps of Engineers (USACE) dredging project that was conducted to obtain material for the beach renourishment component. The suit alleged that the USACE did not conduct a thorough National Environmental Policy Act (NEPA) analysis, and alleging that immediate and irreparable harm would result if dredging went forward. The Court ruled in favor of the petitioners and issued a TRO on March 5, 1999. Subsequently, the USACE and the petitioners reached a Settlement Agreement, which committed the USACE to fund bryozoan studies of Capron Shoal and nearby shoals ($200,000), dredge only in the southern portion of the currently authorized borrow area of Capron Shoal during the first phase of the beach renourishment project, conduct a survey of the effect of beach nourishment on the nearshore hardbottom, and conduct additional NEPA analysis before beginning the next phases. The purpose of this EIS is to address these issues.



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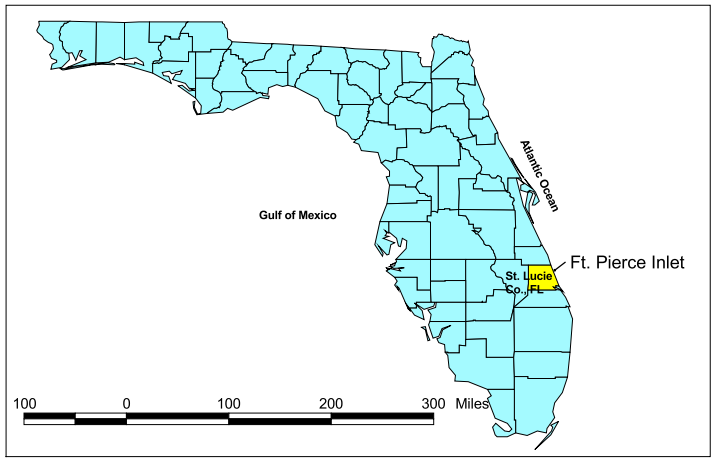
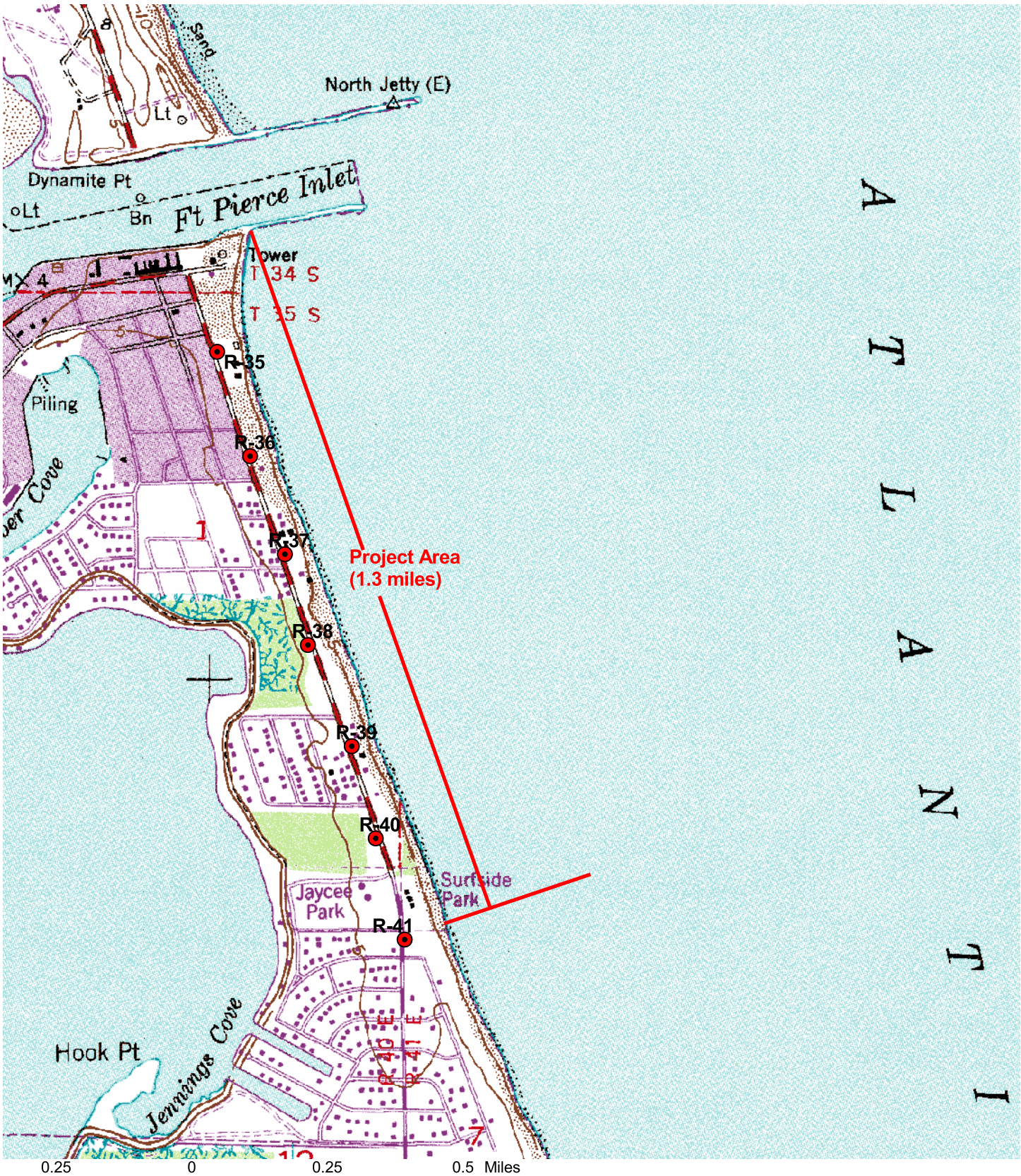


Location Map	
Fort Pierce Shore Protection Project St. Lucie County, Florida	
Scale: 1 inch = 1 mile	Drawn By: MR
Date: May, 2002	
DIAL CORDY AND ASSOCIATES INC	J02-552
	Figure 1



LEGEND

DNR Monument

Project Area

Project Area Map	
Fort Pierce Shore Protection Project St. Lucie County, Florida	
Scale: 1 inch = 0.25 mile	Drawn By: MR
Date: May, 2002	
DIAL CORDY AND ASSOCIATES INC	J02-552
	Figure 2

2.0 ALTERNATIVES

2.1 Description of Alternatives

After considering the various studies performed in association with shoreline erosion south of the Fort Pierce Inlet jetty, the USACE selected the alternatives for the proposed project. The authorized Fort Pierce SPP provides for a design of the restored beach based on the assumptions that wave energy would dissipate seaward of upland property, and adequate area would be provided for recreation. It was determined that a berm elevation of +10 feet MLW would provide protection during all but the most severe storm events. Design slopes for the adjusted post-construction profiles would be 1V:10H from the berm crest out to MLW, and then 1V:20H out to the intersection with the existing profile. These slopes mimic the natural slopes of the beach face. The width of the restored beach would be 50 feet at elevation +10 MLW. Immediately following project construction, the beach width may exceed 50 feet in places due to the width of the sloped beach face between the seaward edge of the 50-foot berm and the MHW shoreline. Advance nourishment material would be placed at the time of construction to offset anticipated erosion losses between nourishments. The recommended renourishment interval was seven years. However, results from most recent nourishment projects indicate a shorter time span is warranted; placed material eroded within 24 months. It was proposed that in addition to the No-Action Alternative, two action alternatives would be examined. The Preferred Alternative would use Capron Shoal as the sand source for nourishment of the 50-foot shoreline extension berm. The third alternative would be to use sand from other shoals and harbor maintenance dredging.

2.1.1 Alternative 1 - No-Action

Alternative 1 assumes that the erosion in the study area will continue with no solutions or remedial measures being constructed, except for those in response to emergency situations. An estimated $64 million in structural improvements is currently susceptible to storm damage south of the Fort Pierce Inlet jetty. This estimate does not include infrastructure such as roads and utilities. It is estimated that nearly $1.5 million in storm damage will occur annually if no action is taken. Local efforts to stop storm and erosion damage have included dune construction, enhancement, and revegetation; geotextile erosion-control-tube installation to hold small quantities of emergency beach fill; construction and repair of coastal armor; and construction of a longshore-parallel spur jetty along the existing south jetty at Fort Pierce Inlet.

2.1.2 Alternative 2 - Continued Periodic Nourishment Utilizing Capron Shoal Borrow Area. (Preferred Alternative)

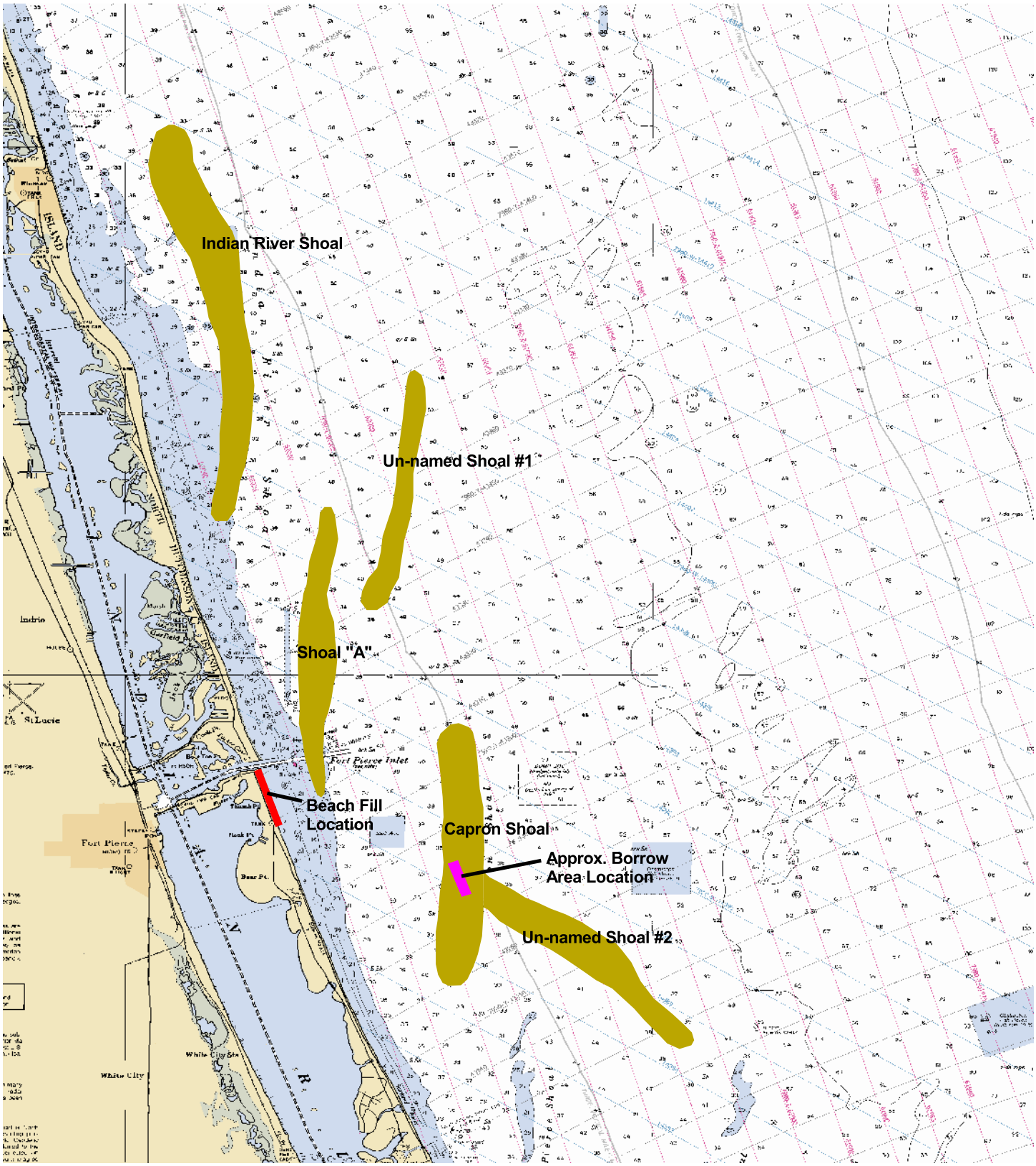
The project area for Alternative 2 extends 1.3 miles from the south Fort Pierce Inlet jetty at FDEP Monument R-34 to the southern terminus of the authorized project at FDEP Monument R-41 in Surfside Park. This alternative, utilizes sand from Capron Shoal. Several of the offshore shoals in the vicinity of Fort Pierce contain appreciable quantities of beach compatible sand. However, the largest sand source near the project beach is Capron Shoal which contains an estimated 23 million cubic yards of beach quality sand The projected requirements for this project are 3.2 million cubic yards of beach-compatible sand. Capron Shoal is capable of supplying all the sand required for the projected life of the project. The Section 934 Study completed in 1995 included an evaluation of potential sand sources available for Fort Pierce South Beach. Based upon available data, Capron Shoals was determined to be an excellent long-term source of beach-quality sediments for renourishment.

