FINAL
ENVIRONMENTAL IMPACT STATEMENT

BREVARD COUNTY, FLORIDA
SHORE PROTECTION PROJECT REVIEW STUDY

September 1996

PREPARED BY:

U.S. Army Corps of Engineers
Jacksonville District
Jacksonville, Florida

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The responsible lead agency is the U.S. Army Corps, Jacksonville District. The non-Federal sponsor for the study is the Brevard County Board of County Commissioners, Melbourne, Florida.

ABSTRACT: This Final Environmental Impact Statement (FEIS) describes the selected plan for a proposed beach restoration project along 20 miles of Atlantic Ocean shoreline within Brevard County, Florida. The recommended project includes placing approximately 2,500,000 cubic yards of sand along 9.4 miles of beach in the north reach of the project area and 1,645,000 cubic yards along 3.4 miles of the south reach. In the Draft EIS the selected plan included all 10.5 miles of the south reach within the study area. Approximately 32 acres of nearshore rock outcrops or hardgrounds exist along the northern two thirds of the south reach. Beach nourishment along the entire south reach would result in burial of this resource. Therefore the selected plan for the south reach has been modified to avoid impacts to the nearshore rock outcrops. The borrow area is located approximately 2-3 miles offshore of Canaveral Bight. The environmental consequences of the project will depend on the quality of the material in the borrow area and the season in which construction occurs. The compatibility of the fill material with the existing beach sand will determine recolonization of the beach by invertebrates as well its suitability for use by nesting sea turtles and subsequent hatching success. Geotechnical analysis of the borrow area indicates that the material is compatible with that on the beach. The benthic community within the area dredged will reestablish itself within a sort time after construction is completed. Construction activities on the beach will not occur during the main part of the sea turtle nesting season. This will ensure that adverse impacts to nesting females and hatchlings will be minimal.

THE OFFICIAL CLOSING DATE FOR THE RECEIPT OF COMMENTS IS 30 DAYS FROM THE DATE ON WHICH THE NOTICE OF AVAILABILITY OF THE FINAL EIS APPEARS IN THE FEDERAL REGISTER.

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Note: Information, displays, maps, etc. discussed in the Feasibility Report for the Brevard County, Florida Shore Protection Project Review Study are incorporated by reference in the EIS.

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1.00 SUMMARY.

1.01 Major Conclusions and Findings. The study area is comprised of the 24 miles of Atlantic Ocean shoreline located in Brevard County between Florida Department of Environmental Protection (FDEP) survey monuments R-1 through R-137 (Figure 1). It includes the City of Cape Canaveral, Cocoa Beach, Satellite Beach, Indian Harbor, Indialantic, and Melbourne Beach. The north reach of the study area is approximately 9.4 miles in length and runs from FDEP monuments R-1 through R-53. The south reach is about 10.5 miles long and extends from R-76 through R-137. The 4.5 miles of shoreline between monuments R-53 and R-76 is part of Patrick Air Force Base (PAFB) which has been excluded from the study at their request. Beaches within the study area are in a state of severe erosion and shoreline recession. The processes which generated this condition continues to degrade the beaches. Investigations and analyses have shown that construction of a protective beach along the 20 miles of shoreline within the north and south reaches to be the optimum means of reducing damage to structures and shorefront property. Approximately 32 acres of nearshore rock outcrops composed of lithified coquina limestone and scattered patches of sabellariid worm rock exist along the northern two thirds of the south reach. Any beach nourishment along this section of the south reach would bury this resource. The recommended plan for the south reach has been modified to avoid impacts to the hardgrounds.

1.02 Areas of Controversy. The U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), U.S. Environmental Protection Agency (EPA), Florida Game and Fresh Water Fish Commission (GFWFC) and the Florida Department of Environmental Protection (FDEP) have expressed concern over probable adverse impact the proposed project would haveon nearshore coquina rock outcrops and scattered worm rock communities. According to these agencies the nearshore rock-reef habitats present in Brevard County represent a unique biological feature, important to the marine ecosystem and should be preserved. The FDEP has also indicated that construction of the south reach as originally proposed would result in a significant marine habitat loss and would not be consistent with section 370.12, Florida Statutes (F.S.), and would not meet the permit criteria of Chapter 373, F.S. This would make the proposed project inconsistent with the Florida Coastal Zone Management Program (CZMP) unless modifications to the project design were made that would eliminate or significantly reduce impacts to the nearshore hardground habitat. Therefore, the selected plan for the south reach has been modified to avoid impacts to the nearshore hardgrounds (refer to section 3.07).

1.03 Unresolved Issues. With the design modification to the south reach, avoiding adverse impacts to hardgrounds, there are no unresolved issues.

1.04 Section 404(b) Evaluation Report Determination. The selected plan has been evaluated in accordance with Section 404 of Public Law 92-500 and has been determined to be consistent

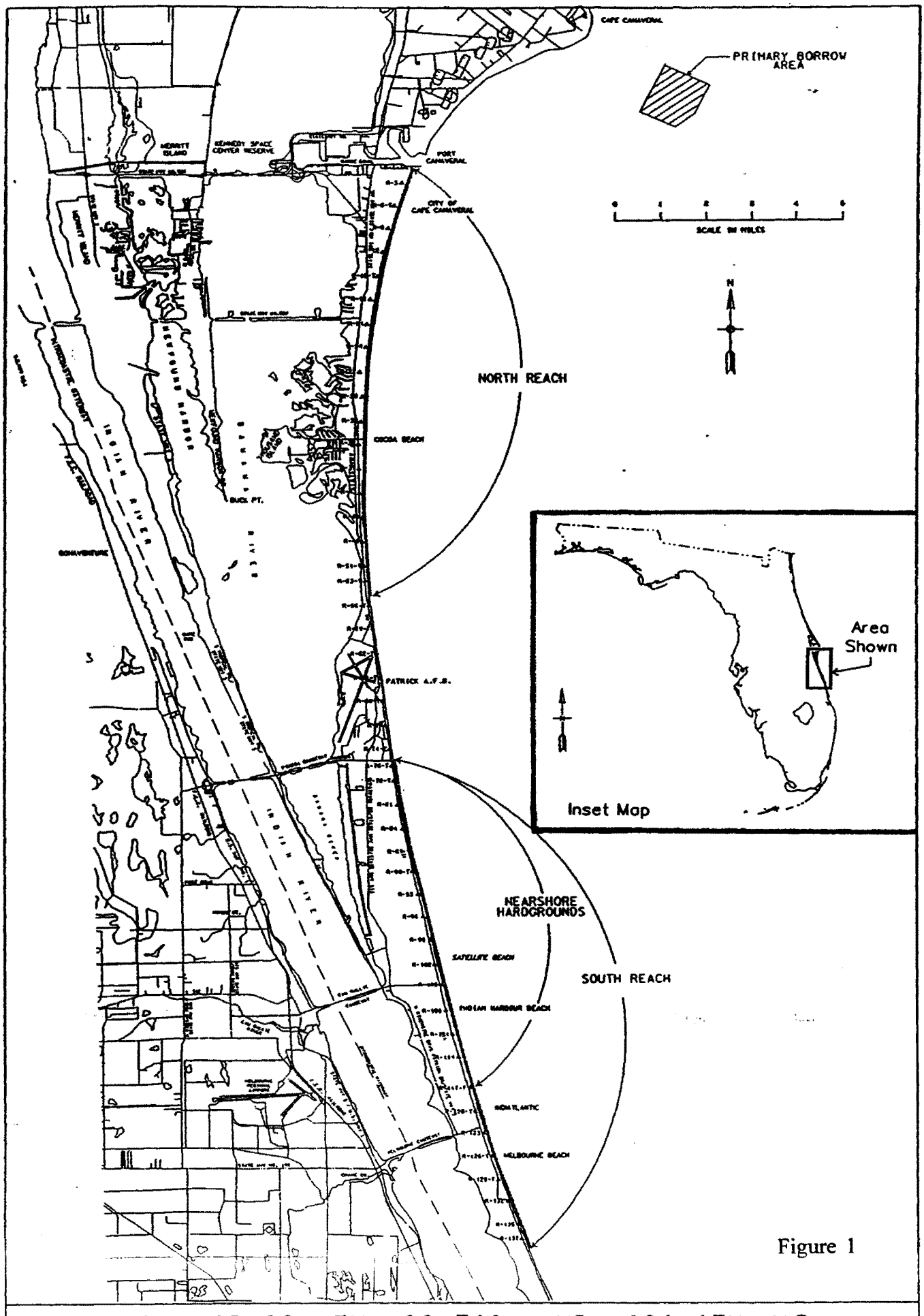

Figure 1

BREVARD COUNTY LOCATION AND VICINITY MAP

with the public interest. A Section 404(b) Evaluation Report has been prepared and is included as Appendix A.

1.05 Coastal Zone Management Act Consistency Evaluation. A Coastal Zone Management Consistency Evaluation has been prepared and is included as Appendix B. The U.S. Army Corps of Engineers has determined that the proposed project is consistent with the Florida Coastal Zone Management Program at this stage.

2.00 NEED AND OBJECTIVES OF ACTION

2.01 Study Authority. The Brevard County Shore Protection Review Study was authorized by the following resolution adopted September 23, 1982 by the Committee on Public Works and Transportation, U.S. House of Representatives:

> "Resolved by the Committee on Public Works and Transportation of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report of the Chief of Engineers on Brevard County, Florida, published in House Document No. 352, 90th Congress, 2nd Session, with a view to determining the advisability of modifying the existing project at the present time, with particular reference to the advisability of providing beach erosion control works in the area from the south line of Patrick Air Force Base southerly to the north line of the Town of Indialantic, with consideration given to the economic and recreational benefits of beach restoration as well as the technical requirements for implementation of restoration projects, and extending the period of Federal participation in the cost of periodic nourishment of the authorized beach erosion control project."

2.02 The Federally authorized Brevard County, Florida, beach erosion control project, as described in House Document No. 352, 90th Congress, 2nd Session dated 8 July, 1968, was authorized by the River and Harbor Act of August 13, 1968. The authorization provides for a protective and recreational beach having a berm 50 feet wide at elevation 10 feet above mean low water and a natural slope seaward as would be shaped by wave action along 14,600 feet of beach at the city of Cape Canaveral and 10,600 feet of beach at Indialantic and Melbourne Beach, and for periodic nourishment of the restored beach at Indialantic and Melbourne Beach. Nourishment of the restored beach at the City of Cape Canaveral would be by the authorized sand-transfer plant being planned for Canaveral Harbor.

2.03 Public Concerns. The primary concern within the study area is the continual shoreline erosion, subjecting existing shorefront structures, infrastructure, and public beach to potential storm related damage. The erosion problem is a threat to private commercial, residential and public recreational properties within Brevard County. The USFWS, NMFS, EPA, GFWFC, and FDEP have expressed concerns regarding potential impacts to nearshore hardground and worm

rock communities that exist along a portion of the study area. They are also concerned about potential adverse impacts to sea turtle nesting and hatching.

2.04 Planning Objectives. The primary planning objective for this study is to provide an effective, economically justified, and environmentally acceptable way of providing storm damage reduction to upland development within the study area thus, preventing damage to public and private property.

3.00 ALTERNATIVES. This section describes the alternative plans considered, plans eliminated from further action, the no action alternative, the final recommended plan and other reasonable alternatives that were studied in detail.

3.01 Plans Eliminated From Further Study. Several alternatives were considered during the plan formulation process before arriving at the recommended plan. These alternatives can be generally classified as either structural or non-structural. The following non-structural alternatives were considered: no action (NS-1), construction control line (NS-2), moratorium on construction (NS-3), establish a no-growth program (NS-4), relocation of structures (NS-5), flood proofing of structures (NS-6), condemnation of land and structures (NS-7) and various combinations of the preceding non-structural alternatives (NS-8). All of these alternatives were rejected during plan formulation since they failed to meet the planning objectives.

(1) NS-1 -- the no action alternative perceives the continuation of existing conditions and provides no solutions to the existing problems. However, it also avoids any undesirable effects that may be associated with structural or nonstructural plans of improvement. The no action alternative does not provide the benefits needed to protect the coast from the effects of erosion and storm damage and therefore, does not address any of the planning objectives for this study.

(2) NS-2 -- a construction control line would not affect existing development and could only be effective in the unforeseeable future as buildings are razed and destroyed by storms. However, this alternative is acknowledged and included in the nonstructural combination plan, and plans are developed around it. A construction control line that does not prohibit construction, but does provide stringent structural restrictions, has been established by the State of Florida for all of Brevard County.

(3) NS-3 -- a moratorium on construction is rejected by the non-Federal sponsor and local interests since the desired growth of the area is oriented towards tourism and recreation, attracting retirees, and promoting a stable construction industry.

(4) NS-4 -- the establishment of a no-growth program is rejected by local interests. Growth in the area, particularly that in connection with beach activities, is needed to provide economic depth to the communities. This alternative is therefore excluded from detailed studies.

(5) NS-5 -- the relocation of the structures would allow the area to continue to erode and the land in this area would be lost until an equilibrium shoreline was reached. However, most structures within the area cannot be economically or physically moved from the area which would be lost and would have to be abandoned with new structures provided for the existing residents. In addition, implementation of this alternative would result in the loss of valuable recreational beach as shoreline recession continues and would necessitate the condemnation of the land and structures in this area.

(6) NS-6 -- flood proofing of existing structures and regulation of flood plain and storefront development are considered part of building code modifications and is not considered as a separate alternative.

(7) NS-7 -- condemnation of land and structures would allow the shoreline to erode in the area with a loss of land until shoreline equilibrium was established. This alternative is excluded as it fails to meet the planning objectives.

(8) NS-8 -- it is recognized that various aspects of many of the preceding non-structural solutions would be prudent to implement either collectively or in combination with structural alternatives. For the study shoreline, a single non-structural plan does not seem applicable for the entire area.

3.02 The following structural alternatives were also considered: seawalls (S-1), revetments (S-2), beach nourishment (S-3), Groins (S-4), submerged artificial reefs (S-5), nearshore placement (S-6), breakwaters (S-7), dunes and vegetation (S-8) and a combination of beach fill and nearshore placement (S-9). Eight of these alternatives were eliminated from further consideration. The reasons for eliminating each alternative are discussed below:

(1) S-1 -- the construction of additional concrete seawalls or improvements to and maintenance of the existing bulkheads/seawalls would provide a significant degree of protection; however, this would be accomplished at the expense of a recreational beach, resulting in substantial economic loss to the area. Reflecting wave energy off the existing seawalls and bulkheads has resulted in a steepening of the offshore profiles with resulting hazardous bathing conditions due to increased undertow and runouts. The high initial costs of seawall construction in addition to the adverse effects on coastal processes eliminate this alternative from further consideration.

(2) S-2 -- revetments have been placed on similar beaches over the past to protect critically damaged or eroding areas. These measures have provided temporary relief but have not reduced the erosion of the beaches. The hardening of the beach in one area will merely transfer the location of the problems further down the beach. Emergency construction of revetment type

structures, in-line with current State of Florida coastal armoring statutes, is implicit in the storm damage analysis, but is not carried forward as an implementable project alternative.

(3) S-4 -- Groins. Project designed groins or a groin field in the problem area would help hold a beach in front of existing development and prevent further losses of land. The construction of groins would have to be supplemented with nourishment so that adjacent beaches would not be starved of sand. For this reason, groins are considered as a method to help hold the fill in place and to reduce the periodic renourishment requirements. Groins could also be considered to offer additional stabilization to inlet areas. This alternative is excluded as it fails to meet the planning objectives.

(4) S-5 -- Submerged Artificial Reefs. This alternative would use the perched beach concept to limit the amount of underwater fill and retain the dry beach for a longer period. This would be accomplished by placement of an artificial submerged reef as a perched beach structure to reduce fill quantities, reduce nourishment requirements and mitigate the environmental impacts of nearshore rock outcropping burial. Hardgrounds in the south reach of the study area are located in shallow depths which would not facilitate construction of submerged artificial reefs. This alternative would not be effective in the study area and is excluded from future consideration.

(5) S-6 -- Nearshore Placement. Dredged material would be place in the nearshore to provide wave attenuation benefits, nourishment of the active profile, or a combination of both. This method is now feasible due to improvements in dredging technology, allowing placement is waters as shallow as 15 feet deep. Its low cost compared to onshore disposal by hopper dredge has been shown to generate higher benefit to cost ratios where haul distance preclude the use of pipeline dredges. Placement in the nearshore, if determined to be economically justified, would be handled in such as way as not to adversely impact existing hardbottom communities. Landward movement of material placed in the nearshore would be limited to the landward extent of the swash zone. This alternative by itself would not provide onshore design elevations adequate for the requisite storm damage reduction. Therefore, this alternative is not considered for further analysis.

(6) S-7 -- the construction of breakwaters offshore along the Brevard County problem area is considered as an alternative to reduce periodic nourishment quantities needed to maintain a protective and recreational beach fill in this area. Such structures would reduce the amount of wave energy reaching the shoreline in their lee. The formation of a partial tombolo would occur if the breakwaters are of sufficient size, thus, decreasing the rate of annual erosion and thereby decreasing the annual nourishment requirements. Costs, State regulations, and environmental concerns preclude further consideration of this alternative.

(7) S-8 -- Dunes and Vegetation. Along high energy coasts, vegetation will stabilize the beach only as related to losses by deflation. This is being considered by State and sponsor interests, and will not be addressed in this report.

(8) S-9 -- Combined Placement: Beach fill and Nearshore Placement. This alternative involves the placement of suitable beach quality sand on both the dry beach and the active portion of the offshore beach profile. Combined placement has been considered herein as an alternative to the construction of a typical beach fill design template in order to avoid burial of nearshore rock outcrops located along a portion of the study area. The method would be used to place the optimized volume of material within the active portion of the beach profile with the combination of dry beach and nearshore placement. The equilibrium profile theory is used to predict the volume of fill which, if placed on the beach face, would "toe out" landward of the nearshore hardbottom. An additional volume of fill, designed to remain seaward of the nearshore hardbottom, would be bottom dumped along the active portion of the offshore beach profile. This alternative was dropped from further consideration based on the following. Existing engineering guidance on offshore placement of fill material for the expressed purpose of nourishing the existing profile or providing wave attenuation benefits is inadequate. Furthermore, the impacts associated with the combined placement alternative on wave transformation, water level, nearshore circulation and other physical processes are not well known. Also, the uncertainty associated with quantification of project benefits and disbenefits render the combined placement alternative unacceptable at this time.

3.03 The remaining structural alternative, beach nourishment (S-3), was the only alternative plan not eliminated from consideration. This was the only plan that met all of the planning objectives and therefore, has become the selected plan. This alternative would provide a beach with appropriate project dimension size for a buffer against wave attack. An offshore source of sand is considered as inland sources do not contain sufficient quantities of beach quality sand. The proposed borrow area is located between 2 to 3 miles east of the tip of Cape Canaveral, within the area known as Canaveral Shoals. Renourishment of the beach would be undertaken periodically to maintain the recreational and erosion control features within design dimensions. Dimensions of the beach fill would be based on the degree of protection the project should provide.

3.04 No Action Alternative. Although this option, was eliminated from further consideration, it is carried throughout the plan formulation process as a basis of comparing the effects of other alternatives.

3.05 Selected Plan. The following paragraphs describe the selected plan. Plates 1 through 16 enclosed with the Feasibility Report display plan views and cross sections of the north and south reach design templates as well as the advance nourishment and construction sections of the selected plan.

3.06 The recommended plan identified for the north reach of the study area consists of beach fill with a 1,500 foot transition section at the southern limit of the reach. The north reach is bounded by the south jetty of Canaveral Harbor to the north and by PAFB to the south. The design berm elevation is +10.0 feet (ft) mean low water (MLW) extending from the shoreward intersection of the existing profile seaward to the location of the pre-project mean high water (MHW) shoreline. At the location of the MHW shoreline, the design template slopes 1 vertical (V) to 15 horizontal (H) seaward to the location of MLW thence 1 V to 50 H out to intersection with the existing profile. Construction of the north reach would require placement of approximately 1,984,000 cubic yards (cy) of initial fill and 516,000 cy of advance material (2,500,000 cy total). Construction of the north reach is anticipated in 1998. The primary borrow source would be the Canaveral Shoals located between 2 to 3 miles offshore of the tip of Cape Canaveral in 8 ft to 20 ft of water. Future nourishments in the amount of 516,000 cy would be provided in 6 year intervals at years 6, 12, 18, 24, 30 and 36. The final nourishment in year 42 of the project would require the placement of 688,000 cy of fill. Cost estimates developed for various alternatives indicate that a pipeline dredge would be the most cost effective plant for construction of the north reach.

3.07 In the Draft Feasibility Report and DEIS the recommended plan for the south reach consisted of beach nourishment from PAFB south to Spessard Holland Park (R-76 to R-137). Constructing the design template for this plan would bury approximately 32 acres or more of intertidal and nearshore coquina rock outcrops located between R-76 and R-117. The location of these rock outcrops are shown on plates 8 - 13 in the feasibility report. The burial of 32+ acres of hardgrounds was determined to be inconsistant with the Florida CZMP (refer to section 1.02); therefore the south reach was shortened to avoid impacts to the hardground resource. The modified recommended plan for the south reach consists of a beach fill between R-119 and R-137 with a 1,000 foot transition section at the northern limit and a 1,500 foot transition section at the southern limit of the reach. The northern end of the transition fill would be approximately 500 feet south of the closest hardground (plate 13). The design berm elevation is +10.0 feet (ft) mean low water (MLW) extending from the shoreward intersection of the existing profile seaward to the location of the pre-project mean high water (MHW) shoreline. At the location of the MHW shoreline, the design template slopes 1 vertical (V) to 15 horizontal (H) seaward to the location of MLW thence 1 V to 50 H out to intersection with the existing profile. Construction of the south reach would require placement of approximately 1,044,000 cy of initial fill and 601,000 cy of advance material for a total of 1,645,000 cy. The primary borrow source for the south reach would also be Canaveral Shoals. Future nourishments of the south reach, in the amount of 601,000 cy would be conducted in 6 year intervals at years 6, 12, 18, 24, 30 and 36. The final nourishment in year 42 of the project would require the placement of 801,000 cy of fill. Cost estimates developed for various alternatives indicate that a hopper dredge with pumpout would be the most cost effective plant for construction of the south reach.

3.08 Analysis of Impacts of Selected Plan and No-Action Plan on Significant Resources. Impacts projected under the selected and the no-action alternatives are displayed in Table 1. Details on impacts can be found in Section 5.00 Environmental Consequences of the FEIS.

3.09 Mitigation. The selected plan for the south reach has been modified to avoid impacts to the nearshore rock outcrops and associated worm rock. Therefore, no mitigation is proposed.

4.00 AFFECTED ENVIRONMENT.

4.01 General Environmental Conditions. The study area is located in Brevard County on the east coast of Florida approximately halfway down the state peninsula. The navigation channel at Canaveral Harbor is the north boundary of the study area and serves Port Canaveral, the U. S. Air Force, and the U. S. Navy Trident Submarine facility. The Canaveral peninsula, is a barrier island that separates the Atlantic Ocean from the Banana River. The Banana River is bounded on the west by Merritt Island, which is separated from the mainland by the Indian River. The Banana and Indian Rivers are shallow, tidal lagoons, except for portions maintained for navigational purposes. The public is allowed free and unrestricted use of the beaches south of the harbor. North of the harbor, military installations and the Merritt Island National Wildlife Refuge take up most of the beach frontage. The barrier island ranges in width from approximately 10 miles at the Cape to a few hundred feet just north of Patrick Air Force Base. Land elevations are generally less than 12 feet mean low water (MLW), except for occasional dunes that range from 9 to 25 ft NGVD (MLW = -1.9 NGVD). The beach sediments are primarily fine to medium quartz sand with varying percentages of shell content (Olsen Assoc., 1989). The mean range of ocean tide is 3.5 feet, with a spring range of 4.1 feet. Littoral drift is predominantly southerly, except for a seasonal reversal in May through September.

4.02 Fish and Wildlife Resources.

4.03 Dune Community. An upland dune system is present throughout most of the study area ranging from well developed in the southern part to weakly defined or nonexistent in the north. The dune is generally narrow where it exist, except for some relatively wider parts located within state, county or local parks and recreation areas. The seaward face of the dune has been severely eroded by wave action and is very steep. From Cocoa Beach north to the Canaveral Harbor entrance channel, the dune has been virtually eliminated by the construction of seawalls and revetments.

4.04 The natural dune areas are characterized as coastal strand and maritime hammock ecosystems. The coastal strand is typically vegetated with sea oats (*Uniola paniculata*), dune grass (*Ammophila breviligulata*), sea grape (*Coccoloba uvifera*), sea rocket (*Cakile edentula*), cacti (*Opuntia compressa*), croton (*Croton puntatus*), pennywort (*Hydrocotyle bonariensis*), beach elder (*Iva imbricata*), sea purslane (*Sesuvium portulacustrum*), wild bean (*Strophostyles helvola*), and morning glory (*Ipomea purpurescens*). The maritime hammock is composed of sea

Table 1. Summary of Impacts of Selected Plan and No-Action Plan on Significant Resources.

	NO ACTION	SELECTED PLAN
Fish and wildlife resources	Erosion of beach and dune habitats.	Stabilization of the beach/dune habitats; short-term reduction in beach and borrow area infaunal invertebrate populations; some disruption to fish during construction.
Hardground resources	No effect	Plan for the south reach has been modified to avoid hardgrounds. No effect is anticipated.
Threatened and endangered species	Increased erosion of sea turtle nesting habitat; increased erosion of dune may impact any existing beach mouse habitat.	Potential increase of sea turtle nesting habitat; protection of dune system and potential beach mouse habitat; potential effects related to sea turtle nest relocation and beach lighting during night construction; slight increase in the risk of manatee/vessel collision.
Cultural resources	No effect	No anticipated effect. Borrow area designed to avoid potentially significant cultural resources.
Air quality	No effect	Temporary and localized decrease in air quality from equipment during construction.
Water quality	No effect	Temporary increase in turbidity during initial construction and future renourishments.
Aesthetic values	Natural beach characteristics preserved but beach will narrow and portions of the dune may erode.	Temporary adverse visual effect during construction activities; wider natural appearing beach with dune protected.
Recreation	Continued erosion reducing beach width and opportunities for beach recreation activities.	Increased area for beach recreation; temporary disruption of beach activities during construction.

myrtle (*Baccharis halimilifolia*), salt cedar (*Timorous gallic*), wax myrtle (*Maraca cerifera*), yaupon (*Ilex vomitoria*), senna (*Cassia fasiculata*), southern red cedar (*Juniperus silicicola*), muscadine (*Vitis rotundifolia*), Virginia creeper (*Partenocissuss quinquefolia*), and greenbriar (*Smilax bona-nox*).

4.05 Wildlife species that are expected to occur in the beach dune, coastal strand and maritime hammock communities include small mammals, birds, reptiles and invertebrates. Mammals include raccoon (*Procyon lotor*), domesticated and feral cats (*Felis cattus*), domesticated dogs (*Canis familiaris*), house mouse (*Mus musculus*), and possibly the threatened southeastern beach mouse (*Peromyscus polionotus niveiventris*). Typical birds that can be observed include brown pelican (*Pelicanus occidentalis*), gulls, herons, terns, doves, and sandpipers. Florida scrub jays (*Aphelocoma c. coerulescens*) were also obsevered during field investigation of the study area. Reptiles include threatened and endangered sea turtles, loggerhead (*Caretta caretta*), green (*Chelonia mydas*), and leatherback (*Dermochelys coriacea*) that utilize the beach for nesting, various snakes and lizards. Invertebrates expected to occur include the ghost crab (*Ocypode quadrata*), and various insects and spiders.

4.06 Beach and Nearshore Community. The proposed project fill area is comprised of sandy beaches and sandy nearshore bottom with some nearshore rock outcrops. Olsen (1989), describes the overall character of the existing beach as fairly uniform, fine grained quartz sand with only slight variances in shell content. The mean grain size and shell content increased while the sorting value decreased from the north to the south. The composite grain size ranged from 2.07 to 2.97 phi (0.24 to 0.13mm) and averaged 2.45 phi (0.19mm). The composite sorting (+/- phi standard deviation) ranged from 0.47 to 0.88 and averaged 0.82 or moderately sorted. The shell content varied from 0.1 to 35.0 percent with an average composite value of 4.0 percent. The silt content ranged from 2.9 to 9.6 percent with a average of 5.1 percent.

4.07 The intertidal beach zone within the study area is generally characterized by a quartz sand and shell hash bottom with occasional coquina rock outcrops. The intertidal zone extends from MHW to MLW and is routinely inundated by water and influenced by wave action during each tidal cycle. The beach in this zone is generally populated by small benthic macroinfauna that are short lived and highly fecund. The mole crab (*Emerita talpoida*), coquina clams (*Donax variabilis, D. parvula*) and several species of polychaetes tend to be the dominant species within the intertidal zone (Nelson, 1985; Gorzelany and Nelson, 1987). Other invertebrates known to inhabit the intertidal zone within the project area include several species of gastropods, isopods, and amphipods (Gorzelany and Nelson, 1987). Shorebirds that can be found utilizing the intertidal zone for foraging are the least tern (*Sterna antillarum*), royal tern (*Sterna maxima*), sandwich tern (*Sterna sandvicensis*), black skimmer (*Rynchops niger*), and snowy plover (*Charadrius alexandrinus*) (Myers and Ewel 1990).

4.08 The bottom characteristics of the nearshore area within the surfzone are similar to the intertidal zone except that the sand is constantly inundated with water. Benthic invertebrate

species reported to inhabit this area include bivalves, gastropods, polychaetes, amphipods, portunid crabs, and sand dollars. The dominant fish species that occur in this zone are bottom feeding carnivores that feed on the benthic invertebrate fauna (Gilmore, et al., 1981). These include catfish (*Arius felis*), lizardfish (*Synodus foetens*), croakers and kingfish (Sciaenidae), and pompano (*Trachinotus carolinus*) (Nelson 1985; Gilmore. et al., 1981). Other fish species that can be found in the surfzone periodically include jacks (Carangidae), mackerals (Scombridae), ladyfish (*Elops saurus*), bluefish (*Pomatomus saltator*), anchovies (Engraulidae) and herrings (Clupeidae) (Gilmore, et al., 1981).

