
**DECEMBER 1993
(REVISED JUNE 1994)**

MARTIN COUNTY, FLORIDA SHORE PROTECTION PROJECT

GENERAL DESIGN MEMORANDUM WITH ENVIRONMENTAL ASSESSMENT



**US Army Corps
of Engineers**
Jacksonville District

**MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT
GENERAL DESIGN MEMORANDUM**

**DECEMBER 1993
(REVISED JUNE 1994)**

**PREPARED BY
JACKSONVILLE DISTRICT
SOUTH ATLANTIC DIVISION
U.S. ARMY CORPS OF ENGINEERS**

SYLLABUS

This report summarizes the detailed planning and engineering for construction of the shore protection project for Martin County, Florida. Details of the engineering investigations and design are contained in Appendix A. Benefit analysis are summarized in Appendix B. Real estate requirements for construction are summarized in Appendix C. Pertinent correspondence is presented in Appendix D.

The project as authorized provides for a protective beach berm and storm dune 4.0 miles long at Hutchinson Island, Florida, with periodic nourishment of the restored beach and such adjacent shoreline as may be needed and justified for the life of the project. The recommended plan described within this report would modify the authorized project to provide for restoration of the beach and dune with periodic nourishment for about 3.75 miles of shoreline on Hutchinson Island.

Initial restoration of the project shoreline would require 1,297,500 cubic yards of material. The borrow area for initial and future renourishments is located within a shoal area about 3,000 feet offshore of the southern project area. Also, the restored beach will require about 589,600 cubic yards of material every 11 years to maintain project dimensions.

The estimated total first cost of the recommended project is \$10,491,400, including additional monitoring and interest during construction. The annual cost, including interest and amortization of the first cost and periodic nourishment, is \$1,142,000. Benefits generated by project construction include: \$4,888,600 in storm damage reduction benefits, \$83,200 for prevention of land loss, and \$702,400 in incidental recreation benefits. The total annual benefits less the total annual costs equal the net benefits amounting to \$4,532,200. The benefit to cost ratio is 5.0.

The Federal share of the initial costs of construction is \$4,970,300. The non-Federal share of the costs for initial construction is \$5,521,200. The Federal share of each future periodic nourishment is 46.59 percent of applicable nourishment costs. The non-Federal share of the cost of each future nourishment is 53.41 percent. The final percentage of cost apportionment shall be based on law, policy and regulation, shore ownership and use at the time of construction or subsequent periodic nourishment.

**MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT
GENERAL DESIGN MEMORANDUM
PERTINENT DATA**

PHYSICAL DATA

Initial Fill Length	3.75 Miles
Initial Fill Volume	
Design Volume	337,500 Cubic Yards
Fill Behind Erosion Control Line	156,000 Cubic Yards
1992-1996 Anticipated Erosional Losses	214,400 Cubic Yards
Advance Nourishment	589,600 Cubic Yards

TOTAL INITIAL FILL QUANTITY 1,297,500 Cubic Yards

Borrow Area - Initial Fill	Offshore Hutchinson Island
Berm Height (MLW)	9.1 Feet
Berm Width	35 Feet
Dune Height (MLW)	13.6 Feet
Dune Width	20 Feet
Future Periodic Nourishment	589,600 Cubic Yards
Nourishment Interval	11 Years
Borrow Area - Periodic Nourishment	Offshore Hutchinson Island

FINANCIAL DATA

First Cost	
Initial Restoration	
Initial Fill	6,265,600
Administrative Costs-Lands	314,000
Monitoring	128,000
Contingencies	1,548,800
Engineering and Design	1,031,000
Construction Management	448,000
	<u>9,735,400</u>

Additional Monitoring Years 1-11 (Present Worth) 756,000

TOTAL FIRST COST 10,491,400

Interest Rate 8.00 %

Annual Cost	
Initial Restoration	795,800
Additional Monitoring	61,800
Future Nourishment	252,000
Interest During Construction	<u>32,400</u>

TOTAL ANNUAL COST 1,142,000

Annual Benefits	
Storm Damage Reduction	4,888,600
Prevention of Loss of Land	83,200
Recreation	<u>702,400</u>

TOTAL ANNUAL BENEFITS 5,674,200

FINANCIAL DATA (Continued)

NET BENEFITS	4,532,200
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BENEFIT-TO-COST RATIO	5.0
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COST APPORTIONMENT

FEDERAL COST-INITIAL CONSTRUCTION	<u>Percent</u>	<u>Amount</u>
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Initial Restoration		
Mob & Demob	46.59	782,700
Design Fill Volume	50.88	772,800
1992-1996 Anticipated Erosional Losses	50.88	490,900
Advance Nourishment Volume	46.59	1,236,100
Fill Behind ECL (Public and Private Developed)	50.88	302,700
Monitoring	46.59	71,600
Administrative Costs-Lands	46.59	182,900
Planning, Engineering and Design	46.59	527,900
Construction Management	46.59	250,500
Additional Monitoring Years 1-11 (Present Worth)	<u>46.59</u>	<u>352,200</u>

TOTAL FEDERAL COST-INITIAL WORK	47.37	4,970,300
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PERCENT FEDERAL PARTICIPATION	
- EACH FUTURE NOURISHMENT	46.59

NON-FEDERAL COST-INITIAL CONSTRUCTION	<u>Percent</u>	<u>Amount</u>
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Initial Restoration		
Mob & Demob	53.41	897,300
Design Fill Volume	49.12	746,000
1992-1996 Anticipated Erosional Losses	49.12	473,900
Advance Nourishment Volume	53.41	1,417,100
Fill Behind ECL (Public and Private Developed)	49.12	292,200
(Public Undeveloped)	100.00	107,100
Monitoring	53.41	82,000
Lands, Easements, Rights-of-Way	100.00	0
Administrative Costs-Lands	53.41	209,600
Planning, Engineering and Design	53.41	605,100
Construction Management	53.41	287,100
Additional Monitoring Years 1-11 (Present Worth)	<u>53.41</u>	<u>403,800</u>

TOTAL NON-FEDERAL COST-INITIAL WORK	52.63	5,521,200
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PERCENT NON-FEDERAL PARTICIPATION	
- EACH FUTURE NOURISHMENT	53.41

**MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT
GENERAL DESIGN MEMORANDUM**

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MARTIN COUNTY, FLORIDA SHORE PROTECTION PROJECT GENERAL DESIGN MEMORANDUM

INTRODUCTION

1. The purpose of this report is to reaffirm the basic planning decisions, update environmental impacts, advance the level of engineering and design, and reconfirm the economic feasibility of the authorized project for shore protection at Martin County, Florida. The plan presented in this report, when approved, will be the basis for preparation and approval for plans and specifications.

SCOPE

2. The investigations made during the preparation of this report involved an updating and expansion of previous data and findings. Additional economic, environmental, and engineering studies provided more detail to better compare costs, benefits, and other impacts to identify what, if any, portion of the authorized project is feasible for construction. Consequently, the scope of technical analyses are sufficient for the final design of project features and the preparation of accurate cost estimates. Studies and analyses were in accordance with guidance for the preparation of post authorization studies presented in Engineering Regulation 1110-2-1150. Items of work during the study included detailed subsurface investigations of potential borrow areas, topographic and hydrologic surveys, coastal processes analysis including SBEACH and GENESIS shoreline change modeling, review of environmental impacts including the determination of nearshore hardbottom impacts, and the determination of costs and economic benefits arising from the construction of beach fill.

THE AUTHORIZED PROJECT

AUTHORIZATION AND DESCRIPTION

3. The shore protection project for Martin County, Florida, is described in feasibility report titled, "Beach Erosion Control Study for Martin County, Florida, with Environmental Impact Statement", dated September 1985 (Revised June 1986). The project was authorized by the Water Resource Development Act of 1990 (Public Law 101-640). The final Environmental Impact Statement was filed with the Environmental Protection Agency in 1986. The authorized plan consisted of restoration of 4 miles of shorefront southward from the St. Lucie County line to near the limit of Stuart Public Beach park. The plan would include restoration of the primary dune as needed to an elevation of 12.5 feet above mean sea level (MSL) and a top width of 20 feet.

A 35-foot-wide protective berm would be provided at an elevation of 8.0 feet MSL with a 1 foot vertical on 8.5 foot horizontal foreshore slope to mean low water then a 1 foot vertical on 20 foot horizontal slope to the existing bottom. In order to maintain the protective beach, advance nourishment is included in the initial beach fill, and periodic nourishment would be provided at 8 year intervals to replace anticipated erosion losses. The project is described in the 1985 feasibility report. Figure 1 displays a map of the project area.

ITEMS OF PROJECT COOPERATION

4. The authorization of a shore protection project for Martin County, Florida, was made with the provision that Federal cost sharing would be in accordance with policy established by existing law, and the percentages based on conditions of shore ownership and use existing at the time of construction: Provided that, prior to construction, local interests furnish assurances satisfactory to the Secretary of the Army that they will:

a. Provide without cost to the United States all necessary lands, easements, rights-of-way, and relocations required for construction, operation, and maintenance of the project, including that required for periodic nourishment;

b. Hold and save the United States free from claims for damages which may result from construction and subsequent operation, maintenance, and public use of the project, except damages due to the fault or negligence of the United States or its contractors;

c. Assure continued conditions of public ownership and use of the shore upon which the amount of Federal participation is based during the economic life of the project;

d. Assure maintenance and repair during the economic life of the project as required to serve the intended purposes, in accordance with regulations prescribed by the Secretary of the Army;

e. Provide and maintain necessary access roads, parking areas, and other public use facilities, open and available to all on equal terms, and as required to realize the benefits upon which Federal participation is based;

f. Provide a cash contribution for beach erosion control equal to the appropriate percentage of the final construction cost allocated to this function, exclusive of lands, easements, rights-of-way, alterations, and relocations, the percentage to be in accordance with existing law and based on shore ownership at the time of implementation;

g. Provide a cash contribution for periodic nourishment for the life of the project, such contribution to be made prior to each nourishment, with the actual amount to be based on existing law and conditions of ownership at the time of each nourishment; and

h. Provide a cash contribution for the cost of beach fill placed landward of the erosion control line on private lands, during initial construction or subsequent nourishment, the cost to be determined at the time of construction or periodic nourishment.

MODIFICATIONS TO THE ITEMS OF PROJECT COOPERATION

5. The Water Resources Development Act of 1986 (Public Law 99-662) specifies new cost sharing for water resource projects, including shore protection. Allocation of project costs in accordance with current law and policy is discussed in detail later under cost apportionment.

6. Section 103(i) of the Act specifies that the non-Federal interests shall provide all lands, easements, rights-of-way, and disposal areas necessary for construction, and perform all necessary relocations. Section 103(i) also specifies that the value of any contributions under the preceding sentence shall be included in the non-Federal share of the project cost.

7. Section 103(j)(1) of the Act specifies that a project shall be initiated only after non-Federal interests have entered into binding agreements with the Secretary of the Army to pay 100 percent of the operation, maintenance, and replacement and rehabilitations costs of the project, to pay the non-Federal share of the costs of construction, and to hold and save the United States free from damages due to the construction or operation and maintenance of the project, except for damages due to the fault or negligence of the United States or its contractors. A Project Cooperation Agreement (PCA) will be entered for construction of this project if approved by the Assistant Secretary of the Army (Civil Works).

8. Section 103(j)(2) of the Act specifies that the agreement specified in Section 103(j)(1) shall be in accordance with the requirements of Section 221 of the flood control Act of 1970.

9. Section 402 of the Act, as amended by Section 14 of the Water Resources Development Act of 1988, requires that "before construction of any project for local flood protection or any project for hurricane or storm damage reduction, the non-Federal interests shall agree to participate in and comply with applicable Federal flood plain management and flood insurance programs.: An item of project cooperation was added to insure compliance with Section 402. The PCA will reflect this requirement.

10. The items of project cooperation have been revised to reflect the current legislation and are presented as follows:

- a. Provide to the United States all necessary lands, easements, and rights-of-way, and relocations including suitable borrow and disposal areas as determined by the Chief of Engineers to be required for construction of the project, including that required for periodic nourishment;
- b. Provide a cash contribution of initial construction cost based upon 35 percent of the total cost of initial construction attributable to hurricane and storm damage reduction, 50 percent of the total initial construction cost attributable to recreation and 100 percent of the total cost of initial construction attributable to protection of lands not open to the public (the cumulative percentage will be based on the conditions of shore ownership and use at time of construction);
- c. Pay cash contributions in a lump sum prior to the start of construction or, as may be permitted by the Chief of Engineers, in installments prior to the start of pertinent project units or sections and in accordance with his construction schedules;
- d. Provide all costs of construction for placement of fill on lands not open to the public and share in the costs of construction for placement of fill on public lands landward of the Corps Construction Line (CCL).
- e. Provide a cash contribution for periodic nourishment based upon 35 percent of the total cost of periodic nourishment attributable to hurricane and storm damage reduction, 50 percent of the periodic nourishment cost attributable to recreation and 100 percent of the total cost of periodic nourishment attributable to protection of lands not open to the public (the cumulative percentage will be based on the conditions of shore ownership and use at time of construction);
- f. Hold and save the United States free from damages due to the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the United States or its contractors;
- g. Assure continued conditions of public ownership and use of the shore upon which the amount of Federal participation is based during the economic life of the project;
- h. Provide and maintain necessary access roads, parking areas, and other public use facilities, open and available to all on equal terms;
- i. Agree to pay 100 percent of the operation, maintenance, and replacement and rehabilitation costs of the project, or functional element thereof;

j. Participate in and comply with applicable Federal flood plain management and flood insurance programs prior to initiation of construction and during the economic life of the project;

k. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987, Public Law 100-17, and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, and maintenance, of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

l. Comply with applicable Federal and State laws and regulations, including Section 601 of Title VI of the Civil Rights Act of 1964, Public Law 88-352, and Department of Defense Directive 5500.II issued pursuant thereto and published in Part 300 of Title 32, case of Federal Regulations, as well as Army Regulations 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army";

m. Maintain and repair the protective measures and/or structures during the economic life of the project as required to serve the intended purposes and in accordance with regulations prescribed by the Secretary of the Army;

n. Grant the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the non-Federal Sponsor owns or controls for access to the project for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project;

o. Perform, or cause to be performed, such investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, on lands necessary for project construction, operation, and maintenance; and,

p. To the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA.

PROJECT SPONSORSHIP

11. The Martin County Board of Commissioners is the non-Federal sponsor for the project. The county expressed their desire to serve as the non-Federal interest that will share in the costs of the project in the letter of intent dated October 2, 1985 and reiterated their intent to sponsor the project by letter dated June 9, 1994. Copies of

these letters are contained in the correspondence appendix. The non-Federal sponsor has consistently demonstrated their strong support of this project and their desire that it be constructed in a timely manner.

PROJECT DESIGN

MODIFICATIONS TO THE AUTHORIZED PROJECT

12. **Project Description.** The authorized project provided for restoration of 21,120 feet of beachfront on Hutchinson Island at Stuart, Florida. The initial beach fill was comprised of 942,000 cubic yards of material which included 8 years advance nourishment with an overfill ratio of 1.15. The annual nourishment rate for this reach was 61,000 cubic yards. The cross section of the beach fill consisted of a restored primary dune with a 20-foot-wide crest at +12.5 feet MSL, a berm 35 feet wide at an elevation of +8 feet MSL, and seaward slopes of 1V:8.5H to an elevation of mean low water, then 1V:20H to the existing bottom. The selected borrow area for beach fill material was located from 1/2 mile to 1 mile offshore of Stuart Public Beach park. Approximately 8 million cubic yards of sand were estimated to be located in this shoal area. An overfill ratio of 1.15 was estimated for material from this borrow area. Renourishment of 488,000 cubic yards was estimated to be required at 8-year intervals to replace anticipated losses. The cost of the initial beach fill was estimated at \$9,521,000. The average annual benefits for the recommended plan were estimated at \$2,225,000. The average annual cost of construction was \$1,340,000 with a resulting benefit to cost ratio of 1.7 to 1.

13. **Project Length Modifications.** Since initiation of the GDM, numerous investigations including side-scan sonar with ground truthing, aerial photography, and underwater diver-verified reef characterization studies, have been conducted along the project reach. Although these investigation revealed the presence of hard bottom communities throughout the project area, it was apparent that those located between DEP monuments R-21 through R-25 at the southern end of the project, would especially be impacted by the fill due to their close proximity to shore. Coordination with the State of Florida Department of Environmental Protection (DEP) indicated that project construction within this area, even with associated mitigation, was unacceptable. Therefore, the authorized beach nourishment of this segment is considered to be non-implementable. Coordination indicated that construction from the St. Lucie/Martin County line to DEP monument R-21 with a gradual taper of the fill to zero width at R-23 would be acceptable. Construction of the dune system along the entire project reach to monument R-23 would also be acceptable. It is recommended that the length of the project fill be reduced by about 1,800 feet with the southern limit terminating at DEP monument R-23.

14. Project Berm Modifications. The authorized project berm elevation is 8.0 feet mean sea level with a width of 35 feet. Based on the maximization of net storm damage reduction benefits alone, the 35 foot authorized beach width should be increased to a 100 foot wide berm extension. However, construction of a larger beach section would impact the nearshore hardground areas by direct burial of the hardgrounds from the adjusted fill sections. Based upon current policies of the State and the Department of the Army, proposals for construction should not result in any net adverse impacts to the environment. The U.S. Army Corps of Engineers policy requires that environmental aspects of all projects must not only be given consideration, but must bare equal standing among other plan formulation criteria. Only after adverse impacts are minimized, can the National Economic Development plan (NED) be determined and unavoidable impacts compensated through appropriate mitigation. In order to reduce adverse impacts to the maximum extent practicable from the coverage of nearshore hardbottom communities by the adjusted fill, the Jacksonville District has determined that the authorized 35-foot design is the maximum acceptable design section which will not significantly impact the environment. The proposed berm elevation of 9.1 feet mean low water is equivalent to the authorized level and is selected to coincide with the natural berm elevation in the problem area.

15. Project Dune Modifications. The authorized project includes a beach dune 20 feet wide at an elevation of 12.5 feet mean sea level with a 1 on 5 slope down to the intersection with the recommended project beach berm. The proposed dune elevation of 13.6 feet mean low water is equivalent to the authorized elevation. The proposed dune width of 20 feet is identical to the authorized project dimension.

16. Modifications to Volume of Fill Required. The original authorized project fill requirement for the Hutchinson Island segment of the Martin County project was 942,000 cubic yards. Of this volume, 454,000 cubic yards was the design beach fill quantity including the dune, 424,000 cubic yards was the advance nourishment for anticipated erosion losses, and 64,000 cubic yards was the additional yardage required due to an overfill ratio of 1.15. Corresponding volumes required for the currently recommended plan include 493,500 for the design berm and dune fill and 589,600 for the advance nourishment volume. There is no volume associated with the overfill ratio since the current estimate of the ratio is 1.00. Variation in the design fill volume is due to the altered beach fill cross section based on current survey data and the reduction of the overall beach fill length by 1,800 feet. A different advance nourishment volume arises due to an update of the annual volumetric losses within the project length and a renourishment interval optimizing economically at 11 years versus 8 years as contained within the authorized project.

17. Potential Sand Sources. Two potential borrow areas were identified during the feasibility stage of investigations. The northern site is referred to as Gilbert Shoal and is located approximately three miles north of St. Lucie Inlet, 4,000 feet offshore. The southern site consisted of a shore parallel strip roughly 4,000 feet wide extending along the developed portion of Jupiter Island which is south of St. Lucie Inlet. Due to the close proximity to the project site and the availability of about 6 million cubic yards with 5 percent or less silt content, the Gilbert Shoal was chosen as the borrow area for the currently recommended project fill. The offshore borrow area is shown on Plate 11.

18. Environmental Related Modifications. Recent environmental investigations have resulted in the mapping and characterization of numerous hardbottom communities within the project area. From coordination and cooperative site visits with personnel of the United States Fish and Wildlife Service and the State of Florida Department of Environmental Protection, it has been determined that this resource would not be directly impacted with the project fill as currently recommended. However, extensive multi-year monitoring is being recommended to ascertain what secondary impacts, if any, have occurred to hardbottom habitat and associated flora and fauna due to beach fill activities. Mitigation will be undertaken should monitoring determine it is required. The authorized project did not include monitoring nor mitigation.

THE RECOMMENDED PROJECT MODIFICATION

19. The authorized project provides for initial restoration of about 4.0 miles of shoreline on Hutchinson Island with future renourishment as needed and justified. The recommended plan contained within this report is equivalent to that authorized except for a length reduction of about 1,800 feet from the southern end of the project. It has been determined in Appendix B, Economic Analysis, that this plan is economically justified. The engineering details are also contained within Appendix A.

PLAN DESCRIPTION

20. Initial Restoration and Periodic Nourishment. The recommended plan for Martin County provides for restoration of a protective beach along 3.75 miles of shoreline. The north limit of initial restoration is the St. Lucie/Martin County line. The south limit is at DEP survey monument R-23. A total of 1,297,500 million cubic yards of sand would be placed during the initial construction. This material consists of fill placed behind the Erosion Control Line, design beach section fill, advance nourishment fill and anticipated erosional losses expected from the date of the survey (1992) through the time of construction (1996). Each of these quantities is discussed as follows.

VOLUME OF MATERIAL

21. **Fill Behind Erosion Control Line.** The State of Florida requires that the non-Federal sponsor establish an erosion control line (ECL) at the existing mean high water line. The purpose of the line is to establish where state-owned bottom land ends and private uplands begin. Plates 2 through 10 show the estimated location of this line. A portion of the project fill is contained landward of the ECL. It is estimated that about 156,000 cubic yards of sand will be placed landward of the ECL over the entire 3.75 mile project fill.

22. **Design Fill Volume.** The existing beach profile cross-sections were compared with the considered design section to determine the average area of fill between two adjacent profile lines. The average area was then multiplied by the distance between the survey lines to estimate the volume. Summation of these quantities then resulted in the total fill for the entire project length. The design sections were developed using the berm widths and elevations discussed previously. The estimated volume of the fill required for the design berm exclusive of the amount behind the ECL, anticipated erosional losses and advance nourishment is 337,500 cubic yards.

23. **Anticipated Erosional Losses.** Since the survey was accomplished in 1992, it is expected that the project scope will grow due to additional erosion prior to construction. The estimated construction completion date is 1996, approximately 4 years following the 1992 survey. The anticipated erosional volume is based on the long-term annual losses for this project, approximately 53,600 cubic yards based on comparative surveys taken from 1971 to 1992). The estimated additional volume required to offset anticipated erosional losses is 214,400 cubic yards (53,600 X 4).

24. **Advance Nourishment.** In anticipation of continuing erosion of the shoreline after the project fill has been placed, a sacrificial volume of material called advanced nourishment is also included to offset these losses. The volume of advanced nourishment is based on the long-term erosion losses and the anticipated renourishment interval. As mentioned above, the long-term annual losses were estimated to be 53,600 cubic yards. The number of years of advance nourishment placed during initial construction is dependent upon an economic determination of the least average annual equivalent cost. Nourishment intervals from one to twenty years were evaluated as contained in the cost estimate section of Appendix A. A renourishment interval of 11 years resulted in the lowest equivalent annual cost. The associated volume without overfill is 589,600 cubic yards.

25. **Future Periodic Nourishment.** After project construction, performance monitoring of the placed material would be required to determine with greater accuracy the future periodic nourishment requirements. For the purpose of this report, the amount of future periodic nourishment required is based on the historic

pre-project volumetric losses. This quantity is the same amount as that required for advanced nourishment without overfill.

26. Overfill Volume. The overfill quantity is determined by multiplying the overfill ratio by the quantity of material expected to undergo the sorting action of waves on the beach. This quantity of material is the advance nourishment volume. The overfill ratio is a measure of stability of the individual grain size from the borrow area compared to that of the native beach material. The overfill ratio for material from the Martin County borrow site is 1.0, indicating that the material has a grain size equal to or larger than that on the native beach. Therefore, there will be no additional volume required to be placed on the beach to offset losses attributable to borrow site grain size.

27. Borrow Sources. The borrow area for the initial and periodic future renourishments is shown on Plate 11. Geologic sections for the borrow site are shown on Plate 12. The borrow area consists of a shoal located about 3,000 feet offshore of southern Hutchinson Island and about 3 miles northeast of St. Lucie Inlet. The site is irregularly shaped and about 3,000 feet wide and about 6,750 feet long at a maximum. It is estimated that this area contains about 6.0 million cubic yards of beach quality material. The mean grain size is 0.38 millimeters and sorting of 1.39. The borrow material is estimated to contain less than 5 percent silt within a deposit 10 to 16 feet thick.

28. Magnetometer Survey. A magnetometer survey of the borrow site was conducted between February 22-26, 1993. The results of this investigation are contained within a report titled "A Cultural Resource Magnetometer Survey of Proposed Borrow Area, Martin County, Florida" prepared by Wes Hall, Mid-Atlantic Technology. No potentially significant submerged archeological resources were identified in the offshore borrow area which will be used for the recommended project. The results of the survey have been coordinated with the State of Florida.

ENVIRONMENTAL CONSIDERATIONS

29. The environmental impacts of the Martin County shore protection project were described in the Final Environmental Impact Statement (FEIS) on beach erosion control, which was filed in 1986 with the Environmental Protection Agency. A draft Environmental Assessment has been prepared for the recommended plan and was forwarded for coordination by letter dated 23 December 1993. The major change from the plan as considered in the 1985 FEIS is the reduction of the overall project length for nourishment by about 1,800 feet.

30. In the course of preparation of the 1985 Feasibility Report and the 1985 FEIS, information on all considered borrow areas and the project fill area was furnished by the U.S. Fish and Wildlife Service pursuant to the Fish and Wildlife Coordination

Act. The FWS investigations showed that there were hard bottom biological communities located throughout the project fill area but none within or immediately adjacent to the borrow area offshore of Hutchinson Island. The FWS recommended that the toe of the beach fill not be allowed to encroach farther seaward than the landward extent of the nearshore reef (hardbottom) and that the borrow area be located a minimum of 1,000 feet from any reef structure. FWS also recommended that due to the extremely high density of sea turtle nesting along Hutchinson Island that the nourishment of the four mile segment between the Martin/St. Lucie County line to a point south of Stuart public beach not be conducted during the period from April to November. In addition, no material should be used for beach nourishment that exceeds the maximum silt and clay content recommended by a Waterways Experiment Station (WES) which due to its compaction would adversely affect sea turtle nesting.

31. The currently recommended project has been altered to reduce associated environmental impacts to minimum levels. Of primary importance is the impact of project construction on sea turtle nesting. In order to avoid these impacts, the construction of the Martin County shore protection project is scheduled to occur between the first of November and the fifteenth of April. In addition, sea turtle nest monitoring and relocation would occur between the first of March through the fifteenth of April as required. To reduce the potential impacts on nearshore hardbottoms, the project length has been reduced by 1,800 feet resulting in no hardbottom loss. As stated previously, the borrow material is comparable in grain size to the native beach and its estimated to contain 5 percent or less of silt and fines. As such, compaction effects on sea turtle nesting are expected to be minimized. However, if during construction and subsequent monitoring it becomes apparent that the compaction of fill is excessive, tilling of the beach surface would be initiated.

CONSTRUCTION

32. Due to the environmental dredging window, beach nourishment would be accomplished by mobilizing two cutterhead pipeline type dredges with discharge directly onto the project beach. The initial discharge of material would be formed into a shore parallel dike which would advance alongshore ahead of the construction template backfill. The dike would help to contain the discharge effluent allowing time for sediments to drop from the flow. Construction would generally commence at the south end of the project and work toward the north with the actual shaping of the construction template being performed by land based heavy equipment. Assuming a production rate of 209,000 pay cubic yards per month per dredge, the actual time required for placing the total volume on the beach is 3.1 months. The time required for mobilization and demobilization is 30 days. In addition, 30 days is generally allowed for a contractor to initiate mobilization after receiving their "notice to proceed". Therefore, total construction time from initiation to completion of the project would be close to 5 months.

REAL ESTATE REQUIREMENTS AND RELOCATIONS

33. Temporary construction easements are needed from the upland property owners for access to the construction site and to place dredged material on private lands behind the Corps Construction Line (CCL) to avoid creating a gap between the toe of the dune and retaining walls or structures. The CCL is defined, herein, as the landward limit required for construction and maintenance of the proposed project dimensions. Permanent easements will be required along the beach front on the private land landward from the ECL to the CCL for initial beach fill, periodic nourishment, and dune nourishment, as well as making the area open to the public. The costs of construction are cost shareable and administrative costs for lands are creditable in front of developed private lots where perpetual easements make the land open to the public. However, in front of undeveloped private lands, the cost of construction and lands are 100% non-Federal as there is no Federal interest. A detailed evaluation of real estate requirements is contained within Appendix C.

SCHEDULE FOR PLANS, SPECIFICATIONS, AND CONSTRUCTION

34. The anticipated time for preparation of plans and specifications, and initial construction is about 18 months. Construction time for future nourishments is estimated at five months for each nourishment including time for mobilization and demobilization. Construction schedules are contingent upon project Federal and non-Federal funding, acquisition of appropriate permits, and the execution of the Project Cooperation Agreement (PCA) between the U.S. Army Corps of engineers and the non-Federal sponsor.

PROJECT MONITORING

35. An "as-built" beach profile survey is taken of the constructed beach nourishment project by the contractor. This survey allows verification of in-place material, and would be used as the base survey for the physical performance monitoring of the completed work. Physical monitoring will include profile line beach/hydrographic surveys, measurements of dry beach widths taken seasonally and after major storms, aerial photography, and bathymetric surveys of the borrow area. In addition to the physical monitoring plan extensive environmental monitoring is proposed. Pre-project conditions based on 9 permanent ecological offshore transects including evaluation of sediment on hardbottoms, organisms on hardbottom habitat, fish census at hardbottoms, and turbidity monitoring would again serve as a project baseline. These monitoring items would be repeated at selected time intervals to monitor project performance. The proposed schedule for physical and environmental monitoring is presented in Table 1, Project Monitoring Requirements.

TABLE 1
MONITORING SCHEDULE

REQUIREMENT TYPE	FREQUENCY OF REQUIREMENT													
	Pre-Const. FY-1994	Pre-Const. FY-1995	Const. FY-1996	1 FY-1997	2 FY-1998	3 FY-1999	4 FY-2000	5 FY-2001	6 FY-2002	7 FY-2003	8 FY-2004	9 FY-2005	10 FY-2006	11 FY-2007
Physical Monitoring														
Beach / Hydro Surveys * (At FDEP monument locations, from 150 feet behind monuments to 2000 feet offshore)	X **	X **	X	X ****	X			X			X			X
Dry Beach Widths (Post - construction MHW to base of dune at FDEP monument locations for seasonal changes)				X	X			X			X			X
Aerial Survey (Uncontrolled, but based on location of known landmarks)	X ***			X	X			X			X			X
Bathymetry at Borrow Site	X **	X **		X	X			X			X			X
Environmental Monitoring +														
Reef Tracts Ecological Characterization	X ++													
Set-up Sampling Transect Stations (9 permanent transect stations)	X ++													
Sea Turtle Protection Plan (As required)			X	X	X			X			X			X
Sediment on Hardbottoms (Sediment trap comparison of project beach and south of project beach)	X ++	X	X	X	X			X			X			X
Organisms on Hardbottom Habitat (Photogrammetric comparison of permanent quadrats along 9 transect lines)	X ++	X	X	X	X			X			X			X
Fish Census at Hardbottoms (Modified Bohnsack technique at selected reef tracts)	X ++	X	X	X	X			X			X			X
Turbidity Monitoring (At beach and north/south of project area for background)	X ++	X	X	X	X			X			X			X
TOTAL COSTS (w/o contingencies, E&D, S&I)	\$195,000	\$166,000	\$128,000	\$157,000	\$157,000			\$157,000			\$157,000			\$157,000

* And after storms as required.
 ** Plans and Spec scope surveys.
 *** Flown in May 1992.
 **** To be surveyed 6 months after construction.

+ Estimates are based on 6 visits to the site per year (quarterly and two times after possible storm events).
 ++ For FY94, total costs include setup of monitoring stations necessary for environmental monitoring.

ECONOMICS OF THE RECOMMENDED PROJECT MODIFICATIONS

COST ESTIMATES

36. Project cost estimates are based on December 1993 price levels. The cost estimates include 20 percent contingencies with an additional 15 percent included for the remaining engineering and design and for construction management. An interest rate of 8 percent was used to determine the equivalent average annual costs.

37. Interest and Amortization of First Costs. Interest and amortization of the project costs are determined by multiplying the initial work capital recovery factor (0.081743 @ 8 percent) times the cost of the work accomplished during initial construction. Interest and amortization of the initial cost of construction (\$795,800) plus the annualized cost of project performance monitoring during the first 11 years of the project life (\$61,800) was estimated to be \$857,600.

38. Interest During Construction. Interest during construction accounts for the cost of capital incurred during the construction period. The cost of a project to be amortized is the investment incurred up to the time that the project begins to produce benefits, or the time when it is placed in operation. The investment cost at that time is the sum of the construction and other initial costs plus interest during construction. Interest during construction for this project was computed in accordance with accounting practices which provide for interest from the middle of the month in which expenditures are made to the in-service date of the function or separable unit thereof. The in-service date is the first of the month following availability for service. Interest during construction was calculated and annualized at 8.00% over the 50-year project life and was estimated to be \$32,400.

39. Annual Cost of Future Beach Nourishment. The cost of each future beach nourishment utilizing the recommended offshore borrow area is \$4,194,000. The equivalent annual cost of the nourishment based on 11 year intervals is \$252,000.

40. Engineering Circular 1110-2-538 dated 28 February 1989 requires the establishment and consistent use of a standard code of accounts to be used when estimating costs for civil works projects. Cost estimates for the initial construction of the recommended project are presented in Table 2 and are listed by the specified code of accounts for each separable item. Table 3 shows the cost estimates in the standard code of accounts for future project construction based upon December 1993 price levels. Quantities required for future construction were determined following methods

TABLE 2
MARTIN COUNTY, FLORIDA
INITIAL COST - BEACH NOURISHMENT

ACCOUNT CODE	ITEM	QUANTITY	UNIT	PRICE	AMOUNT
17.00.01	Mob. & Demob.	1	JOB	L.S.	1,400,000
17.00.16	Pipeline Dredging				
	Design Volume	337,500	CY	3.75	1,265,600
	Fill Behind ECL	156,000	CY	3.75	585,000
	Advance Nourish.	589,600	CY	3.75	2,211,000
	Anticip. Erosion	214,400	CY	3.75	804,000
06.03.73	Monitoring	1	JOB	L.S.	<u>128,000</u>
	Subtotal, Construction Costs				6,393,600
01.--.--	Lands and Damages				314,000
30.--.--	Planning, Engineering, and Design				1,031,000
31.--.--	Construction Management				448,000
17.00.Z	Contingencies				<u>1,548,800</u>
	TOTAL CONSTRUCTION COSTS*				9,735,400

* Excludes Interest During Construction

**TABLE 3
TOTAL PROJECT COST SUMMARY**

TOTAL - ALL CONTRACTS			**** TOTAL PROJECT COST SUMMARY ****						PAGE 1 OF 11		
PROJECT: MARTIN COUNTY BEC			THIS ESTIMATE IS BASED ON THE SCOPE CONTAINED IN THE GOM, DATED: DEC 93						DISTRICT: JACKSONVILLE		
LOCATION: MARTIN COUNTY, FLORIDA									P.O.C.: MILTON WITT, CHIEF, COST ENGINEERING		
			CURRENT MCACES ESTIMATE PREPARED: DEC 93			AUTHORIZ./BUDGET YEAR: 1996			.....FULLY FUNDED ESTIMATE.....		
			EFFECTIVE PRICING LEVEL: DEC 93			EFFECT. PRICING LEVEL: 1 OCT 94					
ACCOUNT	FEATURE DESCRIPTION	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	COST (\$K)	CNTG (\$K)	FULL (\$K)
06---	FISH AND WILDLIFE	1,425	285	20%	1,710	1,450	295	1,745	2,461	503	2,964
17---	BEACH REPLENISHMENT	17,909	3,581	20%	21,490	18,297	3,660	21,957	37,271	7,455	44,726
TOTAL CONSTRUCTION COSTS =====>		19,334	3,866	20%	23,200	19,747	3,955	23,702	39,732	7,958	47,690
01---	LANDS AND DAMAGES	314	79	25%	393	317	83	400	330	87	417
30---	PLANNING, ENGINEERING AND DESIGN	2,068	308	15%	2,376	2,099	316	2,415	3,697	639	4,336
31---	CONSTRUCTION MANAGEMENT	1,355	271	20%	1,626	1,385	278	1,663	2,878	579	3,457
TOTAL PROJECT COSTS =====>		23,071	4,524	20%	27,595	23,548	4,632	28,180	46,637	9,263	55,900
TOTAL FEDERAL COSTS =====>										25,600	
TOTAL NON-FEDERAL COSTS =====>										30,300	

THIS TPCS REFLECTS A PROJECT COST CHANGE OF \$ (56,900,000)

DISTRICT APPROVED:

[Signature] CHIEF, COST ENGINEERING
[Signature] CHIEF, REAL ESTATE ^{CT}
[Signature] CHIEF, PLANNING
[Signature] CHIEF, ENGINEERING
[Signature] CHIEF, CON-OPS
[Signature] CHIEF, PROGRAMS MANAGEMENT
[Signature] PROJECT MANAGER
[Signature] DDE (PM)

THE MAXIMUM PROJECT COST IS =====> \$ _____

DIVISION APPROVED:

 CHIEF, COST ENGINEERING

 DIRECTOR,, REAL ESTATE

 CHIEF, PROGRAMS MANAGEMENT

 DIRECTOR OF PPMD

APPROVED DATE: _____

TABLE 3 (Continued)
TOTAL PROJECT COST SUMMARY

INITIAL FILL AND ADVANCE NOURISHMENT					*** TOTAL CONTRACT COST SUMMARY ***					PAGE 2 OF 11				
PROJECT: MARTIN COUNTY BEC					THIS ESTIMATE IS BASED ON THE SCOPE CONTAINED IN THE GDM, DATED: DEC 93					DISTRICT: JACKSONVILLE				
LOCATION: MARTIN COUNTY, FLORIDA										P.O.C.: HILTON WITT, CHIEF, COST ENGINEERING				
CURRENT MCACES ESTIMATE PREPARED: DEC 93					AUTHORIZ./BUDGET YEAR: 1996					.....FULLY FUNDED ESTIMATE.....				
EFFECTIVE PRICING LEVEL: DEC 93					EFFECT. PRICING LEVEL: 1 OCT 94									
ACCOUNT NUMBER	FEATURE DESCRIPTION	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	OMB (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	FEATURE MID PT	OMB (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
06---	FISH AND WILDLIFE FACILITIES	128	26	20%	154	1.9%	130	27	157	FEB 96	3.8%	135	28	163
17---	BEACH REPLENISHMENT	6,265	1,253	20%	7,518	2.2%	6,401	1,280	7,681	FEB 96	3.9%	6,653	1,330	7,983
TOTAL CONSTRUCTION COSTS =====>		6,393	1,279	20%	7,672		6,531	1,307	7,838			6,788	1,358	8,146
01---	LANDS AND DAMAGES	314	79	25%	393	1.8%	317	83	400	MAR 96	4.3%	330	87	417
30---	PLANNING, ENGINEERING AND DESIGN	1,031	102	10%	1,133	1.3%	1,042	106	1,148	MAR 95	0.5%	1,046	108	1,154
31---	CONSTRUCTION MANAGEMENT	448	89	20%	537	2.4%	458	92	550	FEB 96	5.8%	485	97	582
TOTAL COSTS =====>		8,186	1,549	19%	9,735		8,348	1,588	9,936			8,649	1,650	10,299

TABLE 3 (Continued)
TOTAL PROJECT COST SUMMARY

Monitoring (1997)				**** TOTAL CONTRACT COST SUMMARY ****										PAGE 3 OF 11															
				THIS ESTIMATE IS BASED ON THE SCOPE CONTAINED IN THE GDM, DATED: DEC 93																									
PROJECT:		MARTIN COUNTY BEC				DISTRICT: JACKSONVILLE																							
LOCATION:		MARTIN COUNTY, FLORIDA				P.O.C.: MILTON WITT, CHIEF, COST ENGINEERING																							
				CURRENT MCACES ESTIMATE PREPARED: DEC 93						AUTHORIZ./BUDGET YEAR: 1996				.....FULLY FUNDED ESTIMATE.....															
				EFFECTIVE PRICING LEVEL: DEC 93						EFFECT. PRICING LEVEL: 1 OCT 94																			
ACCOUNT				COST		CNTG		CNTG		TOTAL		OMB		COST		CNTG		TOTAL		FEATURE		OMB		COST		CNTG		FULL	
NUMBER		FEATURE DESCRIPTION		(\$K)		(\$K)		(%)		(\$K)		(%)		(\$K)		(\$K)		(\$K)		MID PT		(%)		(\$K)		(\$K)		(\$K)	
06---		FISH AND WILDLIFE FACILITIES		157		31		20%		188		2.1%		160		32		192		MAR 97		7.3%		172		34		206	
		TOTAL CONSTRUCTION COSTS =====>		157		31		20%		188				160		32		192						172		34		206	
01---		LANDS AND DAMAGES																											
30---		PLANNING, ENGINEERING AND DESIGN		13		2		15%		15		0.0%		13		2		15		JUN 96		6.7%		14		2		16	
31---		CONSTRUCTION MANAGEMENT		11		2		18%		13		0.0%		11		2		13		MAR 97		7.7%		12		2		14	
		TOTAL COSTS =====>		181		35		19%		216				184		36		220						198		38		236	

TABLE 3 (Continued)
TOTAL PROJECT COST SUMMARY

MONITORING (1998)					**** TOTAL CONTRACT COST SUMMARY ****										PAGE 4 OF 11									
					THIS ESTIMATE IS BASED ON THE SCOPE CONTAINED IN THE GDM, DATED: DEC 93																			
PROJECT: MARTIN COUNTY BEC					DISTRICT: JACKSONVILLE																			
LOCATION: MARTIN COUNTY, FLORIDA					P.O.C.: MILTON WITT, CHIEF, COST ENGINEERING																			
					CURRENT MCACES ESTIMATE PREPARED: DEC 93										AUTHORIZ./BUDGET YEAR: 1996				FULLY FUNDED ESTIMATE.....				
					EFFECTIVE PRICING LEVEL: DEC 93										EFFECT. PRICING LEVEL: 1 OCT 94									
ACCOUNT	FEATURE DESCRIPTION	COST	CNTG	CNTG	TOTAL	OMB	COST	CNTG	TOTAL	FEATURE	OMB	COST	CNTG	FULL										
NUMBER		(\$K)	(\$K)	(%)	(\$K)	(%)	(\$K)	(\$K)	(\$K)	MID PT	(%)	(\$K)	(\$K)	(\$K)										
06---	FISH AND WILDLIFE FACILITIES	157	31	20%	188	2.1%	160	32	192	MAR 98	10.9%	178	35	213										
	TOTAL CONSTRUCTION COSTS =====>	157	31	20%	188		160	32	192			178	35	213										
01---	LANDS AND DAMAGES																							
30---	PLANNING, ENGINEERING AND DESIGN	13	2	15%	15	0.0%	13	2	15	JUN 97	13.3%	15	2	17										
31---	CONSTRUCTION MANAGEMENT	11	2	18%	13	0.0%	11	2	13	MAR 98	15.4%	13	2	15										
	TOTAL COSTS =====>	181	35	19%	216		184	36	220			206	39	245										

TABLE 3 (Continued)
TOTAL PROJECT COST SUMMARY

MONITORING (2001)		**** TOTAL CONTRACT COST SUMMARY ****								PAGE 5 OF 11				
PROJECT: MARTIN COUNTY BEC		THIS ESTIMATE IS BASED ON THE SCOPE CONTAINED IN THE GDM, DATED: DEC 93								DISTRICT: JACKSONVILLE				
LOCATION: MARTIN COUNTY, FLORIDA										P.O.C.: MILTON WITT, CHIEF, COST ENGINEERING				
		CURRENT MCACES ESTIMATE PREPARED: DEC 93				AUTHORIZ./BUDGET YEAR: 1996				.....FULLY FUNDED ESTIMATE.....				
		EFFECTIVE PRICING LEVEL: DEC 93				EFFECT. PRICING LEVEL: 1 OCT 94								
ACCOUNT		COST	CNTG	CNTG	TOTAL	OMB	COST	CNTG	TOTAL	FEATURE	OMB	COST	CNTG	FULL
NUMBER	FEATURE DESCRIPTION	(\$K)	(\$K)	(%)	(\$K)	(%)	(\$K)	(\$K)	(\$K)	MID PT	(%)	(\$K)	(\$K)	(\$K)
06---	FISH AND WILDLIFE FACILITIES	157	31	20%	188	2.1%	160	32	192	MAR 01	21.4%	194	39	233
	TOTAL CONSTRUCTION COSTS =====>	157	31	20%	188		160	32	192			194	39	233
01---	LANDS AND DAMAGES													
30---	PLANNING, ENGINEERING AND DESIGN	13	2	15%	15	0.0%	13	2	15	JUN 00	26.7%	16	3	19
31---	CONSTRUCTION MANAGEMENT	11	2	18%	13	0.0%	11	2	13	MAR 01	30.8%	14	3	17
	TOTAL COSTS =====>	181	35	19%	216		184	36	220			224	45	269

TABLE 3 (Continued)
TOTAL PROJECT COST SUMMARY

MONITORING (2007)

**** TOTAL CONTRACT COST SUMMARY ****

PAGE 7 OF 11

THIS ESTIMATE IS BASED ON THE SCOPE CONTAINED IN THE GDM, DATED: DEC 93

PROJECT: MARTIN COUNTY BEC

DISTRICT: JACKSONVILLE

LOCATION: MARTIN COUNTY, FLORIDA

P.O.C.: MILTON WITT, CHIEF, COST ENGINEERING

CURRENT MCACES ESTIMATE PREPARED: DEC 93

AUTHORIZ./BUDGET YEAR: 1996

EFFECTIVE PRICING LEVEL: DEC 93

EFFECT. PRICING LEVEL: 1 OCT 94

.....FULLY FUNDED ESTIMATE.....

ACCOUNT NUMBER	FEATURE DESCRIPTION	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	OMB (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	FEATURE MID PT	OMB (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
06---	FISH AND WILDLIFE FACILITIES	157	31	20%	188	2.1%	160	32	192	MAR 07	45.8%	233	47	280
	TOTAL CONSTRUCTION COSTS =====>	157	31	20%	188		160	32	192			233	47	280
01---	LANDS AND DAMAGES													
30---	PLANNING, ENGINEERING AND DESIGN	13	2	15%	15	0.0%	13	2	15	JUN 06	53.3%	20	3	23
31---	CONSTRUCTION MANAGEMENT	11	2	18%	13	0.0%	11	2	13	MAR 07	53.8%	17	3	20
	TOTAL COSTS =====>	181	35	19%	216		184	36	220			270	53	323

TABLE 3 (Continued)
TOTAL PROJECT COST SUMMARY

NOURISHMENT 2 (2018)

**** TOTAL CONTRACT COST SUMMARY ****

PAGE 9 OF 11

THIS ESTIMATE IS BASED ON THE SCOPE CONTAINED IN THE GDM, DATED: DEC 93

PROJECT: MARTIN COUNTY BEC

DISTRICT: JACKSONVILLE

LOCATION: MARTIN COUNTY, FLORIDA

P.O.C.: MILTON WITT, CHIEF, COST ENGINEERING

CURRENT MCACES ESTIMATE PREPARED: DEC 93

AUTHORIZ./BUDGET YEAR: 1996

EFFECTIVE PRICING LEVEL: DEC 93

EFFECT. PRICING LEVEL: 1 OCT 94

.....FULLY FUNDED ESTIMATE.....

ACCOUNT NUMBER	FEATURE DESCRIPTION	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	OMB (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	FEATURE MID PT	OMB (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
06---	FISH AND WILDLIFE FACILITIES	128	26	20%	154	1.9%	130	27	157	JAN 18	102.5%	263	55	318
17---	BEACH REPLENISHMENT	2,911	582	20%	3,493	2.2%	2,974	595	3,569	JAN 18	102.9%	6,033	1,207	7,240
	TOTAL CONSTRUCTION COSTS =====>	3,039	608	20%	3,647		3,104	622	3,726			6,296	1,262	7,558
01---	LANDS AND DAMAGES													
30---	PLANNING, ENGINEERING AND DESIGN	243	49	20%	292	2.1%	248	50	298	APR 16	101.3%	499	101	600
31---	CONSTRUCTION MANAGEMENT	213	43	20%	256	2.3%	218	44	262	JAN 18	112.2%	463	93	556
	TOTAL COSTS =====>	3,495	700	20%	4,195		3,570	716	4,286			7,258	1,456	8,714

TABLE 3 (Continued)
TOTAL PROJECT COST SUMMARY

NOURISHMENT 3 (2029)					**** TOTAL CONTRACT COST SUMMARY ****					PAGE 10 OF 11				
PROJECT: MARTIN COUNTY BEC					THIS ESTIMATE IS BASED ON THE SCOPE CONTAINED IN THE GDM, DATED: DEC 93									
LOCATION: MARTIN COUNTY, FLORIDA					DISTRICT: JACKSONVILLE									
					P.O.C.: MILTON WITT, CHIEF, COST ENGINEERING									
					CURRENT MCACES ESTIMATE PREPARED: DEC 93					AUTHORIZ./BUDGET YEAR: 1996				
					EFFECTIVE PRICING LEVEL: DEC 93					EFFECT. PRICING LEVEL: 1 OCT 94				
					FULLY FUNDED ESTIMATE									
ACCOUNT	FEATURE DESCRIPTION	COST	CNTG	CNTG	TOTAL	OMB	COST	CNTG	TOTAL	FEATURE	OMB	COST	CNTG	FULL
NUMBER		(\$K)	(\$K)	(%)	(\$K)	(%)	(\$K)	(\$K)	(\$K)	MID PT	(%)	(\$K)	(\$K)	(\$K)
06---	FISH AND WILDLIFE FACILITIES	128	26	20%	154	1.9%	130	27	157	JAN 29	183.4%	368	77	445
17---	BEACH REPLENISHMENT	2,911	582	20%	3,493	2.2%	2,974	595	3,569	JAN 29	183.7%	8,436	1,688	10,124
TOTAL CONSTRUCTION COSTS =====>		3,039	608	20%	3,647		3,104	622	3,726			8,804	1,765	10,569
01---	LANDS AND DAMAGES													
30---	PLANNING, ENGINEERING AND DESIGN	243	49	20%	292	2.1%	248	50	298	APR 28	186.9%	712	143	855
31---	CONSTRUCTION MANAGEMENT	213	43	20%	256	2.3%	218	44	262	JAN 29	193.5%	640	129	769
TOTAL COSTS =====>		3,495	700	20%	4,195		3,570	716	4,286			10,156	2,037	12,193

TABLE 3 (Continued)
TOTAL PROJECT COST SUMMARY

MOORISHMENT 4 (2040)

**** TOTAL CONTRACT COST SUMMARY ****

PAGE 11 OF 11

PROJECT: MARTIN COUNTY BEC		THIS ESTIMATE IS BASED ON THE SCOPE CONTAINED IN THE GDM, DATED: DEC 93								DISTRICT: JACKSONVILLE					
LOCATION: MARTIN COUNTY, FLORIDA										P.O.C.: MILTON WITT, CHIEF, COST ENGINEERING					
		CURRENT MCACES ESTIMATE PREPARED: DEC 93								AUTHORIZ./BUDGET YEAR: 1996			FULLY FUNDED ESTIMATE.....	
		EFFECTIVE PRICING LEVEL: DEC 93								EFFECT. PRICING LEVEL: 1 OCT 94					
ACCOUNT		COST	CNTG	CNTG	TOTAL	OMB	COST	CNTG	TOTAL	FEATURE	OMB	COST	CNTG	FULL	
NUMBER	FEATURE DESCRIPTION	(\$K)	(\$K)	(%)	(\$K)	(%)	(\$K)	(\$K)	(\$K)	MID PT	(%)	(\$K)	(\$K)	(\$K)	
=====															
06---	FISH AND WILDLIFE FACILITIES	128	26	20%	154	1.9%	130	27	157	JAN 40	296.8%	516	107	623	
17---	BEACH REPLENISHMENT	2,911	582	20%	3,493	2.2%	2,974	595	3,569	JAN 40	298.1%	11,839	2,368	14,207	
TOTAL CONSTRUCTION COSTS =====>		3,039	608	20%	3,647		3,104	622	3,726			12,355	2,475	14,830	
=====															
01---	LANDS AND DAMAGES														
30---	PLANNING, ENGINEERING AND DESIGN	243	49	20%	292	2.1%	248	50	298	APR 39	297.3%	985	199	1,184	
31---	CONSTRUCTION MANAGEMENT	213	43	20%	256	2.3%	218	44	262	JAN 40	306.1%	885	179	1,064	
TOTAL COSTS =====>		3,495	700	20%	4,195		3,570	716	4,286			14,225	2,853	17,078	

previously described in this report. The costs for temporary construction easements, rights-of-ways, relocations and damages (LERRD) were determined as indicated in the attached Real Estate Appendix (Appendix C).

BENEFITS SUMMARY

41. The primary purpose of the Martin County shore protection project is to prevent physical damages. The project provides protection to over \$7 million in private and commercial upland development, as well as infrastructure such as roads and utilities. Physical loss of land is prevented and incidental recreation are generated by increased recreational usage of the project beach. The project will increase usable nesting beach for endangered and threatened turtle species. The economic value of these benefits are summarized in Table 4. Detailed analysis of project benefits are presented in Appendix B.

ECONOMIC JUSTIFICATION

42. Table 4 summarizes the economic justification for the recommended project. Annual costs and benefits for an 8 percent interest rate are displayed. The benefit-to-cost ratio is 5.0 with net primary benefits of \$3,829,800.

PLAN IMPLEMENTATION

COST APPORTIONMENT

43. Section 103(d) of the Water Resources Development Act of 1986 (Public Law 99-662) specifies that the cost of construction measures for beach erosion control are assigned to the appropriate purpose(s) specified in Section 103(c) of the Act. These purposes are normally hurricane and damage reduction and/or separable recreation, and shared in the same percentages as to the purposes to which the costs are assigned, except no costs are assigned to incidental recreation. Hurricane and storm damage reduction projects are cost shared at 65 percent Federal, and separable recreation projects are cost shared at 50 percent Federal. Cost sharing for beach erosion control measures must also consider shore ownership and use. Additional guidance on cost sharing for shore protection projects provided in Engineering Regulation 1165-2-130 dated June 15, 1989. A summary table of shore ownership and level of Federal participation for the 3.75 mile problem area is displayed in Table 5.

44. The Federal project consists of the project being built, both, seaward and landward of the ECL. The location of this line is defined on Plates 2 through 9. Construction landward of the ECL to the CCL on undeveloped private property is 100 percent non-Federal. However, cost of construction are cost shareable and lands

TABLE 4
ECONOMIC SUMMARY
RECOMMENDED PROJECT
(MODIFIED AUTHORIZED PROJECT)

ITEM	INTEREST RATE 8.00%
ANNUAL PROJECT COSTS	
Initial Restoration	795,800
Additional Monitoring	61,800
Future Beach Nourishment	252,400
Interest During Construction	32,400
TOTAL ANNUAL PROJECT COSTS	1,142,000
PRIMARY BENEFITS	
Prevention of:	
Damage to Development	4,888,600
Loss of Land	83,200
Total Primary Benefits	4,971,800
NET PRIMARY BENEFITS	3,829,800
INCIDENTAL BENEFITS	
Recreation Benefits	702,400
TOTAL PROJECT BENEFITS	5,674,200
BENEFIT-TO-COST RATIO	5.0

TABLE 5
MARTIN COUNTY, FLORIDA, SHORE PROTECTION PROJECT
APPORTIONMENT OF COST

PROFILE LINE NUMBER (A)	LOT DESCRIPTION (B)	LOT WIDTH (FT) (C)	SHORELINE DESCRIPTION (D)	WITHIN PROJECT LIMITS (E)	SHORE 1/ WITHIN OWNERSHIP 1/4 MILE OF ACCESS (F)	AND PROJECT PURPOSE (G)	LEVEL OF FEDERAL PARTN (H)	FEDERAL PARTICIPATION TIMES LOT WIDTH ((C)*(H)) (I)	DESIGN VOLUME (Cable Yards) (J)	
R-1	HOUSE (PRIV.RES.)	110	DEVELOPED	Y	Y	II.A.	65.00%	71.5		
	D CONDO	210	DEVELOPED	Y	Y	II.A.	65.00%	136.5	3,929	
	subtotal	320					65.00%	208.0	2,554	FEDERAL SHARE OF VOLUME
R-2	D CONDO	450	DEVELOPED	Y	Y	II.A.	65.00%	292.5		
	HOUSE (PRIV.RES.)	190	DEVELOPED	Y	Y	II.A.	65.00%	123.5	13,489	
	PRIVATE LOT	450	UNDEVELOPED	Y	Y	IV.	0.00%	0.0		
	REALTY OFFICE	230	DEVELOPED	Y	Y	II.A.	65.00%	149.5		
	subtotal	1320					42.84%	565.5	5,779	FEDERAL SHARE OF VOLUME
R-3	JENSEN BEACH PK	1050	PUBLIC BEACH	Y	Y	II.B.	50.00%	525.0		
	CONCESSION STND	170	PUBLIC BEACH	Y	Y	II.B.	50.00%	85.0	11,457	
	subtotal	1220					50.00%	610.0	5,729	FEDERAL SHARE OF VOLUME
R-4	GAZEBO	230	PUBLIC BEACH	Y	Y	II.B.	50.00%	115.0		
	BATHHOUSE	280	PUBLIC BEACH	Y	Y	II.B.	50.00%	140.0	14,262	
	subtotal	510					50.00%	255.0	7,131	FEDERAL SHARE OF VOLUME
R-5	GAZEBO	180	PUBLIC BEACH	Y	Y	II.B.	50.00%	90.0		
	LIFEGUARD BLDING	670	PUBLIC BEACH	Y	Y	II.B.	50.00%	335.0	10,803	
	subtotal	850					50.00%	425.0	5,402	FEDERAL SHARE OF VOLUME
R-6	MOTEL	510	DEVELOPED	Y	Y	II.A.	65.00%	331.5		
	UNDEVELOPED LOT	790	UNDEVEL PUBLIC	Y	Y	II.B.	50.00%	395.0	16,229	
	subtotal	1300					55.88%	726.5	9,070	FEDERAL SHARE OF VOLUME
R-7	HOUSE (PRIV.RES.)	130	DEVELOPED	Y	N	III.	0.00%	0.0		
	HOUSE (PRIV.RES.)	100	DEVELOPED	Y	N	III.	0.00%	0.0		
	CONDO	180	DEVELOPED	Y	N	III.	0.00%	0.0		
R-11	BOB GRAHAM PK	4010	PUBLIC BEACH	Y	Y	II.B.	50.00%	2,005.0		
	HOUSE (PRIV.RES)	100	DEVELOPED	Y	Y	II.A.	65.00%	65.0	67,954	
	subtotal	4520					45.80%	2,070.0	31,121	FEDERAL SHARE OF VOLUME

TABLE 5 (Continued)
MARTIN COUNTY, FLORIDA, SHORE PROTECTION PROJECT
APPORTIONMENT OF COST

PROFILE LINE NUMBER (A)	LOT DESCRIPTION (B)	LOT WIDTH (FT) (C)	SHORELINE DESCRIPTION (D)	WITHIN PROJECT LIMITS (E)	SHORE 1/ WITHIN OWNERSHIP 1/4 MILE OF ACCESS (F)	AND PROJECT PURPOSE (G)	LEVEL OF FEDERAL PARTN (H)	FEDERAL PARTICIPATION TIMES LOT WIDTH ((C)*(H)) (I)	DESIGN VOLUME (Cu Mc Yards) (J)	
R-12U	GAZEBO	110	PUBLIC ACCESS	Y	Y	II.B.	50.00%	55.0		
	CONDO	200	DEVELOPED	Y	Y	II.A.	65.00%	130.0		
	POOL	130	DEVELOPED	Y	Y	II.A.	65.00%	84.5		
	CONDO	200	DEVELOPED	Y	Y	II.A.	65.00%	130.0	16,258	FEDERAL SHARE
	subtotal	640					62.42%	399.5	10,149	OF VOLUME
R-13	CONDO	330	DEVELOPED	Y	Y	II.A.	65.00%	214.5		
	PUBLIC LANDS	230	PUBLIC ACCESS	Y	Y	II.B.	50.00%	115.0		
	PRIVATE LOT	180	UNDEVELOPED	Y	Y	IV.	0.00%	0.0		
	HOUSE (PRIV.RES.)	80	DEVELOPED	Y	Y	II.A.	65.00%	52.0	27,192	
	subtotal	820					46.52%	381.5	12,651	
R-14	CONDO	200	DEVELOPED	Y	Y	II.A.	65.00%	130.0		
	CONDO	270	DEVELOPED	Y	Y	II.A.	65.00%	175.5		
	CONDO	300	DEVELOPED	Y	Y	II.A.	65.00%	195.0	26,097	
	subtotal	770					65.00%	500.5	16,963	
R-15	CONDO	370	DEVELOPED	Y	Y	II.A.	65.00%	240.5		
	CONDO	150	DEVELOPED	Y	Y	II.A.	65.00%	97.5		
	THE M CONDO	120	DEVELOPED	Y	Y	II.A.	65.00%	78.0		
	THE M CONDO	120	DEVELOPED	Y	Y	II.A.	65.00%	78.0		
	THE M CONDO	150	DEVELOPED	Y	Y	II.A.	65.00%	97.5		
	VIRGINIA FOREST BC	450	PUBLIC BEACH	Y	Y	II.B.	50.00%	225.0	15,917	
	subtotal	1360					60.04%	816.5	9,556	FEDERAL SHARE
R-16	HOUSE (PRIV.RES.)	210	DEVELOPED	Y	Y	II.A.	65.00%	136.5		
	HOUSE (PRIV.RES.)	110	DEVELOPED	Y	Y	II.A.	65.00%	71.5		
	HOUSE (PRIV.RES.)	130	DEVELOPED	Y	Y	II.A.	65.00%	84.5		
	PRIVATE LOT	150	UNDEVELOPED	Y	Y	IV.	0.00%	0.0	15,917	
	subtotal	600					48.75%	292.5	7,760	
R-17	PRIVATE LOT	560	UNDEVELOPED	Y	Y	IV.	0.00%	0.0		
	B CONDO	340	DEVELOPED	Y	Y	II.A.	65.00%	221.0		
	PRIVATE LOT	225	UNDEVELOPED	Y	N	IV.	0.00%	0.0	14,385	
	subtotal	1125					19.64%	221.0	2,826	

TABLE 5 (Continued)
MARTIN COUNTY, FLORIDA, SHORE PROTECTION PROJECT
APPORTIONMENT OF COST

PROFILE LINE NUMBER	LOT DESCRIPTION	LOT WIDTH (FT)	SHORELINE DESCRIPTION	SHORE 1/ WITHIN OWNERSHIP 1/4 MILE AND PROJECT OF LIMITS ACCESS PURPOSE			LEVEL OF FEDERAL PARTN	FEDERAL PARTICIPATION TIMES LOT WIDTH ((C)*(H))		DESIGN VOLUME (Cubic Yards)
				(B)	(F)	(G)		(I)	(J)	
R-18	HH CONDO	190	DEVELOPED	Y	Y	II.A.	65.00%	123.5		
	HH CONDO	135	DEVELOPED	Y	Y	II.A.	65.00%	87.8		
	CLUBHOUSE	110	DEVELOPED	Y	Y	II.A.	65.00%	71.5		
	LOP CONDO	120	DEVELOPED	Y	Y	II.A.	65.00%	78.0		
	LOP CONDO	190	DEVELOPED	Y	Y	II.A.	65.00%	123.5		
	subtotal	745					65.00%	484.3		27,799
										FEDERAL SHARE OF VOLUME
R-19	ST CONDO	440	DEVELOPED	Y	Y	II.A.	65.00%	286.0		
	CLUBHOUSE	160	DEVELOPED	Y	Y	II.A.	65.00%	104.0		
	TIGERS SHORES ACC	150	PUBLIC ACCESS	Y	Y	II.B.	50.00%	75.0		30,341
	IS CONDO	140	DEVELOPED	Y	Y	II.A.	65.00%	91.0		
	subtotal	890					62.47%	556		18,955
R-20	PRIVATE LOT	410	UNDEVELOPED	Y	Y	IV.	0.00%	0.0		
	HOUSE (PRIV.RES.)	100	DEVELOPED	Y	Y	II.A.	65.00%	65.0		
	HOUSE (PRIV.RES.)	120	DEVELOPED	Y	Y	II.A.	65.00%	78.0		
	HOUSE (PRIV.RES.)	85	DEVELOPED	Y	Y	II.A.	65.00%	55.3		16,938
	subtotal	715					27.73%	198.25		4,696
										FEDERAL SHARE OF VOLUME
R-21	PRIVATE LOT	1080	UNDEVELOPED	Y	Y	IV.	0.00%	0.0		0
R-22	GAZEBO	230	PUBLIC BEACH	Y	Y	II.B.	50.00%	115.0		
	BOATHOUSE	300	PUBLIC BEACH	Y	Y	II.B.	50.00%	150.0		
	CONCESSION STAND	40	PUBLIC BEACH	Y	Y	II.B.	50.00%	20.0		
	GAZEBO	175	PUBLIC BEACH	Y	Y	II.B.	50.00%	87.5		
	BOATHOUSE	100	PUBLIC BEACH	Y	Y	II.B.	50.00%	50.0		
	LIFEGUARD TOWER	400	PUBLIC BEACH	Y	Y	II.B.	50.00%	200.0		6,645
R-23	subtotal	1245					50.00%	622.5		3,323

TABLE 5 (Continued)
MARTIN COUNTY, FLORIDA, SHORE PROTECTION PROJECT
APPORTIONMENT OF COST

PROFILE LINE NUMBER	LOT DESCRIPTION	LOT WIDTH (F)	SHORELINE DESCRIPTION (D)	WITHIN PROJECT LIMITS (E)	SHORE 1/ WITHIN OWNERSHIP 1/4 MILE AND ACCESS PURPOSE (F)	FEDERAL PARTICIPATION LEVEL OF FEDERAL PARTN (G)	FEDERAL PARTICIPATION TIMES ((C)*(H)) (I)	DESIGN VOLUME (Cable Yards) (J)
TOTALS FOR PROJECT		20,030	SHORELINE LENGTH (Feet)			SUM OF COLUMN (I) IN FE	9,333	171,731
		3.8	SHORELINE LENGTH (Miles)			TOTAL DESIGN VOLUME PLACED IN CUBIC		337,500
<p>THE SUM OF COLUMN (I) DIVIDED BY 20,030 FEET = 46.59 PERCENT WHICH IS THE FEDERAL SHARE OF CONSTRUCTION COSTS SUCH AS ADVANCE NOURISHMENT COSTS WHICH ARE LINEARLY DISTRIBUTED ALONG THE PROJECT.</p> <p>THE TOTAL SUM OF COLUMN (J) DIVIDED BY THE TOTAL DESIGN VOLUME IS EQUAL TO 50.88 PERCENT, WHICH IS THE FEDERAL SHARE OF NON-LINEAR PROJECT COSTS FOR THE DESIGN VOLUME.</p>								
1/ SHORE OWNERSHIP AND PROJECT PURPOSE (As defined in ER 1165-2-130)						Max Level Fed Participation Construct Costs		
I.	Federally Owned					100.00%		
II.	Publicly and Privately Owned - Protection Results in Public Benefits.							
A.	Hurricane and Storm Damage Reduction					65.00%		
B.	Private and Public Land Open for Public Use - Recreation					50.00%		
C.	Separable Recreation					50.00%		
III.	Privately Owned, Use Limited to Private Interests					0.00%		
IV.	Privately Owned, Undeveloped					0.00%		

credible in front of developed private lots where perpetual easements make the lands open to the public. Normally, non-Federal public shores are dedicated to park and conservation areas, and the benefits of protecting such shores will be based on the loss of recreation outputs, with cost sharing 50 percent Federal and 50 percent non-Federal. Public parks and street ends in the project area are cost shared at 50 percent Federal/non-Federal since the primary project output for this shorefront is recreation. The cost sharing would be 65 percent Federal and 35 percent non-Federal for protection of privately owned shores resulting in public benefits.