2.1.3 Alternative 3 - Continued Periodic Nourishment Utilizing Other Shoals as Borrow Area.

The project area for Alternative 3 extends 1.3 miles from the south Fort Pierce Inlet jetty at FDEP Monument R-34 to the southern terminus of the authorized project at FDEP Monument R-41 in Surfside Park (as with Alternative 2) but uses other shoals and maintenance dredging as the sand source. Figure 3 shows the locations of potential offshore borrow areas. The investigation of potential offshore sand sources for beach renourishment in the vicinity of Fort Pierce began in 1965 with the Inner Continental Shelf Sediment and Structure Program (ICONS). The ICONS identified several offshore shoals that contained appreciable quantities of sediments deemed suitable for beach nourishment. Of these shoals, Bethel, Capron, and Indian River Shoal were described as containing “best” quality sediment. Three other shoals (Shoal “A”, Unnamed Shoal #1, and Unnamed Shoal #2) were described as containing “good” quality material. Bethel Shoal, Unnamed Shoal #1, and Unnamed Shoal #2 were removed from consideration due to their greater distance from the project area.

2.2 Comparison of Alternatives

Table 1 lists alternatives considered and summarizes the major features and consequences of the Preferred Alternative and the other alternatives considered (see Section 4.0 for a more detailed discussion). Alternatives 2 and 3 would have approximately the same costs and benefits with respect to sand application, as that aspect is identical for both. However, the alternatives differ with respect to sand source and associated impacts. The results of geotechnical investigations included in the 1998 General Re-Evaluation Report indicated that Capron Shoals was the best long-term supply of beach-compatible sand.



Location of Potential Offshore Borrow Areas	
Fort Pierce Shore Protection Project St. Lucie County, Florida	
Scale: 1 inch = 3 miles	Drawn By: MR
Date: May, 2002	
DIAL CORDY AND ASSOCIATES INC	J02-552
	Figure 3

Table 1 Comparison of Features and Impacts of Alternatives Evaluated

	Alternative 1 No-Action	Alternatives 2 & 3
Hardbottom Coverage	N/A	7.8 acre
Annual Damages	$1,481,300	$234,400
Annual Project Costs	N/A	$983,300
Annual SDR Benefit	N/A	$1,246,900
Benefit/Cost Ratio	N/A	1.27

Economic data from 1993 Section 934 Study

2.3 Preferred Alternative

Based on factors and considerations summarized in Section 2.2, Alternative 2, the periodic nourishment of beaches with a 50-foot shoreline extension utilizing Capron Shoal borrow area, has been selected as the Preferred Alternative. Because of excessive erosion in the project area, further actions are also currently being evaluated for their effectiveness in retaining material at the shoreline. These alternatives include such structural elements as groins and breakwaters. Additional measures for the project area will be evaluated and discussed in a General Re-Evaluation Report/Environmental Assessment (GRR/EA) that is currently in preparation by the USACE.

2.4 Alternatives Eliminated From Detailed Evaluation

Plans for addressing shoreline erosion south of the Fort Pierce Inlet were formulated in conjunction with the 1978 General Design Memorandum (GDM) and the 1998 GRR/EA (USACE, 1998). Together, they form an extensive list of potential alternatives considered by the USACE. The plan formulation section of the 1978 GDM was incorporated by reference and appended to the 1998 GRR/EA.

2.4.1 Alternatives Considered in the 1978 GDM

The initial array of alternatives in the 1978 study included both nonstructural and structural measures. Nonstructural alternatives and their fates included the following:

Rezoning of Beach Area. Carried forward as part of the nonstructural combination plan of the intermediate alternatives.

Modification of Building Codes. Failed to reduce erosion of recreational beach. Eliminated from further consideration.

Construction Setback Line. Carried forward as part of the nonstructural combination plan of the intermediate alternatives.

Moratorium on Construction. Carried forward as part of the nonstructural combination plan of the intermediate alternatives.

Flood Insurance. Does not prevent damage. Eliminated from further consideration.

Evacuation Planning. Carried forward as part of the nonstructural combination plan of the intermediate alternatives.

Establishment of a No-Growth Program. Growth was considered necessary for economic depth to the community. Eliminated from further consideration.

Various Combinations of Above. It was recognized that various aspects of many of the nonstructural plans could be implemented collectively or in combination with structural measures. It was determined that a single nonstructural plan would not be applicable.

Structural measures and their fates consisted of the following:

Offshore Breakwater. Retained for further evaluation as an intermediate alternative.

Continued Periodic Nourishment. Retained for further evaluation as an intermediate alternative.

Beach Nourishment with Maintenance Material from Fort Pierce Inlet. Uncertainty regarding periodicity of maintenance dredging and available quantities of beach-quality material relegates this measure to providing only supplemental material when available. Eliminated from further consideration.

Groins with Periodic Maintenance. Retained for further evaluation as an intermediate alternative.

Seawalls. Because it would result in the loss of beach, this would be unacceptable to residents. Eliminated from further consideration.

Hurricane Surge Protection – Sand Dune. This measure was found to be neither practicable nor economically feasible. Eliminated from further consideration.

Stabilization of Beaches and Dunes by Vegetation. Not applicable to the conditions at Fort Pierce. Eliminated from further consideration.

Relocation of Structures. Most structures in the area cannot be moved economically. Eliminated from further consideration.

Flood Proofing of Structures. Considered to be part of building code modifications. Eliminated from further consideration.

Condemnation of Land and Structures. This alternative would allow the shoreline to erode until equilibrium becomes established. Eliminated from further consideration.

Of the five alternatives retained for intermediate-level analysis, the construction of an offshore rubble breakwater was considered to have an excessive cost and was eliminated from additional consideration. The non-structural plan was eliminated from further consideration

because it would not alleviate problems experienced by existing development or prevent the erosion and loss of the existing beach.

Periodic nourishment of the beach using an offshore source of sand was selected as the preferred plan in the 1978 GDM. Analyses revealed that the plan would provide the more practical and acceptable means for addressing the erosion problem while the beneficial effects would offset the detrimental effects. The benefit-to-cost ratio was determined to be greater than unity.

2.4.2 Other Sand Sources

Upland Sand Sources. Several commercial sand mines, located in Brevard County, were identified in the Brevard County Shore Protection Study Reconnaissance Report(1993). The report indicated all but one mine contained material of beach quality. However, quantities were questionable, and costs were prohibitive.

Apalachicola Sand Source. Beach-quality sand is available from the Apalachicola dredging project. However, current costs of transporting it to the project site are prohibitive.

2.5 Mitigation

Although long-term adverse impact to biological communities are not anticipated due to the Preferred Alternative, the USACE is prepared to mitigate for any short-term effects this project may have on hardbottom habitat. The multifaceted plan was approved by the FDEP for the 1.3-mile Fort Pierce beach renourishment project that was conducted in 1998-1999.

3.0 AFFECTED ENVIRONMENT

This section describes only those environmental resources that are relevant to the three alternatives that remain under consideration. 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 illustrates the baseline conditions for determining the environmental impacts of the alternatives that remain under consideration.

3.1 General Environmental Setting

Hutchinson Island is a 24-mile-(38-kilometer)-long, narrow barrier island, bordered by Fort Pierce Inlet on the north, St. Lucie Inlet on the south, the Indian River Lagoon on the west, and the Atlantic Ocean on the east. The general project area on Hutchinson Island is composed primarily of multifamily homes and small condominium complexes facing either the Indian River Lagoon to the west or the Atlantic Ocean to the east. The northern end of Hutchinson Island provides public parking and beach access and therefore comprises hard impermeable surfaces. The dune system in this area, which affords some protection for the waterfront development, is low, and has suffered erosion due to overwash events during severe winter storms. Because of this, erosion of the protective beach along Fort Pierce is a severe seasonal problem.

3.2 Fish and Wildlife Resources

The biological communities found in the general project areas are all well adapted to the particular physicochemical and hydrodynamic conditions associated with the supralittoral beach zone and the intertidal swash zone (Nelson 1985). Additional descriptions of the biological communities that occur in the SPP area are given in the U.S. Fish and Wildlife Service's (USFWS) Final Fish and Wildlife Coordination Act Report (Appendix E).

3.2.1 Beach and Inshore Softbottom Communities

The dune system immediately adjacent to the project area is largely artificial, and was built as part of previous restoration projects. Dominant plant species in that community 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*) and bay bean (*Canavalia maritim).* Inkberry (*Scaevola plumier)*, sea lavender (*Mallotonia gnaphalodes)*, spider lily (*Hymenocalis latifolia)*, beach star (*Remirea maritima)*, and coconut palm (*Coco nucifera)* are also present. In recent years, much of Florida's shoreline has become dominated by larger exotic vegetation such as the Australian pine (*Casuarina litorea)*.

These trees have a shallow root system and are prone to being uprooted during strong winds. The invasion of this destabilizing exotic species can be detrimental to nesting sea turtles as they tend to increase erosion, and fallen trees and root systems can be detrimental to both turtle eggs as well as hatchlings (National Research Council 1990**).**

The biological communities in the highly dynamic intertidal swash zone must cope with being aerially exposed during normal tidal cycles as well as being subjected to the high energy of the ocean waves. Typically, these habitats exhibit low species diversity because of the environmentally harsh conditions present. However, animals that are able to successfully adapt to these dynamic conditions are faced with very little competition from other organisms. A dominant invertebrate found along the shoreline of Fort Pierce is the Atlantic coquina clam (*Donax variabilis)*. It is because of this lack of competition and adaptability of most organisms to the dynamic conditions found along the project area that *D. variabilis* is able to numerically dominate the biological community (Edgren 1959). A variety of polychaete worms, another of the few taxa that are adapted to this highly dynamic and stressful environment, can be found within the intertidal zone along the Fort Pierce beaches. These intertidal organisms also provide an important food source for foraging shore and wading birds. Amphipods and isopods, which are frequently washed out of their burrows by receding waves and suspended in the water column, serve as an important food source for a variety of nearshore fishes. Highly visible decapod crustaceans of the Fort Pierce supralittoral zone include the ghost crab (*Ocypode quadrata*), mole crab (*Emerita talpoida*), and Atlantic fiddler crab (*Uca pugilator*). These organisms are highly motile and burrow into the moist sand for refuge (Barnes 1974).

3.3 Threatened and Endangered Species

3.3.1 Sea Turtles

3.3.1.1 Nesting Habitat for Sea Turtles

Five species of sea turtle have been observed in St. Lucie County and associated waters. The County is within the normal nesting range of three species of sea turtles: the loggerhead (*Caretta caretta*, the green (*Chelonia mydas*), and the leatherback (*Dermochelys coriacea*. The loggerhead, is currently responsible for the vast majority of the nesting, both statewide and in St. Lucie County, although data suggest increasing numbers of green and leatherback turtles nesting statewide. Green and leatherback turtles are both listed as *endangered* under the U.S. Endangered Species Act of 1973 and Chapter 370 of the Florida Statutes. The loggerhead is listed as *threatened*.

All three species noted above have been documented as nesting on St. Lucie County beaches. The Kemp's ridley (*Lepidochelys kempi*) and hawksbill (*Eretmochelys imbricata*) are infrequent nesters along the east coast of Florida and have not been recorded as nesting on

County beaches. These observations and more-detailed data discussed below are based on the Florida Fish and Wildlife Conservation Commission (FFWCC) Statewide Nesting Beach Survey (SNBS) program, which has collected/collated data along St. Lucie County beaches since 1980. St. Lucie County data are collected along stretches of beach varying in length from 27.7 to 34.4 km.