4.09 Nearshore Rock Outcrop Community. Continental Shelf Associates 1989, reported a well developed line of rock outcroppings running approximately 10 miles from Patrick Air Force Base (R-59) south to Paradise Beach Park (R-110). They reported the rock to be low, showing little relief at the northern and southern extremes, with higher well defined ledges of 2-3 feet of vertical relief in the middle between R-78 and R-93. The rock outcrops are comprised of lithified coquina rock of the Pleistocene Anastasia Formation (Olsen 1989). The coquina rock provides substrate for the sabellariid polychaete worm *Phragmatopoma lapidosa.* These worm construct reefs by collecting sand grains of suitable size and cementing them together by mixing the sand 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 (Kirtley 1974; Jaap and Halloack 1991). These worm reefs provide two very important functions. First, as hardened structures, the reef helps to dissipate destructive wave energy. Second, the reefs provide substrate for sessile benthic invertebrates and plants, and structural habitat for a wide variety of invertebrates and fishes. Although worm reefs are found from Cape Canaveral to Key Biscayne, they are best developed between St. Lucie and Martin Counties off Hutchinson Island. In the project study area, colonies of worm rock were observed by Corps of Engineers and USFWS biologists growing on various places along the coquina rock outcrops. These colonies ranged from large dense patches of worm rock to small isolated patches located along the sides of the rock ledges. Based on field observations, it is estimated that worm rock comprises 5 to 10 percent of the hardground habitat. Using aerial photographs taken in July 1995, hardground areas were outlined and digitized to determine areal extent. The amount of rock outcrop and associated worm rock within the study area (R-76 through R-117) was determined to be approximately 32 acres. The location of these outcrops are shown on plates 8 - 13 of the feasibility report. Some species reported to inhabit nearshore rock outcrops include amphipods, isopods, decapod and stomatopod crustaceans including the porcellanid crab (*Pachycheles monilifer*), the xanthid crab (*Menippe nodifrons*), and the graspid crab (*Pachygrapsus transversus*) (Gore et al. 1978). Gilmore et al. (1984), lists 107 fish species associated with nearshore hardgrounds in this area. They are dominated by two demersal blenny species *Labrisomus nuchipinnis* and *Blennius cristatus*, and three semi-demersal species, spottail pinfish (*Diplodus holbrooki*), porkfish (*Anisotremus virginicus*), and sailors choice (*Haemulon parrai*). Sergeant majors (*Abudefduf saxatilis*) were also observed in the field. Several species of macroalgae consisting of green algae (Chlorophyta), red algae (Rhodophyta) and brown algae

(Phaeophyta), were found growing on the rocks, and invertebrate species observed consisted of amphipods, isopods, crabs, tunicates, bryozoans, and the boring sponge (*Cliona lampa*).

4.10 During June 1994 Continental Shelf Associates performed a side-scan sonar and hardground mapping survey of the nearshore waters adjacent to the study area shoreline. The survey encompassed the entire study area from the Canaveral Harbor entrance channel south through Melbourne Beach from as close to shore as possible out to approximately 2,000 feet from shore. The results of the survey indicate that no hardbottom areas, other than the nearshore rock outcrops previously discussed, exist within the study area (Continental Shelf Associates 1994).

4.11 Borrow Area Community. The proposed offshore borrow area is located within the Cape Canaveral shoal system, between two and three miles southeast of the Canaveral Bight. The borrow area is approximately 6000 feet by 6500 feet in area and contains and estimated volume of 16 million cubic yards of dredgeable beach quality sand. The water depth ranges from 18 feet on the western side to 6 feet on the eastern side of the borrow area. A side-scan sonar survey was performed by Continental Shelf Associates (CSA, 1994) to describe the bottom features within and adjacent to the borrow area. The results of the survey indicated that the bottom type within the borrow area was bare sand with no evidence of hardbottom areas or features of biological significance. Infauna and other benthic fauna that can be expected within the borrow area include bivalves, decopod crustaceans, echinoderms, and neritic icthyofauna (Gilmore, et al., 1981).

4.12 Based on the analysis of core borings, the sand within the borrow area contains poorly graded fine quartz sand with varying amounts of whole and broken shell. The composite mean grain size of the sand is 1.75 phi (0.30mm) with a composite sorting of 1.03 or poorly sorted. The average silt content of the borrow area is 5.5 percent. The visual estimates of shell content ranged from 2 to 23 percent with an average of 9 percent. A more detailed discussion on the borrow area can be found in the Geotechnical Report prepared for this study which is included as Appendix E in the Feasibility Report that accompanies this FEIS.

4.13 Threatened and Endangered Species.

4.14 Listed Species. Listed species which may occur in the vicinity of the project are: loggerhead turtle (*Caretta caretta*, T), green turtle (*Chelonia mydas*, E), leatherback turtle (*Dermochelys coriacea*, E), hawksbill turtle (*Eretmochelys imbricata*, E), Kemp's ridley turtle (*Lepidochelys kempii*, E), finback whale (*Balaenoptera physalus*, E), humpback whale (*Megaptera novaeangliae*, E), right whale (*Eubalaena glacialis*, E), sei whale (*Balaenoptera borealis*, E), sperm whale (*Physeter macrocephalus catodon*, E), and the manatee (*Trichecus manatus*, E). All can be found in the Atlantic coastal waters off Brevard County during certain times of the year. Loggerhead, green and leatherback sea turtles are also known to utilize the

beaches for nesting. The southeastern beach mouse (*Peromyscus polionitus niveiventris*, T) may be found inhabiting the dune and scrub communities within the study area.

4.15 All the sea turtle species listed above are known to occur in the coastal waters of eastern Florida. Of these species the loggerhead, green and leatherback turtles are regular nesters in Florida (Meyland et al. 1995). The loggerhead, green, and Kemps' ridley are also know to congregate within the Canaveral Harbor entrance channel during certain times of the year.

4.16 The loggerhead was listed as threatened on July 28, 1978. Within the United States it nests primarily on beaches from North Carolina to Florida. Approximately ninety percent of loggerhead nesting within the U.S. occurs in Florida (Murphy and Hopkins 1984). The highest density nesting beaches in Florida occur from Canaveral National Seashore, Volusia County south to John U. Lloyd State Recreation Area in Broward County (Conley and Hoffman 1986). Nesting densities vary from less than one nest per kilometer on the average for some beaches in the northeast, southeast, and the panhandle of Florida to over 600 nests per kilometer on some stretches of beach in south Brevard County (Ehrhart and Witherington 1986). The U.S. loggerhead population, one of the two most significant nesting populations in the world, may represent up to 30 percent of the worldwide loggerhead nesting population (Ross 1982). This is in contrast to all other sea turtle species where nesting occurs largely outside the U.S. The loggerhead nesting season encompasses late April - September with most nesting occurring in June and July. Incubation period is temperature dependent and most nests hatch within 60 days although up to 70 days may be required for some nests in the northern periphery of the nesting range. Within the study area nesting activity is relatively low north of Patrick Air Force Base. Most of the shoreline is armored from Cocoa Beach to Cape Canaveral and little suitable nesting beach is available. Nesting data from Jetty Park at Port Canaveral from 1990 through 1992 (Meylan et al. 1995) shows nesting densities ranging from 7-34 nests per kilometer. Nesting activity increases to the south. Nesting densities at Patrick Air Force Base during the period from 1989 through 1992 (Meylan et al. 1995) ranged from a low of 132 nests/km to a high of 247 nests/km. Nesting along the south Brevard beaches ranged from 323 nests/km to 484 nest/km for the same period (Meylan et al. 1995).

4.17 Green turtle nesting within the U.S. occurs principally along southeast Florida coast from Volusia through Broward Counties (Meylan et al. 1995). Nesting densities are much lower than for the loggerhead and range from 1-5 nests per kilometer on most beaches within its major nesting range to 13-30 nests per kilometer on high density green turtle nesting beaches in south Brevard County and south Jupiter Island in Palm Beach County (Ehrhart and Witherington 1986; Meylan et al. 1995). Brevard County accounts for 39.5% of the green turtle nesting in the state with the majority of the nesting occurring on the South Brevard Beaches (Meylan et al. 1995), which includes part of the study area. Nesting occurs from May - September with the peak nesting occurring in July - August. Hatching period is similar to the loggerhead. The green turtle was listed on July 28, 1978 as endangered in Florida and the west coast of Mexico and threatened elsewhere.

4.18 The leatherback was listed as endangered throughout its range on June 2, 1970. Nesting within the U.S. occurs primarily in Puerto Rico and the Virgin Islands. Eighty-nine leatherback nests however, were recorded on Florida east coast beaches in 1985 (Conley and Hoffman 1986). Nesting begins as early as late February and terminates by late July. Much of the nesting occurs in St. Lucie, Martin, and Palm Beach Counties but scattered nesting has been recorded on almost all Florida east coast county beaches (Meylan et al. 1995). South Brevard County is documented by Meylan et al. 1995 to have nesting activity as recent as 1992, but most occurs out of the proposed project area. Cape Canaveral and Kennedy Space Center also report nestings in 1992 (Meylan et al. 1995).

4.19 The hawksbill listed as endangered on June 2, 1970, is a rare nester on southeastern U.S. beaches with only 1-2 nests recorded annually on Florida beaches (Lund 1985; McMurtray and Richardson 1985; Meylan et al. 1995). Nesting has occurred from June through October and has been documented from Volusia, Martin, Palm Beach, Broward, Dade and Monroe Counties (McMurtray and Richardson 1985; Lund 1985; Meylan et al. 1995). No nesting has been recorded for Brevard County.

4.20 The West Indian Manatee can be found in the coastal and esturine areas of Brevard County during most of the year. The Indian and Banana Rivers are important manatee feeding, resting and travel areas. Manatees have been observed in the ocean within the study area but are not known to utilize ocean waters for feeding or resting. Manatees use both the Canaveral Harbor Channel and Sebastian Inlet to move to and from the ocean and the Indian/Banana River lagoon system.

4.21 Of the whale species listed in section 4.14, the National Marine Fisheries Service (NMFS) has determined that the only right whale and the humpback whale may be adversely impacted by dredging operation associated with beach nourishment projects (NMFS, Biological Opinion, August 25, 1995). Right whales are the most endangered of the large whale species, whose population in the North Atlantic is estimated at a few hundred individuals. The nearshore waters of northeast Florida and southern Georgia have been identified as calving and nursery areas for the right whale and were formally designated as critical habitat on June 3, 1994. The critical habitat extends from the mouth of the Altamaha River in Georgia to Sebastian Inlet in Florida and includes the coastal waters within the study area. The calving season for the right whale occurs during the period from December 1 through March 31. Humpback whales occur in the coastal waters of the United States throughout the year and can be found in Florida waters during annual migrations between their summer and winter ranges.

4.22 The Southeastern beach mouse was listed in the Federal Register as threatened on May 12, 1989 (USFWS 1992). Historically, the Southeastern beach mouse ranged from Ponce Inlet in Volusia County, Florida south to Hollywood Beach in Broward County, Florida (USFWS 1992). Populations of this species currently exist on, Cape Canaveral National Seashore, Merritt Island

National Wildlife Refuge, Kennedy Space Center, Cape Canaveral Air Force Station and the southern half of Sebastian Inlet State Recreation Area (USFWS 1992, Stout 1992). The beach mouse inhabits primary sand dune areas vegetated by sea oats and dune panic grass. The mouse can also be found in sandy areas with scattered scrub found behind primary dune. The decline of beach mouse populations can be attributed to loss of suitable habitat by development and erosion along the beach and from predation. Competition from other mouse species can also be a threat. Fieldwork performed by the U.S. Fish and Wildlife Service (USFWS) in the study area revealed remnant mouse habitat; however, their was no indication of mouse habitation in the area. Of the dune areas observed within the study area, optimum beach mouse habitat still remains at Lori Wilson County Park.

4.23 Section 7 Coordination. Coordination and consultation with the U. S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) is required by Section 7 of the Endangered Species Act of 1973, as amended, to avoid and minimize impacts to listed threatened and endangered species. Section 7 consultation with both agencies has been completed for this study. A Regional Biological Opinion (RBO) for hopper dredging along the South Atlantic Coast was issued by the NMFS on August 25, 1995. The RBO addresses the dredging of sand from offshore borrow sites to be used for beach nourishment projects. A copy of the RBO can be found in Appendix C of this EIS. The USFWS included a Biological Opinion (BO) in their Fish and Wildlife Coordination Act Report (CAR) for the study, dated December 7, 1995. The CAR and BO can also be found in Appendix C.

4.24 Cultural, Historic, and Archeological Resources. Archival research and field investigations, in addition to consultation with the Florida State Historic Preservation Officer (SHPO), have been conducted for the Brevard County Shore Protection Project. European exploration of Florida began in the early 16th century. On the return to Europe, the ships traveled through the Straits of Florida and followed the Gulf Stream north to Cape Canaveral. From this landmark, the ships turned northeast toward Bermuda before heading east to the Azores and Europe. During the historic period, a number of shipwrecks were recorded in the vicinity of Cape Canaveral. The actual locations of most of these wrecks are not known.

4.25 Because of the probability that historic shipwreck material may be located in the study area, a cultural resource magnetometer survey was conducted for the Canaveral Shoal borrow area, located southeast of Cape Canaveral. The results of these investigations are included in the report *A Cultural Resources Survey of Proposed Borrow Area, Vicinity of Cape Canaveral, Brevard County, Florida*, prepared by Tidewater Atlantic Research. The magnetometer survey and the report referenced above were completed under contract with the U.S. Army Corps of Engineers, Jacksonville District. Nine magnetic targets were identified during this survey. Eight of these targets are included in two clusters which may represent significant historic properties. Three hundred foot radius "no work zones" will be established around these two clusters. One target, CC-06, is an isolated ferrous object and is not believed to represent significant historic material.

4.26 Field investigations were not conducted for the beach segments which are scheduled to be nourished for this shore protection project. Most of the property located along the beach has been developed and about 20% of the beach in this study area has been previously nourished. Because erosion has occurred along the beach segments included in this study area, it is not likely that significant historic properties are located there. Beach nourishment will protect any unidentified historic properties, which may be located west of the beach, from the effects of erosion.

4.27 Water Quality. The waters within the project area are used for swimming, fishing, boating and other recreational uses; therefore, the quality of the Atlantic Ocean waters is affected by those activities. The State of Florida lists the area's waters as Class III which is suitable for recreation and the propagation and management of fish and wildlife.

4.28 Air Quality. Air quality within the project area is good due to the lack of industrial development and presence of either on or offshore breezes. Brevard County is classified as an attainment area for all Federal Air Quality Standards.

4.29 Aesthetic Resources. The proposed project study area comprises two separate segments (North Segment and South Segment) of the Atlantic Ocean coastline in Brevard County, Florida. The Brevard County project beach aesthetics typically range from moderate to good with varying dune and vegetation widths, depending on development encroachment. The beach is a light tan with a somewhat constant width., and gentle slope to the ocean. The panoramic Atlantic Ocean picks up the famous Caribbean blue appearance which contrasts strikingly with the sandy shoreline color. Nearshore and shoreline wormrock outcroppings contrast with the ocean, breakers, and beach, and add interest to the county beach experience.

4.30 The North Segment begins at the Canaveral Harbor south jetty and stretches south for 9.4 miles to the Patrick Air Force Base north property line. Project aesthetics near the jetty area are very good due to the wide beach, more natural dune and background vegetation within Canaveral Jetty Park lands. To the south of the park, the beach narrows and development impacts the dunes. Where native vegetation occurs it provides a positive aesthetic backdrop. High-rise and multi-story commercial and residential development generally adversely impacts aesthetics more than single family residential development. Bulkheads, riprap, denuded dunes, footpaths, and boardwalks also decrease dune and beach aesthetic values. Beachfront parks, undeveloped oceanfront lots, and dune friendly oceanfront development provide the good aesthetic values of the north segment project area.

4.31 The South Segment begins at the Patrick Air Force Base south property line and stretches 10.5 miles into Melbourne Beach. The south project segment possesses good aesthetics values along much of the beachfront area. The northern portion of the segment has more high-rise and multi-story commercial and residential development with bulkheads and cleared dunes. This

adversely impacts aesthetics in those areas. Interspersed amongst the condos and hotels are large tracts of undeveloped oceanfront lots which improve aesthetics in those areas. To the south of Melbourne Causeway, A1A narrows and single family residential development is common. High-rise impacts are decreased but single family development produces impacts to the aesthetics of the dunes and adjacent beach.

4.32 Recreation. The project study area experiences local, state, and national recreational use throughout most of the calendar year. The beach, nearshore and offshore water are used by sunbathers beachcombers, fishermen, swimmers, snorkelers, SCUBA divers, windsurfers, surfers, and various types of boaters. Space shuttle launches are ideally viewed from the beaches. Many local businesses cater to the recreating public which frequent Brevard County Beaches. Many county beachfront parks provide beach recreation access, restrooms, and vehicular parking.

5.00 ENVIRONMENTAL CONSEQUENCES.

5.01 Effects on Fish and Wildlife Resources.

5.02 No-Action Alternative. If no action is taken the shoreline within the study area would continue to erode. This could diminish the beach area available to sea turtles for nesting. Impacts due to project implementation would be avoided.

5.03 Selected Alternative. Implementation of the selected alternative would restore some of the beach's ability to provide protection against storms and coastal flooding. It would also enhance the appearance and suitability for recreation along the beach. The placement of sand on the beach would benefit and help stabilize the existing dune system and may provide additional nesting areas for sea turtles.

5.04 Effects on Dune, Beach and Nearshore Communities. In those areas where dunes exist, the placement of sand may impact the seaward toe of the dune. Depending on the depth of material placed at the toe of the dune, some of the lower vegetation at the toe and pioneer zone may be buried. The vegetation in this area is adapted to inundation by shifting sand and can probably withstand some minor coverage without detrimental effects. The new beach fill will provide additional sand to the dunes and will help to stabilize the seaward face of the dune. The additional beach widths provided by the project will reduce the effects of storms on dune vegetation.

5.05 During the placement of sand on the beach there may be some interruption of foraging and resting activities for shorebirds that utilize the project area. This impact would be short-term and limited to the immediate area of disposal and time of construction. There would be sufficient beach area north and south of the renourishment sites that can be used by displaced birds while construction takes place. Increased foraging opportunities for some species, such as sea gulls,

may also occur as a result of the discharge activity. Elevated turbidity levels within the immediate vicinity of the discharge site may interfere with foraging by sight feeders such as the brown pelican (*Pelecanus occidentalis*). However, increased turbidity levels would be limited to a small portion of the shoreline and should not result in significant impacts to foraging activities.

5.06 Dredging activities in the borrow area and the disposal of sand on the beach would have temporary impacts to the macroinfaunal communities within those areas. Some organisms may be buried and lost, but many organisms inhabiting the intertidal and surf zones are well adapted for burrowing and would be able to burrow up through the fill material and survive. Turbidity levels along the disposal site would temporarily increase, but would return to normal after beach equilibrium is achieved. Organisms inhabiting this zone would be impacted by the run off from the disposal area but are adapted for survival in such conditions and impacts should be minor. Dominant infaunal inhabitants of the intertidal zone, such as amphipods, isopods and polychaetes typically possess high fecundity and rapid turnover rates during their breeding season. Because of this, any losses due to construction activities would be replaced within a short time. The sand to be used as beach fill material is similar to the sand that currently exists on the beach. This will minimize the impacts to the benthic infaunal communities and will enhance recovery to pre project population levels. No long-term adverse effects are anticipated to the intertidal macroinfaunal community due to nourishment activities (Deis, et al. 1992, Nelson 1985, Gorzelany & Nelson 1987).

5.07 Effects on Fishes. Impacts on fish within the surf zone and immediate nearshore area would include temporary increases in turbidity, noise, and disturbance of the sediment in general. The effects of turbidity fish are difficult as most nearshore fish are adapted to periodic short-term, storm generated turbidity. Clogging of gill membranes could occur in some less adapted species or if sediment loads stay high for extended periods of time and fish do not migrate out of the area. The overall impact on fishes are expected to be minimal.

5.08 Effects on Nearshore Rock Outcrop Communities. Coquina rock outcrops and scattered worm rock reef exist within the study area from Patrick Air Force Base (R-76) south to Paradise Beach Park (R-117). Based on aerial photography it has been estimated that approximately 32 acres of rock outcrops exist in the study area. Because the selected plan for the south reach has been modified to avoid the nearshore harground communities, no adverse impacts are expected.

5.09 Impact on Threatened and Endangered Species.

5.10 No-Action Alternative. If no action is taken, the beach would continued to erode. This would ultimately result in the loss of sea turtle nesting habitat and/or poor nest site selection. No adverse impacts are expected on other listed species.

5.11 Selected Alternative. Consultation with the NMFS and USFWS is required and has been completed for the proposed project in accordance with Section 7 of the Endangered Species Act

of 1973, as amended. The consultations have resulted in Biological Opinions from NMFS and USFWS that the proposed activity will not be likely to jeopardize the continued existence of any Federally listed threatened or endangered species. Section 7(b)(4) of the Act requires that when a proposed action is found consistent with Section 7(a)(2) of the Act and the project may result in the take of some individuals of the listed species, the NMFS and USFWS will issue a statement that specifies the amount or extent of such incidental taking. The Act also requires that reasonable and prudent measures, coupled with terms and conditions to implement these measures, be provided to minimize such impacts. The reasonable and prudent measures and terms and conditions issued by the NMFS and USFWS for the proposed action are outlined in their Biological Opinions which are included as Appendix C to the FEIS.

5.12 Sea Turtles. Beach nourishment would provide a higher and wider dry beach area that would be less susceptible to inundation during storm events. This would be a positive impact on sea turtles by providing more dry beach area for nesting and would reduce the chance of nests being destroyed by inundation. Other potential effects of beach nourishment activities have been well documented by Erhart and Raymond (1983), Nelson (1987), and Nelson and Dickerson (1989). Beach nourishment and associated activities have the potential to impact sea turtles and may have the following effects.

1. Scarp development leading to hinderance or blockage of accessibility to nesting habitat.

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

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

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

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

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

By using proper management techniques such as, nest relocation, tilling of compacted beaches, use of compatible sand, and smoothing of scarp formations, most of the negative effects can be corrected (Nelson and Dickerson, 1989).

5.13 Artificial lighting along the beach is known to effect the orientation hatchlings (Nelson and Dickerson, 1989; Witherington, 1991) and to effect the emergence of nesting females onto the beach (Witherington, 1992). Construction activities may occur during the early (March 1 through April 30) or late (November 1 through November 30) part of sea turtle nesting season. If construction occurs a night during that time, lighting on the beach may effect hatchlings and nesting females. Research has shown that low pressure sodium (LPS) lights that emit only yellow wavelengths do not attract hatchlings (Dickerson and Nelson 1988 and 1989; Nelson and Dickerson, 1989b). Witherington (1992) demonstrated that LPS lights on the beach did not significantly effect the nesting behavior of green or loggerhead sea turtles. The use of LPS lighting at the construction site can reduce the potential for lighting effects on sea turtles.

5.14 Hopper dredging in harbors and entrance channels is known to adversely effect sea turtles by entrainment. These incidents occur because sea turtles utilize and are concentrated in these channels during certain times of the year. Sea turtles have been documented to occur in the Canaveral Harbor entrance channel throughout the year. The NMFS is concerned that sea turtles may utilize sand bottoms as internesting or resting habitat. It is not expected that sea turtles will concentrate in the sandy borrow area as they do in navigation channels; however, since sea turtles are known to congregate in the Canaveral Harbor channel it is likely that they could be found within the proposed borrow area located a few miles north of the channel. During past beach nourishment projects there has been no evidence of sea turtles being entrained by a hopper dredge dredging sandy material from an offshore borrow area. To ensure that sea turtles are not entrained by the dredge, the use of a newly developed rigid deflector draghead would be required on the dredge. The deflector draghead is designed to form a sand wedge in front of it that will push out of the way any sea turtle that it comes in contact with. This new deflector draghead has been successfully tested at a site with a historical problem of sea turtle entrainment (Canaveral Harbor) while significant numbers of sea turtles were present in the channel.

5.15 Manatees. No significant impacts to the manatee are expected by the proposed activities. There are no seagrass beds or other known food sources for manatee within the project area. Manatees are known to use both the Canaveral Harbor entrance channel and Sebastian Inlet to travel to and from the ocean and the Indian and Banana Rivers. It is likely that manatees may also be found travelling along the beaches within the project area. The primary concern to manatees is increased boat and barge traffic associated with dredging and nourishment activities and the potential for vessel impact with a manatee. It is expected that manatees will avoid the project area during construction activities, however, various protective measures will be implemented during construction to avoid injuring manatees.

5.16 In order to protect any manatee that might be encountered in the project area, the following contract requirements will be implemented:

> To insure the contractor and his personnel are aware of the potential presence of the manatee in the project area, their endangered status, and the need for

precautionary measures, the contract specifications will include the standard protection clauses concerning manatees. The contractor will instruct all personnel associated with the construction of the project about the presence of manatees in the area and the need to avoid collisions with manatees. All vessels associated with the project shall operate at 'no wake' speeds at all times while in shallow waters, or channels, where the draft of the boat provides less than three feet clearance of the bottom. Boats used to transport personnel shall be shallow draft vessels, preferably of the light-displacement category, where navigational safety permits. Vessels transporting personnel between the landing and any work boat shall follow routes of deep water to the extent possible. Shore crews or personnel assigned to the disposal site for the workshift shall use upland road access if available. All personnel would be advised that there are civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the Endangered Species Act and the Marine Mammal Protection Act. The contractor shall be held responsible for any manatee harmed, harassed, or killed as a result of the construction of the project. If a manatee is sighted within 100 yards of the dredging area, appropriate safeguards would be taken, including suspension of dredging, if necessary, to avoid injury to manatees. The contractor shall keep a log of all sightings, collision, injuries, or killings of manatees during the contract period. Any manatee deaths or injuries will be immediately reported to the Corps of Engineers and the USFWS (Jacksonville Field Office).

5.17 Southeastern Beach Mouse. Except for possibly Lori Wilson County Park in Cocoa Beach, optimum beach mouse habitat was not found in the study area. Field reconnaissance of the study area by the USFWS did not indicate any presence of the southeastern beach mouse. Although no evidence of beach mice was found, they may still inhabit the area, specifically in Lori Wilson County Park. If they do occur, beach nourishment activities may impact any beach mice that may be found at the toe of the primary dune. In their BO the USFWS has determined that the proposed project is not likely to jeopardize the continued existence of the southeastern beach mouse. To minimize any potential impacts, construction equipment will not be permitted on the primary and secondary dune systems and a trapping program will be initiated during construction for any beach mice that may be affected.

5.18 Right and Humpback Whales. One of the primary human caused sources of injury and mortality for right and humpback whales are collisions with vessels. If a hopper dredge is used during beach nourishment activities, the transit of the hopper dredge from the borrow are to the beach disposal site is likely to result in increased vessel traffic in the vicinity of right and humpback whales. This increased vessel traffic may increase the likelihood of whale/vessel interactions. Although whales have been observed in areas of hopper dredge operations, there have been no documented collisions between hopper dredges and whales. To insure that adverse impacts to whales are avoided the precautions recommended in NMFS Regional Biological Opinion will be followed (refer to Appendix C).

5.19 **Effects on Cultural, Historic, and Archeological Resources.**

5.20 No-Action Alternative. The no-action alternative would have no effect on cultural, historic or archeological resources.

5.21 Selected Alternative. Eight potentially significant magnetic targets were identified in the proposed Canaveral Shoal borrow area. The targets are divided into two clusters, one in the northwest corner and the other in the south central section of the borrow area. A 300 foot radius "no work zone" will be established around each of the two clusters to protect potentially significant historic properties from the effects of dredging. Because "no work zones" will be established, dredging in this borrow area will not have an adverse effect on potentially significant historic properties.

5.22 Although the beach segments scheduled for nourishment have not been subjected to a systematic survey, the shoreline has eroded and most of the properties along the beach have been developed. It is not likely that significant historic properties are located on the beach in the study area. If any resources eligible for inclusion in the National Register of Historic Places are located on property west of the beach, project construction will protect those resources from the adverse effects of shoreline erosion.

5.23 It is the Corps of Engineers' determination that the proposed project, including dredging in the borrow area and placement of sand on the beach will have no adverse effect on historic properties included in or eligible for inclusion in the National Register of Historic Places. The Florida State Historic Preservation Officer (SHPO) concurred with this determination in an August 9, 1994 letter.

5.24 **Effects on Water Quality.**

5.25 No-Action Alternative. If no action was taken, present water quality conditions would be maintained.

5.26 Selected Alternative. The project would cause temporary increases in turbidity at dredging and beach disposal sites. 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's 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 returned to normal. The project has been evaluated in accordance with

Section 404 of the Clean Water Act and a 404(b) evaluation report has been included as Appendix A of this FEIS.

5.27 Effects on Aesthetics.

5.28 No-Action Alternative. Without the proposed project the shoreline would continue to erode. This would eventually result in the loss of existing sand dunes and local beach park facilities which would reduce the visual aesthetics of the area.

5.29 Selected Alternative. There would be a temporary increase in the noise level during construction. The principle noise would stem from the vicinity of the discharge point on the beach and the dredge. Construction equipment would be properly maintained to minimize the effects of noise. Increases to the current levels of noise as a result of this project would be localized and minor, and limited to the time of construction. Engine exhaust fumes would be rapidly carried away by breezes. Any temporary decrease in air quality caused by this work would be corrected once work is completed. Hundreds of feet of dredge pipe lying on the beach or just offshore would have a negative visual impact on the aesthetics of the area. This impact would only be temporary and would be removed along with the pipe at the completion of the work. The negative visual impacts of the equipment and pipe would be offset to an extent by the natural curiosity of some individuals to see what is going on and how work is progressing. There would also be a temporary increase in turbidity during construction adjacent to the point of discharge. Turbidity would return to normal levels once construction activities cease. Once completed the proposed project would result in an overall improved aesthetic quality. The placement of sand on the beach would restore the natural appearance of the shore. Existing dunes would be protected maintaining their pleasing visual appearance.