45. The apportionment of project costs was determined for both linear and non-linear costs. The volume of design fill placed along any given reach of the project shoreline varies considerably. The cost to construct the design section is therefore a non-linear cost. The project was segmented into reaches based on profile lines as shown in Table 5. The volume for each reach was determined and is shown in the table. The appropriate Federal share of the design volume for each reach was then determined. The Federal share of the design volume of 337,500 cubic yards is 171,720 cubic yards, or 50.88 percent.

46. Linear costs are those project costs which are uniformly distributed throughout the length of the project (i.e., periodic nourishment and overfill costs). Linear costs are also costs applied to the project as a whole, such as mobilization and demobilization costs, monitoring, contingencies, engineering and design, contract supervision and contract administration. As indicated in Table 5, the Federal share of linear costs was determined to be 46.59 percent.

47. Revised Policy Guidance Letter 11 (issued by CECW-RP, 21 April 1989) directs the use of the "Federal rule of valuation" which provides for an offset of benefits in determining compensation for properties including severance. Lands seaward of the CCL may have value; credit for these lands will be based on the Federal rules of valuation. The non-Federal project sponsor is entitled to credit for administrative costs incurred in providing lands for the Federal project except for lands in front of vacant private lots. The administrative costs for upland temporary construction easements are not part of the Federal total project costs and are a non-Federal responsibility.

48. The cost of establishing the State's required erosion control line (ECL) is a non-Federal cost. Once this line has been approved by the Florida Cabinet, all project lands fronting the developed private shore within the project are considered open to use by the public. The cost sharing for developed private lands shown in Table 5 is based on the assumption that the ECL will be approved by the Florida Cabinet prior to project construction. Periodic nourishment is considered "construction" for cost sharing purposes.

49. Final apportionment is based on current law and conditions of shore ownership and use at the time of construction or subsequent nourishment. Cost sharing for non-linear costs (i.e., the quantity of design volume) would be based on the last physical survey of shoreline conditions prior to construction. This survey is normally the contract plans and specifications survey.

FEDERAL RESPONSIBILITY

50. The U.S. Army Corps of Engineers would be responsible for Federal funding and construction of the project features. The total cost of initial project construction is \$10,491,400. This cost is defined as the total project cost in the PCA. The Federal share of the total project cost is presently estimated at \$4,970,300 (47.37 percent). The Federal cost sharing by project feature is summarized in Table 6. The Federal share of the cost of each future periodic nourishment is \$1,953,985 or 46.59 percent. Prior to construction the U.S. Army Corps of Engineers will prepare an operation and maintenance manual which will describe the non-Federal project sponsor's obligations toward operation, maintenance, repair, replacement, and rehabilitation of the completed project.

NON-FEDERAL RESPONSIBILITY

51. The non-Federal project sponsor would provide an up-front cash contribution for initial construction of the proposed project. The value of this contribution is estimated at \$4,912,300 of the total project cost defined above. The non-Federal sponsor would also provide the entire cost of all material placed on undeveloped private land and share in the placement of fill on developed private lands and public lands landward of the ECL to the CCL. This cost is currently estimated to be \$399,300. The cost for lands, easements, and rights-of-way and a portion of the administrative costs associated with land requirements (\$209,600) is also a non-Federal responsibility. The total non-Federal responsibility for the initial work is \$5,521,200 or about 52.63 percent of the total project cost. The non-Federal share of the cost of each future periodic nourishment is \$2,240,015 or 53.41 percent.

OTHER NON-FEDERAL REQUIREMENTS

52. Other general non-Federal responsibilities including continued public use of the project beach, control of water pollution to safeguard the health of bathers, and operation and maintenance of the project beach must be assumed by the non-Federal sponsor. These costs are estimated at \$833,000. Operation and maintenance includes beach berm reshaping and maintenance of storm drainage outfalls as contained within the operation and maintenance manual. The items of project cooperation are listed in the section entitled "Modifications to the Items of Project Cooperation" of this report. The delineation of Federal and non-Federal responsibility is defined in the project cooperation agreement (PCA).

TABLE 6
TOTAL PROJECT COST SHARING

ITEM	TOTAL COST	PERCENT FEDERAL	FEDERAL SHARE	PERCENT NON-FEDERAL	NON-FEDERAL SHARE
Initial Restoration					
Design Volume (337,500 c.y.)	\$1,518,800	50.88%	\$772,800	49.12%	\$746,000
Anticipated Erosional Losses (214,400 c.y.)	\$964,800	50.88%	\$490,900	49.12%	\$473,900
Advance Nourishment (589,600 c.y.)	\$2,653,200	46.59%	\$1,236,100	53.41%	\$1,417,100
Fill Behind ECL (156,000 c.y.) *					
Public and Private Developed	\$594,900	50.88%	\$302,700	49.12%	\$292,200
Private Undeveloped	\$107,100	0.00%	\$0	100.00%	\$107,100
Mob, Demob & Preparatory Work	\$1,680,000	46.59%	\$782,700	53.41%	\$897,300
Monitoring	\$153,600	46.59%	\$71,600	53.41%	\$82,000
LERRD **	\$0	0.00%	\$0	100.00%	\$0
LERRD Administration	\$392,500	46.59%	\$182,900	53.41%	\$209,600
Planning, Engineering & Design	\$1,133,000	46.59%	\$527,900	53.41%	\$605,100
Construction Management	\$537,600	46.59%	\$250,500	53.41%	\$287,100
Add'l Monitoring Years 1-11 (Present Worth)	\$756,000	46.59%	\$352,200	53.41%	\$403,800
TOTAL	\$10,491,500	47.37%	\$4,970,300	52.63%	\$5,521,200
Total Non-Federal Responsibility					\$5,521,200
Less LERRD					\$0
Equals Total Non-Federal Cash Requirement					\$5,521,200

* Public (85,299 c.y.) and Private (46,911 c.y.) Developed and Private Undeveloped (23,790 c.y.).

** Refer to Real Estate Appendix C, paragraph 9.f.

VIEWS OF THE NON-FEDERAL SPONSOR

53. The Martin County Board of County Commissioners provided a letter of intent dated October 2, 1985, which specifies the county intent to eventually serve as the non-Federal interest that will share in the costs of the project. By letter, dated June 9, 1994, Martin County has reiterated their intent to sponsor the recommended project as described in this report. Informal meetings were held in Jacksonville, Stuart, and Tallahassee during the preparation of the GDM to advise county and state interests of the status of the study and to coordinate areas of study interest which would avoid future permitting difficulties. The county has continued active support for the project as evidenced by letters contained within the pertinent correspondence appendix.

FINANCIAL ANALYSIS

54. Financial analysis is required for any plan being considered for Corps of Engineers implementation that involves non-Federal cost sharing. The ultimate purpose of the financial analysis is to ensure that the non-Federal sponsor understands the financial commitment involved and has a reasonable plan for meeting that commitment. The financial analysis includes the non-Federal sponsor's statement of financial capability, the non-Federal sponsor's financing plan, and an assessment of the sponsor's financial capability.

55. Non-Federal Sponsor Financing Plan and Financial Statement. The non-Federal sponsor is preparing its financing plan and the statement of financial capability. The county's statement of financial capability and financing plan will be contained within the Project Cooperation Agreement (PCA) package following review of the GDM by the county. The financing plan will include the details of the county's financing plan and the State's contribution of funds. Since the county will be the only non-Federal signatory to the PCA, only the county need prepare a financing plan and statement for financial capability. The county, as part of its plan, will include evidence of the State's authority to provide state funding, along with evidence of the State's legal commitment to the non-Federal sponsor.

56. State Financing Plan. The State of Florida has authority to provide funds to county governments for shore protection projects. This authority is provided by Chapter 161, Florida Statutes. State funding is scheduled to be included in the State's Fiscal Year budget for 1995.

57. Financing Assessment. The Martin County Board of Commissioners is empowered by Chapter 161, Florida Statutes, to act as the county beach and shore preservation authority. Such powers specifically include the authority to make contracts and enter into agreements, to acquire and hold lands and property by any lawful means, to exercise the power of eminent domain, and to construct, acquire,

operate and maintain shore protection works and facilities. The county has the authority to tax property or issue bonds to meet the costs of the county beach and shore preservation program.

58. Chapter 161 also provides for state financial assistance in funding beach erosion control and shore preservation projects. Any county may make application to the Division of Beaches and Shores, Florida Department of Environmental Protection, for state funds for these projects. For Federal projects, the State is authorized to fund up to 75 percent of the non-Federal construction and maintenance costs of projects authorized by the Congress of the United States, subject to certain restrictions. The State is authorized to expend funds from the Erosion Control Trust Fund account for such projects.

59. The Board of County Commissioners has the authority and financial capability to provide the required non-Federal cash contribution for project construction, and to fulfill the other items of project cooperation. The county, through the assistance and authority of the Florida Department of Environmental Protection and the Trustees of the State Internal Improvement Trust Fund, can resolve the paramount issue of riparian rights by establishing an erosion control line, and thereby comply with the important non-Federal responsibility to furnish all lands, easements and rights-of-way needed for project construction.

DEPARTURES FROM THE AUTHORIZED PROJECT

60. Changes have occurred since the Martin County shore protection project was authorized in 1990. These changes include physical, economic, and cost apportionment differences. Table 7 summarizes differences between the authorized project and the proposed 1994 modified authorized project as described herein.

PHYSICAL CHANGES

61. Since the preparation of the feasibility report in 1985 and project authorization in 1990, the recession of the Martin County shoreline has continued. The length of shoreline considered for nourishment has been decreased from 21,120 to 19,800 feet primarily due the increased direct coverage of nearshore hardbottom with the longer project. Initial fill requirements have increased by 355,500 cubic yards. The project berm and dune width and elevation have remained as authorized. The design fill has increased from 454,000 to 493,500 cubic yards which includes 156,000 cubic yards behind the ECL. Advanced nourishment has increased from 488,000 to 589,600 cubic yards (including overfill) with the reduced project length being offset by increases in the anticipated long-term erosion losses. The determination that the lowest equivalent annual cost occurs with a renourishment interval of eleven years

TABLE 7
SUMMARY OF CHANGES TO THE AUTHORIZED PROJECT

ITEM	AUTHORIZED PROJECT (1985 FEASIBILITY RPT)	RECOMMENDED PROJECT MODIFICATIONS (REV. JUNE 1994 GDM)
Physical Data		
Fill Length (miles)	4.00	3.75
Berm Elevation (MLW)	9.10	9.10
Berm Width (feet)	35	35
Dune Elevation (MLW)	13.60	13.60
Dune Width (feet)	20	20
Initial Volume (cy)	942,000	1,297,500
Future Nourishment (cy)	488,000	589,600
Nourishment Interval (yrs)	8	11
Financial Data		
Price Levels	1984	1993
Interest Rate	8.625%	8.00%
Total First Cost (\$)	9,521,000	10,491,400
Total Annual Cost (\$)	1,340,000	1,142,000
Total Benefits (\$)	2,225,000	5,674,200
Net Benefits (\$)	884,700	4,532,200
Benefit-to-Cost Ratio	1.7	5.0
Cost Apportionment		
Federal Responsibility:		
Initial Construction		
Amount (\$)	4,380,500	4,970,300
Percent	50.3	47.37
Future Nourishment		
Percent	50.3	46.59
Non-Federal Responsibility:		
Initial Construction		
Amount (\$)	5,038,500	5,521,200
Percent	49.7	52.63
Future Nourishment		
Percent	49.7	53.41

represents an increase of three years over the authorized plan. The authorized project computed overfill (or sorting losses) by applying a factor of 1.15 to the advanced nourishment volume. A decrease in volume of overfill required is due to new geotechnical data which estimates the overfill factor at 1.00.

FINANCIAL CHANGES

62. Costs. The project cost has increased due to several factors. The primary factor is the additional monitoring recommended during the first 11 years of the project life. Additional monitoring is recommended in order to ascertain what secondary impacts, if any, the beach fill activities will have on the hardbottom habitat adjacent to the project area. Other factors, such as, increase in volume attributable to additional erosion occurring since authorization, reevaluation of long-term erosion rates, the change in overfill factor associated with the borrow area, have also contributed to the increase of project cost. In addition, price levels for mobilization and demobilization have increased due to the recommended use of two cutterhead pipeline dredges (in order to avoid turtle nesting season) versus one hopper dredge with pumpout through a nearshore monobouy, as authorized. The initial cost of construction of the modified project is \$10,491,400.

63. Benefits. Benefits for the modified plan are estimated at \$5,674,200 of which \$4,971,800 is for storm damage reduction and prevention of loss of land, and \$702,400 for recreation. This compares to values estimated within the feasibility report of \$1,080,800 and \$1,144,200, respectively. The benefit-to-cost ratio increased from 1.7 to 5.0.

64. Cost Apportionment. The Federal interest in the project has decreased from 50.3 to 47.37 percent for initial construction and from 50.3 to 46.59 for future periodic nourishment and is due primarily to a more detailed evaluation of ownership and use of shorefront property.

STUDY SUMMARY

This report summarizes the preconstruction studies conducted to ready the Martin County shore protection project for construction. Based on these studies, the following was concluded:

Storm damage is negatively impacting 3.75 miles of Atlantic shoreline on Hutchinson Island. About \$7 million of shorefront development is threatened by storms.

67. A contributing factor to the susceptibility to storm damage is relative sea level rise. If the upper limit of relative sea level rise actually occurs, it will increase the shoreline recession and storm damages estimated within this report.

68. The most practical and economical means to prevent or reduce structural damages is to construct the authorized shore protection project as modified herein.

69. The non-Federal sponsor supports construction of the project.

FLOOD PLAIN DEVELOPMENT

70. The selected plan is in the base flood plain (100-year flood) and has been evaluated in accordance with Executive Order 11988. Relocation of the proposed project outside the flood plain would not be responsive to the problems and needs of the study area and was not considered further. A non-flood plain alternative for the potential development with the project would be to restrict all future development to those areas outside the flood plain or elevated above the flood plain. Potential flood plain development with the project would be restricted as a result of local ordinances and State law. Any induced potential damage as a result of local project implementation would be minimal. The project would have minimum impact on the natural and beneficial values of the flood plain. In the without project flood plain (that area immediately adjacent to the proposed project), there will be minimal loss of natural resources due to potential development. Implementation of any non-structural plans that would minimize potential damage to or within the flood plain beyond those laws and regulations already adopted by local and state interests are not viable solutions under the planning constraints of this study.

COST EFFECTIVENESS OF DESIGN

71. Section 911 of Public Law 99-662 requires a cost effectiveness review of the project design for any water resources project which has a total cost in excess of \$10,000,000, and for which construction has not been initiated by November 17, 1986. The review shall employ cost control techniques which will ensure that such project is designed in the most cost-effective way for the life of the project. Engineering Circular No. 1110-2-259 dated February 1, 1989 provides guidance for implementing cost control techniques for projects in accordance with Section 911.

72. The District Engineer will certify, based on the recommendation of the project design review team, that the design achieved in the preconstruction, engineering and design phase is the most cost effective design. The District Engineer's letter of certification is provided in the correspondence appendix.

PUBLIC ACCESSIBILITY

73. In the determination of the Federal interest in cost-sharing, Federal participation was limited to the areas where adequate parking and access were provided. Federal participation is limited to those shoreline reaches within 1/4 mile from an access point, a reasonable walking distance for a beach visitor. The entire project fits this criteria, therefore, Federal participation is warranted.

CONCLUSIONS

74. Consideration has been given to all significant aspects of the authorized project in the overall public interest, including engineering feasibility, economic, social and environmental effects. The modifications to the authorized project described in this report provide the optimum solution for protection of upland development on Hutchinson Island.

RECOMMENDATIONS

75. It is recommended that the authorized project for Martin County, Florida be modified and Federal construction funding provided in accordance with the selected plan herein, with such modifications as in the discretion of the Chief of Engineers may be advisable.

DISCLAIMER

76. The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to higher authority as proposals for project modification and/or implementation funding.

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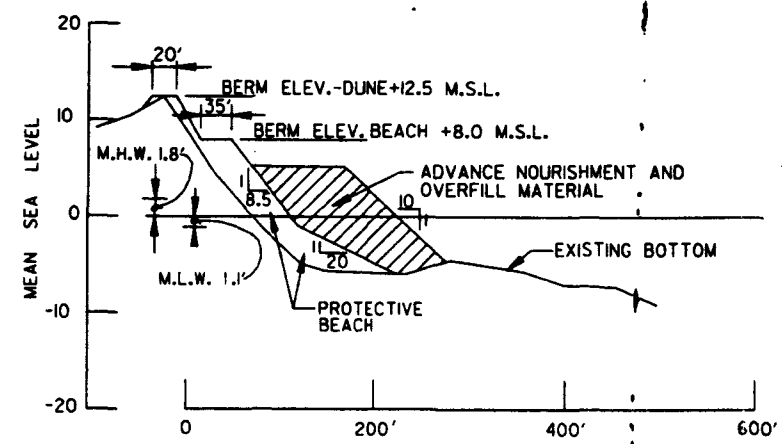
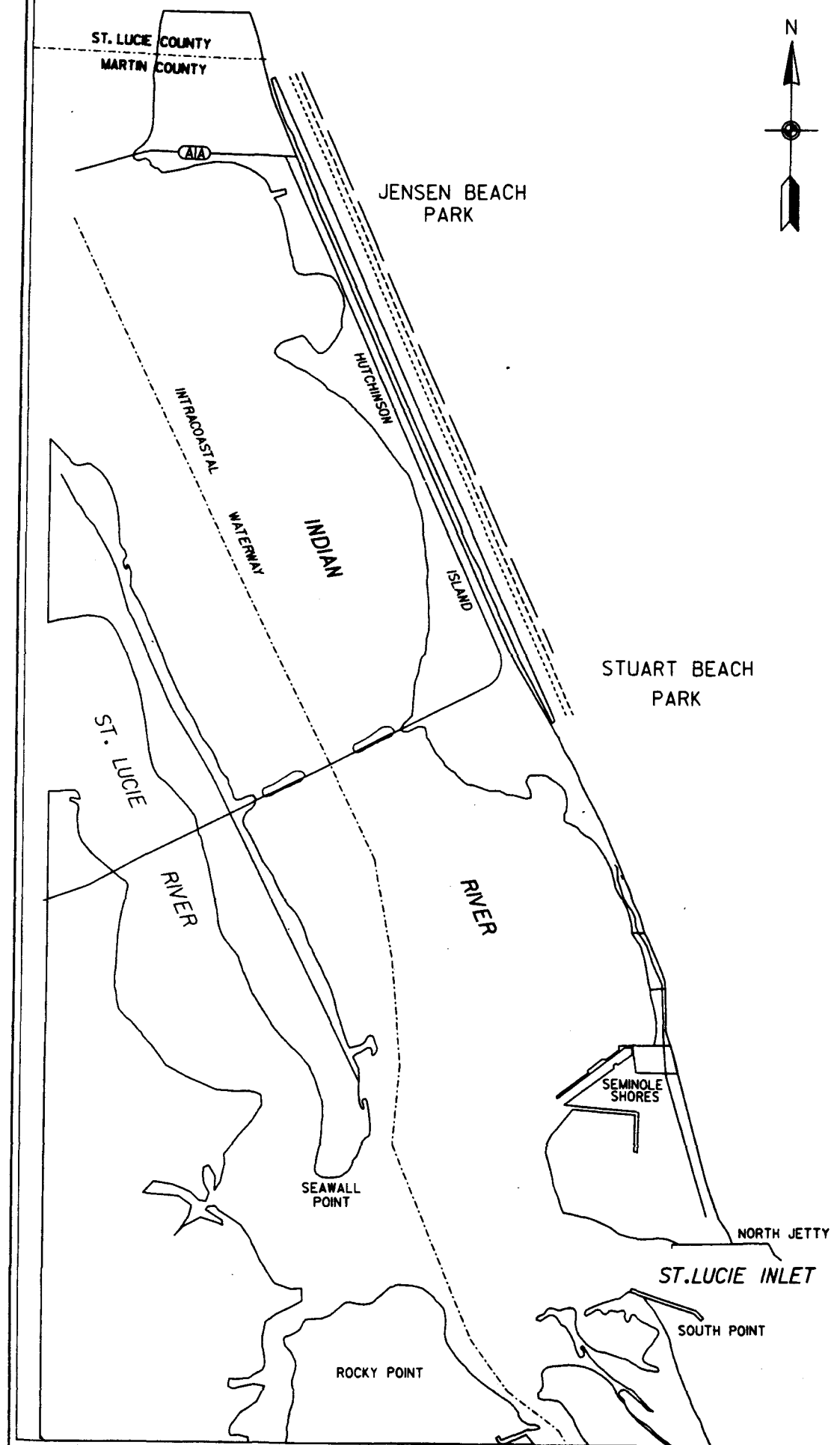
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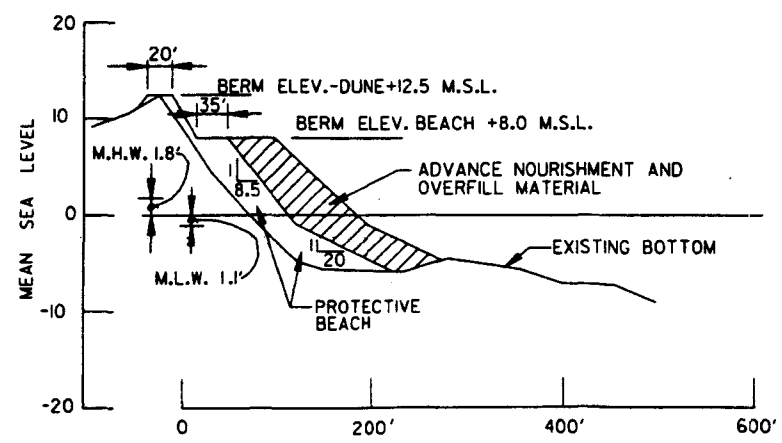
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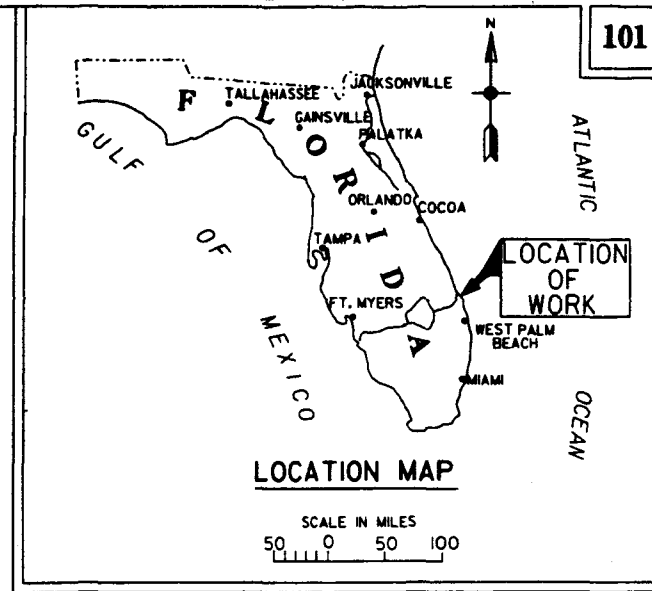
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AUTHORIZED TYPICAL SECTION
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(JENSEN BEACH)



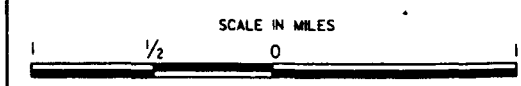
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(JENSEN BEACH)



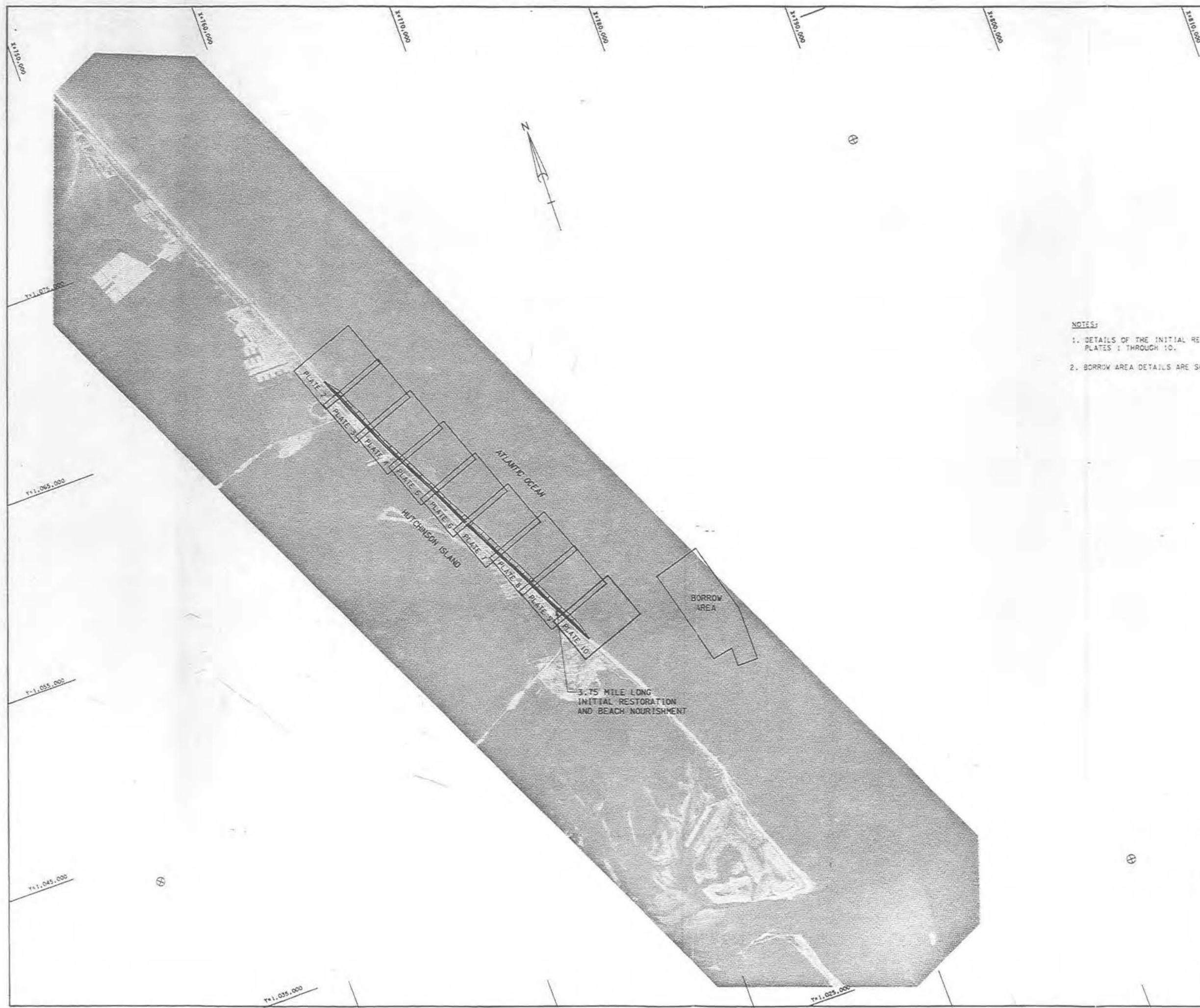
LEGEND

- PERIODIC NOURISHMENT AS NEEDED AS AUTHORIZED
- INITIAL RESTORATION AS AUTHORIZED
- INITIAL RESTORATION AS PROPOSED

MARTIN COUNTY, FLORIDA
SHORE PROTECTION



SCALE AS SHOWN
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA



- NOTES:
1. DETAILS OF THE INITIAL RESTORATION ARE SHOWN ON PLATES 1 THROUGH 10.
 2. BORROW AREA DETAILS ARE SHOWN ON PLATES 11 THROUGH 17.



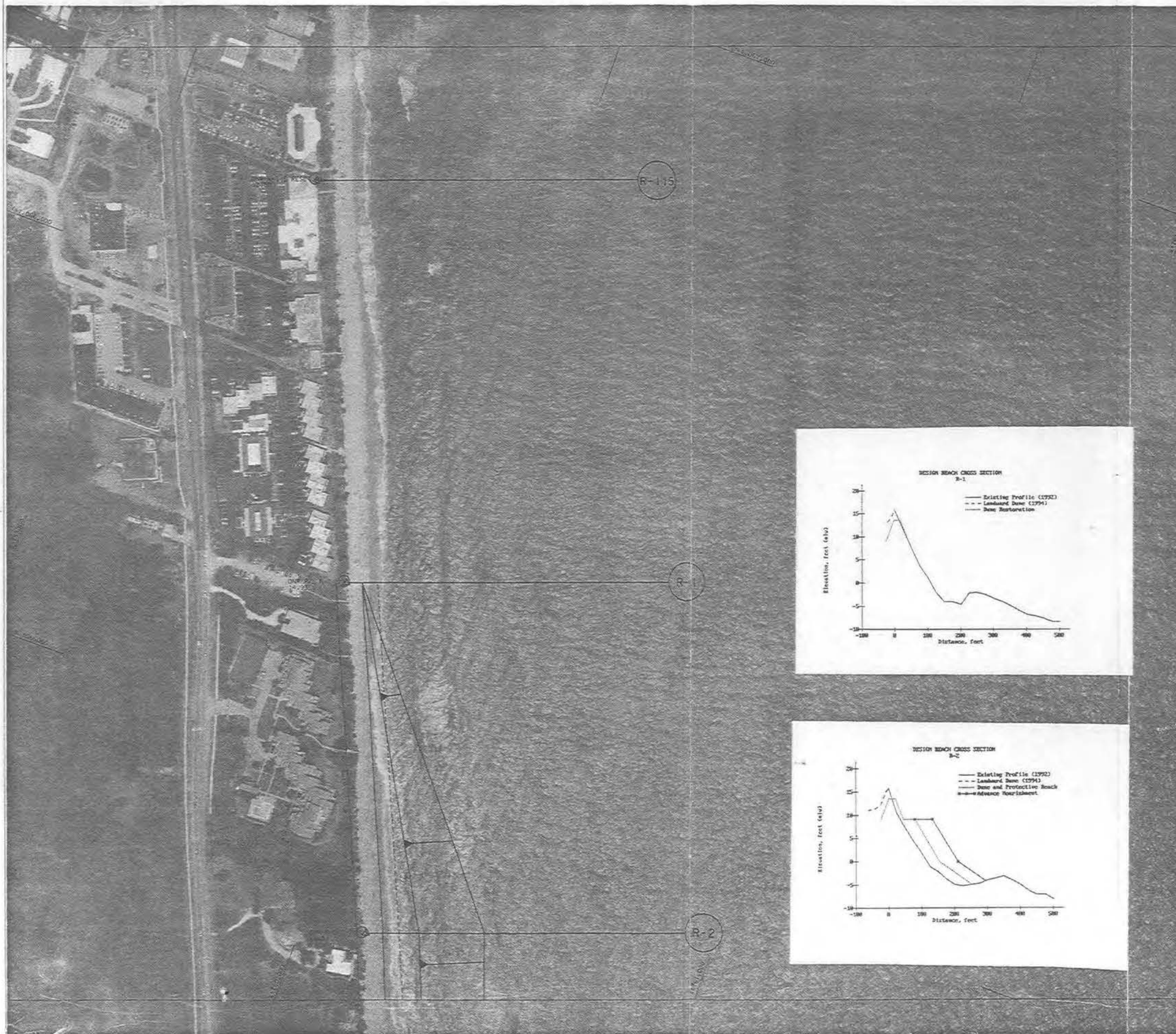
MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

**SELECTED PLAN
COVER SHEET**

SCALE AS SHOWN
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

DATED: DECEMBER 1993

D.C. FILE NO. 24-36,534



NOTES:

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DATE: 4/21/92 - 5/31/92
AREA: EACH PROFILE LINE
EPS CONTROL
10. REFER TO FIELD BOOK(S): 92 MARTIN COUNTY 150 THRU 153.
11. THE CONSTRUCTION BERM WIDTH WILL VARY DEPENDING ON THE ACTUAL CONSTRUCTION SLOPE USED.
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LEGEND

R-5 PROFILE LINE NO.

△ APPROXIMATE LOCATION OF FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION MONUMENT.

ESTIMATED LOCATION OF EROSION CONTROL LINE

ESTIMATED SEAWARD LIMIT OF TOE OF FILL OF DESIGN BEACH AFTER ADJUSTMENT BY WAVE ACTION (INCLUDES ADVANCED NOURISHMENT AND OVERFILL ALLOWANCE)

ON 8.5 SLOPE TO M.L.W.
ON 20 SLOPE TO EXISTING BOTTOM

ESTIMATED LOCATION OF THE 13.6 - FOOT CONTOUR LINE

ESTIMATED LOCATION OF THE 9.1 - FOOT CONTOUR LINE

PLAN VIEW LEGEND



MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

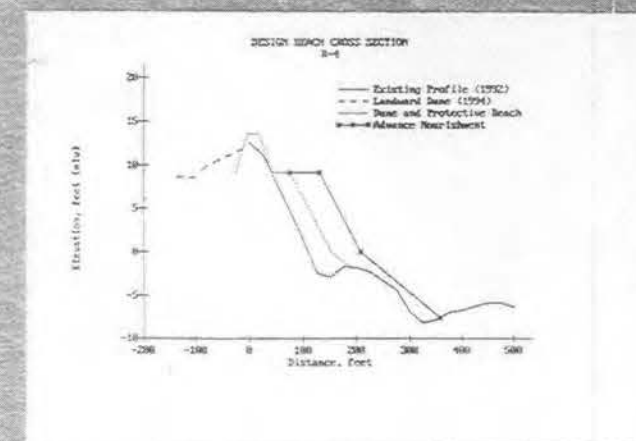
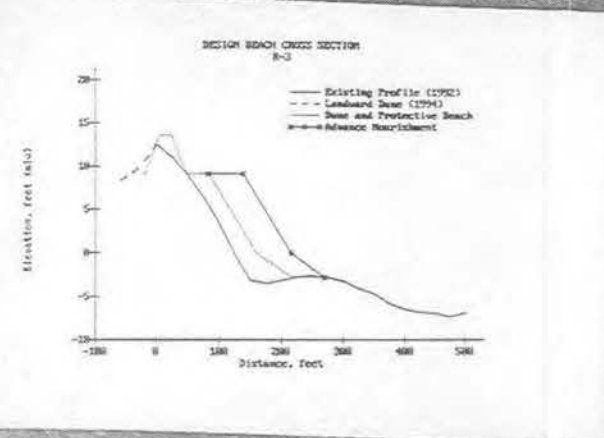
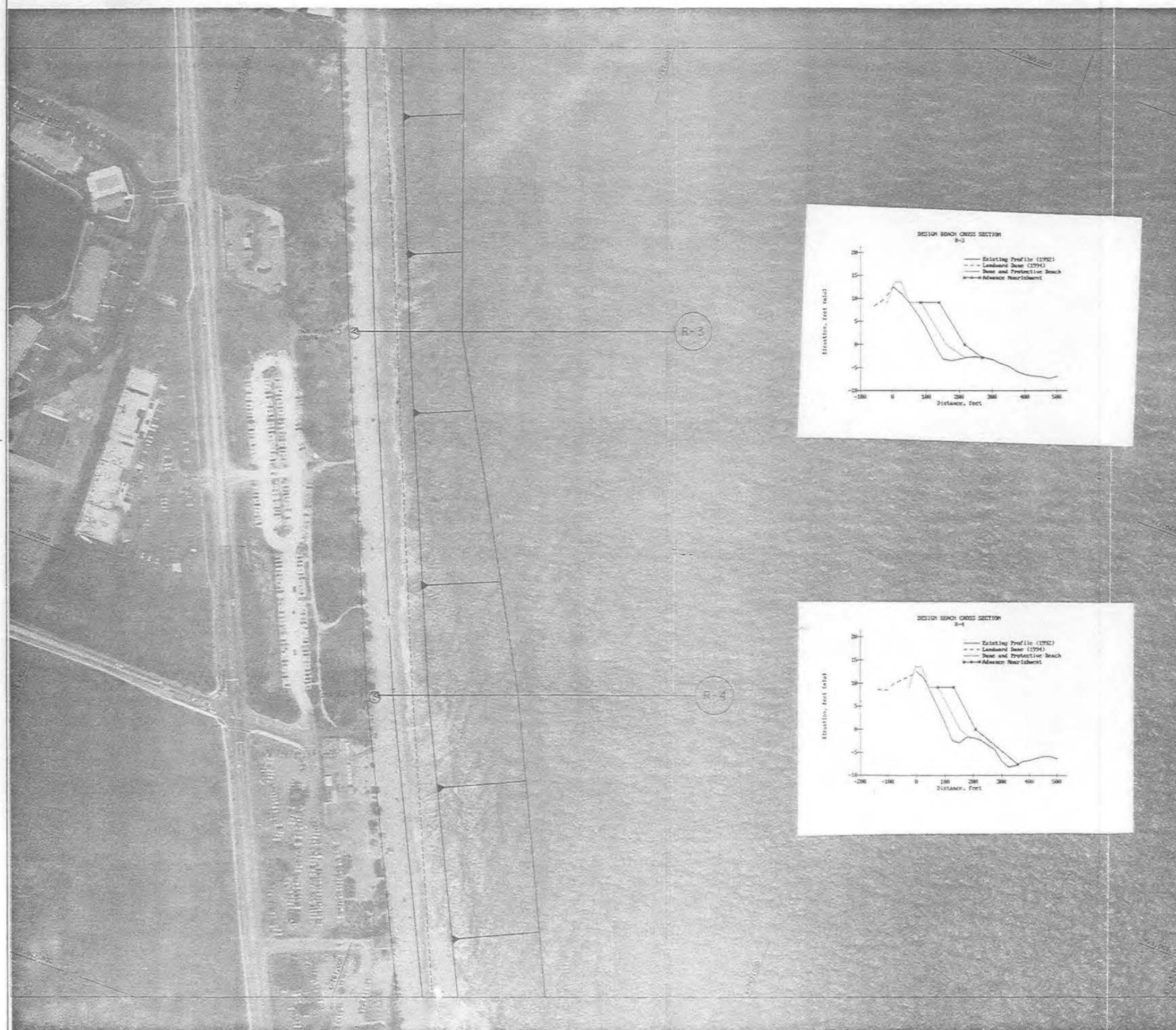
SELECTED PLAN

SCALE AS SHOWN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

DATED: DECEMBER 1993

D.O. FILE NO. 24-36,534



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LEGEND

R-3 PROFILE LINE NO.

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ESTIMATED LOCATION OF EROSION CONTROL LINE

ESTIMATED SEAWARD LIMIT OF TOE OF FILL OF DESIGN BEACH AFTER ADJUSTMENT BY WAVE ACTION (INCLUDES ADVANCED NOURISHMENT AND OVERFILL ALLOWANCE)

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ON 20 SLOPE TO EXISTING BOTTOM

ESTIMATED LOCATION OF THE 13.6 - FOOT CONTOUR LINE

ESTIMATED LOCATION OF THE 9.1 - FOOT CONTOUR LINE

PLAN VIEW LEGEND



MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

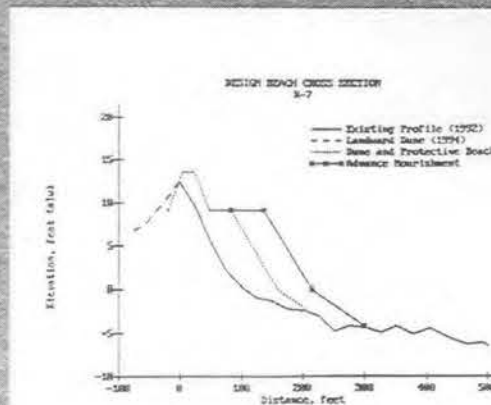
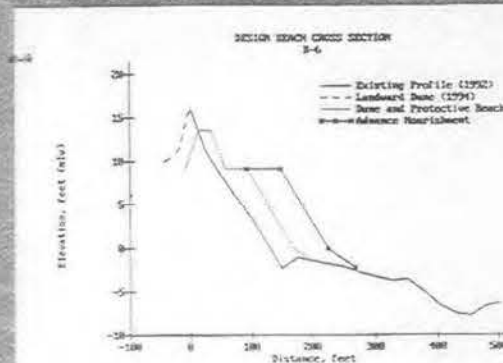
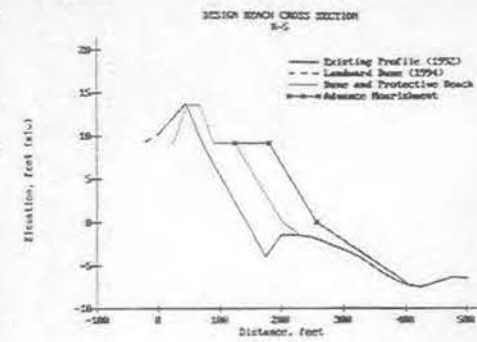
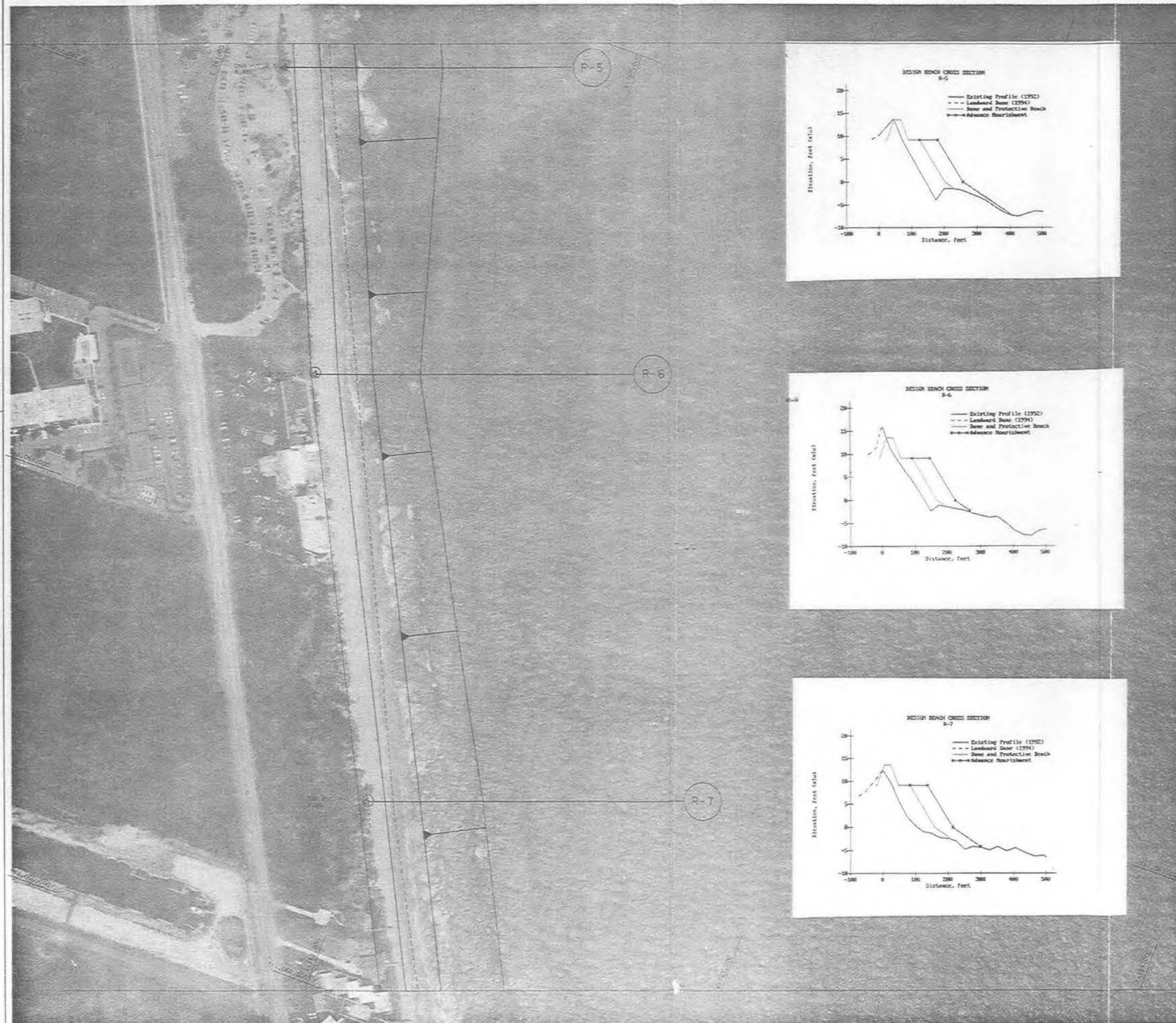
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JACKSONVILLE, FLORIDA

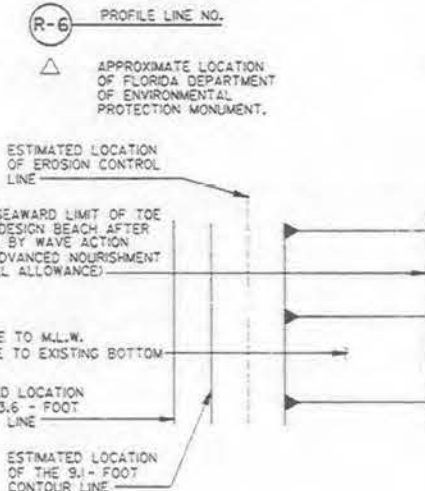
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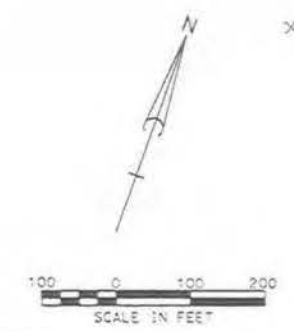


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PLAN VIEW LEGEND



MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

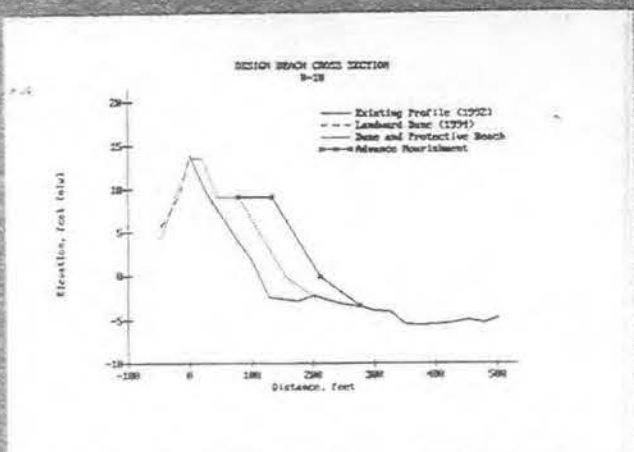
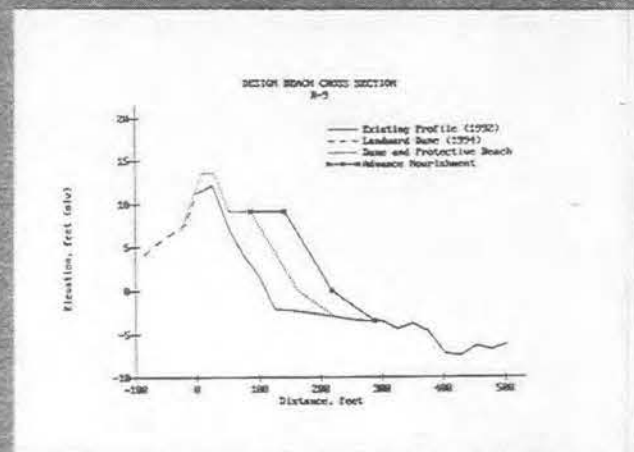
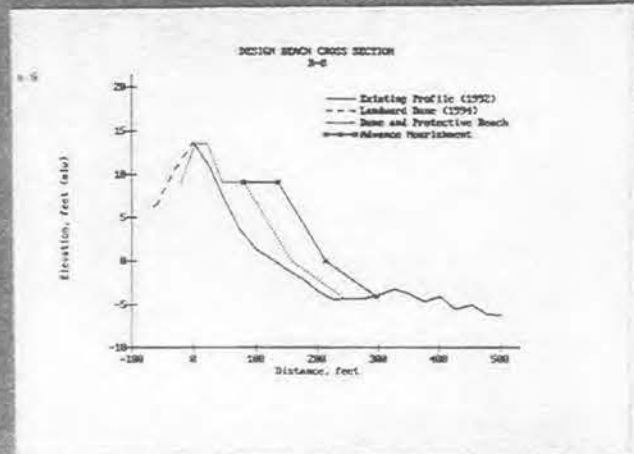
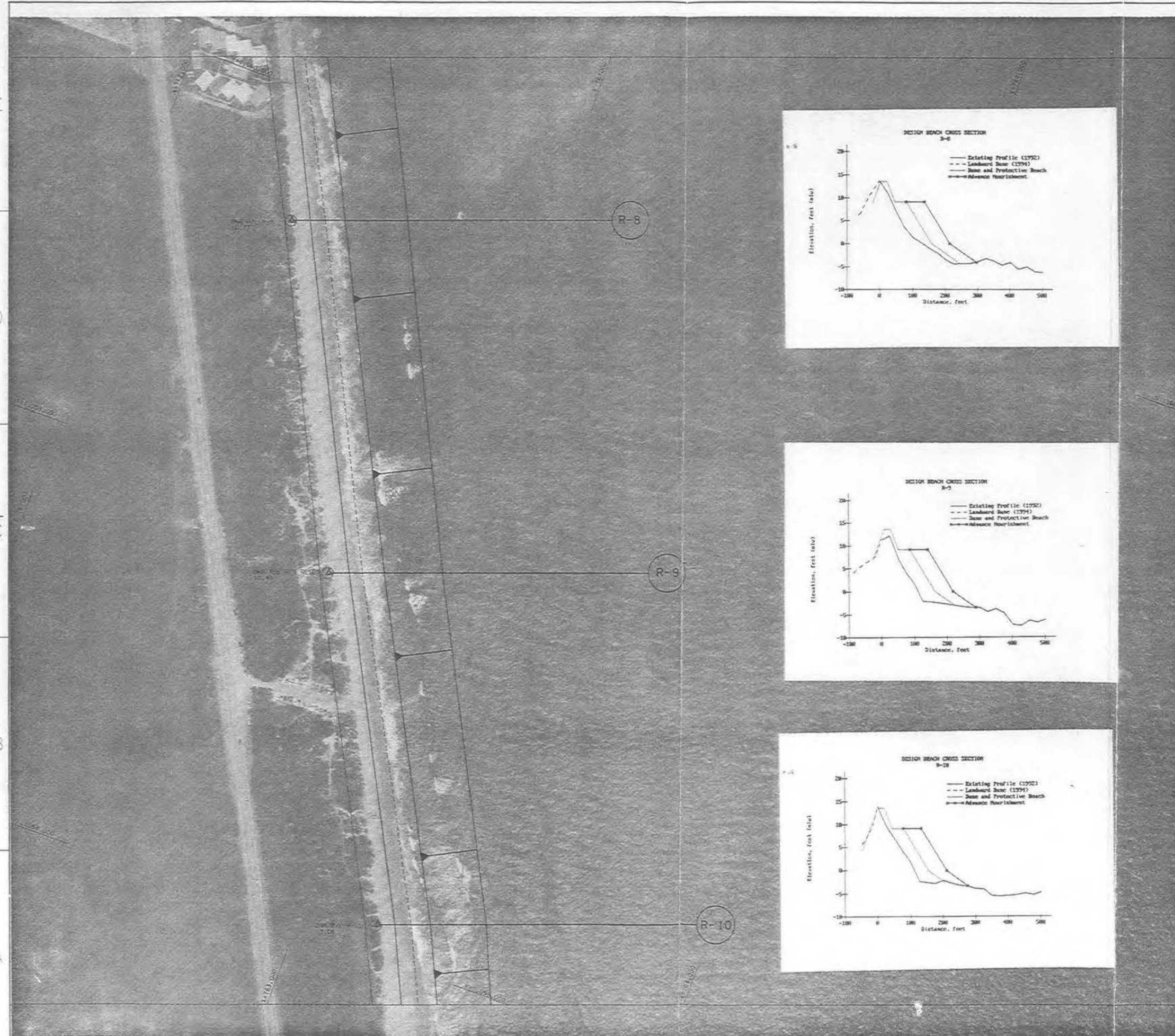
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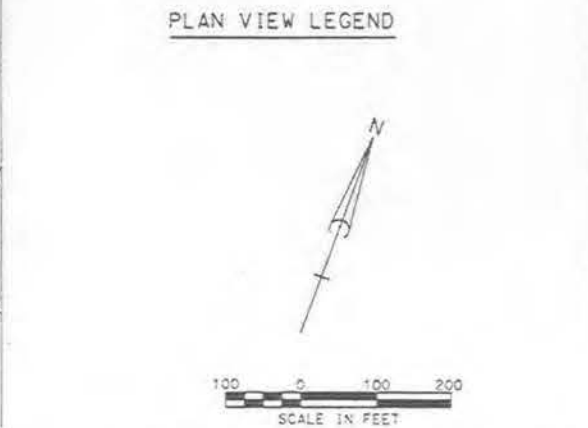
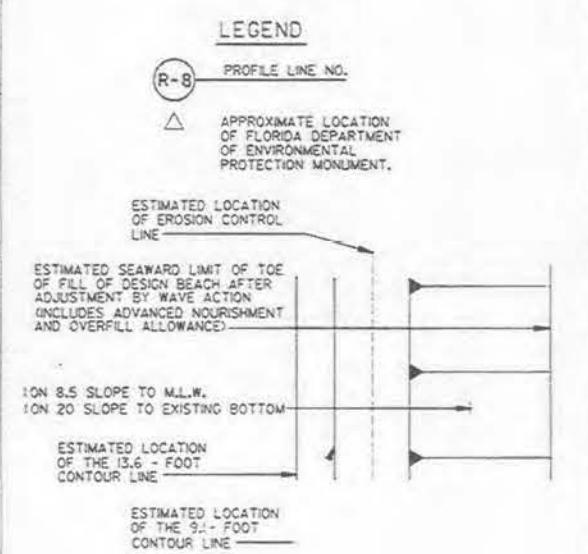
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MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

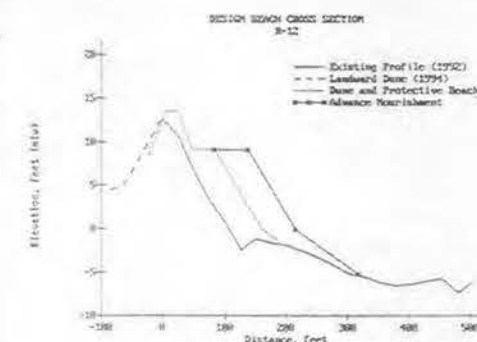
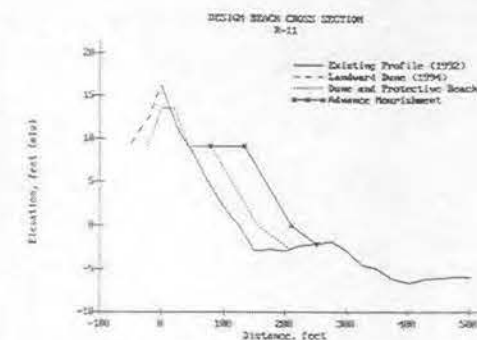
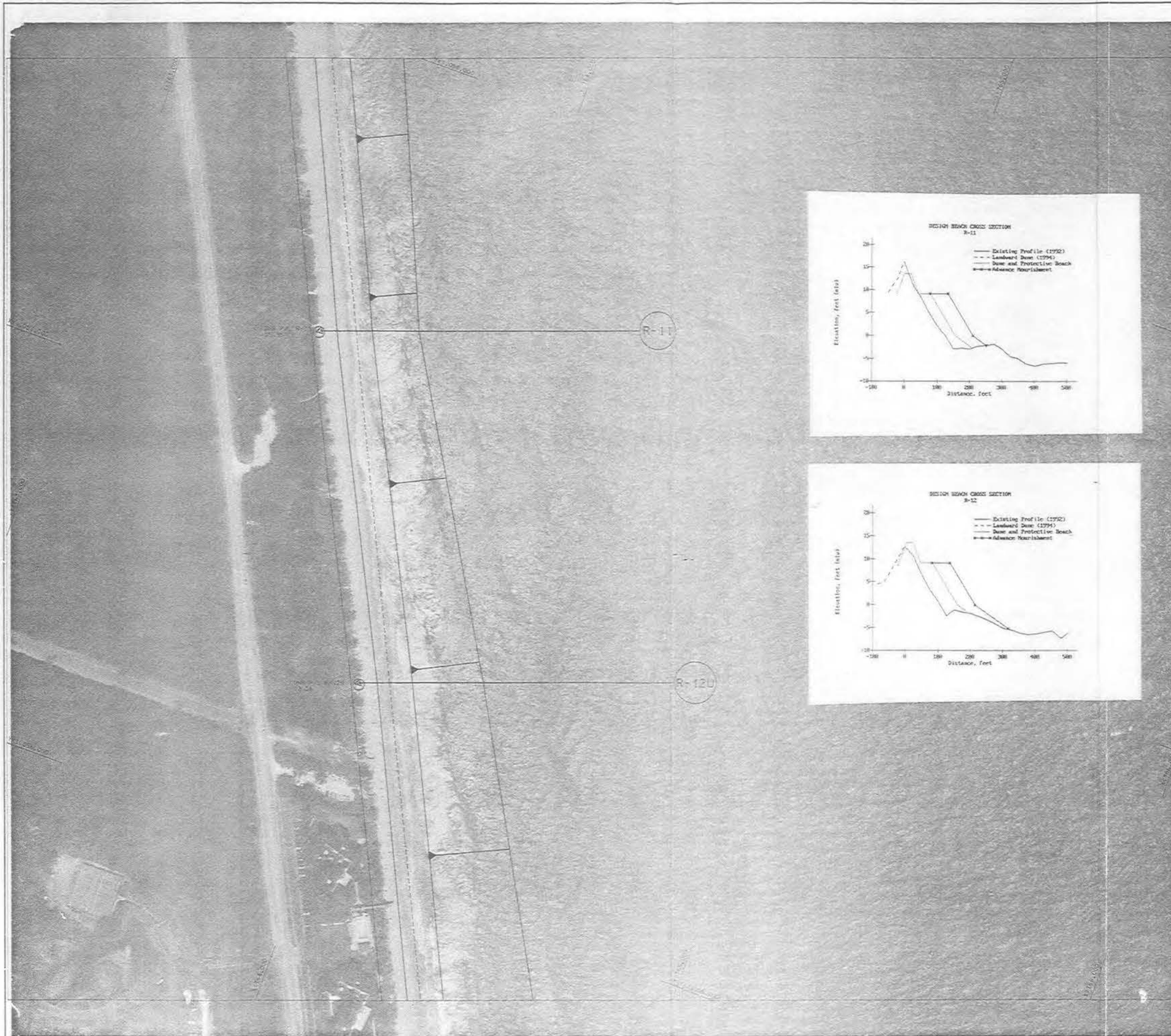
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JACKSONVILLE, FLORIDA

DATED: DECEMBER 1993

D.O. FILE NO. 24-36.534



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LEGEND

R-11 PROFILE LINE NO.