3.3.1.1.1 Loggerhead Turtle

Loggerheads nest in the southeastern U.S. from April through September, with peak nesting occurring in June and July (National Marine Fisheries Service and USFWS 1991a). From 1988-2001, the average number of loggerhead nests was 161 nests/km for the beaches surveyed in the southeastern U.S. (FFWCC SNBS 2001).

3.3.1.1.2 Green Turtle

Green turtles nest in Florida from June through late September. The mean nesting density for areas surveyed from 1988-2001 was 2.5 nests/km (FFWCC SNBS 2001).

3.3.1.1.3 Leatherback Turtle

Leatherback turtles nest primarily from April through July. FFWCC statewide nesting data show that for 1988 to 2001 leatherback turtle nesting density was 1.0 nests/km on the beaches the County surveyed (FFWCC SNBS 2001).

3.3.1.2 Nearshore and Offshore Habitat for Sea Turtles

Sea turtles use the habitats offshore of St. Lucie County to different degrees during different stages of their life-cycle. During summer months, hatchlings utilize this habitat as a corridor to deeper waters farther off the coast. Juvenile and sub-adult turtles use the offshore habitats as a foraging area and to travel to inshore areas such as Indian River Lagoon, while adult turtles are present year round with seasonally high abundances during the breeding season.

3.3.1.2.1 Loggerhead Turtle

Hatchlings emerge primarily at night and swim offshore in a "frenzy" until they arrive at offshore weed and debris lines (Carr 1986; Wyneken and Salmon 1992). Post-hatchling turtles from the Florida coast enter currents of the North Atlantic Gyre, eventually returning to the western Atlantic coastal waters (Bowen et al. 1993). When loggerheads reach a carapace length of approximately 40-60 cm, they leave the pelagic environment and move into various nearshore habitats (Carr 1986). These juvenile and sub-adult loggerhead turtles are found

throughout the year in the Indian River Lagoon and the offshore reef habitats of St. Lucie County. Very few loggerheads have been captured on nearshore wormrock reefs by the University of Central Florida marine turtle research program in Indian River County (Ehrhart et al. 1996). However, large numbers of loggerhead turtles have been captured at the Florida Power and Light Company's (FP&L) St. Lucie Nuclear Power Plant (Quantum Resources, Inc. 1999), which suggests that juvenile loggerheads use habitat within this general area. Adult loggerheads in South Florida utilize foraging grounds in the Caribbean basin, Gulf of Mexico, and along the U.S. east coast (Meylan et al., 1983). Abundances of adult loggerhead turtles in Florida waters increase during the nesting season (Magnuson et al., 1990).

3.3.1.2.2 Green Turtle

Green turtles have a life-history pattern similar to that of loggerheads, but they leave the pelagic phase and enter developmental habitats at a considerably smaller size, about 20-25 cm carapace length (Magnuson et al., 1990). Typical developmental habitats are shallow, protected waters where seagrasses are prevalent (Carr et al., 1978), but green turtles are commonly found in reef habitats where algae is present (Ehrhart et al., 1996; Coyne 1994). Green turtles nesting in Florida have a minimum size of 83.2 cm carapace length, but they appear to leave Florida developmental habitats by about 60-65 cm carapace length (Witherington and Ehrhart 1989), perhaps migrating to the southeastern Caribbean. St. Lucie County contains two significant developmental habitats for green turtles: the Indian River Lagoon and the nearshore reef system (Ehrhart et al., 1996). There are no data on the seasonality of habitat use of juvenile green turtles within St. Lucie County. Dietary needs of juvenile turtles along with seasonal abundances of seagrasses and algae within the area may be factors influencing the habitat use by juvenile turtles within the area. Data from the FP&L St. Lucie Power Plant show juvenile green turtles captures offshore to be more or less consistent all year (Quantum Resources, Inc. 1999). As adults, offshore habitat utilization would be greatest during the nesting period.

As noted above, green turtles leave the early pelagic life stage and enter benthic foraging areas at about 20-25 cm carapace length. During this time they shift from an omnivorous diet to a more herbivorous diet. Juvenile green turtles feed primarily on seagrasses and algae during this life stage. In Florida, these turtles feed primarily on a diet of seagrasses such as *Halodule wrightii*, *Syringodium filiforme*, and red and green algae (Lutz and Musick 1997). Data from the FP&L St. Lucie Power Plant show that juvenile turtles are present within the area offshore of the facility all year. There are some data to suggest there may be a seasonal reduction in the amount of foraging habitat present in the offshore area. The seasonal abundances of algal species offshore may limit the offshore foraging areas in the winter months. Nelson (1988) noted a great seasonal reduction in algal species richness (56 summer vs. 16 winter) on the nearshore reefs to the north at Sebastian Inlet.

3.3.1.2.3 Leatherback Turtle

Leatherback turtles occur worldwide in pelagic waters from the tropics to near the Arctic and Antarctic Circles. Nesting is primarily on the Pacific coast of Mexico and the Caribbean coast of South America, with some continental U.S. nesting in Florida. The majority of leatherback nesting activity is located within St. Lucie, Martin, and Palm Beach counties (Meylan et al., 1995).

3.3.2 Threatened and Endangered Mammals

3.3.2.1 West Indian Manatee

The West Indian manatee (*Trichechus manatus*) is protected under both the Endangered Species Act and the Marine Mammal Protection Act and is also protected under Florida State law. The Florida manatee, a subspecies of the West Indian manatee, is most numerous along the coasts of Georgia and Florida, but can also be found in coastal waters of Gulf Coast states. Manatees frequently inhabit shallow areas where seagrasses are present and are commonly found in protected lagoons and freshwater systems. Manatees occasionally use open ocean passages to travel between favored habitats (Hartman 1979). They migrate seasonally, particularly on the east coast of Florida. During the summer months, manatees utilize habitats all along the coast. However, during winter, when water temperatures drop, manatees use warm-water refuges such as springs or warm water discharges at power plants. Within St. Lucie County, manatees infrequently use nearshore Atlantic waters, but are found more frequently within protected lagoon areas, especially during the summer months.

3.3.2.2 Southeastern Beach Mouse

The southeastern beach mouse (*Peromyscus polionotus neveiventris*) is listed as a threatened species at both the federal and state levels. Beach mice primarily use coastal dune communities containing stands of sea oats for habitat. Grasslands and open sandy areas in the fore-dune area may also be utilized (Humphrey 1992). This subspecies was originally endemic to coastal dunes along the Florida coast from Ponce Inlet (Volusia County) to Hollywood Beach (Broward County). Declines in beach mouse populations have been attributed to loss of habitat due to coastal development and beach erosion.

Southeastern beach mice have been historically documented within St. Lucie County (Humphrey 1992). It appears, however, that the southeastern beach mouse may recently have been extirpated from its local range due to erosion of favored habitats.

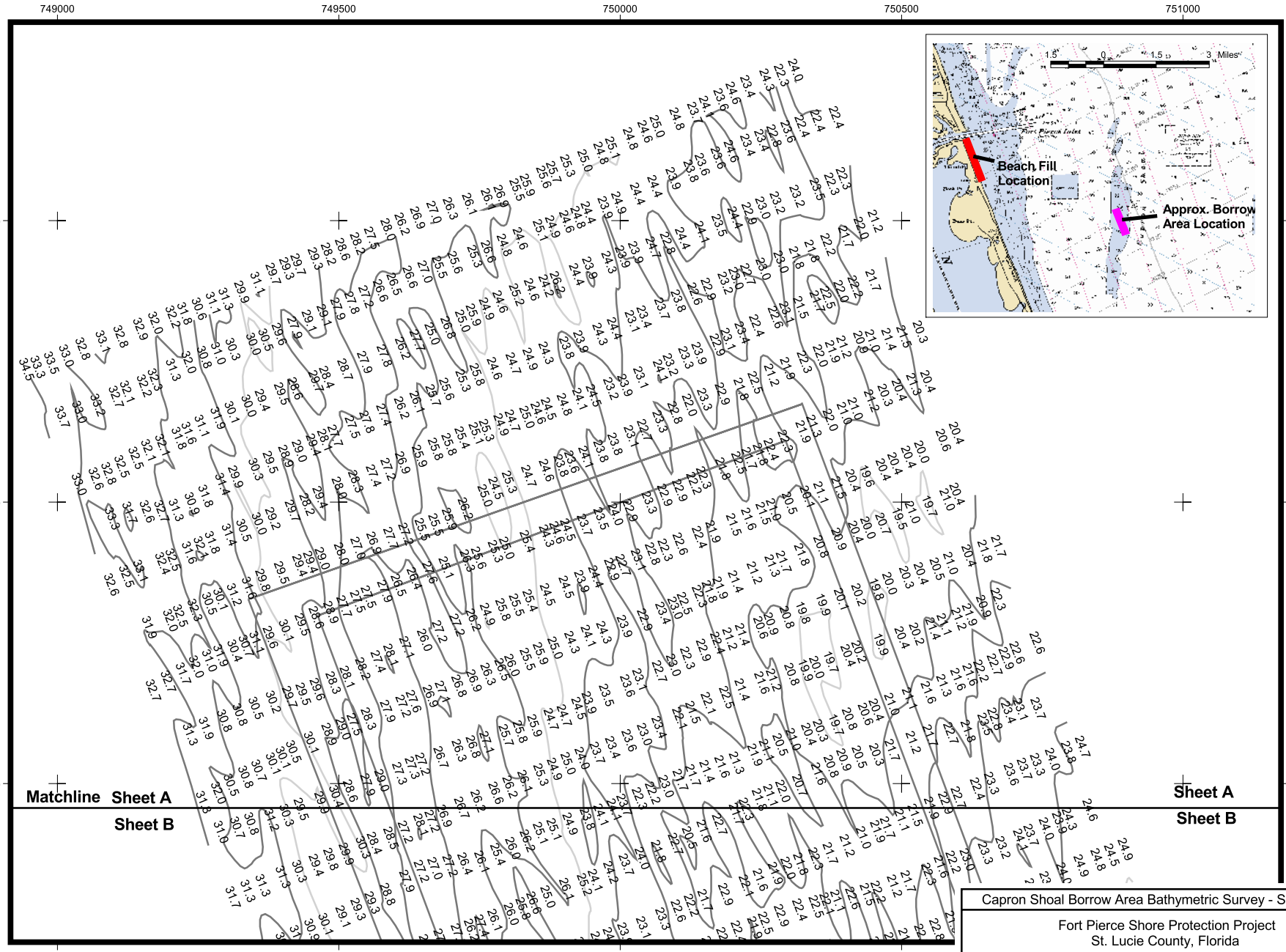
3.3.2.3 Northern Right Whale

The northern right whale (*Eubalaena glacialis*) is a federally listed endangered species and is protected under the Marine Mammal Protection Act. Just a decade ago, the migratory population within the Atlantic Region was less than 350 animals (Humphrey 1992). Right whales are highly migratory, and summer in the Canadian Maritime Provinces. They migrate southward in winter to the eastern coast of Florida. The breeding and calving grounds for the right whale occur off of the coast of southern Georgia and northern Florida. During winter months, right whales are routinely seen close to shore and have been sighted as far south as south Florida, with isolated sightings into the Gulf of Mexico. Offshore of St. Lucie County, the peak probability of occurrence of right whales would occur from December through March.

3.4 Offshore Borrow Area Resources

The area selected as the sand source borrow site (Capron Shoals) for the proposed project (Figure 4) is located in approximately 25 to 30 feet of water three miles or less offshore. These sandbars were formed in the recent geologic past by the migration of relic inlets through the barrier island (Moody 1964). As a tidal inlet migrates, its ebb shoal becomes elongated and eventually detaches from the shoreline due to rising sea level and the landward retreat of the shoreline. There are a number of these shoal formations along the local coast, including St. Lucie, Pierce, and Capron Shoals in St. Lucie County, and the Indian River Shoal located offshore of southern Indian River County and northern St. Lucie County.