5.30 Effects on Recreation.

5.31 No-Action Alternative. Without the proposed project the shoreline would continue to erode. This would eventually reduce the amount of beach available for recreation and would result in the degradation or loss of local beach park facilities thus, adversely impacting the recreational opportunities within the area.

5.32 Selected Alternative. During nourishment activities, the use of the beach in the vicinity of construction would drop or be restricted temporarily. Use of the beach in the immediate area of the discharge pipe and equipment would be restricted for public safety. Noise from the heavy equipment needed to spread and smooth the sand would disturb some users as well. Many visitors would seek quieter areas for sunbathing or swimming. As portions of the renourished beaches come available, use by the general public would increase once more. After nourishment of the beach, use by the general public and those who stay at the condominiums and hotels would return to pre-erosion activity levels. The general public would be more inclined to use these beaches rather than by-passing them for others with more sand above the high tide line. There

would be a temporary adverse effect on recreational fishing in the immediate area of beach fill operations and at the borrow area due to construction activities and turbidity. Fishing would not be affected outside the area of immediate construction.

5.33 Effects on Air Quality. The short-term impact from emissions by the dredge and other construction equipment associated with the project would not significantly impact air quality. The Florida Department of Environmental Protection does not regulate marine or mobile emission sources (dredge and construction equipment) within Brevard County. No air quality permits would be required for this project. Brevard County is designated as an attainment area for Federal air quality standards under the Clean water Act. Since the project is located within an attainment area EPA's General Conformity Rule to implement Section 176(c) of the Clean Air Act does not apply and a conformity determination is not required.

5.34 Hazardous, Toxic and Radioactive Waste (HTRW) Assessment. A Phase I Environmental Site Assessment was performed in conformance with ER 1165-2-132 and the scope and limitations of ASTM Practice E 1527. The area involved in the assessment included 24 miles of Brevard County Atlantic Ocean Shoreline located Between FDER monuments R-1 through R-137. This area included the City of Cape Canaveral, Cocoa Beach Satellite Beach, Indian Harbor, Indialantic, and Melbourne Beach. The 4.5 mile of shoreline within Patrick Air Force Base (monuments R-53 through R-76) is not part of the Brevard County Shore Protection Study and was not included in the HTRW assessment. The area assessed was found to be free of hazardous or toxic wastes. A comprehensive record search November 28 through December 2, 1995, consisted of a study of aerial photographs, and interviews. Several aerial photographs were reviewed for the purpose of delineating the actual property for the purpose of detecting any signs that would indicate past activity that could have resulted in the existence of a current hazard. None of the above items revealed any indication of potential HTRW contamination.

5.35 Energy Requirements and Conservation. The energy requirements for this construction activity would be confined to fuel for the dredge, labor transportation, and other construction equipment. The no-action alternative would eliminate the energy requirement related implementation of the proposed project. However, it would allow conditions to develop that may endanger coastal property from storm surges and wave erosion during future storm events. On-site preventive measures and post clean-up under the no-action alternative would likely demand greater energy than that required of the proposed action.

5.36 Natural or Depletable Resources. The beach quality sand used to construct the project is a depletable resource. Using sand from the proposed borrow area would deplete the sand source at that site. Eventually sand would return to offshore areas and be redistributed over nearshore areas. It is unlikely that the redistributed sand would return to where it was removed, resulting in a depletion of that resource in the borrow area. The gasoline and diesel fuel used by the dredge and other construction equipment is also a depletable resource.

5.37 Cumulative Impacts. Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7). The proposed project would result in long-term benefits which should outweigh any short-term environmental losses. The cumulative impact of shore protection projects along the Florida coast has been to restore and maintain many beaches which otherwise would have experienced severe erosion or would have totally disappeared. In addition, these activities have reduced property damage and helped to maintain property value. Monitoring would be performed to facilitate comparison of pre-project conditions with post-project conditions in order to determine short-term and long-term impacts to the nearshore hardbottom, fishes, benthic infauna, water quality, and sea turtles.

5.38 Irreversible and Irretrievable Commitment of Resources. The use of the sand from the proposed borrow area would (for all practical purposes) irreversibly diminish the quantity of suitable sand reserves within the area dredged that could be used for beach renourishment. The sands would not replenish, in sufficient quantity, to use the borrow area again for future nourishment activities. There will however, be sufficient sand remaining in the dredged area for recolonization of benthic organisms. The energy and fuel used during construction would also be an irreversible commitment of resources. Benthic organisms within the borrow area and beach fill area that would be eliminated during construction would be irretrievably lost for a period of time. However, the high rate of repopulation expected from these organisms reduces the significance of the loss.

5.39 Unavoidable Adverse Environmental Effects. Some of the relatively non-motile infaunal invertebrates that inhabit the borrow area and the beach sites to be filled would be lost during dredging and beach fill operations. Populations of these organisms are expected to recover within a short time after construction. There would be an unavoidable reduction in water clarity and increased siltation and sedimentation in the immediate dredging and beach fill areas during construction. This impact will be temporary and should disappear shortly after construction activities cease.

6.00 RELATIONSHIP OF THE RECOMMENDED PLAN TO ENVIRONMENTAL REQUIREMENTS. Table 2 shows the relationship of the proposed project to Federal and State environmental laws and other policies.

Table 2. Relationship of the proposed project to Environmental Protection Statutes and Other Environmental Requirements.

Federal Acts	Project Compliance
Archeological and Historic Preservation Act, as amended, 16 U.S.C. 468, et seq. P.L. 93-291	Full Compliance
Clean Air Act, as amended, 42 U.S.C. 1857h-7, et seq. P.L. 91-604	Full Compliance
Clean Water Act, as amended, (Federal Water Pollution Control Act) 33 U.S.C. 1251, et seq. P.L. 92-500	Full Compliance
Coastal Barrier Resources Act, 16 U.S.C. 3501, et seq. P.L. 97-348	Full Compliance
Coastal Zone Management Act, as amended, 16 U.S.C. 1451, et seq. P.L. 92-583	Full Compliance
Endangered Species Act, as amended, 16 U.S.C. 1531, et seq. P.L. 93-205	Full Compliance
Estuary Protection Act, 16 U.S.C. 1221, et seq. P.L. 90-454	Full Compliance
Federal Water Project Recreation Act, as amended, 16 U.S.C. 460-1(12), et seq. P.L. 89-72	Full Compliance
Fish and Wildlife Coordination Act, 48 Stat. 401, as amended, 16 U.S.C. 661, et seq. P.L. 85-624	Full Compliance
Land and Water Conservation Fund Act, as amended, 16 U.S.C. 4601-4601-11, et seq. P.L. 88-578	Not Applicable
Marine Mammal protection Act, 16 U.S.C. 1361, et seq. P.L. 92-522	Full Compliance
Marine Protection, Research and Sanctuaries Act, 33 U.S.C. 1401, et seq. P.L. 92-532	Not Applicable
National Historic Preservation Act, as amended, 16 U.S.C. 470a, et seq. P.L. 89-655	Full Compliance
National Environmental Policy Act, as amended, 42 U.S.C. 4321, et seq. P.L. 91-190	Full Compliance
River and Harbor Act, 33 U.S.C> 401, et seq.	Full Compliance
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, et seq. P.L. 83-566	Not Applicable
Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271, et seq. P.L. 90-542	Not Applicable

Executive Orders	
Floodplain Management (E.O. 11988)	Full Compliance
Protection of Wetlands (E.O. 11990)	Full Compliance
Protection and Enhancement of Environmental Quality (E.O. 11514, Amended E.O. 11991)	Full Compliance
Protection and Enhancement of the Cultural Environment (E.O. 11593)	Full Compliance
Federal Compliance with Pollution Control Standards	Full Compliance

Table 2. Relationship of the proposed project to Environmental Protection Statutes and Other Environmental Requirements, continued.

Other Federal Policies	
CEQ Memorandum of August 11, 1980: Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing NEPA	Not Applicable
CEQ Memorandum of August 10, 1980: Interagency Consultation to avoid or Mitigate Adverse Effects on Rivers in the Nationwide Inventory	Not Applicable
Migratory Bird Treaties and Other International Agreements listed in the Endangered Species Act of 1973, as amended, Section 2(a)(4)	Full Compliance
State Policies	
Florida Coastal Zone Management Program	Full Compliance

Definitions:

Full Compliance: Having met all requirements of the Statute, Executive Order, or other environmental requirements for the current stage of planning (either pre- or post-authorization).

Partial Compliance: Not having met some of the requirements that normally are met in the current stage of planning. Partial compliance entries should be explained in appropriate places in the report and/or Environmental Impact Statement and referenced in the table.

Non-Compliance: Violation of a requirement Statute, Executive Order, or other environmental requirement. Non-compliance entries should be explained in appropriate places in the report and/or Environmental Impact Statement and referenced in the table.

Not Applicable: No requirements for the Statute, Executive Order, or other environmental requirement for the current stage of planning.

7.00 LIST OF PREPARERS.

Name	Discipline/ Expertise	Role in EIS Preparation	Experience
Kenneth R. Dugger	Chief, Environmental Coordination Section	Supervisor	10 years Corps biologist at Savannah & Jacksonville Districts, 5 years Puerto Rico DNR biologist, 2 years EPA biological technician
Michael Dupes	Biology	Biological impact assessment; principle writer	4 years water quality, 10 years Natural Res. Mgmt, 6 years environmental studies; Jacksonville District
Janice E. Adams	Archeology	Historic properties impact assessment	10 years historic properties management
Paul C. Stevenson	Landscape Architect	Aesthetic and recreation analysis	6 years Jacksonville District, 5 years private practice, Registered Landscape Architect - Florida
Peter Besrutschko	Chemical/Environmental Engineering	Water quality and HTRW assessment	4 years production, 5 years design & construction 10 years environmental design and audit
Thomas D. Smith	Coastal Engineering	Technical study manager. Performed engineering design and economic analysis	6 years- engineering, economic analysis, and study management - Jacksonville District. Registered professional engineer, Florida.
Garry Holem	Coastal Geology	Geotechnical analysis of borrow area sands	6 years geotechnical analysis, Jacksonville District

8.00 PUBLIC INVOLVEMENT, REVIEW AND COORDINATION.

8.01 Public involvement for the feasibility phase of the study was initiated with a scoping letter dated October 5, 1994. A Notice of Intent (NOI) to prepare a Draft Environmental Impact Statement (DEIS) was published in the Federal Register on October 24, 1994. The Draft Feasibility Report and DEIS were circulated for agency and public review and comment on May 31, 1996. A Notice of Availibility was published in the Federal Register on June 14, 1996. The public comment period ended on July 29, 1996. All comment letters and other pertinent correspondence concerning the DEIS are included Appendix D of the FEIS.

8.02 Required Coordination. The proposed project has been coordinated with the following agencies: U.S. Fish and Wildlife Service, National Marine Fisheries Service, U.S. Environmental Protection Agency, Florida State Clearinghouse, Florida State Historic Preservation Officer (SHPO), Florida Department of Environmental Protection, Canaveral Port

Authority, U. S. Navy, and the U.S. Air Force. The comments received from these parties are included in Appendix D. Additional coordination was conducted with the USFWS under the Fish and Wildlife Coordination Act (FWCA) and with USFWS and NMFS under Section 7 of the Endangered Species Act (ESA). Results of this coordination can be found in Appendix C.

8.03 Statement Recipients.

Federal Agencies

Advisory Council on Historic Preservation, Washington, D.C.
Environmental Protection Agency, Washington, D.C.
Environmental Protection Agency, Atlanta, Georgia
Department of the Interior, U.S. Fish and Wildlife Service, Atlanta, Georgia
Department of the Interior, U.S. Fish and Wildlife Service, Jacksonville, Florida
National Marine Fisheries Service, Panama City, Florida
National Marine Fisheries Service, St. Petersburg, Florida
Federal Emergency Management Administration, Atlanta, Georgia
Federal Maritime Commission, Washington, D.C.
U.S. Dept. of Commerce, Director, Ecology and Conservation Office, Washington, D.C.
Housing and Urban Development, Atlanta, Georgia
U.S. Coast Guard, Seventh District, Miami, Florida
U.S. Air Force, Patrick Air Force Base, Florida

State Agencies

Florida State Clearinghouse, Department of Community Affairs, Tallahassee, Florida
Florida Department of Environmental Protection, Florida Marine Institute, Tequesta, Florida
Florida Department of Environmental Protection, Office of Aquatic Preserves, Ft. Pierce, Florida
Florida Department of Environmental Protection, Division of Beaches and Coastal Systems, Tallahassee, Florida
Florida Dept. of Environmental Protection, Bureau of State Lands, West Palm Beach, Florida
Florida Game and Fresh Water Fish Commission, Tallahassee, Florida
Division of Historical Resources, State Historic Preservation Officer, Tallahassee, Florida
St. Johns River Water Management District, Palatka, Florida

Local Agencies

Brevard County Board of County Commissioners, Melbourne, Florida
Brevard County Natural Resources Management Division, Melbourne, Florida

Canaveral Port Authority, Cape Canaveral, Florida
Brevard County Administrator, Melbourne, Florida
Town Manager, Melbourne Beach, Florida
City Manager, Melbourne, Florida
City Manager, Satellite Beach, Florida
City Manager, Cape Canaveral, Florida
Town Manager, Indialantic, Florida
City Manager, Indian Harbour Beach, Florida
City Manager, Cocoa Beach, Florida

Individuals and Interest Groups

Florida Audubon Society, Casselberry, Florida
Isaak Walton League, Palm Beach, Florida
Florida Wildlife Federation, Tallahassee, Florida
Professor John Gifford, Rosenstiel School of Marine and Atmospheric Science, Miami, Florida
Environmental Services, Inc., Jacksonville, Florida
Caribbean Conservation Corporation, Gainsville, Florida

8.04 Results of Coordination. The results of FWCA and ESA coordination are discussed in the appropriate sections of the FEIS. Written comments on the DEIS were received from the following Federal agencies: U.S. Environmental Protection Agency, U.S. Department of Commerce - NOAA (National Marine Fisheries Service and National Geodetic Survey), Department of the Interior (U.S. Fish and Wildlife Service), Department of Health & Human Services, and Department of Housing and Urban Development. State agencies responding to the DEIS include: Department of Community Affairs (State Clearinghouse), Department of Environmental Protection, Florida Game and Fresh Water Fish Commission, Florida Department of State (Division of Historical Resources - SHPO), Department of Transportation, Department of Health and Rehabilitative Services, and St. Johns River Water Management District. Local agencies responding included the Brevard County Office of Natural Resources Management and the City of Melbourne. No individuals or interest groups responded. All letters of comment received on the DEIS have been reproduced and are included in Appendix D.

8.05 The great majority of comments received on the DEIS, from NMFS, USFWS, EPA, FDEP and GFWFC, concerned the burial of approximately 32 acres of nearshore limestone rock crops and scattered patches of worm rock. Adequate mitigation for the loss of these hardground resources was also an issue. To avoid impacting the hardground resources, the recommended plan for the south reach of the project has been modified. The modified plan shortens the length of beach to be filled, thus avoiding the section of shoreline where hardgrounds exist (refer to sections 1.01, 1.02 and 3.07). The modified plan completely avoids any adverse impacts to the nearshore hardgrounds, therefore, mitigation will not be needed.

8.06 The National Geodetic Survey (NGS) was concerned about potential effects the project may have on their horizontal and vertical geodectic control monuments. NGS also indicated that the National Ocean Service (NOS) would require copies of "as built plans" upon project completion in order to revise future editions of NOS nautical charts. During the development of plans and specifications for this project the Corps will coordinate with NGS to identify any control monuments that may be affected. Once the project is constructed the results of post-construction surveys will be provided to NOS to update nautical charts.

8.07 In addition to comments concerning impacts to hardgrounds, EPA had other comments on the feasibility report and DEIS. Corps of Engineers responses to these comments immediately follow EPA's letter in Appendix D.

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APPENDIX A

SECTION 404(b) EVALUATION

SECTION 404(b) EVALUATION

BREVARD COUNTY, FLORIDA
SHORE PROTECTION PROJECT REVIEW STUDY

I. Project Description

a. Location. The proposed work will be performed along the Florida Atlantic Coast within Brevard County. The north reach of the proposed project area runs from Florida Department of Environmental Protection (FDEP) monument R-1 through R-53 with a 1,500 foot tapered transition fill extending south of R-53. The north reach includes the City of Cape Canaveral and Cocoa Beach. The south reach extends from R-119 through R-137 and includes the cities of Satellite Beach, Indian Harbour Beach, Indialantic, and Melbourne Beach. Tapered transition fills will extend 1,000 feet north of R-119 and 1,500 feet south of R-137. Refer to location map, figure 1, in the Final Environmental Impact Statement (FEIS).

b. General Description. The proposed plan calls for the nourishment of 12 miles of shoreline along two reaches as identified in 1a, above. Approximately 4,145,000 cubic yards (cy) of sand material will be required for the initial beach fill including the first advance fill. The sand will come from an offshore borrow area.

c. Authority and Purpose. The existing authorized shore protection project for Brevard County was authorized by the River and Harbor Act of August 13, 1968 and described in House Document No. 352, 90th Congress, 2nd Session dated July 8, 1968. The Brevard County Shore Protection Project Review Study is in response to a resolution adopted September 23, 1982 by the Committee on Public Works and Transportation, U.S. House of Representatives.

d. General Description of Dredged or Fill Material.

(1) General Characteristics of Material. The sand that will be used to renourish the beach will come from an offshore borrow area located within the Cape Canaveral shoal system, between 2-3 miles southeast of the cape. The material is poorly graded fine quartz sand with varying amounts of whole and broken shell. The composite mean grain size of the sand is 1.75 phi (0.30mm) with composite sorting of 1.03 or poorly sorted. The average silt content of the borrow area is 5.5 percent. The visual estimates of shell content ranged from 2 to 23 percent with an average of 9 percent.

(2) Quantity of Material. Construction of the north reach (R-1 through R-53 plus transition fill) of the proposed project would require placement of approximately 1,984,000 cy of

initial fill and 516,000 cy of advance material (2,500,000 cy total). Future nourishments of 516,000 cy would be accomplished in 6 year intervals at years 6, 12, 18, 24, 30 and 36. The final nourishment in year 42 would require the placement of 688,000 cy of sand. Construction of the south reach (R-119 through R-137 plus transition fills) would require placement of approximately 1,044,000 cy of initial fill and 601,000 cy of advance material for a total of 1,645,000 cy. Future nourishments of 601,000 cy would be accomplished in 6 year intervals at years 6, 12, 18, 24, 30 and 36. The final nourishment in year 42 would require the placement of 801,000 cy of sand.

(3) Source of Material. Beach compatible material for this project will come from an offshore borrow area located between 2 and 3 miles south east of Cape Canaveral (figure 1 in FEIS). The borrow area is approximately 6000 ft by 6500 in size and lies in 6 to 18 feet of water.

e. Description of the proposed Discharge Site.

(1) Location. The north reach of the project fill is approximately 9.4 miles long and extends from FDEP monument R-1 to about 1,500 feet south of R-53. The south reach of the project is approximately 3.4 miles long and extends from approximately 1,000 feet north of FDEP monument R-119 to about 1,500 south of R-137.

(2) Size. Approximately 322 acres of beach will be filled within the north reach and approximately 217 acres in the south reach.

(3) Type of Site. The site for disposal of the sand material is a segment of eroded, sandy, recreational beach and inshore seabed.

(4) Type of Habitat. The habitat within the disposal area consists of a currently eroding quartz sand beach and inshore seabed.

(5) Timing and Duration of Discharge. The exact time that nourishment activities will occur is not known. However, construction will not occur during the peak sea turtle nesting season between May 1 and October 31. The actual dates of construction will be determined during the process of contractor selection and contract award.

f. Description of Disposal Method. It is anticipated that the material will be obtained from the offshore borrow area either by a hydraulic pipeline dredge pumping directly on the beach, or by a hopper dredge with pumpout capability. However, it is possible that a mechanical (clamshell) dredge loading into a barge with pumpout capability could also be used. Once the material is pumped on the beach, grading will be implemented by the use of conventional earth moving equipment to achieve the desired construction profile.

II. Factual Determinations

a. Physical Substrate Determinations.

(1) Substrate Elevation and Slope. The design berm elevation for both the north and south reaches, is +10.0 feet mean low water (MLW) extending from the shoreward intersection of the existing profile seaward to the location of the pre-project mean high water (MHW) shoreline. At the location of the MHW shoreline, the design template slopes 1 vertical (V) to 15 horizontal (H) seaward to the location of MLW thence 1 V to 50 H out to where it intersects with the existing bottom.

(2) Sediment Type. The material in the offshore borrow area that will be placed on the beach consists of fine quartz sand with calcium carbonate shell fragments.

(3) Dredge/Fill Material Movement. The beach fill material will be subject to erosion by waves with the net movement of fill material to the south.

(4) Physical Effects on Benthos. Some benthic organisms inhabiting the intertidal beach zone will be buried by the beach fill. Benthic organisms found in the intertidal areas along the project beach are adapted for existence in an area with considerable substrate movement, thus most will be able to burrow up through the fill material. Recolonization is expected to occur within a year after construction activities cease. It is anticipated that no long-term adverse impacts will occur.

b. Water Circulation, Fluctuation and Salinity Determination.

(1) Water Column Effects. The placement of fill on the beach will increase turbidity in the nearshore area. Because the immediate nearshore area is a high wave energy system and subject to naturally occurring elevated turbidity, increases due to the project will not be significant. Fill placement will have no long-term or significant impacts, if any, on salinity, water chemistry, clarity, color, odor, taste, dissolved gas levels, nutrients or eutrophication.

(2) Current Patterns and Circulation. Currents in the project area are both tidal and longshore. Net movement of water due to the longshore current is from the north to the south. The project will have no significant effect on current patterns or flow, velocity, stratification or the hydrologic regime in the area.

(3) Normal Water Level Fluctuations and Salinity Gradients. Fill placement will not affect normal tide fluctuations or salinity.

c. Suspended Particulate/Turbidity Determinations.

(1) Expected Changes in Suspended Particulates and Turbidity Levels in the Vicinity of the Disposal Site. The project would cause temporary increases in turbidity levels at the borrow area during dredging and along the beach fill sites during discharge. Turbidity will be short-term and localized and no significant adverse impacts are expected. The Florida State water quality standards for turbidity (29 NTU above background) outside an allowable mixing zone will not be exceeded.

(2) Effects on the Chemical and Physical Properties of the Water Column.

(a) Light Penetration. Light penetration will decrease during discharge in the immediate area where sand is being deposited on the beach. There may also be some decrease of light penetration in the vicinity of the borrow area. This effect will be temporary and will have no adverse impact on the environment.

(b) Dissolved Oxygen. Dissolved oxygen levels will not be altered by this project due to the high energy wave environment and associated adequate reaeration rates.

(c) Toxic Metals, Organics, and Pathogens. Because of the inert characteristics of the material to be dredged and placed on the beach, no toxic metals, organics, or pathogens are expected to be released by the project.

(d) Aesthetics. The aesthetic quality of the water adjacent to the project will be reduced during construction due to increased turbidity. This will be a short-term temporary condition. The placement of clean beach compatible material on an erosive beach will likely improve the aesthetic quality of the immediate area.

(3) Effects on Biota.

(a) Primary Productivity and Photosynthesis. Primary productivity is not a recognized, significant phenomenon in the surf zone, where a temporarily increased level of suspended particulates will occur. There will be no effect on the nearshore productivity as a result of the proposed beach fill.

(b) Suspension/Filter Feeders. An increase in turbidity could adversely impact burrowing invertebrate filter feeders along the beach fill area. It is not expected that a short-term, temporary increase in turbidity will have any long-term negative impact on these highly fecund organisms.

(c) Sight Feeders. No significant impacts on these organisms are expected as the majority of sight feeders are highly motile and can move outside the project area.

d. Contaminant Determinations. Deposited fill material will not introduce, relocate, or increase contaminants. The material to be dredged is clean sand compatible with the existing beach. An initial Hazardous Toxic and Radioactive Waste (HTRW) assessment for the area has indicated that there is no potential for HTRW problems.

e. Aquatic Ecosystem and Organism Determinations. The fill material that will be placed on the beach will consist of quartz sand with some shell that is similar enough to the existing substrate so that no impacts are expected. The materials meet the exclusion criteria, therefore, no additional chemical-biological interactive testing will be required.

(1) Effects on Plankton. No adverse impacts on autotrophic or heterotrophic organisms are anticipated.

(2) Effects on Benthos. There may be some mortality of benthic infauna along the beach fill area and within the area that is dredged. Recolonization of these organisms are expected within one year after construction. No adverse long-term impacts to non-motile or motile benthic invertebrates are anticipated.

(3) Effects on Nekton. No adverse impacts to nektonic species are anticipated.

(4) Effects on the Aquatic Food Web. No adverse long-term impact to any trophic group in the food web is anticipated.

(5) Effects on Special Aquatic Sites.

(a) Hardground and Coral Reef Communities. No hardground or coral reef communities exist within the area proposed for beach fill.

(6) Endangered and Threatened Species. There will be no significant adverse impacts on any threatened or endangered species or on critical habitat of any threatened or endangered species. Both the National Marine Fisheries Service and the U. S. Fish and Wildlife Service have been consulted under Section 7 of the Endangered Species Act. Project construction will not occur during the main part of the sea turtle nesting season (May 1 through October 31). If construction takes place during the early or late part of the nesting and hatching season, a nest relocation program will be implemented. All sea turtle nests discovered within the beach disposal area will be removed and relocated to a nearby self-release beach hatchery. All relocation and incubation efforts will conform to the guidelines in the "Manual of Sea Turtle Research and Conservation Techniques", Second Edition, 1983, prepared for the Western

Atlantic Sea Turtle Symposium and distributed by the Florida Department Environmental Protection.

(7) Other Wildlife. No adverse impacts to small foraging mammals, reptile, or wading birds are expected.

(8) Actions to Minimize Impacts. All practical safeguards will be taken during construction to preserve and enhance environmental, aesthetic, recreational, and economic values in the project area. Specific precautions are discussed elsewhere in this 404(b) evaluation and in the FEIS for this project.

f. Proposed Disposal Site Determinations.

(1) Mixing Zone Determination. Clean sand, compatible with the existing beach, would be placed on the beach. This will not cause unacceptable changes in the mixing zone water quality requirements as specified by the State of Florida's Water Quality Certification permit procedures. No adverse impacts related to depth, current velocity, direction and variability, degree of turbulence, stratification, or ambient concentrations of constituents are expected from implementation of the project.

(2) Determination of Compliance with Applicable Water Quality Standards. Because of the inert nature of the fill material, Class III water quality standards will not be violated.

(3) Potential Effects on Human Use Characteristics.

(a) Municipal and Private Water Supplies. No municipal or private water supplies will be impacted by the implementation of the project.

(b) Recreational and Commercial Fisheries. Fishing in the immediate beach disposal area will be prohibited during construction. Otherwise, recreational and commercial fisheries will not be impacted by the disposal of dredged material on the beach or by dredging construction activities within the borrow area.

(c) Water Related Recreation. Beach/water related recreation in the immediate vicinity of the beach fill will be prohibited during construction activities. This will be a short-term impact. Water related recreation will be preserved and enhanced by the nourishment of the beach.

(d) Aesthetics. The existing environmental setting will not be adversely impacted. The disposal of sand on the beach will maintain a natural appearing protective beach. Construction activities will cause a temporary increase in noise and air pollution caused by

equipment as well as some temporary increase in turbidity. These impacts are not expected to adversely affect the aesthetic resources over the long term and once construction ends, conditions will return to pre-project levels.

(e) Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves. No such designated sites are located within the project area.

g. Determination of Cumulative Effects on the Aquatic Ecosystem. There will be no cumulative impacts that result in a major impairment of water quality of the existing aquatic ecosystem as a result of the placement of fill at the project site.

h. Determination of Secondary Effects on the Aquatic Ecosystem. There will be no secondary impacts on the aquatic ecosystem as a result of the beach nourishment project.

III. Findings of Compliance or Non-compliance with the Restrictions on Discharge.

a. No significant adaptations of the guidelines were made relative to this evaluation.

b. No practicable alternative exists which meets the study objectives that does not involve discharge of fill into waters of the United States.

c. After consideration of disposal site dilution and dispersion, the discharge of fill materials will not cause or contribute to, violations of any applicable State water quality standards for Class III waters. The discharge operation will not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

d. The disposal of beach compatible material on the beach will not jeopardize the continued existence of any species listed as threatened or endangered or result in the likelihood of destruction or adverse modification of any critical habitat as specified by the Endangered Species Act of 1973, as amended.

e. The placement of fill material will not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreational and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic species and other wildlife will not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values will not occur.

f. On the basis of the guidelines, the proposed disposal site for the discharge of dredged material is specified as complying with the requirements of these guidelines.

APPENDIX B

FLORIDA COASTAL ZONE MANAGEMENT PROGRAM
FEDERAL CONSISTENCY DETERMINATION

FLORIDA COASTAL ZONE MANAGEMENT PROGRAM
FEDERAL CONSISTENCY EVALUATION PROCEDURES

BREVARD COUNTY, FLORIDA
SHORE PROTECTION PROJECT REVIEW STUDY

1. Chapter 161, Beach and Shore Preservation.

The intent of the coastal construction permit program established by this chapter is to regulate construction projects located seaward of the line of mean high water and which might have an effect on natural shoreline processes.

Response: The proposed plans and information will be submitted to the state in compliance with this chapter.

2. Chapters 186 and 187, State and Regional Planning.

These chapters establish the State Comprehensive Plan which sets goals that articulate a strategic vision of the State's future. It's purpose is to define in a broad sense, goals, and policies that provide decision-makers directions for the future and provide long-range guidance for an orderly social, economic and physical growth.

Response: The proposed project has been coordinated with various Federal, State and local agencies during the planning process. The project meets the primary goal of the State Comprehensive Plan through preservation and protection of the shorefront development and infrastructure.

3. Chapter 252, Disaster Preparation, Response and Mitigation.

This chapter creates a state emergency management agency, with the authority to provide for the common defense; to protect the public peace, health and safety; and to preserve the lives and property of the people of Florida.