△ APPROXIMATE LOCATION OF FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION MONUMENT.

ESTIMATED LOCATION OF EROSION CONTROL LINE

ESTIMATED SEAWARD LIMIT OF TOE OF FILL OF DESIGN BEACH AFTER ADJUSTMENT BY WAVE ACTION (INCLUDES ADVANCED NOURISHMENT AND OVERFILL ALLOWANCE)

ON 8.5 SLOPE TO M.L.W.
ON 20 SLOPE TO EXISTING BOTTOM

ESTIMATED LOCATION OF THE 13.8 - FOOT CONTOUR LINE

ESTIMATED LOCATION OF THE 9.1 - FOOT CONTOUR LINE

PLAN VIEW LEGEND



MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

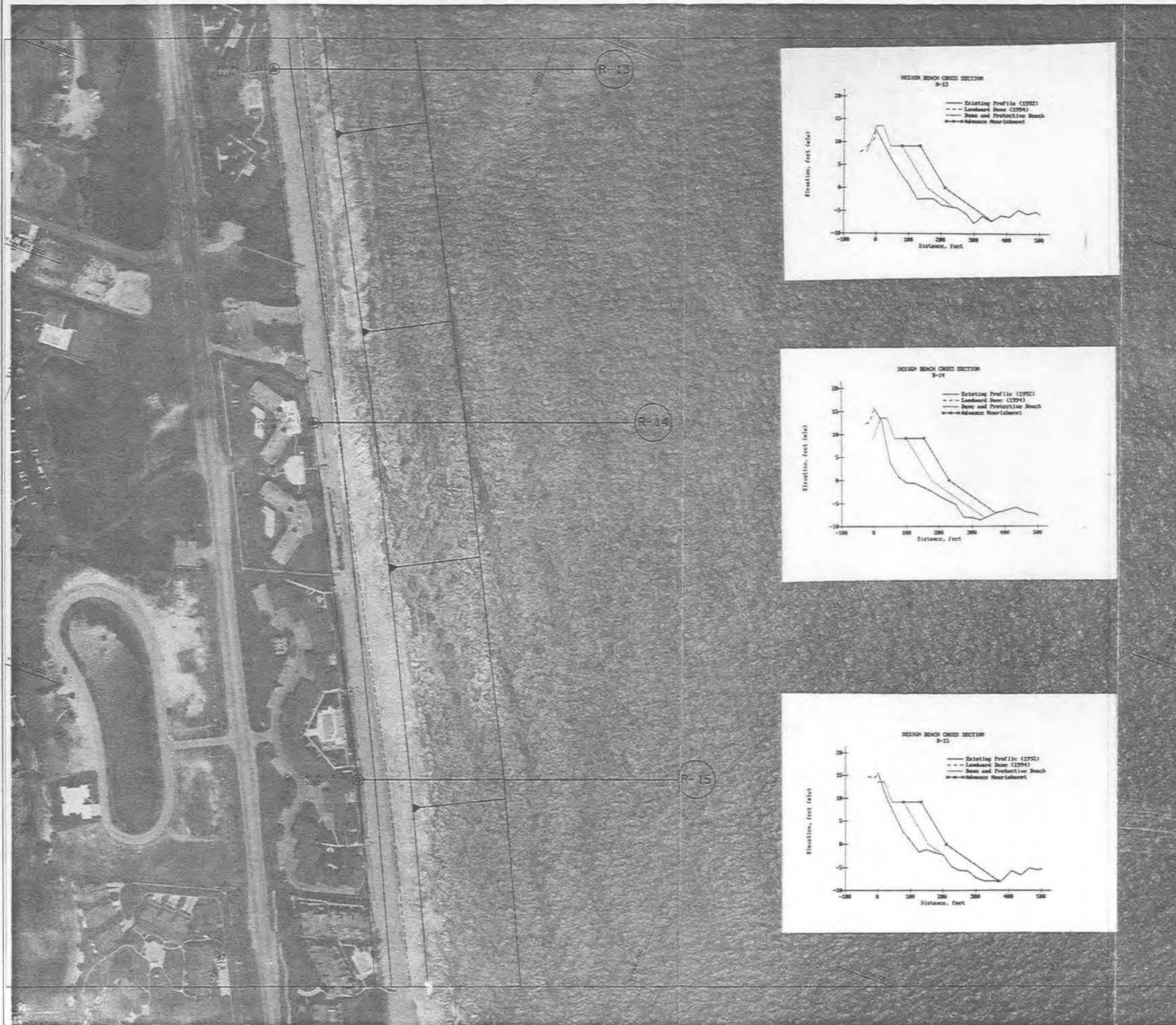
SELECTED PLAN

SCALE AS SHOWN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

DATE: DECEMBER 1993

D.O. FILE NO. 24-36,524



NOTES:

1. REFER TO SURVEY NO. 92-146
2. SOUNDINGS ARE IN FEET AND TENTHS AND REFER TO MEAN LOW WATER, WHICH IS 1.10 FEET BELOW NATIONAL GEODETIC DATUM OF 1929.
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WB-12 4/21/92 - 5/31/92 EACH PROFILE LINE
10. REFER TO FIELD BOOK(S): 92 MARTIN COUNTY 150 THRU 153.
11. THE CONSTRUCTION BERM WIDTH WILL VARY DEPENDING ON THE ACTUAL CONSTRUCTION SLOPE USED.
12. ALL PROFILES ARE REFERENCED TO MONUMENTS, WHICH ARE RANGE 0, INCREASING SEAWARD.

LEGEND

PROFILE LINE NO.

APPROXIMATE LOCATION OF FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION MONUMENT.

ESTIMATED LOCATION OF EROSION CONTROL LINE

ESTIMATED SEAWARD LIMIT OF TOE OF FILL OF DESIGN BEACH AFTER ADJUSTMENT BY WAVE ACTION (INCLUDES ADVANCED NOURISHMENT AND OVERFILL ALLOWANCE)

1 ON 8.5 SLOPE TO M.L.W.
1 ON 20 SLOPE TO EXISTING BOTTOM

ESTIMATED LOCATION OF THE 13.6 - FOOT CONTOUR LINE

ESTIMATED LOCATION OF THE 9.1 - FOOT CONTOUR LINE

PLAN VIEW LEGEND



MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

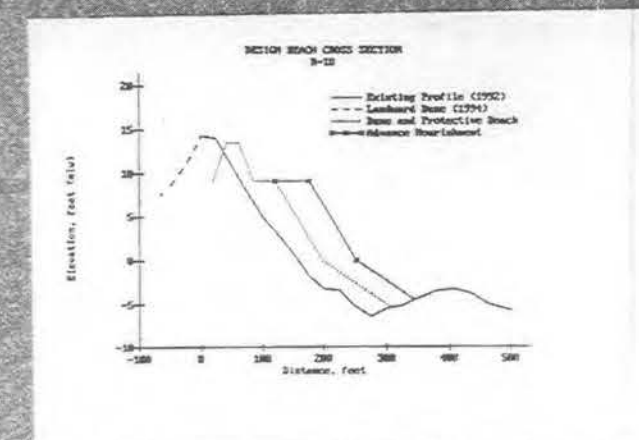
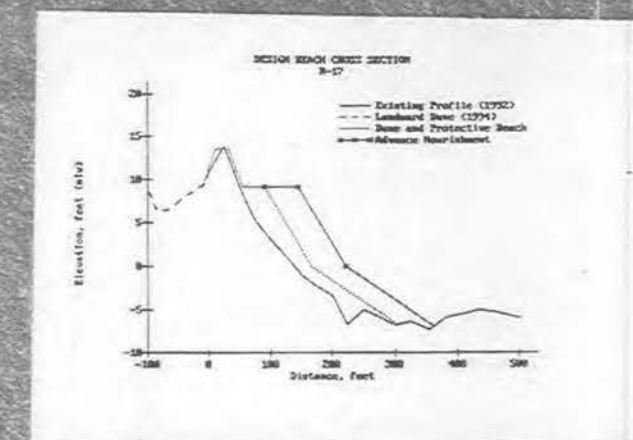
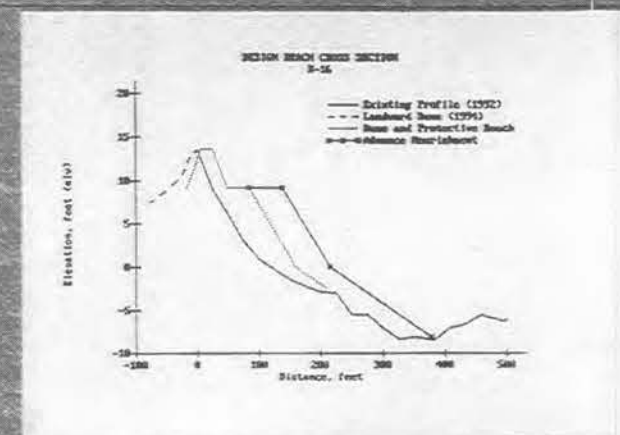
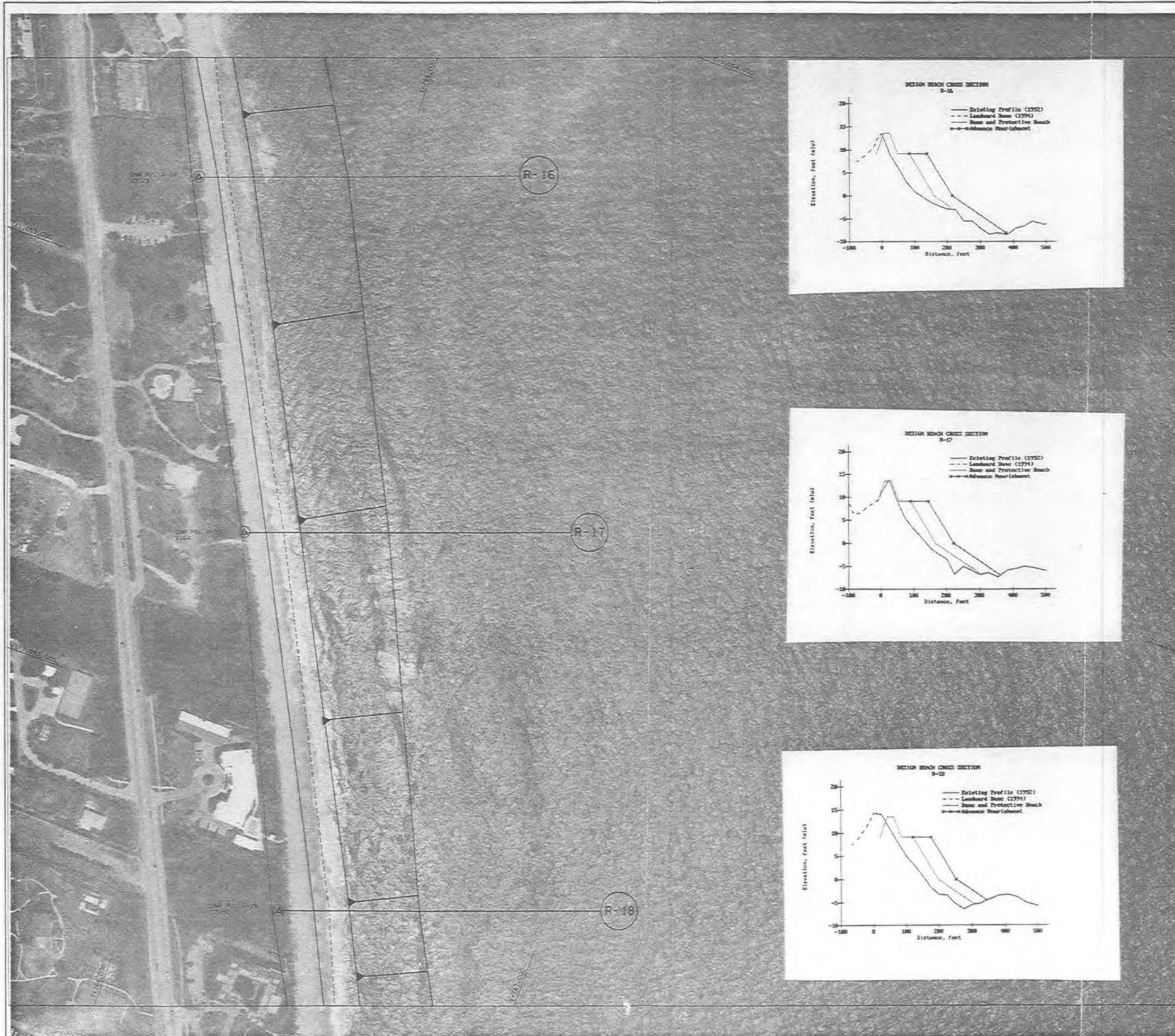
SELECTED PLAN

SCALE AS SHOWN

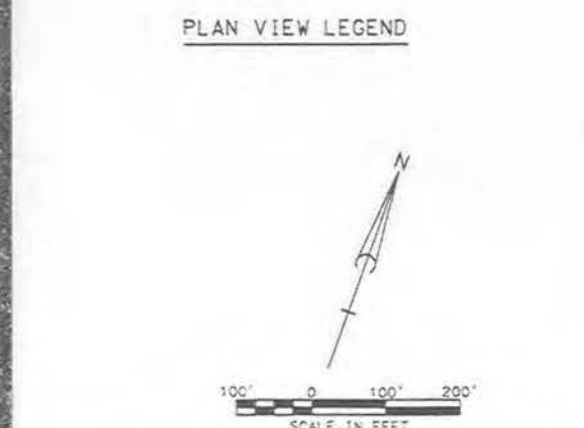
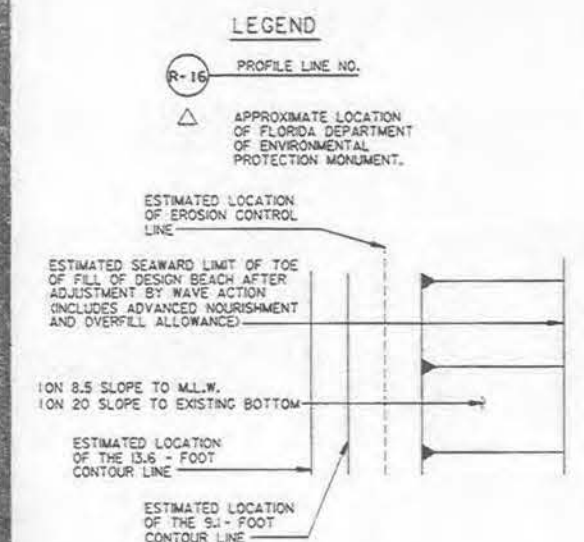
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

DATED: DECEMBER 1993

D.O. FILE NO. 24-36,534



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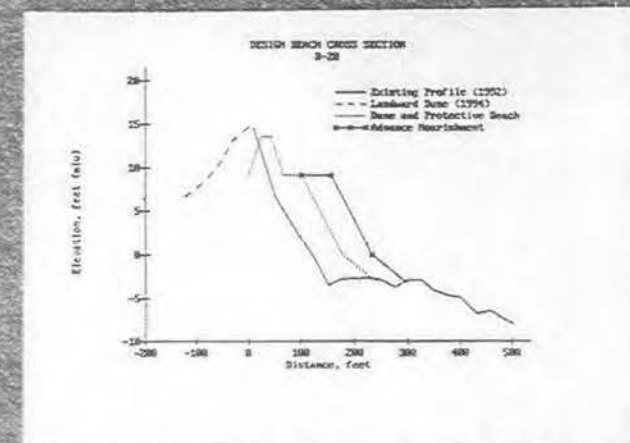
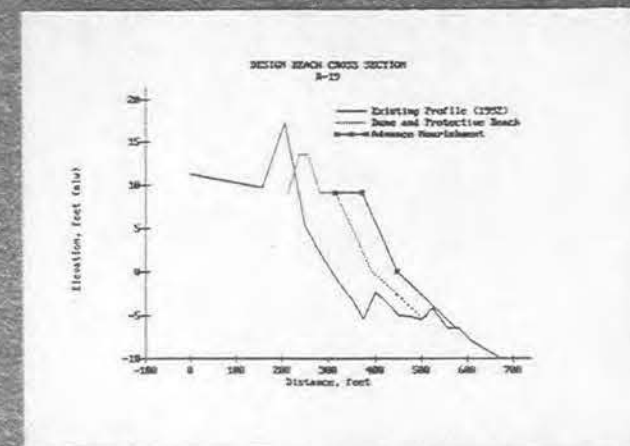
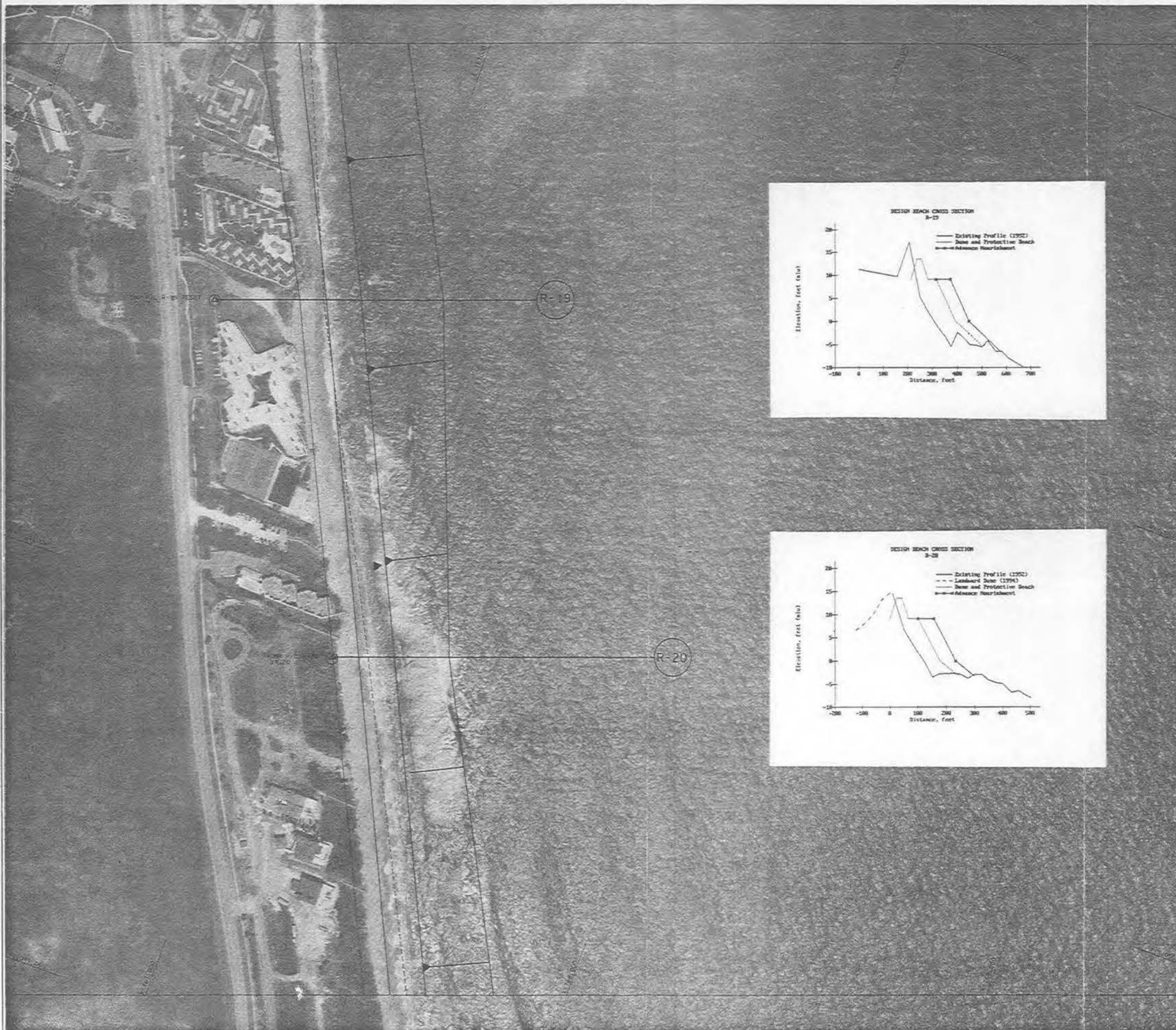
MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

SELECTED PLAN

SCALE AS SHOWN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

DATED: DECEMBER 1993 D.O. FILE NO. 24-36,534



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LEGEND

- R-19 PROFILE LINE NO.
- △ APPROXIMATE LOCATION OF FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION MONUMENT.

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ION 8.5 SLOPE TO M.L.W.
ION 20 SLOPE TO EXISTING BOTTOM

ESTIMATED LOCATION OF THE 13.6 - FOOT CONTOUR LINE

ESTIMATED LOCATION OF THE 9.1 - FOOT CONTOUR LINE

PLAN VIEW LEGEND



100 0 100 200
SCALE IN FEET

MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

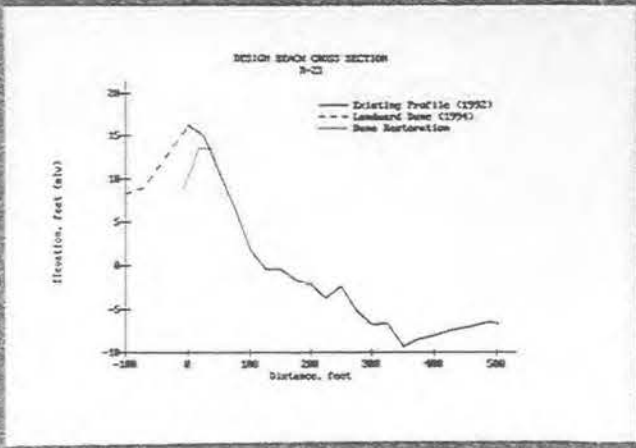
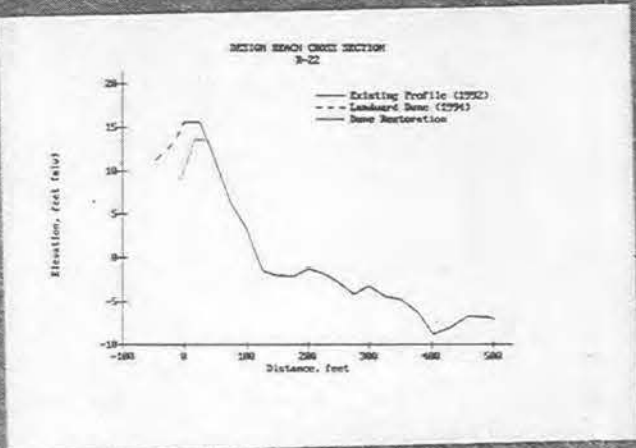
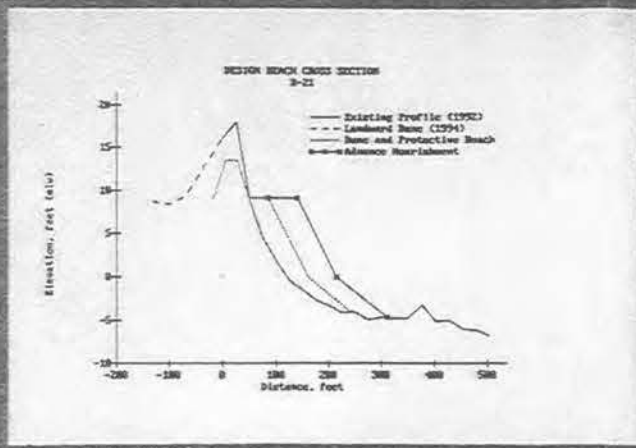
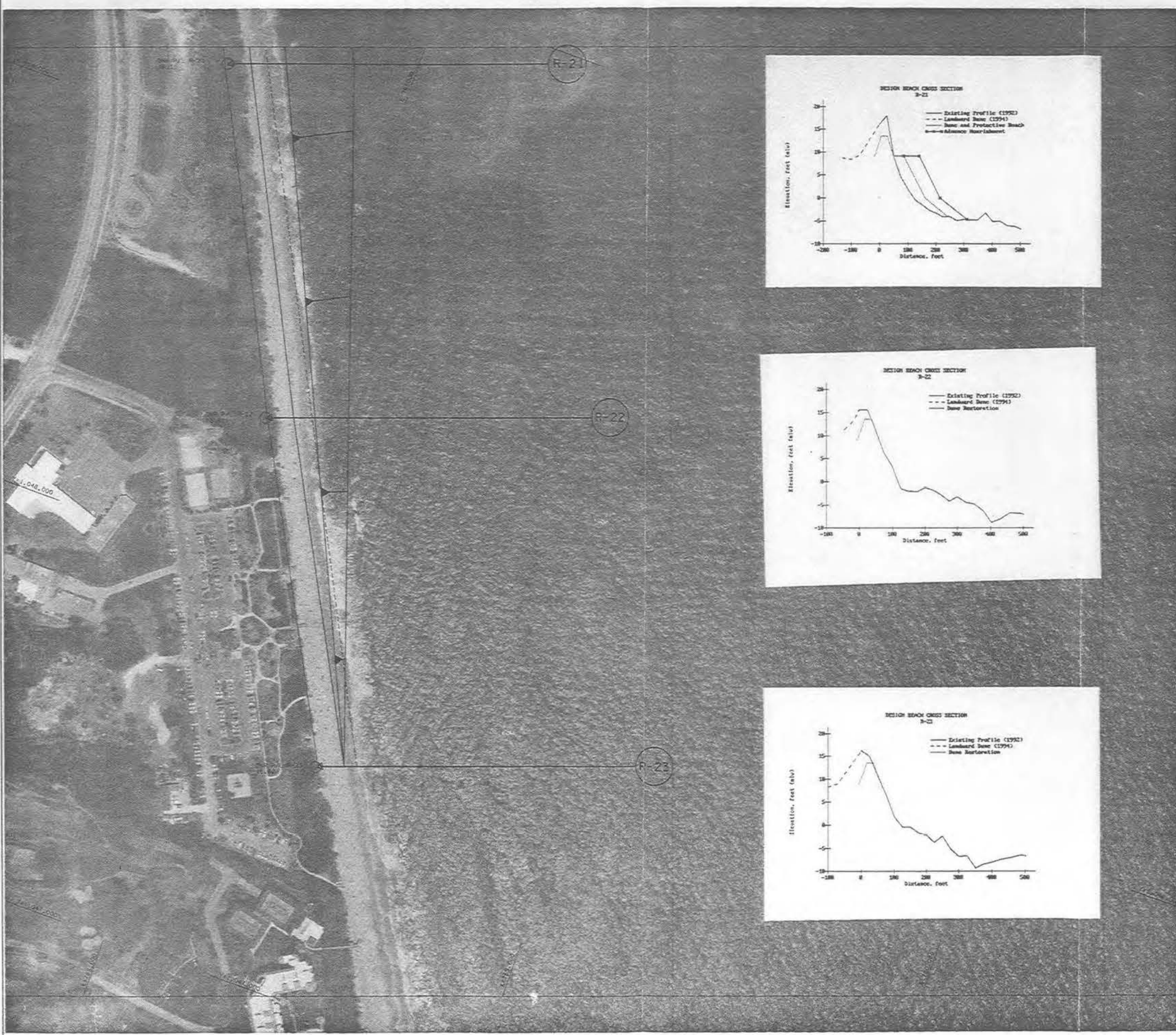
SELECTED PLAN

SCALE AS SHOWN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

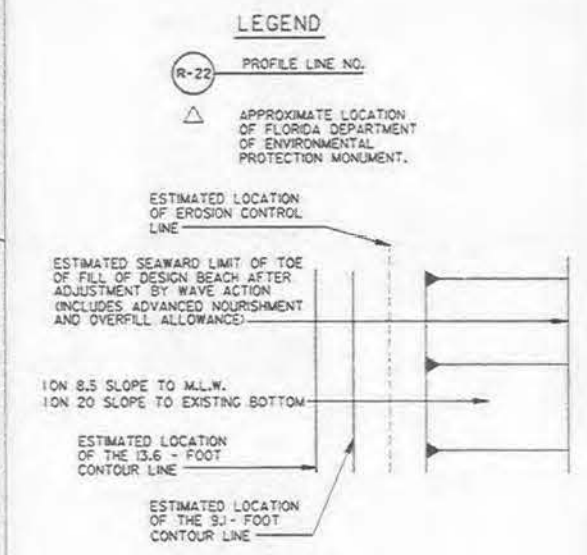
DATED: DECEMBER 1993

D.O. FILE NO. 24-36.534



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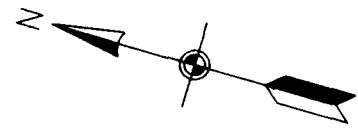


MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

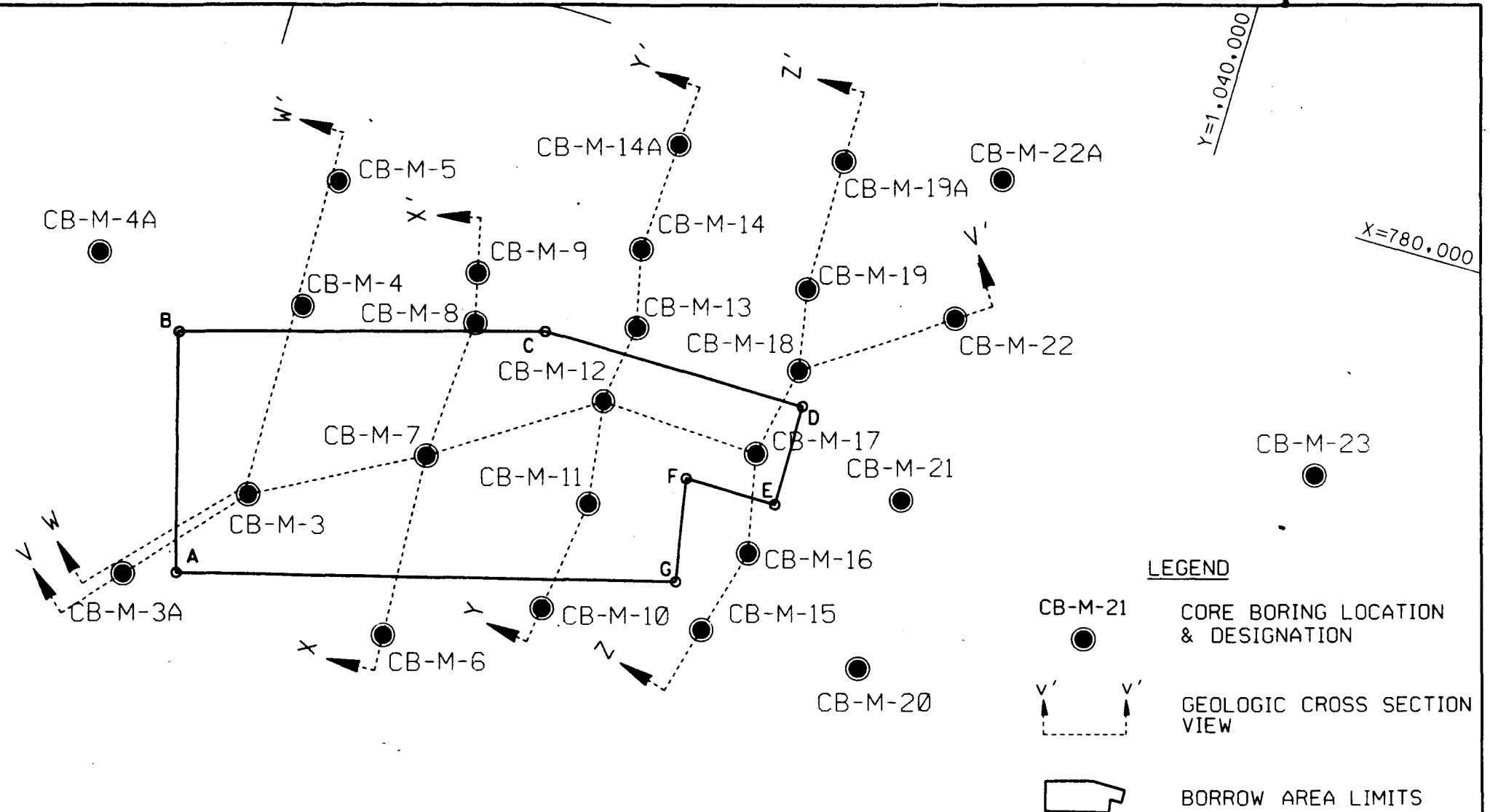
SELECTED PLAN

SCALE AS SHOWN

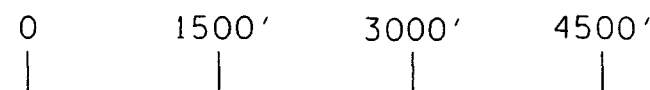
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA



BORROW AREA		
P.I.	COORDINATES	
	X	Y
A	773,000	1,049,500
B	775,500	1,050,200
C	776,600	1,046,400
D	776,600	1,043,500
E	775,500	1,043,500
F	775,500	1,044,500
G	774,400	1,044,300



GRAPHIC SCALE



HUTCHINSON ISLAND

DESIGN ENG.:	
D.R.	
DWN BY:	CKD BY:
F.B.S.	D.R.

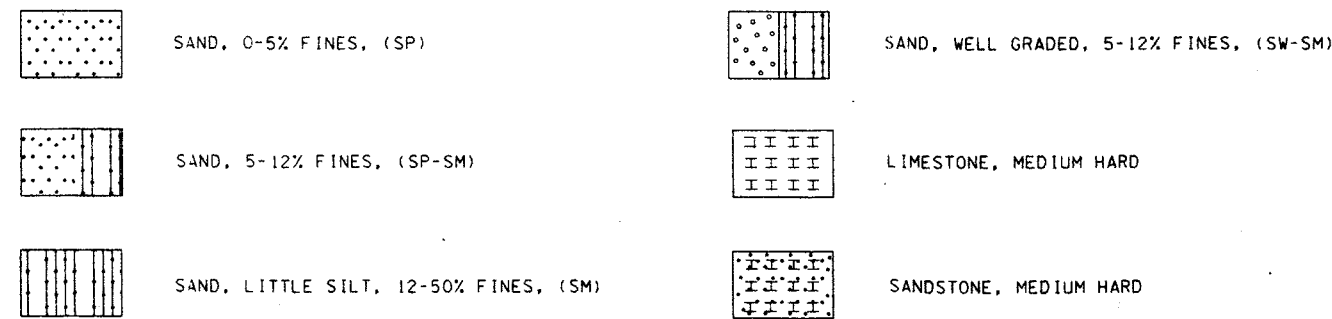
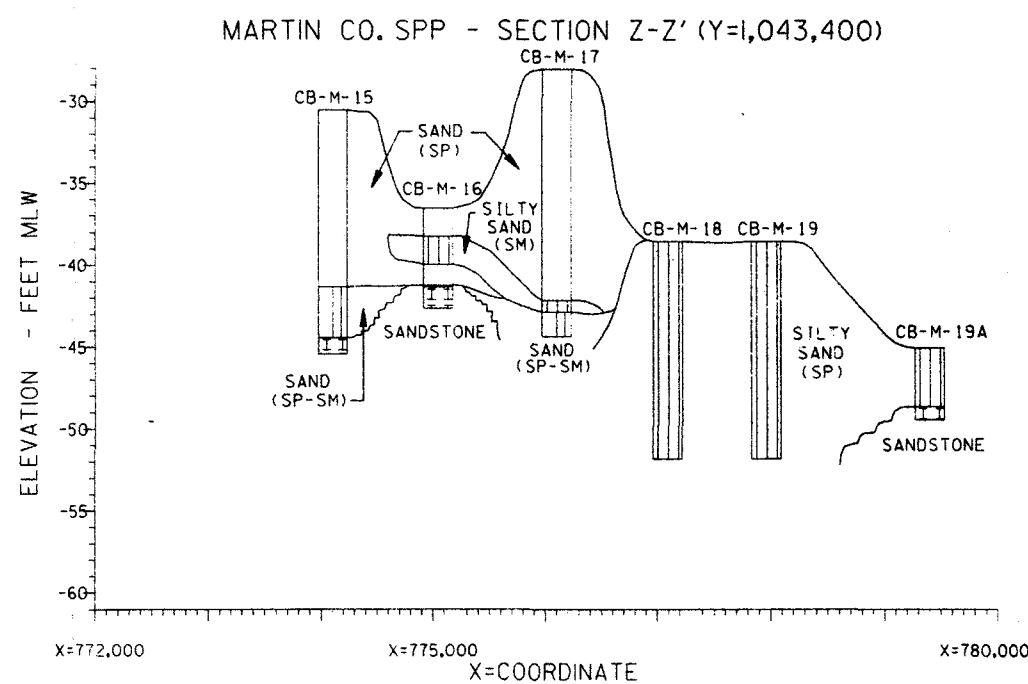
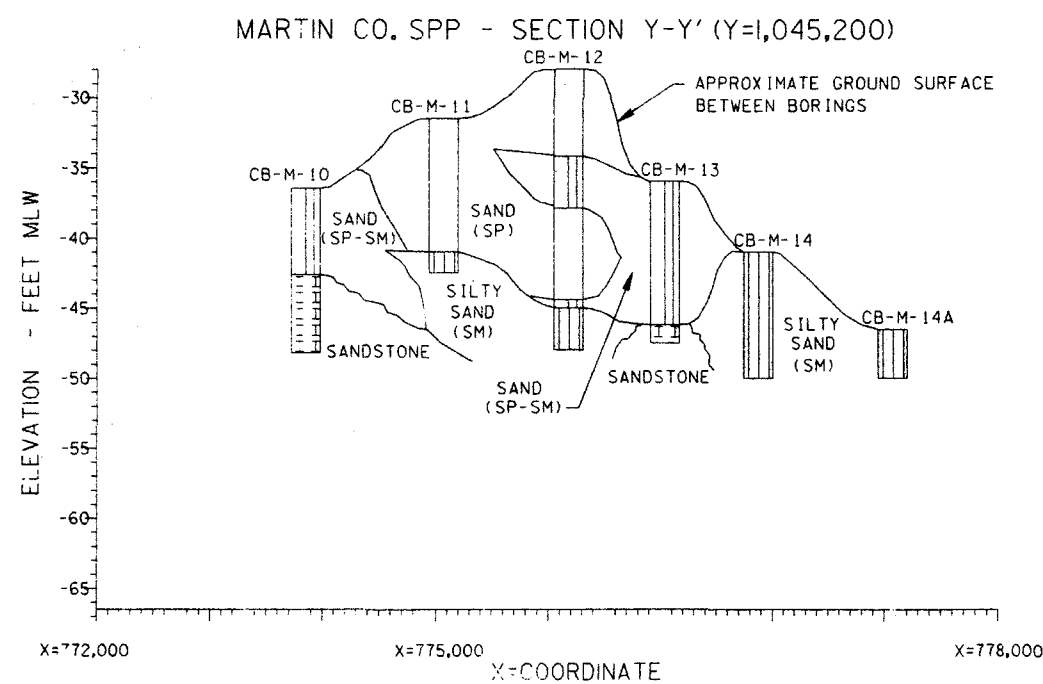
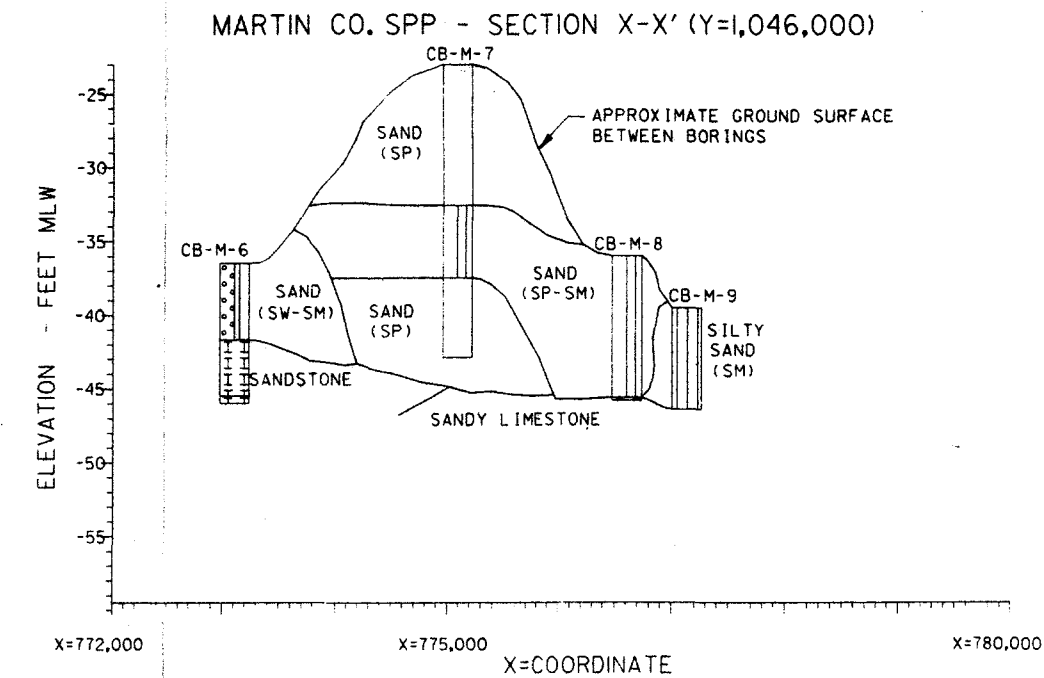
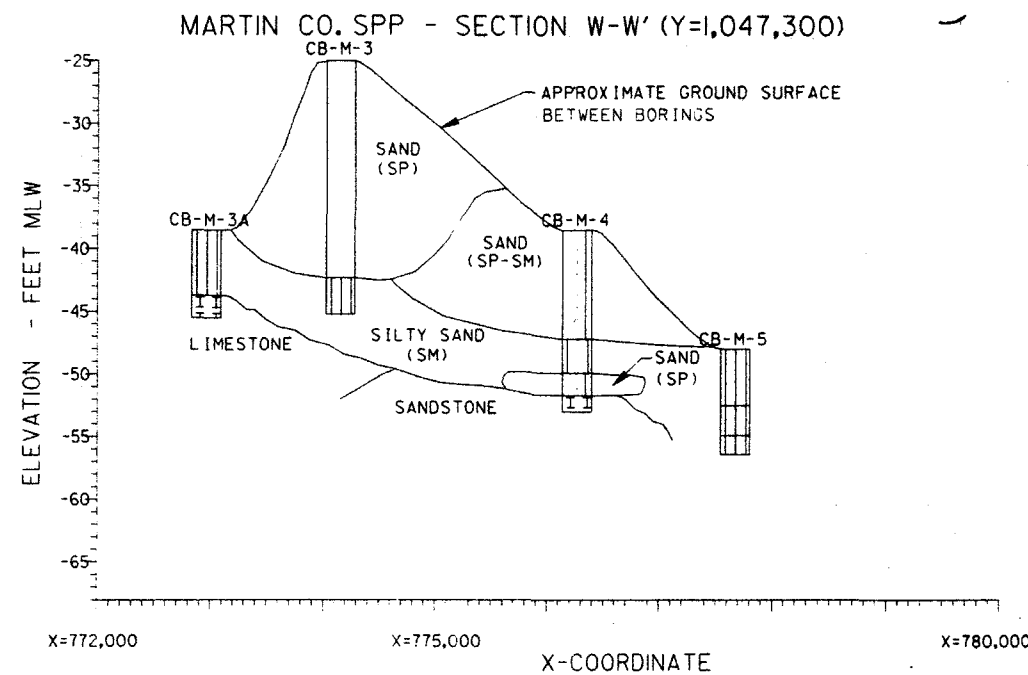
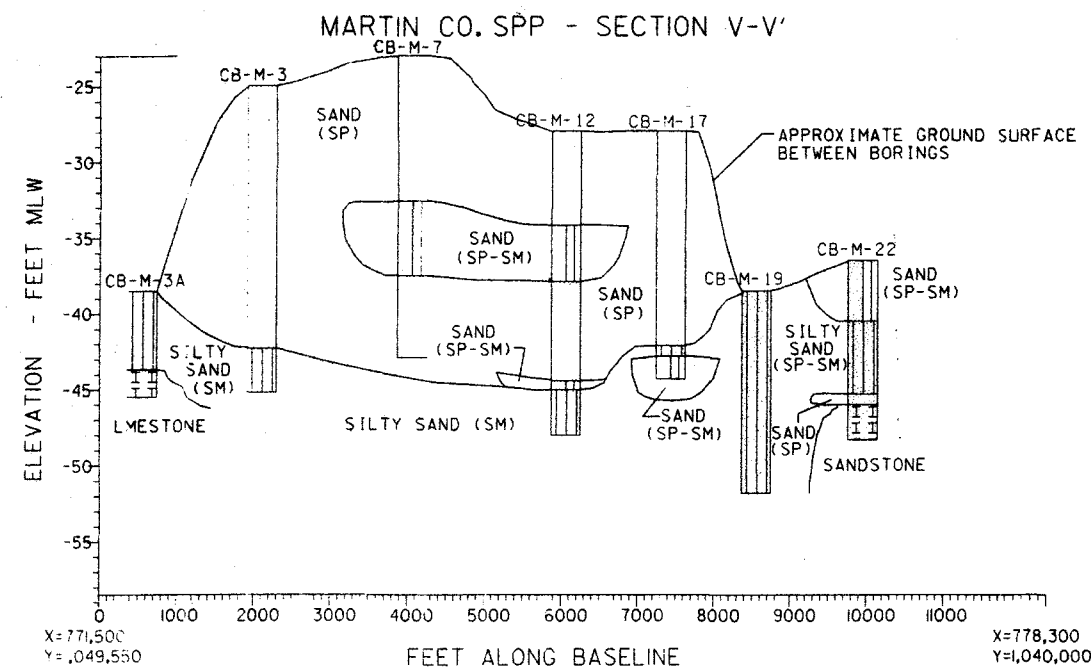
MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

BORROW AREA, CORE BORING LOCATIONS
AND GEOLOGIC CROSS SECTION LOCATION

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
GENERAL DESIGN MEMORANDUM

DATED: OCTOBER 1993

D.O. FILE NO. 24-36, 534



MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

GEOLOGIC CROSS SECTIONS

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
GENERAL DESIGN MEMORANDUM

DESIGN ENG.
D.R.
DWG. BY:
F.B.S.

CRD. BY:
D.R.

DATED: OCTOBER 1993

D.O. FILE NO. 24-36,534

**APPENDIX A
ENGINEERING DESIGN AND COST ESTIMATES
MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT
GENERAL DESIGN MEMORANDUM**

PROBLEM IDENTIFICATION

A-1. The northernmost 4 miles of Hutchinson Island in Martin County, Florida has experienced considerable beach erosion over recent years. The combined effects of wind, waves and tides amplified during storms conditions has resulted in erosion and lowering of the beach profiles as well as recession of the shoreline. The shoreline has receded up to 65 feet in some areas within this 4-mile reach. This appendix provides the engineering analysis to advance the level of engineering and design for providing damage protection to Hutchinson Island in Martin County.

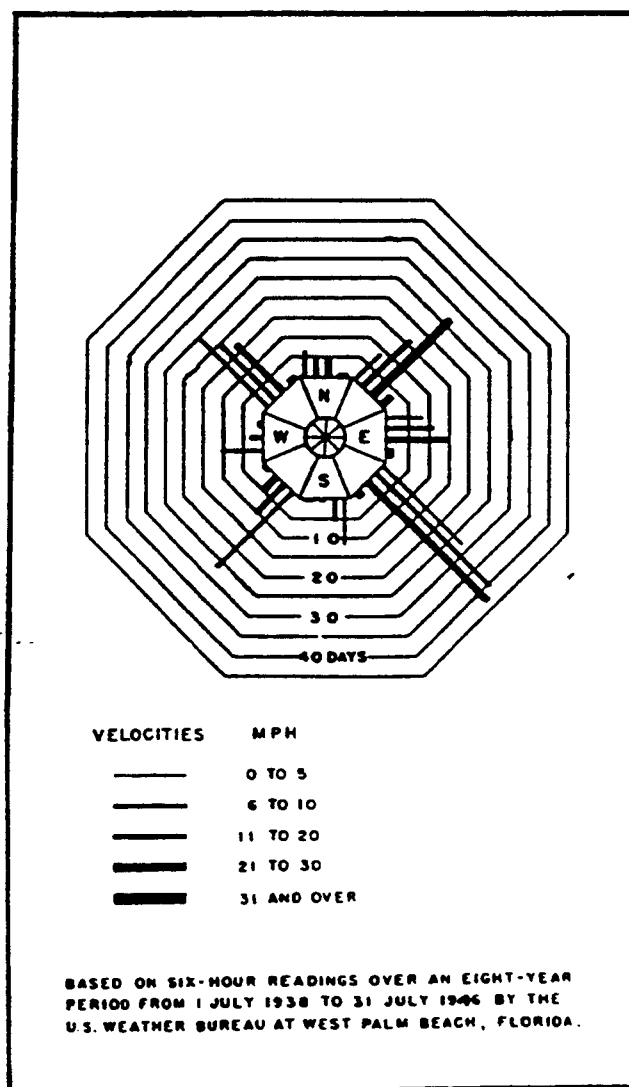
NATURAL FORCES

A-2. There are a number of contributing factors controlling the coastal processes along the shoreline of Martin County. The natural factors include winds, tides, currents, waves and storm events. The role of each of these factors and their contribution to the problem associated with the Martin County Shore Protection Project are described in the following paragraphs.

WINDS

A-3. Local winds are the primary generating mechanism of the short period waves experienced in the project area. The winds in the area vary notably with the seasons. The wind rose in Figure A-1 is based on data taken at the U.S. Weather Bureau Station in West Palm Beach, Florida during the 8-year period from July 1938 to July 1946. This diagram indicates that the prevailing winds are from the northeast through the southeast with the winds from the southeast occurring most often. During winter months (December through March), winds are often out of the northwest through the northeast. Cold fronts, associated with areas of low pressure generally traverse the continental U.S. from west to east. Severe northeasters can cause extensive beach erosion and shorefront damage. The summer months (June to September) are characterized by tropical weather systems traveling east to west in the lower latitudes. These tropical systems have the potential to develop into tropical storms and hurricanes, which can generate devastating winds. Southeast tradewinds make up the typical summer wind climate.

FIGURE A-1
AVERAGE DIRECTION, DURATION, AND VELOCITY OF WINDS
FOR ONE YEAR AT WEST PALM BEACH, FLORIDA



TIDES AND CURRENTS

A-4. Tides in the project area are a mixture of semi-diurnal and diurnal types. The mean range of tide in the Atlantic Ocean at Hutchinson Island is 2.6 feet; the spring range is 3.1 feet (National Ocean Service, NOAA 1993). All elevations, depths, and water levels in this report refer to mean low water (MLW) which is 1.1 feet below the 1929 NGVD and 2.9 feet below mean high water (MHW).

A-5. The most significant ocean current off the east coast of Florida is the Florida Gulf Stream. With the exception of intermittent local reversals, it flows northward. The average annual current velocity is approximately 28 miles per day, varying from an average monthly low of about 17 miles per day in November to an average monthly high of approximately 37 miles per day in July. The axis of the Florida Gulf Stream is about 30 nautical miles to the east of Hutchinson Island.

WAVES

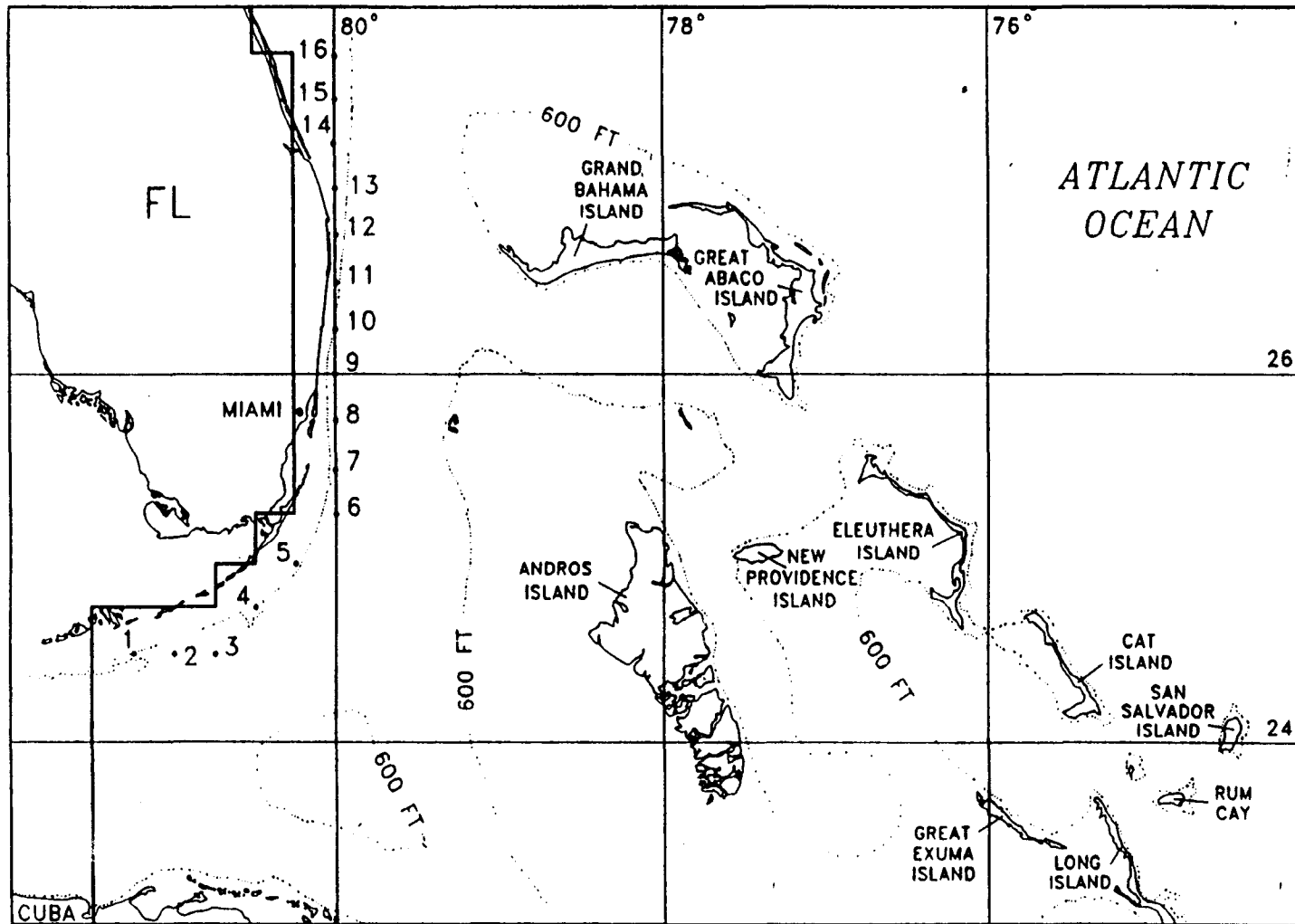
A-6. The principal cause of beach erosion is the action of storm waves breaking on the beach and protective dune. Wave size and frequency of occurrence coupled with associated storm surge are the most important factors in shaping the shoreline of Hutchinson Island. Wind generated storm waves are the most familiar type, and the primary cause of losses of sand from the beaches in the project area.

A-7. The U.S. Army Waterways Experiment Station completed a wave hindcast study for the Atlantic coast of the United States, documented in Wave Information Study (WIS) Reports 2, 6 and 9. The time period considered in the hindcast extends over 20 years, from 1956 to 1975. Wave measurements made by the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Army Corps of Engineers (USACE) during the 1980's and 1990's made verification of these WIS results possible. Comparisons indicated that the distribution of hindcast wave heights, periods and directions differed from the distributions of measured data. These comparisons led to the decision to revise the WIS information for the Atlantic coast for the period 1956-1975. The revised hindcast results are compiled in WIS Report 30 (Hubertz, Brooks, Brandon and Tracy, 1993) and supersedes the three phases of the previous study.

A-8. The wave statistics used in this report were obtained from Station 14 (WIS Report 30) located at latitude 27.25 north and longitude 80.00 west (Figure A-2). This station is located at a water depth of 180 feet offshore of Hutchinson Island, where the shoreline angle was taken to be 24° west of due north.