These offshore sand habitats support a diverse fauna, although there has been comparatively little research conducted in this environment. There are several studies of invertebrates and fishes from the open sand habitat in the general proposed project area. Johnson (1982) collected over 188 species of invertebrates in benthic grab samples from the Capron Shoal area off Fort Pierce Inlet. In a study offshore of Hutchinson Island in St. Lucie County, Futch and Dwinell (1977) collected lancelets (sand-dwelling chordates in the subphylum Acrania) in densities as high as 1,750 per m^2. Other important invertebrates that utilize these sand areas as habitats are bryozoans. Winston and Hakansson (1986) found at least twelve new species from the Capron Shoal area. Brostoff (2002) in Appendix C re-examined the areas around Capron Shoal and found most of these bryozoan species do occur on nearby shoals. Gilmore et al. (1981) collected 194 species of fishes from open shelf sand habitats to the north in the Indian River County area. Flatfishes, searobins, and cusk eels, along with an assortment of batfishes and skates, dominated the fish fauna in similar habitats.

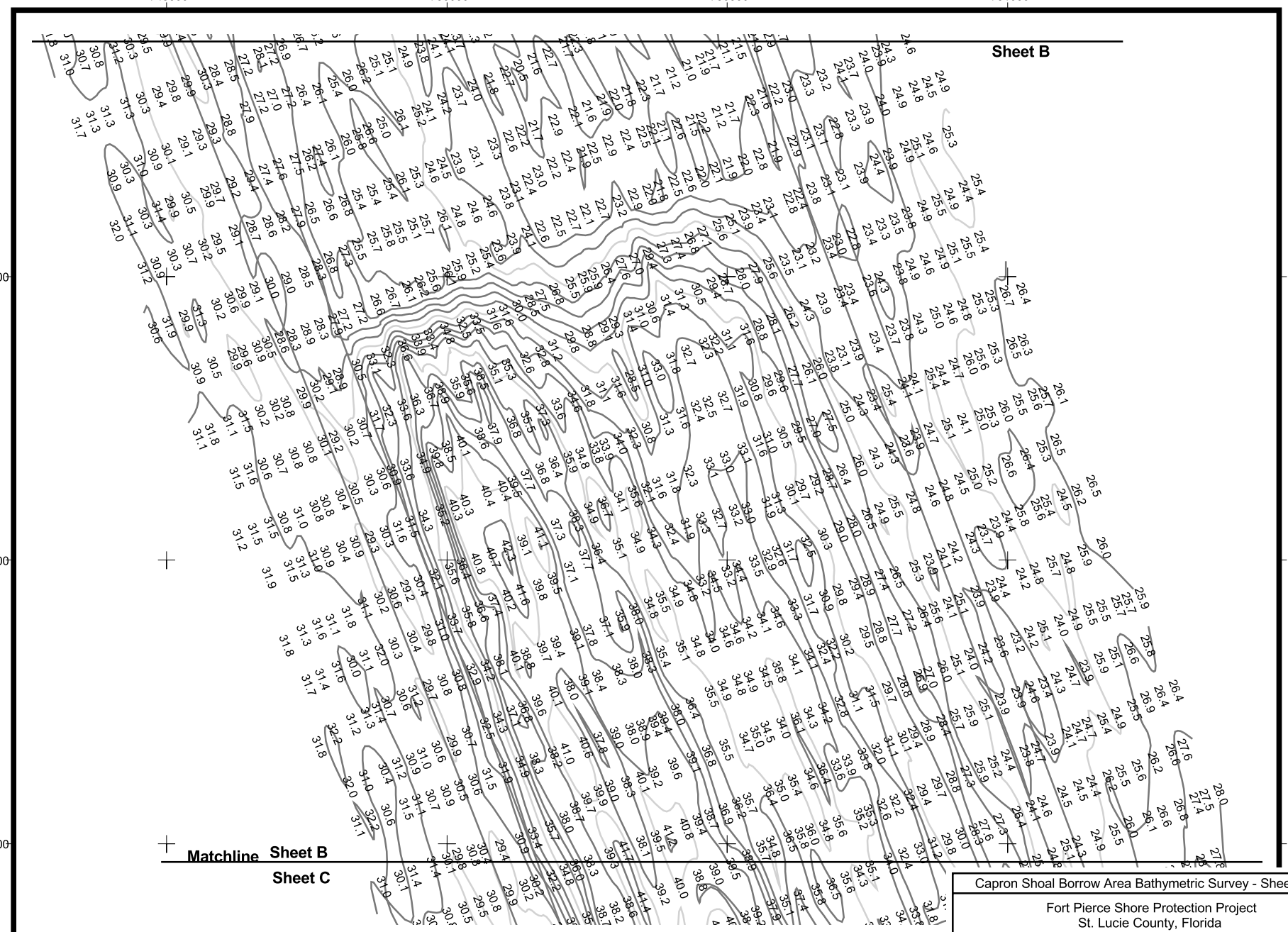


Capron Shoal Borrow Area Bathymetric Survey - Sheet A

Fort Pierce Shore Protection Project
St. Lucie County, Florida

Scale: 1" = 250'	Drawn By: MR
Date: May, 2002	
DIAL CORDY AND ASSOCIATES INC	J02-552
	Figure 4a

Coordinate Grid: NAD 27, Florida State Plane, East Zone (feet)

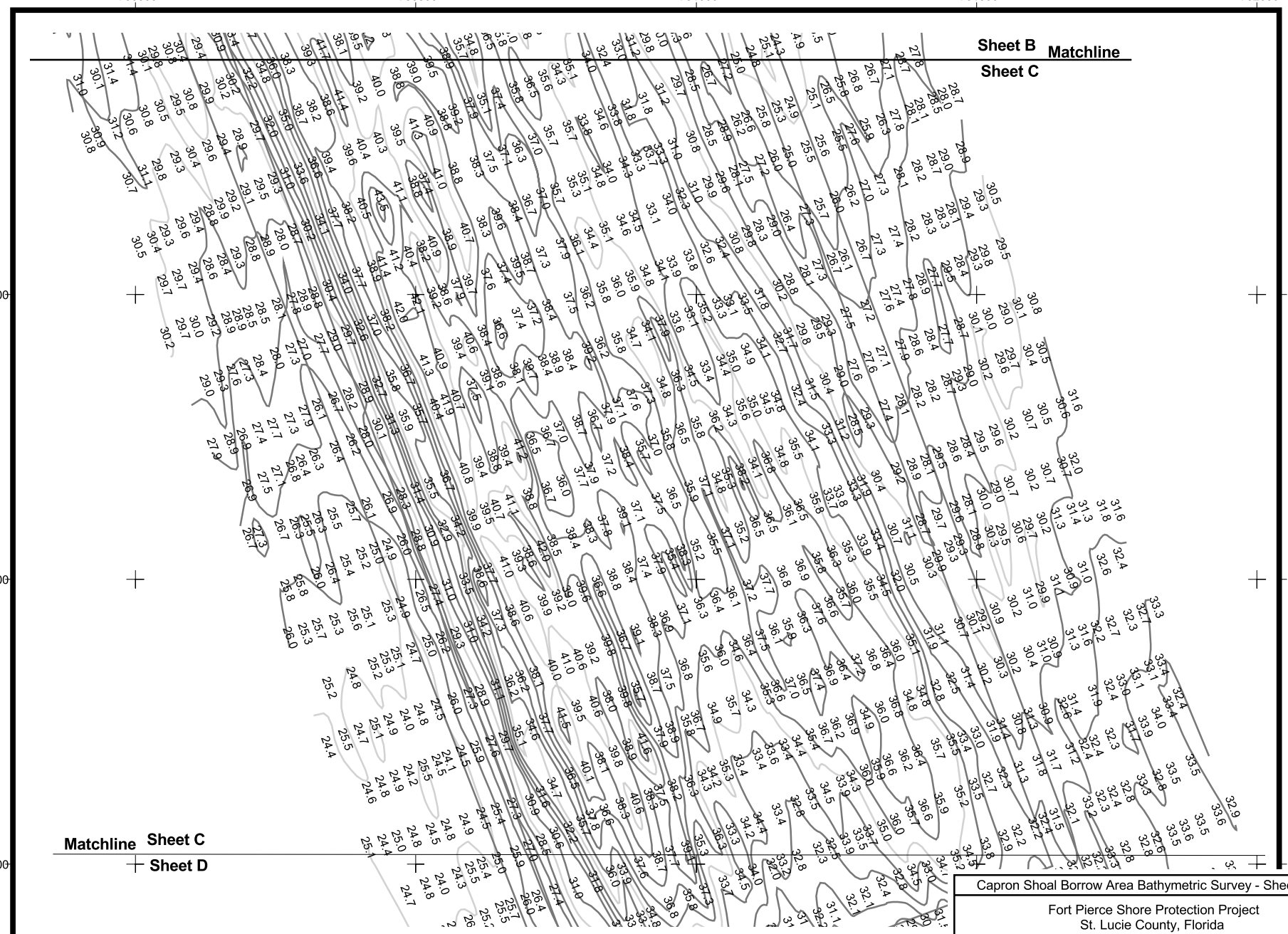


Capron Shoal Borrow Area Bathymetric Survey - Sheet B

Fort Pierce Shore Protection Project
St. Lucie County, Florida

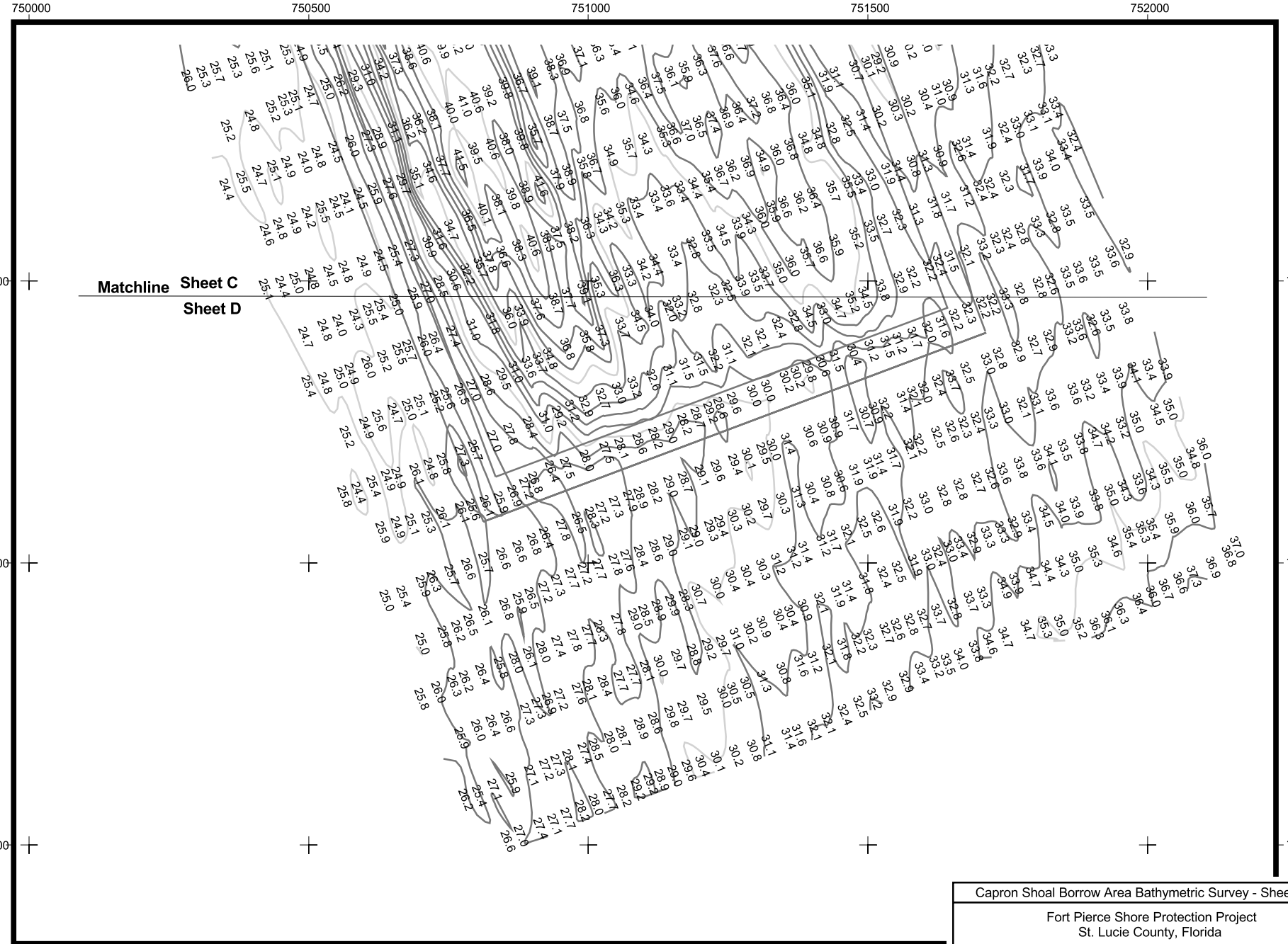
Scale: 1" = 250'	Drawn By: MR
Date: May, 2002	
DIAL CORDY AND ASSOCIATES INC	J02-552
	Figure 4b