Response: The proposed project involves the placing of beach compatible material onto an eroding beach as a protective means for residents, development and infrastructure located along the Atlantic shoreline within Brevard County. Therefore, this project would be consistent with the efforts of Division of Emergency Management.

4. Chapter 253, State Lands.

This chapter governs the management of submerged state lands and resources within state lands. This includes archeological and historical resources; water resources; fish and wildlife resources; beaches and dunes; submerged grass beds and other benthic communities; swamps, marshes and other wetlands; mineral resources; unique natural features; submerged lands; spoil islands; and artificial reefs.

Response: The proposed beach nourishment would create increased recreational beach and potential sea turtle nesting habitat. No seagrass beds are located within the area proposed to receive fill. The proposed project would comply with the intent of this chapter.

5. Chapters 253, 259, 260, and 375, Land Acquisition.

This chapter authorizes the state to acquire land to protect environmentally sensitive areas.

Response: Since the affected property already is in public ownership, this chapter does not apply.

6. Chapter 258, State Parks and Aquatic Preserves.

This chapter authorizes the state to manage state parks and preserves. Consistency with this statute would include consideration of projects that would directly or indirectly adversely impact park property, natural resources, park programs, management or operations.

Response: The proposed project area does not contain any state parks or aquatic preserves nor are there any within the immediate vicinity of the project that would be affected. The project is consistent with this chapter.

7. Chapter 267, Historic Preservation.

This chapter establishes the procedures for implementing the Florida Historic Resources Act responsibilities.

Response: This project has been coordinated with the State Historic Preservation Officer (SHPO). Cultural resources investigations were conducted in the project area. An archival and literature search, in addition to a magnetometer survey of the proposed borrow area were conducted. The SHPO has indicated that the proposed project will not adversely affect any significant cultural or historic resources. The project will be consistent with the goals of this chapter.

8. Chapter 288, Economic Development and Tourism

This chapter directs the state to provide guidance and promotion of beneficial development through encouraging economic diversification and promoting tourism.

Response: The proposed beach nourishment would provide more space for recreation and the protection of recreational facilities along the receiving beach. This would be compatible with tourism for this area and therefore, is consistent with the goals of this chapter.

9. Chapters 334 and 339, Public Transportation.

This chapter authorizes the planning and development of a safe balanced and efficient transportation system.

Response: No public transportation systems would be impacted by this project.

10. Chapter 370, Saltwater Living Resources.

This chapter directs the state to preserve, manage and protect the marine, crustacean, shell and anadromous fishery resources in state waters; to protect and enhance the marine and estuarine environment; to regulate fishermen and vessels of the state engaged in the taking of such resources within or without state waters; to issue licenses for the taking and processing products of fisheries; to secure and maintain statistical records of the catch of each such species; and, to conduct scientific, economic, and other studies and research.

Response: The proposed beach fill may represent a temporary short-term impact to infaunal invertebrates by burying these organisms. However, these organisms are highly adapted to the periodic burial by sand in the intertidal zone. These organisms are highly fecund and are expected to return to pre-construction levels within 6 months to one year after construction. Nourishment activities would not be performed during the main part of the sea turtle nesting season. It is not expected that sea turtles would be significantly impacted by this project. Based on the overall impacts of the project, the project is consistent with the goals of this chapter.

11. Chapter 372, Living Land and Freshwater Resources.

This chapter establishes the Game and Freshwater Fish Commission and directs it to manage freshwater aquatic life and wild animal life and their habitat to perpetuate a diversity of species with densities and distributions which provide sustained ecological, recreational, scientific, educational, aesthetic, and economic benefits.

Response: The project will have no effect on freshwater aquatic life or wild animal life.

12. Chapter 373, Water Resources.

This chapter provides the authority to regulate the withdrawal, diversion, storage, and consumption of water.

Response: This project does not involve water resources as described by this chapter.

13. Chapter 376, Pollutant Spill Prevention and Control.

This chapter regulates the transfer, storage, and transportation of pollutants and the cleanup of pollutant discharges.

Response: The contract specifications will prohibit the contractor from dumping oil, fuel, or hazardous wastes in the work area and will require that the contractor adopt safe and sanitary measures for the disposal of solid wastes. A spill prevention plan will be required.

14. Chapter 377, Oil and Gas Exploration and Production.

This chapter authorizes the regulation of all phases of exploration, drilling, and production of oil, gas, and other petroleum products.

Response: This project does not involve the exploration, drilling or production of gas, oil or petroleum product and therefore, this chapter does not apply.

15. Chapter 380, Environmental Land and Water Management.

This chapter establishes criteria and procedures to assure that local land development decisions consider the regional impact nature of proposed large-scale development.

Response: The proposed renourishment project will not have any regional impact on resources in the area. Therefore, the project is consistent with the goals of this chapter.

16. Chapter 388, Arthropod Control.

This chapter provides for a comprehensive approach for abatement or suppression of mosquitoes and other pest arthropods within the state.

Response: The project will not further the propagation of mosquitoes or other pest arthropods.

17. Chapter 403, Environmental Control.

This chapter authorizes the regulation of pollution of the air and waters of the state by the Florida Department of Environmental Regulation (now a part of the Florida Department of Environmental Protection).

Response: A Final Environmental Impact Statement addressing project impacts has been prepared and will be reviewed by the appropriate resource agencies including the Florida Department of Environmental Protection. Environmental protection measures will be implemented to ensure that no lasting adverse effects on water quality, air quality, or other environmental resources will occur. Water Quality Certification will be sought from the State prior to construction. The project complies with the intent of this chapter.

18. Chapter 582, Soil and Water Conservation.

This chapter establishes policy for the conservation of the state soil and water through the Department of Agriculture. Land use policies will be evaluated in terms of their tendency to cause or contribute to soil erosion or to conserve, develop, and utilize soil and water resources both onsite or in adjoining properties affected by the project. Particular attention will be given to projects on or near agricultural lands.

Response: The proposed project is not located near or on agricultural lands; therefore, this chapter does not apply.

APPENDIX C

U.S. FISH AND WILDLIFE SERVICE
FISH AND WILDLIFE COORDINATION ACT REPORT
AND ENDANGERED SPECIES ACT BIOLOGICAL OPINION

NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT REGIONAL BIOLOGICAL OPINION
FOR HOPPER DREDGING OF CHANNELS AND BEACH NOURISHMENT
ACTIVITIES IN THE SOUTHEASTERN UNITED STATES FROM
NORTH CAROLINA THROUGH FLORIDA EAST COAST

United States Department of the Interior

FISH AND WILDLIFE SERVICE
6620 Southpoint Drive, South
Suite 310
Jacksonville, Florida 32216-0912

IN REPLY REFER TO:

DEC 07 1995

A.J. Salem
Chief, Planning Division
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Salem:

In accordance with the Fiscal Year 1995 Transfer Fund Agreement between the Fish and Wildlife Service and the Jacksonville District Corps of Engineers, this letter transmits the Final Coordination Act Report and Biological Opinion on the proposed Brevard County Shore Protection Project, Brevard County, Florida.

Copies of the final are also being sent to the National Marine Fisheries Service, the Florida Department of Environmental Protection, Indian River Lagoon National Estuary Program, Florida Game and Freshwater Fish Commission, the Brevard County Environmental Division, Dr. L. Erhart (UCF), and Dr. W. Nelson (FIT).

If you have a question, please contact Deborah Manz in this office (904-232-2580).

Sincerely,

Michael M. Bentzien

Michael M. Bentzien
Assistant Field Supervisor

cc:
Brevard County
FDEP
FFFG
IREP
NMFS
Dr. L. Ehardt (UNF)
Dr. W. Nelson (FIT)
File (with pictures)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, Maryland 20910

Colonel James H. Simms, USA
Acting Commander
South Atlantic Division, Corps of Engineers
Room 313, 77 Forsyth St., S.W.
Atlanta, Georgia 30335-6801

AUG 25 1995

Dear Colonel Simms:

Enclosed is the biological opinion that concludes formal Endangered Species Act Section 7 consultation on hopper dredging of channels and beach nourishment activities in the southeastern United States from North Carolina through Florida East Coast. The National Marine Fisheries Service (NMFS) concurs with COE findings that dredging windows and further development of the rigid draghead deflector reduces the effects of hopper dredging on sea turtle species, while allowing dredging to continue. As you know, this consultation supersedes a previous regional opinion issued to the COE South Atlantic Division (SAD) on channel dredging in which NMFS found that continued hopper dredging activity in southeast channels along the Atlantic Coast was likely to jeopardize the continued existence of the Kemp's ridley sea turtle (November 25, 1991). The reasonable and prudent alternative issued with the 1991 opinion included the prohibition of hopper dredging in the Canaveral channel, seasonal restrictions which allowed hopper dredging from December through March in channels from North Carolina through Canaveral, or use of other dredges in all southeastern U.S. channels. Since the implementation of this alternative in the winter of 1991, only 14 takes of sea turtles, including three live turtles, have been documented on board hopper dredges in channels along the southeastern U.S. Atlantic Coast.

The Incidental Take Statement, reasonable and prudent measures, and conservation recommendations listed in the enclosed opinion have been discussed with the COE's SAD staff. Of note, hopper dredging windows are modified from the windows established in 1991 and observer requirements have been expanded to incorporate beach nourishment activities. The continued deployment of observers, and participation in the Right Whale Early Warning System, are also listed requirements within this biological opinion. Please note that the authorization for this incidental take expires August 5, 2000. In addition, consultation must be reinitiated when 75% of the authorized incidental take is reached.

Hopper dredging in Cape Canaveral, Florida is not considered under this consultation since turtle concentrations in Canaveral remain high year-round. Projects requiring the use of a hopper dredge in Canaveral will require further, project-specific, consultation.

Much of the new information considered in the enclosed opinion was the result of extensive research efforts recently concluded by COE in six southeast channels: Morehead City Harbor entrance channel, Charleston Harbor entrance channel, Savannah Harbor entrance channel, Brunswick Harbor entrance channel, Fernandina Harbor-St. Marys River entrance channel, and the Canaveral Harbor entrance channel. The results of this research support some modifications to previous seasonal restrictions for hopper dredging in these channels. Additionally, a draghead deflector has been developed that has shown promising results during preliminary tests and field application.

Through an extensive sea turtle research program and participation on the Right Whale Recovery Plan Implementation Team, the COE's SAD has become a leader among Federal action agencies in the southeast region in endangered species research and conservation. We look forward to continued cooperative efforts with your division.

Sincerely,

William W. Fox, Jr., Ph.D.
Director
Office of Protected Resources

Enclosure

cc: ACOE Charleston District, Col. George Hazel
Wilmington District, Col. Robert Sperperg
Savannah District, William Bailey
Jacksonville District, A. J. Salem
F/SE013 - Oravetz

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, Maryland 20910

Endangered Species Act - Section 7 Consultation

Biological Opinion

Agency: U.S. Army Corps of Engineers, South Atlantic Division

Activity: Hopper dredging of channels and beach nourishment activities in the Southeastern United States from North Carolina through Florida East Coast

Consultation Conducted By: National Marine Fisheries Service, Southeast Regional Office

Date Issued: August 25, 1995

BACKGROUND

The U.S. Army Corps of Engineers (COE) has primary responsibility for maintaining navigational channels in U.S. waters. To accomplish this task, dredging is periodically required. A variety of dredge types and techniques are employed on a channel-specific basis, dependent upon the characteristics of channels, availability of disposal sites, local environmental regulations, types of material to be removed, proposed timing of the dredging, etc. In the southeastern United States, at least three types of dredges (hopper dredges, clamshell dredges, and pipeline dredges) are commonly used.

In addition, Congress has mandated that the COE provide periodic beach nourishment to certain beaches in the southeastern U.S. that suffer severe erosion rates. Nourishment activities consist of dredging coarse high-quality sand from offshore borrow areas then pumping the material onshore.

A formal consultation conducted on dredging and beach nourishment operations from North Carolina through Cape Canaveral, Florida, in 1991, and incorporated by reference, concluded that clamshell and pipeline dredges were not likely to adversely affect listed species. There is no new information to change the basis for

that finding. Lethal takes of sea turtles by hopper dredges have been documented, however, and consultations on takes have been conducted since 1980.

Previous Consultations

Consultation on the effects of hopper dredging in the Canaveral ship channel was initiated in August 1978, after NMFS trawl surveys verified reports of high turtle abundance in the channel. On March 30, 1979, NMFS issued a biological opinion based on a threshold examination of the situation. This opinion concluded that insufficient information existed to determine whether or not dredging was likely to jeopardize the continued existence of sea turtles. Through agreement with the COE and the U.S. Navy, trawl surveys were implemented to further assess turtle abundance and distribution in the channel.

On January 22, 1980, the National Marine Fisheries Service (NMFS) issued a biological opinion concluding that "dredging may result in the loss of large numbers of loggerhead sea turtles but is not likely to result in jeopardizing either the loggerhead or Atlantic ridley sea turtle stocks." This opinion recommended that NMFS-approved observers be placed aboard hopper dredges in the Canaveral channel to monitor turtle take, and that dredging be restricted to the period of August 1 through November 1. No evidence of turtle take by hopper dredges existed at this point, but the potential for take was recognized.

A total of 71 turtle takes by hopper dredges were documented in the Canaveral channel over the period of July 11 through November 13, 1980. These takes were considered minimum estimates of mortality due to restrictions inherent in observing turtles within the dredged material. From 1980 through 1986, NMFS, the COE, and the U.S. Navy continued efforts to reduce or eliminate turtle take by hopper dredges in the Canaveral entrance channel. Efforts included attempts to scare turtles out of the channel, detect and capture turtles, remove and relocate turtles, and deflect turtles from the draghead. No acceptable means of eliminating the take of sea turtles by hopper dredges was identified, and take of sea turtles continued.

Trawl surveys of five east coast channels, conducted during 1981 and 1982 (Butler et al., 1987), indicated that these channels did

not contain sea turtles at abundances approaching those observed in Canaveral. One or two turtles were collected in each of the surveyed channels, while hundreds were caught in the Canaveral channel. Because NMFS had no information to suggest that turtle takes in other channels was significant, additional channel surveys were not required, and the Canaveral hopper dredging project was treated as a unique problem.

In 1986, the U.S. Navy reinitiated Endangered Species Act (ESA) Section 7 consultation on Kings Bay, Georgia, channel dredging. The scope of the project involved widening and deepening existing channels and extension of the channel approximately 14 miles. The Navy proposed to implement sea turtle conservation measures including observer coverage, screening of the dredge, and a stand-by trawler to catch and remove turtles, if necessary. From July 1987 through December 1989, a total of 21 turtles were taken during hopper dredging operations in the Kings Bay project.

Turtle take by hopper dredges in Kings Bay resulted in major changes in NMFS policy on channel dredging. This was the first documented take of turtles by hopper dredges anywhere other than in the Canaveral channel. Additionally, while takes in Canaveral were confined to loggerhead turtles, Kings Bay takes included three endangered Kemp's ridley turtles and three endangered green turtles. NMFS began to consider the additive consequences of hopper dredging along the southeast coast.

The Jacksonville District COE and the COE Waterways Experiment Station jointly sponsored a May 11-12, 1988, "National Workshop on Methods to Minimize Dredging Impacts on Sea Turtles," held in Jacksonville, Florida. This workshop brought together representatives of the COE, NMFS, the U.S. Navy, the dredging industry and the environmental community to discuss the dredging/sea turtle conflict. In a July 8, 1988, letter from the Assistant Administrator for Fisheries to the Acting Commander of the COE, NMFS applauded the COE efforts in sponsoring the workshop and advised the COE of agency plans to assess the cumulative impacts to sea turtles of dredging in channels other than Canaveral. Formal consultation was requested for all areas in which hopper dredging was proposed, and observers were required on 25-100 percent of all hopper dredging activities in Brunswick, Savannah, and Wilmington Harbor dredging projects.

Consultation was reinitiated in 1991 in response to the high levels of turtle takes observed, as well as nearby strandings of crushed turtles, during hopper dredging in Brunswick and Savannah channels. The biological opinion, issued November 25, 1991, found that continued unrestricted hopper dredging in channels along the southeast region's Atlantic coast could jeopardize the continued existence of listed sea turtles. A reasonable and prudent alternative was given which included the prohibition of hopper dredging in the Canaveral channel, seasonal restrictions which allowed hopper dredging from December through March in channels from North Carolina through Canaveral, or use of alternative dredges in all southeastern U.S. channels.

The reasonable and prudent alternative issued in the 1991 biological opinion has proven very effective in reducing sea turtle captures. Since the implementation of the measures of the 1991 biological opinion, only 14 takes of sea turtles, includfng three live turtles, have been documented on board hopper dredges in channels along the southeastern U.S. Atlantic coast.

The COE has recently concluded extensive research in six southeast channels: Morehead City Harbor entrance channel, Charleston Harbor entrance channel, Savannah Harbor entrance channel, Brunswick Harbor entrance channel, Fernandina Harbor - St. Marys River entrance channel, and the Canaveral Harbor entrance channel. Seasonal restrictions were supported by the research; however, refinements in the restrictions due to new, more precise information were requested in the COE request for a new consultation, dated November 8, 1994. Additionally, a draghead deflector has been developed that has shown promising results in preliminary tests.

PROPOSED ACTIVITY

This consultation addresses COE channel dredging activities along the southeastern Atlantic seaboard from North Carolina through Key West, Florida (see Figure 1 from COE's Biological Assessment submitted November 8, 1994). This includes maintenance dredging, new construction dredging, and beach nourishment activities. A summary of major channel dredging projects in which hopper dredges are normally used include: Oregon Inlet, Morehead City, and Wilmington Harbor in North Carolina; Charleston and Port

Royal in South Carolina; Savannah, Brunswick, and Fernandina-St. Marys in Georgia (King's Bay); Jacksonville, St. Augustine, Ponce Inlet, Canaveral, West Palm Beach, and Miami in Florida.

Information on the timing and amount of materials removed during past hopper dredging projects in these channels was provided in the Biological Assessment (COE, November 8, 1994). Generally, the COE has asked that channel hopper dredging windows specified in the 1991 biological opinion be modified from no hopper dredging in Canaveral and dredging in other regional channels from December through March to:

HOPPER DREDGING IN SOUTH ATLANTIC DIVISION		
LOCATION	HOPPER DREDGING WINDOW[1]	INCIDENTAL TAKE MONITORING[2]
North Carolina to Pawles Island, S.C.	Year Round	1 May - 1 Nov
Pawles Island, S.C. to Tybee Island, Ga.	1 Nov - 31 May	1 Nov - 1 Jan 1 Apr - 31 May
Tybee Island, Ga. to Titusville, Fla.	15 Dec - 1 May	15 Dec - 1 Jan 15 Mar - 1 May
Titusville, Fla. to Key West, Fla.	Year Round[3]	Year Round

1 Applies to all hopper dredging along South Atlantic Coast. Use of sea turtle deflecting draghead is required unless waiver is granted by CESAD.

2 For navigation projects this requires inflow screens and NMFS approved observers. For beach nourishment projects this can be accomplished by either monitoring the beach or use of observers and screens on the hopper dredge.

3 Use of hopper dredging at Canaveral Navigation Channel will be restricted to those times when there is an urgent need for this type of equipment.

During a meeting between the COE and NMFS in February 1995, it was determined that the impacts of beach nourishment activities along the southeastern U.S. Atlantic coast should also be considered in this biological opinion. Therefore, projects being considered in this consultation include those listed in the Biological Assessment submitted on November 8, 1994, as well as channels south of Canaveral, and beach nourishment activities along the southeastern U.S. Atlantic coast in which hopper dredges may be used. Specific projects which have been considered in ongoing consultations include: Palm Beach Harbor maintenance dredging; the Fort Pierce Harbor entrance channel and turning basin; and the Dade County Beach Erosion Control Project at the northern end of Sunny Isles.

LISTED SPECIES AND CRITICAL HABITAT

Listed species under the jurisdiction of the NMFS that may occur in channels along the southeastern United States and which may be affected by dredging include:

THREATENED:
(1) the threatened loggerhead turtle - *Caretta caretta*

ENDANGERED:
(1) the endangered right whale - *Eubalaena glacialis*
(2) the humpback whale - *Megaptera novaeangliae*
(3) the endangered/threatened green turtle - *Chelonia mydas*
(4) the endangered Kemp's ridley turtle - *Lepidochelys kempii*
(5) the endangered hawksbill turtle - *Eretmochelys imbricata*
(6) the endangered shortnose sturgeon - *Acipenserbrevirostrum*

Green turtles in U.S. waters are listed as threatened, except for the Florida breeding population which is listed as endangered.

Information on the biology and distribution of these species was given in the 1991 biological opinion, and is incorporated by reference. Channel-specific information has been collected by COE for channels at Morehead City, Charleston, Savannah, Brunswick, Fernandina and Canaveral, and is presented in detail in the COE summary report entitled "Assessment of Sea Turtle

Abundance in Six South Atlantic US Channels" (Dickerson et al., 1994) and in the COE Biological Assessment. New information is included below.

Additional endangered species which are known to occur along the Atlantic coast include the finback (Balaenoptera physalus), the sei (Balaenoptera borealis), and sperm (Physeter macrocephalus) whales and the leatherback sea turtle (Dermochelys coriacea). NMFS has determined that these species are unlikely to be adversely affected by hopper dredging activities.

PROPOSED, THREATENED:
(1) Johnson's seagrass - Halophila johnsonii

According to federal regulations (50 CFR Section 402.10), a conference is required if a planned federal action is likely to jeopardize the continued existence of a proposed species. At this time, NMFS is unable to make a determination on the collective effects of hopper dredging in and adjacent to channels in which Johnson's seagrass occurs. The COE should develop estimates of annual take of seagrass anticipated by projects within Florida's intracoastal waterways within Johnson's seagrass habitat. Consideration of impacts to H. johnsonii should continue on a project-by-project basis until collective impacts have been estimated and/or listing has been finalized.

ASSESSMENT OF IMPACTS

Sturgeon

Table 1, taken from the February 6, 1995 draft Shortnose Sturgeon Recovery Plan (NMFS, 1995), gives the current, best available information on the distribution and abundance of shortnose sturgeon. South of the Chesapeake Bay, there is inadequate information to estimate the shortnose sturgeon population size in most rivers. Low abundance estimates have been made for the Ogeechee and Altamaha rivers.

Generally in southern rivers, adult sturgeon remain in estuaries and at the interface of salt and freshwater until late winter, when they move upriver to spawn. Embryos produced tend to remain

in areas of irregular bottom, where they appear to seek cover. Juveniles, like adults, occur primarily at the interface between salt and freshwater. Recent observations suggest that salinity levels greater then seven ppt are harmful (Smith et al., 1992). In the Savannah River, shortnose sturgeon are found over sand/mud substrate in 10-14 m. depths (Hall et al., 1991). Spawning occurs in upstream channels of the Savannah, where the substrate consists of gravel, sand and logs (Hall et al., 1991). Shortnose sturgeon feed on crustaceans, insect larvae, and molluscs (NMFS, 1995).

Impacts of hopper dredging on sturgeon

NMFS believes that shortnose sturgeon may be adversely affected by hopper dredging within some channels and seasons. While endangered species observers on hopper dredges have documented the take of Atlantic sturgeon, no take of a shortnose sturgeon has been observed. Sturgeon may be encountered in channels north of Pawles Island, South Carolina, where dredging may be conducted year-round. Winter windows south of Pawles, however, will reduce the period in which shortnose sturgeon may be impinged. Adult sturgeon may occur in estuarine and tidal waters until February, when they migrate upstream to spawn. Salinity ranges favorable to adults and juveniles can exist in inner harbors during fall months. Use of the rigid draghead deflector developed to reduce the likelihood of incidental take of sea turtles by hopper dredges may also reduce the take of shortnose sturgeon. The impacts on small juveniles, larvae, and eggs, by other suction dredge types used upriver, will be considered on a case-by-case basis.

In addition to the possibility of a direct take of sturgeon, maintenance dredging by all dredge types has likely reduced foraging areas within dredged channels, since inter-dredging periods may be too brief to allow forage species to re-establish. Current primary foraging habitat is thought to occur outside of dredged channels.

Shortnose sturgeon are not likely to be affected by beach nourishment activities.

Sea Turtles

Precise data regarding the total number of sea turtles in waters of the southeastern U.S. Atlantic are not available. Trends in turtle populations are identified through monitoring of their most accessible life stages on the nesting beaches, where hatchling production and the number of nesting females can be directly measured. Figures 2 through 4 illustrate loggerhead, green and Kemp's ridley nesting trends at regularly monitored nesting beaches.

Index nesting beaches on which data collection methods and effort were standardized were established in Florida in 1989. Over 90 percent of all U.S. loggerhead nests occur in Florida, and over 80 percent of these are within indexed beaches (B. Schroeder, pers comm). During the six years monitored in this standardized manner, illustrated in Figure 2, loggerhead nesting appears to be stable. All green turtle nests in the United States occur in Florida, and most occur on index beaches. The pattern of green turtle nesting shows biennial peaks in abundance, with a generally positive trend during the six years of regular monitoring (Figure 3).

The abundance of ridleys nests in Rancho Nuevo, Mexico, have been increasing since 1987 (Figure 4). Over 1500 nests were observed during the 1994 nesting season, representing the highest nesting year since monitoring was initiated in 1978. While these data need to be interpreted cautiously due to expanded monitoring efforts since 1990, up to 110,000 hatchlings were released from Rancho Nuevo during 1994, compared to 50,000 to 80,000 over the previous five to six years (Byles, pers comm).

Stranding data are generally believed to reflect the nearshore distribution of sea turtles (Figure 5). The use of turtle excluder devices (TEDs) in shrimp trawls is likely responsible for the sharp decrease in strandings after 1990 through a reduction in mortality resulting from incidental capture in shrimp trawls. While TEDs were required seasonally in most areas during much of 1990, compliance was poor until 1991. Since 1991, documented strandings of loggerheads were steady, while green turtle strandings increased in 1994 and ridleys in 1993 and 1994. Factors that may be affecting the distribution and abundance of sea turtles and turtle mortalities (ie. the distribution of

strandings) include: vessel activity, fishery operations, and environmental factors such as storms, temperature changes, and eutrophication events.

The data suggest that green and Kemp's ridley turtle populations may be rising. While this supports cautious optimism, the numbers are well below recovery criteria established in the recovery plans.

Impacts of hopper dredging on sea turtles

Channels

NMFS believes that hopper dredging activities in the southeastern United States may adversely affect the endangered Kemp's ridley and Florida green turtles and the threatened loggerhead turtle. While hawksbill turtles likely occur infrequently in ship channels, they may be present during beach nourishment activities in areas near or between hard-bottom reefs.

Past maintenance dredging in the southeastern United States has been demonstrated to adversely affect sea turtles. The biological opinion issued in 1991 in response to the high levels of turtle takes observed, as well as nearby strandings of crushed turtles during hopper dredging in Brunswick and Savannah channels, concluded that continued unrestricted hopper dredging in channels along the southeast region's Atlantic coast could jeopardize the continued existence of listed sea turtles. Takes of 225 sea turtles had been documented since 1980 in southeast channels, including 22 turtles that were alive when found. The COE's strict adherence to the measures included in the 1991 biological opinion, including a prohibition of hopper dredging in Canaveral and seasonal restrictions on hopper dredging from North Carolina through the Canaveral ship channel, has greatly reduced the rate of sea turtle takes by hopper dredges. Only 14 sea turtle takes have been documented in hopper dredges since 1991, including three turtles that were alive when collected.

The COE conducted a comprehensive research program, beginning in 1991, to investigate the occurrence of sea turtles in six southeast channels to determine seasonal abundance, as well as spatial distribution within the channel and within the water column. Monthly surveys were conducted in Canaveral, Kings Bay, Brunswick, Savannah, Charleston, and Morehead City channels. The

Canaveral surveys supplement surveys conducted by NMFS and the COE since 1978.

Briefly, the surveys found the following: In areas where sea turtles occur, moderate to high abundance can be expected when water temperature is greater than or equal to 21 degrees C. Lower abundances were observed when temperatures were less than 16 degrees C. Other workers have observed sea turtles in waters as low as 8 degrees C, sometimes for extended periods (Morreale, pers comm 1993). Loggerheads, primarily adults, were the most abundant turtle captured (n = 645), although some Kemp's ridleys (n = 20) and green turtles (n = 5) were also taken. Juveniles of all species were observed, although only a few juvenile loggerheads were encountered in Canaveral. As documented in previous surveys, the Canaveral ship channel supports aggregations of sea turtles during all months of the year and, particularly during cooler winter months (Henwood, 1987; Butler et al., 1987; Henwood and Ogren, 1987). North of Canaveral, turtles were seasonally abundant, with lower numbers from December through February. Recaptures of relocated sea turtles suggest some site fidelity, and the effectiveness of relocation efforts appeared to be related to the distance of relocation. Catch per unit effort (CPUE) in the surveyed channels, for all seasons cumulatively, was: Canaveral, 1.43 turtles per hour; Kings Bay, 0.571 turtles per hour; Brunswick Harbor, 0.489 turtles per hour; Charleston Harbor, 0.206 turtles per hour; and Morehead City Harbor, 0.025 turtles per hour.

As a result of observed CPUE, which were generally lower during cool water periods in the northern channels, the COE has asked NMFS to relax dredging windows to allow year-round dredging north of Pawles Island, South Carolina (which includes the ship channels at Oregon Inlet, Morehead City and Wilmington), and between November and May 31 from Tybee Island, Georgia through Pawles Island (including Charleston, Port Royal and Savannah channels). In recent years, the COE SAD has shown a willingness to cease dredging in channels in which take rates exceed those anticipated, despite the fact that the incidental take level was not approached. Given the COE's conservative record in these channels, and the great reduction in takes observed under current dredging windows, NMFS concurs that some expansion of hopper dredging windows, with requirements for observers and use of the rigid draghead deflector, may result in sea turtle takes, but is

not likely to jeopardize the continued existence of any sea turtle species.