A-9. Tables A-1 to A-4 summarize the revised hindcast wave results for Station 14. Table A-1 contains the distribution of spectral wave height, peak period, and peak mean direction by month for the 20-year period. This table is useful in showing the

FIGURE A-2
LOCATION MAP - WIS STATION 14



A-4

TABLE A-1
SUMMARY OF WAVE INFORMATION BY MONTH FOR ALL YEARS

STATION: 14

OCCURRENCES OF WAVE HEIGHT BY MONTH FOR ALL YEARS

Hmo(m)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0.00 - 0.49	131	200	315	404	776	1383	1739	1396	431	236	136	177	7324
0.50 - 0.99	1806	1692	2075	2227	2760	2750	2923	3259	2602	1630	1372	1624	26720
1.00 - 1.49	1527	1197	1487	1420	975	462	236	259	1114	1366	1546	1527	13116
1.50 - 1.99	817	752	731	526	329	118	41	43	358	804	899	823	6241
2.00 - 2.49	428	411	254	168	92	47	21	2	229	443	410	428	2933
2.50 - 2.99	153	210	69	43	26	11	17	1	54	253	207	225	1232
3.00 - 3.49	60	38	23	5	2	12	11	12	12	119	131	90	497
3.50 - 3.99	21	13	4	2	3	12	11	8	8	53	64	48	227
4.00 - 4.49	4	3	2	3	1	1	1	1	1	26	19	10	76
4.50 - 4.99	3	3	1	1	1	1	1	1	1	21	10	4	44
5.00 - 5.49	2	1	1	1	1	1	1	1	1	8	6	4	20
5.50 - 5.99	2	1	1	1	1	1	1	1	1	1	1	1	4
6.00 - 6.49	4	1	1	1	1	1	1	1	1	1	1	1	4
6.50 - 6.99	2	1	1	1	1	1	1	1	1	1	1	1	2
7.00 - 7.49	1	1	1	1	1	1	1	1	1	1	1	1	0
7.50 - 7.99	1	1	1	1	1	1	1	1	1	1	1	1	0
8.00 - 8.49	1	1	1	1	1	1	1	1	1	1	1	1	0
8.50 - 8.99	1	1	1	1	1	1	1	1	1	1	1	1	0
9.00 - 9.49	1	1	1	1	1	1	1	1	1	1	1	1	0
9.50 - 9.99	1	1	1	1	1	1	1	1	1	1	1	1	0
10.00 - GREATER	1	1	1	1	1	1	1	1	1	1	1	1	0
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

STATION: 14

OCCURRENCES OF PEAK PERIOD BY MONTH FOR ALL YEARS

Tp(sec)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
3.0 - 3.9	92	122	197	318	251	568	441	365	180	131	84	94	2843
4.0 - 4.9	469	597	779	661	689	902	804	907	610	389	367	466	7640
5.0 - 5.9	620	588	834	780	615	483	566	621	752	526	483	600	7466
6.0 - 6.9	695	649	777	774	713	481	331	415	560	355	696	612	7301
7.0 - 7.9	773	637	536	603	522	768	879	821	689	963	773	689	8429
8.0 - 8.9	747	625	458	399	764	736	1306	1148	740	903	720	589	9052
9.0 - 9.9	344	425	294	280	650	325	460	483	665	677	515	574	5809
10.0 - 10.9	278	346	270	309	386	204	80	120	297	349	293	436	3341
11.0 - 11.9	343	310	270	297	219	105	47	121	192	248	330	430	2842
12.0 - 12.9	267	245	258	155	76	27	12	23	66	120	221	271	1741
13.0 - 13.9	158	164	140	161	39	11	11	6	20	60	187	150	1097
14.0 - 14.9	95	85	59	48	19	13	13	8	22	70	74	493	493
15.0 - 15.9	52	32	42	15	9	1	1	6	10	45	20	231	231
16.0 - 16.9	19	3	23	1	5	1	1	8	3	12	7	80	80
17.0 - 17.9	6	16	13	1	1	1	1	4	2	3	1	46	46
18.0 - 18.9	1	6	7	1	2	1	1	2	1	1	1	19	19
19.0 - 19.9	1	1	3	1	1	1	1	1	1	1	1	6	6
20.0 - LONGER	1	2	1	1	1	1	1	1	1	1	1	1	2
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

STATION: 14

OCCURRENCES OF PEAK DIRECTION BY MONTH FOR ALL YEARS

DIRECTION BAND & CENTER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
348.75 - 11.24 (0.0)	411	420	376	285	85	24	2	30	22	118	277	310	2360
11.25 - 33.74 (22.5)	557	475	410	374	252	211	46	147	343	507	564	502	4388
33.75 - 56.24 (45.0)	1482	1211	1311	1273	1235	968	494	752	1871	2117	1516	1564	15794
56.25 - 78.74 (67.5)	1093	169	787	877	1343	1152	1164	1230	1376	1409	1607	1365	14172
78.75 - 101.24 (90.0)	492	339	426	780	1178	1240	2387	2063	635	360	356	488	10744
101.25 - 123.74 (112.5)	132	160	194	242	321	315	390	340	173	119	99	127	2612
123.75 - 146.24 (135.0)	122	166	245	168	129	261	160	121	103	78	61	74	1688
146.25 - 168.74 (157.5)	99	151	193	125	112	155	44	61	50	58	33	72	1153
168.75 - 191.24 (180.0)	121	253	304	188	105	137	74	71	98	36	46	76	1509
191.25 - 213.74 (202.5)	44	49	67	43	52	78	59	45	35	14	17	23	526
213.75 - 236.24 (225.0)	40	42	46	39	19	75	20	37	32	5	12	24	392
236.25 - 258.74 (247.5)	32	29	44	43	20	94	45	32	32	28	25	58	700
258.75 - 281.24 (270.0)	54	63	119	128	40	88	64	32	16	29	35	56	531
281.25 - 303.74 (292.5)	67	84	138	64	31	2	10	9	6	27	45	101	621
303.75 - 326.24 (315.0)	96	131	141	51	17	1	1	8	3	27	45	101	621
326.25 - 348.74 (337.5)	119	178	159	120	13	1	1	2	2	50	80	118	843
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

TABLE A-2
OCCURRENCES OF WAVE HEIGHT AND PEAK PERIOD
FOR 45° DIRECTION BANDS

STATION: 14 (337.50 - 22.49) 0.0 DEG											
Hmo(m)	3.0- 4.9	5.0- 6.9	7.0- 8.9	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- LONGER	TOTAL
0.00 - 0.99	490	867	143	2	.	.	.	.	.	.	1502
1.00 - 1.99	108	1400	339	28	.	.	.	.	.	.	1855
2.00 - 2.99	.	189	325	23	3	.	.	.	.	.	540
3.00 - 3.99	.	.	76	29	.	.	.	.	.	.	105
4.00 - 4.99	.	.	1	11	.	.	.	.	.	.	12
5.00 - 5.99	.	.	.	.	.	.	.	.	.	.	0
6.00 - 6.99	.	.	.	.	.	.	.	.	.	.	0
7.00 - 7.99	.	.	.	.	.	.	.	.	.	.	0
8.00 - 8.99	.	.	.	.	.	.	.	.	.	.	0
9.00 - GREATER	.	.	.	.	.	.	.	.	.	.	0
TOTAL	598	2456	884	73	3	0	0	0	0	0	4014

STATION: 14 (22.50 - 67.49) 45.0 DEG											
Hmo(m)	3.0- 4.9	5.0- 6.9	7.0- 8.9	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- LONGER	TOTAL
0.00 - 0.99	1046	2748	3647	3036	2078	639	136	49	8	.	13387
1.00 - 1.99	105	2133	3529	2281	1680	636	116	7	.	.	10487
2.00 - 2.99	.	90	1386	596	257	136	18	2	.	.	2485
3.00 - 3.99	.	.	84	305	28	28	12	2	.	.	459
4.00 - 4.99	.	.	1	57	33	2	.	.	.	.	93
5.00 - 5.99	.	.	.	4	20	.	.	.	.	.	24
6.00 - 6.99	.	.	.	.	6	.	.	.	.	.	6
7.00 - 7.99	.	.	.	.	.	.	.	.	.	.	0
8.00 - 8.99	.	.	.	.	.	.	.	.	.	.	0
9.00 - GREATER	.	.	.	.	.	.	.	.	.	.	0
TOTAL	1151	4971	8647	6279	4102	1441	282	60	8	0	26941

STATION: 14 (67.50 - 112.49) 90.0 DEG											
Hmo(m)	3.0- 4.9	5.0- 6.9	7.0- 8.9	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- LONGER	TOTAL
0.00 - 0.99	3123	1666	6254	2400	355	83	4	2	.	.	13887
1.00 - 1.99	91	2679	662	243	113	52	25	3	.	.	3868
2.00 - 2.99	.	45	560	27	8	14	.	.	.	.	654
3.00 - 3.99	.	.	23	86	.	.	.	.	.	.	109
4.00 - 4.99	.	.	1	5	1	.	.	.	.	.	7
5.00 - 5.99	.	.	.	.	.	.	.	.	.	.	0
6.00 - 6.99	.	.	.	.	.	.	.	.	.	.	0
7.00 - 7.99	.	.	.	.	.	.	.	.	.	.	0
8.00 - 8.99	.	.	.	.	.	.	.	.	.	.	0
9.00 - GREATER	.	.	.	.	.	.	.	.	.	.	0
TOTAL	3214	4390	7500	2761	477	149	29	5	0	0	18525

STATION: 14 (112.50 - 157.49) 135.0 DEG											
Hmo(m)	3.0- 4.9	5.0- 6.9	7.0- 8.9	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- LONGER	TOTAL
0.00 - 0.99	1776	327	62	1	.	.	.	.	.	.	2103
1.00 - 1.99	39	1010	117	4	.	.	.	.	.	.	1112
2.00 - 2.99	.	24	17	13	.	.	.	.	.	.	145
3.00 - 3.99	.	.	.	3	.	.	.	.	.	.	30
4.00 - 4.99	.	.	.	.	.	.	.	.	.	.	3
5.00 - 5.99	.	.	.	.	.	.	.	.	.	.	0
6.00 - 6.99	.	.	.	.	.	.	.	.	.	.	0
7.00 - 7.99	.	.	.	.	.	.	.	.	.	.	0
8.00 - 8.99	.	.	.	.	.	.	.	.	.	.	0
9.00 - GREATER	.	.	.	.	.	.	.	.	.	.	0
TOTAL	1815	1361	196	21	0	0	0	0	0	0	3393

STATION: 14 (157.50 - 202.49) 180.0 DEG											
Hmo(m)	3.0- 4.9	5.0- 6.9	7.0- 8.9	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- LONGER	TOTAL
0.00 - 0.99	1037	344	3	.	.	.	.	.	.	.	1384
1.00 - 1.99	53	642	75	.	.	.	.	.	.	.	770
2.00 - 2.99	.	31	151	3	.	.	.	.	.	.	185
3.00 - 3.99	.	.	15	6	.	.	.	.	.	.	21
4.00 - 4.99	.	.	.	4	1	.	.	.	.	.	5
5.00 - 5.99	.	.	.	.	.	.	.	.	.	.	0
6.00 - 6.99	.	.	.	.	.	.	.	.	.	.	0
7.00 - 7.99	.	.	.	.	.	.	.	.	.	.	0
8.00 - 8.99	.	.	.	.	.	.	.	.	.	.	0
9.00 - GREATER	.	.	.	.	.	.	.	.	.	.	0
TOTAL	1090	1017	244	13	1	0	0	0	0	0	2365

TABLE A-2 (Continued)
OCCURRENCES OF WAVE HEIGHT AND PEAK PERIOD
FOR 45° DIRECTION BANDS

Hmo(m)	STATION: 14 Tp(sec)										TOTAL
	3.0- 4.9	5.0- 6.9	7.0- 8.9	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- LONGER	
0.00 - 0.99	579	3	.	.	.	.	.	.	.	.	582
1.00 - 1.99	193	58	.	.	.	.	.	.	.	.	251
2.00 - 2.99	.	3	.	.	.	.	.	.	.	.	3
3.00 - 3.99	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.99	.	.	.	.	.	.	.	.	.	.	0
5.00 - 5.99	.	.	.	.	.	.	.	.	.	.	0
6.00 - 6.99	.	.	.	.	.	.	.	.	.	.	0
7.00 - 7.99	.	.	.	.	.	.	.	.	.	.	0
8.00 - 8.99	.	.	.	.	.	.	.	.	.	.	0
9.00 - GREATER	.	.	.	.	.	.	.	.	.	.	0
TOTAL	772	64	0	0	0	0	0	0	0	0	836

Hmo(m)	STATION: 14 Tp(sec)										TOTAL
	3.0- 4.9	5.0- 6.9	7.0- 8.9	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- LONGER	
0.00 - 0.99	837	.	.	.	.	.	.	.	.	.	837
1.00 - 1.99	289	52	.	.	.	.	.	.	.	.	341
2.00 - 2.99	.	9	.	.	.	.	.	.	.	.	9
3.00 - 3.99	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.99	.	.	.	.	.	.	.	.	.	.	0
5.00 - 5.99	.	.	.	.	.	.	.	.	.	.	0
6.00 - 6.99	.	.	.	.	.	.	.	.	.	.	0
7.00 - 7.99	.	.	.	.	.	.	.	.	.	.	0
8.00 - 8.99	.	.	.	.	.	.	.	.	.	.	0
9.00 - GREATER	.	.	.	.	.	.	.	.	.	.	0
TOTAL	1126	61	0	0	0	0	0	0	0	0	1187

Hmo(m)	STATION: 14 Tp(sec)										TOTAL
	3.0- 4.9	5.0- 6.9	7.0- 8.9	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- LONGER	
0.00 - 0.99	336	19	5	2	.	.	.	.	.	.	362
1.00 - 1.99	381	289	32	1	.	.	.	.	.	.	673
2.00 - 2.99	.	141	32	.	.	.	.	.	.	.	144
3.00 - 3.99	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.99	.	.	.	.	.	.	.	.	.	.	0
5.00 - 5.99	.	.	.	.	.	.	.	.	.	.	0
6.00 - 6.99	.	.	.	.	.	.	.	.	.	.	0
7.00 - 7.99	.	.	.	.	.	.	.	.	.	.	0
8.00 - 8.99	.	.	.	.	.	.	.	.	.	.	0
9.00 - GREATER	.	.	.	.	.	.	.	.	.	.	0
TOTAL	717	449	10	3	0	0	0	0	0	0	1179

Hmo(m)	STATION: 14 Tp(sec)										TOTAL
	3.0- 4.9	5.0- 6.9	7.0- 8.9	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- LONGER	
0.00 - 0.99	9224	5974	10052	5440	2433	722	140	51	8	.	34044
1.00 - 1.99	1259	8263	4669	2534	1793	688	141	10	.	.	19357
2.00 - 2.99	.	532	2542	653	268	150	18	2	.	.	4165
3.00 - 3.99	.	.	215	439	28	28	12	2	.	.	724
4.00 - 4.99	.	.	3	80	35	2	.	.	.	.	120
5.00 - 5.99	.	.	.	4	20	.	.	.	.	.	24
6.00 - 6.99	.	.	.	.	6	.	.	.	.	.	6
7.00 - 7.99	.	.	.	.	.	.	.	.	.	.	0
8.00 - 8.99	.	.	.	.	.	.	.	.	.	.	0
9.00 - GREATER	.	.	.	.	.	.	.	.	.	.	0
TOTAL	10483	14769	17481	9150	4583	1590	311	65	8	0	58440

range distribution of height, period, and direction throughout the year. Table A-2 shows the number of occurrences for eight different direction bands each 45° in width, and for all directions. This table is useful to find the dominant direction from which wave energy affects a given location of shoreline. It also identifies the distribution of wave height and period. For this station, 45,466 occurrences out of a

total of 58,440 are from directions between the compass directions NNE and ESE, and most of these are lower than 1 meter in height with a period between 7.0 to 8.9 seconds. The distribution of wind speed and direction, on a monthly basis, is shown in Table A-3. This table is valuable for understanding the climatology of winds at a site. Local sea conditions and wind-driven currents can be inferred from the wind climatology. At this station, winds are generally less than 7.5 m/sec and are from the northeast through the southeast. Table A-4 summarizes mean and maximum wave heights by month for each of the 20 years hindcast.

A-10. The hindcast provides a time history of wave height, period and direction, listed at three-hour intervals over the 20-year study period. The significant wave height (H_{m0}) represents the combination of sea and swell. The wave period (T_p) and direction are of the dominant wave. Wave direction (D_p) is measured clockwise in degrees from true north.

TABLE A-3
OCCURRENCES OF WIND SPEED AND DIRECTION
BY MONTH FOR ALL YEARS

STATION: 14

OCCURRENCES OF WIND SPEED BY MONTH FOR ALL YEARS

WS(m/sec)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0.00 - 2.49	280	217	239	304	508	585	706	669	463	292	184	199	4646
2.50 - 4.99	1948	1778	1940	2165	2775	3192	3582	3523	2744	2134	1806	1852	29439
5.00 - 7.49	1364	1132	1588	1388	1155	714	592	684	1130	1232	1309	1433	13721
7.50 - 9.99	892	907	884	820	486	255	79	82	385	833	1035	1032	7690
10.00 - 12.49	330	327	223	86	35	19	1	2	51	343	341	315	2082
12.50 - 14.99	132	149	80	31	8	19	1	26	120	106	118	118	789
15.00 - 17.49	7	2	6	2	1	1	1	1	1	6	14	8	54
17.50 - 19.99	7	2	6	2	1	1	1	1	1	6	14	8	54
20.00 - GREATER	7	2	6	2	1	1	1	1	1	6	14	8	54
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

STATION: 14

OCCURRENCES OF WIND DIRECTION BY MONTH FOR ALL YEARS

DIRECTION BAND & CENTER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
337.50 - 22.49 (0.0)	651	523	677	377	264	133	81	174	345	687	798	690	5200
22.50 - 67.49 (45.0)	976	659	577	630	643	450	259	559	1155	1732	1303	1221	10164
67.50 - 112.49 (90.0)	907	711	905	1320	1530	1286	1729	1762	1517	1119	1109	1090	14985
112.50 - 157.49 (135.0)	679	674	901	846	874	1109	1330	989	790	451	420	506	9569
157.50 - 202.49 (180.0)	404	530	582	450	531	591	615	565	278	169	180	338	5233
202.50 - 247.49 (225.0)	318	340	399	331	369	597	640	469	275	148	193	234	4213
247.50 - 292.49 (270.0)	417	449	527	482	478	494	350	287	254	249	307	319	4613
292.50 - 337.49 (315.0)	608	634	592	364	271	140	56	155	186	405	490	562	4463
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

TABLE A-4
MEAN AND MAXIMUM WAVE HEIGHTS BY MONTH FOR ALL YEARS

STATION: 14

SUMMARY OF MEAN Hmo(m) BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1956	1.31	0.97	1.05	0.90	1.07	0.73	0.54	0.50	1.07	1.54	1.76	0.97	1.03
1957	1.24	1.23	0.84	1.12	0.71	0.71	0.75	0.43	0.87	1.41	1.33	1.59	1.01
1958	1.67	1.34	0.93	1.03	0.97	0.73	0.72	0.55	0.86	1.48	0.99	1.44	1.06
1959	1.41	1.12	1.22	1.05	0.85	0.52	0.65	0.49	1.14	0.84	1.61	1.65	1.06
1960	1.01	1.32	1.09	1.06	0.79	0.70	0.70	0.71	0.76	0.72	1.27	1.61	1.00
1961	1.23	1.06	0.83	0.91	0.74	0.65	0.65	0.60	0.98	1.77	1.21	1.03	0.96
1962	1.29	1.07	1.46	0.94	0.83	0.54	0.63	0.57	0.76	1.17	1.60	1.19	0.99
1963	1.24	1.24	0.98	0.94	0.91	0.61	0.61	0.48	1.05	1.85	1.34	1.56	1.05
1964	1.17	1.08	1.04	0.94	0.72	0.47	0.71	0.66	1.18	1.36	1.19	1.41	1.00
1965	1.17	1.30	0.94	0.77	0.71	1.08	0.72	0.56	1.28	1.19	1.36	1.41	1.00
1966	1.42	1.43	1.17	1.01	0.82	1.08	0.72	0.66	0.82	1.34	1.98	1.19	1.09
1967	1.11	1.27	1.20	1.14	0.74	0.72	0.72	0.52	1.04	1.34	1.50	1.25	1.03
1968	1.34	1.19	1.19	0.92	0.69	0.62	0.74	0.47	0.82	1.15	1.05	1.10	0.93
1969	1.48	1.62	1.25	1.14	1.08	0.52	0.52	0.69	0.92	1.75	1.67	0.97	1.14
1970	1.30	1.69	1.20	0.87	1.07	0.67	0.52	0.66	0.83	1.62	1.31	0.97	1.06
1971	1.07	1.26	1.03	0.76	0.65	0.46	0.51	0.61	1.00	0.74	1.50	1.57	0.93
1972	1.15	1.24	1.09	0.91	1.03	0.99	0.63	0.51	0.90	1.28	0.94	1.37	1.00
1973	1.28	1.41	1.22	1.25	0.69	0.67	0.51	0.62	0.72	1.45	1.04	1.14	1.00
1974	0.77	1.06	0.79	0.96	0.64	0.53	0.47	0.60	0.81	1.91	1.23	0.96	0.89
1975	1.34	0.85	1.21	1.02	0.59	0.46	0.72	0.57	0.95	0.92	1.66	1.87	1.02
MEAN	1.25	1.24	1.09	0.99	0.83	0.66	0.56	0.59	0.95	1.35	1.39	1.31	

STATION: 14

MAX Hmo(m)*10 WITH ASSOCIATED Tp(sec) AND Dp(deg/10) BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAX
1956	29 835	22 7 9	31 8 0	26 718	26 7 8	17 611	14 5 7	10 431	25 9 3	4510 4	5411 3	19 531	5411 3
1957	39 9 5	32 8 5	19 530	29 8 9	18 7 8	17 619	14 421	15 7 3	16 6 7	34 8 1	39 9 5	34 8 1	39 9 5
1958	6812 4	31 819	24 713	24 734	18 610	18 6 7	16 6 9	12 511	21 6 9	3811 3	31 9 5	37 9 6	6812 4
1959	42 9 6	26 7 4	4310 8	31 8 2	29 8 8	15 617	18 6 7	13 5 8	20 8 6	20 7 0	34 9 1	3710 5	4310 8
1960	26 736	25 820	32 835	29 8 8	23 7 5	20 710	18 6 8	16 6 15	40 914	16 615	24 8 7	4510 3	26 736
1961	34 9 7	29 816	22 718	27 7 7	23 7 8	15 6 5	11 5 8	11 5 8	23 9 4	39 9 4	22 715	24 736	34 9 7
1962	31 7 0	42 9 1	32 16	22 710	23 7 7	10 6 8	12 5 26	11 5 13	1811 4	4214 4	3614 4	4214 4	31 7 0
1963	29 8 6	30 813	34 9 4	26 8 6	31 7 8	17 7 4	12 5 26	12 5 5	2811 5	31 8 6	31 8 6	31 8 6	29 8 6
1964	3011 5	29 819	20 9 4	24 7 7	24 7 7	10 420	10 7 8	10 7 8	2810 1	36 9 0	36 9 0	36 9 0	3011 5
1965	32 8 0	27 814	20 8 4	16 8 6	12 5 4	10 6 7	10 6 7	11 5 10	3611 1	40 10 0	36 9 0	36 9 0	32 8 0
1966	32 735	42 9 18	24 10 4	22 7 9	16 619	14 613	18 6 7	19 9 5	18 10 0	28 8 8	40 10 0	36 9 0	32 735
1967	32 735	42 9 18	24 10 4	22 7 9	16 619	14 613	18 6 7	19 9 5	18 10 0	28 8 8	40 10 0	36 9 0	32 735
1968	38 9 4	37 813	28 8 15	21 7 7	19 8 7	15 512	12 5 10	12 5 10	1811 1	37 9 4	37 9 4	37 9 4	38 9 4
1969	38 9 4	37 813	28 8 15	21 7 7	19 8 7	15 512	12 5 10	12 5 10	1811 1	37 9 4	37 9 4	37 9 4	38 9 4
1970	32 8 1	461118	26 815	1810 3	19 617	18 611	11 5 10	12 5 10	17 6 8	37 9 4	4510 4	461118	32 8 1
1971	36 835	31 817	22 534	19 617	18 611	8 410	11 5 10	12 5 10	2510 4	31 8 1	32 8 1	32 8 1	36 835
1972	40 9 1	30 8 2	26 8 4	24 7 9	25 8 7	37 915	14 6 18	19 6 9	16 8 6	23 7 5	23 7 5	23 7 5	40 9 1
1973	25 7 0	30 7 0	31 818	26 719	18 613	16 610	8 4 18	19 6 9	15 7 5	26 8 8	23 7 5	23 7 5	25 7 0
1974	16 8 4	31 8 0	17 7 5	29 8 9	22 718	26 718	8 4 18	12 510	2310 4	5712 5	28 7 4	24 710	16 8 4
1975	26 716	26 819	24 810	26 810	11 414	9 7 5	2314 5	15 512	24 818	32 8 6	40 8 8	36 8 1	26 716
MAX	6812 4	461118	4310 8	42 9 6	3111 4	39 912	2314 5	26 710	5611 3	5712 5	5411 3	5410 4	

MAX Hmo(m): 6.8 MAX Tp(sec): 12. MAX Dp(deg): 40. DATE(gmt): 58010312

MAX WIND SPEED(m/sec): 19. MAX WIND DIRECTION(deg): 305. DATE(gmt): 62112812

A-11. Table A-5 summarizes wave statistics for Station 14 for the entire 20-year hindcast by return period. It should be noted that the direction of these waves was generally from north-northeast to east-southeast.

TABLE A-5
WAVE STATISTICS FOR STATION 14
(WIS REPORT 30)

RETURN PERIOD (Years)	SIGNIFICANT WAVE HEIGHT	
	(Meters)	(Feet)
20	6.8	22.3
10	5.7	18.7
5	5.4	17.7
2	4.5	14.8
1	4.0	13.1

STORM SURGE

A-12. Storm surge elevation is defined as the rise of the ocean surface above its normal high tide level during a storm. The increased elevation is attributable to a variety of factors which include waves, wind shear stress, and atmospheric pressure. An estimate of these water-level changes is essential for the design of the crest elevation of a beach fill area. An increase in water depth will allow larger storm waves to attack the shore.

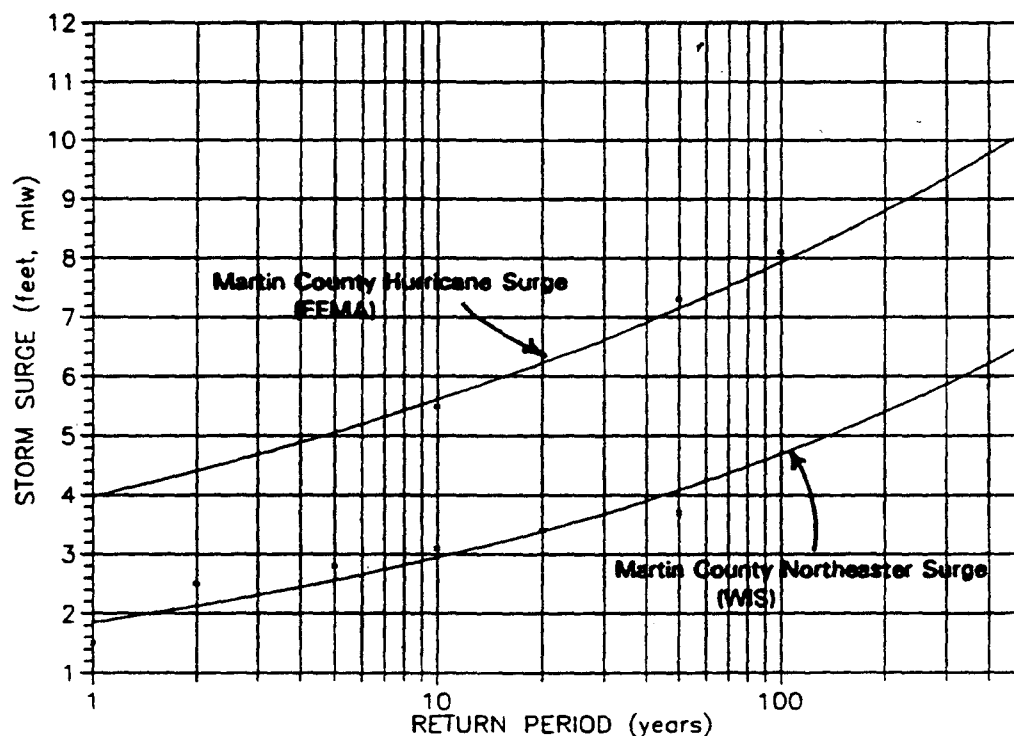
A-13. The major threats to the shoreline of Hutchinson Island are surge and waves caused by northeasters, subtropical and tropical storms, and hurricanes. It is possible to classify and predict storm surge elevations for various storms through the use of historical information and theoretical models.

A-14. The Federal Emergency Management Agency (FEMA) has developed still water flood elevation frequency relationships for hurricane storm events for Martin County (FEMA, July 1983). Methodology used in this study was developed by the National Academy of Sciences, and the results include the effects of waves. Assumptions made in the analysis include; 1) breaking wave heights are limited to 0.78 of the local still water depth, 2) the wave crest constitutes 70% of the wave height, and 3) waves are dissipated by features such as sand dunes, dikes and

seawalls, buildings, and vegetation. Regeneration of wave heights over areas of large fetch was also considered, and the maximum crest elevation at the Atlantic Ocean shoreline resulted to be 11 feet. Figure A-3 shows the elevations for hurricane surge levels at selected recurrence intervals for the Martin County Atlantic coast. The hurricane surge curve is based on data points for the 10-, 50-, 100-, and 500-year recurrence intervals.

A-15. Higher frequency of occurrence storms and storm surge elevations for other meteorological induced water-level anomalies (i.e northeaster type storms) were obtained from WIS Report 7 (Ebersole, 1982). Hindcasting of the northeaster storm surges was performed utilizing historical wind and pressure fields. The water levels given in WIS Report 7 are referenced to the still water level. The data for northeaster events for Martin County is based on interpolation between the storm surge data for Mayport and Miami Beach, Florida (See Figure A-3).

**FIGURE A-3
STORM SURGE FREQUENCY CURVE
MARTIN COUNTY, FLORIDA**



RECENT STORM HISTORY

A-16. Hurricanes. Hurricanes are severe tropical storms originating in the tropical and subtropical latitudes in the Atlantic Ocean north of the equator. Their formation invariably occurs over oceanic regions in areas where the existence of high water temperatures allows above normal convective activity. A hurricane is characterized by low barometric pressure, high winds over 75 miles per hour, heavy rainfall, large waves and tidal surges. The hurricane season runs from June to Late October, although tropical disturbances have affected Florida's coasts as early as March and as late as December.

A-17. A total of 50 hurricanes have passed within a radius of 150 miles of Martin County between 1830 and 1985 (Jacksonville District, USACE, 1986). Of that total, 19 hurricanes passed within a 50-mile radius. In recent years, Martin County has been relatively unaffected by hurricanes. Most of the notable storm events have been northeasters.

A-18. Northeasters. During storms in the North Atlantic, northeasterly winds blowing across the water surface for hundreds of miles produce wind setup and large waves. When combined with the accompanying storm surge, the beach and dune system are subjected to wave attack and runup at higher elevations than normal. A prolonged northeaster, combined with extraordinary high tides, can result in erosion which exceeds that of a tropical storm or hurricane. Erosion in the project area is a direct result of such storms.

A-19. Northeasters may form with little or no advance warning and persist for as long as a week to 10 days. The average duration of a northeaster, however, is only about 2 or 3 days. In the fall, winter and spring months, the Martin County shoreline is vulnerable to northeasters. Particularly severe northeasters that have affected the project area occurred in 1956, 1957, 1962, 1963, 1964, 1979, 1981, 1984 and 1990.

A-20. The northeast storm of November 20-26, 1984, locally referred to as the "Thanksgiving Day Storm", was a severe storm event that caused wide spread damage along the east coast of Florida. During the storm peak on November 23-24, wind gusts were estimated at 68-71 mph in Hutchinson Island. This storm, as related to Martin County, was estimated to be a once in fifteen year occurrence event. The storm occurred coincidentally with the highest or spring tide which occurs at or near the time of new or full moon. A tide station located at the mouth of the St. Lucie Inlet measured a total water elevation of 4.75 feet NGVD during the peak of the storm. Significant wave heights in excess of 12 feet were observed over a period of about 18 hours. Based on survey data taken in February-March 1984 and January 1985, the "Thanksgiving Day Storm" eroded 2.9 cubic yards per foot of shoreline above MSL, in the Martin County area (Balsillie, 1985).

YEARLY DEPTH LIMIT

A-21. For natural sand beaches, one depth useful in coastal engineering is the yearly limit to the very active nearshore profile. This is the depth beyond which repetitive surveys reveal little sand level change throughout the seasonal wave climate changes. Hallermeier (September 1978) has developed a procedure for estimating this profile close-out depth d_c . This depth is based on the approximate extreme wave condition for nearshore significant extreme waves, the following equation is used to calculate d_c :

$$d_c = 2.28 H_e - 68.5 (H_e/gT_e^2)$$

where,

H_e = nearshore extreme significant wave height

T_e = nearshore extreme significant wave period

g = acceleration of gravity constant, 32.2 ft/sec²

A-22. Review of the hindcast wave statistics for station 14 (Revised Level II) reveals that waves between 3.0 to 3.99 meters with wave periods between 9.0 to 9.9 seconds occur 21.8 hours from the northeast direction (67.5 degrees). The limiting depth d_c was computed to be 29.3 feet in depth, using a 13-foot wave with an 9 second period.

SEA LEVEL RISE

A-23. Throughout geologic history, global sea level variations, both rise and fall, have occurred. Some authorities have found evidence to indicate that we may be entering a new ice age with a resultant sea level drop. Others argue that increasing atmospheric concentrations of carbon dioxide and other gases are causing the earth to warm, contributing to a sea level rise. Both global cooling or warming thus contribute to absolute global sea level change. Eustatic sea level change is defined as a global change of oceanic water level. Total relative sea level change is the difference between the eustatic sea level and any change in local land elevation.

A-24. The National Research Council (NRC) has recently published a book entitled Responding to Changes in Sea Level. Engineering Implications (NRC, 1987) which presents a mathematical procedure for developing the total relative sea level rise for any location with a known rate of land elevation change. Total relative sea level rise is the local component plus the eustatic component, computed by the following equation:

$$T(t) = (0.0012 + M/100)t + bt^2$$

where,

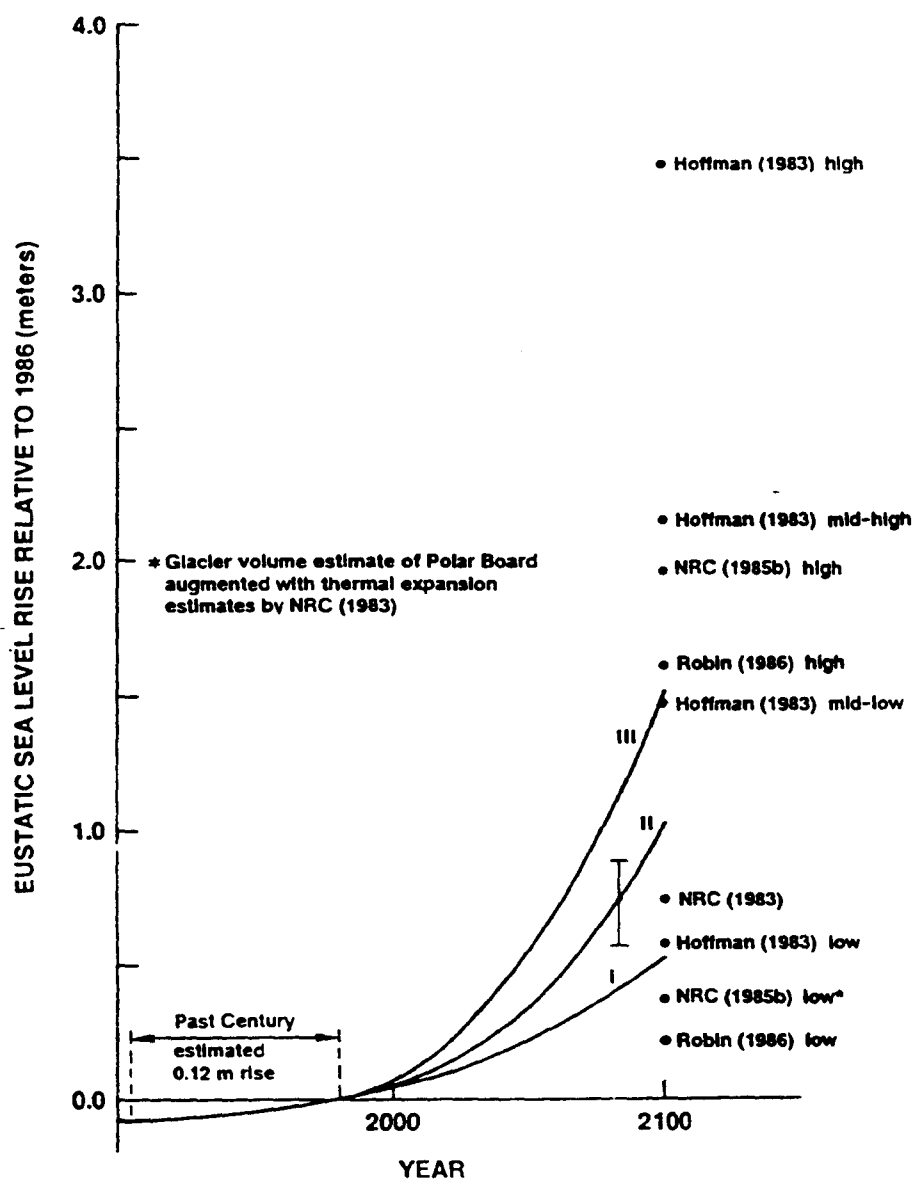
$T(t)$	=	total relative sea level rise in meters at time t .
0.0012	=	historic global sea level rise, expressed in meters per year, over the last century.
M	=	the rate of subsidence or uplift, in mm/yr.
t	=	any given year of interest, note $t(0) = 1986$.
b	=	the appropriate coefficient (in m/yr^2) for the three future sea level rise scenarios (Curve I, $b = 0.000028$; Curve II, $b = 0.000066$; and Curve III, $b = 0.000105$).

A-25. Figure A-4, shows three scenarios for eustatic sea level rise, reproduced from the NRC report. The three scenarios for eustatic sea level rise developed by the NRC approximate the three estimates of potential total eustatic rises of 0.5, 1.0 and 1.5 meters by the year 2100.

A-26. The rate of subsidence or uplift is unknown for the project area ($M = 0$). Therefore, the rate of uplift ($M = +1.1$) for Miami Beach, Florida, which is the nearest area with a computed rate, will be used. The historic trend or "low" estimate, between 1940 through 1980, for the southern east coast of the U.S. is a relative rise of 0.006 feet per year. This estimate has a standard error of trend of plus or minus 0.0013 feet per year (Hicks, 1983). Using the equation above, the total relative sea level rise in feet by the year 2046 would be 0.32 feet based on the historic trend, and 1.47 feet based on Curve III or "high" estimate.

A-27. Shoreline Recession-Sea Level Rise. Per Brunn (1962) proposed a formula for computing the rate of shoreline recession from the rate of sea level rise that takes into account local topography and bathymetry. His contention is that with a rise in sea level, the beach profile attempts to reestablish the same bottom depths relative to the surfaces of the sea that existed before the sea level rise. If the along-shore littoral transport into and out of, a given shoreline is equal, then the quantity of material required to reestablish the nearshore slope must be derived from erosion of the shore. The historic estimate of relative sea level rise is 0.32 feet by the year 2046. The shoreline recession attributed to this low estimate along the shore of the project area would be 15 feet, or 0.28 feet per year. The Curve III "high" estimate of sea level rise by the year 2046 is 1.47 feet. The corresponding recession would be 68.9 feet, or 1.3 feet per year. These recessions were computed using Dr. Brunn's equation (Brunn's Rule) as follows:

FIGURE A-4
EUSTATIC SEA LEVEL RISE SCENARIOS
(NRC)



$$x = ab/(h+d)$$

where,

- x = shoreline recession (in feet) attributable to sea level rise.
- h = elevation of shoreline above mean sea level (+9.1 feet berm).
- d = MSL depth contour beyond which there is no significant sediment motion (29.3 feet, yearly depth limit).
- b = horizontal distance (1800 feet averaged) from the beach profile berm elevation to the depth contour d.
- a = specified relative sea level rise for time period t.

A-28. The Brunn procedure is applicable to long straight sandy beaches having an uninterrupted supply of sand. Little is known about the rate at which profiles respond to changes in water level. Therefore, this procedure should only be used for estimating long term changes. The procedure is not a substitute for the analysis of historical shoreline and profile changes. If little or no historical data is available, then historical analysis may be supplemented by this method to provide an estimate of long-term erosion rates attributable to sea level rise. The offshore contours in the project area are not entirely straight and parallel; however, Brunn's rule does show the potential order of magnitude in future shoreline changes within the project area attributable to the relative rise in sea level.

A-29. Shoreline Erosion-Sea Level Rise. It is assumed that an eroding shore maintains approximately the same profile above the seaward limit of significant transport while it erodes. Therefore, the erosion volume per foot of shoreline is the vertical distance from the dune base (+9.1 feet) or berm crest to the depth of the seaward limit of the active profile d, multiplied by the horizontal retreat of the profile, Δx . Using the "low" estimate of shoreline retreat of 15 feet for Δx , the potential erosion volume would be 0.4 cubic yard per foot of shoreline per year by the year 2046. Using the "high" estimate of shoreline retreat of 68.9 feet for Δx , the potential erosion volume would be 1.8 cubic yards per foot of shoreline per year by the year 2046.

A-30. Surge Levels-Sea Level Rise. Another result of long-term relative sea level rise is the increase in storm surge water elevations. Table A-6 displays the storm surge elevation frequency data computed by WIS and FEMA. Also displayed is the increase in surge elevations attributed to the "low" and "high" estimates of relative sea level rise by the year 2046. It is evident that the damage potential of storms will become greater as a result of the increase in relative sea level. For example, the 20-year storm surge level has an elevation of 3.4 feet. By the year 2046, using the "high" estimate of relative sea level rise, this former 20-year surge value would increase to a 3.7-foot elevation. The 3.4-foot surge elevation at the year 2046 would have a return interval of a 10-year event based on the WIS plus sea level rise curve.

**TABLE A-6
SUMMARY OF SURGE ELEVATIONS
(YEAR 2046 CONDITIONS)**

SOURCE	STORM SURGE ELEVATION, FEET (MLW)						
	RETURN PERIOD, YEARS						
	2*	5*	10*	20*	50	100	500
WIS, FEMA (No Rise)	2.5	2.8	3.1	3.4	7.3	8.1	9.9
WIS, FEMA (Historic**)	2.8	3.1	3.4	3.7	7.6	8.4	10.2
WIS, FEMA (High***)	4.0	4.3	4.6	4.9	8.8	9.6	11.4

* The 2-, 5-, 10-, and 20-year were taken from the WIS curve on Figure A-3. The 50-, 100- and 500-year surge elevations were taken from the FEMA curve.

** WIS, FEMA value plus 0.32 feet, based on historic rate (Year 2046).

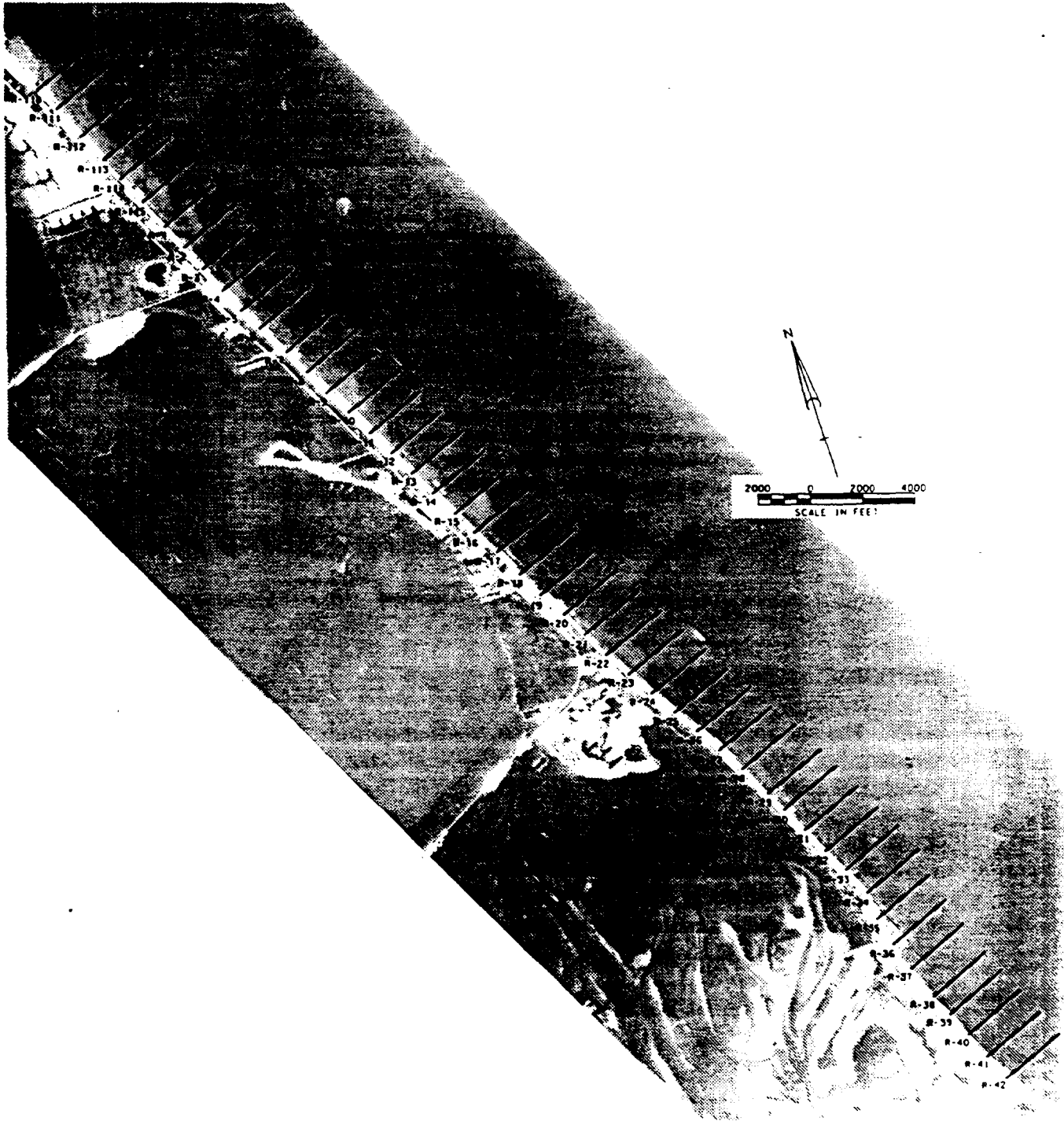
*** WIS, FEMA value plus 1.47 feet, based on NRC Curve III (Year 2046).

COASTAL PROCESSES

HISTORIC SHORELINE CHANGES

A-31. The mean high water in Martin County was mapped by the U.S. Coast and Geodetic Survey in 1882-1883, 1928-1930, 1940-1942, and 1966-1969; by the U.S. Geological Survey in 1942-1948, 1945-1949, 1967-1970 and 1980; and by the National Ocean Service in 1970-1973. The Florida Department of Environmental Protection (FDEP) surveyed the Martin County portion of Hutchinson Island in 1971, 1976 and 1982 for their coastal construction control line program; in 1984 and 1985 for post-storm conditions; and in 1984 and 1986 for shoreline conditions. FDEP surveyed the island's shoreline in St. Lucie County in 1972 and 1987 for their coastal construction control line program; and in 1983, 1984, 1987 and 1989 for shoreline conditions. Figure A-5 shows the location of FDEP's profiles on Hutchinson Island. The U.S. Army Corps of Engineers, Jacksonville District, surveyed the Hutchinson Island shoreline in 1992.

FIGURE A-5
FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
PROFILES LOCATION MAP



A-32. Table A-7 shows the position of the mean high water shoreline for Hutchinson Island between 1883 and 1992. The data suggest both, shoreward and seaward movement of the shoreline for the period of record. Between 1883 and 1930, the shoreline receded over the entire length of the island (See Figure A-6). The phenomenal recession at the south end of the island was caused by the initial cut of St. Lucie Inlet through the barrier island in 1892. Between 1930 and 1948, the shoreline advanced seaward to a position which approximately coincided with the 1883 shoreline position. This recovery of the shoreline was due to the construction of a north jetty in 1929 which stabilized the north shore of St. Lucie Inlet. From 1948 through 1971, data shows the shoreline continued to advance over most of the island, especially the shoreline immediately north of the north jetty. Figure A-7 illustrates seaward and shoreward movement of the shoreline during the period 1971 to 1982. The receding problems on the south end of Hutchinson Island, between R-35 to R-38, are probably primarily due to a net flux of sand being transported offshore during the natural onshore/offshore seasonal motion of sand (Walton, 1974). For the period 1982 to 1992, the shoreline experienced substantial recession, due partly to major storms (1984 Thanksgiving Day Northeaster and 1990 Halloween Day Northeaster) which accelerated the recession of the shoreline and dunes, and lowered the beach profile.

A-33. The comparative positions of the shoreline for the study area during the period 1971 to 1992 are shown in Figure A-7. The study area (St. Lucie County R-110 to R-115 and Martin County R-1 to R-42) receded an average of 1.1 feet per year. The project area, R-1 to R-25, averaged 1.3 feet per year of recession. These rates are used as input in the analysis to determine future shoreline positions under the without project condition and calculating land loss and storm damage values.

HISTORIC VOLUMETRIC CHANGES

A-34. Volumetric changes for the study area were based on surveys which extended beyond wading depth (-6 feet MLW). Extensive surveys were performed in the Martin County portion of the study area (R-1 to R-42) by FDEP in 1971, 1982 and by Jacksonville District in 1992. However, the St. Lucie portion of study area (R-110 to R-115) was surveyed by FDEP in 1972, 1987 and by Jacksonville District in 1992. Based on the known data, St. Lucie County volume changes were estimated for the periods 1971-1982, 1982-1992 and 1971-1992 for consistency with the Martin County data. Volumetric changes in the study area are shown in Figure A-8.

A-35. Between 1971 and 1982, data suggest the shoreline accreted approximately 2,781,200 cubic yards along 42,400 feet of shoreline. Further analysis of the data revealed erosional and accretional patterns above mean low water along the entire length of the study area. Most of the accretion during this period occurred in the offshore portion of the beach profiles. The study area lost about 4,357,400 cubic yards of sand between 1982 and 1992. In the early 1980's, an extension to the St.

TABLE A-7
HISTORICAL SHORELINE POSITIONS

PROFILE LINE	DISTANCE FROM MONUMENT TO MHW, FEET					
	SURVEY DATES					
	1883	1930	1948*	1971*	1982*	1992
R-110	302	208	240	148	140	161
R-111	250	119	186	135	98	111
R-112	236	153	225	151	157	159
R-113	238	148	247	193	195	183
R-114	170	77	177	133	130	109
R-115	165	90	214	162	108	117
R-1	116	31	143	87	97	72
R-2	110	29	151	94	94	89
R-3	151	73	153	101	107	89
R-4	174	111	180	112	123	92
R-5	187	80	212	123	129	95
R-6	202	68	203	130	120	86
R-7	216	55	107	106	112	69
R-8	226	60	75	88	100	83
R-9	229	59	115	128	132	86
R-10	165	28	63	86	115	89
R-11	141	41	116	122	126	93
R-12	154	29	127	108	113	79
R-13	145	23	102	108	109	64
R-14	155	46	87	103	104	47
R-15	132	61	74	97	89	75
R-16	162	66	80	103	93	68
R-17	142	50	112	125	124	103
R-18	155	78	90	112	116	126
R-19	368	275	277	318	301	275
R-20	156	105	92	135	118	90
R-21	175	115	82	125	132	90
R-22	184	136	141	128	119	102
R-23	207	114	116	158	132	95
R-24	180	95	93	135	125	105
R-25	135	86	120	117	113	111
R-26	148	84	84	150	137	120
R-27	147	144	107	149	147	149
R-28	126	92	67	62	123	117
R-29	99	38	14	60	74	--
R-30	131	72	70	108	119	107
R-31	133	71	73	108	116	105
R-32	129	78	66	101	155	140
R-33	153	77	54	105	121	93
R-34	130	94	67	124	133	115
R-35	258	169	193	280	238	141
R-36	241	96	42	347	156	141
R-37	27	-300	-168	290	118	101
R-38	19	-456	-242	144	131	103
R-39	21	-600	-278	127	183	134
R-40	-34	-727	-315	102	185	124
R-41	-191	-801	-353	119	219	152
R-42	-96	-862	-279	133	260	246

* Most of the monuments were surveyed in 1948, 1971 and 1982, except monuments R-110 to R-115, which are located immediately north of the project area, were surveyed in 1972 and 1987. Monuments R-1 to R-6 were surveyed in 1947.

FIGURE A-6
HISTORICAL SHORELINE CHANGES

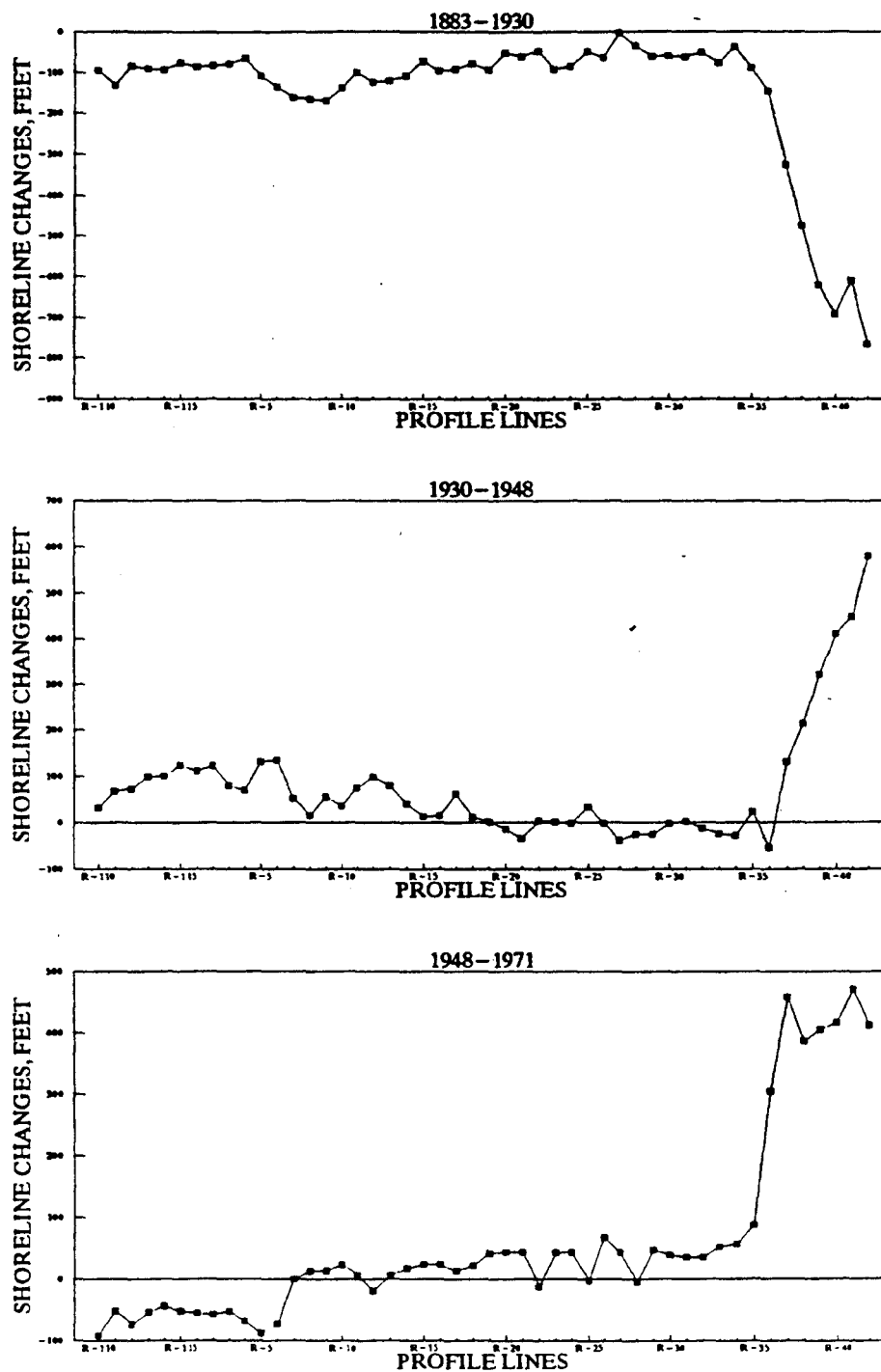


FIGURE A-7
HISTORICAL SHORELINE CHANGES

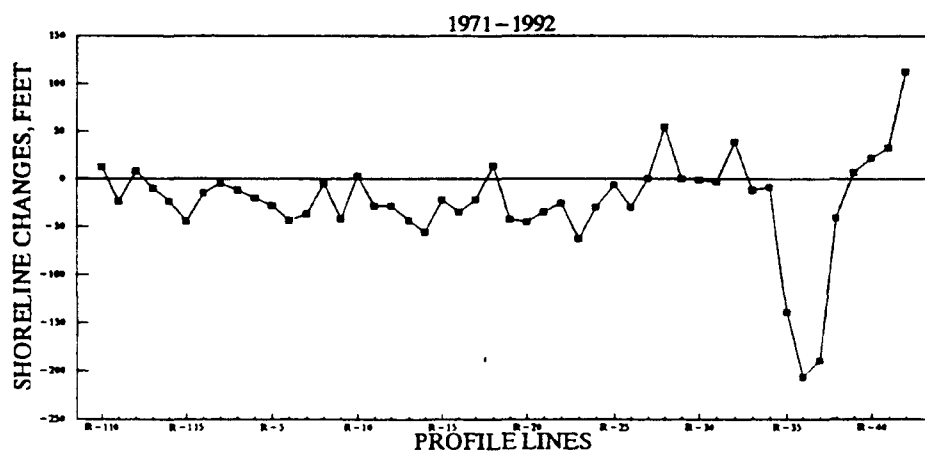
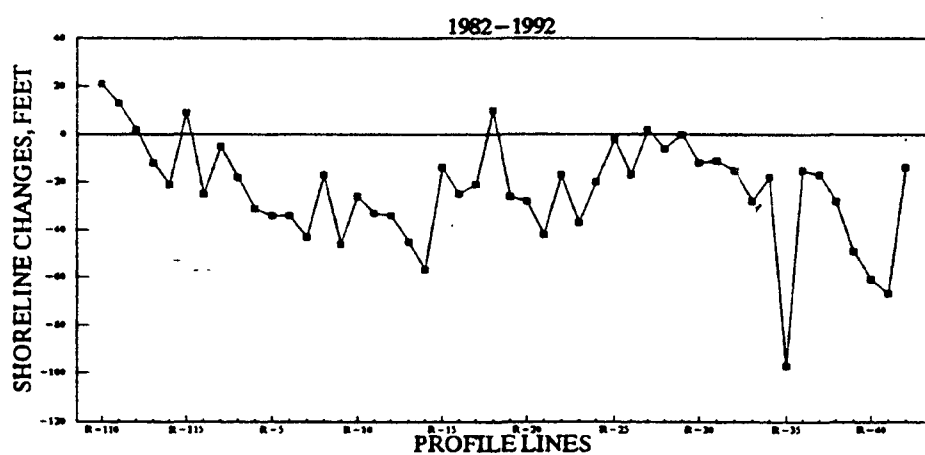
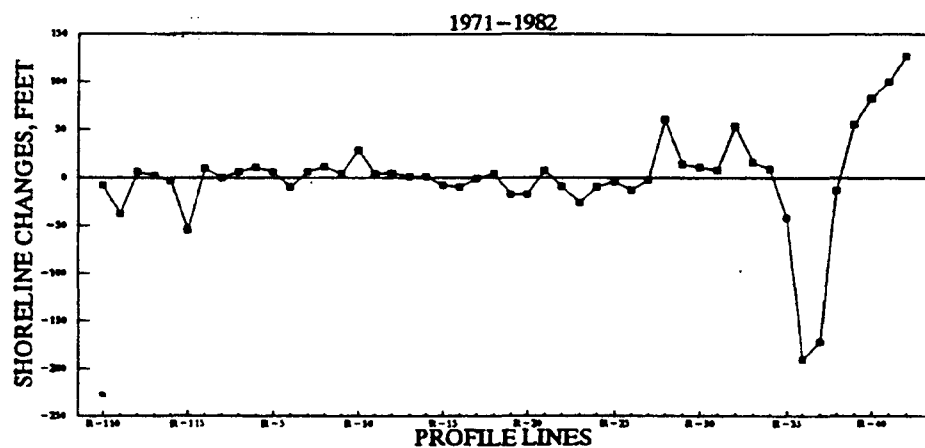
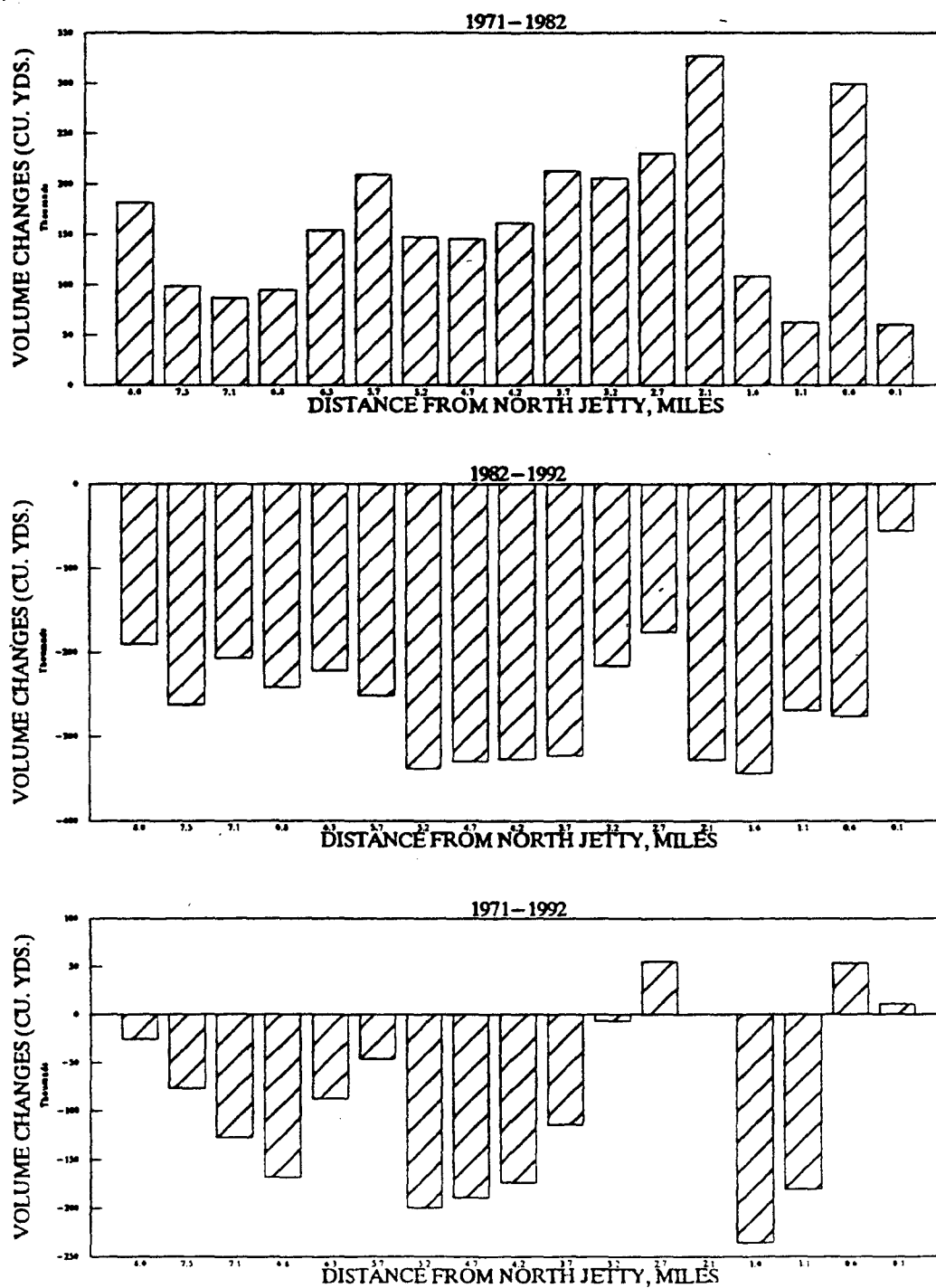


FIGURE A-8
HISTORICAL VOLUMETRIC CHANGES



Lucie Inlet's north jetty and a breakwater were constructed, however, these improvements only affected the southernmost shoreline. No other construction took place within the study area which can have altered the volumetric pattern from that of 1971 to 1982. The presence of two major storms (1984 Thanksgiving Day and 1990 Halloween Day northeasters) contributed to the erosion during this period of 1982 to 1992.

A-36. In the last 21 years, the study area has eroded an estimated 1,508,700 cubic yards, of which 1,104,000 cubic yards have eroded within the project area limits, R-1 to R-25. This results in an erosion rate of 53,600 cubic yards per year or 2.6 cubic yards per foot of shoreline per year for the project area. This erosion rate will be used to estimate future erosion losses with and without a project beach fill conditions.

INLET EFFECTS

A-37. Table A-8 presents the history of navigation improvements at St. Lucie Inlet. When the inlet was cut in 1892, the shoreline experienced a phenomenal initial recession on both sides of the inlet. By 1922, the inlet had widened to 2,600 feet. Between 1882 and 1928, the shoreline, up to 1.5 miles north of the inlet, receded considerably, with a maximum recession of about 2000 feet directly north of the inlet.

A-38. When the north jetty was constructed, the north shore of St. Lucie Inlet stabilized and, accretion on the north side of the jetty took place. However, the jetty functioned as a littoral barrier and continued causing erosion of the shore south of the inlet. Between 1946 and 1962, the mean high water shoreline directly north of the inlet had advanced 500 feet further, whereas the shoreline to the south of the inlet continued to recede up to a maximum of 720 feet.

A-39. Survey records reflect a pattern of shoreline erosion and accretion north of the inlet, and of continual erosion south of the inlet for the period 1971 to 1992. The beaches on the south portion of Hutchinson Island are not influenced by the St. Lucie Inlet's north jetty to nearly the same extent as are the beaches to the south of the inlet on Jupiter Island. The accretional influence of the jetty on the north shoreline is limited to approximately 2 miles north of the inlet. Whereas, the erosional problems experienced on the south shoreline of Jupiter Island extend a longer distance.

A-40. Maintenance dredging records from January 1965 to June 1993 indicate a total quantity of 2,482,195 cubic yards of material has been dredged from St. Lucie Inlet. The average annual quantity of sand removed from the inlet is 68,800 cubic yards.

TABLE A-8
HISTORY OF NAVIGATION IMPROVEMENTS ACCOMPLISHED
AT ST. LUCIE INLET

- 1892 - St. Lucie Inlet, located at the south end of Hutchinson Island, is reported to have been cut through the barrier island by local residents. Initially, the inlet was 30 feet wide and 5 feet deep.
- 1909 - Federal interest in a navigation project recommended Federal funding of a 18-foot channel as well as a jetty along the north side of the channel.
- 1913 - The 1913 River and Harbor Act provided initial appropriation of funds for experimental dredging of a channel 18 feet deep across the reef and ocean bar.
- 1916 - Federal construction of the channel seaward from the mouth of the inlet began. The dredged portion of the project rapidly shoaled with sand and abandonment was recommended in 1917 and again in 1933, but no action was taken.
- 1929 - Local interests build a 3,325-foot coquina stone jetty on the north shoreline of the inlet between 1926 and 1929. Martin and St. Lucie Improvement District dredged a turning basin at Port Sewall and a 150-foot wide by 10,000 feet long channel.
- 1948 - A 10 by 200-foot channel about 750 feet across the seaward bar and reef was constructed under the authorization of the 1945 River and Harbor Act, which allowed a modification of the project.
- 1965 - Emergency dredging in the St. Lucie entrance in accordance with the River and Harbor Act of 1945 was undertaken to restore a depth of at least 6 feet between the Intracoastal Waterway and the Atlantic Ocean.
- 1966 - Federal legislation was passed modifying the St. Lucie Inlet project to include maintenance of a 6 by 100-foot channel along the best natural deep water alignment between the Federal bar-cut channel and the Intracoastal Waterway.
- 1974 - An extension of the north jetty and modification to it for a weir section, excavation of a sand impoundment basin, construction of a south training jetty with a fishing walkway, a 10 by 500-foot channel through the bar-cut tapering to 150 feet through the inlet, and a 7 by 100-foot channel to the Intracoastal Waterway were authorized by Congress.
- 1982 - Construction of the project was carried out with the addition of an offshore breakwater directly seaward of the south jetty.

EXISTING SHOREFRONT PROTECTIVE STRUCTURES

A-41. The shoreline in the study area has been armored with a limited number of seawalls and revetments, and the north jetty at St. Lucie Inlet. The existing seawalls and revetments lie within the project area between R-18 and R-20. The effect of the seawalls and revetments on the shore processes is minimal.

A-42. Details of the effect of the north jetty on the adjacent shorelines are explained in the previous section of this appendix, titled "Inlet Effects". The portion of the north jetty perpendicular to the shore (3,325 feet long), was built of coquina stone in 1929. Use of coquina stone, limited underlayers and weathering of the stone since the time it was constructed has made this section of the jetty extremely porous. The 650-foot angled extension of the jetty, built of granite stone in 1982, is less porous than the landward section. However, it functions as a breakwater to reduce wave transmission into the inlet and probably has a minimal effect on the accretion occurring on the south shoreline of Hutchinson Island.