Coordinate Grid: NAD 27, Florida State Plane, East Zone (feet)



Coordinate Grid: NAD 27, Florida State Plane, East Zone (feet)

Capron Shoal Borrow Area Bathymetric Survey - Sheet C	
Fort Pierce Shore Protection Project St. Lucie County, Florida	
Scale: 1" = 250'	Drawn By: MR
Date: May, 2002	
DIAL CORDY AND ASSOCIATES INC	J02-552
	Figure 4c



Coordinate Grid: NAD 27, Florida State Plane, East Zone (feet)

Capron Shoal Borrow Area Bathymetric Survey - Sheet D	
Fort Pierce Shore Protection Project St. Lucie County, Florida	
Scale: 1" = 250'	Drawn By: MR
Date: May, 2002	
DIAL CORDY AND ASSOCIATES INC	J02-552
	Figure 4d

3.5 Hardbottom and Reefs

Both nearshore and offshore reefs are found along much of the Atlantic coast of Florida and significantly contribute to the high biodiversity found in these areas. Limestone deposition, which forms ridges and rocky outcrops and contributes to live-bottom communities, is found along the entire length of the project area. Hardbottom habitat surveys were conducted on May 22 - 26, 2000, which involved video mapping along 14 transects. Each of the transects, set at intervals of 500 feet, were located between FDEP Monuments R-34.5 and R-41 and were approximately 1,700 feet long. In order to compare baseline video transect mapping conducted in 1994 and 1997 with the May 2000 surveys, habitat maps from the 1994 and 1997 studies were scanned into ArcView, projected in a manner similar to those with the 2000 information, and overlain with the 2000 mapped data. From this composite overlay of temporal mapped data, the percent composition for each substrate type by distance along the transects and by area within the survey block was calculated. Direct habitat loss was calculated by spatially comparing the location of rock features in 1994, 1997, and 2000. Modeling to investigate potential direct and/or indirect impacts to hardbottom and sand habitats was not conducted. Substrate types identified and mapped from the video mapping surveys included the following:

1) Predominately sand bottom with < 10 percent rock cover.

2) Exposed rock with 10 to 50 percent algal sponge community cover.

3) Exposed rock with > 50 percent algal sponge community cover.

4) Live wormrock.

Based on the total transect length, the percentage of exposed rock with at least 10 percent cover and greater than 50 percent cover was 53 percent, while the remaining 47 percent was open sand. A trend analysis in substrate cover types from 1994 to 2000 showed that the area of exposed hardbottom with 10 to 50 percent biotic cover increased from 81.8 acres to 93.7 acres, while the area of hardbottom with > 50 percent cover decreased from 97.5 acres to 60.5 acres at both inshore and offshore areas. Sand bottom was most commonly observed adjacent to the beach, between the two rock outcrops along the southern half of the survey area, and interspersed between areas of narrow rock outcrops in the northern half of the survey area. The polychaete worm, *P. lapidosa*, forms extensive worm rock colonies off Fort Pierce. Temporal changes from 1994 to 2000 in worm rock distribution along each transect were quite varied. The mean percentage of dense worm rock did not change significantly (12 percent to 11 percent), but the percentage of scattered worm rock declined from 43 percent to 25 percent.

In addition, photodocumentation of permanent stations established in 1994 was conducted (SeaByte 1994). Of the seven stations, two stations (PQ-1, and PQ-3) were not found and subsequently not photodocumented. The photoquadrats were photographed using a Nikonos

V camera equipped with a 28 mm lens mounted on a camera framer jig. The area photographed within each frame for analysis was 0.16 m^2.

Fixed photographic analysis of the hardbottom cover revealed that either rock or sand/shell accounted for over 95 percent of the total area analyzed. No spatial differences were apparent from the data presented except for an increase in worm rock cover at the southern study area limit and the lack of urchins at the southern inshore station (PQ-6) as compared to the other stations farther offshore (PQ-4, 5, and 7). In comparison to the fixed photographic analysis performed in September 1994, the cover area of animals and plants was significantly less during the 2000 monitoring event than previously observed. While the dominant marine species were observed during both studies, the total area of biotic cover significantly declined.

Off the east coast of central Florida, low relief hardbottom areas are constructed by the tropical sabellarid marine bristle worm. These worms collect sand grains of suitable size and the sand is than cemented together by mixing the sand grains with a protein mucus (Barnes 1974). The worm reefs expand as worm larvae settle on existing worm tubes and the entire process is continually repeated. These worm reefs provide two very important functions. First, as hardened structures, the reefs tend to help dissipate destructive wave energy. Second, the reefs provide attachment area for live-bottom plants and structural habitat for a wide variety of invertebrates and fishes. Worm rock colonies were observed extensively within the first outcrop and less commonly on the outer, more scattered rock outcrops. Areas of dense worm rock cover occurred along the western edge of the first outcrop and, to a lesser degree, on the eastern edge of the first outcrop and offshore outcrops. Colonies ranged from very small (< 20 cm in diameter) to over 1.5 to 2 m in height and 2 to 3 m in diameter. Along many transects, worm rock colonies occurred continuously for distances of over 100 m.

Marine flora and fauna identified from the video survey were limited due to low visibility and were generally larger organisms that could be observed from the video. Consequently, the species list compiled from the surveys does not accurately reflect the diversity of marine species associated with the nearshore hardbottom habitat. The 1994 baseline survey was more extensive in scope and provides a more thorough summary of the marine species common to this area (SeaByte 1994).

The algal sponge community present off Fort Pierce is highly characteristic of nearshore rock outcroppings found along the east central and southeast coast of Florida. Marine algae observed included seven species of green algae, dominated by *Caulerpa racemosa*, *Halimeda* sp., and *Padina gymospora*; two species of brown algae, *Dictyota* sp. and *Dictyopteris delicatula*; and three species of red algae including *Bryothamnion seaforthii*, *Hypnea musciformis*, and *Jania rubens*. Common invertebrates observed included the sponges *Cliona lampa*, *Tethya* sp. and *Anthosigmella varians*; several species of unidentified hydroids and the star coral, *Siderastrea radians*; bryozoans; and two species of sea urchins, including *Echinometra lucunter* and *Lytechinus variegates*. The polychaete worm, *P. lapidosa*, forms the extensive colonies of worm rock located off Fort Pierce.

Crevices in these limestone outcrops provide important refuge for commercially important crustaceans such as the stone crab (*Menippe mercenaria*), blue crab (*Callinectes sapidus*), and spiny lobster (*Panulirus argus*). These limestone outcrops form three-dimensional structures that provide the only vertical habitat found along vast expanses of sandy substrate. Large carnivores such as snapper (*Lutianus* sp.), grouper (*Epinephelus* sp.) and sea bass (*Centropristis sp*.) are frequently found around these rocky structures. Smaller reef fishes such as the sheepshead (*Archosaraus probatocephalus*), porkfish (*Anisotremus virginicus*), and spadefish (*Chaetodipterus faber*) are also commonly seen foraging around the hardbottom habitat.

3.6 Essential Fish Habitat

The South Atlantic Fisheries Management Council (SAFMC) (1998) has designated seagrass, nearshore hardbottom, and offshore reef areas within the study area as Essential Fish Habitat (EFH) (Table 2). The nearshore bottom and offshore reef habitats of Central Florida have also been designated as Essential Fish Habitat-Habitat Areas of Particular Concern (EFH-HAPC) (SAFMC 1998). As many as 60 corals can occur off the coast of Florida (SAFMC 1998) and all of these fall under the protection of the management plan.

Table 2 Essential Fish Habitat

Marine Areas	
	Live/Hardbottom
	Coral and Coral Reef
	Artificial Reefs
	Sargassum
	Water Column

Source: South Atlantic Fisheries Management Council 1998

Managed species that commonly inhabit the inshore and offshore habitats within the study area include pink shrimp (*Farfantepenaeus duorarum*), and spiny lobster (*Panularis argus*). Members of the 73 species snapper-grouper complex include sailors choice (*Haemulon parra*), gray snapper (*Lutjanus griseus*), mahogany snapper (*Lutjanus mahogoni*), and porkfish (*Anisotremus virginicus*). These species utilize the inshore habitats as juveniles and sub-adults and the hardbottom and offshore reef communities as adults. In the offshore habitats, the number of species within the snapper-grouper complex that may be encountered increases. Coastal migratory pelagic species also commonly utilize the offshore area adjacent to the study area. In particular, king mackerel (*Scomberomorus cava*lla) and Spanish mackerel (*S. maculatus*) are the most common.

3.7 Coastal Barrier Resources

The Coastal Barrier Resources Act of 1982, as amended, protects undeveloped coastal barriers and related areas by prohibiting direct or indirect federal funding of various projects in these areas that might support development. The Act also established a Coastal Barrier Resources System, consisting of undeveloped coastal barriers and other areas on the coastal U.S. Because of urbanization and the highly developed nature of Hutchinson Island both north and south of the Fort Pierce Inlet, there is little available terrestrial habitat in the immediate project area to support large numbers of diverse plants and animals. The northern end of Hutchinson Island is not part of the Coastal Barrier Resources System.

3.8 Water Quality

Waters off the coast of St. Lucie County are classified as Class III waters by the State of Florida. Class III waters are designated as suitable for recreation and the propagation of fishes 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 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 winter, corresponding with winter storm events and the rainy season (Dompe and Haynes 1993; Coastal Planning and Engineering 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 within several days to several weeks, depending on the duration of the perturbation (storm event of other) and on the amount of suspended fines. Strict control over water quality is addressed by the FDEP in applying specific water quality monitoring requirements during the dredging and beach fill operations stage.

3.9 Hazardous, Toxic, and Radioactive Waste

The coastline within the project area is located adjacent to predominantly residential, commercial, and recreational areas. There are no known industrial activities that produce hazardous, toxic, and/or radioactive wastes adjacent to the project site that discharge effluents

near the shoreline and no known records of such activities in the past. Sediments within the littoral zones of the project area, as well as sediments from the borrow areas, are composed of particles of a large grain-size. Normally, contaminants do not adhere to materials with such properties. Sediments in the potential borrow sites are sufficiently removed from shipping lanes and are located in high-energy areas. Hence, they are unlikely to have been contaminated by pollutants.

3.10 Air Quality

Fort Pierce lies within the Southeast Florida Intrastate Air Quality Region, as established by 40 CFR Part 81.49. St. Lucie County has been designated by U.S. Environmental Protection Agency (USEPA) (40 CFR Part 81.310) as being in attainment with National Ambient Air Quality Standards for ozone, nitrogen dioxide, carbon monoxide; total suspended particulates, and sulfur dioxide that are better than national standards. USEPA has not made a designation for lead in southeastern Florida.

Ambient air quality along coastal St. Lucie County is generally good due to prevalent ocean breezes from the northeast through the southeast. The urbanization of the City of Fort Pierce and the popularity of the beaches area all contribute to a large number of motorized vehicles and vessels being in the project area at any given time. Because of the sea breezes that are usually present along the Fort Pierce shore, airborne pollutants are readily dispersed. No air quality permits are required for this project.

3.11 Noise

Ambient noise levels in the project area are seasonal in nature with higher levels expected during the winter tourist season. Due to urbanization and development found along the shoreline, the shoreline along Fort Pierce is a favorite recreational area for both residents and tourists. The Fort Pierce Inlet, which provides access to the Atlantic Ocean from the Indian River Lagoon Estuary, is a busy waterway for both commercial and recreational watercraft.