Beach Nourishment Activities

There has been increasing concern regarding the effects of hopper dredging during beach nourishment activities along the southeastern U.S. coast. Anecdotal accounts from divers and biologists suggest that sea turtles may use offshore fine sediment bottoms, as well as areas adjacent to hard bottom reefs, as internesting habitat. Limited observations have noted that at times of extreme drops in temperature, turtles have been observed buried in fine silt covering area reefs, either after beach nourishment or extreme freshwater runoff. Over 174 sea turtles have been observed on the sea surface during 16 right whale aerial surveys conducted between February 27 and March 19, 1995 along line transects within approximately 10 nm of the borrow area off of Jacksonville, Florida, suggesting an abundance of sea turtles in the vicinity of the borrow area. These turtles may be taken by hopper dredges. There has been no documented take of sea turtles during past beach nourishment activities at the borrow areas. However, due to potential impact, one hundred percent observer coverage is necessary for beach nourishment activities during the periods identified on the table. This observer coverage may be subsequently altered upon authorization from NMFS.

NMFS remains concerned that nearshore reefs, which provide foraging habitat and shelter for sea turtles, can be impacted by turbidity caused by dredging. While hopper dredges produce less turbidity than other dredge types, water quality impacts are still likely. State monitoring requirements do not relate directly to light restrictions caused by dredging, which has been shown to impact these ecosystems. Direct mechanical damage to hard bottom reefs, which may also be important turtle habitats, has also been documented (Draft Environmental Assessment prepared for the Second Periodic Nourishment of the Sunny Islands and Miami Beach Segments, Beach Erosion Control and Hurricane Protection Project, Dade County, Florida, January, 1995). The COE has proposed 1:1 mitigation of hard bottom habitat; however, replacement of biological material lost cannot be mitigated. Preventative steps should be identified within dredging contracts for borrow areas near hard-bottom reefs.

Rigid Draghead Deflector

Included within the COE's comprehensive research program, initiated in 1991, was a program to develop a mechanical solution to reduce the take of sea turtles at the dredge draghead. The COE SAD and the Waterways Experiment Station (WES) developed a rigid deflector for attachment to the draghead. This rigid draghead deflector has shown promising results during preliminary tests. The rigid device, similar in principal to the cow catchers developed for trains, is designed to deflect sea turtles encountered during hopper dredging activities. When deployed with mock turtles, the deflector draghead effectively avoided taking 95 percent of the models. According to the terms and conditions of the Incidental Take Statement issued for the 1991 biological opinion, testing of the effectiveness of the rigid deflector draghead in a channel where sea turtles occur present was necessary. NMFS recommended that the COE evaluate the new draghead in September in the Canaveral shipping channel, when juvenile turtles are present, but adults and gravid females are scarce. A supplementary biological opinion regarding the impacts of dredging using the deflector draghead in the Cape Canaveral channel for up to 15 days between September 14 and October 14, 1994 was issued in September 1994.

Although trawl sampling indicates that sea turtles were present in Canaveral at levels observed in previous years, only one sea turtle, a live green turtle, was observed entrained by the dredge. Twenty-one surface sightings of sea turtles were made in the channel, transit area, and at the disposal site. These results supported the mock turtle trials. However, despite the use of the rigid draghead deflector, two green turtle entrainments were documented in the Palm Beach Harbor entrance channel. Takes by a hopper dredge equipped with the deflector were also documented in Brazos Pass, in the Gulf of Mexico. NMFS believes that instruction of private dredge contractors is necessary to improve the performance of the rigid deflector draghead. Additionally, the effectiveness of the draghead may be dependent on the ability of the dredge operator to keep the dredging pumps disengaged when the dragheads are not firmly on the bottom to prevent impingement of sea turtles within the water column. Lastly, flexibility at the draghead is reportedly needed to improve the performance and ease of operation of this mechanical device. Additional assessment and development appears to be needed before the rigid draghead deflector can replace

seasonal restrictions as a method of reducing sea turtle captures during hopper dredging activities.

Whales

Right whale

The nearshore waters of northeast Florida and southern Georgia were formally designated as critical habitat for right whales on June 3, 1994 (28793). These waters were first identified as a likely calving and nursery area for right whales in 1984. Since that time, Kraus et al. (1993) have documented the occurrence of 74 percent of all the known mature females from the North Atlantic population in this area. While sightings off Georgia and Florida include primarily adult females and calves, juveniles have also been observed.

Twenty percent of all right whale mortalities observed between 1970 and 1989 were caused by vessel collisions/interactions with right whales. Seven percent of the population exhibit scars indicative of additional, non-lethal vessel interactions (Kraus, 1990). As a result of the potential for interactions between hopper dredges and right whales, the 1991 biological opinion required observers on board dredges operating from December through March in Georgia and northern Florida to maintain surveys for the occurrence of right whales during transit between channels and disposal areas. Continuation of aerial surveys, which had been instituted in Kings Bay, Georgia, was also required. Since January 1994, aerial surveys funded by the COE in association with dredge activities in the southeast have been amplified through the implementation of the right whale early warning surveys. These surveys, funded by COE, as well as the Navy and Coast Guard, are conducted to identify the occurrence and distribution of right whales in the vicinity of ship channels in the winter breeding area, and to notify nearby vessel operators of whales in their path. The COE has been instrumental in NMFS' communications with other federal action agencies regarding the importance of pro-active protection of right whales through a cooperative recovery plan implementation team.

Whales observed on aerial and shipboard surveys are individually identified and counted, cow/calf pairs are recorded, and the movements and distribution of the whales are noted. Dredge speeds are reduced to five knots or less during evening hours or

periods of low visibility for 24 hours after sightings of right whales within 10 nm of the channel or disposal areas.

Data collected during these surveys suggest that right whales are observed off Savannah, Georgia, in December and March, and are relatively abundant between Brunswick, Georgia, south to Cape Canaveral from December through March. During early 1995, a right whale was also observed by shipboard observers off Morehead City, North Carolina (1/10/95, probable right whale).

Humpback whale

Humpback whales occur in waters under U.S. jurisdiction throughout the year. Migrations occur annually between their summer and winter ranges. The summer range for the Western North Atlantic stock includes the Gulf of Maine, Canadian Maritimes, western Greenland, and the Denmark Strait. All humpback whales feed while on the summer range.

The primary winter range includes the Lesser Antilles, the Virgin Islands, Puerto Rico, and the Dominican Republic (NMFS, 1991). In general, it is believed that calving and copulation take place on the winter range. Calves are born from December through March and are about 4 meters at birth. Sexually mature females give birth approximately every two to three years. Sexual maturity is reached between 4 and 6 years of age for females and between 7 and 15 years of age for males. Size at maturity is about 12 meters.

Until recently, humpback whales in the mid- and south Atlantic were considered transients. Few were seen during aerial surveys conducted over a decade ago (Shoop et al., 1982). However, since 1989, sightings of feeding juvenile humpbacks have increased along the coast of Virginia and North Carolina, peaking during the months of January through March in 1991 and 1992 (Swingle et al., 1993). Studies conducted by the Virginia Marine Science Museum (VMSM) indicate that these whales are feeding on, among other things, bay anchovies and menhaden. Researchers theorize that juvenile humpback whales, which are unconstrained by breeding requirements that result in the migration of adults to relatively barren Caribbean waters, may be establishing a winter foraging area in the mid-Atlantic (Mayo, pers comm, 1993). The lack of sightings south of the VMSM study area is a function of

shipboard sighting effort, which was restricted to waters surrounding Virginia Beach, Virginia.

In concert with the increase in whale sightings, strandings of humpback whales have increased between New Jersey and Florida since 1985. Strandings were most frequent during the months of September through April in North Carolina and Virginia waters, and were composed primarily of juvenile humpback whales of no more then 11 meters in length (Wiley et al., 1995). Of the 18 humpbacks for which the cause of mortality was determined, 6 (33 percent) were killed by vessel strikes. An additional humpback had scars and bone fractures indicative of a previous vessel strike that may have contributed to its mortality.

Shipboard observations conducted during daylight hours during dredging activities in the Morehead City Harbor entrance channel during January and February 1995 documented sightings of young humpback whales on at least six days near the channel and disposal area, until the last sighting on January 22, 1995. Three humpback strandings were documented in North Carolina, one each in February, March, and April, suggesting that humpback whales remained within waters of the South Atlantic Division through April.

Impacts of hopper dredging on whales

Hopper dredging may adversely affect right and humpback whales, which occur during winter months in the vicinity of dredging projects within the SAD. While dredging itself is not likely to be a problem, the transit of hopper dredges between borrow, channel, and disposal areas is likely to result in increased vessel traffic in the vicinity of humpback and right whales, especially within right whale critical habitat. As discussed above, ship strikes are one of the primary human-caused sources of mortality for both humpback and right whales, and increased vessel traffic may increase the likelihood of whale/vessel interactions. Although whales have been observed in areas of dredge operations, as discussed below, there have been no documented collisions between dredges and whales.

Observers on dredges have documented close approaches between whales and dredges. On February 6, 1988, a right whale reacted to the approach of a hopper dredge within 100 yards by orienting

itself toward the vessel in a defensive profile. On February 28, 1988, during clamshell dredging of Canaveral channel, a right whale remained in the Canaveral channel for a period of about 10 minutes. Fortunately, this took place during daylight hours and when no vessels were transiting the channel. On January 12, 1995, a humpback whale was observed within a quarter of a mile of the dredge at Wilmington channel and resurfaced near the dredge. An approaching humpback on January 13, 1995 was observed ahead of the dredge initially, but resurfaced near the stern after the vessel slowed. Dredging was stopped while the whale, and two other humpbacks nearby, approached within 100 yards, including one passage under the bow. On January 18, still within the Wilmington Harbor channel dredging area, one of a few humpbacks observed feeding surfaced and quickly dove again within 10 meters of the dredge.

NMFS believes that the cooperation of the dredge operators with endangered species observers greatly reduces the chance of whale/dredge interactions. Additional precautions that reduce the likelihood of dredge collisions with endangered whales include: aerial surveys conducted in right whale critical habitat during the breeding season, the adoption by dredge operators of necessary precautions when whales are sighted, and reduction in dredge speed during evening hours or days of limited visibility when whales have been spotted within the previous 24 hours.

CONCLUSIONS

NMFS concludes that endangered and threatened sea turtles, including the threatened loggerhead (*Caretta caretta*), and endangered Kemp's ridley (*Lepidochelys kempii*), green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*) sea turtles, may be adversely affected by hopper dredging of channels and during beach nourishment activities along the U.S. southeast Atlantic coast, but are not likely to be jeopardized under the terms and conditions of the attached Incidental Take Statement. Shortnose sturgeon (*Acipenser brevirostrum*) may be adversely affected by hopper dredging of channels, but are not likely to be jeopardized in rivers of the Southeast Region. Right whales (*Eubalaena glacialis*) and humpbacks (*Megaptera novaengliae*) also may be adversely affected due to increased vessel traffic, but severe

impacts can be avoided through continued cooperation between dredge operators and endangered species observers during the seasons whales may occur in the project area.

CONSERVATION RECOMMENDATIONS

Pursuant to section 7(a)(1) of the ESA, the following conservation recommendations are made to assist the COE in reducing/eliminating adverse impacts to loggerhead, green, and Kemp's ridley turtles that result from hopper dredging in the southeastern United States. Many of these recommendations have been discussed and agreed upon at the recent COE/NMFS meeting in St. Petersburg, Florida.

1. The COE should continue to investigate possible modifications to existing dredges which might reduce or eliminate the take of sea turtles. The effectiveness of the rigid draghead deflectors should continue to be evaluated.

2. Spring and fall surveys are necessary in the Canaveral shipping channel to identify sea turtle temporal and spatial movement patterns if hopper dredging will be needed regularly for the Canaveral channel in the future. Telemetry using depth recorders may be needed to obtain information on water column use.

3. Spatial distribution of sea turtles taken in COE trawl surveys of southeast ship channels appeared to be non-random. Additional investigation into the characteristics of "preferred" sites may provide information to expand dredging windows in channel areas adjacent to these areas of greater abundance.

4. The COE should provide NMFS with a list of inshore and offshore borrow areas along the southeastern U.S. Atlantic in which hopper dredges are likely to be used. Frequency of anticipated beach nourishment activities should be identified as accurately as possible.

5. The COE should summarize information regarding borrow areas in which hopper dredges may be deployed. Information regarding the biological resources found at each borrow area

should be listed to identify the possible suitability of the area for foraging sea turtles.

6. The COE should evaluate the collective impact of all dredging projects within the Florida intracoastal waterways on Johnson's seagrass. A summary of anticipated projects and estimates of annual seagrass take levels should be developed to allow NMFS to provide a comprehensive conference or consultation.

7. NMFS, based on the recommendations of Griffen (1974), has recommended water column sediment load deposition rates of no more then 200 $mg/cm^2/day$, averaged over a seven day period to protect coral reefs and hard bottom communities, rather than use of only state standards.

INCIDENTAL TAKE STATEMENT

Section 7(b)(4) of the Endangered Species Act (ESA) requires that when a proposed agency action is found to be consistent with section 7(a)(2) of the ESA, and the proposed action may incidentally take individuals of listed species, NMFS will issue a statement that specifies the impact of any incidental taking of endangered or threatened species. It also states that reasonable and prudent measures, and terms and conditions to implement the measures, be provided that are necessary to minimize such impacts. Only incidental taking resulting from the agency action, including incidental takings caused by activities approved by the agency, that are identified in this statement and that comply with the specified reasonable and prudent measures, and terms and conditions, are exempt from the takings prohibition of section 9(a), pursuant to section 7 of the ESA.

Based on results of previous hopper dredging activities in southeastern U.S. channels, new information regarding Kemp's ridley and green sea turtle abundance, and expanded dredging windows and appended monitoring of beach nourishment activities in the South Atlantic Division, NMFS anticipates that future hopper dredging activities may result in the injury or mortality of loggerhead, Kemp's ridley, green, and hawksbill turtles. Therefore, a low level of incidental take, and terms and conditions necessary to minimize and monitor takes, is established. The documented incidental take, by injury or mortality, of seven (7) Kemp's ridleys, seven (7) green turtles, two (2) hawksbills, twenty (20) loggerhead turtles, and five (5) shortnose sturgeon is set pursuant to section 7(b)(4) of the ESA. This take level represents the total authorized take per year for hopper dredging in the Atlantic projects of the South Atlantic Division (SAD).

To ensure that the specified levels of take are not exceeded early in any project, the COE should reinitiate consultation for any project in which more than one turtle is taken in any day, or once five or more turtles are taken. The Southeast Region, NMFS, will cooperate with the COE in the review of such incidents to determine the need for developing further mitigation measures or to terminate the remaining dredging activity. Formal consultation must be reinitiated when 75% of the authorized incidental take is reached. The authorization for these incidental takes expires on August 31, 2000.

Section 7(b)(4)(c) of the ESA specifies that in order to provide an incidental take statement for an endangered or threatened species of marine mammal, the taking must be authorized under section 101(a)(5) of the Marine Mammal Protection Act of 1972 (MMPA). Since no incidental take in the Atlantic Region has been authorized under section 101(a)(5) of the MMPA, no statement on incidental take of listed right whales is provided.

The reasonable and prudent measures that NMFS believes are necessary to minimize the impact of hopper dredging in the southeastern United States have been discussed with the COE. The following terms and conditions are established to implement these measures and to document the incidental take should such take occur. It is anticipated that beach nourishment will not occur year-round, due to environmental protections instituted by other agencies.

1. Regular maintenance activity in Canaveral Harbor shall not be conducted with a hopper dredge. A hopper dredge should be considered only under emergency conditions when no other type of dredge can be used to remove hazardous shoaling in an expedited timeframe. Separate, specific Section 7 consultations must be conducted for all dredging activities in the Canaveral ship channel that may require the use of a hopper dredge. These consultations will be accelerated if warranted by emergency conditions.

2. One hundred percent inflow screening is required, and 100 percent overflow screening is recommended when sea turtle observers are required on hopper dredges in areas and seasons in which sea turtles may be present (see table below). If conditions disallow 100 percent inflow screening, inflow screening can be reduced but 100 percent overflow screening is required, and an explanation must be included in the preliminary dredging report (see 6, below).

3. The sea turtle deflecting draghead is required for all hopper dredging during the months that turtles may be present, unless a waiver is granted by the COE SAD in consultation with NMFS.

4. Beach observers cannot be used in place of shipboard observers for hopper dredging of borrow areas unless the COE

can demonstrate that the volume of sand deposited on beaches will not preclude observation and identification of turtles or turtle parts.

5. To prevent impingement of sea turtles within the water column, every effort should be made to keep the dredge pumps disengaged when the dragheads are not firmly on the bottom.

6. Reporting: A preliminary report summarizing the results of the dredging and the sea turtle take must be submitted to the COE and NMFS within 30 working days of completion of any given dredging project. An annual report (based on either calendar or fiscal year) must be submitted to NMFS summarizing hopper dredging projects, documented sea turtle and sturgeon incidental takes, and whale sightings.

7. The COE's continued participation in the Right Whale Early Warning System is necessary. Dredging within right whale critical habitat from December through March must follow the protocol established within the Early Warning System.

8. NMFS requires monitoring by endangered species observers with at-sea large whale identification experience to conduct daytime observations for whales between December 1 and March 31, when humpback and right whales occur in the vicinity of channels and borrow areas, north of Cape Canaveral. Monitoring will be 100% for the first year of the biological opinion, unless subsequently altered upon authorization from NMFS. During daylight hours, the dredge operator must take necessary precautions to avoid whales. During evening hours or when there is limited visibility due to fog or sea states of greater than Beaufort 3, the dredge must slow down to 5 knots or less when transitting between areas if whales have been spotted within 15 nm of the vessel's path within the previous 24 hours. South of Cape Canaveral, surveys for whales should be conducted by endangered species observers during the intervals between dredge spoil monitoring.

9. The seasonal observer requirements under these terms and conditions are listed on the following table. North of the St. Johns River, in Florida, endangered species observers on hopper dredges within nearshore and riverine areas must also monitor for shortnose sturgeon impingements.

RESTRICTIONS AND MONITORING REQUIREMENTS FOR HOPPER DREDGING ACTIVITIES IN THE ATLANTIC WATERS OF THE COE SOUTH ATLANTIC DIVISION

AREA	WHALE MONITORING for beach nourishment, navigation channels, and transit	SEA TURTLE MONITORING: NAVIGATION CHANNELS		SEA TURTLE MONITORING: BEACH NOURISHMENT ACTIVITIES	
		WINDOWS	MONITORING	WINDOWS	MONITORING[1]
North Carolina to Pawles Island, SC (includes channels at Oregon Inlet, Morehead City and Wilmington)	100% dedicated daytime whale observer coverage between 1 Dec and 31 Mar. Monitoring by sea turtle observer between 1 Apr and 30 Nov.	Year Round	100% observer monitoring from 1 Apr - 30 Nov	Year Round	100% observer monitoring from 1 Apr - 30 Nov
Pawles Island, SC to Tybee Island, GA (includes channels at Charleston, Port Royal and Savannah)	100% dedicated daytime whale observer coverage between 1 Dec and 31 Mar. Monitoring by sea turtle observer between 1 Apr - 30 Nov.	1 Nov - 31 May	100% observer monitoring from 1 Nov - 30 Nov and 1 Apr - 31 May	Year Round	100% observer monitoring from 1 Apr - 30 Nov
Tybee Island, GA to Titusville, FL (includes channels at Brunswick, Kings Bay, Jacksonville, St. Augustine, and Ponce de Leon Inlet)	Aerial surveys in right whale critical habitat, 1 Dec thru 31 Mar. 100% dedicated daytime whale observer coverage between 1 Dec and 31 Mar.	1 Dec - 15 Apr	100% observer monitoring from 1 Apr - 15 Apr	Year Round	100% observer monitoring from 1 Apr - 15 Dec
Titusville, FL to Key West, FL (includes channels at West Palm Beach, Miami and Key West)	Whale observations are not necessary beyond those conducted between monitoring of dredge spoil.	Year Round	100% observer monitoring year round	Year Round	100% observer monitoring year round

[1] 100% of the dredge material must be screened and 100% of the screened material must be observed.

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Table 1 Shortnose Sturgeon Population Estimates.

Locality	Time Segment	Population Segment	Marked m	Captured c	Recaptured r	Estimate Type	Population Estimate	Precision 95% CI		mc/4N	Source and Notes
St. John	1973-77	Adult	3,705	4,082	343	S-J	18,000	±30%		>1	Dadswell (1979)
Kennebec	1977-81	Adult	675	272	34	PET	5,273	3,632	6,914	8.7	Squiers et al. (1982)
	1977-81	Adult	703	272	56	SCH	7,222	5,046	10,765		Squiers et al (1982)
Merrimack	1989	Spawning, males				CAP	5	5	20		Kynard (unpublished data)
	1988-90	Spawning, males				CAP	12	10	28		Kynard (unpublished data)
	1989-90	Total				CAP	33	18	89		Kynard (unpublished data)
Connecticut											
Upper	1992	Spawning				CAP	47	33	80		Kynard (unpublished data)
	1993	Spawning				CAP	98	58	231		Kynard (unpublished data)
	1976-77	Total	61	162	16	PET	516	317	898	>1	Taubert (1980)
	1976-78	Total	51	56	4	PET	714	280	2,856	>1	Taubert (1980)
	1977-78	Total	119	56	18	PET	370	235	623	>1	Taubert (1980)
	1978-78	Total	170	56	24	PET	297	267	618	>1	Taubert (1980)
Lower		Total				SHU	895	799	1,018		Savoy and Shake (1993)
		Total				SCH	875				
		Total				CHA	856				
Hudson	1979	Spawning	548	899	38	PET	12,669			>1	Dovel (1981)
	1980	Spawning	811	698	40	PET	13,844			>1	Dovel (1981)
	1980	Total					30,311				Dovel (1981), extrapolation
Delaware	1981-84	Partial				PET	14,080	10,079	20,378		Hastings et al. (1987)
	1981-84	Partial				SCH	12,796	10,288	16,267		Hastings et al. (1987)
	1983	Partial				S-J	6,408				Hastings et al. (1987)
Ogeechee	1993	Total	31	36	5	PET	223				Rogers and Webber (1993)
Altamaha	1991	Total	551			SPET	3,250				Rogers (unpublished data)

Estimates Type:
S-J: Seber Jolly
PET: Modified Peterson
SCH: Modified Schnabel
CAP:CAPTURE Methodology
SHU: Schumacher
CHA:Chapman
SPET:Simple Peterson

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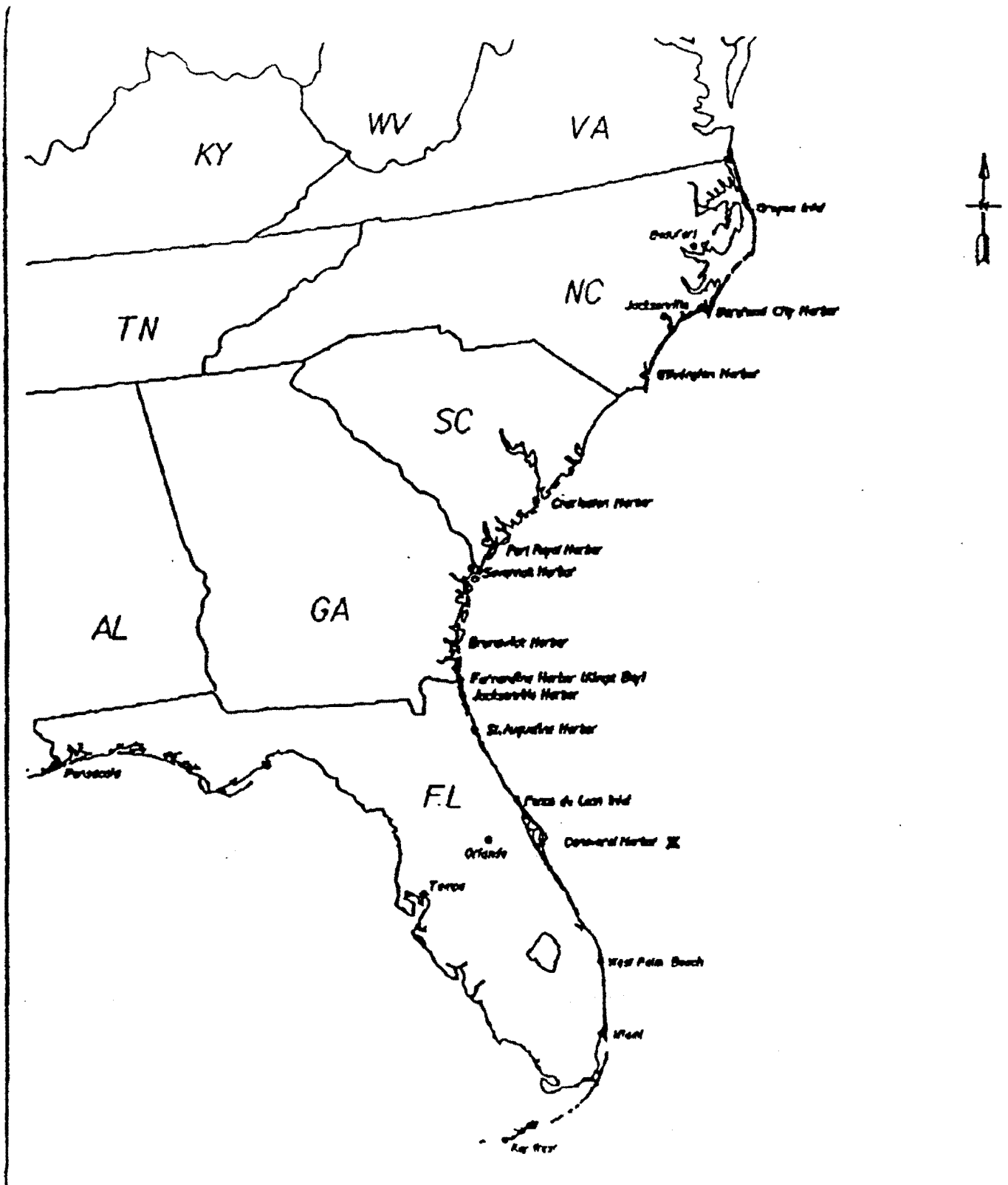