A-43. The natural hardbottom features in the study area affect the shore processes as well as the manmade structures. Within the northern study area, numerous random hardbottoms exist which influence wave propagation. However, more notable effects of the hardbottoms are visible in the southernmost shoreline of Hutchinson Island. Coquina and worm rock reefs lie at the water line or the shallow water offshore. These features, known locally as Bathtub Reef, extend north from the entrance of St. Lucie Inlet to the approximate location of profile line R-35, where the reef intersects the shoreline. These reefs perform as a breakwater by dissipating wave energy and protecting the coastline from further erosion. Approximately 2.7 miles north of the inlet, extensive worm rock and coquina formations at the shoreline (in the vicinity of the present House of Refuge Museum) have prevented the barrier island from breaking through into the Indian River.

LITTORAL TRANSPORT

A-44. Littoral transport along Hutchinson Island is predominantly from north to south. Previously, the net littoral drift for the entire study area had been estimated to be approximately 230,000 cubic yards per year to the south.

A-45. Further analysis of the longshore transport within the study area has been possible with the use of the numerical model GENESIS. GENESIS results (discussed in detail later in this appendix) suggest extreme differences in localized net littoral drift patterns. For example, GENESIS runs show the annual net longshore transport rate to the south varying from 131,000 cubic yards at the northern limit of the Bathtub Reef area to less than 10,000 cubic yards in the vicinity of the rock outcrops just north of the reef area between 1971 and 1976. For the period 1976 to 1982,

again, the net longshore transport was to the south and varied from 102,000 cubic yards at the northern study boundary to less than 10,000 cubic yards in the vicinity of the rock outcrops north of Bathtub Reef.

A-46. Previous net littoral drift estimates were based on a wave climate interacting with straight and parallel contours. However, the bathymetry within the study area and its interaction with waves is far more complex. GENESIS presented reliable data of the processes that occurred during the period of 1971 to 1982.

SHORELINE RESPONSE MODELS

STORM-INDUCED BEACH CHANGE MODEL (SBEACH)

A-47. At present, no known theoretical model of beach profile change or dune erosion exists which can be applied for engineering purposes. However, there are several empirical dune erosion models. A cooperative study between investigators at the Coastal Engineering Research Center and the Department of Water Resources Engineering developed a numerical model called SBEACH (Storm-Induced Beach Change model) which simulates beach profile change under varying storm waves and water levels. Formation and movement of major morphologic features such as longshore bars, troughs, and berms produced by breaking waves are also simulated.

A-48. The SBEACH model is empirically based and was originally developed from a large data set of net cross-shore sand transport rates and beach profile changes observed in large wave tanks, then verified using high-quality field data. The model does not simulate longshore wave, current, and sediment transport processes. Basic assumptions underlying SBEACH are that (1) breaking waves and variations in water level are the major causes of sand transport and profile change, (2) the major part of cross-shore sand transport takes place in the surf zone, (3) conservation of mass exist, that is, the amount of material eroded must equal the amount deposited, (4) median grain diameter on the profile is reasonably uniform across-shore, (5) influence of structures blocking longshore transport is small, and the shoreline is straight (longshore effects are negligible), and (6) linear wave theory is applicable everywhere along the profile without shallow-water wave approximations.

A-49. SBEACH has significant capabilities that make it useful for quantitative study of beach profile response to storms. It accepts as input a pre-storm beach profile (either idealized or surveyed), time series of water level as produced by storm surge and tide, time series of wave height and period, median sediment grain size, three transport parameters and two characteristic slope parameters. The model allows for variable cross-shore grid spacing, wave refraction by specifying wave direction, randomization of input waves to better represent forcing conditions in the field, and

water level setup due to wind parameters imputed. Output data consists of a final calculated profile at the end of the simulation, simulated profiles at intermediate time steps, intermediate and maximum wave heights, intermediate and maximum total water elevations plus setup, maximum water depth, volume change and a record of various coastal processes that may occur at any time-step during the simulation (accretion, erosion, overwash, boundary-limited runup, and/or inundation).

A-50. Because of the empirical foundation of SBEACH and the natural variability that occurs along the beach during storms, the model requires calibration of the transport and slope parameters by using a pre- and post-storm profile with the wave and water level hydrographs of the storm.

A-51. Calibration. Calibration refers to the procedure of reproducing with SBEACH the change in profile shape, particularly in the dune and berm, produced by a storm of known intensity. The calibration procedure requires iteration among combinations of values of controlling parameters and ambiguous input data. The time required for calibrations is minimized if the initial values of the parameters are close to the final ones determined in the calibration.

A-52. The 1984 Thanksgiving Day northeaster storm was selected to be used for calibration of SBEACH as related to Martin County. The selection of the storm was based on the effects it had on the coast of Martin County and the availability of the data needed for input in to SBEACH. Input data for the calibration procedure was obtained from a variety of sources. Pre-storm and post-storm beach profile data was obtained from the October 1984 and January 1985 FDEP surveys. Total water elevation (storm surge and tide), wave height, wave direction, wind speed, wind direction and water temperature data was obtained from Florida Oceanographic Society in Stuart, Florida. Wave period data used was provided by the Coastal and Oceanographic Engineering Department at the University of Florida (UF). Median grain size of the beach material used was based on information presented later in this appendix.

A-53. SBEACH developers recommend beach profile data used for the calibration procedure be taken considerably before and after the storm erosion event to be modeled, 3 to 6 months before the storm and 1 to 3 months after the storm. The Thanksgiving Day storm affected the Martin County coast during November 21-26, 1984. The pre-storm survey was taken October 3, 1984 and the post-storm survey was performed on January 8, 1985, well within the recommended time frame. Only limited number of profiles were surveyed to wading depth on both of these dates. One profile was chosen and subaqueous profile measurements obtained from other surveys were used to construct complete pre- and post-storm profiles.

A-54. Median grain size used, including shell content, was 0.27 mm. The water temperature, measured hourly throughout the duration of the storm, averaged 23°C. Measured wind speed and wind direction were imputed at 6-hour intervals. Wave height and direction used were recorded at Hutchinson Island, however, these parameters were not measured but observed. The water depth of the observed waves was assumed to be 25 feet. Wave period was obtained from data measured at a Marineland, Florida (offshore of St. Augustine) gage every six hours. The wave period data was shifted in accordance with the 24-hour delay of the storm when it reach Martin County. Total water elevation (storm surge and tide) was measured by a tidal gage located at on the north shore of St. Lucie Inlet. It is known that the tide at the inlet throat is lower and lags that of the ocean, however, adjustments to the water elevation were neglected since erosion of the dune was being reproduced adequately in the model runs.

A-55. After many runs (approximately 125 runs) of continuous iteration of the model parameters, a transport rate coefficient of $0.0000015 \text{ m}^4/\text{N}$, a slope dependent coefficient of $0.0015 \text{ m}^2/\text{s}$, and a transport rate decay factor of 0.40 provided the most acceptable calculated post-storm profile. The number of time steps used was 792 with value of time steps being 10 minutes. In order to control the amount of erosion on the dune, the maximum profile slope prior to avalanching was set at 30 degrees. The sum of squares of differences between measured and calculated profiles was 414.5 ft^2 , one of the lowest values obtained. The calculated storm induced recession was 117 feet, 3 feet more than the measured 114 feet. Pre- and post-storm profiles along with the calculated final profile are shown in Figure A-9.

A-56. Verification. Verification refers to the procedure of applying the calibrated model to reproduce change on the same beach produced by another storm, or to reproduce changes on the same beach for the same storm as used in the calibration but at a different location on the beach. Due to the lack of pre and post-storm survey data for another storm event, a different profile was chosen to verify the model using the same storm used in calibration.

A-57. Using the same storm data as in calibration, the combinations of model parameters which gave the best calibration results were applied with a different profile. The best verification run was obtained with the same model parameters which provided the best calibration results. However, the degree of error between the profile calculated during verification and the post-storm profile was smaller than in the calibration procedure. The sum of squares of differences between measured and calculated profiles was 202.8 ft^2 , the lowest value obtained. The calculated storm induced recession was 88 feet, 3 feet more than the measured 85 feet. Figure A-10 shows the pre- and post-storm profiles used and the final profile calculated during verification of the model.

FIGURE A-9
SBEACH CALIBRATION PROFILES

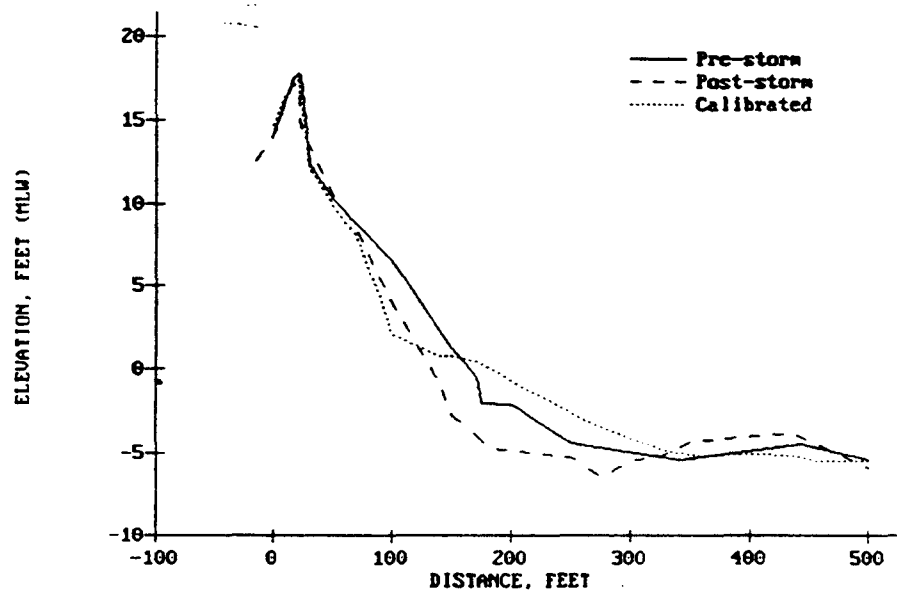
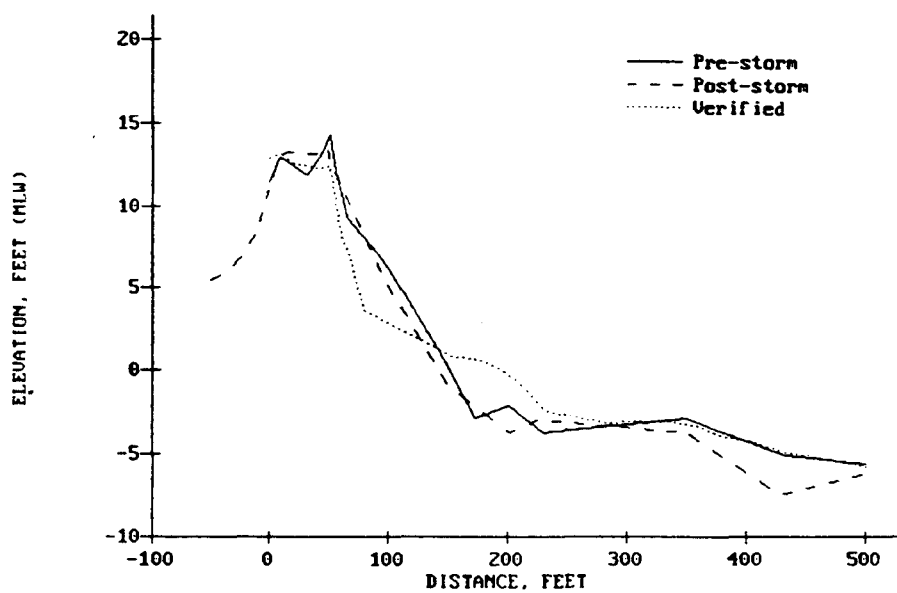


FIGURE A-10
SBEACH VERIFICATION PROFILES



A-58. Observations. In attempting to reproduce a measured post-storm profile utilizing SBEACH, many aspects were considered. Input data assumptions, storm-induced recession, conservation of mass, and difference in area between measured and calculated profiles were checked continuously throughout the calibration and verification procedures.

A-59. Several parameters related to the input data were assumed. Since the surveys were only performed to wading depth, offshore measurements from other surveys were utilized to complete the profiles used for calibration and verification. However, emphasis was given to reproducing the dune and berm features, not to offshore bars. Another parameter estimated was the water depth of the observed waves. The waves were observed at a certain distance before breaking. Calculations revealed waves were breaking at about the 18- to 20-foot depth contour depending on the height of the wave. Water depths of 35, 30 and 25 feet for the input waves were assumed and then used in SBEACH. The erosion on the dune and berm was reproduced more accurately with a water depth of 25 feet.

A-60. SBEACH overestimated, only by 3 feet, the storm-induced recession. However, it should be noted that the actual measured recession was based on a survey taken approximately a month after the storm. Recovery of the beach profile could have taken place during this period of time. SBEACH would not have simulated this amount of recovery.

A-61. Conservation of mass between the pre- and post-storm profiles was not achieved. Volume conservation could have been affected by longshore processes acting on the profiles. SBEACH conserves sand volume, and does not consider longshore transport. Therefore, no amount of calibration effort would fully reproduce beach change if volume was not conserved.

A-62. The difference in area between measured and calculated profiles was reduced considerably with new every run made. However, full reproduction of the post-storm profile was not attained. Most of the difference in area occurred in the offshore portion of the profiles. Measured offshore data immediately before and after the storm could have provided better SBEACH results.

A-63. Simulations. The SBEACH model, now calibrated and verified, was used to determine the probability of storm induced recession for existing beach conditions. Storm induced recession, as discussed herein, is defined as the horizontal distance from the pre-storm mean high water shoreline to the furthest landward extent of the storm erosion envelope. It is assumed the storm induced recession distance, defined herein as the distance d (ft), is the predicted median recession distance for a given storm surge event. It is recognized that during an actual storm event there are natural variations about the mean along a given stretch of shoreline subjected to the same

storm event. This variability occurs from several factors, such as man-made structures or certain geological features which are beyond the capabilities of the SBEACH model.

A-64. Pre-storm beach profile data for SBEACH simulations was obtained from the May 1992 Jacksonville District survey. The project area, which lies between R-1 to R-25, was divided into five reaches and one representative profile was chosen to depict each reach. After several SBEACH simulations, it was noticed that recessions of all the profiles were within ± 5 feet of each other. Based on the proximity of the recession results, one typical pre-storm profile was generated for use in all SBEACH simulations by averaging the representative profiles from each reach.

A-65. Measured wave and water level data for the project site are lacking, so hindcasts were used. WIS wave data was used in the simulations and it was obtained through the Coastal Engineering Data Retrieval System (CEDRS). Waves for the entire hindcast period were ranked based on height and return period. Storms events were extracted from the hindcast based wave height frequencies of 3 months, 6 months, 1 year, 2 years, 5 years, 10 years, and 20 years. These hindcast storms provided the remainder of the input data (height, direction, and period of waves, as well as, speed and direction of wind) necessary for SBEACH simulations with exception of the water level.

A-66. Records of measured tide data for the project site were provided by NOAA. Peak storm surge elevations used in SBEACH simulations were obtained from WIS Report 7. The storm surge data for Martin County is based on interpolation between the storm surge data for Mayport and Miami Beach, Florida. Since only peak storm surge elevations were obtained, storm surge time series were developed using a utility program provided by the Coastal Engineering Research Center (CERC). The surge curves generated by this utility program used a cosine-squared function and assumed symmetry about the peak of the surge. Time of occurrence and duration of the surge throughout the storm had to be determined based on storm characteristics and specified to the program. The generation of time histories of total water elevations were possible, with the use of another utility program from CERC, and the use of engineering judgement in phasing the tide and surge time series.

A-67. Coastal storms are generally categorized in terms of frequency of occurrence of storm surge, not frequency of occurrence of wave heights. At this time, no known source correlates wave height frequency and surge level frequency within storms. For the purposes of SBEACH, storms with surge level frequencies of 1, 2, 5, 10, 20, 50 and 100 years were simulated using different wave height scenarios. For example, three SBEACH simulations were performed for a storm with a surge level frequency of 5 years. All three simulations, however, had different wave conditions associated with same surge level. One simulation had extremely high wave conditions (5-year frequency waves), another simulation had high waves (2-year frequency waves) and a

third had moderate wave conditions (1-year frequency waves). Table A-9 shows the different scenarios of storm surge and waves conditions used for the SBEACH simulations.

TABLE A-9
SURGE AND WAVE SCENARIOS OF STORMS FOR SBEACH SIMULATIONS

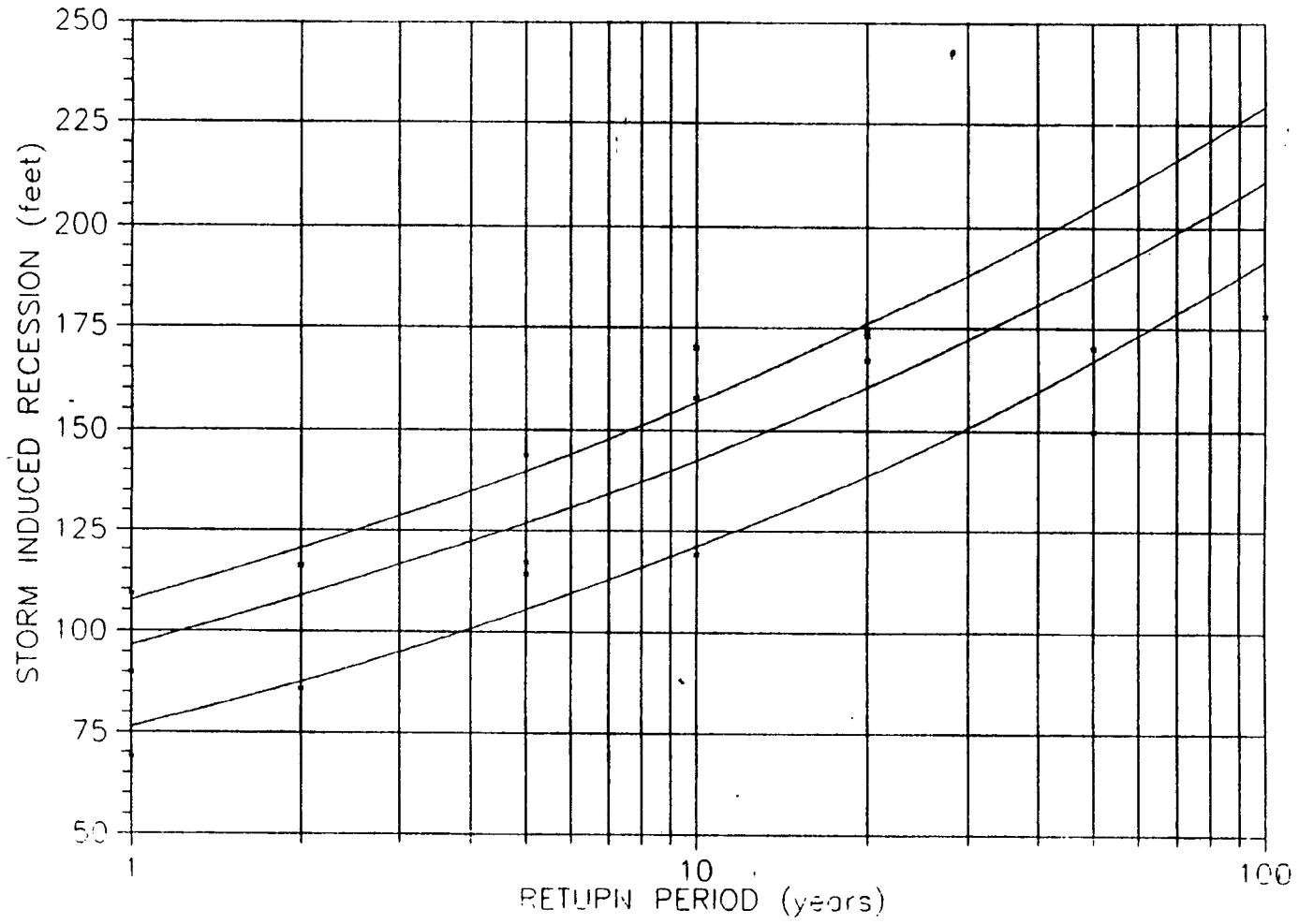
STORM SURGE FREQUENCY (YEARS)	EXTREMELY HIGH WAVES FREQUENCY (YEARS)	HIGH WAVES FREQUENCY (YEARS)	MODERATE WAVES FREQUENCY (YEARS)
1	1	6 MONTHS	3 MONTHS
2	2	1	6 MONTHS
5	5	2	1
10	10	5	2
20	20	10	5
50	*	20	10
100	*	*	20

* The wave hindcast is limited to 20 years. Recessions for these storm conditions were extrapolated from the curves.

A-68. Using the approach mention above, cumulative frequency curves of storm induced recession were developed using SBEACH. With 18 storms simulated at various surge levels and wave conditions, the relationship between probability and shoreline recession was determined. The resulting cumulative frequency curves of storm-induced recession for existing conditions is shown in Figure A-11. Data for the three output curves is tabulated in Table A-10.

A-69. Modeling Summary. As mentioned above, the model's calculated storm-induced recessions for calibration and verification were within an acceptable range of error, $\pm 3\%$. Based on the proximity of these results to the measured data, overall model performance for simulating the storm induced recession for existing beach conditions was reasonable. Also, by simulating storm events of particular surge levels with diverse wave conditions, an envelope of shoreline recession probabilities was developed. Measured recession due to storm events is expected to be within this envelope of probability.

FIGURE A-11
CUMULATIVE FREQUENCY CURVES OF STORM INDUCED RECESSION
FOR HUTCHINSON ISLAND



A-34

**TABLE A-10
HUTCHINSON ISLAND STORM INDUCED RECESSION**

RETURN PERIOD OF STORM (YEARS)	RECESSION, d (FEET)		
	EXTREMELY HIGH WAVES	HIGH WAVES	MODERATE WAVES
1	109	90	69
2	120	108	86
5	140	127	105
10	158	143	122
20	176	159	138
50	206*	188	166
100	230*	212*	192

* These values were extrapolated from the curves.

SHORELINE CHANGE MODEL (GENESIS)

A-70. A version of the GENESIS (Generalized Model for Simulating Shoreline Change) has been prepared by CERC for use with personal computers and was selected to model shoreline changes and transport quantities with and without a project beach fill in Martin County. The GENESIS model provides a long-term numerical method of determining shoreline change on an open coast as produced by spatial and temporal differences in longshore sand transport. This model is similar in theory to previous shoreline change models, but offers better calibration procedures to improve accuracy in computation of sediment movement. These procedures allow the model to be calibrated to site-specific conditions which are determined by shoreline surveys, sediment analysis, wave climate, offshore bathymetry, presence of coastal armoring, beach fills, and offshore breakwaters. Locations of the shoreline, coastal structures, and beach fills are referenced to a baseline that defines the orientation of the modeling grid which is divided into cells with each cell constituting a control volume. Longshore transport rates are calculated at the cell boundaries utilizing methodology described in the Shore Protection Manual (CERC, 1984). Site specific wave data (period, wave height, and direction) are used in the longshore transport equation at each time step to simulate the potential for movement of material through the cell boundaries. Two coefficients (K_1 and K_2) in the longshore transport equation can be adjusted to calibrate the model based on historical shoreline changes.

A-71. In addition, due to the complex bathymetry offshore of the study area, it was decided that some form of wave propagation model should be used to convert deep water wave conditions to that to be utilized as input to the GENESIS model. The numerical model RCPWAVE (Regional Coastal Processes Wave Propagation Model) is a short wave model used to predict linear, plane wave propagation over an open coast region of arbitrary bathymetry. RCPWAVE uses linear wave theory because it has been shown to yield fairly accurate first-order solutions to wave propagation problems at a relatively low cost. Refractive and bottom-induced diffractive effects are included in the model; however, the model cannot treat diffraction caused by surface-piercing structures. The model does not include nonlinear wave effects or a spectral representation of irregular waves.

A-72. Waves. Wave data used in the simulations originated from the Wave Information Study (WIS). The wave data was accessed through the Coastal Engineering Data Retrieval System (CEDRS). This hindcast data has been generated through atmospheric pressure and wind speed readings over the years 1956 to 1975 excluding tropical weather systems. The original time step of the WIS data was increased from 3 to 6 hours to decrease program run time. The wave data was then transformed from the deep water hindcast station to the offshore boundary of the RCPWAVE model grid with a specified shoreline orientation and water depth. All events which had a direction which would not contribute to alongshore transport within the study area were filtered from the 20 years of record. Finally, the wave events were grouped into 9 separate angle bands and 8 separate period bands to further simplify the RCPWAVE model for ultimate input into the GENESIS program. The results of this analysis are presented in Table A-11 .

A-73. An effort was made to determine which years of record produced sediment movement that was close to the 20 year average gross and net movement. This required that each years wave data be evaluated by use of the program SEDTRAN which estimates the regional potential longshore gross and net transport for that year. The results of this analysis are presented in Table A-12. The four years 1957, 1964, 1965, and 1969 best represented average conditions of sediment transport and therefore those years of wave data are utilized for shoreline modeling outside of the twenty years of WIS wave data record.

A-74. Shoreline Modeling Grids. Shoreline modeling required a two dimensional grid for RCPWAVE and a one dimensional grid for GENESIS. The two dimensional RCPWAVE bathymetric grid was prepared for the Jacksonville District by CERC. The grid was generated with a W 24° N rotation angle to approximate the study area shoreline orientation. Cell spacing was 500 feet alongshore and 250 feet onshore/offshore. This resulted in a grid consisting of 97 cells alongshore (48,500 feet) and 241 cells offshore (60,250 feet). Cell 92 is equivalent to the north jetty at St. Lucie Inlet. The input bathymetric data consisted of 48 profile lines (St. Lucie County R-110 to R-115 and Martin County R-1 to R-42) surveyed to approximately

TABLE A-11
SUMMARY OF WAVE EVENTS BY ANGLE AND PERIOD BAND

WAVE TYPE	ANGLE BAND	NUM OF EVENTS	AVG ANGLE	WAVE TYPE	PERIOD BAND	NUM OF EVENTS	AVG PERIOD
SEA	1	254	79.71	SEA	1	5207	3.93
SWELL		84	79.69	SWELL		3687	3.91
TOTAL		338	79.71	TOTAL		8894	3.92
SEA	2	2509	63.65	SEA	2	12585	5.5
SWELL		1345	64.34	SWELL		2882	5.35
TOTAL		3854	63.89	TOTAL		15467	5.47
SEA	3	4046	40.27	SEA	3	11475	7.48
SWELL		1135	41.55	SWELL		1233	7.46
TOTAL		5181	40.55	TOTAL		12708	7.48
SEA	4	14167	20.54	SEA	4	6076	9.38
SWELL		1914	21.02	SWELL		734	9.43
TOTAL		16081	20.60	TOTAL		6810	9.39
SEA	5	8209	-0.23	SEA	5	3192	11.37
SWELL		850	-0.47	SWELL		505	11.34
TOTAL		9059	-0.25	TOTAL		3697	11.37
SEA	6	5894	-20.36	SEA	6	1173	13.34
SWELL		1429	-24.15	SWELL		198	13.38
TOTAL		7323	-21.10	TOTAL		1371	13.35
SEA	7	2705	-46.11	SEA	7	227	15.23
SWELL		1536	-46.51	SWELL		57	15.28
TOTAL		4241	-46.25	TOTAL		284	15.24
SEA	8	2100	-67.86	SEA	8	26	17.19
SWELL		1006	-64.63	SWELL		9	17
TOTAL		3106	-66.81	TOTAL		35	17.14
SEA	9	77	-81.68	SEA	9	0	0
SWELL		6	-81.6	SWELL		0	0
TOTAL		83	-81.67	TOTAL		0	0.00

-30 feet MLW in 1992 and NOAA surveys collected in 1930 (nearshore) and 1967 (offshore). The rotated generated grid was contoured to check for any irregularities when the three data sources were merged. The contours seemed reasonable, and no large gaps or rapid depth changes were found. The offshore limit of the grid extended to the -200 foot depth contour however this seaward boundary was reduced by 18 offshore cells to simplify the RCPWAVE modeling. A three dimensional plot of the bathymetric grid is presented in Figure A-12.

A-75. The one dimensional GENESIS grid was configured to match the orientation of the RCPWAVE grid. The GENESIS grid cells were 250 feet alongshore and 250 feet offshore requiring that the output wave parameter information from each RCPWAVE cell would be applied to two corresponding GENESIS cells. The southern boundary of the GENESIS grid corresponds to the north jetty at St. Lucie Inlet and the northern boundary was set just north of DNR monument R-110 in St. Lucie County. The resulting modeled distance was about 43,500 feet or 174 cells.

TABLE A-12
REGIONAL TRANSPORT RATES FOR YEARS 1956-1975

ANGLE BAND #1		1		2		3		4		5		6		7		8		9		SED. TRANSPORT			
WAVE	YEAR	# OF	AVE	# OF	AVE	# OF	AVE	# OF	AVE	# OF	AVE	# OF	AVE	# OF	AVE	# OF	AVE	# OF	AVE	# OF	AVE	1,000 CU. MYR	
TYPE		EVENTS	H	EVENTS	H	EVENTS	H	EVENTS	H	EVENTS	H	EVENTS	H	EVENTS	H	EVENTS	H	EVENTS	H	EVENTS	H	NET	GROSS
SEA	1956	11.00	0.85	162.00	0.98	216.00	1.33	611.00	1.33	440.00	0.99	342.00	0.65	144.00	0.81	85.00	0.47	3.00	0.80	1200	1500		
SWE		13.00	0.86	91.00	0.75	67.00	0.60	73.00	0.58	52.00	0.60	73.00	0.57	48.00	0.62	19.00	0.53	0.00	0.00	23	59		
COM		24.00	0.86	253.00	0.90	283.00	1.16	684.00	1.75	492.00	0.95	415.00	0.64	192.00	0.76	104.00	0.64	3.00	0.80	1300	1600		
SEA	1957	7.00	0.76	70.00	1.19	144.00	1.35	701.00	1.06	481.00	1.26	278.00	0.95	128.00	0.85	87.00	0.78	1.00	0.70	530	1000		
SWE				48.00	0.62	52.00	0.62	89.00	0.55	38.00	0.82	57.00	0.51	86.00	0.57	60.00	0.59			3	46		
COM		7.00	0.76	118.00	0.96	196.00	1.16	790.00	1.00	519.00	1.23	335.00	0.88	214.00	0.74	147.00	0.70	1.00	0.70	530	1100		
SEA	1958	30.00	0.89	181.00	1.02	183.00	0.99	551.00	1.13	424.00	1.20	388.00	0.87	146.00	0.95	101.00	0.94	3.00	0.83	770	1300		
SWE		15.00	0.85	123.00	0.64	63.00	0.56	62.00	0.56	48.00	0.65	62.00	0.59	65.00	0.52	37.00	0.55			20	56		
COM		45.00	0.88	304.00	0.87	246.00	0.68	613.00	1.07	472.00	1.14	450.00	0.83	211.00	0.82	138.00	0.84	3.00	0.83	790	1400		
SEA	1959	9.00	0.89	119.00	1.29	238.00	1.24	646.00	1.14	515.00	1.16	324.00	0.80	152.00	0.84	74.00	0.74	2.00	0.70	770	1200		
SWE		4.00	0.75	508.00	0.63															-11	68		
COM		13.00	0.83	627.00	0.76	238.00	1.24	646.00	1.14	515.00	1.16	324.00	0.80	152.00	0.84	74.00	0.74	2.00	0.70	760	1300		
SEA	1960	14.00	0.71	194.00	1.01	343.00	1.09	604.00	1.69	352.00	1.14	285.00	0.69	72.00	0.81	128.00	0.95	7.00	0.80	720	1100		
SWE		2.00	0.75	42.00	0.67	98.00	0.64	84.00	0.54	28.00	0.68	52.00	0.58	55.00	0.61	34.00	0.65			12	50		
COM		16.00	0.72	236.00	0.95	441.00	0.99	688.00	1.82	380.00	1.11	337.00	0.67	127.00	0.72	162.00	0.89	7.00	0.80	730	1100		
SEA	1961	21.00	0.74	162.00	0.84	192.00	1.04	622.00	1.08	363.00	1.05	326.00	0.82	170.00	0.89	129.00	0.78	5.00	0.76	390	910		
SWE				70.00	0.65	54.00	0.68	98.00	0.58	31.00	0.66	67.00	0.56	51.00	0.54	32.00	0.53			23	50		
COM		21.00	0.74	232.00	0.78	246.00	0.95	720.00	1.81	384.00	1.12	382.00	0.77	221.00	0.81	161.00	0.73	5.00	0.76	420	960		
SEA	1962	20.00	0.91	125.00	1.25	225.00	1.30	895.00	1.10	343.00	0.93	194.00	0.85	71.00	0.80	65.00	0.70	5.00	0.74	1100	1300		
SWE		17.00	0.98	124.00	0.91	68.00	0.60	65.00	0.65	32.00	0.61	28.00	0.50	53.00	0.55	69.00	0.60			45	77		
COM		37.00	0.94	249.00	1.08	293.00	1.14	960.00	1.87	375.00	1.00	222.00	0.63	124.00	0.88	134.00	0.86	5.00	0.74	1200	1400		
SEA	1963	13.00	0.74	138.00	0.95	268.00	1.19	773.00	1.20	338.00	0.81	228.00	0.81	81.00	0.74	89.00	0.84	3.00	0.77	910	1200		
SWE		6.00	0.63	94.00	0.70	57.00	0.68	123.00	0.64	46.00	0.66	58.00	0.55	59.00	0.60	31.00	0.60		0.87	33	72		
COM		19.00	0.71	232.00	0.85	325.00	1.10	896.00	1.12	384.00	1.14	286.00	0.76	131.00	0.82	129.00	0.78	6.00	0.82	950	1300		
SEA	1964	10.00	0.85	121.00	0.96	227.00	1.23	747.00	1.67	383.00	1.24	249.00	0.88	136.00	0.91	164.00	0.81	8.00	0.73	640	1000		
SWE		3.00	0.83	80.00	0.65	52.00	0.63	125.00	0.54	17.00	0.66	66.00	0.64	65.00	0.66	78.00	0.63	1.00	1.10	7	67		
COM		13.00	0.85	201.00	0.84	279.00	1.13	872.00	0.99	400.00	1.22	315.00	0.83	201.00	0.83	242.00	0.75	9.00	0.77	650	1100		
SEA	1965	7.00	0.84	109.00	0.94	259.00	1.08	684.00	1.05	478.00	1.18	294.00	0.74	112.00	0.85	117.00	0.98	1.00	0.80	810	1100		
SWE		2.00	0.75	58.00	0.63	39.00	0.53	121.00	0.63	64.00	0.77	77.00	0.58	74.00	0.54	67.00	0.56			7	50		
COM		9.00	0.82	167.00	0.83	298.00	1.01	805.00	0.99	542.00	1.13	371.00	0.71	186.00	0.73	184.00	0.83	1.00	0.80	620	1200		
SEA	1966	6.00	0.77	139.00	1.05	173.00	1.23	712.00	1.17	439.00	1.20	302.00	1.00	175.00	0.98	108.00	1.00			620	1300		
SWE		3.00	0.67	100.00	0.70	62.00	0.70	124.00	0.57	48.00	0.81	79.00	0.56	113.00	0.60	46.00	0.55			16	77		
COM		9.00	0.74	259.00	0.91	235.00	1.09	836.00	1.08	267.00	1.16	381.00	0.91	208.00	0.83	154.00	0.87	0.00	0.00	630	1400		
SEA	1967	3.00	0.80	70.00	1.16	249.00	1.29	956.00	1.07	348.00	1.30	299.00	0.64	137.00	0.82	59.00	0.79	4.00	0.75	960	1200		
SWE				49.00	0.55	51.00	0.78	77.00	0.75	27.00	0.72	85.00	0.59	96.00	0.54	31.00	0.60			25	70		
COM		3.00	0.80	119.00	0.91	300.00	1.29	1033.00	1.05	375.00	1.26	284.00	0.63	233.00	0.70	90.00	0.72	4.00	0.75	980	1300		

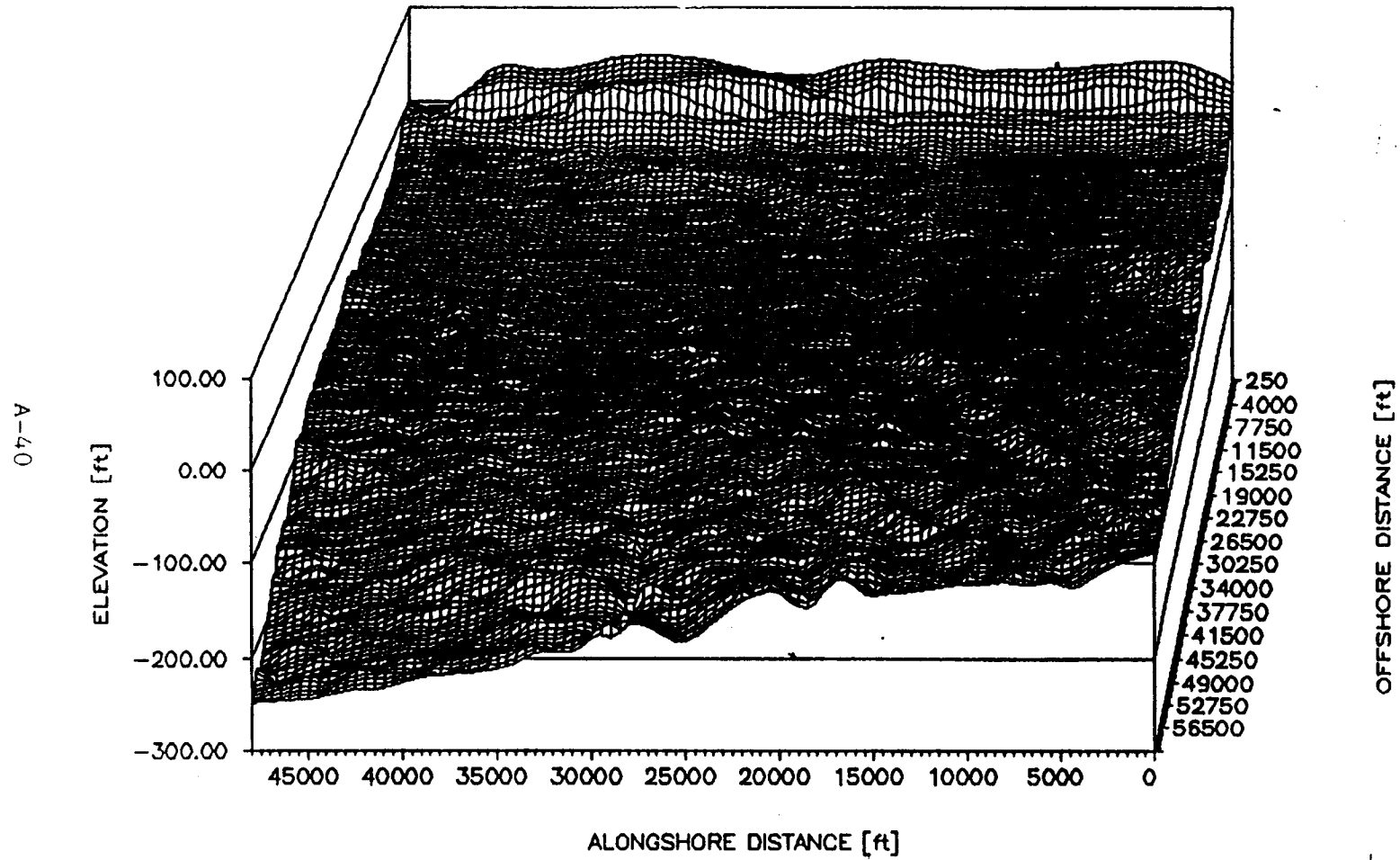
TABLE A-12 (Cont'd)
REGIONAL TRANSPORT RATES FOR YEARS 1956-1975

ANGLE BAND #1		3		4		5		6		7		8		9		10		11		SED. TRANSPORT 1,000 CU. MYR	
WAVE TYPE	YEAR	# OF EVENTS	AVE H	# OF EVENTS	AVE H	# OF EVENTS	AVE H	# OF EVENTS	AVE H	# OF EVENTS	AVE H	# OF EVENTS	AVE H	# OF EVENTS	AVE H	# OF EVENTS	AVE H	# OF EVENTS	AVE H	NET	GROSS
SEA	1968	14.00	0.79	124.00	1.03	139.00	1.07	803.00	0.98	395.00	1.16	242.00	0.71	67.00	1.17	37.00	1.26	3.00	0.80	410	850
SWE		5.00	0.74	61.00	0.74	58.00	0.64	121.00	0.65	35.00	0.65	63.00	0.53	34.00	0.69	21.00	0.51			25	57
COM		19.00	0.78	185.00	0.93	197.00	0.94	924.00	0.94	430.00	1.12	305.00	0.67	101.00	1.01	58.00	0.99	3.00	0.80	430	900
SEA	1969	16.00	0.85	98.00	1.16	122.00	1.47	769.00	1.18	648.00	1.22	341.00	0.84	123.00	0.93	97.00	0.89	4.00	0.77	460	1300
SWE		4.00	0.75	116.00	0.71	94.00	0.71	120.00	0.64	55.00	0.76	45.00	0.72	77.00	0.66	58.00	0.63			62	94
COM		20.00	0.83	214.00	0.92	216.00	1.14	889.00	1.11	703.00	1.18	386.00	0.84	200.00	0.83	155.00	0.79	4.00	0.77	690	1300
SEA	1970	17.00	0.74	136.00	1.26	215.00	1.25	542.00	1.15	494.00	1.11	371.00	0.87	155.00	0.88	112.00	1.00	2.00	0.80	630	1200
SWE		5.00	0.70	61.00	0.61	46.00	0.57	86.00	0.60	77.00	0.64	78.00	0.64	84.00	0.58	75.00	0.59	1.00	0.70	-8	56
COM		22.00	0.73	197.00	1.06	261.00	1.13	628.00	1.07	571.00	1.05	449.00	0.83	239.00	0.77	187.00	0.84	3.00	0.77	620	1300
SEA	1971	12.00	0.83	159.00	1.04	214.00	1.18	549.00	1.02	354.00	1.17	213.00	0.85	128.00	0.73	135.00	0.77	3.00	0.73	620	920
SWE		1.00	0.70	37.00	0.67	44.00	0.57	82.00	0.58	29.00	0.71	65.00	0.62	85.00	0.62	43.00	0.63			-6	55
COM		13.00	0.82	196.00	0.97	258.00	1.00	631.00	0.96	383.00	1.13	278.00	0.80	213.00	0.69	178.00	0.74	3.00	0.73	620	980
SEA	1972	9.00	0.72	85.00	1.02	159.00	1.30	776.00	1.10	424.00	1.19	246.00	1.02	120.00	0.90	104.00	0.84	3.00	0.77	520	1100
SWE		17.00	0.51	36.00	0.51	36.00	0.51	81.00	0.52	21.00	0.69	87.00	0.53	99.00	0.53	53.00	0.53			-11	32
COM		9.00	0.72	192.00	0.94	195.00	1.07	857.00	1.05	445.00	1.17	333.00	0.80	219.00	0.74	159.00	0.75	3.00	0.77	510	1100
SEA	1973	10.00	0.74	148.00	1.18	182.00	1.34	551.00	1.10	380.00	0.99	346.00	0.81	148.00	0.92	161.00	0.89	8.00	0.83	490	1000
SWE		2.00	0.95	35.00	0.73	48.00	0.56	84.00	0.60	40.00	0.70	120.00	0.64	100.00	0.68	45.00	0.65			-20	74
COM		12.00	0.78	183.00	1.09	230.00	1.15	635.00	1.05	420.00	0.96	466.00	0.78	248.00	0.83	206.00	0.84	8.00	0.83	470	1100
SEA	1974	3.00	0.63	101.00	0.84	112.00	1.17	772.00	1.03	259.00	1.21	324.00	0.77	165.00	0.81	91.00	0.77	5.00	0.88	740	1100
SWE		3.00	0.63	27.00	0.47	42.00	0.50	84.00	0.67	37.00	0.74	110.00	0.52	56.00	0.51	37.00	0.48			10	39
COM		3.00	0.63	128.00	0.76	154.00	1.01	856.00	0.99	296.00	1.15	434.00	0.71	221.00	0.73	128.00	0.69	5.00	0.88	750	1100
SEA	1975	2.00	0.65	48.00	1.11	184.00	1.05	903.00	0.93	371.00	1.14	284.00	1.01	255.00	0.94	135.00	0.84	7.00	0.84	260	1100
SWE		2.00	0.75	45.00	0.77	55.00	0.64	121.00	0.55	75.00	0.80	77.00	0.90	132.00	0.64	115.00	0.61	1.00	0.70	-27	110
COM		4.00	0.70	93.00	0.92	241.00	0.96	1024.00	0.89	446.00	1.00	365.00	0.99	387.00	0.85	250.00	0.79	8.00	0.82	230	1200

WAVE TYPE: SEA = SEA WAVE EVENTS; SWE = SWELL WAVE EVENTS; COM = COMBINED WAVE EVENTS;

COM AVERAGE	16.90	0.78	214.75	0.91	254.20	1.00	799.35	1.04	450.45	1.12	342.15	0.78	202.40	0.78	152.35	0.78	4.15	0.74	694.00	1207.00
COM SIGMA	13.67	0.07	110.84	0.09	59.16	0.09	132.67	0.08	85.02	0.10	43.75	0.10	42.88	0.09	40.31	0.08	2.41	0.10	253.19	171.03
AVG. + SIGMA	30.57	0.84	324.79	1.01	313.76	1.17	932.02	1.13	535.47	1.23	425.88	0.88	245.28	0.84	200.84	0.86	6.56	0.92	947.19	1378.03
AVG. - SIGMA	3.23	0.71	104.71	0.82	197.44	0.90	666.68	0.96	365.43	1.02	298.42	0.68	169.52	0.69	104.24	0.70	1.74	0.57	440.81	1035.97
YEAR	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
POINTS	13	18	14	14	15	16	8	15	18	18	14	13	10	19	16	17	17	14	13	10

FIGURE A-12
HUTCHINSON ISLAND'S OFFSHORE BATHOMETRY



A-76. Historical Shoreline Data. The majority of the study area and the entire project area lies within the northern portion of Martin County. The most extensive surveys for the project area were obtained by the Florida Department of Environmental Protection (FDEP) on 12 October 1971, 28 January 1976, 16 February 1982, and by the Jacksonville District on 21 May 1992. However, the portion of the study area north of Martin County in St. Lucie County was surveyed by FDEP in 1966, 1 June 1972, 11 February 1987 and by Jacksonville District on 21 May 1992. An effort was made to convert the known St. Lucie County shorelines to those dates consistent with the Martin County surveys by interpolating between known survey years. The result was four shorelines for the entire study area for the years 1971, 1976, 1982, and 1992. These four shorelines were rotated and translated from their initial state plane coordinates to a common baseline for input to GENESIS modeling. Following interpolation of these shorelines to 50-foot intervals, the data was filtered to obtain shoreline positions for each 250-foot GENESIS cell for each year to be imputed.

A-77. Manmade and Natural Coastal Armor. Manmade structures within the study area consist of a limited portion of seawalls and revetments and the north jetty at St. Lucie Inlet. The seawalls and revetments play a minimal role in the shore processes within the area. The north jetty serves as a boundary/barrier to material being transported south from the Bathtub Reef area and to material which may move to the north from the deposition spit inside the inlet to the beaches north of the jetty. The landward portion of the jetty is extremely porous due to the use of native limestone with limited underlayers and subsequent subsistence and weathering since its construction in the 1920's. The seaward angled 650 feet of the north jetty was constructed of granite with underlayer in the 1980's, and although not designed to be sand tight, it should be considered to be significantly less porous than the landward section. However, the seaward portion lies on and parallel to the southern portion of hardbottom known as Bathtub Reef. This structure performs as a breakwater similar to the reef itself but with significantly less wave transmission due to its elevation above water level.

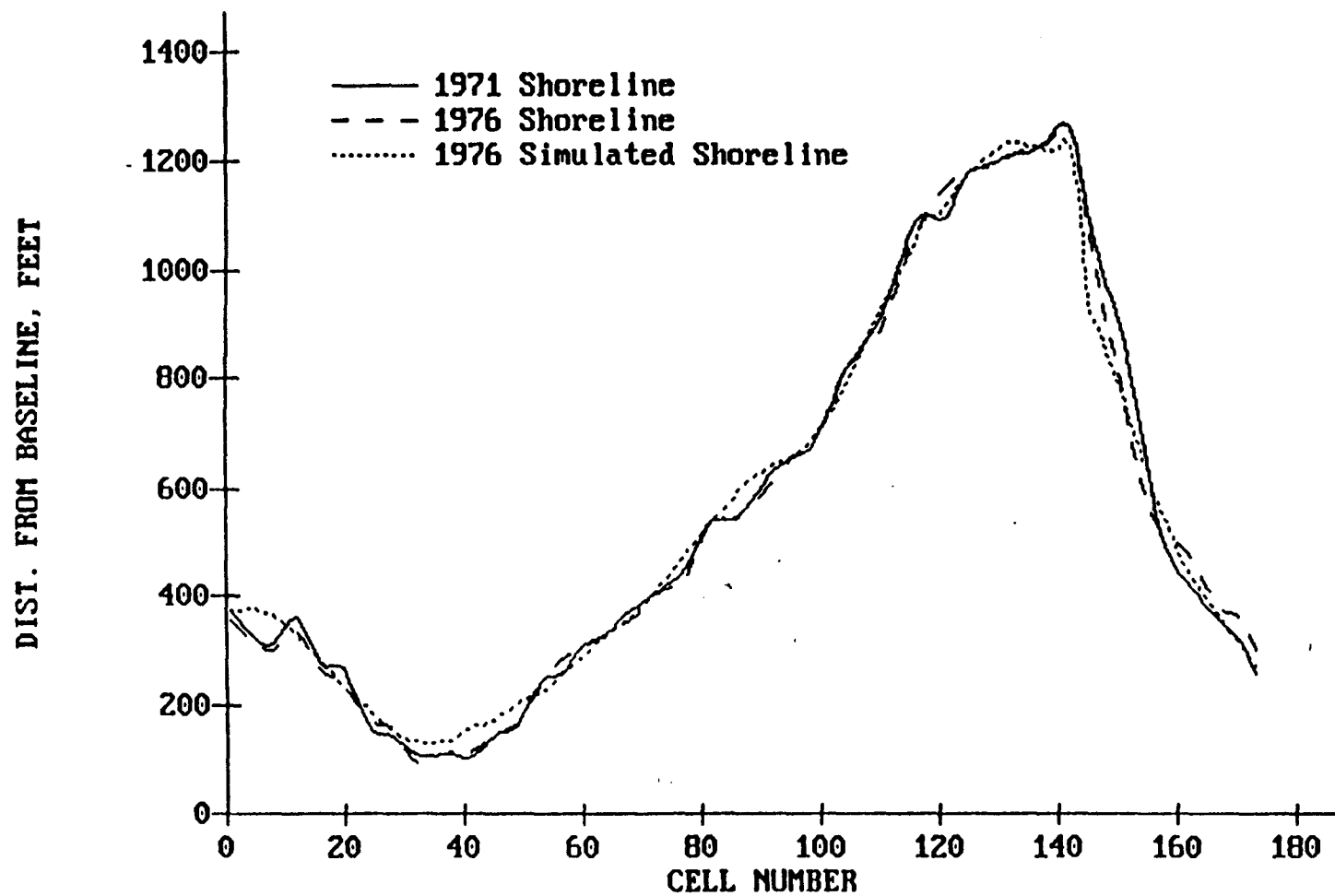
A-78. Of greater significance to the study area are the natural hardbottom features themselves. Within the northern project area numerous random hardbottoms exist which would influence wave propagation. However, the output depth for RCPWAVE modeling is 30 feet. The GENESIS model then brings the waves to breaking using straight and parallel contours. Therefore, these features are not modeled in this case. North of Bathtub Reef extensive stretches of shoreline have significant outcroppings which alters both the immediate nearshore transport and the source of localized sediment supply. These areas have been modeled as a seawall at the shoreline. Bathtub Reef itself acts to diminish the wave action at the shoreline due to the relative water depth over the reef and the width of the reef. Bathtub Reef has been simulated by incorporating nine separate detached breakwaters with varying but relatively high wave transmissions coefficients.

A-79. Calibration. Calibration of the GENESIS model was conducted for the period 12 October 1971 through 28 January 1976. Longshore sand transport calibration coefficients, K_1 and K_2 , were set at 0.10 and 0.10, respectively. Median grain size diameter, D_{50} , was 0.27 mm, active berm height 11 feet MLW, and average depth of closure -29 feet MLW. The calculated volume change over the period was an accretion of about 10,000 cubic yards per year over the entire reach modeled with an accretion of about 83,000 cubic yards per year within the project fill area. The annual net longshore transport rate was to the south and varied from about 131,000 cubic yards at the northern limit of the Bathtub Reef area to less than 10,000 cubic yards in the vicinity of the rock outcrops just north of the reef area. Shoreline changes were modeled within an average of about 25 feet over the entire study area when compared with the actual 1976 shoreline survey. Predicted and measured shoreline changes are shown in Figure A-13 and average annual net longshore transport rates are shown in Figure A-14.

A-80. Verification. The model was verified by using identical values for input variables from the calibration run and predicting the measured shoreline change from 1976 to 1982. Since the estimated WIS wave data was provided only to year 1975, a wave data file was assumed which consisted of the four years with the gross and net longshore transport most closely approximating the 20 year average. Volumetric accretion for this period was estimated to be about 85,000 cubic yards per year for the modeled reach with an accretion of about 69,000 cubic yards per year within the project area. Again, the annual net longshore transport rate was to the south and varied from about 102,000 cubic yards at the northern study boundary to less than 10,000 cubic yards in the vicinity of the rock outcrops north of Bathtub Reef. Shoreline change predicted was closer than in the calibration run with an average variance from the measured 1982 shoreline of about 21 feet. Predicted and measured shoreline changes also are shown in Figure A-15 and the average annual net longshore transport rate shown in Figure A-16.

A-81. Observations. During the period 1971 to 1982, the Martin County study area was generally accretive volumetrically with localized segments experiencing shoreline accretion and erosion. WIS wave data used to calibrate and verify a GENESIS model was directly related up to 1975 with average years wave data used from 1976 to 1982. The calibration and verification model runs were adjusted to provide the closest fit between predicted and known shoreline positions. To accomplish this fit, other considerations such as longshore transport and volume entering St. Lucie Inlet were allowed to be established contrary to previous studies and estimates. For example, previous Jacksonville District studies had estimated the net littoral drift for the entire study area to be in the magnitude of 230,000 cubic yards per year to the south. Also, dredging history at the inlet since the channel improvements of the early 1980's indicates a shoaling rate of 60,000 cubic yards of material from the north. The results of the calibration and verification runs, although within the approximate order of magnitude for the previous estimates, indicate a much more complex

FIGURE A-13
SHORELINE CHANGES
GENESIS CALIBRATION RUN



A-43

FIGURE A-14
 AVERAGE ANNUAL NET LONGSHORE TRANSPORT RATES
 GENESIS CALIBRATION RUN

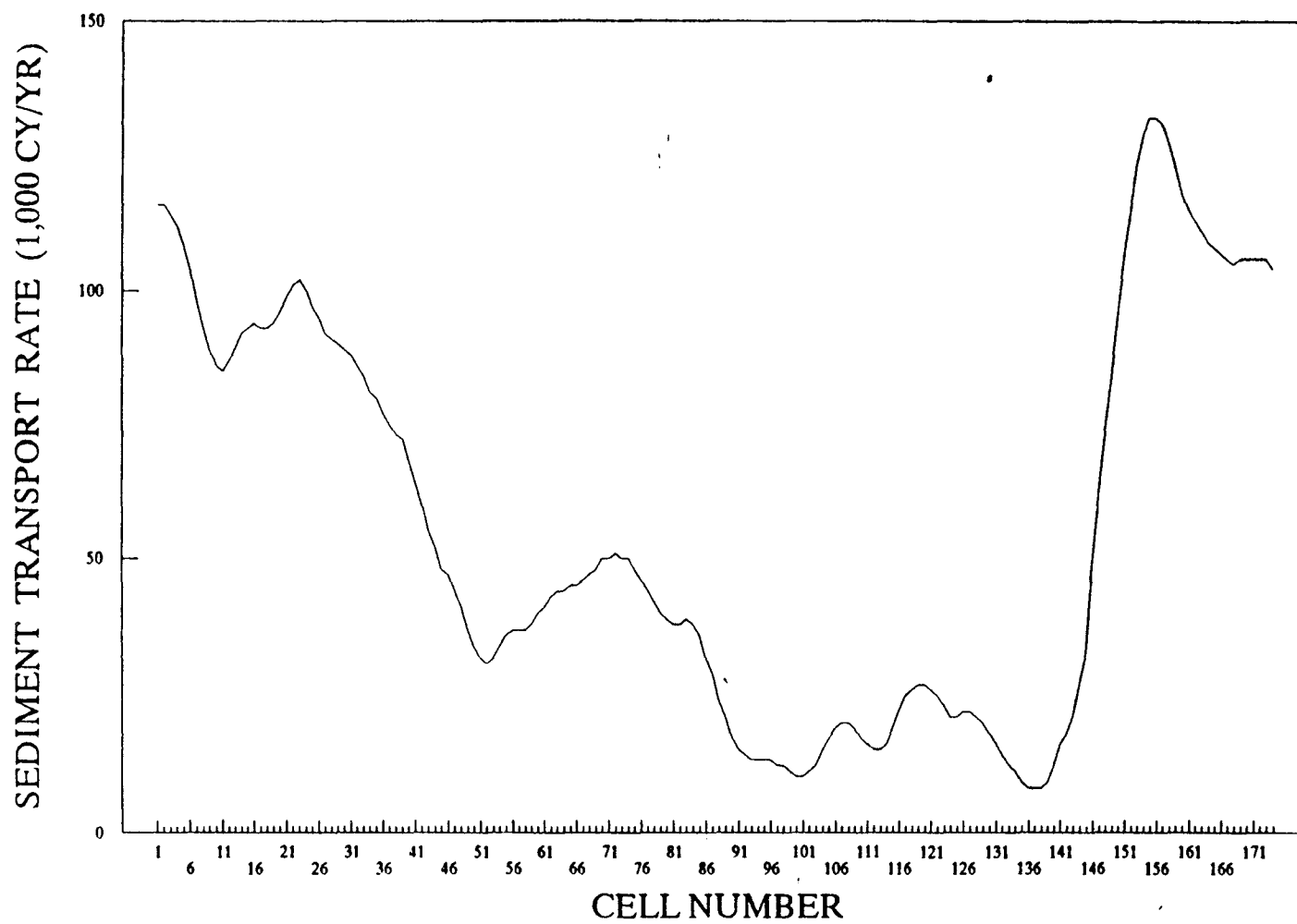
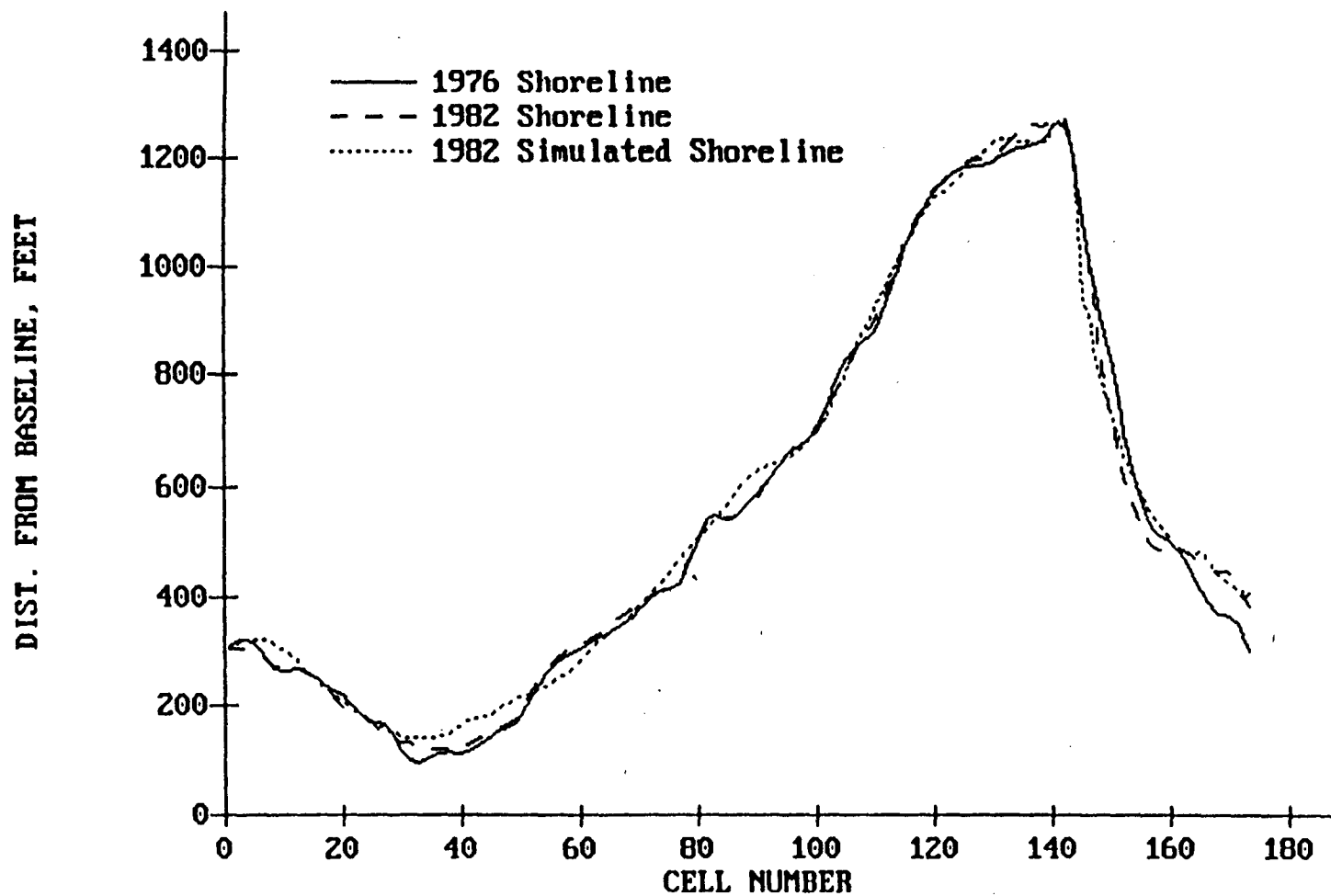
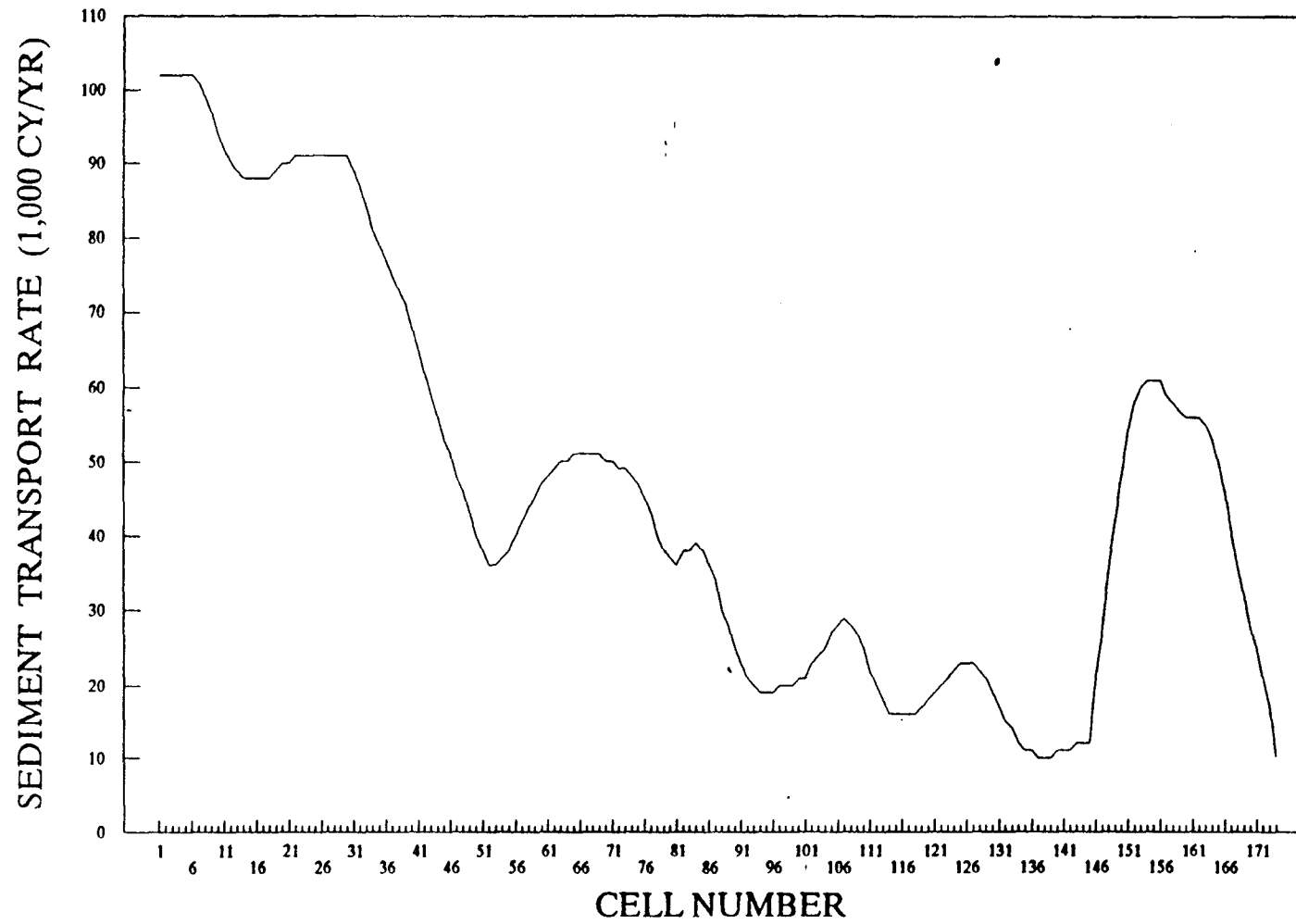


FIGURE A-15
SHORELINE CHANGES
GENESIS VERIFICATION RUN



A-45

FIGURE A-16
AVERAGE ANNUAL NET LONGSHORE TRANSPORT RATES
GENESIS VERIFICATION RUN



interaction between wave forces (height, period, and direction), localized bathymetry (rock outcrops, nearshore hardbottoms, and reefs), and longshore transport. For example, simply adjusting the entire deepwater wave climate by plus or minus 15 degrees of incident angle resulted in extreme differences in the localized net littoral drift patterns. If anything, the use of the GENESIS model for this shoreline has indicated the failure of previous investigations to accurately portray the longshore processes. To simply estimate the net littoral drift (230,000 cubic yards to the south) based on a wave climate interacting with straight and parallel contours as a single value for the entire coastline is a gross simplification of the situation. The calibration and verification GENESIS runs are considered to portray an accurate representation of the processes which were occurring within the time period 1971 to 1982.