The major noise-producing sources include breaking surf, beach and nearshore water activities, adjacent residential and commercial areas, and boat and vehicular traffic. The density of all these activities can be expected to contribute to noise in the surrounding area.

3.12 Aesthetic Resources

Aesthetic resources are those natural and cultural features of the environment that elicit a pleasurable response in the observer, most notably through visual perception. Consequently, aesthetic resources are commonly referred to as visual resources, i.e., features that can be seen. Historically, the project area consisted of light sandy beige beaches with natural sand dunes contrasting strikingly with the deep hues of the panoramic Atlantic Ocean. Currently,

the project area has a narrow beach eroded by strong winds and waves. Sand dunes in the project areas have been eroded and few trees can be found along the project. Three locally managed beach parks located in the project area also appear to be affected by erosional forces. The Atlantic beach and ocean interface along other portions of southeastern Florida reflects characteristics of beaches of the Caribbean Sea. This contrasts sharply with the narrow band of existing beach sand found in the project area.

There is no area within the vicinity of the project that has been designated under 40 CFR 81.407 as a Class I Federal Area, where visibility is an important value.

3.13 Recreation Resources

The minimal amount of commercial development has contributed to the retention of much of the natural appearance of the area, and residents and visitors have mentioned that the area has retained the overall atmosphere of "Old Florida" as it existed prior to the extensive development of the tourist industry along much of the remainder of the Florida east coast. This atmosphere appeals to many recreationists who prefer to avoid the pace characteristic of the more heavily developed resort areas.

Recreation in the Fort Pierce area is predominately water-related. Several boat launches and marinas at Fort Pierce facilitate sport fishing and recreational boating. Shallow, nearshore hardbottom areas are conducive to scuba diving and lobster fishing. Fishermen are often seen on boats in the inlet, within the Indian River Lagoon, and in nearshore and offshore areas. Fishing from the jetties is popular.

There are no state or national wildlife refuges, management areas, forests, wilderness areas, trails, estuaries, or research reserves within the project area. However, the Fort Pierce Inlet State Park, on the northern side of the inlet has camping and picnicking facilities.

The beaches of Fort Pierce have traditionally been popular with residents and tourists. While the Atlantic beach north of the inlet has continued to maintain its popularity, shoreline erosion has diminished the popularity of the beach south of the inlet. The eroded beach conditions in the project area do not present an appealing atmosphere for active or passive recreation.

3.14 Navigation

Although there is some commercial shipping associated with the Port of Fort Pierce, most of the vessel traffic in the Fort Pierce area is associated with recreational boating and fishing. While most of the concentrated vessel traffic is within the Indian River Lagoon and the Fort Pierce Inlet, private and chartered fishing boats can be found in the vicinity of nearshore and offshore reefs and shoals.

The proposed borrow area is located away from commercial shipping routes. Boating in the area is associated mainly with recreational and commercial fishing, including the harvesting of shrimp and scallops.

3.15 Historic Properties

Documented exploration and transportation activities along Florida's east coast date from the second half of the 16th century. Because of over 400 years of navigation in the Bahama Channel, several hundred shipwrecks have been identified in the waters off the state's southeast coast. Remains of recorded and unrecorded shipwrecks may be located in the area affected by the proposed Fort Pierce SPP.

Archival research and field investigations have been conducted for the study area, and coordination with the Florida State Historic Preservation Officer (SHPO) has been initiated. Results of the investigation of Capron Shoal are included in the draft report *Submerged Historic Properties Survey Capron Shoal Borrow Site, Fort Pierce Beach Erosion Control Project, St. Lucie County, Florida*, December 4, 1997. Mid-Atlantic Technology and Environmental Research completed the fieldwork and prepared the report under contract to the USACE.

One magnetic target was identified during the remote sensing survey. Analysis indicated that the target's magnetic signature does not have characteristics similar to historic shipwreck sites. It was concluded that the target probably was a single modern object and not likely to represent a resource eligible for inclusion in the National Register of Historic Places.

Based on archival research and consultation with SHPO no significant historic properties are known to exist on the beach segment proposed for renourishment. No additional fieldwork is proposed for either the borrow area or beach at Fort Pierce.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 General Environmental Setting

The planting of native salt-tolerant vegetation along the project area will help to control and conserve wind-blown sand. Completion of the project will ensure that a wide beach exists at high tide as well as a protective sand dune system above the supralittoral zone. The new beach will have a positive effect on the existing dune system. Besides providing protection to the dunes from wave and tidal generated energy, opportunistic and salt-tolerant grasses and other beach vegetation will tend to trap wind blown sand, thereby further building up the dune system in the project area. Addition of a beach and dune system will provide increased foraging habitat for many small birds, mammals, and reptiles as well as protection from storm waves and tides for coastline residents and infrastructure.

4.2 Fish and Wildlife Resources

4.2.1 No-Action (Status Quo)

The No-Action Alternative would have an impact on the vegetation resources within the project area. Continued erosion of the County's beaches would result in continued loss of habitat and eventually loss of vegetated dune areas. Also, the armoring measures that would be taken by residents along the beaches would result in impact to the plant and animal communities within these areas.

4.2.2 Preferred Alternative

The Preferred Alternative would have no impact on the vegetation resources of the County. Sand placement on the beach would not impact the nearby dune communities. The placement of the material on the beach would act as a buffer to these communities from the surge associated with storm events.

Nelson (1989) reviewed the literature on the effects of beach renourishment projects on sand beach fauna and concluded…"Minimal biological effects result from beach nourishment. Some mortality of organisms may occur where grain-size is a poor match to existing sediments, however, recovery of the beach system appears to be rapid." Nelson reviewed several studies on the most common beach invertebrates of the southeastern U.S., including the mole crab, the surf clam, *Donax* sp., and the ghost crab. None of the studies cited in Nelson (1989) showed significant or lasting impacts to any of the above species resulting from beach nourishment. Hackney et al. (1996) provide a more recent review of the effects of beach restoration projects on beach infauna in the southeastern U.S. They also reviewed studies on

the above species and agreed with Nelson's conclusions, with the caveats that construction should take place in winter months to minimize impacts, and that the sand used should be a close match to native beach sands. In most of the studies reviewed by the previously mentioned authors there was a considerable short-term reduction in the abundances of mole crabs, surf clams, and ghost crabs attributable to direct burial. Recruitment and immigration were generally sufficient to reestablish populations within one year of construction. The proposed projects would be constructed in the winter season, outside the recruitment window for these species, with a high-quality sand source containing a small percentage of fine material. These features would minimize adverse effects on most beach infauna (Hackney et al., 1996). The proposed project would not have any significant, long-lasting impacts on sand beach infaunal communities.

4.3 Threatened and Endangered Species

4.3.1 No-Action (Status Quo)

The No-Action Alternative would adversely impact the threatened and endangered species utilizing these habitats. The continued erosion of the beaches in this critically eroded area may result in the armoring of additional shoreline in the near future. This loss of beach habitat would have the greatest impact on sea turtles that utilize this habitat for nesting. Nesting success may be diminished as the total area of suitable nesting habitat is reduced by erosion. In some areas, particularly in the vicinity of armoring structures, sea turtle nesting habitat may be lost completely. The hatching success of nests that are successfully laid would also be reduced, as nests on narrow, eroded beaches are more vulnerable to repeated inundation and washout. Loss of beach width would additionally reduce the habitat for the endangered southeastern beach mouse, which utilizes these littoral and vegetated beach habitats.

4.3.2 Preferred Alternative

Although they are not generally considered permanent residents of sandy beach areas, sea turtles are organisms of major concern, as they use the supralittoral zone for nesting activities and some species use nearshore hardbottom areas for foraging. Providing compatible beach fill would result in increasing the beach area available to nesting threatened and endangered species. The USFWS issued their Biological Opinion letter October 9, 1997 (Appendix E) and listed several issues and concerns in order to ensure that the likelihood of possible impacts to sea turtles and other species will be kept to a minimum. A detailed summary of these concerns can be found in the attached Fish and Wildlife Coordination Act Report and separate Biological Opinion (Appendix E). To ensure that the project would have little to no affect on sea turtles, special precautions would be taken to protect nesting sea turtles and emerging hatchlings with prior approval of the USFWS.

Nests on renourished beaches generally hatch successfully (Nelson and Dickerson 1988). Herren (1999) found no significant difference in hatching success in the renourished area in the first or second season after the Sebastian Inlet sand transfer renourishment. Ecological Associates Inc. (EAI 1999) found lower overall hatch success on nourished beaches following construction compared to controls, but the differences were not statistically different. The EAI study did show changes in incubation environment, but these changes did not affect the hatching success. Both the Herren and EAI studies point to erosional losses of nests created low on the newly constructed berms as the primary source of impact. A proper relocation program could largely eliminate this source of impact.

Because of where the borrow areas are located, care must be taken by the dredge ship operator to ensure that there would be no collisions with migrating marine mammals such as the northern right whale (*E. alacialis*) or West Indian manatee. With heightened awareness of the possibility that marine mammals may be present in the project area and by following the various precautions mandated in the Marine Mammal Protection Act, the possibility of inadvertently harming any marine mammal would be significantly reduced.

4.4 Offshore Borrow Area Resources

4.4.1 No-Action (Status Quo)

The No-Action Alternative would have no impact on the native characteristics of the offshore borrow area or any of its associated resources.

4.4.2 Preferred Alternative

Dredging of the borrow area would remove a relatively small portion of the existing top layer of habitat and thereby change the topography of the benthic surface. This would have temporary impacts on the benthic infaunal communities. Most studies on the infauna of sand borrow areas have shown little lasting impact in terms of species diversity and total abundance or density. Previous studies have shown dredging to have little long-term adverse effects on benthic habitats (Culter and Mahadevan 1982; Saloman et al., 1982; Hammer et al., 2000). Johnson and Nelson (1985) found that abundance and species richness returned to near normal 9 to12 months after dredging off Fort Pierce Inlet in the same general location as the proposed Project. Similar results were reported by Saloman et al. (1982) off Panama City Beach, Florida, and by Tuberville and Marsh (1982) in Broward County. Benthic infauna would be expected to start re-colonizing these areas within days after dredging is completed. Care should be taken not to construct an abrupt pit in the bottom and to dredge a cut with shallow sloping sides. This would aid in the re-colonization of benthic organisms. Barry A. Vittor and Associates, Inc. (1999) found that the amount of silt/clay present within sediments and the location offshore could also affect recovery time of benthic infauna. Since very little fine material (silt/clay) is present within the borrow area, recovery should occur rapidly. Infaunal

assemblages within the study area should become re-established within one to two years following dredging.

Recent concern over the habitats that comprise the Capron Shoal area have been addressed in the literature, especially concerning potentially unique bryozoan communities that may utilize these offshore sand habitats (Winston and Hakansson 1986; Brostoff, 2002) (Appendix C). A petition was also filed in February 1999 to list new species of bryozoans discovered at Capron Shoal as endangered species under the Endangered Species Act (ESA) (Federal Register, Vol. 64, Number 103). The NMFS stated in response to this petition that "….the petition does not present substantial scientific or commercial information to warrant the petition action…", furthermore the NMFS stated in the same Federal Register document that:

> "NMFS acknowledges that dredging Capron Shoal will temporarily remove a portion of the bryozoan population and some features that make this area suitable habitat for bryozoans. However, NMFS biologists are confident that new surfaces exposed by dredging, when reshaped by natural events such as prevailing currents and wave action, will support the recolonization of the site by bryozoan larvae. The source for these bryozoan larvae will be undredged portions of Capron Shoal, nearby shoals, and the Indian River Lagoon system."

4.5 Hardbottom Habitats and Reefs

4.5.1 No-Action (Status Quo)

The No-Action Alternative would have no effect on the hardbottom or reef habitats within the study area.