LOCATION OF SOUTHEASTERN HARBOR PROJECTS IN WHICH HOPPER DREDGES ARE USED

* NOTE: HOPPER DREDGING IN CANAVERAL HARBOR WAS SUSPENDED IN 1981

FIGURE 1

FIGURE 1

FIGURE 22

FLORIDA INDEX NESTING BEACH SURVEYS
Caretta caretta

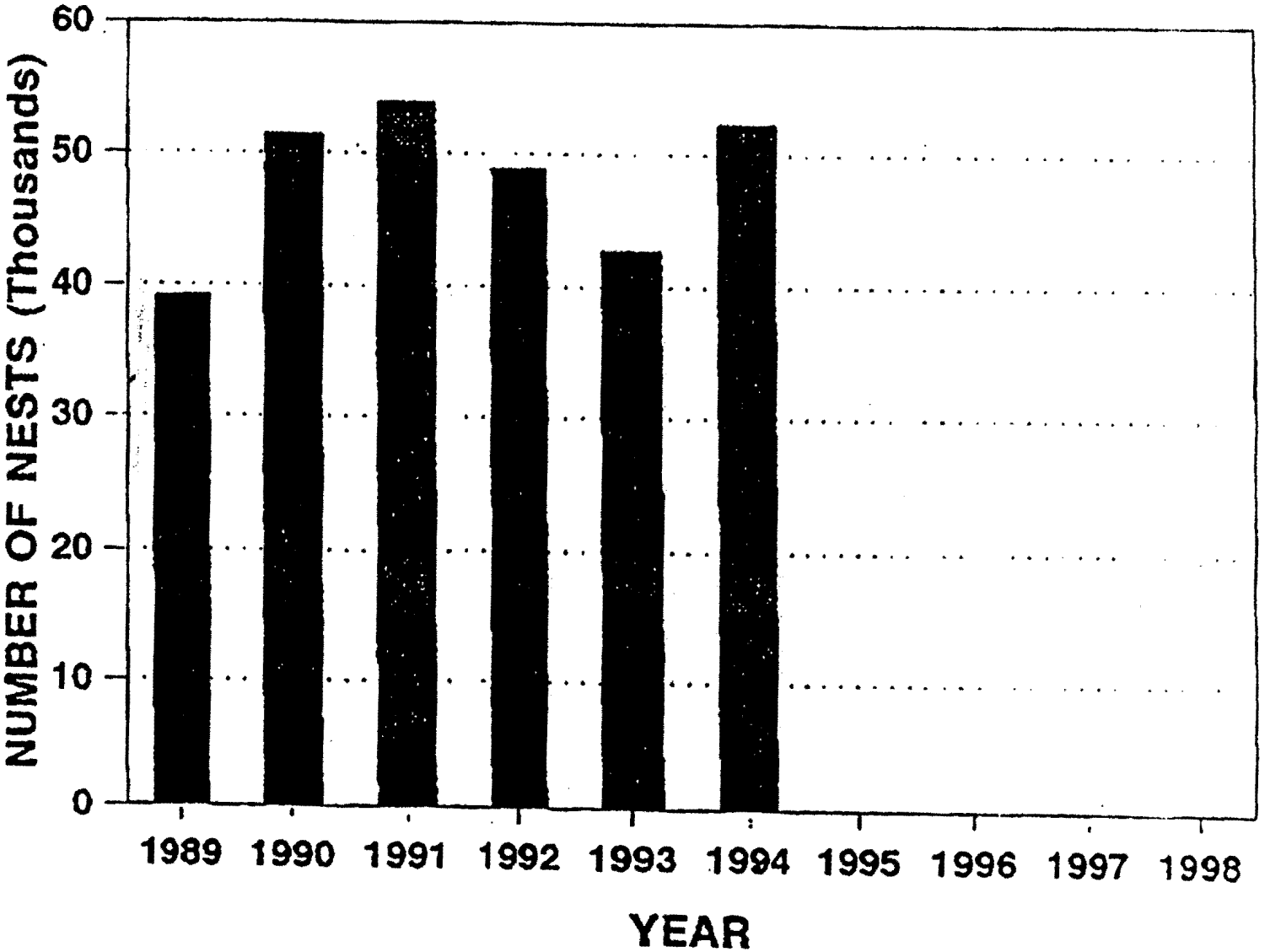


FIGURE 3

FLORIDA INDEX NESTING BEACH SURVEYS
Chelonia mydas

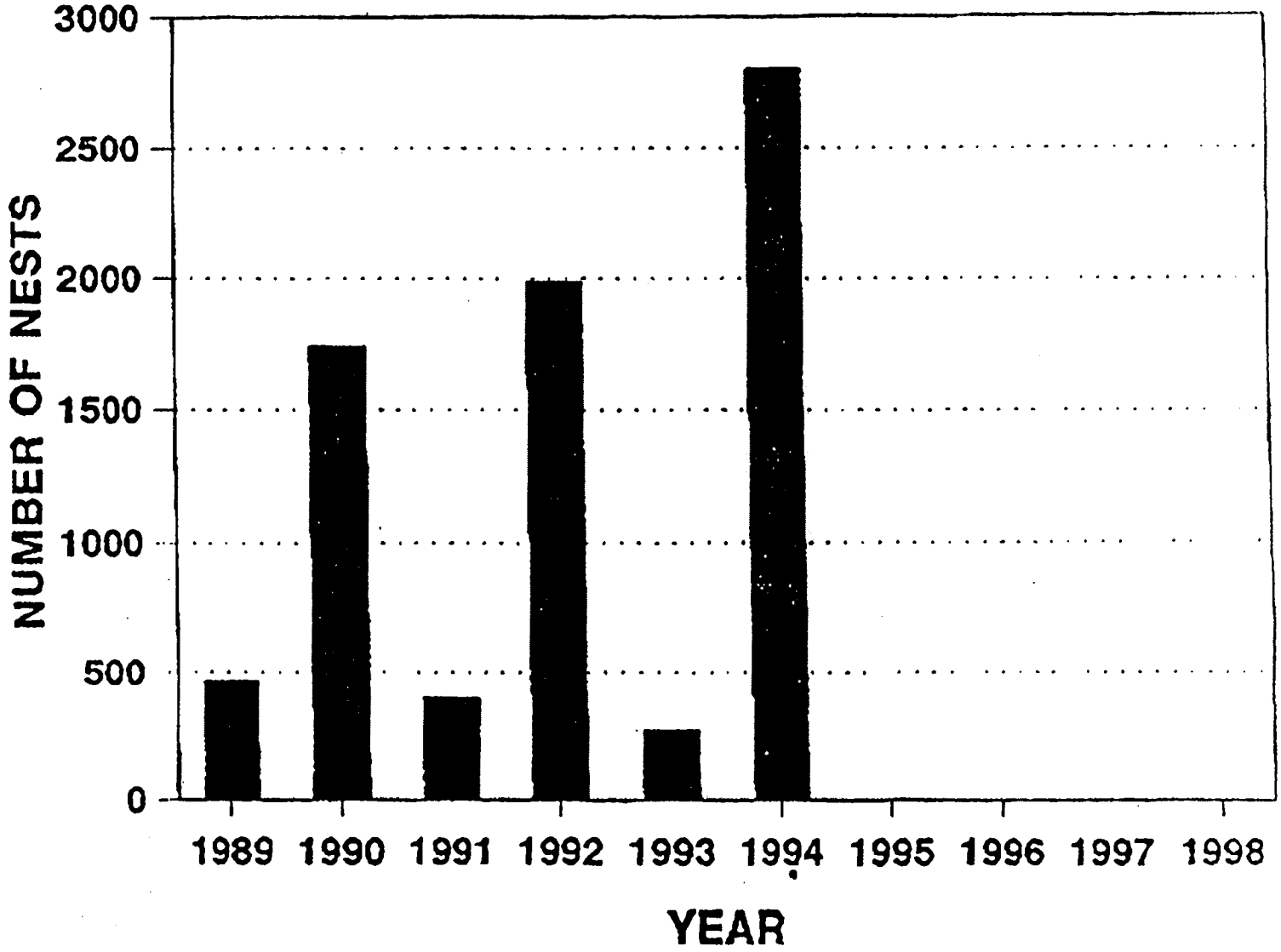
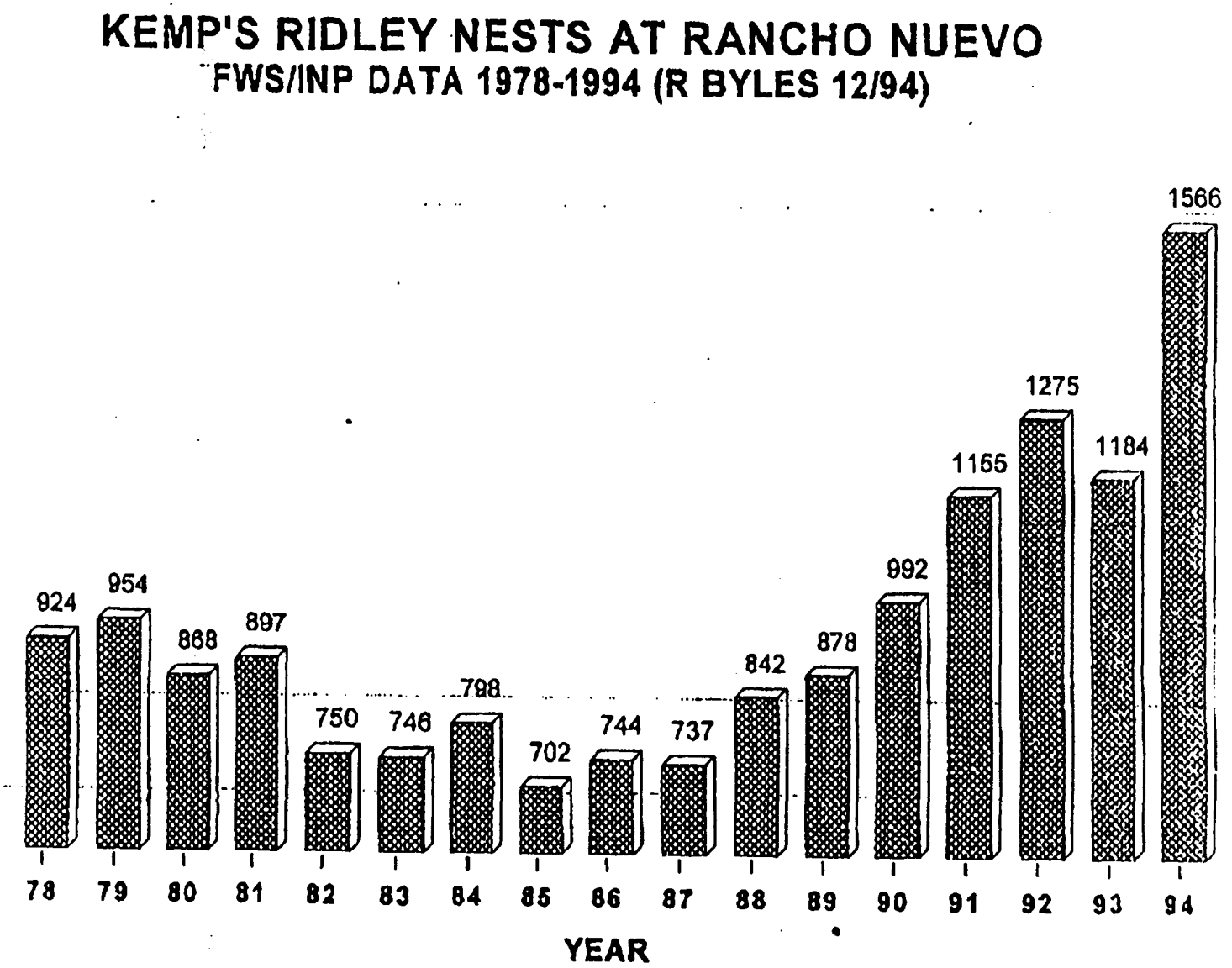


FIGURE 4


KEMP'S RIDLEY NESTS AT RANCHO NUEVO
FWS/INP DATA 1978-1994 (R BYLES 12/94)
924
954
868
897
750
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798
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992
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1184
1566
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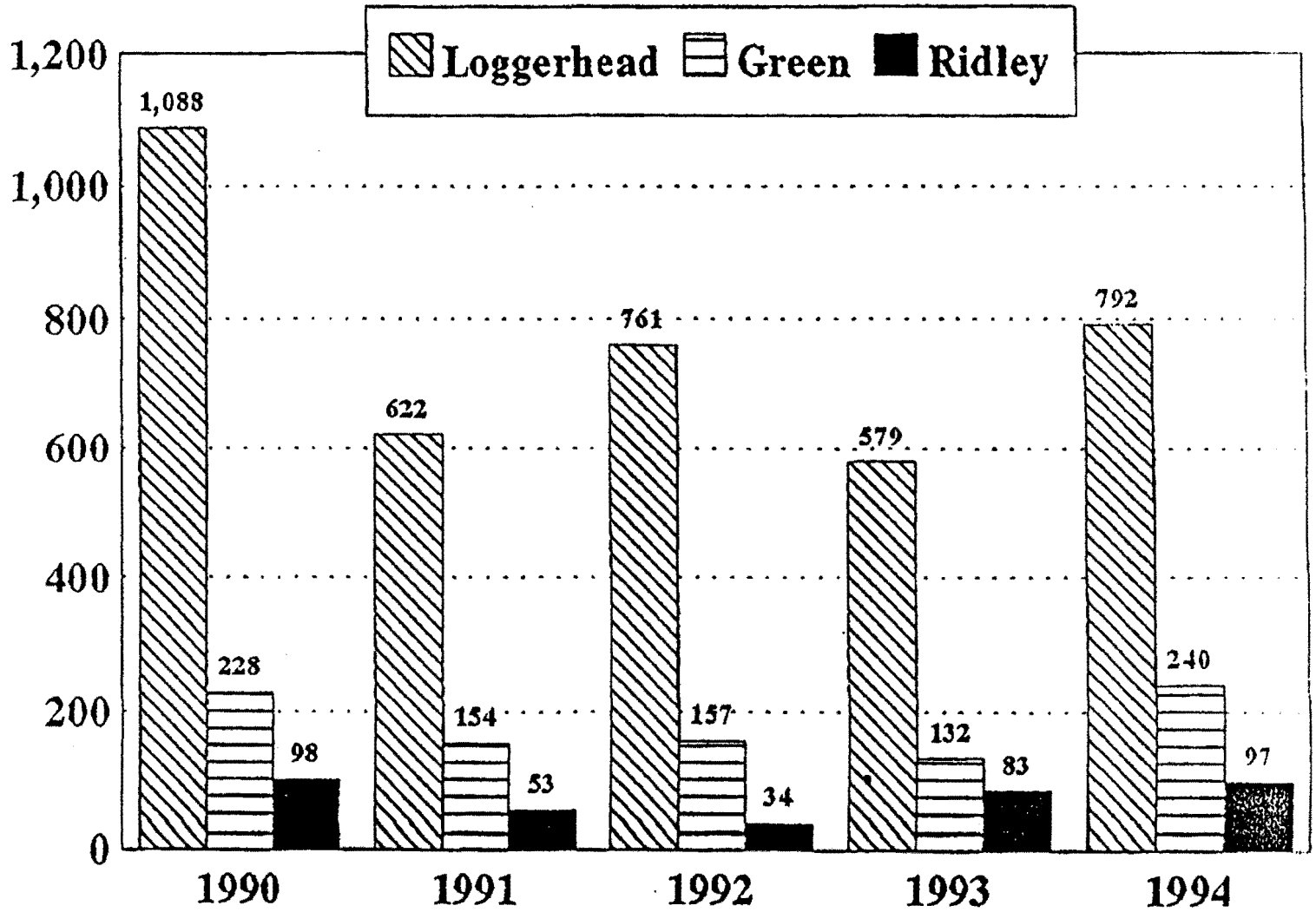
94
YEAR

Figure 5

Southeast U.S. Atlantic Coast

Sea Turtle Strandings, 1990 - 1995



BREVARD COUNTY, FLORIDA
SHORE PROTECTION PROJECT
REVIEW STUDY

U.S Fish and Wildlife Service
Coordination Act Report

FINAL REPORT

Submitted to:
Department of the Army
Jacksonville District U.S. Army Corps of Engineers
Planning Division, Environmental Branch
Jacksonville, Florida

Submitted by:
Department of the Interior
U.S. Fish and Wildlife Service
Ecological Services Office
Jacksonville, Florida
December 1995

1.0 INTRODUCTION

The purpose of this study is to assess and minimize the impacts to existing fish and wildlife resources in and adjacent to the U.S. Army Corps of Engineers (USACE) beach renourishment project in Brevard County, Florida. The U.S. Fish and Wildlife Service (USFWS) has evaluated the study area and commented on project impacts, including recommendations for conservation measures. Nourishment of the Atlantic shoreline of Brevard County was authorized by the River and Harbor Act of 1968 (N.A. 1992). This study is authorized by Section 933 of the Water Resources Development Act of 1990.

This project was authorized under a resolution adopted September 23, 1982 by the Committee on Public Works and Transportation, U.S. House of Representatives. Since that time, correspondence between Brevard County and the USACE reflects the county's interest in nourishing or renourishing problem areas. The USACE posted Public Notice in January 1992, and the USFWS responded with a Planning Aid Report in March 1992. Field reconnaissance took place on June 12-15, 1995, with members of the USACE, USFWS, and Brevard County Natural Resources Management Division.

2.0 PROJECT DESCRIPTION

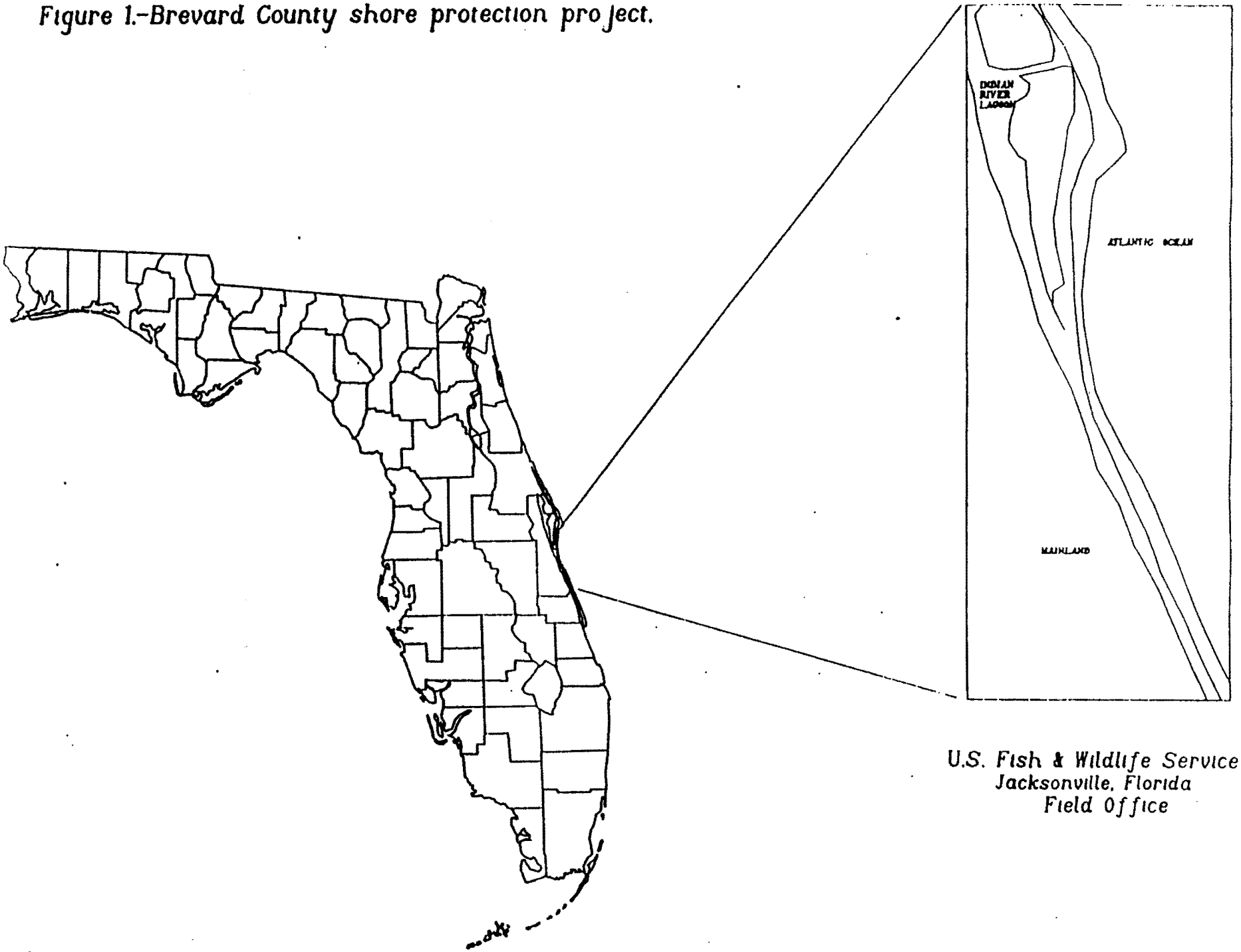
The Jacksonville District of the USACE is currently determining the feasibility of a beach renourishment project in Brevard County, Florida which would place sand dredged from offshore shoals onto twenty miles of coastline. The study area begins adjacent to Port Canaveral at Jetty Park and extends twenty miles south to the project terminus at the southern limit of Melbourne Beach (figure 1). Fill material to be used for nourishment would originate from shoals located approximately two miles from Cape Point near Cape Canaveral (figure 2), and consists of beach quality sand.

3.0 BACKGROUND

Brevard County is located on the east coast of central Florida and occupies a large inland area and extensive barrier island/estuarine lagoon system (Indian River, Banana River, and Mosquito Lagoon). The county is 72 miles long with a northwesterly to southeasterly orientation. The shoreline consists of sandy beach, vegetated dunes, barrier island strand, and maritime hammock habitat. Access to the study area is by causeway from the mainland and by coastal highway A1A.

Historically, beaches in the project area were more stable and maintained an equilibrium of sand net loss/gain. The following information is derived primarily from Olsen (1989). Natural winds and a north to south littoral drift pattern kept the process of coastline accretion and depletion balanced. Erosional shoreline loss as a result of "long term recession of the

Figure 1.-Brevard County shore protection project.



U.S. Fish & Wildlife Service
Jacksonville, Florida
Field Office

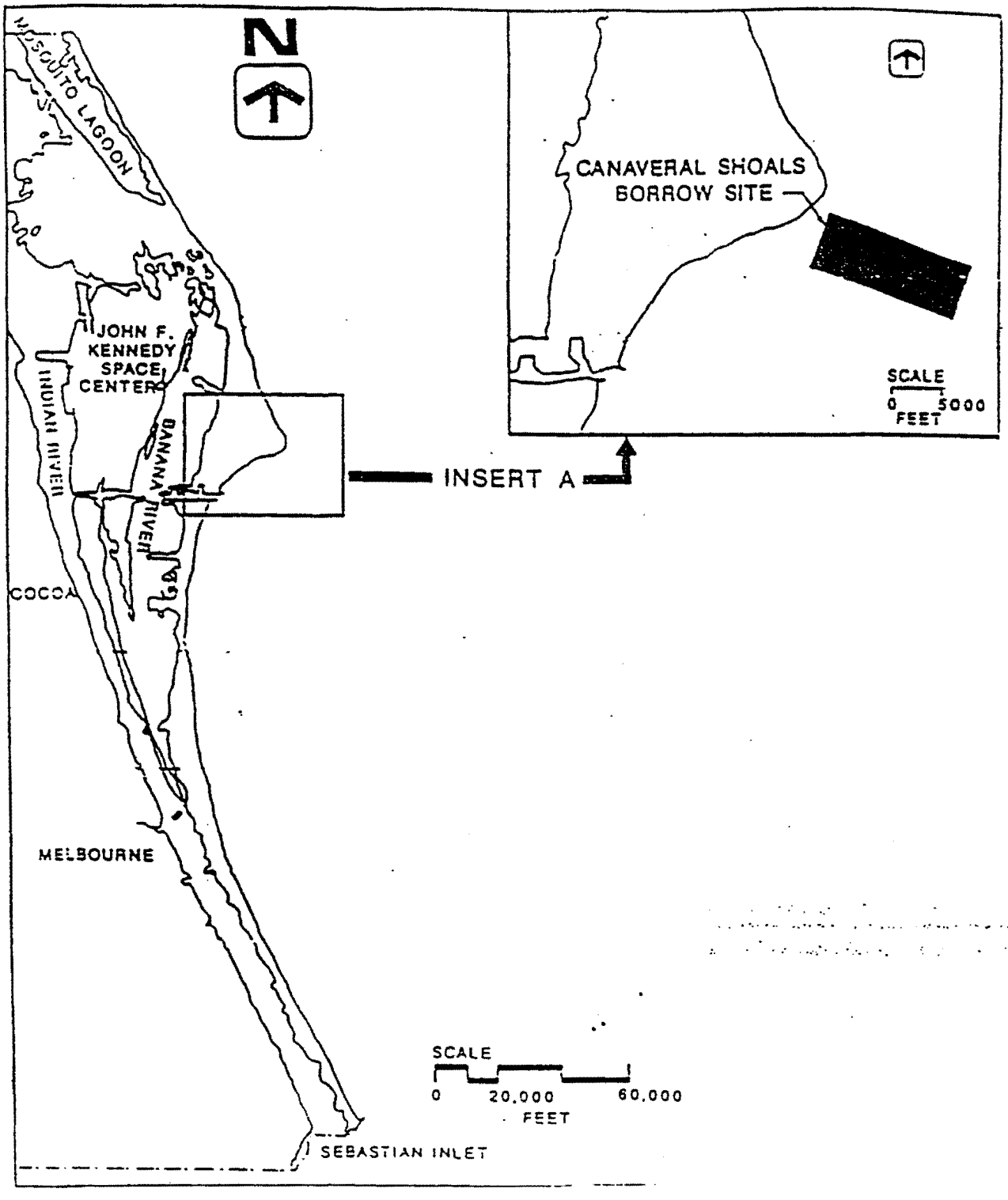


Figure 2. - Canaveral Shoals borrow site.

duneline and the general lowering of the nearshore beach profile" (USACE 1992) was a natural phenomenon over time. The addition of intense meteorological events such as "northeaster" storms in the fall and winter months, and hurricanes in the spring and summer months, act as major transporters and transformers of the beach/dune environment. Usually the dry or upper beach and bluff line are hardest hit. This reduces or eliminates the sand "reservoir" and effects the stability and longevity of the entire beach.

The creation of Port Canaveral has changed the natural littoral drift transport patterns in the immediate area and southward which exacerbates natural current reversals and drift fluctuations. This results in severe erosional "hotspots" as well as a few areas of accretion. The following areas have been included for potential renourishment: Cape Canaveral, Indialantic - Melbourne, Cocoa Beach, and Satellite - Indian Harbor Beach (USACE 1992). Current loss rates range from one foot a year at Melbourne Beach to fifteen feet a year at Cape Canaveral. In response, several beach restoration and nourishment projects have been undertaken by Brevard County and the USACOE. Strong longshore drift and reversal patterns cause these areas to naturally lose sand which accretes to the south. The USACE plan includes renourishment at varying intervals to maintain design template dimensions. Since this project will be conducted in two phases, the northern and southern reach, the Service and the Corps have agreed that each phase will require an amended Coordination Act Report from the Service, as will any new design documents forthcoming.

4.0 GENERAL DESCRIPTION OF PROJECT AREAS

4.1 Upland Dune / Dry Beach Zone

The upland dune areas of Brevard County are present throughout the project area and range from well developed in the southern portion to weakly defined in the north (See figures 3 and 4). These areas consist of dry sand beach above the mean high water level and is usually located 110-180 cm. in elevation from the mean low water level. The highest and most xeric area is characterized by a rapid loss of water and sharp temperature fluctuations. Shoreward, water is irregularly replenished through storms and high tides (Zottoli 1978). Natural processes and human impact have severely reduced the original formations. Most areas are developed with residential or commercial structures. Seawall armorment dominates the shoreline from Cocoa Beach north. Fragmented and degraded natural beach and dunes lie to the south. The natural areas are characterized as coastal strand and maritime hammock ecosystems. Typical vegetation of the coastal strand observed in the field consists of sandy, barren patches mixed with sea oats (*Uniola paniculata*), dune grass (*Ammophila breviligulata*), sea rocket (*Cakile edentula*), cacti (*Opuntia compressa*), iva (*Iva imbricata*), pennywort (*Hydrocotyle bonariensis*), croton (*Croton punctatus*), sea purslane (*Sesuvium portulacustrum*), wild bean (*Strophostyles helvola*), and morning glory (*Ipomoea purpurescens*) (Stalter 1993). The maritime hammock is composed of sea myrtle (*Baccharis halimifolia*), salt cedar (*Tamarix gallica*), wax myrtle (*Myrica cerifera*), yaupon, (*Ilex vomitoria*), senna (*Cassia fasciculata*),

Figure 3. Well developed foredune and upland dune zone in southern Brevard County

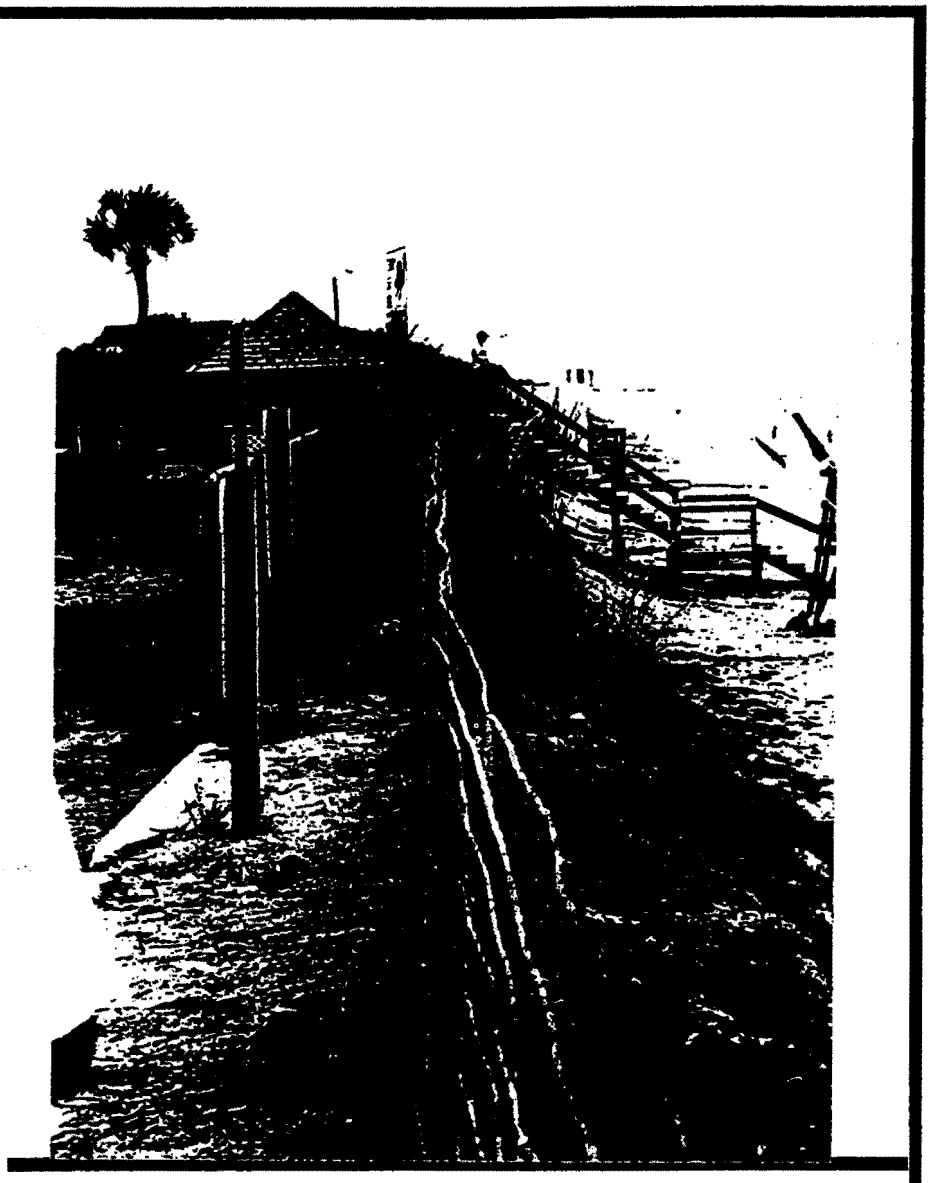


Figure 4. Weakly defined dunes in central Brevard County.

southern red cedar (*Juniperus silicicola*), muscadine (*Vitis rotundifolia*), Virginia creeper (*Parthenocissuss quinquefolia*), and greenbrier (*Smilax bona-nox*) (Stalter 1993).

Wildlife known in this area consists of raccoon (*Procyon lotor*), domesticated and feral cats (*Felis cattus*), domesticated dogs (*Canis familiaris*), the threatened southeastern beach mouse (*Peromyscus polionotus niveiventris*), threatened and endangered sea turtles, including the loggerhead (*Caretta caretta*), green (*Chelonia mydas*), Kemp's ridley (*Lepidochelys kempii*),and leatherback (*Dermochelys coriacea*); the American oystercatcher (*Haematopus palliatus*), Wilson's plover (*Charadrius wilsoni*), willet (*Catoptrophorus semipalmatus*), and laughing gull (*Larus atricilla*), gull-billed tern (*Sterna nilotica*), and Caspian tern (*Sterna caspia*) (Myers and Ewel 1990). Scrub jays (*Aphelocoma c. coerulescens*), a red-shouldered hawk (*Buteo lineatus*) and several common song birds were observed in the maritime scrub/hammock habitat throughout the study area. The ghost crab (*Ocypode quadrata*) was also observed in great numbers along the entire project area in swash, foredune and upland dune zones.