A-82. During the period 1982 to 1992, the entire study reach became erosional volumetrically with practically uniform shoreline retreat. Although the improvements to St. Lucie Inlet were accomplished during the early 1980's, it appears that the inlet's region of influence to the north is terminated by the northern limit of Bathtub Reef and the rock outcrops to the north which act as a breakwater and groin field, respectively. No other beach fills or updrift structures were constructed during this period which would so drastically alter the littoral regime in direct contrast to the 1971 to 1982 period. Another potential cause of this shift from accretion to erosion would be the localized wave climate (changes in direction, frequency, and height). However, with no corresponding long term offshore wave data (WIS or otherwise), changes in wave climate cannot be modeled during this study effort. Work is currently underway at CERC to update the WIS data to more recent time periods however, this data is not complete at the present time. Additionally, two major storms occurred within this ten year period (the 1984 Thanksgiving Day and 1990 Halloween Day northeaster storms) which contributed to the erosion during the period. Again, the effects of these storm systems cannot be modeled by this GENESIS study effort.

A-83. Simulation. The GENESIS model, adjusted for the period 1971 to 1982, was then used to predict the performance of the project fill from initial construction up to the first renourishment operation. A 1995 shoreline was estimated by applying the erosion rates from 1982 to 1992 to the known 1992 shoreline. A beach fill with a mean high water extension of 125 feet was added to the base 1995 shoreline and the GENESIS model was allowed to simulate the resulting shoreline after 11 years of average WIS wave input. The final GENESIS shoreline for year 2006 was adjusted to account for erosional losses during the 11 years simulated. This adjusted final GENESIS shoreline was compared to the estimated 2006 shoreline without a project fill to evaluate the relative impact of the shore protection project. The results of this investigation are presented in Table A-13 and Figure A-17.

TABLE A-13
GENESIS SHORELINE CHANGES WITH OR WITHOUT BEACH FILL

MONUMENT	CELL NO.	DISTANCE FROM NORTH	SHORELINE CHANGE, FEET				
			1992-1995	1995-2006 W/O FILL	1995-2006 WITH FILL	1992-2006 W/O FILL	1992-2006 WITH FILL
R-110	1	250	1.64	7.15	7.15	8.79	8.79
	2	500	0.09	0.39	0.58	0.47	0.67
	3	750	-1.47	-6.38	-3.88	-7.85	-5.35
R-111	4	1000	-3.04	-13.20	-7.80	-16.24	-10.84
	5	1250	-1.68	-7.32	0.89	-9.00	-0.80
	6	1500	-0.33	-1.43	8.97	-1.76	8.64
R-112	7	1750	1.01	4.40	16.20	5.41	17.21
	8	2000	0.56	2.42	15.82	2.98	16.38
	9	2250	0.10	0.44	18.24	0.54	18.34
R-113	10	2500	-0.35	-1.54	21.66	-1.89	21.31
	11	2750	-0.81	-3.52	21.48	-4.33	20.67
	12	3000	-1.26	-5.50	20.20	-6.77	18.93
R-114	13	3250	-1.71	-7.43	20.37	-9.13	18.67
	14	3500	-2.15	-9.35	20.55	-11.50	18.40
	15	3750	-2.59	-11.27	22.33	-13.87	19.73
R-115	16	4000	-3.04	-13.20	26.40	-16.24	23.36
	17	4250	-3.71	-16.12	31.48	-19.82	27.78
	18	4500	-4.36	-18.98	33.32	-23.34	28.96
R-1	19	4750	-5.03	-21.89	27.81	-26.92	22.78
	20	5000	-5.69	-24.75	24.05	-30.44	18.36
	21	5250	-3.96	-17.21	36.38	-21.17	32.43
R-2	22	5500	-2.21	-9.63	47.98	-11.84	45.76
	23	5750	-0.48	-2.09	58.11	-2.57	57.63
	24	6000	-1.84	-8.02	57.58	-9.86	55.74
R-3	25	6250	-1.44	-6.25	64.15	-7.69	62.71
	26	6500	-1.02	-4.44	67.96	-5.46	66.94
	27	6750	-0.61	-2.67	71.53	-3.29	70.91
R-4	28	7000	-0.84	-3.63	71.97	-4.47	71.13
	29	7250	-1.04	-4.54	70.96	-5.59	69.91
	30	7500	-1.27	-5.51	70.69	-6.77	69.43
R-5	31	7750	-1.48	-6.41	73.19	-7.89	71.71
	32	8000	-1.72	-7.48	76.02	-9.20	74.30
	33	8250	-1.97	-8.55	77.35	-10.52	75.38
R-6	34	8500	-2.21	-9.62	78.18	-11.83	75.97
	35	8750	-2.46	-10.69	80.21	-13.15	77.75
	36	9000	-2.79	-12.13	81.67	-14.92	78.88
R-7	37	9250	-3.11	-13.52	82.88	-16.63	79.77
	38	9500	-3.44	-14.97	82.33	-18.41	78.89
	39	9750	-4.09	-17.80	80.50	-21.89	76.41
R-8	40	10000	-4.76	-20.69	79.51	-25.44	74.76
	41	10250	-5.41	-23.52	78.98	-28.93	73.57
	42	10500	-5.19	-22.56	82.14	-27.74	76.96
R-9	43	10750	-4.98	-21.65	84.65	-26.63	79.67
	44	11000	-4.77	-20.74	89.26	-25.51	84.49
	45	11250	-4.55	-19.78	90.62	-24.33	86.07
R-10	46	11500	-3.57	-15.50	92.90	-19.07	89.33
	47	11750	-2.58	-11.22	101.08	-13.81	98.49
	48	12000	-1.60	-6.95	110.05	-8.55	108.45
R-1	49	12250	-0.61	-2.67	114.53	-3.29	113.91
	50	12500	-1.76	-7.64	108.06	-9.40	106.30
	51	12750	-2.89	-12.56	103.44	-15.45	100.55
R-2	52	13000	-4.03	-17.53	98.97	-21.56	94.94
	53	13250	-5.16	-22.45	93.25	-27.61	88.09
	54	13500	-3.32	-14.43	101.37	-17.75	98.05
R-3	55	13750	-1.48	-6.41	114.19	-7.89	112.71
	56	14000	0.37	1.60	127.20	1.97	127.57
	57	14250	-0.61	-2.67	124.13	-3.29	123.51
R-4	58	14500	-1.60	-6.95	119.35	-8.55	117.75
	59	14750	-2.58	-11.22	116.58	-13.81	113.99

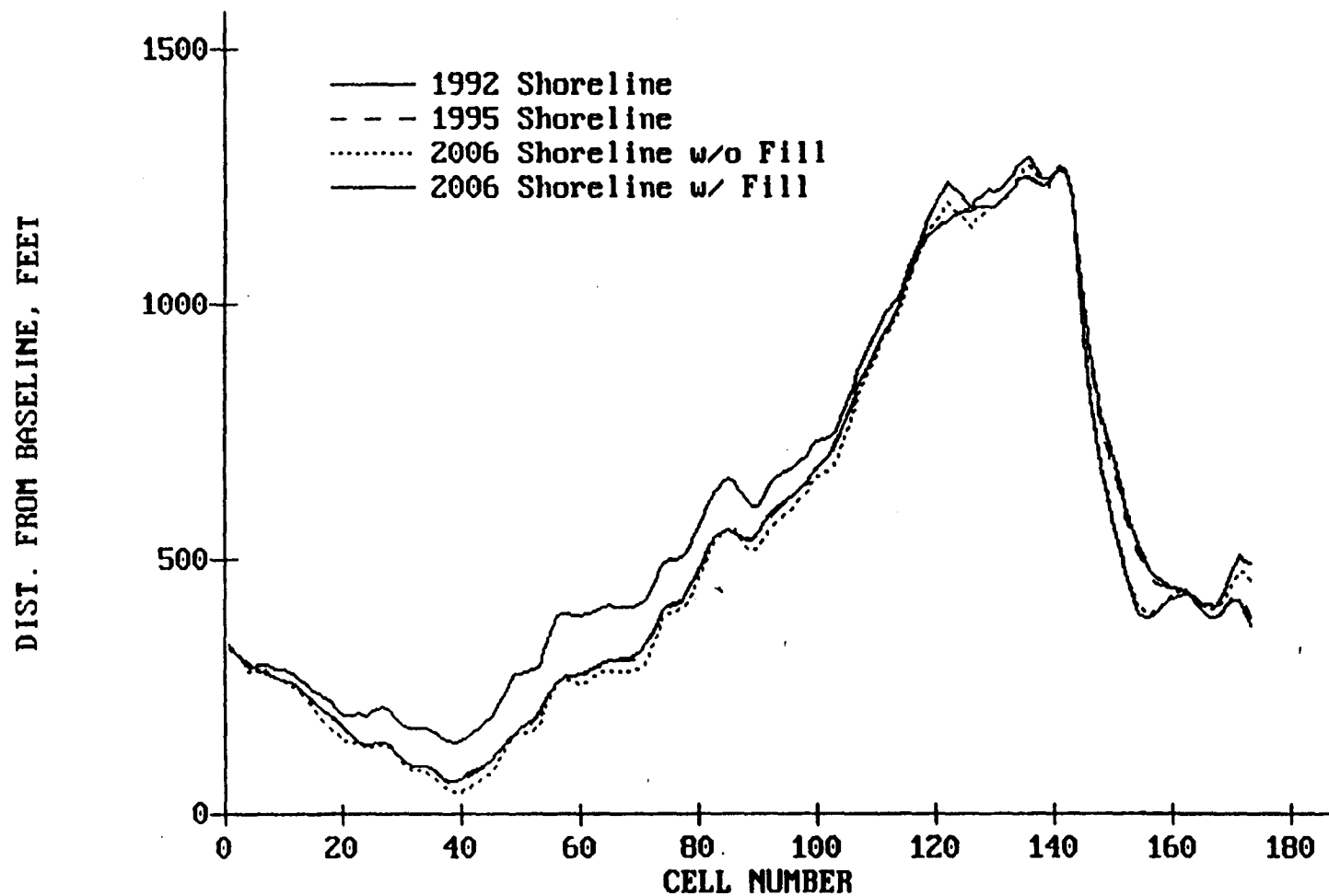
TABLE A-13 (Cont'd)
GENESIS SHORELINE CHANGES WITH OR WITHOUT BEACH FILL

MONUMENT	CELL NO.	DISTANCE FROM NORTH	SHORELINE CHANGE, FEET			
			1992-1995	1995-2006 W/O FILL	1995-2006 WITH FILL	1992-2006 W/O FILL
R-11	60	15000	-3.57	-15.50	115.80	-19.07
	61	15250	-3.57	-15.50	113.40	-19.07
	62	15500	-3.57	-15.50	108.90	-19.07
	63	15750	-3.57	-15.50	108.10	-19.07
R-12	64	16000	-3.57	-15.50	109.40	-19.07
	65	16250	-3.93	-17.10	108.80	-21.04
	66	16500	-4.30	-18.71	106.09	-23.01
	67	16750	-4.67	-20.31	104.39	-24.98
R-13	68	17000	-5.04	-21.91	102.79	-26.95
	69	17250	-5.41	-23.52	100.58	-28.93
	70	17500	-6.15	-26.72	96.58	-32.87
	71	17750	-6.88	-29.93	91.67	-36.82
R-14	72	18000	-5.50	-23.89	94.11	-29.39
	73	18250	-4.09	-17.80	95.10	-21.89
	74	18500	-2.70	-11.76	98.04	-14.46
	75	18750	-3.11	-13.52	94.18	-16.63
R-15	76	19000	-3.50	-15.23	90.77	-18.74
	77	19250	-3.91	-17.00	87.50	-20.91
	78	19500	-4.30	-18.71	84.49	-23.01
	79	19750	-3.91	-17.00	85.80	-20.91
R-16	80	20000	-3.50	-15.23	87.07	-18.74
	81	20250	-3.11	-13.52	87.38	-16.63
	82	20500	-2.70	-11.76	87.14	-14.46
	83	20750	-1.60	-6.95	92.35	-8.55
R-17	84	21000	-0.49	-2.14	98.36	-2.63
	85	21250	0.61	2.67	100.87	3.29
	86	21500	1.72	7.48	103.58	9.20
	87	21750	-0.61	-2.67	92.23	-3.29
R-18	88	22000	-2.95	-12.83	80.77	-15.78
	89	22250	-5.29	-22.98	65.32	-28.27
	90	22500	-5.37	-23.36	56.54	-28.73
	91	22750	-5.46	-23.73	58.67	-29.19
R-19	92	23000	-5.53	-24.05	65.85	-29.58
	93	23250	-5.29	-22.98	66.72	-28.27
	94	23500	-5.04	-21.91	63.09	-26.95
	95	23750	-4.79	-20.85	61.55	-25.64
R-20	96	24000	-4.55	-19.78	60.62	-24.33
	97	24250	-4.30	-18.71	57.99	-23.01
	98	24500	-3.85	-16.73	55.97	-20.58
	99	24750	-3.41	-14.81	55.59	-18.21
R-21	100	25000	-3.20	-13.90	57.30	-17.09
	101	25250	-4.71	-20.47	48.43	-25.18
	102	25500	-6.23	-27.10	37.50	-33.33
	103	25750	-7.74	-33.67	28.23	-41.42
R-22	104	26000	-6.74	-29.29	28.61	-36.03
	105	26250	-5.72	-24.85	28.35	-30.57
	106	26500	-4.70	-20.42	31.78	-25.11
	107	26750	-3.69	-16.03	33.97	-19.72
R-23	108	27000	-2.95	-12.83	34.27	-15.78
	109	27250	-2.21	-9.62	37.48	-11.83
	110	27500	-1.48	-6.41	36.39	-7.89
	111	27750	-0.74	-3.21	35.49	-3.94
R-24	112	28000	-1.48	-6.41	33.49	-7.89
	113	28250	-2.21	-9.62	27.78	-11.83
	114	28500	-2.95	-12.83	19.57	-15.78
	115	28750	-3.69	-16.03	13.37	-19.72
R-25	116	29000	-2.46	-10.69	20.01	-13.15
	117	29250	-1.23	-5.34	13.26	-6.57
	118	29500	5.08	22.07	61.07	27.15
	119	30250				66.15

TABLE A-13 (Cont'd)
GENESIS SHORELINE CHANGES WITH OR WITHOUT BEACH FILL

MONUMENT	CELL NO.	DISTANCE FROM NORTH	SHORELINE CHANGE, FEET				
			1992-1995	1995-2006 W/O FILL	1995-2006 WITH FILL	1992-2006 W/O FILL	1992-2006 WITH FILL
R-28	122	30500	6.76	29.40	70.40	36.16	77.16
	123	30750	3.23	14.06	55.86	17.29	59.09
	124	31000	-0.31	-1.34	40.06	-1.64	39.76
	125	31250	-3.84	-16.68	23.72	-20.51	19.89
R-29	126	31500	-7.38	-32.07	7.53	-39.45	0.15
	127	31750	-4.95	-21.54	17.46	-26.49	12.51
	128	32000	-2.54	-11.06	26.74	-13.61	24.19
R-30	129	32250	-0.12	-0.53	33.77	-0.66	33.64
	130	32500	-0.18	-0.80	28.50	-0.99	28.31
	131	32750	-0.25	-1.07	27.23	-1.31	26.99
	132	33000	-0.31	-1.34	27.46	-1.64	27.16
R-31	133	33250	-0.37	-1.60	25.60	-1.97	25.23
	134	33500	1.35	5.88	29.28	7.23	30.63
	135	33750	3.07	13.36	32.06	16.44	35.14
R-32	136	34000	4.79	20.85	35.75	25.64	40.54
	137	34250	2.70	11.76	25.16	14.46	27.86
	138	34500	0.61	2.67	15.57	3.29	16.19
R-33	139	34750	-1.48	-6.41	11.59	-7.89	10.11
	140	35000	-1.39	-6.04	-5.94	-7.43	-7.33
	141	35250	-1.29	-5.61	-5.61	-6.90	-6.90
	142	35500	-1.20	-5.24	-5.24	-6.44	-6.44
R-34	143	35750	-1.11	-4.81	-4.81	-5.92	-5.92
	144	36000	-5.10	-22.18	-22.18	-27.28	-27.28
	145	36250	-9.10	-39.55	-64.55	-48.65	-73.65
	146	36500	-13.09	-56.92	-76.72	-70.02	-89.82
R-35	147	36750	-17.09	-74.30	-73.00	-91.38	-90.08
	148	37000	-19.83	-86.21	-76.61	-106.04	-96.44
	149	37250	-22.58	-98.19	-91.99	-120.77	-114.57
R-36	150	37500	-25.32	-110.11	-115.51	-135.43	-140.83
	151	37750	-24.81	-107.86	-113.56	-132.67	-138.37
	152	38000	-24.28	-105.56	-111.16	-129.84	-135.44
	153	38250	-23.76	-103.32	-111.02	-127.08	-134.78
R-37	154	38500	-23.23	-101.02	-111.52	-124.26	-134.76
	155	38750	-19.60	-85.20	-97.20	-104.80	-116.80
	156	39000	-15.96	-69.38	-78.28	-85.33	-94.23
	157	39250	-12.32	-53.56	-59.36	-65.87	-71.67
R-38	158	39500	-8.68	-37.74	-42.04	-46.41	-50.71
	159	39750	-5.04	-21.91	-27.61	-26.95	-32.65
	160	40000	-3.07	-13.36	-21.86	-16.44	-24.94
	161	40250	-1.11	-4.81	-13.91	-5.92	-15.02
R-39	162	40500	0.86	3.74	-4.26	4.60	-3.40
	163	40750	1.48	6.41	-0.19	7.89	1.29
	164	41000	2.09	9.09	8.49	11.18	10.58
R-40	165	41250	2.70	11.76	11.66	14.46	14.36
	166	41500	3.05	13.26	20.76	16.30	23.80
	167	41750	3.38	14.70	21.50	18.08	24.88
	168	42000	3.72	16.20	30.50	19.92	34.22
R-41	169	42250	4.06	17.64	38.24	21.70	42.30
	170	42500	7.34	31.91	58.21	39.25	65.55
	171	42750	10.62	46.18	78.48	56.80	89.10
R-42	172	43000	13.89	60.40	82.00	74.29	95.89
	173	43250	17.16	74.62	105.62	91.78	122.78

FIGURE A-17
GENESIS SHORELINES WITH OR WITHOUT BEACH FILL



A-84. **Modeling Summary.** As stated previously, variations in the littoral processes from-pre 1982 to post-1982 and the lack of continuous time record wave data render GENESIS modeling questionable for current time periods. However, simulation modeling of the project fill should provide a conservative estimate of beach fill effects in that the final output shorelines would be as far seaward as could be expected. Generally, as shown in Table A-13, the project fill can be expected to spread from the immediate project area northward a distance of about 6,000 feet and to the south a distance of about 9,000 feet. Outside of the immediate project boundaries, the transported fill amounts to about 20 to 30 feet of shoreline advance over the 1992 shoreline with greater values occurring closer to the project fill boundaries.

PROBLEM SUMMARY

A-85. Based on field observations, examination of aerial photography, and beach profile surveys, a 4.0-mile long area of periodic erosion has been identified on Hutchinson Island. This area's northern boundary is at the St. Lucie/Martin County line, and the southern boundary is at profile line R-25. Within this area, storms threaten over \$7 million in structural improvements, not including infrastructure and/or land. Certain areas within the project limits have been armored by various types of coastal structures. This armor was constructed in an attempt to provide some minimum level of protection from storms. The vulnerability of the shoreline to structural damage is evidenced by the passage of the 1984 Thanksgiving Day and 1990 Halloween Day Northeaster storms. Due to these storms, considerable structural damages and substantial beach erosion were sustained within this reach of shoreline. With the continuing erosion of the shoreline, damages from hurricanes, tropical storms and even northeaster events, will continue at a greater level than present.

GEOTECHNICAL INVESTIGATIONS

GEOLOGY

A-86. Peninsular Florida occupies a portion of the much larger geographic unit, the Florida Plateau. Deep water of the Gulf of Mexico is separated from deep water of the Atlantic Ocean by this partially submerged platform nearly 500 miles long and 250 to 450 miles wide. Since the Mesozoic Era, approximately 200 million years B.P. (before present), the plateau has been alternately dry land or covered by shallow seas. During that time, 4,000 to greater than 20,000 feet (north-central and southernmost Florida, respectively) of carbonate and marine sediments were deposited. Either following or concurrent with one of the later periods of emergence,

there appears to have been a tilting of the plateau about its longitudinal axis. The west coast was partially submerged, as indicated by the wide estuaries and offshore channels, while the east coast was correspondingly elevated, producing the Atlantic Coastal Ridge.

A-87. Martin County lies within the Coastal Lowlands physiographic region characterized by terraced level plains. The topography is largely controlled by a series of marine terrace deposits. The deposits were formed during Pleistocene time when sea level rose and fell in response to the advance and retreat of the continental ice sheets. When sea level is relatively stationary for long periods, shoreline features and marine plains develop. Shorelines above present sea level, not submerged by a subsequent transgression of the sea, are generally preserved.

A-88. During the last event of continental glaciers, the Wisconsin Glacial Stage, sea level stood 400 feet below the present level, beyond the edge of the continental shelf. The melting of these glaciers started approximately 20,000 years B.P., marking the beginning of the recent or, in geologic time, the Holocene Epoch. Sea level began a rapid rise at an average rate of 30 feet per 1000 years. About 7000 years B.P., the rate of sea level rise slowed at a sea level position about 30 feet below its present level. Since, sea level rise has progressed at a slower rate of 5 to 10 feet per 1000 years.

A-89. It was at this most recent slowing of sea level rise that the barrier islands of east peninsular Florida began to form and, with continued sea level rise, migrated westward to their present position. The primary cause of sea level rise today is the warming of the atmosphere, causing melting of the polar ice caps and thermal expansion of the ocean waters.

A-90. The Pleistocene Anastasia formation and Pamlico sand are the only formations exposed in Martin County. The Anastasia formation in Martin County consists mostly of sand, shell beds, and thin discontinuous layers of sandy limestone or sandstone. The consolidated coquina (shell) phase of the Anastasia formation crops out on the beach at Blowing Rocks, Jupiter Island and Sewall Point on Hutchinson Island. These beds of exposed coquina rock are not more than 20 feet thick.

PREVIOUS INVESTIGATIONS

A-91. Investigations for an offshore sand source started with the Coastal Engineering Research Center's inner continental shelf study. Reconnaissance and detail grids of geophysical surveys, and vibracore sampling was performed in the late 1960's, identifying potential offshore sand sources (Meisburger and Duane, 1971). Although Martin County had only reconnaissance geophysical survey coverage, a map of offshore sand shoals identified potential offshore sand resources.

A-92. In 1978, the Jacksonville District performed more detailed geophysical surveys and vibracore sampling offshore of Martin County. This work was in support of the Feasibility Study being conducted at the time. This study identified potential sand sources offshore most of the county, including Gilbert Shoal north of St. Lucie Inlet. Thirty-nine vibracore borings were drilled along the Martin County coast, located approximately 1/2 to 2 miles offshore. The boring locations were chosen to cover the coast and sample sand deposits. Core boring locations were determined by electronic positioning equipment. Selected samples were sent to the U.S. Army Corps of Engineers, South Atlantic Division Laboratory (SAD Laboratory) for grain size analysis. All core boring logs and grain size data are included in the Geotechnical Sub-Appendix A1 (Available from Jacksonville District).

A-93. Native beach surface samples were collected along 11 profile lines surveyed in 1965, which covered the entire county shoreline. The samples were collected from the dry beach, at mean high water, at mean low water, and at elevations -3, -6, -12 and -18 feet. Grain size analyses of the beach samples were performed at the SAD Laboratory.

RECENT INVESTIGATIONS

A-94. Applied Technology and Management, Inc. (ATM), under contract by the Martin County Board of County Commissioners, conducted coastal engineering and environmental studies in Martin County and updated information as needed. During this study, new native beach sampling was identified. In 1990, (ATM) collected surface beach samples along eight profile lines, approximately 1,000 to 3,000 feet apart, within the Hutchinson Island project limits. Samples were collected at elevations +10, +5, 0, -5, -10, -15 and -20 feet N.G.V.D. All samples were subjected to grain size analysis in accordance with ASTM D-422. The results were used to analyze the distribution of grain sizes throughout the project beach and perform suitability analysis. The complete report is included in Geotechnical Sub-Appendix A1.

NATIVE BEACH

A-95. The results of the 1965 native beach sampling showed very little material of a size smaller than 0.125 mm exists above mean high water, although finer grained material occurs in the zone from shoreline to a water depth of 6 to 12 feet. The largest grain sized material on the beach occurs at the shoreline. Shell fragments comprise a considerable part of the beach material. Composite mean grain size for the entire county, from the 1965 data was 1.51 phi (0.35 mm), and sorting of 1.74.

A-96. For the native beach sampling performed in 1990, within the Hutchinson Island project limits, the mean grain size is 1.91 phi (0.27 mm), with a sorting of 1.41. Table A-14 shows a summary of native sediment statistics. Figure A-18 illustrates the grain size frequency histogram of the native sediment grain size distribution. Comparison of the native beach and the borrow area cumulative grain size distributions are shown on Figure A-19. Results of all laboratory testing is included in Geotechnical Sub-Appendix A1. No gradation curves were produced for individual samples analysis, only tabulated laboratory results.

TABLE A-14
SUMMARY OF GRAIN SIZE STATISTICS

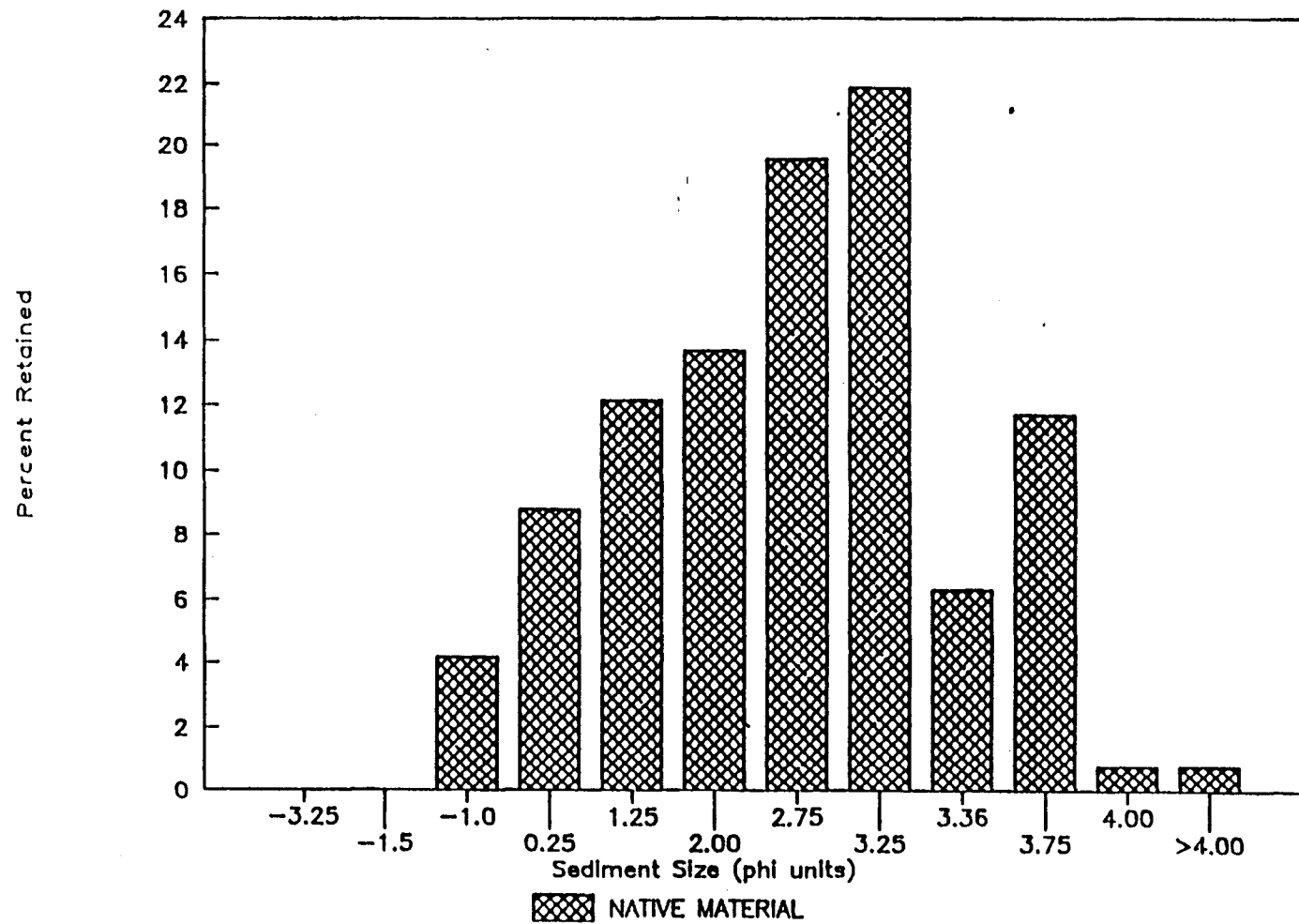
	Phi Mean Grain Size (mm)	Sorting	Adjusted SPM Overfill (Ra)
Native Beach-1965 County Wide	1.51 (0.35 mm)	1.74	----
Native Beach - 1990 Hutchinson Island	1.91 (0.27 mm)	1.41	----
Hutchinson Island Borrow Area Gilbert Shoal	1.41 (0.38 mm)	1.39	1.0

BORROW AREA

A-97. Gilbert Shoal is located approximately three miles north of St. Lucie Inlet, 4,000 feet offshore. The shoal was located by the Jacksonville District geophysical survey, and sampled with 25 vibracore borings. These borings refined the shape of the shoal leading to the borrow area shown on Plate 11 (end of main text), along with the core boring locations. Plate 12 shows the geologic cross-sections through the borrow area. The cross-sections show the distribution of the clean shoal sands from surrounding siltier sand. The borrow area shown on Plate 11 contains approximately 6 million cubic yards of clean sand, mostly containing less than 5 percent silt. This clean sand is in a deposit 10 to 16 feet thick.

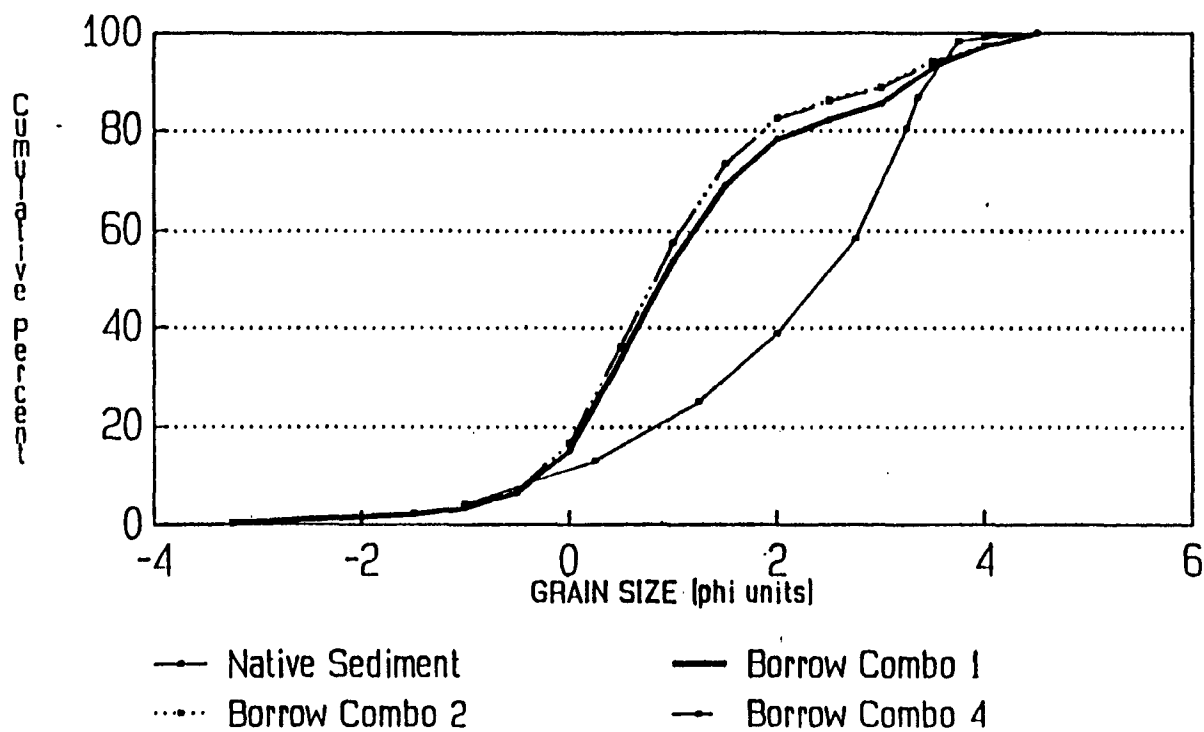
A-98. The mean grain size of the Gilbert Shoal borrow area is 1.41 phi (0.38 mm) and sorting of 1.39. The grain size frequency histogram graphically shows the distribution, Figure A-20. Cumulative grain size distribution curves are shown on Figure 19, along with the native beach curve.

FIGURE A-18
NATIVE SEDIMENT ANALYSIS



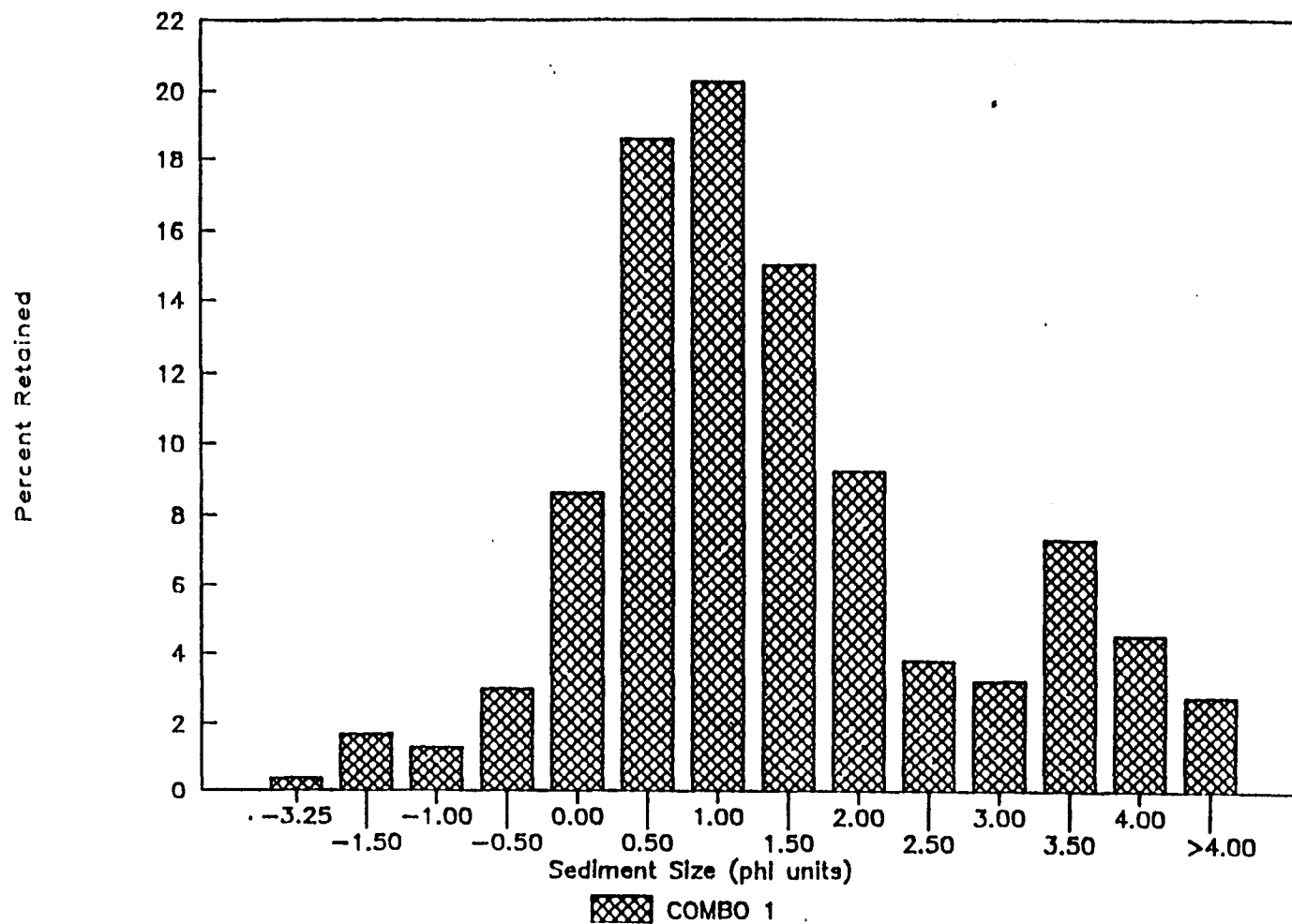
(ATM, 1991 - Figure 4-7)

FIGURE A-19
BORROW AND NATIVE SEDIMENT COMPARISON



(ATM, 1991 - Figure 4-8)

FIGURE A-20
BORROW MATERIAL ANALYSIS (COMBINATION 1)



(ATM, 1991 - Figure 4-4)

A-99. Additional core borings within the borrow area are being conducted at this time by ATM. These additional core borings will further define the quality of the borrow materials and provide sufficient detail data for plans and specifications design of the borrow area.

SUITABILITY ANALYSIS

A-100. The results of the grain size analysis is used to evaluate the suitability of the borrow area for use on the project beach. The Adjusted Shore Protection Manual Method (CERC, 1984) is used to compare the grain size distribution of the borrow area to the grain size distribution of the native beach. Discrepancies in grain sizes of the borrow area material will be compensated for by an overfill ratio, indicating the quantity of borrow material necessary to produce a unit volume of sand with the grain size distribution of the native material. The grain size statistics used in this comparison is summarized in Table A-14, along with the results of the suitability analysis.

A-101. Cumulative gradation curves for the native beach and borrow area are compared on Figure A-19. On Figure A-19, combinations (combo) 1, 2, and 4 represent different areas of the borrow area. These areas are very similar, but combination 1 data was used in this report as best representing the borrow area.

A-102. The results of the suitability analysis shows that the borrow material is coarser grained and has essentially the same sorting as the native beach material. This combination requires no overfill volume, resulting in an overfill ratio of 1.0.

SUMMARY

A-103. In 1978, the Jacksonville District drilled core borings to identify potential sand sources for beach nourishment offshore of Martin County. The core borings offshore of Hutchinson Island identified a borrow area that contained sufficient quantity of high quality sand available for use as a source of sand for beach nourishment. ATM, under contract by Martin County, conducted engineering and environmental studies in the project area. As part of these studies, ATM performed native beach sampling and analysis of compatibility of potential sand sources. The core borings identify a borrow area offshore of Hutchinson Island which contains approximately 6 million cubic yards of high quality sand for beach nourishment. The material requires no overfill volume to be added for differences in grain size from the native beach material.

PROTECTIVE BEACH DESIGN

PROJECT LENGTH

A-104. The authorized project beach fill extended 4.0 miles south from the St. Lucie/Martin County line. Natural hardbottoms lie in very shallow waters at the southern portion of the authorized project. By shortening the length of the protective beach by approximately 1800 direct hardbottom impacts will be avoided.

A-105. The north limit of the design berm is located at profile line R-2. Tapering of the design berm width will continue north an additional 900 feet to intersect the existing shoreline at profile lines R-1. This will locate the northern boundary of the project at the approximate location of the St. Lucie/Martin County line. The south limit of the design berm width is profile line R-21. A 1800-foot taper will extend the southern boundary of the project to profile line R-23. The protective dune will restore the existing dune between profile lines R-1 through R-23. The overall project length is therefore about 3.75 miles (19,830 feet) to include the tapering of the design berm and the protective dune.

DUNE AND BERM ELEVATIONS

A-106. The existing dune will be restored to an elevation of +13.6 MLW (+12.0 MSL) where required within the project length limits. This elevation approximates the natural dune elevation of the existing beach. Construction of a dune substantially higher than this may obstruct the view of shoreline residents or cause increased erosion due to wind blown sand or drainage/passenger routes cut through the dune. Protective dunes built too low may offer little protection to upland development or existing dunes. A dune of sufficient height can protect lower areas landward of the dune line from overtopping and flooding, however, it would not stop back island flooding caused by the rise of estuary levels during storms.

A-107. The design berm elevation for the project beach fill is +9.1 MLW (+8.0 MSL). As for dune elevation, the design berm elevation approximates the natural berm elevation of the existing beach. A berm constructed at a lower elevation would be overtopped excessively by high frequency occurrence events, while a higher berm elevation would probably allow ponding of water behind the restored dune as a result of high rainfall and/or wave overtopping.

DUNE AND BERM WIDTHS

A-108. Many berm widths were considered in order to determine the design berm width which provides the maximum net benefits. Plans that maintain the existing shoreline or add equivalent beach widths of 20, 35, 50, 75, and 100 feet were

developed. The selected design berm width for the project area is 35 feet. The restored dune will have crest width of 20 feet. The design beach fill limits are illustrated in Plates 1 through 10 at the end of the main report.

A-109. In order to maintain a design berm, the Corps of Engineers places advance nourishment with the design beach fill quantity. The Corps also adds additional material if the borrow material is somewhat finer than the native beach material, which is not the case in this project. The borrow material is coarser grained than the native beach material, therefore no overfill volume is required. At the time of initial construction, the advance nourishment material is added to the design volume, resulting in a much larger initial project beach profile.

BEACH SLOPES

A-110. The front slope of the beach fill placed at the time of construction or future renourishment will be steeper than that of the natural profile. The angle of repose of the hydraulically placed material depends upon the characteristics of the fill material and the wave climate in the project area. The estimate of the slope of the material after adjustment is based on averaging the beach profile slopes of the native beach from low-water datum to about the 18-foot depth contour. After adjustment and sorting of the placed material by wave action, the material will adjust to the native beach slope, which is about 1 on 8.5 above MLW and 1 on 20 below MLW. The protective dune slope is 1 on 5 from the crest of the dune to the toe of the dune.

A-111. It is unnecessary and usually impracticable to grade beach slopes artificially below the low-water elevation since they will be shaped by wave action. Fill material is placed to a construction berm width. With steep initial slopes, the material will quickly adjust to the flatter natural slopes. The actual construction profile slope and berm width will be determined during preparation of plans and specifications for construction of the project.

DESIGN FILL VOLUME

A-112. The design beach fill dimensions consist of the primary dune restored to a 20-foot wide crest at an elevation of +13.6 MLW over a distance of 3.75 miles (19,830 feet) and of a berm 35-feet wide at an elevation of +9.1 feet MLW over a distance of 3.4 miles (18,040 feet). A reduced berm width at the same elevation extends an additional 2700 feet to the north and south limits of the project. Design fill sections with these dimensions were compared to the 1992 survey profiles. The estimated design volume required (including fill behind the ECL) for the project is 493,500 cubic yards. Design fill sections for every profile line are shown on Plates 2 through 10.

FILL VOLUME LANDWARD OF EASEMENT LINE

A-113. The State of Florida requires that the non-Federal sponsor establish an erosion control line (ECL) at the existing mean high water line prior to project construction. The purpose of this line is to delineate State-owned land from private uplands. The baseline used for the purposes of this report was the mean high water line from the 1992 survey. Plates 2 through 10 show the approximate location of this line.

A-114. Usually, the design beach cross-section for a project is constructed seaward of the ECL, however this project authorized the restoration of the existing dune which lies landward of the mean high water line. In order to maintain the constant elevation from the natural profile, the design berm commenced, where possible, at the location of the existing (1992) 9.1-foot contour line. Fill placed landward of the ECL, on lands not open to the public and undeveloped private property, is a non-Federal responsibility with no Federal contribution to the construction cost. Comparison of the 1992 survey profiles and the design fill sections resulted in an estimated 156,000 cubic yards of material to be placed landward of the MHW line for the recommended project length.

ANTICIPATED EROSIONAL LOSSES

A-115. Since the survey was accomplished in 1992, it is expected that the project scope will grow due to additional erosion prior to construction. The estimated construction completion date is 1996, approximately 4 years following the 1992 survey. The anticipated erosional volume is based on the long-term annual losses for this project, approximately 53,600 cubic yards based on comparative surveys taken from 1971 to 1992). The estimated additional volume required to offset anticipated erosional losses is 214,400 cubic yards (53,600 X 4).

ADVANCE NOURISHMENT

A-116. In anticipation of continuing erosion of the shoreline after the project fill has been placed, an additional volume of material, called advance nourishment, is placed to offset these expected losses. The volume of advance nourishment is based in part on the long term historic volumetric losses and the economically determined interval between successive renourishment operations. The long term erosional losses for the project area were determined by comparing the 1971 and 1992 surveys. That comparison resulted in annual volumetric losses of 2.6 cubic yards of material per foot of shoreline. This is equivalent to 53,600 cubic yards per year for the project area.

A-117. The optimum number of years of advance nourishment placed during initial construction depends on an economic determination of the lowest average annual equivalent cost of maintaining the project. Table A-15 shows cost estimates for nourishment intervals from one to 20 years. The optimum renourishment interval is 11 years. The total volume required for advanced nourishment is computed by multiplying the long term annual losses times the renourishment interval (11 years), which results in approximately 589,600 cubic yards, without overfill.

FUTURE PERIODIC NOURISHMENT

A-118. The minimum protective cross-section of the project beach consists of a berm width of 35 feet. Depending on the coastal processes between nourishment operations, this minimum protective distance could be reached after or prior to the estimated 11-year renourishment interval. Monitoring throughout the project life would indicate the performance of the fill and the appropriate volume for the selected renourishment interval. However, for the purposes of this report, the amount of future periodic nourishment required is based on the historic pre-project volumetric losses. This quantity is the same amount as that required for advanced nourishment.

OVERFILL VOLUME

A-119. The overfill quantity is determined by multiplying the overfill ratio by the quantity of material expected to undergo the sorting action of waves. This quantity of material is the advanced nourishment volume. The results of the suitability analysis, discussed earlier in this appendix, shows that the borrow material is coarser grained than the native beach material, resulting in an overfill ratio of 1.0. Therefore no overfill volume is required.

COST ESTIMATES

A-120. From conception to completion of the project, the project cost estimate is a paramount management document. It is a guide to further refinement of uncertain features and leads to high confidence in the Federal Government's ability to award and execute contract construction within prescribe cost and time limits. Uncertainty exists in all estimates. The goal is to identify the uncertainty associated with a cost element, to forecast the risk of cost or time growth associated with the uncertainty and to assign a contingency to the cost element that will express the cost which, within a high degree of confidence, will not be exceeded when further detailed information is available. During pre-construction engineering and design, the focus is on detailed investigations and design and a significant increase in the detail of the cost estimate and decrease in the contingencies.

TABLE A-15
AVERAGE ANNUAL EQUIVALENT COST VS. RENOURISHMENT INTERVAL

OPTIMIZATION OF BEACH RENOURISHMENT INTERVAL FOR MARTIN COUNTY, FLORIDA (35-FOOT BERM WIDTH)

ECONOMIC ANALYSIS PERIOD =	50 YEARS	MOBILIZATION COST =	\$1,400,000.00
INTEREST RATE =	8.000 PERCENT	PRICE PER CUBIC YARD =	\$3.75
ANNUAL EROSION RATE =	53,600 CUBIC YARDS	MONTHLY PRODUCTION RATE =	418,000 PAY CUBIC YARDS
FILL BEHIND E. LINE =	156,000 CUBIC YARDS	PHYSICAL/ENV. MONITORING =	\$128,000
DESIGN FILL QUANTITY =	337,300 CUBIC YARDS	ADD'L MONIT. (YRS 1-11 ONLY) =	\$756,000 (PRESENT WORTH INCLUDES CONTING., E&D, S&I)
OVERFILL FACTOR =	1.00	LANDS & DAMAGES =	\$314,000
'92-'96 ANTICIPATED		IDC - INITIAL RESTORATION	\$32,400 (AAE COST)
EROSIONAL LOSSES =	214,400 CUBIC YARDS	CONTINGENCY =	20.0%
		E&D, S&I =	15.0%

CAPITAL RECOVERY FACTOR = 0.081743

DECEMBER 1993 PRICE LEVELS

DESIGN FILL + ANTICIP. EROSION (CUBIC YARDS)	NOURISHMENT INTERVAL (YEARS)	ADVANCE NOURISHMENT W/ OVERFILL (CUBIC YARDS)	TOTAL INITIAL FILL W/ OVERFILL (CUBIC YARDS)	ESTIMATED CONSTRUCTION TIME (MONTHS) *	INITIAL COST	INTEREST AND AMMORTIZATION	NOURISHMENT QUANTITY W/ OVERFILL (CUBIC YARDS)	NOURISHMENT COST	ANNUAL COST OF NOURISHMENT	TOTAL AVERAGE ANNUAL EQUIVALENT COST
707,900	1	53,600	761,500	3.8	\$7,554,200	\$617,500	53,600	\$1,420,100	\$1,420,100	\$2,070,000
707,900	2	107,200	815,100	4.0	\$7,847,900	\$641,500	107,200	\$1,697,500	\$816,100	\$1,490,000
707,900	3	160,800	868,700	4.1	\$8,141,600	\$665,500	160,800	\$1,974,900	\$668,300	\$1,348,200
707,900	4	214,400	922,300	4.2	\$8,435,400	\$689,500	214,400	\$2,252,300	\$499,800	\$1,258,700
707,900	5	268,000	975,900	4.3	\$8,729,100	\$713,500	268,000	\$2,529,600	\$431,200	\$1,209,100
707,900	6	321,600	1,029,500	4.5	\$9,022,800	\$737,500	321,600	\$2,807,000	\$382,600	\$1,179,500
707,900	7	375,200	1,083,100	4.6	\$9,316,500	\$761,600	375,200	\$3,084,400	\$345,700	\$1,161,700
707,900	8	428,800	1,136,700	4.7	\$9,610,200	\$785,600	428,800	\$3,361,800	\$316,100	\$1,151,100
707,900	9	482,400	1,190,300	4.8	\$9,904,000	\$809,600	482,400	\$3,639,200	\$291,400	\$1,145,400
707,900	10	536,000	1,243,900	5.0	\$10,197,700	\$833,600	536,000	\$3,916,600	\$270,400	\$1,143,400
707,900	11	589,600	1,297,500	5.1	\$10,491,400	\$857,600	589,600	\$4,194,000	\$255,800	\$1,142,000
707,900	12	643,200	1,351,100	5.2	\$10,785,100	\$881,600	643,200	\$4,471,400	\$235,600	\$1,149,600
707,900	13	696,800	1,404,700	5.4	\$11,078,800	\$905,600	696,800	\$4,748,800	\$220,900	\$1,158,900
707,900	14	750,400	1,458,300	5.5	\$11,372,500	\$929,600	750,400	\$5,026,200	\$207,600	\$1,169,600
707,900	15	804,000	1,511,900	5.6	\$11,666,300	\$953,600	804,000	\$5,303,600	\$195,300	\$1,181,300
707,900	16	857,600	1,565,500	5.7	\$11,960,000	\$977,600	857,600	\$5,581,000	\$184,000	\$1,194,000
707,900	17	911,200	1,619,100	5.9	\$12,253,700	\$1,001,700	911,200	\$5,858,400	\$173,600	\$1,207,700
707,900	18	964,800	1,672,700	6.0	\$12,547,400	\$1,025,700	964,800	\$6,135,700	\$163,800	\$1,221,900
707,900	19	1,018,400	1,726,300	6.1	\$12,841,100	\$1,049,700	1,018,400	\$6,413,100	\$154,700	\$1,236,800
707,900	20	1,072,000	1,779,900	6.3	\$13,134,800	\$1,073,700	1,072,000	\$6,690,500	\$146,200	\$1,252,300

* Includes one month for mob & demob and one month after NTP to start work.

A-121. The cost estimate for the recommended project is based on December 1993 price levels. Quantities for the beach fill design are based on conditions of the shoreline in May 1992, the time of the last beach profile survey. The cost estimates include about 20 percent for project contingencies and 15 percent for remaining planning, engineering and design, and construction management. Annual costs were computed using an 8 percent interest rate. Following are detailed MCACES cost estimates for the recommended project (Levels 1, 2 and 6). MCACES cost estimates exclude interest during construction.

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**U.S. ARMY CORPS OF ENGINEERS
JACKSONVILLE DISTRICT**

**FINAL
ENVIRONMENTAL ASSESSMENT**

**MARTIN COUNTY SHORE PROTECTION PROJECT
HUTCHINSON ISLAND, MARTIN COUNTY, FLORIDA**

JUNE 1994

**MARTIN COUNTY SHORE PROTECTION PROJECT
HUTCHINSON ISLAND, MARTIN COUNTY, FLORIDA**

FINDING OF NO SIGNIFICANT IMPACT

I have reviewed the planning document and the attached Environmental Assessment for the proposed project. Based on the information analyzed in the Environmental Assessment and on pertinent data obtained from cooperating Federal agencies having jurisdiction by law and/or special expertise, and information obtained from the interested public, I conclude that the considered action will have no significant impact on the quality of the human environment. Reasons for this conclusion are, in summary:

a. Measures to prevent or minimize impacts to sea turtles, in accordance with the Biological Opinion from the U.S. Fish and Wildlife Service, will be implemented during and after project construction. Both the National Marine Fisheries Service and the U.S. Fish and Wildlife Service have concurred that there will be no adverse impacts to other threatened or endangered species.

b. Measures to eliminate, reduce, or avoid potential adverse impacts to fish and wildlife resources will be implemented during project construction.

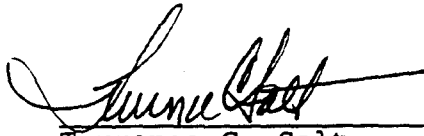
c. State water quality standards will be met.

d. There will be no adverse impacts to known sites of cultural or historical significance. The Florida State Historic Preservation Officer has indicated that the beach nourishment project will have no effect on any sites listed, or eligible for listing, in the National Register of Historic Places.

e. Benefits to the public will be the protection of upland residences and businesses as well as associated infrastructure along an erosive beach from storm generated wave energy. A wider beach will also provide more space for both active and passive saltwater recreational activities for residents and visitors.

In consideration of the information summarized, I find that the considered action does not require an Environmental Impact Statement.

Date: June 13, 1994



Terrence C. Salt
Colonel, U.S. Army
District Engineer

ENVIRONMENTAL ASSESSMENT

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SUMMARY

The Martin County Shore Protection Project was authorized in the Water Resources Development Act of 1990. The authorized project allows for the restoration of a protective and recreational beach along the 4.0 miles (6.4km) of shoreline from the St. Lucie/Martin County line (monument R-1) south to approximately 0.25 miles (0.4km) south of monument R-25. Beach compatible material (silt content of approximately 5%-7%) will be obtained from an offshore borrow area located northwest of the St. Lucie Inlet in approximately 30.0 feet (9.1m) of water.

Aerial photographs of the nearshore project area were taken in 1990. A side scan sonar survey to identify hardbottom habitat locations along the Martin County portion of Hutchinson Island from the county line south to the St. Lucie Inlet was completed in June, 1993. The hardbottom maps produced as a result of this survey were groundtruthed by an interagency (U.S. Army Corps of Engineers (Corps), U.S. Fish and Wildlife Service (FWS), Florida Department of Environmental Protection (DEP), and Martin County) team of scientists utilizing SCUBA in July, 1993. Hardbottom reef tracts consisting of ephemeral limestone outcrops and the marine bristle worm, *Phragmatoma lapidosa*, are found scattered along the project beach between monuments R-1 and R-22 with the western edge beginning approximately 500 feet (152m) seaward of the 1992 shoreline. From monument R-23 and continuing southward to the St. Lucie Inlet, the hardbottom habitat is fairly continuous and much closer to shore (some areas such as Bathtub Reef beginning at monument R-34 are aurally exposed at low tide).

In order to reduce the threat of adverse impacts to the hardbottom areas located to the south, the beach fill project has been shortened by approximately 2,000 feet (606m). A 35 foot (10.6m) wide berm will be constructed onto the eroded project beach between monuments R-2 and R-21 with the material gradually tapered between R-1 and R-2 as well as R-21 and R-23. With the aid of computer models and coastal engineering analysis, it is currently predicted that no nearshore hardbottom habitat will be directly impacted by the nourished sand sloughing seaward as it seeks equilibrium with the ocean bottom. It is also predicted that between initial construction and the next periodic renourishment (11 years), sand will gradually erode from the project beach and flow south due to the longshore current in this area. During this 11 year period, the eroded sand may flow onto or around as much as 20.5 acres of hardbottom habitat south of the project area between monuments R-23 and R-42. A restored dune system will be constructed along the entire reach of the project between monuments R-1 to R-23.

As has been mentioned, eroded sand from the project area may

eventually come into contact with as much as 20.5 acres of hardbottom habitat south of the project area between monuments R-23 and R-34 (a distance of approximately 2.2 miles/3.5km) over an 11 year period. This southern transport of sand represents a potential secondary impact to these hardbottom structures and associated flora and fauna. Whether or not the potential impact to this habitat is realized depends upon a number of variables. It is anticipated that the time it takes the sand to reach these areas will be relatively gradual and not episodic. It is likely that this will reduce the chance of the hardbottom areas being directed buried by eroding sand. From the side scan sonar survey, it appears that the overall relief of these hardbottom areas south of the project is generally low (less than 1.5 feet/0.5m) with the western edge of the hardbottom beginning within 200 feet/60.6m from the 1992 mean high water line. It is likely that these areas are naturally subjected to high rates of sedimentation, elevated turbidity, and sand scouring. The composition of the hardbottom areas is predominantly worm rock (*P. lapidosa*). These annelid structures generally favor environments with high suspended sediment and usually lack significant permanent sessile and encrusting communities because of periodic sand scouring and elevated turbidity. Because of the resiliency of the hardbottom habitat (being periodically aerially exposed, buried, and re-exposed) in this area, it is likely that these organisms would be able to survive in highly turbid conditions that may be present on a temporary basis because of the beach nourishment project.

The dynamic physical conditions of the nearshore waters in this area are such that there are natural fluctuations of turbidity levels and sand scouring events. Because of the naturally occurring high turbidity and sand scouring along the nearshore in this area, it seems unlikely that secondary impacts brought about by gradually eroding sand from the beach project area will produce a significant ecological change in this area. Whether these secondary impacts produce significant ecological consequences depends upon the elevation of turbidity levels (and longevity) and the increase in the number of sand scouring occurrences. Since it is extremely difficult to accurately predict impacts to hardbottom areas in highly dynamic areas such as Hutchinson Island, a thorough quantifiable monitoring and mitigation plan will be undertaken by the Corps. The definition of impact, the cause and effect of these impacts, and the possibility of future mitigation requirements will be discussed and agreed upon by the Corps, FWS, and DEP prior to commencement of the beach fill project. Because of the dynamic physical oceanographic conditions that currently exist in the nearshore environment and the resiliency of the hardbottom habitat along this shoreline, the Corps currently predicts that no significant adverse impact will occur south of the project area as a result of the beach nourishment project. Because of this, the Corps does not anticipate having to mitigate for any hardbottom habitat

south of the project area.

Thorough discussions of the various habitat types along with the associated flora and fauna of each habitat type can be found in section 8.00 of the attached Environmental Assessment (EA). Exact locations of hardbottom areas along with the predicted seaward influence of the project (equilibrium toe line) is included in the EA as Appendix D. Presentation of the proposed monitoring and mitigation activities can be found in Appendix E.

Hutchinson Island is one of the most important sea turtle nesting areas in the world. In order to eliminate or reduce the risk of impacting nesting sea turtles, it is estimated that beach construction activities will commence as soon after the sea turtle nesting season ends (November 1) as possible and will end prior to the beginning of the main nesting season (April 15th). The FWS has agreed to this time period for allowing construction of the beach fill project. Environmental commitments to ensure the safety of endangered and threatened species is discussed in section 9.00 of the EA.