4.5.2 Preferred Alternative

Approximately 7.8 acres of hardbottom habitat currently exists within the design equilibrium toe-of-slope of the 50-foot beach-fill berm. Nearshore reefs are vulnerable to direct burial from beach-fill. Furthermore, nearshore reefs also face the potential of being slowly buried after beach nourishment as the beach fill relaxes and seeks equilibrium with the area and the nearshore zone becomes elevated with resuspended material. Courtenay et al. (1974) suggested that destruction of suitable *habitat* might be more significant than direct impacts on nearshore organisms. An accurate estimate of the environmental impact associated with the nearshore hardbottom area is difficult, if not impossible, to predict due to natural reef exposure fluctuations caused by continuous shifting sand in this highly dynamic area. However, the nearshore habitat to be most acutely affected is already stressed by heavy surf, high turbidities, and biological factors. As the Sea Byte Report (1994) infers, and field observation by Taylor Engineering has verified, hardbottom/reef relief, number of fishes, encrusting organisms, and several other observed biological-value indicators increase with

distance from the shore and south of the project area. Accordingly, sedimentation of beach fill on nearshore hardbottom is not expected to have any long-term adverse impact to either photosynthetic or filter-feeding organisms. Since these organisms currently live in dynamic conditions, resuspension of material in these areas is not an uncommon phenomenon. In fact, the sabellarid worm reefs rely on resuspended sand in order to enlarge their colonies (Barnes 1974; Kirtley 1993).

Although long-term adverse impacts to biological communities are not anticipated, the USACE is prepared to mitigate for any short-term effects this project may have on hardbottom habitats.

4.6 Essential Fish Habitat

4.6.1 No-Action (Status Quo)

The No- Action Alternative would have no adverse effects on EFH within the study area.

4.6.2 Preferred Alternative

Implementation of the beach nourishment associated with the Preferred Alternative would impact hardbottom areas, open sand habitat, and water-column habitat designated as EFH. The hardbottom communities offshore of St. Lucie County have been designated as EFH-HAPC by the SAFMC (1998). There would be a total of 7.8 acres of hardbottom habitat directly impacted by the proposed nourishment. Temporary impacts similar to those described above would also occur. These temporary impacts would include displacement of fishes and some invertebrates from nearshore areas during dredging and fill placement. Other impacts include temporary decrease in water quality due to turbidity and decreased benthic primary productivity until the completion of nourishment.

4.7 Historic Properties

Archival research and field investigations have been conducted for the area that will be affected by the proposed SPP. Only one magnetic target was identified during a remote sensing survey of the Capron Shoal study area. This target is believed to be a single object of modern origin and not a historic property eligible for inclusion in the National Register of Historic Places.

Based on the archival research and field investigations it is the District's determination that placement of sand on the beach would not have an adverse effect on historic properties included in or eligible for inclusion in the National Register of Historic Places. SHPO concurred with this determination. The draft report, *Submerged Historic Properties Survey*

Capron Shoal Borrow Site, Fort Pierce Beach Erosion Control Project, St. Lucie County, Florida, was coordinated with SHPO by a letter dated December 18, 1997. As stated in that letter, it is the District's determination that the proposed shore protection project would not affect historic properties included in or eligible for inclusion in the National Register. SHPO concurrence with this determination has been requested and is expected.

4.8 Socioeconomics

In general, socioeconomic losses result from potential storm damages to buildings and land along the Atlantic coastline, as well as to losses in revenue to the economy of the area. The shoreline recession can potentially undermine oceanfront structures. If the shoreline recession is allowed to continue, there will be incidental repercussions to tourism and the local economy.

The 1998 GRR/EA assessed the economic justification of the project through an evaluation of expected damages from storms and an examination of the National Economic Development (NED) benefits associated with reductions in storm damages that would result from the project. The socioeconomics associated with the proposed project are essentially the same as those described in USACE, 1998. With the No-Action Alternative the shoreline would continue to erode resulting in the further degradation or loss of shorefront property values.

4.9 Aesthetics

Aesthetics of the area would be temporarily degraded during the period of construction with the generation of engine noise, exhaust fumes, and increased turbidity. The presence of construction equipment would temporarily detract from the visual aesthetics of the area, but would be offset somewhat by the natural curiosity of some individuals to observe the operation and its progress. Once completed, the project would result in an overall improved aesthetic quality. The placement of the sand would restore the natural appearance of the shore, which has been severely eroded by high tides, storm generated waves, and high winds.

The sand color of the post-construction beach may be slightly different from the current beach, and may detract from its aesthetic quality. This would be of short duration, as natural working of the dredged sediments by sunlight, rain, and wind would lighten the sediments over time. Restored beach and dune areas will help restore the natural appearance and thus the aesthetic resources of the Fort Pierce beaches.

With the No-Action Alternative the shoreline would continue to erode, resulting in the further loss of the existing shoreline and additional reductions in the visual aesthetics of the area.

4.10 Recreation

During nourishment activities, the use of the beach for recreational purposes near the construction site would decrease. The use of the beach in the immediate area of the discharge pipe and equipment would be restricted for public safety. Many visitors would seek quieter areas for sunbathing or swimming. As portions of the renourished beach come available, use by the public would increase once again. Once the Fort Pierce beach renourishment project is complete, the beach would contain a larger sand berm/beach, which will provide more space for both active and passive saltwater recreation activities. A wider sand berm along the beach would provide for improved family oriented recreation. The beach park areas would regain their appeal, as the entire project area will be restored to its original pre-eroded state.

There would be a temporary adverse effect on recreational fishing in the immediate area of beach fill operations and at the borrow site. Fishing would not be affected outside the area of immediate construction. Nearshore snorkeling and scuba diving activities may also be impacted by increased turbidity during construction activities and shortly thereafter. Long-term adverse effects on these activities are not anticipated. Boat operations may be detoured during construction; however, the extent of detours and the time frame of operations would render impacts insignificant.

With the No-Action Alternative the shoreline would continue to erode resulting in the further degradation or loss of shorefront property, thereby affecting recreation. There would be no effects on fishing, snorkeling, or scuba diving with the No-Action Alternative.

4.11 Coastal Barrier Resources

The purpose of the Coastal Barrier Resources Act is to minimize (1) the loss of human life; (2) wasteful expenditure of federal funds; and (3) damage to fishes, wildlife, and other resources associated with the coastal barriers along the Atlantic coast. The Act would restrict future federal expenditures and financial assistance, which have the effect of encouraging development of coastal barriers. There are no designated Coastal Barrier Resource Act Units located within or adjacent to the project area.

4.12 Water Quality

The project is expected to cause temporary and insignificant increases in turbidity at the borrow area and intertidal swash zone seaward of the beach. Due to the relatively low silt content and high density of the material, sand is expected to quickly fall out of the water column and only a short-term increase in turbidity is expected. The State of Florida water quality regulations require that water quality standards not be violated during dredging operations. The standards state that turbidity outside the mixing zone shall not exceed 29

NTU above background. Results from turbidity monitoring at previous beach nourishment projects have shown that the turbidity did not exceed the standard. Various protective measures and monitoring programs would be conducted during construction to ensure compliance with state water quality criteria. Should turbidity exceed state water quality standards as determined by monitoring, the contractor would be required to cease work until conditions return to normal. The Preferred Alternative has been evaluated in accordance with Section 404 of the Clean Water Act and a 404(b) (1) Evaluation Report (Appendix A). The use of other submerged borrow sites would have similar turbidity impacts on water quality as using the proposed borrow area. Use of upland sources would not have the impacts associated with dredging an offshore borrow area, but would have the same impact along the beach fill area. A mixing zone variance will be requested from the state for this project, and will be included as an attachment to the final EIS.

4.13 Hazardous, Toxic, and Radioactive Waste

There are no known hazardous, toxic, or radioactive waste sites or producers in the project area that would be affected by the chosen alternative action. No impacts associated with the disturbances of such sites are anticipated from either the Preferred Alternative or No-Action Alternative. The Preferred Alternative will not involve placement, use, or storage of hazardous and toxic materials in or near the project area. There is a potential for hydrocarbon spills with dredging and construction equipment in the area, but accident and spill prevention plans delineated in the contract specifications should prevent most spills. All wastes and refuse generated by the project would be properly stored and removed when the project activities are completed.

4.14 Air Quality

The short-term impacts from emissions by dredges and other construction equipment associated with the project would not significantly affect air quality. Because the period of construction activity is brief, exhaust emissions from vehicles, vessels, and construction equipment associated with the project would have a temporary and localized effect on air quality. Because offshore sea breezes would disperse pollutants, there would be no long-term accumulation of particulates in the project area. No air quality permits are required for this project.

4.15 Noise

The immediate project area may experience an increase in noise levels during the beach fill construction phase. Construction equipment would be properly maintained in order to minimize the effects of noise. The elevated noise levels would be localized and be of short duration because of the brief, temporary nature of the construction activity.

4.16 Public Safety

As a public safety measure, beach and water-related recreation in the immediate vicinity of the discharge pipe would be prohibited during project construction. Likewise, water-related activities near the dredge site would also be prohibited during project construction. Recreational access to these areas would return to pre-construction conditions following completion of the project. Long-term effects are not anticipated. The No-Action Alternative would assume continued erosion, allowing the surf zone to advance landward, with the potential of adverse impacts to public safety due to storm damage.

4.17 Energy Requirements and Conservation

Energy requirements for the proposed alternatives would be confined to fuel for the dredge, labor transportation, and other construction equipment. The No-Action Alternative could allow conditions to develop that may endanger coastal property from storm surges and wave erosion during storm events. On-site preventive measures and post-storm clean-up under the No-Action Alternative could require greater energy expenditures that would be required by the Preferred Alternative.

4.18 Natural Depletable Resources

The beach quality sand obtained from the borrow area would be the depletable resource. Using sand from the proposed borrow area would reduce the quantity of beach-quality sand in the borrow area. The No-Action Alternative would allow the sand in the borrow area to remain relatively intact, although redistribution would occur with natural cycles and storm events.

4.19 Scientific Resources

There are no known impacts to scientific resources associated with the Preferred Alternative or the No-Action Alternative.

4.20 Reuse and Conservation Potential

There is no potential for reuse associated with the proposed project activities, therfore this is not applicable to the proposed renourishment project. Energy requirements for the Preferred Alternative would be confined to fuel for the dredge, vehicles, and other construction equipment.

4.21 Cumulative Impacts

As defined in this EIS, the proposed action will temporarily cover 7.8 acres of nearshore hardbottom habitat. The project will have minimal short-term water quality impacts and will not adversely impact any federally or state listed species. The project will restore and protect dry nesting beach, thereby improving and restoring available nesting area for federally protected sea turtles. For purposes of this assessment, the author used the Council on Environmental Quality's (CEQ) regulations (40 CFR 1500-1508) implementing the procedural provisions of the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321 et seq.) to define cumulative effects as follows:

> *The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (federal or non- federal) undertakes such other actions (40 CFR 1508).*

Direct impacts from past and the proposed beach restoration activities on the nearshore hardbottom resources within St. Lucie County/Fort Pierce area are summarized in Table 3. A summary of impacts and mitigation involved with this project is also included in this section.

Table 3 Past and Proposed Future Projects and Direct Hardbottom Impacts Within Fort Pierce/St. Lucie County

Projects	Type	Funding Approved	Permitted	Linear Distance	Hardbottom Impact
Past (FY95-99)	Inlet Transfer Nourishment	Yes Yes	Yes Yes	N/A 1.3 miles	N/A 9 acres
Proposed Future (FY03-07)	Renourishment	No	No	2.3 miles	None

4.21.1 Summary of Impacts to Hardbottom Habitat

Impacts to the nearshore hardbottom habitat and associated biological communities include both direct and indirect impacts. Direct impacts refers to the area of hardbottom habitat located landward of the design toe-of-slope of beach-fill that will be covered by the placement of sand on the beach. Indirect impacts include loss of hardbottom habitat seaward of toe of fill line that could be indirectly tied to the nourishment projects, through transport from the beach and deposition on hardbottom habitat offshore, scouring and loss of biotic cover from sand in suspension, and the reduction in biotic cover on rock outcrops.

The direct habitat lost since the 1994 baseline mapping of the nearshore hardbottom habitat was calculated by spatially analyzing the pre and post-nourishment locations of hardbottom habitat landward of the equilibrium toe of fill limits. Based on this analysis, 1.7 acres of hardbottom habitat and associated biological community were directly lost as a result of the

1995 and/or 1999 projects. This loss included higher quality habitat characterized as exposed rock with >50 percent algal-sponge community cover. Changes in habitat which occurred outside the fill limit included a loss of 8.4 acres of exposed rock with >50 percent cover or 10 to 50 percent cover immediately seaward of the equilibrium toe of fill, reduction in 52.2 acres of habitat originally classified as exposed rock with >50 percent cover to 10 to 50 percent cover to a cover type of sand, <10 percent exposed rock. Due to the natural dynamic changes inherent to nearshore rock habitat, most of the observed spatial changes in cover types may not be indirect impacts; however, it is quite probable that the 8.4 acres of habitat indirectly lost immediately seaward of the equilibrium toe line is a result of stabilization of the beach profile and movement and redeposition of sand from the beach seaward over the rock outcrops.