4.2 SWASH ZONE

The swash zone occupies the entire project area and is composed of quartz sand, shell hash, coquina beach rock and rubble. This zone extends 90-110 cm. in elevation from the mean low water level and is inundated by each tidal cycle. Water circulates easily through the loose-packed sand (Zottoli 1978). Sandy bottom beaches are populated by small, short-lived infauna with high species density and substantial reproductive potential and recruitment. Haustoriid amphipods constitute 50-90% of the fauna and contribute significantly to the total biomass (Nelson 1985). Decapod crustaceans, bivalves, and spionid worms complete the community. Each of these occur in relatively well-defined zones and depend to some extent on the nature of the substrate. Other species which dominate this area are *Emerita talpoida* (mole crab), *Donax* spp.(coquina), and several polychaetes (Nelson 1985, 1992). *Donax* and *Emerita* were observed in the field.

Birds known to inhabit this zone are least terns (*Sterna antillarum*), royal tern (*Sterna maxima*), sandwich tern (*Sterna sandvicensis*), black skimmer (*Rynchops niger*), and snowy plover (*Charadrius alexandrinus*) (Myers and Ewel 1990).

4.3 SURF ZONE

This ecozone also extends the length of the project area and extends from below the mean low water level to 80 cm. in elevation from the mean low water level. The sand remains saturated due to the constant submergence and inundation of the tides, allowing interstitial circulation of water throughout the sand. An increase in depth is typified by finer sediments and tightly packed sand, which inhibits water circulation (Zottoli 1978). Wave energy and exposure

dictate the stability and diversity of the surf zone communities (Nelson 1985). The occupants of sandy bottom in this zone are the same as for the swash zone. Species reported to occupy the surf zone are polychaetes, gastropods, amphipods, sand dollars, portunid crabs, bivalves and small or juvenile fish. The seasonality of surf zone fish is high with few year round residents (Nelson 1985). Common species of fish in the surf zone are Engraulidae (anchovies), Clupeidae (herrings), Carangidae (jacks), Sciaenidae (kingfish, spot, croakers), silversides (*Menidia menidia)*, catfish (*Arius felis*), lizardfishes (*Synodus foetens*), sand drum (*Umbrina coroides*) and scaled sardine (*Harengula jaguana*). This zone also serves as the nursery grounds for the Florida pompano (*Trachinotus carolinus*) (Nelson 1985).

Coquina rock outcrops and scattered live worm rock reef occupy the surf zone and range from Cape Canaveral to the Florida Keys (Zale 1989). The reefs in the study area extend ten miles from the southern portion of Patrick Air Force Base south to Paradise Beach (figures 5-7). Aerial photography provided by the ASIC was inadequate due to high tide conditions which prevented accurate detection of the existing reefs. A unusually low spring tide enabled visual inspection of the reefs without snorkeling or diving. The coquina outcrops consist of Pleistocene remnants of coquina shell hash and sand lithified by a calcareous cement (Schmidt 1979) which provides substrate for the reef-building tube worm (*Phragmatopoma lapidosa*). In addition to the reefs themselves, individual nodules of worm rock were found to be growing on various places on the coquina outcrops, primarily on the undersides of ledges.

This reef system is important for two reasons: 1) it supports a stable and complex community of species, and 2) it functions as an offshore breakwater and sediment trap for suspended sediments which may act to prograde beaches (Zale 1989, Coastal and Oceanographic Engineering and Environmental Laboratory, 1973). Species reported to inhabit the reef are amphipods, isopods, decapod and stomatopod crustaceans including the porcellanid crab (*Pachycheles monilifer*), the xanthid crab (*Menippe nodifrons*), and the graspid crab (*Pachygrapsus transversus*) (Gore et al. 1978). Common fish species reported on or near the reef were striped blennies (*Chasmodes bosquianus*), porkfish (*Anisotremus virginicus*), sailor's choice (*Haemulon parrai*), spottail pinfish (*Diplodus holbrooki*), sargeant majors, amphipods, gastropods, macroalga and orange sponge (*Cliona lampa*) (Continental Shelf Associates 1989). Blennies and sargeant majors were most evident in the field. Several tidal pools created by holes in the rock hosted fish and amphipods. Several species of macroalgae were also growing on the rocks, mostly red (Rhodophyta) and brown (Bryophyta).

4.4 OFFSHORE ZONE

Offshore benthic habitats consist of sand bottoms and reefs. The sandy substrate grades slowly into a sandy-mud consistency as one nears the edge of the continental shelf. Community species found to inhabit the sandy bottom area are squid, amphipods, annelids, bivalves, gastropods, crustaceans and scallops. Reefs of lithified coquina occur in depths of water starting at 2-7 m to 110m (Continental Shelf Associates 1989), and are inhabited by several

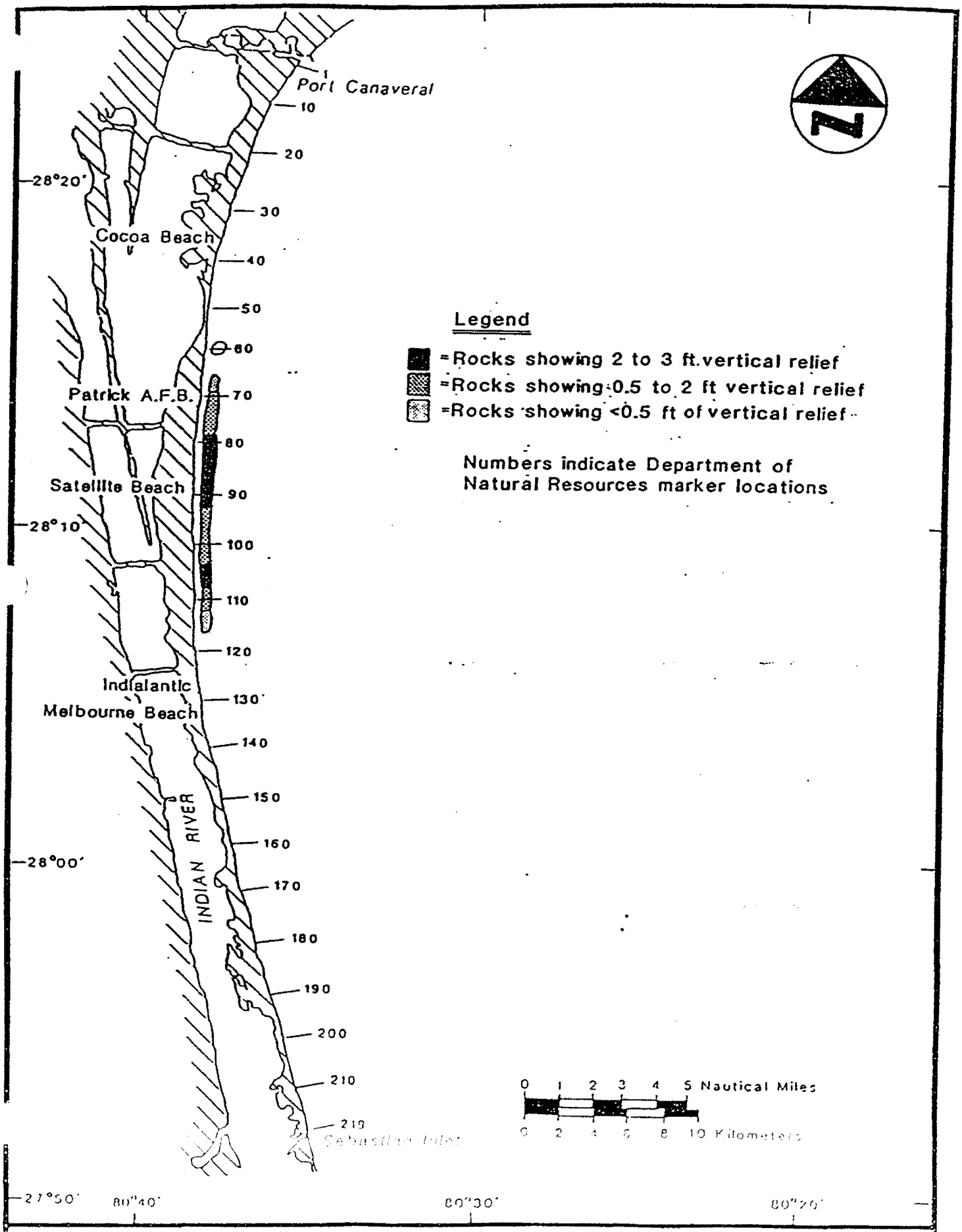


Figure 5 Location of nearshore rock outcrops along Brevard County

Figure 6. Healthy worm reef colonies and associated coquina rock outcrops.

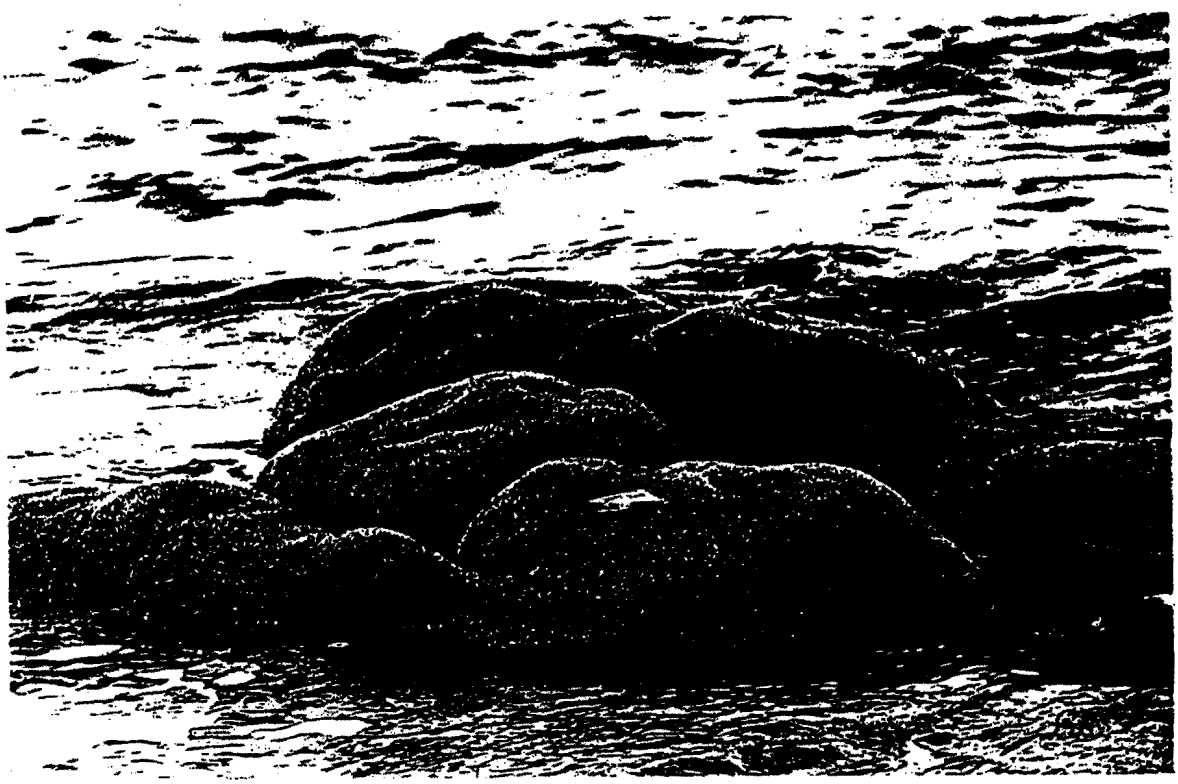


Figure 7. Live reef-building tube worm colony (Phragmatopoma lapidosa) colony in central Brevard County.

species of macroalgae. Minimal impacts from sand burial may occur on algae communities occurring nearer to shore, but should recover quickly. Dredging activity in the shoal area may create a sediment plume up to a half-mile long. The effects of this would be temporal, but may result in the mortality of a number of fish due to suffocation.

5.0 PROJECT IMPACTS

5.1 Upland Dune/ Dry Beach Zone

These areas serve as habitat for several animals including the threatened southeastern beach mouse. The current plan as proposed by the USACOE will avoid impact to the actual dunes and associated uplands but will impact the upper beach where turtles nest. Sand will be placed at the toe of the dunes and distributed by bulldozers. Additionally, the weight of earth-moving equipment is documented to create compaction and shear resistance of the substrate (Nelson and Dickerson 1988). Ghost crabs which occupy this area of the beach also risk burial. Limited information describes the crabs ability to "burrow up" to the surface if buried. If populations drop after nourishment takes place, it would be attributed to the emigration of crabs responding to a decreased food supply in the disturbed intertidal zone rather than from burial mortality (Nelson 1985).

5.2 SWASH ZONE

Information from Nelson (1985,1992) states that the mole crab is the predominant organism in the swash zone and numbers may be greatly reduced by beach nourishment activities. Mole crabs are filter feeders which rely on a high energy environment for food. They also need wet sand to burrow. Both factors place them at risk for beach fill burial. Studies indicate although they are weak swimmers, they will vacate the disturbed area by swimming or transversing the tide line. Few to none have been reported buried. Project areas recovered within two days to two months. *Donax* spp. (coquina) are the second dominant organism in the swash zone community and are most susceptible to beach nourishment activities due to decreased mobility. Nelson (1985, 1992) reports that in a North Carolina renourishment, no *Donax* were found until seven months after the project ceased and most were juveniles carried in by littoral drift. The studies indicate that mortality is due to burial, and recovery is highly dependent on the quality of beach fill used. Limited information on the effects of beach nourishment on polychaetes is inconclusive. Studies done by Nelson (1985) and Saloman and Naughton (1984), agree that beach nourishment reduces polychaete population numbers. Other studies indicate there were no significant effects to polychaetes at Sebastian Inlet, Florida. Nelson (1985) found *Scololepis squamata* to have a certain tolerance for sediment disturbance and concluded this worm could burrow itself out of 0.9 m of material provided the fill had little silt-clay content. Minimal impact is expected.

Placement of fill in the swash zone will eliminate some populations of *Donax* spp. and few polychaetes. Recovery should be rapid for both of these species. Mole crabs may avoid burial by voluntarily vacating the area. The proposed fill material is similar to native beach sand and should enhance the recovery of the existing fauna.

5.3 SURF ZONE

Anticipated impacts from beach nourishment in the surf zone will be actual fill placement (burial) and turbidity (from suspended solids). Although most organisms present in the surf zone are adapted to an increased suspended sediment load, some could be adversely affected. Nelson (1985) found that haustoriid amphipods experienced a negative impact from beach nourishment because of weak swimming capabilities which prohibit escape from sand "dump". This may be common for other organisms limited in mobility. Recovery is slow and new recruitment must come from juveniles or adults which migrate to the area. Polychaetes increase with depth in the intertidal zone and provide a food source for surf zone fishes. Although little conclusive information is available for beach nourishment effects, the burrowing action and cryptic nature of this organism point to possible mortality if emergence is restricted under too thick a layer of fill material. This occurrence could cause mortality for other species in the surf zone as well (Nelson 1985). Mobility is also severely limited for most gastropods and bivalves; therefore placing them at high risk of burial. Increased sediment load may affect the respiration of some species which could cause suffocation. Crustaceans will usually emigrate to other areas while nourishment takes place and return when activity has ceased. Maintenance of food supply and water clarity are important to maintain pre-project population numbers. If burial can be minimized, an increased sediment load should cause few mortalities. Information on surf zone fish is also limited but generally states that most fish will flee and avoid the disturbed area and will return within a few months. Nelson (1985) suggests that loss of habitat may be more harmful to fish than a suspended sediment loading which could clog their gills. Most surf zone fish may tolerate an elevated level of turbidity, but burrowing fish are at greater risk from burial. The overall impact on fishes should be minimal (Nelson 1985, 1992; Continental Shelf Associates 1989, Parkinson and Nelson 1994).

Several authors have concluded that beach nourishment projects are not damaging to existing biological communities in the long term (Gorzelany 1984, Saloman and Naughton 1984, Cutler and Mahadevan 1982, Nelson 1992). However, short term effects could include mortality (resulting from burial, suffocation or loss of habitat) and/or emigration of species to other areas which would reflect an immediate and temporal decline in individual species or species numbers. Many intertidal organisms have high reproductive potential and rapid dispersal rates, which help to enhance recovery from disturbance (Gorzelany 1984). Recovery as documented is fairly rapid depending on the quality of fill material, the seasonality, and living requirements of the species.

Sabellariid worm reefs are a major concern of this project. The reefs are formed by the reef building tube worm *Phragmatopoma lapidosa,* and occur erratically in the central portion of the work area. Reef formation is the aggregation of tubes built from platy shell fragments and sand bonded by a secreted proteinaceous cement lithified over a period of time to form extensive colonies (Coastal and Oceanic Engineering and Environmental Laboratory, 1973.) (figure 8). This species requires a firm substrate on which to attach, and a high energy intertidal surf zone for shell, sand, food, and waste removal (Zale 1989).

The reefs themselves are important landscape features which act as wave breaks and/or provide for the progradation of beach (Zale 1989). Waves break over the reefs more forcefully than over sandy bottoms carrying suspended solids up and over the reef and farther up the beach, trapping sediments on the shoreward side of the reef. The dissipation and absorption of wave energy by the reefs help to protect and prograde the beach. The reefs provide a stable substrate, shelter, and food source which supports a complex and stable marine community.

Several algal species were observed on the rock outcrops in the study area; the following were identified: *Dictyota cervicornis, Padina* spp., *Ulva* spp., *Caulerpa prolifera, Codium decorticatum, Gracillaria* spp. and *Luarencia* spp. Dr. W. Nelson (pers. comm. June 29, 1995) confirmed that the presence of *Padina* and *Caulerpa* indicate the "permanence" of the reefs (figure 9). One area appeared to support a tunicate colony (figure 10). Reef exposure depends on wave action and associated sand movement generated by storms and littoral drift. The history of the longevity and exposure of the reefs are still unknown today; however a study is planned in the near future to date the reefs (Sebastian Tax District Commission, per. comm., June 12, 1995).

The main impacts to the worm rock reefs are burial, turbidity, and hydrogen sulfide poisoning (Main 1986, Myers and Ewel 1990, Zale 1989). Burial by beach sand was tested in the laboratory by Main (1986) and Nelson (1985). Burial could be tolerated by the worms for only 24 hours in summer temperatures (28-31C), and 72 hours for temperatures of 17-23C. Turbidity experiments revealed a maximum tolerance period of 96 hours without suffering significant mortality. Zale (1989), Myers and Ewel (1990), and Main and Nelson (1985) have reported definite or possible mortality of reef-building tube worms as a result of past nourishment projects. Parkinson and Nelson (1994) allude to drifting sand from beach nourishment causing mortality and delayed worm recovery as well as poor algae re-establishment. Hydrogen sulfide may also be a problem when using fill with a high organic content. This is uncontrollable at times, as the dredge may unearth undesirable marine sediments. Research done by Dr. Nelson in 1985 revealed that the hydrogen sulfides contained in organic matter are lethal to *P. lapidosa* when mixed with deoxygenated seawater. These animals are adapted to high-energy, oxygenated environments, and cannot tolerate fine sediments such as silts and mud. If fill is placed in the surf zone, oxygen will slowly dissolve the toxic sulfides. Unless poor quality fill is used, hydrogen sulfides should not impact the worms. The literature indicates that nourishment activities create an environmental detriment to the survival of reef-building tube worms.

Figure 8. Live Phragmatopoma lapidosa worm reef nodule on coquina rock.

Figure 9. Typical species of macroalga observed on live worm/coquina reefs. Note orange sponges and nodes of worm rock.

Due to the possible loss of this valuable resource, the Service recommends that beach nourishment not take place in areas of live worm reef-coquina rock (hard bottom) habitat. Other options to avoid nourishment in these areas should be explored. The Corps has offered four different nourishment options, none of which has been tested. In an effort to select the appropriate method of nourishment, the Corps will also perform computer modeling studies for the effects of sand movement on the reefs from the existing cross-shore drift. The studies are not yet complete at this time. There is also the possibility of a new design document to be formulated by the Corps (Tom Smith, pers. comm., 1995) which would include investigative studies on the various options available for nourishment in reef areas. Lacking that information, we will address each option and make the best recommendation for the resource based on the current literature. As results of these studies become available, it is possible that these recommendations may change. The options as offered by the Corps are as follows:

1). The placement of a "stable" berm at a distance greater than 23 feet behind the worm rock reefs with interval nourishment.

2) The placement of an "active" berm at a distance less than 23 feet behind the worm reefs with interval nourishment.

3) Mitigation - "in-kind"- Implants of a hard substrate would be placed in areas of depleted worm reef-coquina rock outcrops for the reestablishment of *P. lapidosa* and other associated marine life.

4) Mitigation - "out-of-kind" - Creation and placement of an offshore reef substrate to attract displaced fish, etc.

Options one and two involve the placement of berms consisting of dredged fill material behind the reef systems. As stated in preceding paragraphs, the biological and geological importance of the reefs are significant, as these ecosystems are highly productive in terms of biomass, food web constituents, and aquatic habitat for sport fish and endangered and threatened sea turtles (Erhart 1991; pers. comm., 1995). Primary threats to the reef system consist of burial and temperature extremes (Nelson 1985). The Service is concerned that the placement of berms may threaten or destroy the health and viability of the reefs through burial and siltation. This would result in the direct or indirect demise of existing species living in, on, or near the reef through the suffocation of organisms, the depletion of the food source, the impairment of filter feeders, and the hindrance of new *P. lapidosa* settlement. Although studies by Nelson (1985) and Kreuger (1976) indicate the ability for tubeworms to survive 24-72 hours of burial, and up to 96 hours of siltation, death is certain as these time frames expire.

Option 1 includes the placement of a "stable" berm at least 23 feet behind the reef system, with additional periodic nourishment. The berm would remain somewhat stable due to its location and therefore not subjected to the turbulence shoreward. This option is agreeable to the Service at this time, due to the decreased burial and siltation impacts to the worm rock- hard

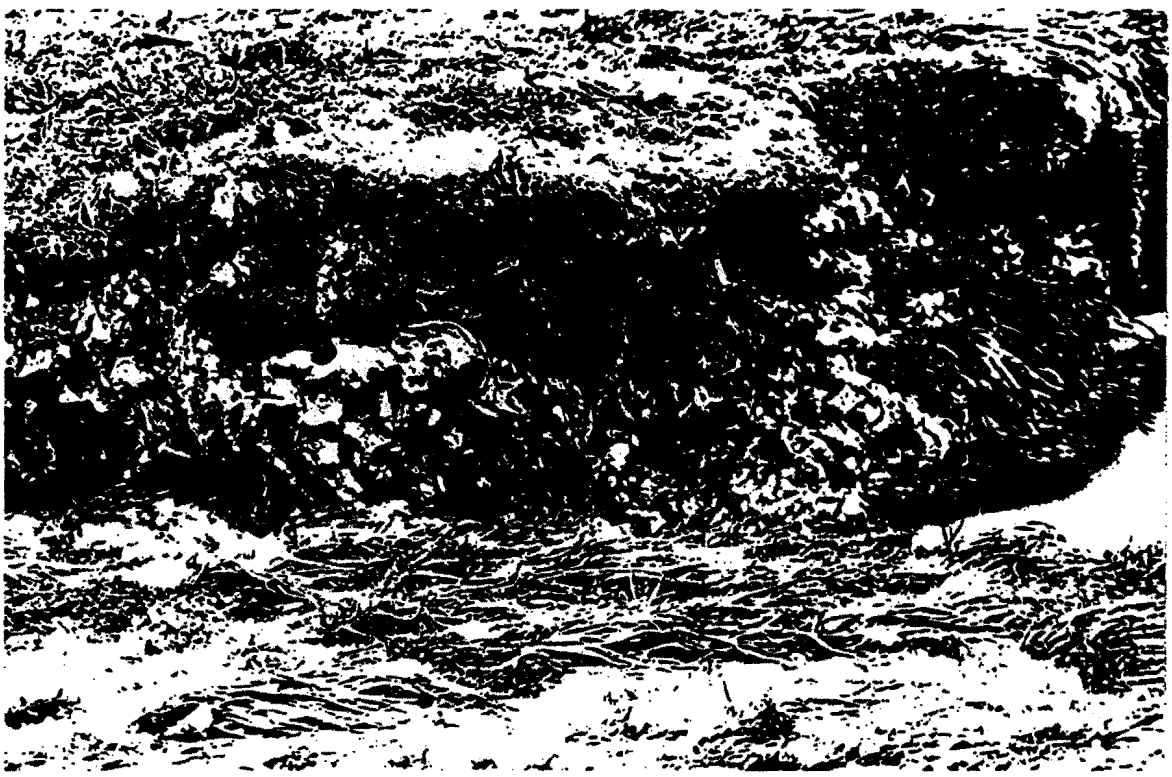


Figure 10. Tunicates and macroalga inhabiting coquina rock reef.

bottom community. We acknowledge this option is the most costly and offers the least feeder benefits; however, this is a technique that has not been tested but could be initiated without further testing. We feel the rock-reef habitats present in Brevard County are a unique biological feature of importance to the marine ecosystem and should be preserved.

Option 2, placement of an active berm with interval supplements, is also untested at this time but offers moderate feeder benefits. This technique is less reliable than option 1 in that its location increases the risk of damage or destruction to the reef. Placement of the berm would be crucial to the survival of sessile and slow-moving animals. Suspended silt particles are a related problem as they increase turbidity. The disadvantages are discussed above. The Service may agree to this method after further testing is concluded.

Options three (in-kind) and four (out-of-kind) involve mitigation as compensation for impacted reef systems in the project area. As of this writing, mitigation for worm rock has never been attempted, and the success of any future attempts would be purely speculative. Studies by Nelson (1985) and Kreuger (1976) point to the possibility of creating new worm rock formations, but only under very specific conditions which are uncertain at best. There exists one documented mitigation study (Cummings 1994) for a hard bottom community in Boca Raton, created for impacted reef resulting from a beach nourishment project. After five and one-half years, results of surveys demonstrated that the artificial reef had been suitable mitigation for the hard bottom communities lost. To measure its success, species present at Red Rock (a natural site nearby) were compared to the mitigation site, and was found to possess a majority of the species present there. Of course, this applies only to the rock outcrop communities, and not to the worm rock reefs.

As requested by the Corps, the following are recommendations as taken from a study done by Krueger (1976) for the reestablishment of *P. lapidosa* on new substrates for investigative purposes:

1. Use a live sample if possible. Reestablishment is more successful with a "catalyst".

2. Use a stable substrate located near an established adult colony. Initial settlement stimulates new growth needed to repair old reefs. For the best method, contact this office or consult Krueger 1976.

3. Locate and position substrate such that a constant supply of shell fragments and sand for food and building materials is available. Initially, establishment may occur on the calmer, shoreward side of the substrate, but growth will accelerate on the seaward side due to the availability of nutrients.

4. Supply a "catalyst" for attracting larvae to the substrate. Testing indicates that pulverized worm reef materials or adult worm cement (proteinaceous mucous) produces the best results.

5. Reapply the attractants after one month as they become water leached or consumed by bacteria.

6. Construct the new substrate with a rough surface instead of smooth, adding indentations or notches for added stability and shelter for settling larvae.

7. Rough weather will destroy new and old worm tubes. Subsequent burial and siltation prevents reestablishment. Lone formations are less stable and suffer damage more readily than group formations.

8. Even though studies reveal that larvae are present year round in the surf, settlement is sporadic at best. Time frames, intensity and extent of settlement are different at every site.

Overall, due to the uncertain nature of sand movement and mitigation success, the Service accepts option #1 and recommends that no further work be done in the area of the Brevard worm reef-hard bottom communities until further experiments or investigative work is performed by the Corps. Upon conclusive evidence as presented by the Corps, a new CAR will be prepared by the USFWS.

5.4 Offshore Zone

Little information is available for nourishment impacts in the offshore zone. Studies indicate the main concern in this zone is that of clogging the gills of resident fish by suspended solids, which may lead to suffocation (Nelson 1985). Pelagic and filter feeding fish are more affected than benthic feeders. The overall impact should be minimal because most fish will leave the work area and return only after the work is done.

This zone also includes the project borrow-site shoals. The dredging of placement material and associated disturbance of benthic sediments will most likely create a turbidity plume. Estimates from Corps personnel (Mike Dupes, pers. comm., 1995) indicate a possible plume size of one-half mile in length. Several studies by various authors on dredged borrow sites and turbidity indicate the short-term impacts to aquatic resources to be the immediate and temporary defaunation of the benthic community (Continental Shelf Associates 1989). Long-term effects observed in the study areas were a reduction in species diversity, density, and community stability. The studies also indicate that the reestablishment of the benthic community correlates directly to the recovery of the physical and chemical characteristics of site sediments. Natural shoal formation processes should help to mitigate for biological losses by replenishing and rebuilding the area. This would result in the restoration of the original physical and chemical composition of the sediments, and help to establish a more diverse and stable community.

6.0 BIOLOGICAL OPINION FWS Log No. 048D

Consultation History

On March 20 1992, the Service provided the USACE with a Planning Aid Report which addressed the reconnaissance phase of this project. Fish and wildlife resources as well as threatened and endangered species were listed and given brief comment. In March of 1992, USACE submitted a reconnaissance report listing possible impacts this project would have on the above listed species, in accordance with Section 7 of the Endangered Species Act of 1973, as amended, and determined impact to sea turtles and the southeastern beach mouse may occur.

Biological Opinion

Southeastern Beach Mouse

The southeastern beach mouse *(Peromyscus polionitus niveiventris)* historically inhabited sand dunes along the coastline from Ponce (Mosquito) Inlet, Florida (Bangs 1898, in Humphrey 1992) to Miami Beach, Florida (Layne 1974, in Humphrey 1992). Since the early 1970's most of the population from Cape Canaveral to Ft. Pierce, Florida has been lost or highly fragmented due to urbanization (see figure 11). Populations from Ft. Pierce southward may be entirely extirpated (Humphrey 1992). Loss of dune habitat from storm erosion and urban development pose the worst threats to this species' survival.

Current studies reveal healthy populations at Cape Canaveral National Seashore,Cape Canaveral proper, and Merritt Island National Wildlife Refuge. A few areas in Indian River County, including south Sebastian Inlet Park, have recently documented small numbers (Humphrey 1992). Recent trapping in south Brevard County (north Sebastian Inlet Park) indicate beach mice are no longer present (K.Owens , USFWS, pers. comm.).