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**FINAL ENVIRONMENTAL ASSESSMENT
MARTIN COUNTY SHORE PROTECTION PROJECT
HUTCHINSON ISLAND, MARTIN COUNTY, FLORIDA**

1.00 INTRODUCTION. A Congressional Resolution was adopted by the Public Works Subcommittee on May 18, 1973, requesting that the U.S. Army Corps of Engineers (Corps) investigate shore protection alternatives for Martin County, Florida. A *Feasibility Report With Environmental Impact Statement* was published in June 1986. This feasibility report identified much of the Atlantic shoreline of Hutchinson Island and Jupiter Island as experiencing significant erosion problems. The feasibility report indicated that it was not economically justified to recommend a Federal project for Jupiter Island at that time. In the same report, it was recommended that Hutchinson Island receive a protective and recreational beach to retard the erosional problems caused by storm wave attack.

2.00 PROJECT LOCATION. Geologically, Hutchinson Island is considered a young shoreline which has emerged from the ocean with the shifting sands comprising the barrier island separating a semi-enclosed lagoon from the coastal ocean (Dolan et al. 1980). Hutchinson Island is an elongated barrier island approximately 24.5 miles (39.2km) long and generally only a mile (1.6km) or less wide separated from mainland Florida by inlets and the Indian River Lagoon (Figure 1). The Martin County Atlantic coastline is located in the southeastern section of Florida (Figure 2) with the Indian River Lagoon to the west, the Atlantic Ocean to the east, St. Lucie Inlet to the south, and St. Lucie County to the north (Figure 3). The seriously eroded beach stretches for 4.0 miles (6.4km) from the St. Lucie/Martin County line to about 0.25 mile (0.4km) south of the southern boundary of Stuart Public Beach Park (Figure 3).

3.00 NEED FOR THE PROPOSED ACTION. The problem along the project area is one of sand erosion and lowering of the beach profile with subsequent recession of the beach and dunes. Severe northeast storms frequently occurring during the winter months have caused considerable erosion and damage to shoreline structures. Seawalls, dune walkways, and shorefront buildings are currently in danger of being significantly impacted by storm generated waves. It is currently estimated that the present shoreline has receded approximately 200 feet (61m) since an 1882 coastal survey was undertaken by the U.S. Coast and Geodetic Survey and continues to erode at approximately 1.3 feet (0.4m) per year.

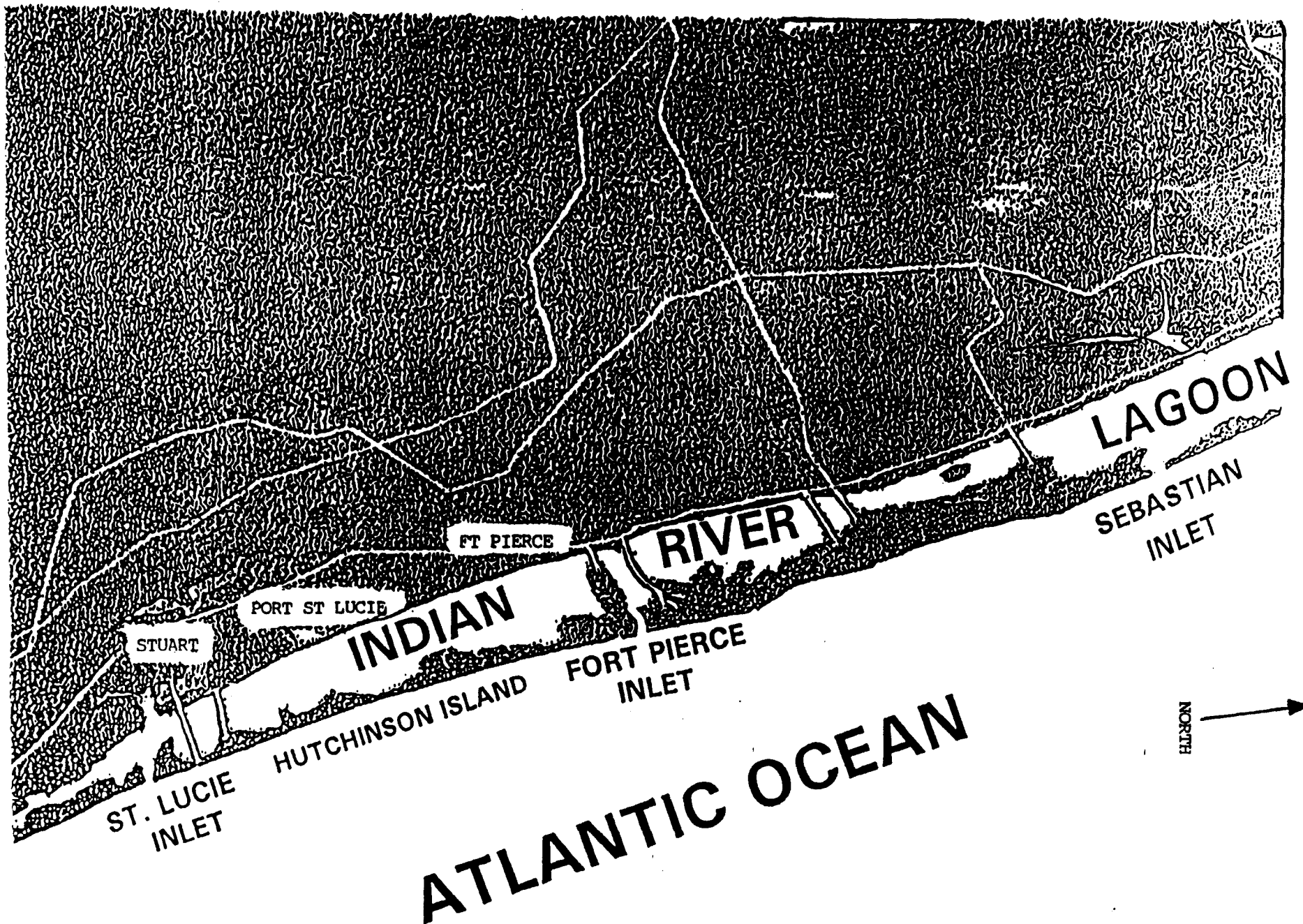


Figure 1. General location of Hutchinson Island, Florida.

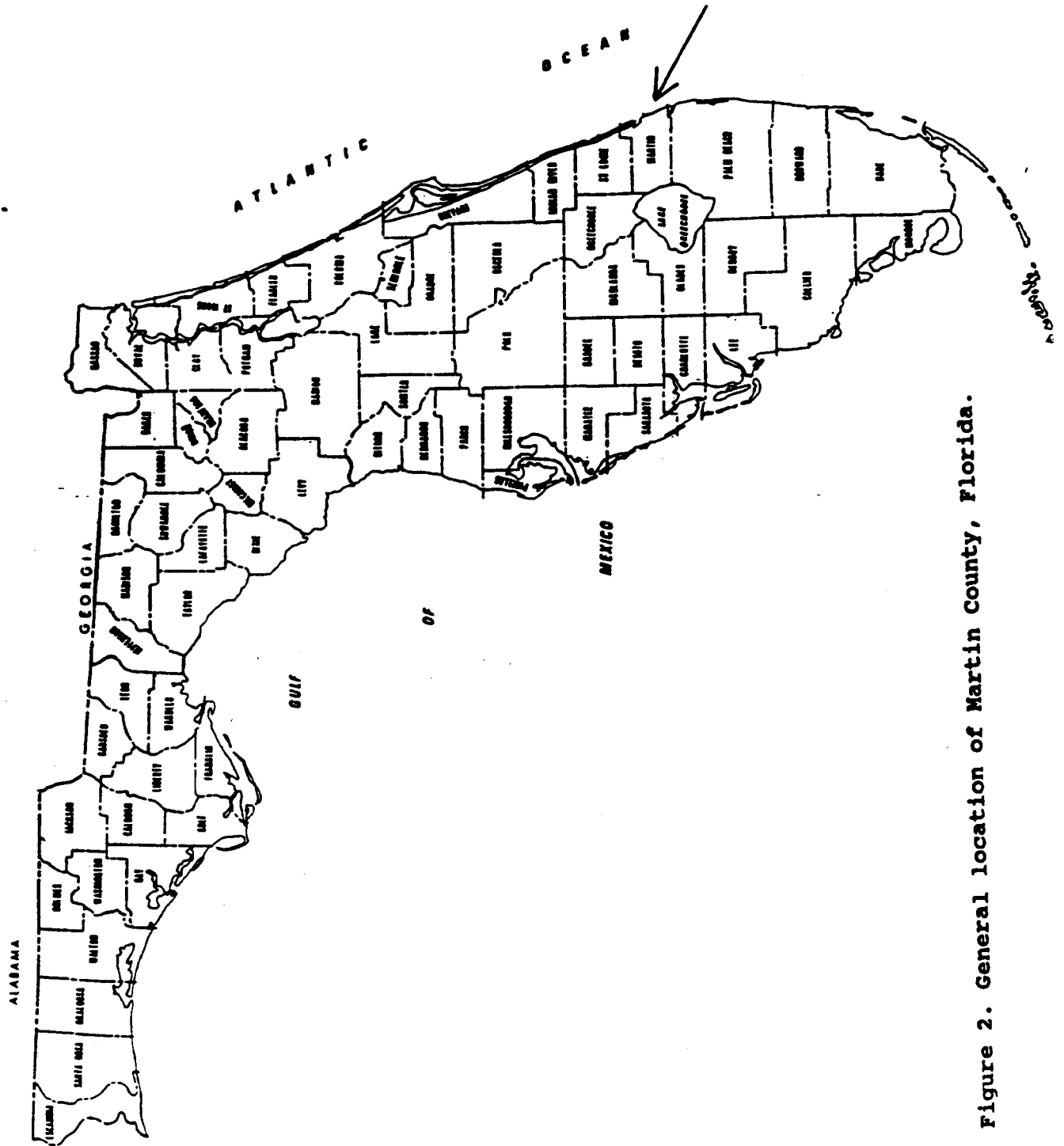


Figure 2. General location of Martin County, Florida.

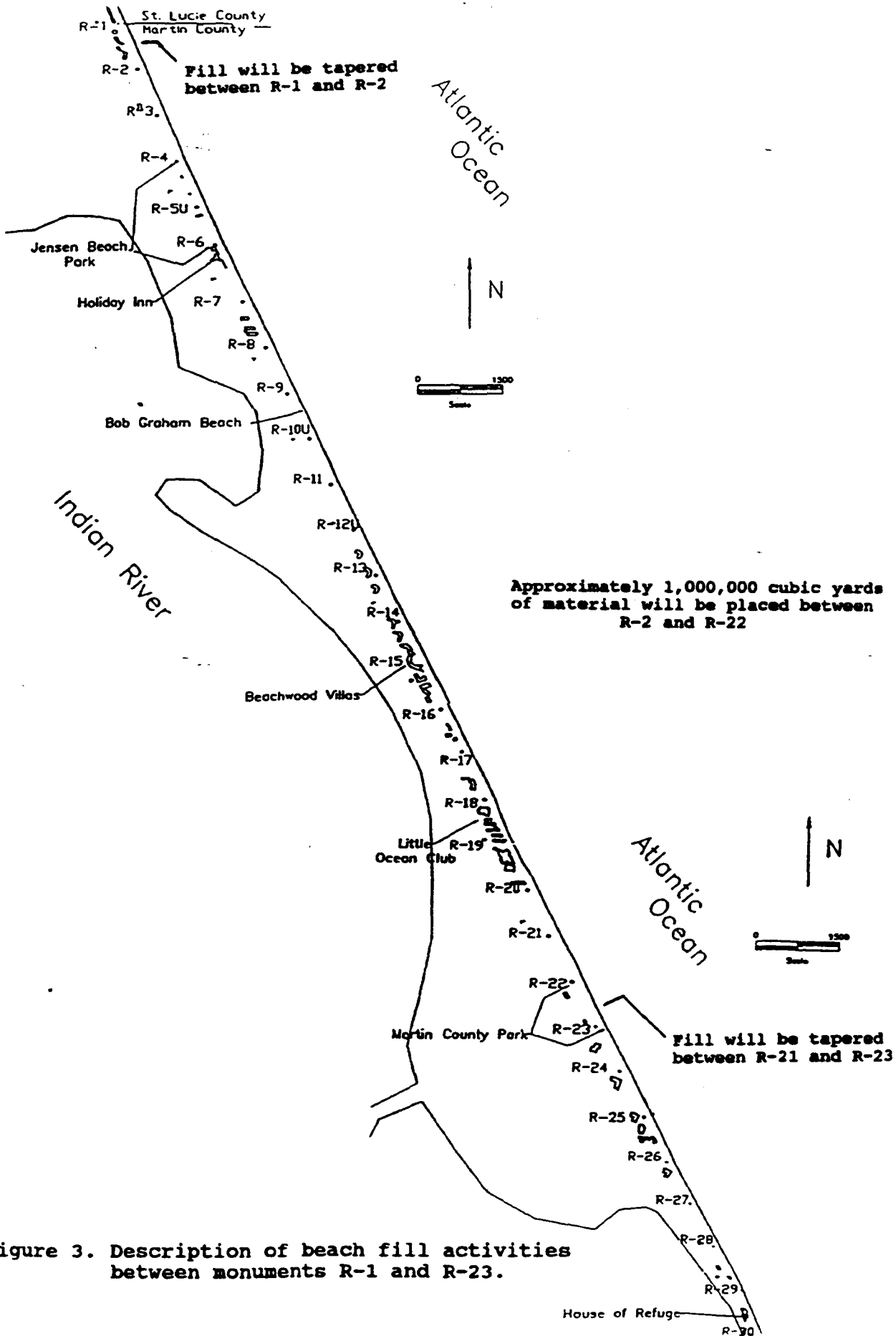
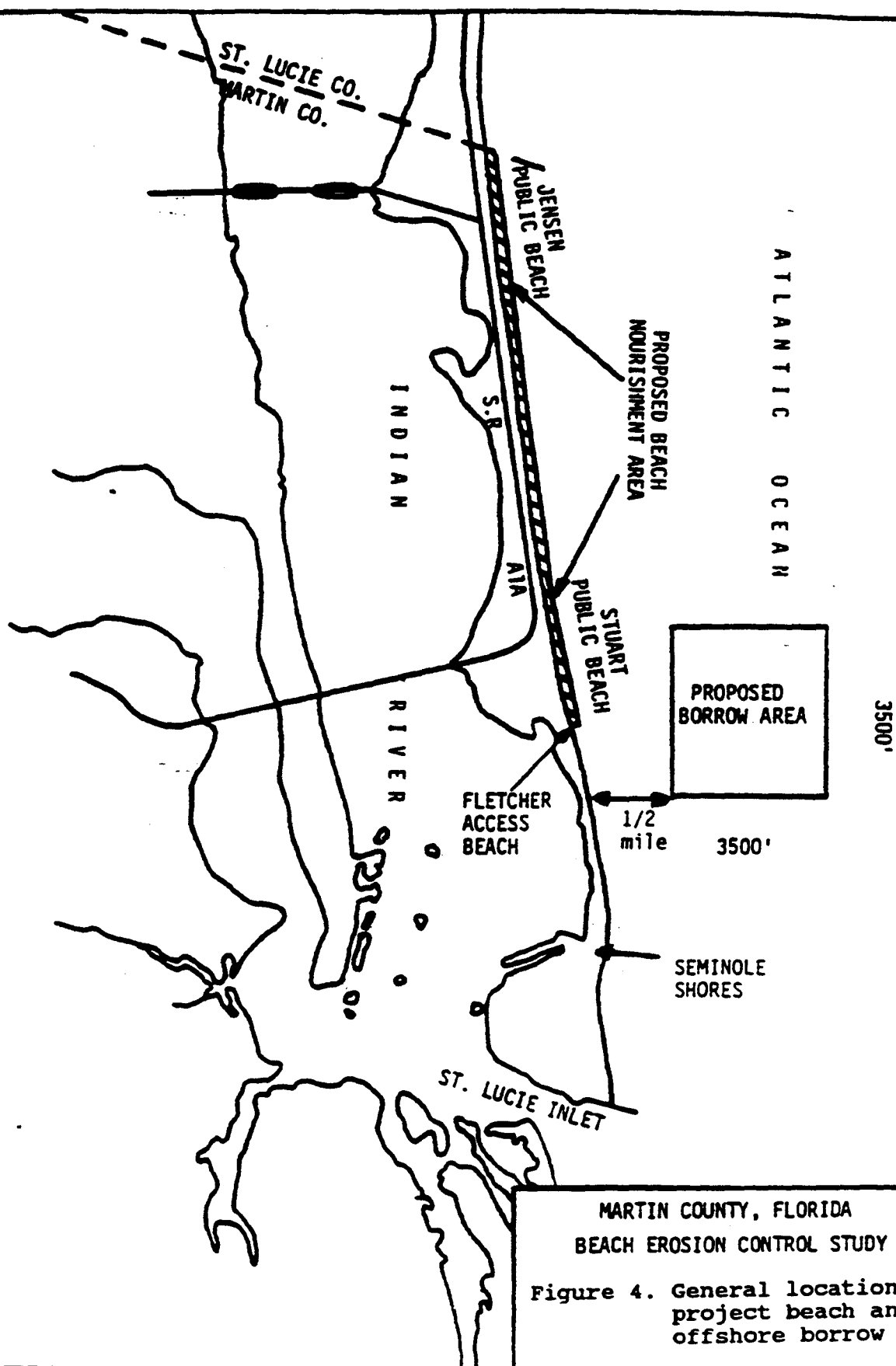


Figure 3. Description of beach fill activities between monuments R-1 and R-23.

4.00 PROPOSED ACTION. The authorized plan provides for 4.0 miles (6.4km) of continuous beach fill from the north county line to about 0.25-miles (0.4km) south of the southern boundary of Stuart Public Beach Park (Figure 4). In order to reduce or eliminate possible impacts to nearshore hardbottom habitat at the southern end of the project, the initial beach fill will place approximately 1,000,000 cubic yards of beach compatible material between monuments R-2 and R-22 (Figure 3). The beach fill will then be tapered between R-1 and R-2 as well as R-22 and R-23. The annual erosion rate for this reach is approximately 53,600 cubic yards. The beach fill design cross section will provide a restored primary dune crest 20-feet (6.1m) wide at 13.6 feet (4.1m) mean low water (mlw), along a 3.75 mile (6.0km) authorized project length (between monuments R-1 to R-23), a 35-foot (10.6m) wide beach berm at 9.1 feet (2.8m) mlw (between R-2 & R-21), and seaward slopes of 1V:8.5H to 0 mlw, then 1V:20H to the existing bottom (Figure 5). Advance nourishment is included in the initial beach fill and periodic nourishment will be provided at 11 year intervals.

5.00 ALTERNATIVES TO THE PROPOSED PLAN. Efforts to plan possible solutions to the erosion problem on Hutchinson Island consist of the "no action plan", eight nonstructural solutions, and twelve structural solutions (Table 1). Each alternative is given very serious consideration during the planning process. Alternatives are eliminated from further consideration if they do not fully meet local planning objectives, maximize benefits as required by the National Economic Development Benefit Evaluation Procedures and the Water Resource Council's "Principles and Guidelines". After careful consideration, the plan which places beach fill on the eroded beach to offer protection from storm waves and inclusion of periodic nourishment for future protection (Plan S-2 in Table 1) is the preferred plan. A thorough discussion of each alternative plan is discussed in the 1986 feasibility report.

6.00 SOURCE OF BEACH FILL MATERIAL. Geotechnical analysis of material was conducted offshore of Martin County at the general locations seen in Figure 6. As a result of these investigations, suitable quantities of sand material are known to exist offshore. An offshore borrow area is considered to be the most environmentally acceptable source of sand. Two potential sand sources are considered as borrow sources for the project. The primary borrow site is located 4,000 feet (1212m) offshore of the project beach and about 3 miles (4.8km) northeast of the entrance to St. Lucie Inlet (Figure 4). This borrow area contains an estimated 6.0 million cubic yards of beach fill material. A secondary borrow area has been located and is offshore of Jupiter Island just south of St. Lucie Inlet and runs northward for a length of 5.5 miles (8.8km) parallel to shore. This secondary or



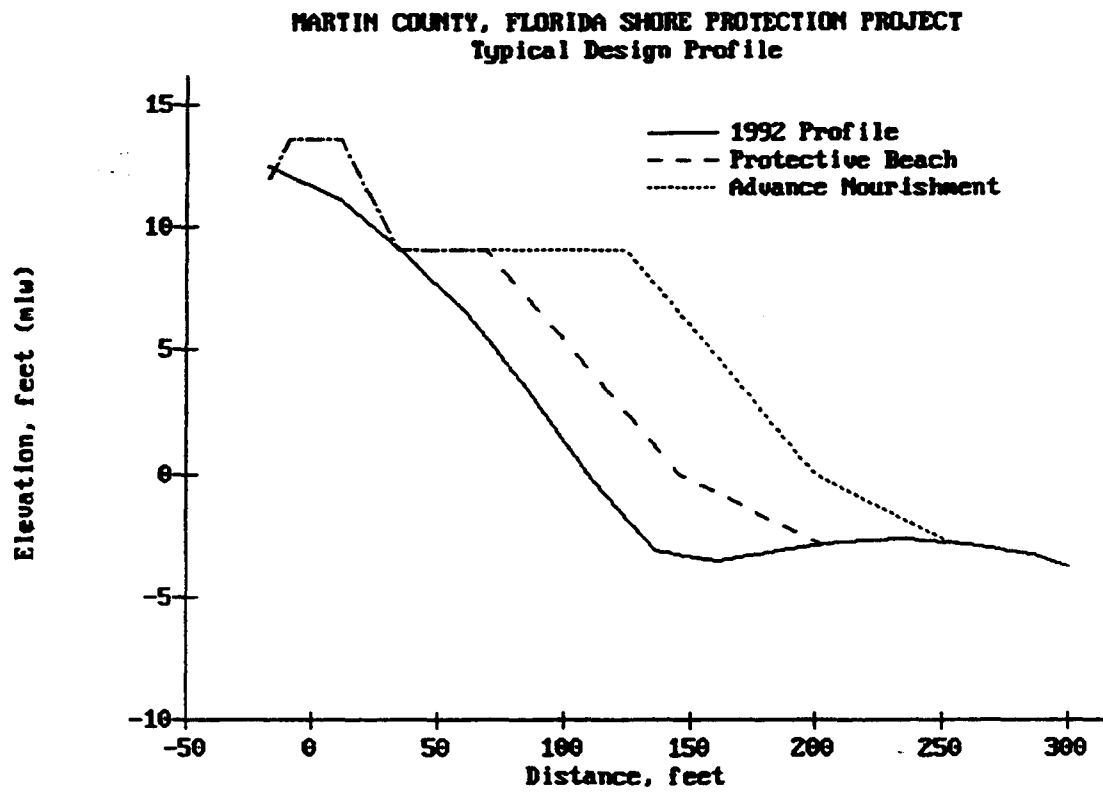


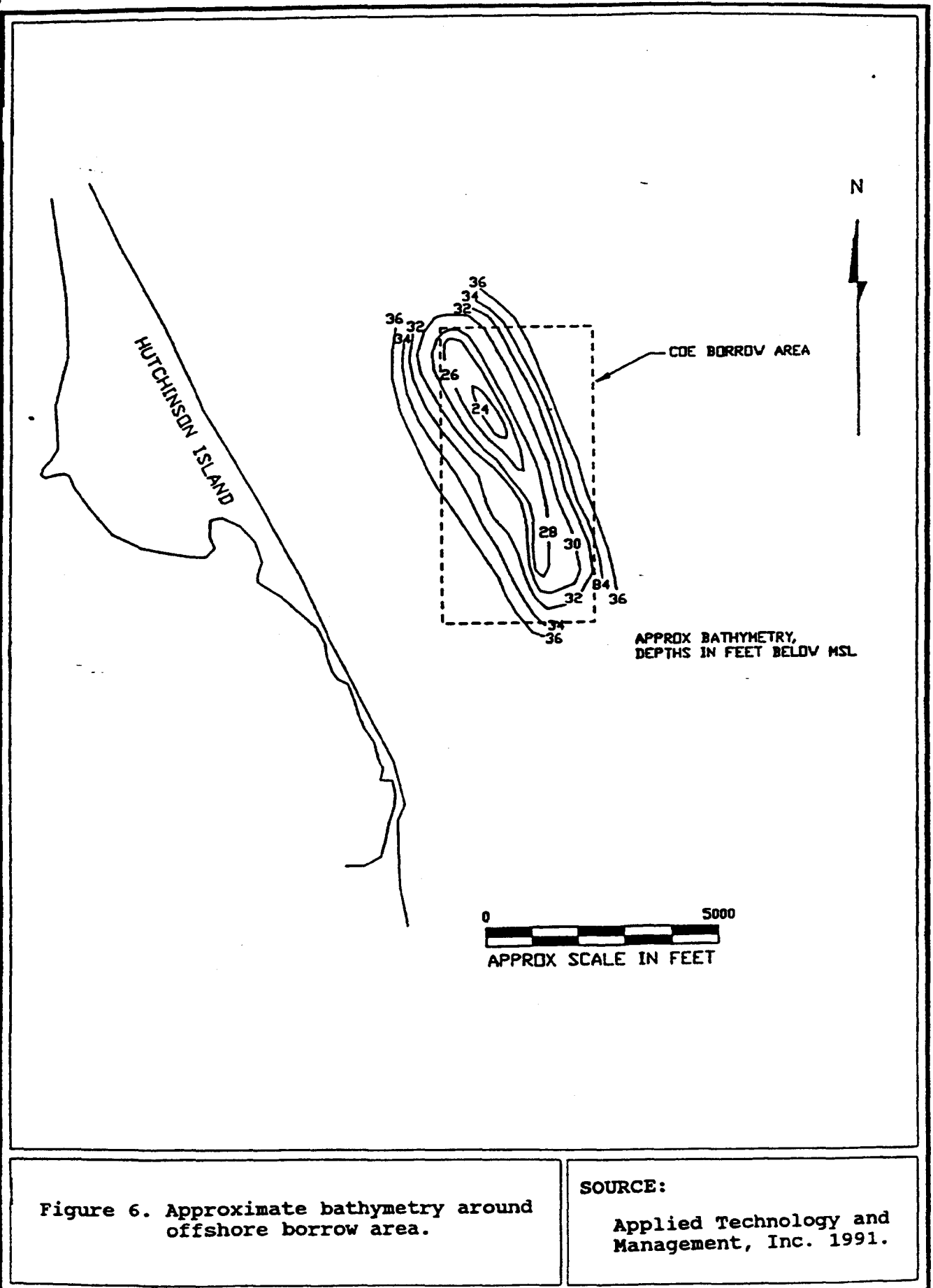
Figure 5. The design profile of the authorized beach fill project.

Table 1. Possible nonstructural and structural solutions to the erosion problem at south Hutchinson Island

POSSIBLE MEASURES		LOCAL PLANNING OBJECTIVES				PRINCIPLES AND GUIDELINES ²			
		PB	FP	EC	TBE	NED	EQ	OSE	RD
NA	<u>NO ACTION</u>	0 ³	0	0	0	0	0	0	0
	<u>NONSTRUCTURAL MEASURES</u>								
NS-1	Rezoning of beach area	0	P	0	P	0	0	P	P
NS-2	Modification of building codes	0	P	0	0	0	0	P	0
NS-3	Construction setback line	0	P	0	P	0	P	P	P
NS-4	Moratorium on construction	0	P	0	0	0	0	0	0
NS-5	Flood insurance	0	0	0	P	0	0	P	0
NS-6	Evacuation planning	0	0	0	0	0	0	P	0
NS-7	Establish a no-growth program	0	0	0	0	0	0	0	0
NS-8	Other recreational facilities	0	0	0	0	0	0	0	0
	<u>STRUCTURAL MEASURES</u>								
S-1	Modification of St. Lucie Inlet	P	P	P	P	P	P	P	P
S-2	Beach fill with periodic nourishment	F	P	F	F	F	F	F	F
S-3	Beach fill with hurricane surge protection sand dune and periodic nourishment	F	P	F	P	P	P	0	P
S-4	Beach fill with periodic nourishment and offshore breakwater	F	P	P	P	P	P	0	P
S-5	Corps 1968 Plan of Improvement	P	P	P	P	P	0	P	P
S-6	Hurricane surge protection-sand dune	P	P	P	P	0	P	P	0
S-7	Revetment	0	P	P	0	0	0	P	0
S-8	Seawall	0	P	P	P	P	0	P	0
S-9	Stabilization of beaches and dunes by vegetation	0	P	P	0	0	P	0	0
S-10	Modification of building codes and rezoning of beach area	0	P	P	0	P	P	0	0
S-11	Flood proofing of structures	0	P	0	0	0	0	P	0
S-12	Condemnation of land and relocation of structures	0	P	0	0	0	0	P	0

NOTES:

- ¹PB - Provision of recreation beach
 FP - Protection of flooding and wave damage
 EC - Beach erosion control
 TBE - Protection of tourist base economy
²NED - National Economic Development
 EQ - Environmental Quality
 OSE - Other Social Effects
³RD - Regional Development
 F - Meet fully objective
 P - Meet partially objective
 0 - Not meeting objective



backup borrow area contains approximately 77.0 million cubic yards of beach fill material. The primary borrow site lies in 24 feet (7.3m) to 30 feet (9.1m) of water (Figure 6) and was visually inspected by an interagency team of scientists in July of 1993. This visual inspection confirmed that no hardbottom or seagrass habitat exists within the borrow site. An unidentified object was indicated by the side scan sonar survey (Figure 7). A visual inspection utilizing SCUBA did not reveal any object existing at the indicated coordinates. The borrow area consisted entirely of sand with the bottom scattered throughout with sand dollars. Exploratory borings were drilled offshore of Martin County in and immediately adjacent to the borrow area in 1978 and in 1993 (Figure 8). A geotechnical description of the sand from this borrow area can be found in Appendix A of this report.

7.00 EXISTING ENVIRONMENT CONDITIONS.

7.01 General Environmental Setting. The State of Florida is a portion of the Floridan Plateau, the plateau being exposed as dry land during periods of drop in sea level. Each retreat of the sea left behind a wide variety of hard marine deposits, which subsequently have been moved about by waves and currents. The movements of these deposits have formed present day sandy beaches, offshore bars, and barrier islands (Kennett 1982). Shore processes over time have enlarged and extended these barrier islands. Hutchinson Island is a 24 mile (38 kilometer) long and narrow barrier island with the Fort Pierce Inlet to the north, the St. Lucie Inlet to the south, the Indian River Lagoon to the west, and the Atlantic Ocean to the east (Figure 1). The general project area is composed primarily of multifamily homes, small condominium complexes, and large hotels facing either the Indian River Lagoon to the west or the Atlantic Ocean to the east. The project shoreline also includes a number of public parks. The dune system in this area that affords some protection of the shorefront development is subject to being overwashed and eroded away during severe winter storms. Because of this, erosion of the protective beach along Hutchinson Island is a severe seasonal problem. Much of the vegetation in the project area consists primarily of small grasses, herbs, and scrubs. In recent years, much of Florida's shoreline has become dominated by larger exotic vegetation such as the Australian pine (*Casuarina litorea*). These trees have a very shallow root system and tend to be more prone to being uprooted during very strong winds. The invasion of this destabilizing exotic species can be detrimental to nesting sea turtles as fallen trees and shallow root systems can entangle both turtle eggs as well as emergent hatchlings (National Research Council 1990).

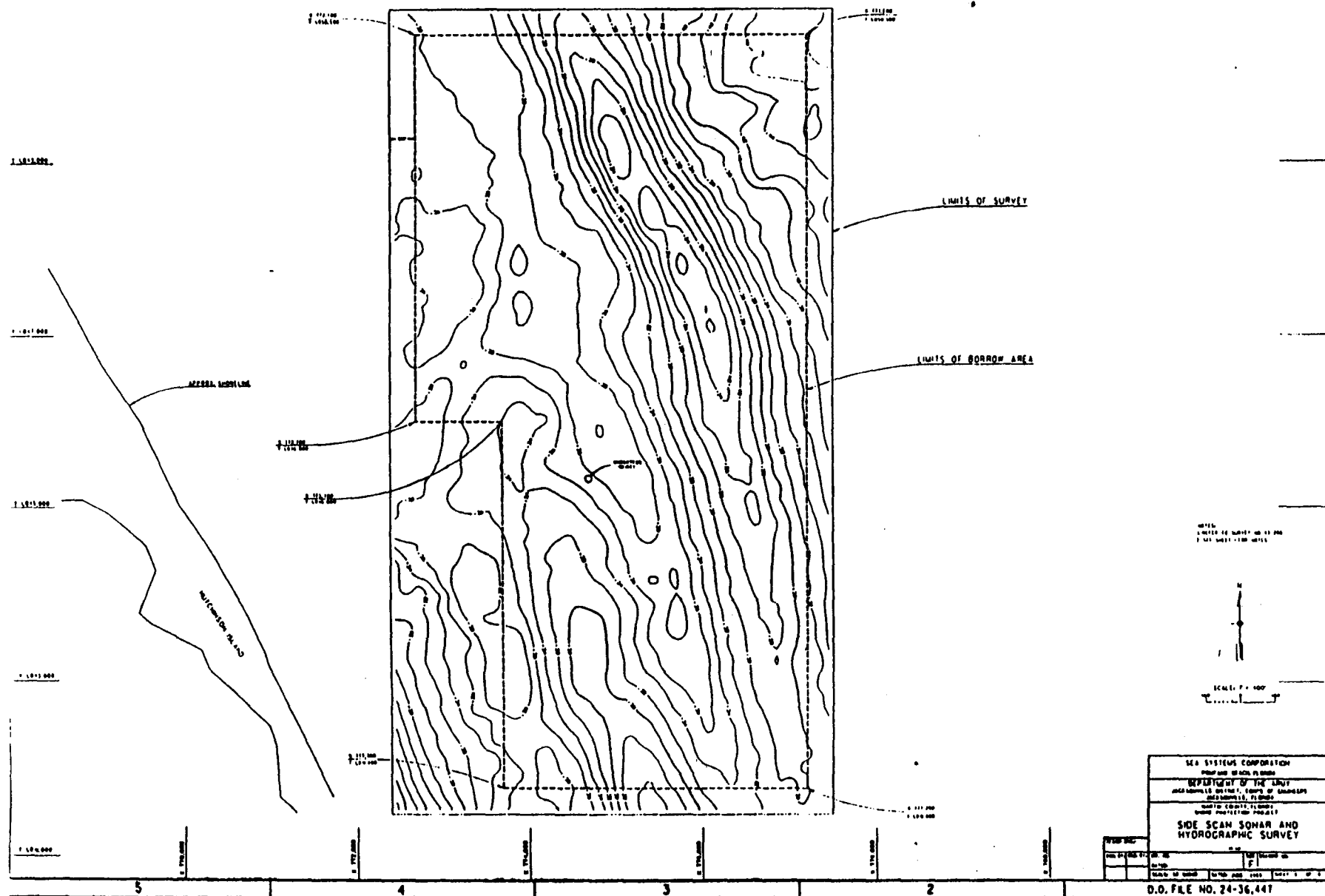


Figure 7. Side scan/bathymetric map of offshore borrow area.

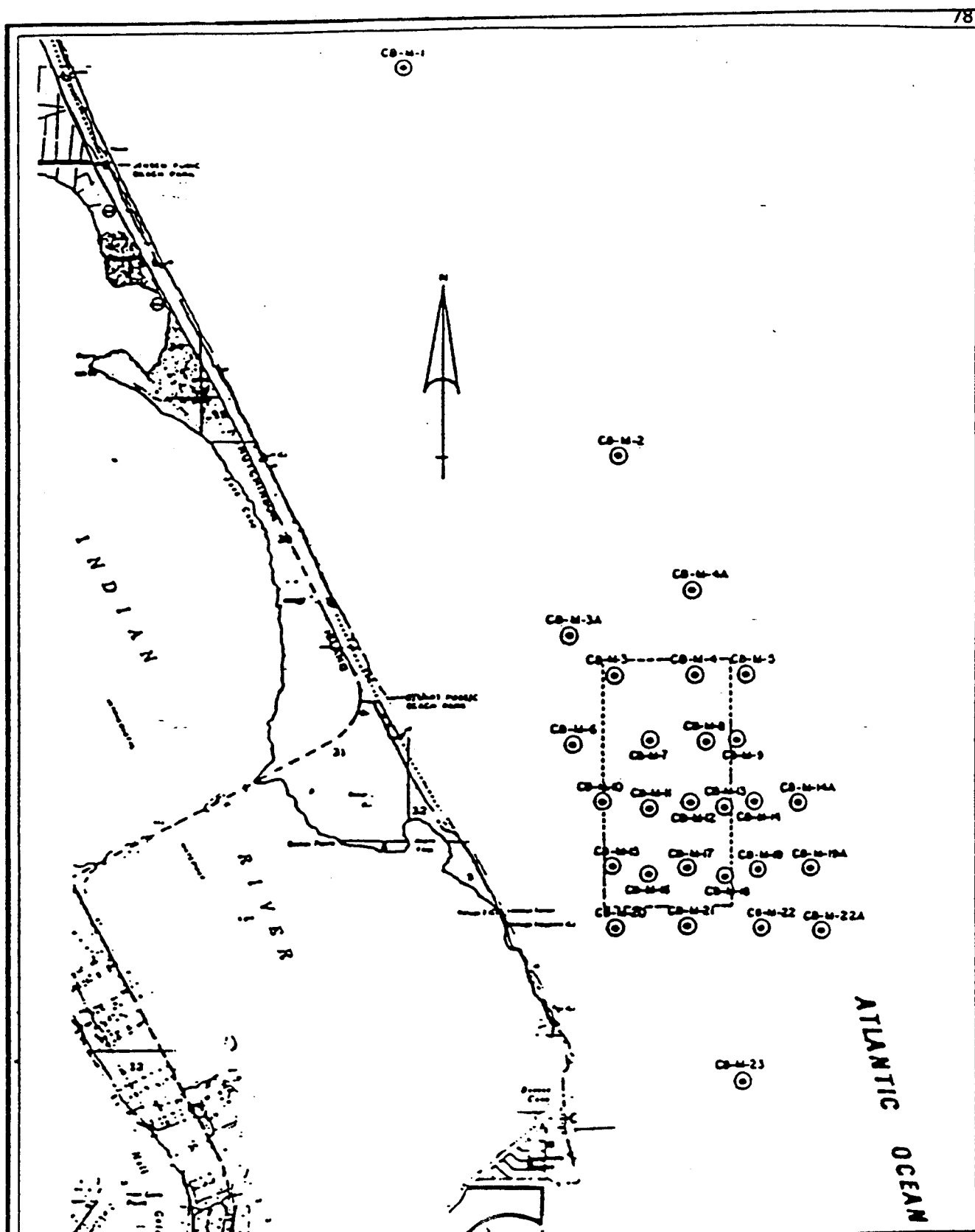


Figure 8. General locations indicating where geotechnical core borings were obtained.

SOURCE:

Applied Technology and Management, Inc. 1991.

7.02 Fish and Wildlife Resources. The biological communities found in the general project area are all well adapted to the particular physiochemical and hydrodynamic conditions associated with the supralittoral beach zone, intertidal swash zone, nearshore reefs, offshore reefs and the offshore borrow area. Because of the intermittent extensive development found throughout the project area, the majority of wildlife inhabiting the supralittoral zone likely consists of small rodents and reptiles. The motility of these species allows these organisms to seek protective refuge and forage for food in the beach grasses and tree stands that comprise a portion of this area. The beaches of Martin County are typical of south-central Atlantic coastal areas which are subject to very dynamic and stressful conditions. Inhabitants in the intertidal swash zone must cope with diurnal tides which leave many of these organisms aerially exposed for up to six hours at a time as well as being subjected to the high energy of the ocean waves. Typically, these habitats have low species diversity because of the harshness of the environmental conditions present. However, animals that are able to adapt to these dynamic conditions are faced with very little competition from other organisms. Hence, the populations that are able to survive in this dynamic zone usually consist of a very large number of individuals.

The Atlantic coquina clam (*Donax variabilis*) is a very common small mollusk that is well suited to living in areas of dynamic conditions where resuspension of material caused by wave action continually buries their burrows. With the passage of each wave, the clams rapidly dig a new burrow with their muscular foot appendage. Smaller crustaceans such as haustoriid amphipods have to continually burrow into the sand as each passing wave tends to wash away their burrows. Receding waves tend to wash amphipods and isopods out of their burrows and suspend these organisms into the nearshore water column where they serve as an important food source for many nearshore fish such as the Florida pompano (*Trachinotus carolinus*) and permit (*T. falcatus*). A variety of polychaete worms are also highly specialized for life in this dynamic environment and successfully adapt to these more turbid conditions. These intertidal organisms also provide an important food source for foraging shore and wading birds. Highly visible decapod crustaceans of the supralittoral zone include the ghost crab (*Ocypode quadrata*), mole crab (*Emerita talpoida*), and Atlantic fiddler crab (*Uca pugilator*). These organisms are highly motile and burrow into the moist sand for refuge and to retard water evaporation from their bodies during aerial exposure (Barnes 1974).

Both nearshore and offshore reefs are found along the entire Atlantic coast of Florida (Figure 9) and significantly contribute to the high biodiversity found in these areas. Limestone depositions which forms ridges and rocky outcrops and contributes

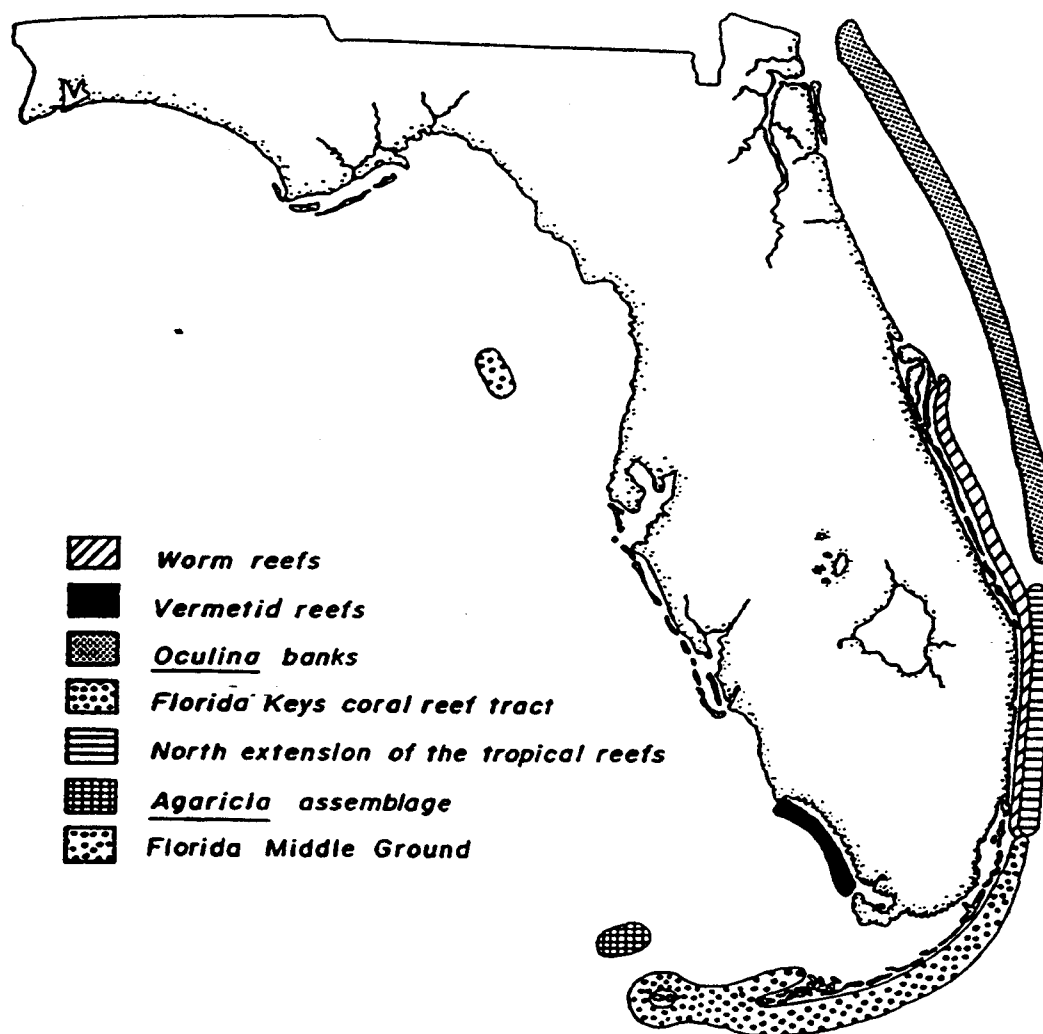


Figure 9. Distribution of Florida reef assemblages. Map units describe extent of potential habitat distribution; actual occurrences are often disjunct (patchy).

SOURCE: Japp, W. C. and P. Hallock. 1990. Coral Reefs. IN: R. L. Myers and J. J. Ewel (eds.). P. 574 - 616. Ecosystems of Florida. University of Central Florida Press. Orlando.

to live-bottom communities are found along the entire length of the project area. Live-bottom biota are among the most widely distributed benthic communities in Florida waters. Many of the rocky outcrops are carved and shaped by sand scouring and through bioerosion caused by rock-boring organisms such as clionid sponges and clams. From these erosional forces, the overall surface area of the rock structures is increased (an increase in rugosity) and forms important attachment sites for sessile organisms. The first inhabitants of these rocks usually are the attached algae. Herbivory by nearby crustaceans is well documented (Barnes and Hughes 1988) and the attached algae provide the primary food source for a wide variety of invertebrates. Crevices in these limestone outcrops provide important refuge for commercially important crustaceans such as the stone crab (*Menippe mercenaria*), blue crab (*Callinectes sapidus*) and spiny lobster (*Panulirus argus*). These limestone outcrops that form three dimensional structures provide the only vertical habitat found along vast expanses of sandy substrate. Large carnivores such as Great barracuda (*Sphyraena barracuda*), lane snapper (*Lutjanus synagris*) and yellowtail snapper (*Ocyurus chrysurus*), grouper (*Epinephelus* sp.) and sea bass (*Centropristis* sp.) are frequently found around these rocky structures. Smaller reef fish such as the sheepshead (*Archosargus probatocephalus*), porkfish (*Anisotremus virginicus*), hairy blenny (*Labrisoma nuchipinnis*), slippery dick (*Halichoeres bivittata*), and doctorfish (*Acanthurus chirurgus*) are also commonly seen foraging around the hardbottom habitat. A quantitative fish census was undertaken by the U.S. Fish and Wildlife Service and is reported in the Coordination Act Report (Appendix C).

Off the east coast of central Florida, varying vertical relief hardbottom structures are constructed by the tropical sabellarid marine bristle worm *Phragmatopoma lapidosa* (Figure 10). These worms collect sand grains of suitable size and the sand is then cemented together by mixing the sand grains with a protein mucus (Barnes 1974). The worm reefs expand as worm larvae settle on existing worm tubes and the entire process is continually repeated (Kirtley 1974, Jaap and Hallock 1991). These worm reefs provide two very important functions. First, as hardened structures, the reefs tend to help dissipate destructive wave energy. Second, the reefs provide attachment area for livebottom plants and structural habitat for a wide variety of invertebrates and fishes. Although these worm reefs are found from Cape Canaveral to Key Biscayne (Figure 9), they are best developed between St. Lucie and Martin counties off the Hutchinson Island coast.

The offshore borrow area is located in 24-36 feet (7.3m -10.9m) of water approximately 3,000 feet (909m) offshore of Hutchinson Island (Figure 4, Figure 6). Numerous species of relatively nonmotile infaunal invertebrates (mollusks) as well as motile



Figure 10. A closeup view of the marine bristle worm (*Phragmatopoma lapidosa*) collecting sand grains (white areas) for tube construction.

epifaunal invertebrates (crustaceans) may inhabit the borrow area. A side scan sonar survey of the borrow area revealed no hardbottom habitat exists within this area. An interagency team of scientists groundtruthed the borrow area utilizing SCUBA and verified that no hardbottom habitat exists within the borrow site. A team of diver biologists dove the borrow area in 1991 and collected benthic macroinvertebrates in the area as well as made a video recording of each sampling station. The substrate was described as containing fine to medium grain sand with a mixture of shell hash. The area consisted entirely of sand with no epifauna organisms seen except for the arrowhead sand dollar (*Encope emarginata*). A similar dive of the borrow area in 1993 revealed the same results. A strong current was present (approximately 0.5-1.0 knots) with arrowhead sand dollars (*E. emarginata*) scattered throughout the sandy substrate.

7.03 Threatened or Endangered Species. The approximate 206 mile (330 kilometer) stretch of beach along the Atlantic coast of Florida between St. Johns County and Palm Beach County (Figure 2) supports the largest number of nesting sea turtles in the western Atlantic (National Research Council 1990). The supralittoral zone of the project area provides nesting habitat for the endangered leatherback sea turtle (*Dermochelys coriacea*), threatened loggerhead sea turtle (*Caretta caretta*) and green sea turtle (*Chelonia mydas*). In addition, the endangered West Indian manatee (*Trichechus manatus*) frequently migrates in and out of the Indian River Lagoon through the Fort Pierce Inlet (Figure 1). During the winter months, the Atlantic coast of Florida is inhabited by migrating cetaceans such as the endangered right whale (*Eubaleana glacialis*). Table 2 and Table 3 list potential endangered and threatened species which may be found within the general project area and are under the jurisdiction of the U.S. Fish and Wildlife Service (Table 2) and National Marine Fisheries Service (Table 3). There is no designated or proposed critical habitat vital to the continued existence of any endangered or threatened species in the study area (Table 3).

7.04 Historic, Cultural, and Archeological Resources. Archival research, literature review, and coordination with the State Historic Preservation Officer (SHPO) have been completed for the Martin County Shore Protection Project. In compliance with 36 CFR Part 800, a magnetometer survey of the chosen offshore borrow area located northeast of the St. Lucie Inlet (Figure 4, Figure 8) was conducted between February 22-26, 1993. The report resulting from the fieldwork is titled *A Cultural Resource Magnetometer Survey for a Proposed Borrow Area, Martin County, Florida* by Wes Hall, Mid-Atlantic Technology. No potentially significant submerged archeological resources were identified in the offshore borrow area which will be used for the authorized project. In a May 7, 1993 letter, the SHPO concurred with the District's determination that no significant cultural resources

Table 2. List of Federally listed threatened and endangered species and candidates for Federal listing that may be present in south Hutchinson Island, Martin County

Scientific Name	Common Name	Status
Amphibians and Reptiles		
<u>Alligator mississippiensis</u>	American alligator	T(S/A)
<u>Caretta caretta caretta</u>	Atlantic loggerhead turtle	T
<u>Chelonia mydas mydas</u>	Atlantic green turtle	E
<u>Dermochelys coriacea</u>	Leatherback turtle	E
<u>Drymarchon corais couperi</u>	Eastern indigo snake	T
<u>Eretmochelys imbricata</u>	Atlantic hawksbill turtle	E
<u>Gopherus polyphemus</u>	Gopher tortoise	C2
<u>Heterodon simus</u>	Southern hognose snake	C2
<u>Lepidochelys kempfi</u>	Atlantic ridley turtle	E
<u>Ophisaurus compressus</u>	Island glass lizard	C2
<u>Pituophis melanoleucus</u>	Florida pine snake	C2
<u>mugitus</u>		
<u>Pseudobranchius striatus</u>	Gulf hammock dwarf siren	C2
<u>lustricolus</u>		
<u>Rana areolata aesopus</u>	Florida Crawfish frog	C2
<u>Sceloporus woodi</u>	Florida scrub lizard	C2
Birds		
<u>Aphelocoma coerulescens</u>	Florida scrub jay	T
<u>coerulescens</u>		
<u>Charadrius melodus</u>	Piping plover	T
<u>Dendroica kirtlandii</u>	Kirtland's warbler	E
<u>Falco peregrinus tundrius</u>	Arctic peregrine falcon	T
<u>Falco sparverius paulus</u>	Southeastern American kestrel	C2
<u>Haliaeetus leucocephalus</u>	Bald eagle	E
<u>Lanius ludovicianus migrans</u>	Migrant loggerhead shrike	C2
<u>Mycteria americana</u>	Wood stork	E
<u>Picoides borealis</u>	Red-cockaded woodpecker	E
<u>Polyborus plancus audubonii</u>	Audubon's crested caracara	T
<u>Vermivora bachmanii</u>	Bachman's warbler	E
Mammals		
<u>Blarina carolinensis</u>	Sherman's short-tailed shrew	C2
<u>(=brevicauda) shermani</u>		
<u>Neofiber alleni</u>	Round-tailed muskrat	C2
<u>Peromyscus (= Podomys)</u>	Florida mouse	C2
<u>floridanus</u>		
<u>Plecotus rafinesquii</u>	Southeastern big-eared bat	C2
<u>Scalopus aquaticus bassi</u>	Englewood mole	C2
<u>Trichechus manatus</u>	West Indian manatee	E
<u>latirostris</u>		
<u>Ursus americanus floridanus</u>	Florida black bear	C2
Plants		
	Family Anonaceae	
<u>Asimina tetramera</u>	Four-petal pawpaw	E

**Table 3. Endangered and threatened species and critical habitats
under National Marine Fisheries Service jurisdiction**

Florida: Atlantic Coast

<u>Listed Species</u>	<u>Scientific Name</u>	<u>Status</u>	<u>Date Listed</u>
finback whale	<u>Balaenoptera physalus</u>	E	12/02/70
humpback whale	<u>Megaptera novaeangliae</u>	E	12/02/70
right whale	<u>Eubaleana glacialis</u>	E	12/02/70
sei whale	<u>Balaenoptera borealis</u>	E	12/02/70
sperm whale	<u>Physeter catodon</u>	E	12/02/70
green sea turtle	<u>Chelonia mydas</u>	Th	07/28/78
hawksbill sea turtle	<u>Eretmochelys imbricata</u>	E	06/02/70
Kemp's (Atlantic) ridley sea turtle	<u>Lepidochelys kemp</u>	E	12/02/70
leatherback sea turtle	<u>Dermochelys coriacea</u>	E	06/02/70
loggerhead sea turtle	<u>Caretta caretta</u>	Th	07/28/78

SPECIES PROPOSED FOR LISTING

None

LISTED CRITICAL HABITAT

None

PROPOSED CRITICAL HABITAT

None

will be affected by the authorized project. No terrestrial archeological sites are recorded for the 4 mile (6.4km) eroded project beach segment of Hutchinson Island.

7.05 Water Quality. The State of Florida classifies surface waters from I (drinking water quality) to V (industrial water discharge quality). The biological composition of Class V waters is minimal due to the high toxicity of the water. The water quality around the St. Lucie Inlet and Atlantic Ocean has a State classification of III. This designation means that the surrounding waters are acceptable for recreational bathing, fishing, and wildlife management.

7.06 Hazardous, Toxic and Radioactive Wastes (HTRW). A Phase 1 HTRW study was performed. County records and numerous site inspections have shown that the area along the project shoreline consists primarily of residences and motels and is void of any heavy industry or repair shops. No hazardous or toxic wastes are believed to be in the project area or are knowingly discharged into the waters of the Indian River Lagoon or Atlantic Ocean. Due to the recreational nature of the Florida coastline, it is probable that some amount of petroleum byproduct from recreational boats and jet skis is discharged into the coastal waters adjacent to the project beach.

7.07 Aesthetic Resources. Consideration of aesthetic resources within the project study area is required by the National Environmental Policy Act of 1969 (NEPA), as amended and ER 1105-2-100. Aesthetic resources are defined as "those natural and cultural features of the environment that elicit a pleasurable response" in the observer, most notably from the predominantly visual sense. The four miles of project area public beaches have been eroded by past high tides and strong winds which have deteriorated the aesthetic character and qualities of the area. The authorized shore protection area is developed commercially and residentially and appears to be severely eroded. Residences protected by seawalls and bulkheads have been exposed due to intense wave action. Residential development appears to be in scale with the existing treeline and blends with it when viewed from a distance. Aesthetic resources of the proposed project area have been degraded annually by shoreline erosion.

7.08 Coastal Barrier Resources. The Coastal Barrier Resources Act of 1982 (Public Law 97-348) encouraged implementation of conservation measures on largely undeveloped coastal barrier islands along the Atlantic and Gulf of Mexico coasts. These conservation measures were designed to help conserve critical habitat for a variety of island flora and fauna. Due to the urbanization and highly developed nature of much of Hutchinson Island, there is little pristine or available terrestrial habitat along the immediate project area to support considerable biodiversity. The northern (St. Lucie County) half and southern

(Martin County) half of Hutchinson Island is not part of the Coastal Barrier Resources System.

7.09 Acoustical Quality. The shoreline along Hutchinson Island supports a considerable amount of human development, public recreation areas, as well as water sports such as fishing, boating, and jet skiing. As with much of the Florida coastline, noticeable noise levels are always present and normally seasonal in amplitude.

7.10 Air Quality. The coastal area of Hutchinson Island consists primarily of automobiles and heavy trucks/buses associated with human development and the tourist trade. The area consists of single family and multifamily homes, condominium complexes, and large hotels. The project area along the island does not support any heavy industry that could be associated with airborne particulates. The airborne particulates produced by motor vehicles are dispersed away from the project area with the aid of offshore ocean breezes. Martin County is designated as an attainment area for the criteria pollutants under the Clean Air Act.

7.11 Recreation. The recreation capacity and potential of the Martin County public beaches in the project area have been reduced due to the erosion of the barrier island. The eroded beach conditions do not present an appealing atmosphere for active or passive recreation use in the project area. During high tide there is very little dry beach available for passive or active recreation activities. Public parks have spent a considerable amount of money to enhance and preserve beaches for public use along high energy shorelines.

8.00 IMPACT OF THE PROPOSED ACTION.

8.01 General Environmental Setting. Numerous areas along the Hutchinson Island shoreline are primarily developed for residential, resort, and tourist accommodation purposes. Development includes restaurants, hotels, condominium complexes, and other service establishments catering directly or indirectly to tourists and other seasonal residents visiting the shore. The erosion of the shoreline along the project beach threatens to destroy many of these complexes. Extending the beach segment will make these developed areas less vulnerable to wave damage. The new beach will likely have a positive impact on the present dune system as well. Besides providing protection for the dunes from wave energy, the grasses and other beach vegetation will tend to trap wind blown sand, thereby further building up the dune system in the project area.

8.02 Fish and Wildlife Resources. Aerial photographs, side scan sonar surveys, and underwater visual assessments conducted by interagency teams of scientists have attempted to locate and "categorize" (as to their perceived ecological importance) all hardbottom reef tracts which exist adjacent to the project beach. Based upon these observations, the locations of all hardbottom areas can be found in Appendix D. Whether or not the beach nourishment project negatively impacts these hardbottom areas depends upon such variables as their distance from shore, relief, and composition (hermatypic coral, worm rock, or limestone).

Based upon 1992 shoreline surveys, expected geochemical composition of beach fill material (% fines), hydrodynamics of the nearshore project area (waves and currents), and position of hardbottom reef tracts (generally south of the project), Corps coastal engineers and biologists currently estimate that no hardbottom areas south of the project will be directly impacted (buried) by placing beach compatible sand onto the eroded project beach north of monument R-23.

Computer models have indicated that no direct impacts are expected to nearshore (depths less than -8.0 ft./-2.4m) low relief (less than 1.5 ft./0.5m) hardbottom reef tracts from implementing the project. Due to frequent scouring caused by wave energy which occurs around the hardbottom areas within the nearshore zone in depths of water less than 10-12 feet (3.0m to 3.6m), shallow water ephemeral coquina limestone outcrops and worm rock (*P. lapidosa*) generally do not support a large diversity of permanent plant and animal communities. Hard surfaces are continually scoured by resuspended sand. Encrusting soft coral, sponges, and sessile algae have a difficult time becoming established on hard surfaces in shallow water because of the constant sand scouring. The loss of these organisms represents a loss of organic carbon to the ecosystem and has a cascading "bottom up" control of higher trophic levels such as invertebrate scavengers and fish. Although these scoured ephemeral hardbottom areas are usually not of high biological quality, high relief (greater than 2 ft./0.6m) rock structures serve as important concentration areas for a large variety of commercial and sport fish. Within the nearshore project area (depths within -8.0 feet/ 2.4m), this nearshore hardbottom habitat is also potentially important to divers and snorklers. It is important to note that underwater visibility is generally poor (less than 2.0 feet/0.6m) during the winter months and throughout much of the year during periods of high wind and rain.

Sand is continually resuspended into the water column during heavy wave events. This increase in resuspended sand potentially buries low relief coquina limestone rock, scours off encrusting and sessile organisms, and negatively impacts the ability of site-dependent carnivores to visually locate their prey. Sand scouring can also create holes, crevices and ledges throughout

the rocky areas. These holes, crevices, and landward facing rock ledges formed by scouring create an excellent refuge for cryptic small fish and commercially important epibenthic invertebrates such as the stone crab (*M. mercenaria*) and spiny lobster (*P. argus*). The sloughing of beach fill sand will tend to increase sedimentation and scouring of nearshore hardbottom areas until the beach fill reaches equilibrium. In low relief ephemeral areas, this increase will present little, if any, problems since these reef areas are generally scoured or temporarily buried periodically anyway.

In reef areas that are permanent and subjected to less scouring events either through an increase in relief or distance from shore, increased sedimentation will likely cause no significant ecological impacts. Current computer models predict and Corps coastal engineers concur that it is likely that no reef tracts outside the project's influence or south of the project area will be directly impacted by the beach nourishment project. Secondary impacts from eroding sand may be experienced by hardbottom habitat and associated flora and fauna located seaward of the project beach as well as nearshore areas south of the project beach towards St. Lucie Inlet. Secondary impacts such as encrusting sponges and sessile algae being scoured off rock surfaces due to the increase in water column turbidity may occur. Holes, crevices, and hanging rock ledges may be partially or fully filled in from the increase in sand sloughing along the bottom. With the loss of autotrophic and heterotrophic invertebrates, small fish lose a valuable food source. When a protective refuge is lost, small fish become easy prey for the larger carnivores. Increases in water column sedimentation and burial of hardbottom areas may also be felt by divers and snorklers in the area as well. However, increases in turbidity and sedimentation are expected to be temporary in nature. Because background turbidity and sedimentation levels are naturally high in this area, no significant changes attributable to the beach nourishment project are expected.

Computer models currently estimate that the renourished material placed onto the project beach is expected to eventually drift south over the 11 year period until the next renourishment. The southern littoral drift of sand caused by the longshore current may eventually come into contact with up to 20.5 acres of hardbottom habitat (monument R-23 to R-42). The sand is expected to slough seaward of the project area (mainly between monuments R-2 and R-22) and gradually move south toward the St. Lucie Inlet over the 11 year period. Because of this gradual movement and naturally occurring dynamic conditions which exist south of the project area, no significant changes to these southern reef tracts are expected to occur because of the beach nourishment project. Since it is extremely difficult to accurately predict what, if any, impact will occur to these hardbottom areas without the implementation of a well planned, quantifiable monitoring

plan, a detailed description of the methods to be used to quantify and assess changes in the nearshore environment can be found in Appendix E.

As previously described in section 6.00, an underwater assessment of the borrow area indicated that no hardbottom habitat existed in this area. Because of the lack of benefits associated with high relief structures, little, if any, fish and epibenthic invertebrates are thought to permanently inhabit this area. Dredging will therefore have little, if any, impact on these organismal groups. The underwater assessment did note a large number of arrowhead sand dollars (*E. emarginata*) scattered throughout the sandy substrate. Dredging may directly impact these organisms by removing them and the increase in turbidity may bury them. These highly fecund invertebrates are expected to repopulate this area after dredging activity ceases.