Observed spatial changes from 1994 to 2000 in the substrate cover types could be the result of seasonal differences in the occurrence of sessile marine invertebrates, temporary or seasonal deposition of a thin layer of sand over the level hardbottom platform, the frequency and severity of storm events since the restoration projects, or other physical factors influencing the ephemeral exposure of hardbottom and biotic cover. Since the origin of the sand now covering formerly exposed hardbottom habitat is unknown, temporal changes in substrate cover types discussed above cannot be attributed to beach restoration projects only. While some of these observed changes may in fact be considered indirect impacts from the beach restoration projects, the exact area of impact cannot be determined with the available information. Periodic nourishment with a 50-foot protective berm over a 1.3-mile length is the project's Preferred Alternative because it fulfills the project's goal and objectives while minimizing the environmental impacts. Upon completion of the renourishment project, the USACE will conduct a survey of the nearshore hardbottom to assess the area buried by sedimentation. In addition, this survey will assess the secondary effects of sedimentation on marine life such as corals, sponges, fishes, and crustaceans.

Indirect changes in habitat cover type that occurred outside the fill limit included a loss of 8.3 acres of exposed hardbottom with >50 percent cover and 10 to 50 percent cover immediately seaward of the equilibrium toe of fill, and a reduction in 52.2 acres of habitat originally classified as exposed hardbottom with >50 percent cover or 10 to 50 percent cover to a cover type of sand, <10 percent exposed hardbottom. An area of 8.4 acres classified as sand, <10 percent exposed rock in 1994 was found to be exposed rock with 10 to 50 percent cover in 2000.

Whether these changes in cover type can truly be considered indirect impacts is questionable due to the natural dynamic changes inherent to nearshore hardbottom habitat. However, it is probable that the 8.3 acres of habitat indirectly lost immediately seaward of the equilibrium toe-of-slope line is a result of stabilization of the beach profile and movement and redeposition of sand from the beach seaward over the rock outcrops. The only persistent features are the 3-foot ledges at the inner and outer reaches of hardbottom platforms. Changes in the classification of cover types could be the result of seasonal deposition of a thin layer of sand over the level rock platform, the frequency and severity of storm events since the restoration projects, or other physical factors influencing the ephemeral exposure of

hardbottom and biotic cover. Since the original location of the sand residing over the former hardbottom habitat with biotic cover during the 2000 survey is unknown, these changes in substrate cover types discussed above can not solely be attributed to the beach restoration projects. While some of these observed changes might, in fact, be considered indirect impacts from the beach restoration projects, the exact area of impact cannot be determined with the available information.

4.21.2 Summary of Impacts to the Beach and Sand Bottom Habitat

There may be some displacement of small mammals, reptiles, and birds that use the beach habitat for foraging or nesting. However, this displacement will be short-term and there are ample areas with similar characteristics north and south of the project area that can be utilized during renourishment activities. Upon completion of the project, naturally invading and planted grasses and other vegetation will provide for additional foraging and nesting habitat for those species temporarily displaced. Increased turbidity levels produced from the placement of fill material onto the beach is not expected to have a significant effect on shorebirds, waterfowl, and wading birds.

The removal of sediment from the proposed borrow area will directly impact the sand habitat including both the infaunal and epifaunal community. Initially this will result in a significant, but localized reduction in the abundance, diversity, and biomass of the immediate fauna. The fauna most affected will include predominately invertebrates such as crustaceans, echinoderms, mollusks, annelids, as well as finfish larvae. Species affected most are those that have limited capabilities or are incapable in avoiding dredging activities such as the surf clam. Crustaceans such as the ghost crab, mole crab, and the fiddler crab are all highly motile crustaceans and consequently have the ability to avoid dredging related activities.

Studies conducted by Reilly and Bellis (1978, 1983) revealed that mortality levels regarding these crustaceans was minimal because they were able to avoid the nourished area. Six weeks after a nourishment project was completed in Panama City, Florida, Saloman et al. (1982) observed no significant numerical differences in the biological communities between areas where fill material was deposited and not. In addition, other studies have shown that populations of the surf clam and certain species of invertebrates can become numerically abundant within a period of six months post fill deposition (USACE 1998b). Also, benthic communities examined near Hallandale Beach, Florida seven years after a nourishment project, revealed no short-term effects of the infaunal community (Marsh and Turbeville 1981). Factors that enhance this rapid recovery period include high fecundity and rapid turnover rates of a majority of the intertidal organisms.

Several other studies have examined the effects of beach nourishment on benthic fauna and sediments. Nelson (1989) reviewed literature regarding the effects of beach nourishment on beach sand fauna and concluded that minimal biological effects occurred. Mortality of some organisms may occur where grain size is a poor match to existing sediments; however, recovery was rapid. Common beach invertebrates of the southeastern U.S. including the mole

crab, the surf clam, and the ghost crab did not exhibit any significant impacts resulting from beach nourishment (Nelson 1989). In a review of beach nourishment effects on beach fauna, Hackney et al. (1996) came to the same conclusions as Nelson (1989), with the suggestion that beach nourishment should take place during the winter months to minimize the impacts, and that the sand should match as closely as possible.

In a beach renourishment project in Panama City Beach, Florida, Culter and Mahadevan (1982) concluded that the initial destruction of the benthic community at the borrow sites was followed by a rapid recovery which was virtually complete after one year. There were minor differences in sediment parameters, but no differences in fauna in or out of the borrow sites were observed. The benthic community at this site consisted primarily of polychaetes, bivalves, gastropods, amphipods, brachyuruns, and amphipods. No species that required a permanent attachment site and only a few tube dwelling organisms were present at the site. The overall findings were that no long-term adverse environmental effects as a result of beach renourishment existed within the nearshore area and that no adverse conditions were present at the borrow sites.

In another study conducted along Panama City Beach, Saloman et al. (1982) observed an immediate decline in the benthic community followed by a rapid recovery within 8-12 months as indicated by species richness, abundance, and diversity. The benthic community was composed of primarily annelids, arthropods, mollusks, and to a much lesser extent platyhelminths, nematodes, echinoderms, and hemichordates. After one year post-dredging, some short-term ecological changes including minor alterations in sediment, and a small decline in the diversity and abundance of benthic invertebrates were reported. However, no long-term effects were observed regarding the benthic community, sediments, and water quality along the shore and in and around the borrow sites.

The removal of sediment from the proposed borrow area will directly impact the benthic habitat including both the infaunal and epifaunal community. Initially this will result in a significant, but localized reduction in the abundance, diversity, and biomass of the immediate fauna. Species affected most are those that have limited capabilities or are incapable in avoiding the dredging activities. The fauna most affected will include predominantly invertebrates such as echinoderms, mollusks, and annelids, as well as finfish larvae. However, due to the relatively small area that will be impacted as viewed on a spatial scale, impacts to the benthic community will be minimal due to the relatively short period of recovery regarding infaunal communities following dredging activities (Culter and Mahadevan 1982; Saloman et al., 1982). Consequently, due to the relatively small area that will be impacted in the proposed project as viewed on a spatial scale, impacts to the infaunal community will be minimal and short-term. Adjacent areas not impacted will most likely be the primary source of recruitment to the impacted area. Implementing best management practices will assist in minimizing any impacts. To further minimize any adverse effects to the fauna common in these areas, the proposed project will utilize fill material from a borrow site containing a high quality source of sand with a small percentage (2 percent) of fine silt/clay material. In summary, the proposed project will have no short-term adverse effects

regarding the supralittoral and intertidal zone organisms in the Fort Pierce Beach nourishment project area.

4.21.3 Mitigation

Although long-term adverse impacts to biological communities are not expected, the USACE will mitigate based on the short-term effects the project will have on hardbottom habitat. The approved FDEP plan for the 1.3-mile Fort Pierce beach project nourished in 1998-99 involved a combination of 2.3 acres of hardground habitat creation, revegetation of approximately 3.7 acres of the upper beach along the 1 mile beach extension, and removal of exotic vegetation on a total of 3 acres on Coon Island. The revegetation of the upper beach and removal of exotic vegetation have been completed along with the planting of 1 acre of natural vegetation in selected areas which serve as recruitment stock where exotics have been removed. As the hardground habitat creation has not yet been done the FDEP has required 5 acres of nearshore hardbottom habitat creation outside the area of beach nourishment effects.

4.22 Unavoidable Adverse Impacts

Although there is not expected to be any long-term adverse impact to biological communities, short-term effects to an estimated 7.8 acres of hardbottom habitat are unavoidable.

4.23 Environmental Commitments

Nearshore hardbottom habitats unavoidably affected by beach fill placement will be appropriately mitigated. No known long-term adverse effects from previous project area nourishment activities have occurred. Measures to avoid, reduce, or mitigate potential fish and wildlife resource effects from any future project construction will be coordinated with appropriate State and Federal agencies. The U.S. Army Corps of Engineers and contractors commit to avoiding, minimizing, or mitigating for adverse effects during construction activities. The commitments to ensure the safety of threatened and endangered nesting sea turtles are discussed in more detail in the U.S. Fish and Wildlife Service's October 28, 1997 Coordination Act Report and October 9, 1997, Biological Opinion contained within USACE, 1998.

4.24 Compliance With Environmental Requirements

Compliance with Federal Statutes, Executive Orders, and polices has been considered for the three project alternatives. The following table includes a list of the various requirements and the compliance status for each of the alternatives.

Table 4 Compliance with Environmental Requirements and Protection Statutes

FEDERAL STATUTES	Alternative 3A (Preferred Alternative)
Archeological and Historic Preservation Act As amended, 16 U.S.C. 469, et seq.	FC
Clean Air Act, As amended, 42 U.S.C. 7401, et seq.	FC
Clean Water (Federal Water Pollution Control Act) As amended, 336 U.S.C. 1251, et seq.	FC
Endangered Species Act, As amended, 16 U.S.C. 1531, et seq.	PC
Fish and Wildlife Coordination Act As amended, 16 U.S.C. 661, et seq.	FC
National Environmental Policy Act As amended, 42 U.S.C. 4321, et seq.	FC
National Historic Preservation Act As amended, 16 U.S.C. 470a, et seq.	FC
Rivers and Harbors Act, 33 U.S.C. 401, et seq.	FC
Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1451, et seq.	FC
Marine Mammal Protection Act of 1972, 16 U.S.C. 1361, et seq.	FC
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, et seq.	FC
Submerged Land Act of 1953, 43 U.S.C. 1301, et seq.	FC
Coastal Barrier Resources Act of 1982, 16 U.S.C. 3501, et seq. And Coastal Barrier Improvement Act of 1990.	FC
Magnuson-Stevens Fishery Conservation and Management Act, as amended, 16 U.S.C. 1801 et seq.	FC
EXECUTIVE ORDERS, MEMORANDA, ETC.	
Floodplain Management (E.O. 11988)	FC
Protection of Wetlands (E.O. 11990)	FC
Environmental Justice (E.O. 12898)	FC

FC - full compliance; PC – partial compliance: NA - not applicable

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6.0 PUBLIC INVOLVEMENT

6.1 Scoping and Draft EIS

A Notice of Intent (NOI) to prepare a draft of this EIS appeared in the Federal Register on May 31, 2002. In addition, the NOI was mailed to interested and affected parties by letter dated August 26, 2002. A copy of the letter and NOI are in Appendix F.

6.2 Agency Coordination

Agency coordination letters are in Appendix F.

6.3 Comments Received and Response

7.0 INDEX

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APPENDICES

Appendix A

404(b) Evaluation

Appendix B

Florida Coastal Zone Management Program Federal Consistency Evaluation

Appendix C

Bryozoan Study

Appendix D

Hardbottom Report

Appendix E

USFWS Coordination Act Report and Biological Opinion

Appendix F

Pertinent Correspondence