Essential habitat for this species is primary and secondary dunes with a supply of sea oats *(Uniola paniculata)* and other grains, seeds and fruits. Field work in the study area revealed remnant mouse habitat and a lack of definite "sign" of mouse habitation. Future trapping activity may take place at Lori Wilson County Park and Spessard Holland State Park where optimum beach mouse habitat remains.

The USACE stated in their reconnaissance report that impact to sand dunes was unknown at that time. If dune nourishment took place, effects would be minimal pending quality of fill material. Sand was to be placed at the toe of the dune which would likely affect the mice and their habitat. Incidental take of this species would occur if beach mice were buried in their burrows during sand deposition.

Subsequently, the USACE has finalized their plans. The project no longer includes dune enhancement, therefore southeastern beach mice will not be impacted. Field reconnaissance for this species also indicated none are known to exist in the study area. However, an exception to this may exist at Lori Wilson County Park in Cocoa Beach where suitable habitat remains. Although "sign" was not noticed, mice may inhabit this area. It is the Service's Biological Opinion that this project is not likely to jeopardize the continued existence of the southeastern beach mouse.

INCIDENTAL TAKE

Section 9 of the Endangered Species Act , as amended (Act), prohibits the taking of listed species without a special exemption. Taking is defined as to mean harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or to attempt to engage in any such conduct. "Harm" and "harass" are further defined in Service regulations (50 CFR 17.3). "Harass" is defined as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns, which include, but are not limited to, breeding, feeding or sheltering. "Harm" is defined as an act which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

Under the terms of Section 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement. The measures described below are nondiscretionary, and must be implemented by the agency so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in Section 7 (o)(2) to apply.

The Federal agency has a continuing responsibility to regulate the activity that is covered by this incidental take statement. If the agency fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of Section 7 (o)(2) may lapse.

The Service has reviewed the biological information for this species, and other available information relevant to this action. Based on our review incidental take is anticipated for all southeastern beach mice that may be found at the toe of the primary dune within the project area, specifically Lori Wilson County Park in Cocoa Beach. This is the only portion of the work area where beach mice may be encountered.

When providing an incidental take statement the Service is required to give reasonable and prudent measures it considers necessary or appropriate to minimize the take along with terms and conditions that must be complied with to implement the reasonable and prudent measures.

Furthermore, the Service must also specify procedures to be used to handle or dispose of any individuals taken. The Service believes the following reasonable and prudent measures are necessary and appropriate to reduce take:

1. The Corps shall instruct the contractor to prohibit mechanized equipment from the primary or secondary dune systems. Mechanized equipment is permitted only up to the toe of the primary dune.

2. The Corps will require the contractor to initiate a trapping program to remove southeastern beach mice that may be affected by the nourishment operation.

To implement the above reasonable and prudent measures, the Service has outlined the following terms and conditions for incidental take. In accordance with the Interagency Cooperation Regulations (50 CFR 402), these terms and conditions must be complied with to implement the reasonable and prudent measures for incidental take:

1. The Contractor shall contract with a qualified and permitted biologist to carry out the trapping program.

2. The trapping effort will be directed to only that section of beach at Lori Wilson County Park which will be impacted within a 24-hour period. The trapping program for that particular reach of beach will begin five days before material is deposited on site, and will conclude the morning of sand disposal. If there is a delay in sand disposal, trapping will continue until the work occurs.

3. Two traps will be placed at each southeastern beach mouse burrow. Captured beach mice will be held until nourishment activity in the area ceases, approximately 48 hours.

4. A report summarizing the number of trap nights and the number of beach mice captured and relocated will be submitted to the Corps and Service three weeks after project completion.

5. If a dead beach mouse is found or one dies in the trap, the specimen should be frozen and the Jacksonville Field Office contacted within 24 hours (904/232-2580).

Loggerhead, Green and Leatherback Sea Turtles

The Fish and Wildlife Service has responsibility for regulating sea turtles when they come ashore to nest. The National Marine Fisheries Service has jurisdiction over sea turtles in the marine environment. For at least two decades, several factors appear to have contributed to the decline of sea turtle populations along the Atlantic coast and in the Gulf of Mexico

(National Research Council 1990a). These factors include commercial overutilization of eggs and turtles, increased natural predation of eggs and hatchlings, incidental catches in commercial fishing operations, degradation of nesting habitat by coastal development, and marine pollution and debris.

The reproductive strategy of sea turtles involves producing large numbers of offspring to compensate for the high natural mortality through their first several years of life. However, human perturbations have drastically reduced sea turtle populations from unnatural causes of mortality. Therefore, activities that affect the behavior and/or survivability of turtles on their remaining nesting beaches, particularly the few remaining high density nesting beaches, could have serious ramifications for the continued existence of U.S. populations.

The threatened loggerhead turtle *(Caretta caretta)* was listed as a threatened species on July 28, 1978, and is the most common nesting sea turtle in Florida. Their nesting range encompasses Virginia, North Carolina, South Carolina, Georgia, Alabama, Mississippi, Louisiana, and both coasts of Florida (Hopkins and Richardson 1984). Primary nesting and hatching occurs from April through October. Total estimated nesting in the Southeast is approximately 50,000 to 70,000 nests per year (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b). There are approximately 49,000 nests laid per year throughout Florida. South Brevard County specifically, including the project area, is second in the world for known beach nesting density (Ross 1982 in Continental Shelf Associates 1989) and accounts for 40% of statewide nesting activity (Meylan *et al.* 1995).

From a global perspective, the southeastern U.S. nesting aggregation is of paramount importance to the survival of the species and is second only to that which nests on islands in the Arabian Sea off Oman (Ross 1982, Erhart 1989, National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b). The status of the Oman colony has not been evaluated recently, but its location in a part of the world that is vulnerable to disruptive events (e.g., political upheavals, wars, catastrophic oil spills) is cause for considerable concern (Meylan *et al.* 1995). The loggerhead nesting aggregations in Oman, the southeastern U.S., and Australia account for about 88 percent of nesting worldwide National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b). About 80 percent of loggerhead nesting in the southeastern U.S. occurs in six Florida counties (Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward Counties) (National Marine Fisheries and U.S. Fish and Wildlife Service).

Recent genetic analyses using restriction fragment analysis and direct sequencing of mitochondrial DNA (mtDNA) have been employed to resolve management units among loggerhead nesting cohorts of the southeastern U.S. (Bowen *et al.* 1993; B.W. Bowen, University of Florida, Gainesville, in litt., November 17, 1994, and October 26, 1995). Assays of nest samples from North Carolina to the Florida Panhandle have identified three genetically distinct nesting populations: (1) northern nesting population - Hatteras, North Carolina, to Cape Canaveral, Florida; (2) South Florida nesting population - Cape Canaveral to Naples, Florida; and (3) Florida Panhandle nesting population - Eglin Air Force Base and the beaches around Panama City,

Florida. These data indicate that gene flow between the three regions is very low. If nesting females are extirpated from one of these regions, regional dispersal will not be sufficient to replenish the depleted nesting population (Bowen *et al.* 1993, B.W. Bowen, University of Florida, Gainesville, in litt., October 26, 1995).

The nesting and hatching season for the southern Florida Atlantic beaches (including Brevard through Dade Counties) extends from March 15 through November 30. Incubation ranges from about 45 to 80 days.

The area from Indialantic to Melbourne Beach may be a transition zone between the densest and more moderate nesting zones. Nest density is calculated at 140 nests per km (Ehrhart 1980 in Continental Shelf Associates 1989). Patrick Air Force Base has been documented since 1987 as a highly successful nesting site with an average of 172 nests per km (Ehrhart 1993).

The northern range of nesting activity from Cocoa Beach to Cape Canaveral is armored and little suitable nesting beach is available. Lights and human interference from urbanization limit nesting. Chief Walker of the Cocoa Beach Fire Department (pers. comm., 1995) indicated moderate nesting does occur there (evidenced by previous relocated nests from 1989-1992). Nesting data from Jetty Park at Port Canaveral (Meylan *et al.* 1995) also indicate some nesting activity occurs. Tracks and nests were observed throughout the study area.

The endangered green sea turtle (*Chelonia mydas*), was listed under the ESA on July 28, 1978 (endangered for breeding populations in Florida and along the Pacific coast of Mexico and threatened elsewhere), and is a regular nester in Florida. Nesting has been recorded in every county on the east coast of Florida except Duval, but most occurs from Volusia through Broward Counties, with greatest densities in the Archie Carr National Wildlife Refuge, Melbourne Beach, Hutchinson Island, and Jupiter Island (Meylan et al. 1995, Moler 1992). Nesting has also been documented along the Gulf Coast of Florida on Santa Rosa Island (Okaloosa and Escambia Counties) and from Pinellas County through Collier County (Meylan, Florida Department of Environmental Protection, in litt., October 17, 1994). Green turtles have been known to nest in Georgia, but only on rare occasions (Georgia Department of Natural Resources, unpubl. data). The green turtle also nests sporadically in North Carolina, where nesting has been reported on Masonboro Island (D. Webster, University of North Carolina, pers. comm., 1993) and Onslow Beach, Camp Lejeune (R. Warren, Camp Lejeune Marine Corps Base, in litt., July 20, 1995). Nesting also occurs at Kennedy Space Center and Cape Canaveral; two nests were recorded at Jetty Park in north Brevard County from 1979 to 1992.

The nesting and hatching season for southern Florida Atlantic beaches (includes Brevard through Dade Counties) is May 1 through November 30. Incubation ranges from about 45 to 60 days.

Guseman and Ehrhart (1990) and Ehrhart (1992) indicate that juvenile greens, subadult loggerheads, and an occasional juvenile hawksbill may use worm reefs as "developmental habitat" or as transitional areas between the first pelagic sea year and the subsequent juvenile years spent in lagoons. It may also be a staging area when inlets to lagoons are not readily found. Because a myriad of algae is found on the reefs, the herbivorous greens possibly forage here along with other species of sea turtles which feed upon the abundant fish and crustaceans. Another important finding by Ehrhart (1990) was that turtles found to inhabit the reefs had no evidence of fibropapilloma disease, which currently affects up to 45% of the turtles in Indian River Lagoon. No explanation is known at this time. Although these studies were done in Indian River County, this could also be occurring in Brevard County. No studies exist to verify it at this time, however, Erhart has observed greens and loggerheads foraging at the reefs at the southern portion of PAFB. Additionally, a documented incident (Erhart et al. 1991) of four green turtles killed in a gill net set over the reefs occurred in 1990. Ehrhart (1992) advocates protection of the nearshore worm rock reefs to support the endangered green turtle.

The leatherback turtle (*Dermochelys coriacea*) was also classified as endangered on June 2, 1970, and regularly nests in Puerto Rico, the U.S. Virgin Islands, and along the Atlantic coast of Florida as far north as Georgia. The U.S. Caribbean (Puerto Rico and the U.S. Virgin Islands) may support nesting by 150 to 200 adult females per year, representing the most significant nesting activity of this species in the U.S. In the U.S. Virgin Islands, nesting has been reported on the islands of St. Croix, St. Thomas, and St. John. In Puerto Rico, leatherbacks nest on the islands of Culebra, Vieques, and Mona. On the main island of Puerto Rico, leatherbacks nest on beaches all around the island. Leatherback nesting in Florida was once considered rare, but today the species is known to nest regularly on the south Atlantic coast of the state. Leatherback nesting is rare on the west coast of Florida. In 1974, a nest was reported on St. Vincent National Wildlife Refuge (LeBuff 1976), a false crawl (non-nesting emergence) was observed on Sanibel in July 1988 (LeBuff 1990), a false crawl and one nest were observed on St. Joseph Peninsular State Park in 1993 (Meylan *et al.* 1995), and four nests were laid on St. George Island in 1995 (T. Lewis, St.Vincent National Wildlife Refuge, pers. comm., 1995). Leatherback turtles have been known to nest in Georgia, but only on rare occasions (Georgia Department of Natural Resources, unpubl. data).

The nesting and hatching season for southern Florida Atlantic beaches (includes Brevard through Dade Counties) is February 15 through November 15.

Nesting ranges from St. Johns County in the north to Dade County in the south, but is concentrated in St. Lucie, Martin and Palm Beach counties with Palm Beach accounting for an average of 50% of statewide nesting (Meylan et al. 1995, Moler 1992). South Brevard County is documented by Meylan et al. 1993 and Erhart (pers. comm.) to have annual nesting activity, but most occurs outside of the project area. Cape Canaveral and Kennedy Space Center also report nestings in 1992 (Meylan et al. 1993), as well as host summer concentrations of feeding leatherbacks in water of depths of 20-40m (Moler 1992).

Environmental Baseline

The project area is located along a 22-mile stretch of Atlantic Ocean shoreline in Brevard County, extending from Port Canaveral south to Melbourne Beach. Natural meteorological events as well as human-induced changes in the coastline have created a severe erosion problem in several areas. These beaches also support a large sea turtle nesting population annually. The Service is concerned that if beach nourishment is conducted during the nesting season (April through October) this activity may discourage turtles from nesting. Work performed during the nesting season may result in the inadvertent crushing or burying of nests. Escarpment formation after nourishment may also prevent nesting.

Direct effects:

Although beach nourishment may increase the potential nesting area, there are significant negative impacts to sea turtles that may result if protective measures are not incorporated during consultation. Nourishment during the nesting season, particularly on or near high density nesting beaches, can cause increased loss of offspring from unnatural mortality and, along with other mortality sources, may significantly impact the long-term survival of the species. For instance, projects conducted during the nesting and hatching season could result in the loss of sea turtles through disruption of adult nesting activity and by burial or crushing of nests or hatchlings. While a nest monitoring and egg relocation program would reduce these impacts, nests may be inadvertently missed or misidentified as false crawls during daily patrols. In addition, nests may be destroyed by operations at night prior to beach patrols being performed. Even under the best of conditions, about 7 percent of the nests can be missed (Schroeder 1994).

Besides the potential for missing nests during a nest relocation program, there is a potential for eggs to be damaged by their movement or for unknown biological mechanisms to be affected. Nest relocation can have adverse impacts on incubation temperature (and hence sex ratios), gas exchange parameters, hydric environment of nests, hatching success, and hatchling emergence (Limpus *et al.* 1979, Ackerman 1980, Parmenter 1980, Mortimer 1982, Nelson and Dickerson 1989). Relocating nests into sands deficient in oxygen or moisture can result in mortality, morbidity, and reduced behavioral competence of hatchlings. In a study of hatching and emergence success of *in situ* and relocated nests at seven sites in Florida, hatching success was lower for relocated nests in five of seven cases by an average of 5.01 percent, and emergence success was lower for relocated nests in all seven cases by an average of 11.67 percent (Florida Marine Research Institute unpubl. data). Finally, relocating nests may concentrate eggs in an area resulting in a greater susceptibility to catastrophic events. Hatchlings released from concentrated areas may be subject to greater predation rates from both land and marine predators.

The placement of pipelines and the use of heavy machinery on the beach during a construction project may also have adverse effects on sea turtles. Even in a construction area that has been completely eroded and is devoid of dry sand, once sand is placed on the beach, turtles will attempt to use it. As a result, pipelines and heavy machinery can create barriers to nesting females

emerging from the surf and crawling up the beach, causing a higher incidence of false crawls and unnecessary energy expenditure.

If the sand placed on the beach is different than the existing sand on the beach, there could be adverse impacts on nest site selection, clutch viability, and emergence by hatchlings (Nelson 1988). This impact can be minimized by making sure the nourishment sand matches the existing sand in grain size, shape, structure, moisture content, temperature, color, and density.

Beach compaction and unnatural beach profiles may result from beach nourishment activities and negatively impact sea turtles regardless of the timing of projects. Very fine sand and/or the use of heavy machinery can cause sand compaction on nourished beaches (Nelson *et al.* 1987, Nelson and Dickerson 1988a). Significant reductions in nesting success have been documented on severely compacted nourished beaches (Fletemeyer 1980, Raymond 1984, Nelson and Dickerson 1987, Nelson *et al.* 1987). Sand compaction may increase the length of time required for female sea turtles to excavate nests and thus cause increased physiological stress to the animals (Nelson and Dickerson 1988c). On hard, nourished beaches, false crawls may occur more frequently than on natural beaches (Nelson *et al.* 1987), also resulting in increased physiological stress to nesting females. These impacts can be minimized by using suitable sand and by tilling the beach after nourishment if the sand becomes compacted. Nelson and Dickerson (1988b) concluded that, in general, beaches nourished from offshore borrow sites are harder than natural beaches, and while some may soften over time through erosion and accretion of sand, others may remain hard for 10 years or more.

On nourished beaches, steep escarpments may develop along their water line interface as they adjust from an unnatural construction profile to a more natural beach profile (Coastal Engineering Research Center 1984, Nelson *et al.* 1987). These escarpments can hamper or prevent access to nesting sites. Researchers have shown that female turtles coming ashore to nest can be discouraged by the formation of an escarpment, leading to situations where they choose marginal or unsuitable nesting areas to deposit eggs (e.g., in front of the escarpments which often results in failure of nests due to tidal inundation). This impact can be minimized by leveling the beach prior to the nesting season.

Another impact to sea turtles is disorientation (loss of bearings) and misorientation (incorrect orientation) of hatchlings from artificial lighting. Visual cues are the primary sea-finding mechanism for hatchlings (Carr and Ogren 1960, Ehrenfeld and Carr 1967, Mrosovsky and Carr 1967, Mrosovsky and Shettleworth 1968, Dickerson and Nelson 1989, Witherington and Bjorndal 1991). Artificial beachfront lighting from buildings and street lights is a well documented cause of hatchling disorientation and misorientation on nesting beaches (Philbosian 1976; Mann 1977; Florida Department of Environmental Protection, unpubl. data). In addition, research has also documented significant reduction in sea turtle nesting activity on beaches illuminated with artificial lights (Witherington 1992).

Construction lights along a project beach and on the dredging vessel may deter females from coming ashore to nest, disorient females trying to return to the surf after a nesting event, interrupt loggerhead and green sea turtle mating since those species copulate in nearshore areas, and disorient and misorient emergent hatchlings from adjacent non-project beaches. Any source of bright lighting can profoundly affect the orientation of hatchlings, both during the crawl from the beach to the ocean and once they begin swimming offshore. Hatchlings attracted to light sources on dredging barges may not only suffer from interference in migration, but may also experience higher probabilities of predation to predatory fishes that are also attracted to the barge lights. This impact could be reduced by using the minimum amount of light necessary (may require shielding) or low pressure sodium lighting during project construction.

Indirect effects:

This project will create or improve sea turtle nesting habitat, thereby attracting turtles into new areas where they may be impacted by existing artificial lighting. The project may also make the area more attractive to new development, thereby increasing the lighting problem. Impacts from lighting can be reduced by continued implementation and enforcement of the Brevard County (or nearby municipality) beach lighting ordinance during the nesting and hatching season each year.

Future erosion of nesting beaches is a potential indirect effect of nourishment projects on sea turtles. Dredging of sand offshore from a project area has the potential to cause erosion of the newly created beach or other areas on the same or adjacent beaches, which also serve as sea turtle nesting beaches, by creating a sand sink. The remainder of the system responds to this sand sink by providing sand from the beach to attempt to reestablish equilibrium (National Research Council 1990b).

Conclusion

After reviewing the current status of the green turtle, the loggerhead turtle and the leatherback turtle, the environmental baseline for the action area , the effects of the proposed beach nourishment, and the cumulative effects, it is the Service's biological opinion that the beach nourishment, as proposed, is not likely to jeopardize the continued existence of the sea turtles listed above, and is not likely to destroy or adversely modify designated critical habitat. No critical habitat has been designated for this species; therfore, none will be affected.

The USACE has stated that work will occur outside of the nesting season; therefore no authorization for relocation is being requested. The Service requests that cone penetrometer readings be taken on the beach immediately following renourishment. If the beach is impenetrable or the average cone index exceeds 500, the beach must be tilled to a depth of 36 inches. Brevard County has also requested that construction take place in the northern reach of the project area in the early part of the nesting season. This request was based on the lower nesting densities occurring in the north area versus the south. The Service does not endorse this request and suggests that although densities may be lower there, the numbers are still great

enough when compared to other parts of Florida and the southeast that nourishment activities would be harmful to the current turtle population. If the applicant has more recent and conclusive evidence than what the Service has on record, we request it be presented for another evaluation.

The Service has reviewed the information relative to sea turtle activity in Brevard County and has evaluated the impact this project will have on nesting turtles. Based on our review, the Service believes this project is not likely to jeopardize the continued existence of the loggerhead, green, or leatherback sea turtles.

INCIDENTAL TAKE

Sections 4(d) and 9 of the ESA, as amended, prohibit taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or the applicant. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be implemented by the agency so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. The U.S. Army Corps of Engineers has a continuing duty to regulate the activity covered by this incidental take statement. If the U.S. Army Corps of Engineers (1) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

Amount or extent of incidental take

The Service has reviewed the biological information and other information relevant to this action. Based on our review, incidental take is anticipated for all sea turtle nests that may be constructed and eggs that may be deposited from March 1 through April 30 and from September 1 through September 30 and missed by a nest survey and egg relocation program within the boundaries of the proposed project. Incidental take is also anticipated for all sea turtle nests

deposited during the period when a nest survey and egg relocation program is not required to be in place within the boundaries of the proposed project.

Effect of the take

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

Reasonable and prudent measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of loggerhead, green and leatherback turtles.

1. Only beach quality sand suitable for sea turtle nesting, successful incubation, and hatchling emergence shall be used on the project site.

2. Beach nourishment activities shall not occur from May 1 through October 31, the period of peak sea turtle egg laying and egg hatching, to reduce the possibility of sea turtle nest burial or crushing of eggs.

3. If the beach nourishment project will be conducted during the period from March 1 through April 30, surveys for early nesting sea turtles shall be conducted. If nests are constructed in the area of beach nourishment, the eggs shall be relocated.

4. If the beach nourishment project will be conducted during the period from November 1 through November 30, surveys for late nesting sea turtles shall be conducted. If nests are constructed in the area of beach nourishment, the eggs shall be relocated.

5. Immediately after completion of the beach nourishment project and prior to the next three nesting seasons, beach compaction shall be monitored and tilling shall be conducted as required by March 1 to reduce the likelihood of impacting sea turtle nesting and hatching activities. The March 1 deadline is required to reduce impacts to leatherbacks that nest in greater frequency along the South Atlantic coast of Florida than elsewhere in the contiguous United States.

6. Immediately after completion of the beach nourishment project and prior to the next three nesting seasons, monitoring shall be conducted to determine if escarpments are present and escarpments shall be leveled as required to reduce the likelihood of impacting sea turtle nesting and hatching activities.

7. The applicant shall ensure that contractors doing the beach nourishment work fully understand the sea turtle protection measures detailed in this biological opinion.

8. During the early and late portions of the nesting season, no construction equipment shall be parked on the beach where it could hinder sea turtle nesting or hatching activities. In addition, all construction pipes shall be located to minimize impacts to sea turtles.

9. During the early and late portions of the nesting season, lighting associated with the project shall be minimized to reduce the possibility of disrupting and disorienting nesting and/or hatchling sea turtles.

Terms and conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the U.S. Army Corps of Engineers must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. All fill material placed shall be sand that is similar to that already existing on the site in both coloration and grain size. All such fill material shall be free of construction debris, rocks, clay, or other foreign matter and shall not contain, on average, greater than 5 percent fines (passing the #200 sieve) and be free of coarse gravel or cobbles.

2. Beach nourishment shall be started after October 31 and be completed before May 1. During the May 1 through October 31 period, no construction equipment or pipes shall be stored on the beach.

3. If the beach nourishment project will be conducted during the period from March 1 through April 30, then daily early morning surveys for early nesting sea turtles shall be conducted within the period from March 1 through April 30 that the project is being conducted, and eggs shall be relocated per the following requirements.

3a. Nest surveys and egg relocations shall only be conducted by personnel with prior experience and training in nest survey and egg relocation procedures. Surveyors shall have a valid Florida Department of Environmental Protection permit. Nest surveys shall be conducted daily between sunrise and 9 a.m.

3b. Only those nests that may be affected by construction activities shall be relocated. Nests requiring relocation shall be moved no later than 9 a.m. the morning following deposition to a nearby self-release beach site in a secure setting where artificial lighting will not interfere with hatchling orientation. Nest relocations in association with construction activities shall cease when construction activities no longer threaten nests. Nests deposited within areas where construction activities have ceased or will not occur for 65 days shall be marked and left in place unless other factors threaten the

success of the nest. Any nests left in the active construction zone shall be clearly marked, and all mechanical equipment shall avoid nests by at least 10 feet.

4. If the beach nourishment project will be conducted during the period from November 1 through November 30, then daily early morning surveys for late nesting sea turtles shall be conducted 65 days prior to project initiation and continue through September 30, and eggs shall be relocated per the preceding requirements.

5. Immediately after completion of the beach nourishment project and prior to March 1 for 3 subsequent years, sand compaction shall be monitored in the area of restoration in accordance with a protocol agreed to by the Service, the state regulatory agency, and the applicant. At a minimum, the protocol provided under 5a and 5b below shall be followed. If required, the area shall be tilled to a depth of 36 inches. All tilling activity must be completed prior to March 1. A report on the results of compaction monitoring shall be submitted to the Service prior to any tilling actions being taken. An annual summary of compaction and the actions taken shall be submitted to the Service. This condition shall be evaluated annually and may be modified if necessary to address sand compaction problems identified during the previous year.

5a. Compaction sampling stations shall be located at 500-foot intervals along the project area. One station shall be at the seaward edge of the dune/bulkhead line (when material is placed in this area); one station shall be midway between the dune line and the high water line (normal wrack line); and one station shall be located just landward of the high water line. At each station, the cone penetrometer shall be pushed to a depth of 6, 12, and 18 inches three times (three replicates). Material may be removed from the hole if necessary to ensure accurate readings of successive levels of sediment. The penetrometer may need to be reset between pushes, especially if sediment layering exists. Layers of highly compact material may lay over less compact layers. Replicates shall be located as close to each other as possible, without interacting with the previous hole and/or disturbed sediments. The three replicate compaction values for each depth shall be averaged to produce final values for each depth at each station. Reports shall include all 27 values for each transect line, and the final 9 averaged compaction values.

5b. If the average value for any depth exceeds 500 psi for any two or more adjacent stations, then that area shall be tilled prior to March 1. If values exceeding 500 psi are distributed throughout the project area but in no case do those values exist at two adjacent stations at the same depth, then consultation with the Fish and Wildlife Service shall be required to determine if tilling is required. If a few values exceeding 500 psi are present randomly within the project area, tilling shall not be required.

6. Visual surveys for escarpments along the project area shall be made immediately after completion of the beach nourishment project and prior to April 1 for 3 subsequent years. Results of the surveys shall be submitted to the Service prior to any action being taken. Escarpments that interfere with sea turtle nesting or that exceed 18 inches in height for a distance of 100 feet shall be leveled to the natural beach contour by April 1. An annual summary of escarpment surveys and actions taken shall be submitted to the Service.

7. The applicant shall arrange a meeting between representatives of the contractor, the Service, the Department of Environmental Protection, and the permitted person responsible for egg relocation at least 30 days prior to the commencement of work on this project. At least 10 days advance notice shall be provided prior to conducting this meeting. This will provide an opportunity for explanation and/or clarification of the sea turtle protection measures.

8. From March 1 through April 30 and November 1 through November 30, no construction equipment shall be parked on the beach where it could hinder sea turtle nesting or hatching activities. In addition, all construction pipes that are placed on the beach shall be located as far landward as possible without compromising the integrity of the existing or reconstructed dune system. Temporary storage of pipes shall be off of the beach to the maximum extent possible. Temporary storage of pipes on the beach shall be in such a manner so as to impact the least amount of nesting habitat and shall likewise not compromise the integrity of the dune systems (placement of pipes perpendicular to the shoreline is recommended as the method of storage).

9. From March 1 through April 30 and November 1 through November 30, all on-beach lighting associated with the project shall be limited to the immediate area of active construction only. Such lighting shall be shielded low pressure sodium vapor lights to minimize illumination of the nesting beach and nearshore waters. Red filters should be placed over vehicle headlights (i.e., bulldozers, front-end loaders). Lighting on offshore equipment shall be similarly minimized through reduction, shielding, lowering, and appropriate placement of lights to avoid excessive illumination of the water, while meeting all U.S. Coast Guard and OSHA requirements. Shielded low pressure sodium vapor lights are highly recommended for lights on offshore equipment that cannot be eliminated.

10. A report describing the actions taken to implement the terms and conditions of this biological opinion shall be submitted to the Jacksonville U.S. Fish and Wildlife Field Office within 60 days of completion of the proposed work for each year when the activity has occurred. This report will include the dates of actual construction activities, names and qualifications of personnel involved in nest surveys and relocation activities, descriptions and locations of hatcheries, nest survey and relocation results, and hatching success of nests.

11. In the event a sea turtle nest is excavated during construction activities, the permitted person responsible for egg relocation for the project should be notified so the eggs can be moved to a suitable relocation site.

12. Upon locating a dead, injured, or sick endangered or threatened sea turtle specimen, initial notification must be made to the Florida Marine Patrol at 1-800-DIAL FMP. Care should be taken in handling sick or injured specimens to ensure effective treatment and care and in handling dead specimens to preserve biological materials in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

13. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. With implementation of these measures, the Service believes that no more than those sea turtle nests and eggs that may be missed by a nest survey and egg relocation program, or those laid during the period when an egg relocation program is not required, will be incidentally taken. If, during the course of the action, this minimized level of incidental take is exceeded, such incidental take represents new information requiring review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. Appropriate native salt-resistant dune vegetation should be established on the restored dunes. The Florida Department of Environmental Protection, Bureau of Beaches and Coastal Systems, can provide technical assistance on the specifications for design and implementation.

2. Surveys for nesting success of sea turtles should be continued for a minimum of 3 years following beach nourishment to determine whether sea turtle nesting success has been adversely impacted.

3. Educational signs should be placed where appropriate at beach access points explaining the importance of the area to sea turtles and/or the life history of sea turtle species that nest in the area.

This concludes formal consultation on the action(s) outlined in the Brevard County Shore Protection Project. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Michael M. Bentzien

Assistant Field Supervisor

December 7, 1995

Date