8.03 Threatened or Endangered Species. Placing sand on the eroded beach has the potential to directly or indirectly harm threatened and endangered birds, mammals, and reptiles. Table 2 and Table 3 list the threatened and endangered species which may be found in and around the project area. Of the listed species, the Florida scrub jay (*Aphelocoma coerulescens coerulescens*) and the piping plover (*Charadrius melodus*) are birds which most likely may be found foraging in the supralittoral zone; the loggerhead sea turtle (*C. caretta*), the green sea turtle (*C. mydas*), and leatherback sea turtle (*D. coriacea*) will be found swimming in the offshore reefs and using the supralittoral zone for nesting; and the West Indian manatee (*T. manatus*) will be found foraging the nearshore reefs for drift algal mats as well as migrating in and out of St. Lucie Inlet.

Hutchinson Island supports the greatest concentration of sea turtle nesting activity in Florida and one of the largest loggerhead (*C. caretta*) nesting aggregates in the world (Ross 1982). Between 1985-1990, the project area produced 7,638 loggerhead (*C. caretta*), 189 green (*C. mydas*), and 55 leatherback (*D. coriacea*) sea turtle nests (Applied Biology, Inc.). As found elsewhere in Florida, the vast majority of the nests are laid during June, July, and August (Figure 11). Peak nesting activity is May through August for *C. caretta* (Table 4), June through August for *C. mydas* (Table 5), and April through June for *D. coriacea* (Table 6). Common sense tells us that widening an eroding beach will only serve to increase the total amount of nesting compatible beach available to nesting sea turtles. It is currently estimated that dredging will commence in either November or December and will continue through late March to April 15. Between 1985-1990 (6 years), a cumulative total of 2 nests were successfully dug in all of Martin County in March (an average of 0.33 nests/year) and 35 nests in April (an average of 5.8 nests/year). With this information in mind, possible impacts to nesting sea turtles are expected to be minimal. Tilling of the

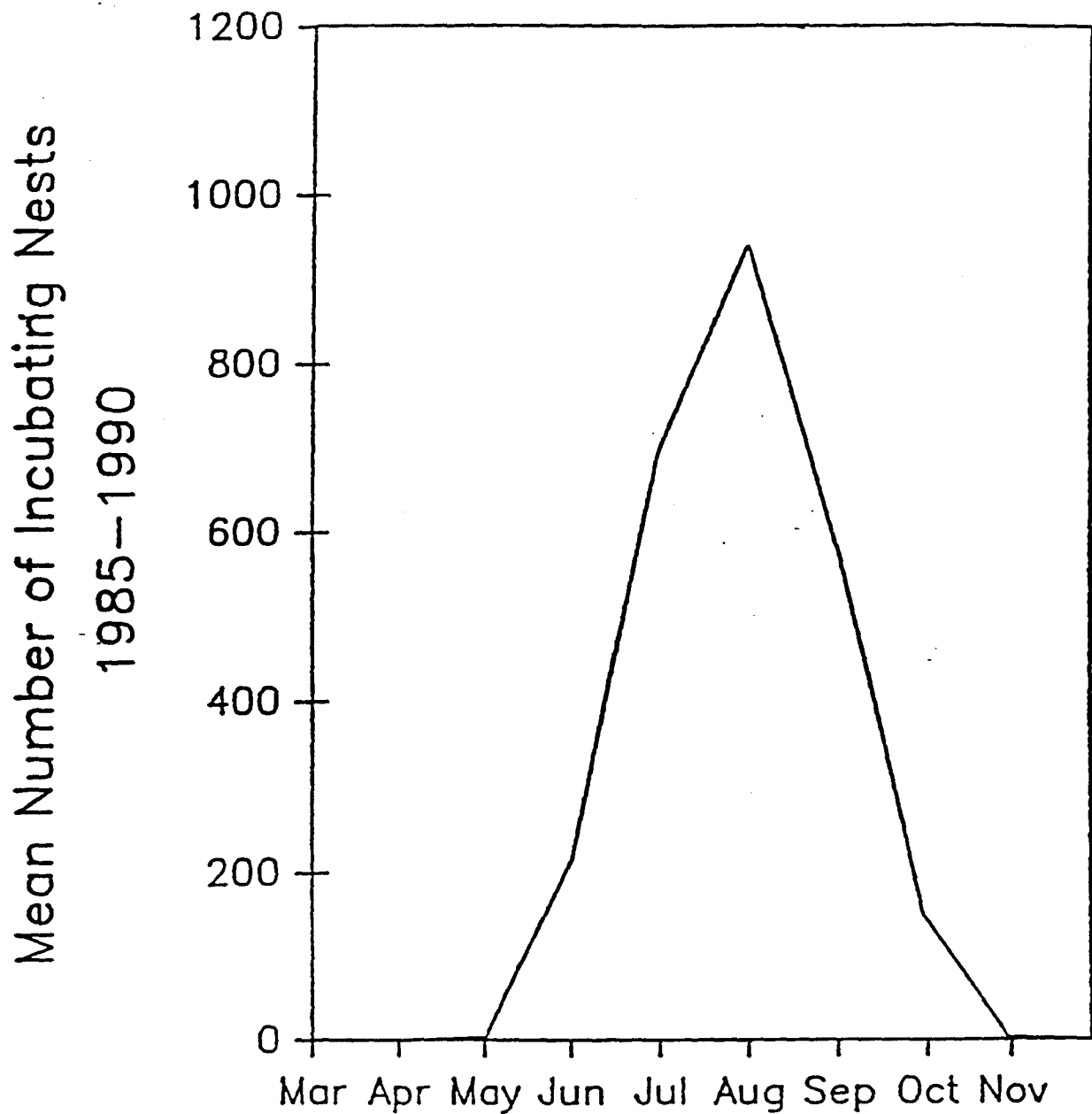


FIGURE 11. ESTIMATE OF MEAN NUMBER OF INCUBATING TURTLE NESTS THROUGH TIME FOR THE SOUTH HUTCHINSON ISLAND RESTORATION AREA, BASED ON 1985-1991 MONITORING DATA

Source: Mote Marine Laboratory, Inc., 1991.



Applied Technology and
Management, Inc.

Table 4. Sea Turtle Nesting Data for the Loggerhead Turtle (*Caretta caretta*) for Hutchinson Island, Martin County, Florida: Survey Areas X Thru Inlet

Year	MONTH							Total
	March	April	May	June	July	Aug	Sept	
1985	0	2	386	827	657	217	1	2090
1986	0	2	302	892	717	177	9	2099
1987	0	0	232	663	710	317	11	1933
1988	0	0	249	840	784	185	3	2061
1989	0	4	380	613	723	216	0	1936
1990	0	17	491	866	762	703	1	2340
TOTAL	0	25	2040	4701	4353	1315	25	12459
MEAN	0.0	4.2	340.0	783.5	725.5	219.2	4.2	2076.5
STD	0.00	5.90	89.36	105.87	40.34	46.18	4.26	135.83
MIN	0	0	232	613	657	177	0	1933
MAX	0	17	491	892	784	317	11	2340

Source: Applied Biology, Inc., Stuart, Florida.

Table 5. Sea Turtle Nesting Data for the Green Turtle (*Chelonia mydas*) for Hutchinson Island, Martin County, Florida: Survey Areas X Thru Inlet

Year	MONTH							Total
	March	April	May	June	July	Aug	Sept	
1985	0	0	0	7	12	11	1	31
1986	0	0	0	4	13	8	2	27
1987	0	0	0	6	16	22	4	48
1988	0	0	0	3	14	13	3	33
1989	0	0	0	8	13	12	0	33
1990	0	0	0	15	28	17	0	60
TOTAL	0	0	0	43	96	83	10	232
MEAN	0.0	0.0	0.0	7.2	16.0	13.8	1.7	38.7
STD	0.00	0.00	0.00	3.89	5.51	4.52	1.49	11.56
MIN	0	0	0	3	12	8	0	27
MAX	0	0	0	15	28	22	4	60

Source: Applied Biology, Inc., Stuart, Florida.

Table 6. Sea Turtle Nesting Data for the Leatherback Turtle (*Dermochelys coriacea*) for Hutchinson Island, Martin County, Florida: Survey Areas X Thru Inlet

Year	MONTH							Total
	March	April	May	June	July	Aug	Sept	
1985	1	1	7	4	0	0	0	13
1986	0	0	2	3	0	0	0	5
1987	0	0	6	5	1	0	0	12
1988	1	0	5	8	0	0	0	14
1989	0	6	7	2	2	0	0	17
1990	0	3	3	1	1	0	0	8
TOTAL	2	10	30	23	4	0	0	69
MEAN	0.3	1.7	5.0	3.8	0.7	0.0	0.0	11.5
STD	0.47	2.21	1.91	2.27	0.75	0.00	0.00	3.95
MIN	0	0	2	1	0	0	0	5
MAX	1	6	7	8	2	0	0	17

Source: Applied Biology, Inc., Stuart, Florida.

beach fill, monitoring of the project beach, and relocation to the nearest and safest beach segment will be implemented. Details on this plan can be found in section 9.00 of this EA. Hydraulic dredging risks entanglement and entrapment of pelagic sea turtles. Placing borrow material that is significantly different than the sand currently found on the beach in terms of color and texture can seriously impact the ability of sea turtles to nest and the embryonic development of the eggs in the underground chamber. Past projects have seen low silt dark material lightened when oxidized and exposed to sunlight. Lighter colored sand would make the egg chamber cooler and darker colored material warmer. Each temperature change could alter the sex ratios of the developing hatchlings (Dalrymple et al. 1985). Smaller grain sizes of sand placed on the beach may increase sand compaction (Nelson 1985, Nelson and Dickerson 1988), and make it difficult or even impossible for nesting sea turtles to successfully dig an egg chamber (National Research Council 1990). Although dredging, boat traffic, and construction equipment associated with the beach nourishment project each represents potential harm to nesting sea turtles, the National Research Council (1990) has assigned a "low" or "unimportant" qualitative ranking to these activities as they relate to mortality factors of nesting sea turtles (Table 7). Section 9.00 details the safety commitments that will be undertaken by the dredge operators as well as the earth moving construction crew to ensure the safety of pelagic sea turtles as well as their eggs.

8.04 Historic, Cultural, and Archeological Resources. As stated in section 7.04, no potentially significant archeological resources were identified in the offshore borrow area which will be used for the proposed Martin County Shore Protection Project. Placement of dredged material on the beach will not affect any known terrestrial archeological resources. The State Historic Preservation Officer (SHPO) concurred with the District's no effect determination in a May 7, 1993 letter.

8.05 Water Quality. Implementation of the beach fill plan will likely create a temporary elevation in turbidity levels during the dredging, construction, beach fill, and periodic nourishment phases. The quality and general characteristics of the material used to nourish the beach is the most important variable in assessing if the beach fill material can be considered environmentally acceptable to the nearshore area. The borrow material has an acceptable silt content (5%-7%) and is coarse enough that it is expected to settle out of the water column. The composition (ephemeral limestone, worm rock) of the nearshore hardbottom habitat will likely determine the extent to which these areas may be impacted from the placement of sand onto the eroded project beach. Ephemeral low relief coquina limestone rock may be buried because of increased sedimentation but will likely be re-exposed during future sand scouring. Being a temporary entity anyway, the overall impact on these ephemeral

Sea Turtle Mortality Associated with Human Activities

Table 7. A qualitative ranking of the relative importance of various mortality factors on juveniles or adults, eggs, and hatchlings with an indication of mortality caused primarily by human activities. Sources are listed in order of importance to juveniles or adults, because this group includes the life stages with greatest reproductive values.

Source of Mortality	Primarily Human Caused	Life Stage		
		Juveniles to Adults	Eggs	Hatchlings
Shrimp trawling	yes	high	none	unimportant
Other fisheries	yes	medium to low	none	unimportant
Non-human predators	no	low	high	high
Weather	no	low	medium	low
Beach development	yes	low	medium	low
Disease	no	low	unimportant	low
Dredging	yes	low	unimportant	unimportant
Entanglement	yes	low	unimportant	low
Oil-platform removal	yes	low	none	unimportant
Collisions with boats	yes	low	none	unimportant
Directed take	yes	low	medium	unimportant
Power plant entrainment	yes	low	none	unimportant
Recreational fishing	yes	low	none	unimportant
Beach vehicles	yes	low to unimportant	medium	unimportant
Beach lighting	yes	low to unimportant	unimportant	medium
Beach replenishment	yes	unimportant	low	low
Toxins	yes	unknown	unknown	unknown
Ingestion of plastics, debris	yes	unknown	none	unknown

SOURCE: National Research Council. 1990. Decline of the Sea Turtles Causes and Prevention. National Academy Press. Washington.

reef areas is considered negligible. Worm rock (*P. lapidosa*) may actually benefit from a temporary increase in turbidity if the increase is not exceedingly large or long in duration. *P. lapidosa* is capable of using the resuspended sand grains to further build and enlarge their rock tubes. As has been discussed throughout this EA, the beach nourishment project is not expected to directly impact any hardbottom habitat within the project area or south toward St. Lucie Inlet. Although eroded sand from the renourished beach is expected to flow south, this sand is not expected to significantly adversely impact any hardbottom areas south of the project beach. However, the overall short-term and long term impact of increased turbidity and sedimentation will be quantitatively assessed with the aid of an extensive monitoring plan (Appendix E). In any instance, State water quality standards will not be exceeded (within 29 NTUs of background conditions) for turbidity.

8.06 Hazardous, Toxic and Radioactive Wastes (HTRW). The offshore dredge, onshore staging area, and the vehicles and earth moving equipment all represent potential polluters due to the possibility of accidental spillage. All motorized vehicles will be maintained and appropriate precautions taken to ensure that no hazardous or toxic wastes are dumped either on the beach or into the nearshore waters.

8.07 Aesthetic Resources. The project beach aesthetics will be improved with the restoration of the primary dune crest, construction of a 35 foot (10.6m) wide beach berm, and seaward slopes to more gradually connect the beach with the ocean. The renourished beach will resemble a more scenic oceanside setting that will represent higher aesthetic value than the existing eroded conditions. The aesthetics of the borrow area for beach quality sand will not be adversely affected by the proposed project. Temporary construction impacts to aesthetics could include some increase in noise and air pollution. Some temporary increase in water turbidity might also occur.

8.08 Coastal Barrier Resources. There are no designated coastal barrier resources within the project area that will be affected by implementation of this project. The project area is not part of the Coastal Barrier Resources System.

8.09 Acoustical Quality. There may be increases in noise levels during the beach nourishment project due to the localized increase in vehicles and machinery. This short-term increase in noise levels will be localized in nature to the project area and will cease once the beach nourishment project is completed.

8.10 Air Quality. Small amounts of air toxicants can be expected to originate from project vehicles and machinery during the beach fill construction phase. These vehicles and machines

will be well maintained in order to reduce the unnecessary release of air toxicants into the atmosphere. Regardless, any toxicant released into the atmosphere is expected to be rapidly dispersed away from the project area by ocean generated breezes.

8.11 Recreation. Recreation on the public beaches will be temporarily interrupted by the shore protection project. The project beach recreation quality, capacity and potential will most likely increase with the shore protection project. The public beach areas will regain their appeal for passive and active recreation use. The entire project area will be restored to a pleasant and enjoyable resource again.

9.00 ENVIRONMENTAL COMMITMENTS.

The U.S. Army Corps of Engineers as well as Martin County and its contractors commit to avoiding, minimizing or mitigating for adverse effects during and after construction activities by including the following commitments in the project contract plans and specifications:

(1) The contractor shall inform dredge personnel of the potential presence of sea turtles in the project area, the turtles' endangered status, the need for precautionary measures, and the Endangered Species Act prohibition on taking sea turtles. Every effort will be made to undertake this project primarily during the winter months (November-March) when any sea turtle in the area will be offshore of Hutchinson Island foraging on the offshore reefs. The project beach will be monitored and any nest in danger of construction activities will be relocated. A complete discussion of the precautions that will ensure the safety of nesting sea turtles can be found in section 8.03 of this EA as well as Appendix C.

(2) Precautions will be taken by the contractor during construction activities to insure the safety of the manatee. To insure the contractor and his/her personnel are aware of the potential presence of the manatee foraging in the project area, its endangered status and the need for precautionary measures, the contract specifications will include the standard protection clauses concerning the manatee.

(3) The contractor will instruct all personnel associated with construction of the project about the potential presence of manatees in the borrow area, nearshore reef areas, the entrance to the St. Lucie Inlet and the need to avoid collisions with manatees. All personnel will 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 this project.

(4) If a manatee is sighted within 100 yards (90.9m) of the dredging area, appropriate safeguards will be taken by the contractor, including suspension of dredging, if necessary, to avoid injury to manatees.

(5) Turbidity will be monitored at both the dredging and discharge sites. Should the monitoring reveal turbidity levels above State standards in the vicinity of the dredge, work will be suspended until turbidity levels return to within State standards.

(6) All practical measures will be taken by the construction crew to avoid adverse impacts to hardground habitat and associated communities. These measures have included predredging surveys to locate all hardground areas. Above water surveys have been completed by the U.S. Fish and Wildlife Service and underwater surveys have been conducted by an interagency team of diver biologists. Anchoring of any dredge barge will be permitted in sandy areas only.

(7) The project area and the area south toward the St. Lucie Inlet will be monitored to document and quantify what changes, if any, are occurring to the hardbottom habitat south of the project (monuments R-23 to R-42). A proposed monitoring and mitigation plan can be found attached as Appendix E of this Final EA.

10.00 COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS.

10.01 National Environmental Policy Act of 1969, as amended. Environmental information on the project has been compiled and this Draft Environmental Assessment (DEA) was prepared and circulated to appropriate local, State, and Federal agencies as well as interested academic institutions and citizens prior to finalization in accordance with the National Environmental Policy Act (NEPA). Comments received from these sources have been addressed in the Final Environmental Assessment. Letters of comment are included in Appendix G.

10.02 Endangered Species Act of 1973, as amended. A list of endangered, threatened, proposed, or candidate species was received from the U.S. Fish and Wildlife Service (FWS) dated December 16, 1992, and from the National Marine Fisheries Service (NMFS) dated November 16, 1992. Consultation was initiated with the NMFS on August 27, 1993, with the submittal of a Biological Assessment (BA). Concurrence with the determination that populations of endangered/threatened species under the purview of the NMFS will not be adversely affected by the project was

completed on September 15, 1993. Consultation was initiated with USFWS on November 3, 1992, with a request for a list of Federal threatened and endangered plants and animals that may be potentially present in and around the borrow area and beach nourishment project area. The BA was sent to the FWS on August 23, 1993. Previously, the USFWS provided the Corps with a Biological Opinion (BO) dated February 8, 1989. Under Section 9 of the Endangered Species Act, this BO allowed for the relocation of sea turtle eggs, where necessary (see Appendix C). This policy has recently been changed to further minimize incidental take of sea turtles and the FWS now recommends that beach nourishment activities be conducted outside of the nesting season (approximately March 1-November 30 in this area). The Corps does not believe that this recommendation is scientifically justified (Section 8.03) and has recently brought this turtle nesting data information to the attention of the FWS (Appendix F). Based on this information, the Corps was notified on November 3, 1993, via telephone that the FWS would modify their BO to allow dredging between November 1 and April 15. Refer to the summary section in the Fish and Wildlife Coordination Act Report, Appendix C. This project has been fully coordinated under the Endangered Species Act; therefore, is in full compliance with the Act.

10.03 Fish and Wildlife Coordination Act of 1958, as amended. The purpose of this Act is to require the Corps to consult with the FWS and the appropriate State fish and wildlife agencies to seek their expert input into how best to manage and modify, if needed, the selected project plan that will help minimize or eliminate any potential adverse impacts to these biological resources. The Corps has been in close contact throughout the field assessment and planning process with FWS and the Florida Department of Environmental Protection. The FWS has assessed the biological resources of the project area and their analysis, comments, and recommendations concerning potential impacts of the project can be found in the attached *Fish and Wildlife Coordination Act Report* (Appendix C). To summarize, the FWS recommends that (1) aerial photographs of the nearshore project area be taken to further quantify the amount of hardbottom habitat which exists adjacent to the project area; (2) impacts to the nearshore hardbottom habitat within the southern 2,500 feet (758m) be avoided (anything south of monument R-23) because of the presence of nearshore hardbottom habitat; (3) all impacted hardbottom habitat should be mitigated for; (4) at least one acre of designed reef should be deployed before sandpumping begins; and (5) all beach nourishment activities be conducted outside of the sea turtle nesting season (the FWS Turtle Coordinator advises after November 1 and before April 15). This Draft Environmental Assessment (EA) with the Proposed Hardbottom Monitoring and Mitigation Plan (Appendix E) responds and addresses these recommendations. With the above consultations, the requirements put forth by this Act have been met.

10.04 National Historic Preservation Act of 1966, as amended. 16 USC 470 et seq., as amended by PL 102-575, 2 Nov 92. The head of any Federal Agency having direct or indirect jurisdiction over a proposed Federal or Federally assisted undertaking shall take into account its effect on any district, site, building, structure, or object that is included, or is eligible for inclusion in the National Register of Historic Places (Advisory Council on Historic Preservation Regulations, 36 CFR Part 800, 44 F.R. 6068, 30 Jan 79).

Consideration of effects are addressed in the body of this NEPA document and comments have been received from the State Historic Preservation Officer (SHPO). The SHPO concurred with the District's determination that there are no significant cultural resources in the proposed borrow area and that placement of sand on the beach will not affect cultural resources included in or eligible for inclusion in the National Register of Historic Places.

10.05 Archeological and Historic Preservation Act (PL 93-291). Cultural resource coordination with the SHPO was conducted for the proposed beach nourishment project. In a May 7, 1993 letter, the SHPO concurred with the District's determination that the proposed project would have no effect on significant cultural resources.

10.06 Executive Order 11593. In compliance with this Executive Order, cultural resource investigations were conducted and the beach nourishment project was coordinated with the SHPO. No known resources included in or eligible for inclusion in the National Register of Historic Places will be affected by the proposed project.

10.07 Clean Water Act of 1972, as amended. This study is in partial compliance. Full compliance will be achieved with issuance of a Section 401 permit from the State. A Section 404(b) Evaluation is included in this report as Appendix A.

10.08 Clean Air Act of 1972, as amended. Martin County is designated as an attainment area for the criteria pollutants under the Act and is not governed by a State Implementation Plan (SIP). Since the project area is within an attainment area the EPA rules for conformity determination do not apply. No permits will be required for this project. The project is in full compliance with the Act.

10.09 Coastal Zone Management Act of 1972, as amended. A Federal consistency determination in accordance with 15 CFR 930 Subpart C is included in this EA as Appendix B. The GDM and draft EA was reviewed for consistency by the State of Florida. In a letter dated March 9, 1994 (Appendix G), the State Clearinghouse stated that the project is consistent with the

Florida CZMP at this stage. Final consistency will be obtained when water quality certification is issued by the State.

10.10 Farmland Protection Policy Act of 1981. No prime or unique farmland will be impacted by implementation of this project. This act is not applicable.

10.11 Wild and Scenic River Act of 1968, as amended. No designated Wild and Scenic river reaches will be affected by project related activities. This act is not applicable.

10.12 Marine Mammal Protection Act of 1972, As Amended. Incorporation of the safe guards used to protect threatened or endangered species during dredging and disposal operations will also protect any marine mammals in the area, therefore, this project is in compliance with the Act.

10.13 Estuary Protection Act of 1968. No designated estuary will be affected by project activities. This act is not applicable.

10.14 Executive Order 11990, Protection of Wetlands. There is no submerged aquatic vegetation within the project area. Therefore, the goals of this Executive Order are not applicable.

10.15 Executive Order 11988, Floodplain Management. The selected plan is in the base floodplain (100-year flood) and has been evaluated in accordance with Executive Order 11988. Refer to the main body of the GDM. This project is in compliance with the goals of this Executive Order.

11.00 **COORDINATION.** This 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 Historic Preservation Officer (SHPO), and the Florida Department of Environmental Protection. A Draft Environmental Assessment (DEA) was circulated for agency review prior to its preparation as a Final Environmental Assessment. Letters of comment on the DEA can be found in Appendix G.

12.00 **PUBLIC INVOLVEMENT.** A Scoping Letter describing the project and soliciting comments was sent to interested governmental agencies, academic institutions, and the interested public on December 10, 1992. Letters of comment resulting from scoping can be found in Appendix F. The DEA was circulated for a forty-five (45) day public review. Letters of comment on the DEA and responses to any significant comments are in Appendix G.

The Draft Environmental Assessment was sent to the following agencies and interested parties:

U.S. Environmental Protection Agency, Washington, D.C.
U.S. Department of Commerce (NOAA), Washington, D.C.
Federal Maritime Commission, Washington, D.C.
Federal Emergency Management Administration, Washington, D.C.
Department of the Interior, Washington, D.C.
Department of Energy, Washington, D.C.
Advisory Council on Historic Preservation, Washington, D.C.
Department of Housing and Urban Development, Atlanta, Georgia
Regional Director, U.S. Fish and Wildlife Service, Atlanta, GA
U.S. Fish and Wildlife Service, Vero Beach, Florida
Seventh Coast Guard District, Miami, Florida
U.S. Environmental Protection Agency (Region 4), Atlanta, Georgia
Insurance and Mitigation Division (FEMA), Atlanta, Georgia
U.S. Geological Survey, Stuart, Florida
National Marine Fisheries Service, Panama City, Florida
National Marine Fisheries Service, St. Petersburg, Florida
Florida State Clearinghouse, Tallahassee, Florida
Florida Department of Environmental Protection, Tallahassee, FL
Florida Dept. of Env. Protection, Port St. Lucie, Florida
Florida Division of Historic Resources, Tallahassee, Florida
Florida Game and Fresh Water Fish Commission, Vero Beach, Florida
Florida Marine Fisheries Commission, Tallahassee, Florida
South Florida Water Management District, West Palm Beach, Florida
Treasure Coast Regional Planning Council, Palm City, Florida
Indian River Lagoon National Estuary Program, Melbourne, Florida
St. Lucie County Department of Public Works, Fort Pierce, Florida
Board of County Commissioners, Stuart, Florida
Superintendent of Beach & Waterways, Martin Co., Stuart, Florida
County Engineer, Martin County, Stuart, Florida
Honorable Connie Mack, Tallahassee, Florida
Honorable Bob Graham, Tallahassee, Florida
Honorable Tom Lewis (16th District), Palm Beach Gardens, Florida
Florida Audubon Society, Maitland, Florida
Florida Wildlife Federation, Tallahassee, Florida
Wilderness Society, Coral Gables, Florida
Prof. John Gifford, University of Miami (RSMAS), Miami, Florida
Harbor Branch Oceanographic Inst., Fort Pierce, Florida
Florida Shore & Beach Preservation Association, Stuart, Florida
Applied Technology & Management, Inc., West Palm Beach, Florida
Applied Technology & Management, Inc., Gainesville, Florida
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16.00 APPENDICES.

Appendix A - Section 404(b) Evaluation

Appendix B - Florida Coastal Zone Management Program Federal Consistency Evaluation

Appendix C - Fish and Wildlife Coordination Act Report

Appendix D - Location of Hardbottom Habitat

Appendix E - Proposed Hardbottom Monitoring and Mitigation Plan

Appendix F - Relevant Correspondence

Appendix G - Comments and Responses to the Draft Environmental Assessment

Appendix A

**Section 404 Evaluation Report
Martin County Shore Protection Project
Hutchinson Island, Martin County, Florida**

SECTION 404 (b) EVALUATION REPORT
MARTIN COUNTY SHORE PROTECTION PROJECT
HUTCHINSON ISLAND, MARTIN COUNTY, FLORIDA

I. Project Description

a. Location. Martin County is located along the southeastern Atlantic coast of Florida approximately 38 miles (61km) north of the City of West Palm Beach. The coastal City of Stuart is located in the eastern portion of the county facing the Indian River Lagoon. The project beach is located on a barrier island with the Indian River Lagoon (and Stuart) to the west. Hutchinson Island is a 24.0 mile (38.4km) long barrier island with Fort Pierce Inlet to the north, St. Lucie Inlet to the south, the Indian River Lagoon to the west, and the Atlantic Ocean to the east.

b. General Description of Project. The beach nourishment project authorizes construction of a protective and recreational beach along a 4.0 mile (6.4km) reach of eroded shoreline from Florida Department of Environmental Protection (DNR) monument number R-1 at the St. Lucie/Martin County line to 0.25 miles (0.4km) south of the southern boundary of Stuart Public Beach Park (monument R-25). In order to eliminate or reduce the risk of beach fill impacting nearshore hardbottom habitat along the project area, the project has been shortened by approximately 2,000 feet (606m). Beach fill will be placed between monuments R-1 and R-23 (the hardbottom habitat begins just south of R-22). The fill will be tapered between R-21 and R-23 (Figure 3) to avoid direct impacts to hardbottom habitat. No beach fill will be put on the beach south of monument R-23. Fill material will be obtained from a borrow area located approximately 3,000 feet (909m) offshore of the barrier island. The dune system which currently affords some protection of the existing residential and commercial development in the project area are low and have been observed to be receding each year. The dune system will be rebuilt along the entire length (R-1 to R-25) of the authorized project.

c. Authority and Purpose. A study of the erosion problems occurring along the Martin County shoreline was conducted at the request of the Committee on Public Works in a resolution dated 18 May 1973. The Martin County Shore Protection Project was authorized in the Water Resources Development Act of 1990. The authorized project allows for the restoration of a protective and recreational beach along the 4.0 miles (6.4km) of shoreline from the St. Lucie/Martin County line (monument R-1) south to 0.25 miles (0.4km) south of monument R-25. The *Revised Feasibility Report with Environmental Impact Statement* was published in June of 1986.

d. General Description of Dredged or Fill Material

(1) General Characteristics of Material. The most recent geotechnical investigations were undertaken in 1990. The existing beach material varies in shell and silt content throughout the beach. The composite mean grain size is 1.91 phi (0.27mm) with a composite sorting (+/- standard deviation) of 1.41 or moderately sorted. The estimates of shell content ranged from 1 to 95 percent, with a mean value of 27 percent. Silt content along the existing beach has a mean value of approximately 5 percent. The offshore borrow material from Gilbert Shoal is generally coarse to medium calcareous sand with a grain size averaging 1.41 phi (0.38mm). As the calcareous material is composed of shell with a low silt content (approximately 5%), it has been determined that the shoal material is suitable for beach nourishment.

(2) Quantity of Material. It has been estimated that the offshore Gilbert Shoal borrow area contains approximately 6.0 million cubic yards of clean sand, the majority of which has a silt content of less than 5%-7%. The majority of the material is coarse calcareous sand with varying amounts of quartz. A geotechnical comparison (mean grain size and silt content) between the material currently on the beach and the material in the offshore borrow area demonstrates that these materials are similar and would be compatible as a beach nourishment source. It is estimated that the project beach will require approximately 1,000,000 cubic yards of beach compatible fill material.

(3) Source of Material. The shoal of interest (borrow area) is located 3.0 miles (4.8km) north of St. Lucie Inlet and 3,000 feet (909m) offshore of the southern portion of Hutchinson Island in approximately 30 feet (9.1) of water. An underwater visual assessment undertaken by an interagency team of diver biologists revealed that no productive habitat (seagrass, coquina limestone rock, worm rock) exists anywhere within the boundaries of the borrow area.

e. Description of the Proposed Discharge Site

(1) Location. The authorized project calls for construction of a protective and recreational beach along a 4.0 mile (6.4km) reach of shore beginning just south of the St. Lucie/Martin County line (monument R-1) and continuing south to approximately 0.25 miles (0.4km) south of monument R-25. The sand currently in the project area experiences severe erosional problems from the dynamic oceanographic conditions common to this area of the Atlantic coast of Florida. Sand is continually scoured away and redistributed during winter northeast storms and

summertime thunderstorms. Because of the presence of nearshore hardbottom habitat, the authorized project has been redesigned (shortened to 3.75 miles/6.0km) to lessen possible environmental impacts.

(2) Size. It is currently estimated that approximately 1,000,000 cubic yards of beach compatible fill material will be placed upon a portion of the significantly eroded beach along the southern half Hutchinson Island in Martin County between monuments R-2 and R-22. The beach fill will be tapered at the northern (R-1 to R-2) and southern (R-21 to R-23) ends of the redesigned project.

(3) Type of Site. The disposal site is a segment of eroded beach consisting primarily of existing calcareous sand, sparse salt-tolerant beach vegetation and a low lying dune system. Because of the steep slope of the beach and the vulnerability of this coastline to severe northeast storms, the nearshore zone is extremely dynamic with sand scouring and ephemeral conditions present throughout.

(4) Type of Habitat. The supralittoral zone habitat consists primarily of eroding carbonate and shell sand. A low lying dune system is present with sparse grasses and other salt tolerant vegetation inhabiting this area. The intertidal swash zone is thought to consist of primarily infaunal mollusks, crustaceans, and polychaete worms. Seaward of these zones, the inshore reef habitat is influenced by storm wave scour which periodically buries these structures. Sabellarid tropical worm reefs are located throughout the project area at various distances from shore. The majority of the nearshore hardbottom habitat is located at the southern end of the project area between monuments R-22 and R-25.

(5) Timing and Duration of Discharge. The initial construction phase of the authorized project is estimated to begin approximately December 1994. Once construction activities commence, it is anticipated that the project will require approximately 4 months to complete. Every effort to adhere to this schedule will be made in order to lessen any possible impacts to nesting sea turtles (the major portion of the nesting season generally begins along the project beach by mid-April). The U.S. Fish and Wildlife Service recommends that construction activities commence after November 1 and end prior to April 15.

f. Description of Disposal Method. Beach compatible fill will be excavated from the offshore Gilbert Shoal borrow area. The material will be graded and shaped by earthmoving equipment in order to achieve the desired beach profile.

II. Factual Determinations

a. Physical Substrate Determinations.

(1) Substrate Elevation and Slope. The cross-sectional configuration of the beach fill for the redesigned project provides for a protective and recreational beach from just south of the St. Lucie/Martin County line (Florida Department of Environmental Protection (DNR) monument marker R-2) to just south of DNR monument marker R-22. The beach fill will be tapered between DNR monuments R-1 and R-2 at the northern end and between R-21 and R-23 at the southern end. The beach fill design cross section will restore a primary dune crest 20 feet (6.1m) wide at +12.5 feet (3.8m) mean sea level (MSL), a 35 foot (10.6m) wide beach berm at +8.0 feet (2.4m), and seaward slopes of 1V:8 1/2H to 0 mean low water (MLW), then 1V:20H to the existing bottom.

(2) Sediment Type. The beach compatible sand to be used as beach fill material will be obtained from the offshore Gilbert Shoal borrow area. The sand is primarily calcareous with a mixture of shell and contains a small (5%-7% or less) amount of silt.

(3) Dredge/Fill Material Movement. The fill material will be subject to erosion by waves with the net movement of fill and upland material expected to be seaward, forming an offshore bar. This bar will be subject to littoral transport to the south by longshore currents. The eroded beach fill material is expected to move offshore and south towards the St. Lucie Inlet. Approximately 20.5 acres of hardbottom habitat exists south of the project area between R-23 and R-42. An assessment of the environmental consequences of this movement on hardbottom areas has been thoroughly discussed throughout the Final EA.

(4) Physical Effects on the Benthos. Non-motile benthic organisms may be directly buried by the beach fill and those found in the borrow site could be excavated. Some burrowing organisms may be able to burrow up through the fill material. Attached epifauna seaward of the project area may be impacted by both direct burial and short-term increases in turbidity levels. Because of the high fecundity and high turnover rate of many benthic invertebrates, recolonization in the project and borrow area by these species is expected in a relatively short period of time (usually within a matter of months). A significant portion of the benthos along the nearshore zone adjacent to the project beach consists of tropical sabellarid worm (*Phragmatopoma lapidosa*) and ephemeral coquina limestone reefs. These structures are periodically buried and reappear due to shifting sand. Because of the dynamic conditions that they are readily adapted to (sand scouring, periodic burial), it is unclear as to

whether placing beach compatible material on an eroding beach will have any long term adverse impacts to these reefs. Further speculation and discussion of possible impacts along with proposed monitoring and mitigation is discussed in considerable detail in Appendix E of this Final EA.

(5) Other Effects. Elevated turbidity levels attributed to the beach nourishment project in the nearshore swash zone will be a temporary condition. Organisms inhabiting the intertidal zone are primarily burrowers which are readily adapted to being periodically buried by resuspended material as well as sabellarid worms which use resuspended material to build their hardened tubes. Dynamic conditions that currently exist in the nearshore zone adjacent to the project area have forced organisms living in this area to adapt to natural conditions such as periodic resuspension of material into the water column as well as sand scouring and burial.

b. Water Circulation, Fluctuation and Salinity Determinations

(1) Water.

(a) Salinity. Because of water movement in and out of the project area from the dynamic oceanographic conditions found along the Atlantic coast in this area, placement of carbonate and shell fill is not expected to cause any change to the salinity of nearshore waters.

(b) Water Chemistry. The shell and carbonate fill does not readily break down in water. Therefore, no significant long term changes in the chemical makeup of the nearshore environment are anticipated.

(c) Clarity. There will be a temporary increase in turbidity during the construction process. The fill material is dense (low silt content) and will resist resuspension in the water column. The oceanographic conditions in this area are very dynamic and beach material is constantly being eroded away and resuspended by wave energy. Therefore, short-term elevated turbidity levels during the construction phase are not expected to significantly alter background water clarity seaward of the project area.

(d) Color. Fill placement will have no long-term or significant impact.

(e) Odor. The fill material is an odorless mixture of

shell and carbonate sand.

(f) Taste. Beach compatible fill material will have no effect on the taste of nearshore waters.

(g) Dissolved Gas Levels. Even with elevated turbidity levels during construction and possible reduction in autotrophic organisms normally associated with this condition, no reduction in dissolved gas levels is expected. Because of the nearshore water agitation caused by breaking waves, dissolved oxygen levels in the water column should not experience any significant reduction.

(h) Nutrients. The beach fill material consists primarily of a mixture of calcareous sand and shell with small amounts of quartz. Because of the low silt content of the material (5%-7% or less), no increase in nutrient levels is expected.

(i) Eutrophication. Because of water exchanges from tides and currents, no significant buildup of macronutrients in the project area is expected. Therefore, there will be no change in the trophic status of the nearshore waters.

(2) Current Patterns and Circulation.

(a) Current Patterns and Flow. The most significant ocean current that exists off the east coast of Florida is the Gulf Stream. With the exception of intermittent local reversals, its flow is northward. The average annual current velocity is approximately 28 miles (45km) per day, about 17 miles (27 km) per day in November and about 37 miles (59km) per day in July. In the study area, offshore and longshore transport of materials is also seasonal in nature. In the winter, the southward littoral movement is the dominant direction of the longshore current.

(b) Velocity. Based on available data (1978), the average wave period that strikes the shoreline along much of Hutchinson Island is about 6.7 seconds. Placing beach fill on an eroding beach is not expected to impede or change water movement along the shoreline. The project would have no adverse impact. The wind generated waves and currents are the primary causes of losses of sand from the beaches, and cause most of the shoreline damage in the project area.

(c) Stratification. Because of the dynamic oceanographic conditions and currents originating from the Fort Pierce Inlet, it is highly unlikely that thermal or haline stratification ever exists. The project will have no adverse impact.

(d) Hydrologic Regime. The project will have no adverse impact.

(3) Normal Water Level Fluctuations. - Tides along Hutchinson Island are semidiurnal (two nearly equal high waters and two nearly equal low waters each tidal day). The mean range of tides along Hutchinson Island is 2.6 feet (0.8m), and the spring tidal range is approximately 3.0 feet (0.9m). Wind set-up (piling up of water on the shoreline) has significantly more effect on seasonal and long-term water fluctuations than astronomical tides. The average annual wave height seaward of the intertidal swash zone along Hutchinson Island is about 2.1 feet (0.6m). The project will present no changes to the tidal regime along Hutchinson Island as the tidal ranges along the shoreline are influenced by both astronomical as well as climatic factors.

(4) Salinity Gradients. Because of constant water exchange from tidal and wind generated forces, salinity in the project area is approximately at open ocean levels (35 parts per thousand). The project will have no impact.

c. Suspended Particulate/Turbidity Determinations.

(1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site. It is anticipated that there will be a temporary increase in turbidity levels seaward of the project area during construction. This short-term increase may have an adverse impact on nonmotile autotrophs and heterotrophs such as periphyton, drifting phytoplankton, sponges, soft corals, and mollusks. These highly fecund organisms usually repopulate the project shoreline within a matter of weeks to months. This elevated turbidity level will be temporary in nature and isn't expected to be significant as state standards for turbidity will not be exceeded (less than 29 NTUs above background levels).

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

(a) Light Penetration. The placement of fill material will temporarily reduce light transmission in the intertidal zone during construction due to elevated levels of suspended particulates. Because of the density of the fill material, this adverse impact is expected to be temporary and short-term in nature.

(b) Dissolved Oxygen. Due to the low level of organic material in the borrow/fill material, anoxic layers of sediment exposed by dredging are anticipated to be minimal. An underwater visual inspection of the borrow site revealed clean sand throughout the area with no sightings of organic muds. -

(c) Toxic Metals. Due to the clean nature of the calcareous borrow/fill material, toxic materials will not be introduced into the water column.

(d) Pathogens. No pathogenic material is expected to be involved with the project.

(e) Aesthetics. Aesthetic quality will be temporarily reduced during the beach construction period, but there will be a long term increase in the aesthetic quality of the project area once the eroded beach is restored.

(3) Effect on Biota.

(a) Primary Production/Photosynthesis. Elevated turbidity levels from resuspended beach fill may have an insignificant adverse impact on drifting autotrophic organisms in the immediate nearshore waters adjacent to the project beach. It is anticipated that this will be a temporary and short-term phenomenon. Exposed intertidal rock provides a valuable attachment surface for photosynthetic algae. If these intertidal rock structures are permanently buried, these organisms and their ecological functions will be lost. Ephemeral hardbottom habitat is subjected to periodic burial as well as scouring from resuspended sand. Every time this condition occurs, it is likely that a portion of the sessile autotrophic population is lost. Because of nearshore water exchange from tidal and wind generated currents, it is probable that photosynthetic organisms are continuously carried into and out of the project area. The transport of these organisms provides a dependable source of carbon to the higher trophic level organisms inhabiting the project area. Since placement of beach fill material will not alter the transport of nutrients or organic carbon into and out of the project area, no long term impacts to photosynthetic organisms are expected.

(b) Suspension/Filter-Feeders. Beach fill material resuspended into the water column may contribute to the clogging of siphons of filter-feeders. This is expected to be a temporary and short-term condition. Because of high fecundity and turnover rates, rapid repopulation of these organisms is expected.

(c) Sight Feeders. Elevated turbidity levels will have a short-term adverse impact on visually dependent carnivores.

However, these organisms are highly motile and are able to migrate into more favorable areas to fulfill their nutritional requirements and ecological functions.

d. Contaminant Determinations. Deposited shell and calcareous fill material is similar to the existing beach material in the surrounding area and will not introduce, relocate or increase contaminants in nearshore waters.

e. Aquatic Ecosystem and Organism Determinations.

(1) Effects on Plankton. Decreased light transmission caused by suspended beach material may have a temporary adverse impact on plankton. However, this is expected to be short-term and insignificant. The Atlantic coast of Florida is highly dynamic in this particular area and resuspension of material is likely a natural phenomenon. Elevated turbidity levels will be a temporary condition and floating planktonic organisms may be removed from the project area via tides and currents. Because of this physical transport mechanism, placement of beach fill on an eroding beach is not expected to have a long term or permanent impact on planktonic organisms.

(2) Effects on Benthos. Those benthic species not able to migrate from the project area will be covered. Because of the high fecundity and high turnover rate of benthic invertebrates, repopulation of benthic communities should occur within a few months once the construction has ceased.

(3) Effects on Nekton. Direct impacts to motile organisms will be insignificant because of the ability of these organisms to avoid unacceptable conditions. Adjacent hardbottom habitat is periodically covered because of scouring and shifting sand. Any hardbottom structure that is permanently buried will have an adverse impact on nektonic (especially cryptic) species. These organisms will lose a protective refuge and a foraging area. Any secondary impact to hardbottom structure through construction of the project will be fully mitigated (refer to Appendix E in the Final EA).

(4) Effects on Aquatic Food Web. Beach nourishment activities are likely to have a temporary and insignificant short-term impact on hardbottom areas and organisms found around these reef habitats seaward of the project area. The nearshore project area is highly dynamic in nature and likely experiences significant seasonal variability. Because of this instability, it is likely that organisms that inhabit this area are highly adaptable to changing conditions (including increased turbidity and sedimentation). Because the nonmotile organisms are quickly able to repopulate nourished intertidal zones, no long term adverse impacts to higher trophic level organisms are expected.

(5) Effects on Special Aquatic Sites. Tropical sabellarid worm reefs are located primarily just south of the project area (mainly south of monument R-22 and continuing to the Ft. Pierce Inlet). The nourishing of the project beach is not expected to have any long term significant adverse impact to these communities. As the beach seeks equilibrium, resuspended sand may settle on these structures. However, the project area lies within highly dynamic oceanographic conditions where resuspended bottom material settling around and on these habitats is not uncommon. The worm, Pharagmatopoma lapidosa, utilizes the suspended material to build protective tubes and increase the acreage of available hardbottom habitat. Although eroded sand from the beach fill area is expected to gradually flow south of the project towards the St. Lucie Inlet, no significant adverse impacts to the hardbottom habitat located south of the project area is expected (see Appendix E for further details concerning monitoring and mitigation activities).

(a) Sanctuaries and Refuges. No Federal or State sanctuaries, refuges, or preserves exist in or adjacent to the project area.

(b) Wetlands. There are no intertidal marshes or submerged seagrasses seaward or adjacent to the project area.

(c) Vegetated Shallows. Because of the dynamic oceanographic conditions common to the project area, it is not uncommon for beach material to be resuspended into the water column. Because of these physical conditions, no submerged rooted aquatic vegetation exists seaward of the project area. The scoured depressions that form within the nearshore zone tend to collect large amounts of drifting macroalgae. Construction of a nourished beach is not expected to significantly alter the average amount of nearshore macroalgae that collects in these scoured depressions.

(d) Coral Reefs. Nearshore sabellarid worm reefs (P. lapidosa) and ephemeral coquina limestone outcrops are an important hardbottom feature that can be found just seaward and primarily south of the project area. The organisms that comprise these reefs are adapted to highly dynamic conditions with continuous resuspended material that periodically buries these communities. Temporary increases in the amount of resuspended sand during the placement of beach fill material is not expected to significantly alter the abundance or composition of these communities. No significant adverse impacts to the hardbottom areas located to the south of the project area are expected. An assessment of the movement of eroded sand to the south and the possible impact to the hardbottom habitat to the south is discussed in the proposed monitoring and mitigation plan (see Appendix E).

(6) Threatened and Endangered Species. In accordance with Section 7 of the Endangered Species Act, the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) have concurred that implementation of the proposed project would not adversely affect threatened or endangered species under their purview. Important safeguards to be implemented to assure that no adverse impacts from the project are experienced by threatened or endangered species are documented in section 9.00 of the FEA, Appendix C and Appendix F (refer to FWS Biological Opinion) of this report. On the advice of the FWS, the project is expected to be constructed almost entirely out of the main portion of the sea turtle nesting season (after November 1 before April 15th). Furthermore, widening of an eroding beach will increase the amount of suitable nesting beach area available to sea turtles. This may aid in the population recovery of these threatened and endangered animals.

(7) Other Wildlife. Renourishing sections of the eroded Atlantic shoreline of south Hutchinson Island in Martin County between monuments R-1 and R-23 is not expected to have a long term significant adverse impact on wading birds or terrestrial foraging animals. These organisms are highly motile animals that are able to actively seek favorable environmental conditions for foraging and nesting and will be able to avoid any unfavorable areas during construction. The widening of an eroding beach may provide more intertidal foraging opportunities for wading birds. Buildup of the dune system is likely to be rapidly invaded by opportunistic grasses and salt-tolerant vegetation. These areas will provide additional protective refuge for small reptiles and mammals.

(8) Actions to Minimize Impacts. All practical safeguards will be taken during construction to preserve and enhance aesthetic, recreational, and economic values in the project area (refer to section 9.00 of the FEA as well as other sections within this report).

f. Proposed Disposal Site Determinations.

(1) Mixing Zone Determination. The fill material will not cause unacceptable changes in the mixing zone that the Florida Department of Environmental Protection (DEP) is expected to specify in the Water Quality Certificate in relation to: depth, current velocity and direction, variability, degree of turbulence, stratification, or ambient concentrations of constituents.

(2) Determination of Compliance with Applicable Water Quality Standards. Class III State water quality standards will not be violated outside of the established mixing

zone. At no time will nearshore turbidity levels exceed 29 NTUs above background conditions.

(3) Potential Effects on Human Use Characteristics.

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

(b) Recreational and Commercial Fisheries. Finfish are highly motile animals and are well equipped to seek favorable environmental conditions elsewhere. Highly motile finfish likely relocate to other nearshore hardbottom tracts or offshore hardbottom habitat during winter storm events which produce significant turbidity and scouring. As long as the nearshore reefs and hardbottom structures are not permanently buried, no significant adverse impacts to pelagic organisms are expected.

(c) Water Related Recreation. The placement of fill will generate a temporary inconvenience for those using the beach for recreational purposes. Once construction has ceased, water related recreation will be preserved as well as enhanced by the creation of additional beach area.

(d) Aesthetics. A temporary decrease in aesthetics will occur with the presence of earthmoving equipment. However, the stabilization of an eroding beach will only improve beachfront aesthetics.

(e) Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves. The widening of an eroding beach will increase the amount of available recreation beach at the county parks within the project area. Widening the eroded beach will offer storm protection to these county parks.

g. Determination of Cumulative Effects on the Aquatic Ecosystem. It is not anticipated that the placement of beach compatible material on an eroding beach will have any significant negative impacts that would result in degradation of the natural, cultural, or recreational resources of the project area. The project will have no cumulative impacts that result in major impairment of water resources and will not interfere with the productivity and water quality of the existing aquatic ecosystem.

h. Determination of Secondary Effects on the Aquatic Ecosystem. No secondary effects are anticipated. Although eroded sand is expected to move south of the project

area via the longshore current, no significant secondary impacts from increases in turbidity and sedimentation are expected to occur to the 20.5 acres of nearshore hardbottom areas that exist south of the project area (monuments R-23 to R-42). Reasons for this no effect determination include the time it will take for the eroded sand to move south (gradual movement over a period of years) and the naturally occurring dynamic conditions that currently exist south of the project area. Several sections of this Draft EA discuss in great detail the movement of sand and possible impacts to hardbottom habitat and associated flora and fauna.

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

1. No significant adaptations of the guidelines were made relative to this evaluation.
2. In addition to considering the basic assumption of the "no action" alternative, a total of 8 nonstructural and 12 structural alternatives were also considered. No practical alternative exists which fully meets the study objectives and National Economic Development Benefit Evaluation Procedures that does not involve discharge of beach compatible fill into waters of the United States.
3. The discharge of beach compatible fill material to be dispersed will not cause or contribute to violation of any applicable State water quality standards for Class III waters.
4. The discharge of calcareous shelly carbonate sand 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.
5. The placement of beach compatible fill material 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.
6. There will be no adverse impact on the water supply of the City of Stuart, City of Jensen Beach, or Martin County from the implementation of this project.

7. Direct (burial) and indirect (increased sedimentation and turbidity) adverse impacts may be felt by nearshore (within approximately 450 feet/136m of the 1992 mean high water line) sabellarid worm reefs and ephemeral coquina limestone rock outcrops. Cryptic fishes may lose a protective refuge habitat if these hardbottom structures are permanently buried. Non-motile sessile invertebrates may be buried by the beach fill and autotrophic and encrusting organisms may lose an attachment surface if the hardbottom structures are permanently buried. Hydrodynamic movements may redistribute offshore larvae of many of these organisms into the project area. Because of the high fecundity of many of these organisms, repopulation and biodiversity is expected to rebound in the project area over time (generally in a matter of months). Currently, computer models predict hardbottom habitat will not receive any primary impacts from the beach nourishment project. In addition, computer models estimate that the renourished sand will eventually be moved through littoral drift south of the project area. It is currently estimated that approximately 20.5 acres of hardbottom habitat exists from the southern end of the project (monument R-23) south towards the St. Lucie Inlet (R-42). As previously alluded to, no significant secondary impact to these hardbottom areas are anticipated due to the nearshore dynamic conditions which naturally exist in the area as well as the fact that many of the high relief areas are emergent during low tide (Bathtub Reef, for example). The accuracy of this hypothesis will be quantified by thorough pre- and post-monitoring data collections (see Appendix E).
8. Short-term elevated turbidity levels during the construction phase may have an adverse impact on attached autotrophic organisms if nearshore hardbottom reef tracts are permanently buried. As turbidity is expected to return to background levels with the cessation of construction, it is anticipated that this impact overall will prove insignificant and temporary.
9. There will not be a direct adverse impact on highly motile organisms. These organisms will be able to actively avoid any unfavorable condition during beach construction. Indirectly, any permanent loss of hardbottom structures such as worm reefs and limestone outcrops represents a loss of juvenile refuge and a food source for foraging adult species. Any loss of hardbottom habitat will be fully mitigated for and these areas monitored.
10. Non-motile infaunal organisms such as bivalve mollusks

in the immediate project area will be buried by the beach fill but are expected to repopulate the area in a matter of months. Motile epifaunal species such as recreationally and commercially important crustaceans should not be adversely affected by the proposed project.

11. It is anticipated that there will be no significant or long term changes in biodiversity of the nearshore areas around Hutchinson Island from the implementation of this project. As much significant hardbottom habitat (as it pertains to vertical relief and surface area) within the equilibrium toe of fill and reef buffer zone (approximately 450 feet/136m seaward of the mean high water line) as possible will be photogrammetrically assessed utilizing underwater photography. Photo quadrats will be analyzed in terms of percent coverage of organisms and biodiversity and any statistically significant negative impact that has occurred and can be attributed to the beach nourishment project will be mitigated for. A complete discussion of the proposed monitoring and mitigation plan can be found in Appendix E.
12. The composition of the beach fill material obtained from the offshore borrow area (calcareous shelly sand with a similar silt content as existing beach material) is such that it will not contribute organics or pollutants to the aquatic environment. Earthmoving equipment is not expected to operate in water (below mean low water) and this will therefore minimize the likelihood that hydrocarbons from machinery will pollute the surrounding water. All responsible precautions will be taken to assure that no hazardous materials (oil, gas) are discharged from any construction equipment.
13. On the basis of the guidelines, the proposed disposal site for the discharge of fill material is specified as complying with the requirements of the Clean Water Act.

Appendix B

**Florida Coastal Zone Management Program
Federal Consistency Evaluation Procedures
Martin County Shore Protection Project
Hutchinson Island, Martin County, Florida**

FLORIDA COASTAL ZONE MANAGEMENT PROGRAM
FEDERAL CONSISTENCY EVALUATION PROCEDURES
MARTIN COUNTY SHORE PROTECTION PROJECT
HUTCHINSON ISLAND, MARTIN COUNTY, FLORIDA

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 what might have an effect on natural shoreline processes.

Response: The primary purpose of this project is to provide shore protection to residential and tourist development. Consideration is given during the planning process to impacts upon natural coastal processes, activity and use criteria, natural vegetation, and adjacent property. Detailed analyses of each of these areas are presented in the 1986 *Feasibility Report with Environmental Impact Statement* and this Final Environmental Assessment (FEA). The goals set forth in this chapter have been met through continuous consultation with appropriate Federal, State, and local agencies.

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: Information regarding this shore protection project has been fully coordinated with appropriate Federal, State, and local governmental agencies. This project meets the primary goal of the State Comprehensive Plan for beaches through preservation of a protective beach. As this project would increase recreational opportunities in the area, it is also considered advantageous to the local economy and would provide for economic growth.

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 public peace, health and safety; and to preserve the lives and property of the people of Florida.

Response: The disposal of beach compatible material onto an eroded beach will help protect the eroded beach from further erosion and reduce potential damage resulting from storms to the residential and commercial property and roads adjacent to the Atlantic coast along the southern end of Hutchinson Island. Therefore, this project will be consistent with the efforts of the 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 resources; submerged lands; spoil islands; and artificial reefs.

Response: This beach nourishment project will create a wider recreational beach and provide necessary storm protection for residential and commercial development and infrastructure along the Atlantic shoreline of Hutchinson Island. Restoring a dune system will add refuge and foraging areas for avifauna. Widening an eroded beach will increase the beach area that is available to endangered and threatened nesting sea turtles.

In a letter dated 7 May 1993, the Florida State Historic Preservation Officer (SHPO) stated that no significant cultural resources will be affected by the beach nourishment project. A magnetometer survey undertaken between 22-26 February 1993 determined that no potentially significant submerged archeological resources were identified in the borrow area which will be used as the project's sand source.

Motile organisms such as fish and epifaunal crustaceans may experience insignificant short-term adverse impacts due to temporary loss of habitat during construction. The short-term adverse impact is likely to be felt primarily by the nonmotile infaunal invertebrates and sessile autotrophic organisms. Because of the high fecundity and high turnover rate of these organisms, it is not anticipated that a numerically significant loss of these communities would be a long-term condition.

The nearshore hardbottom habitats in this area are adapted to a highly dynamic oceanographic environment with constant resuspension and scouring of sand. Because of this, the nearshore hardbottom areas are periodically buried from shifting sand. Placement of beach compatible fill material onto the eroding beach is not expected to significantly increase, retard, or alter this periodic burial and reappearance of hardbottom habitat. At this time no hardbottom habitat is expected to be

buried by fill material. However, any hardbottom habitat that is permanently buried or significantly degraded as a result of this beach nourishment project will be fully mitigated for by placing like material seaward of the impacted habitat. This project therefore complies 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: Much of the southern end of Hutchinson Island in Martin County is in public ownership and the beach has numerous public access points from adjacent parking areas and County/State parks. Therefore, 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: There are three (3) locally managed (County/City) parks along the Atlantic coast in the Martin County project area. The addition of beach compatible material to increase the berm width of the eroded beach will provide protection for these parks from storm generated wave energy as well as have a positive influence on recreational opportunities in the park/beach area. The beach compatible fill material near the existing dune system will quickly be invaded by opportunistic grasses and other salt tolerant vegetation. The beach flora will add refuge and foraging areas for small mammals and reptiles that may inhabit the project area. Therefore, the project is consistent with the intent of this chapter.

7. Chapter 267, Historic Preservation.

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

Response: A magnetometer survey of the offshore borrow area has been conducted and the results have been coordinated with the State Historic Preservation Officer (SHPO). The SHPO has concluded that excavation of sand from the offshore borrow area and placement of the beach compatible sand onto the eroded project beach will not have an adverse effect on terrestrial or marine cultural resources (see Appendix F).

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 shore protection project will provide protection of residential and commercial development and infrastructure along the southern end of Hutchinson Island and more area for recreational opportunities throughout the area. This will be compatible with tourism for this area and is therefore consistent with the goals of this chapter.

9. Chapters 334 and 339, Public Transportation.

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

Response: No long-term adverse impacts to public transportation systems are anticipated 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 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 of research.

Response: Motile species such as fish and epifaunal crustaceans will be able to avoid the area during construction and seek favorable environmental conditions. Any hardbottom habitat negatively expected to be impacted due to the beach nourishment project (currently estimated to be approximately 0.5 acre) will be fully mitigated for by the Corps. Non-motile autotrophic organisms and infaunal invertebrates will be temporarily lost. As demonstrated from past scientific investigations concerning the recolonization success of the benthic communities seaward of nourished beaches, the loss of nonmotile invertebrates is expected to be a short-term situation. Contract specifications will contain protective measures specifically designed to avoid adverse impacts to manatees and sea turtles which may be foraging in the area (refer to section of 9.00 in the EA).

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 disposal of beach compatible material onto the eroded project beach has been coordinated with the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) for compliance under Section 7 of the Endangered Species Act. Both agencies have concurred with the Corps' determination that populations of threatened/endangered species under their purview will not be adversely affected by the proposed action. Upon the advice of the FWS, every effort will be made to complete beach construction prior to the commencement of the main part of the sea turtle nesting season (prior to April 15th). Further discussion of the main portion of the sea turtle nesting season (after November 1 and prior to April 15) and appropriate safeguard requirements can be found in Appendix C (Fish and Wildlife Coordination Act Report) and Appendix F (Relevant Correspondence) of this report. There exists adjacent vegetated areas where small mammals and reptiles could actively seek temporary shelter during beach construction activities. Placement of sand on the beach will likely be quickly invaded by opportunistic grasses and other salt tolerant beach vegetation. This new habitat will provide refuge and foraging opportunities for small species and promote biodiversity in the project area. This project complies with the goals of this chapter.

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 groundwater or surface 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: This project does not involve transportation of any toxic substances. All precautions will be taken during the construction phase to assure that no hydrocarbons or other toxins are expelled into the environment by dredging or earthmoving equipment.

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 products and therefore 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: Beach disposal on the modified project length of 3.75 miles (6.0km) of southern Hutchinson Island in Martin County is unlikely to have any regional impact on resources found along the southeastern Atlantic coast of Florida. The project is consistent with the established 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 would 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.

Response: A temporary increase in air pollution particulates from dredge and construction equipment as well as accompanying vehicles is expected to be insignificant due to strong prevailing coastal winds, and only due to increased vehicular traffic during the construction phase. Water pollution is expected to be minor and short-term, manifesting in construction generated nearshore and borrow area turbidity increases. Monitoring for turbidity during the beach nourishment process will assure compliance with all applicable water quality standards. With adherence to the environmental conditions to be set forth in the Water Quality Certification (WQC) permit, this project will be in full compliance 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 the project on or near agricultural lands.

Response: The shore protection project is not located near or on any agricultural lands. The authorized project is designed to restore and protect an eroding public beach which offers protection for both property and human health against storm generated wave energy as well as recreational opportunities for both the visitor and the resident of the area.

Appendix C

Fish and Wildlife Coordination Act Report
Martin County Shore Protection Project
Hutchinson Island, Martin County, Florida

HUTCHINSON ISLAND MARTIN COUNTY, FLORIDA

BEACH RENOURISHMENT PROJECT

Fish and Wildlife Coordination Act Report



**Submitted to:
Department of the Army
Jacksonville District
Corps of Engineers
Jacksonville, Florida**

**U.S. Fish and Wildlife Service
Ecological Services
Vero Beach, Florida**

JANUARY, 1994



United States Department of the Interior

FISH AND WILDLIFE SERVICE
P.O. BOX 2676
VERO BEACH, FLORIDA 32961-2676

January 24, 1994

Colonel Terrence Salt
District Engineer
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019


Attn: Planning Division

Dear Colonel Salt:

In accordance with the Fiscal Year 1992 Transfer Fund Agreement between The U.S. Fish and Wildlife Service (Service) and the Jacksonville District Corps of Engineers (Corps), this letter represents a Final Coordination Act Report on the proposed Martin County, Florida, Beach Erosion Control Project. The Corps has requested an evaluation of the environmental effects of nourishing 4.0 miles of beaches along the coastline of Martin County with material dredged from an offshore borrow area. This information is needed to enable the Corps to reformulate and evaluate the authorized project to assure that it conforms to current needs and criteria. This report is presented in fulfillment of the Fish and Wildlife Coordination Act (16 U.S.C. 1531 et seq.) and constitutes the final report of the Secretary of the Interior as required by Section 2(b) of the Act.

The Service distributed a Draft Coordination Act Report on the subject project to the Florida Game and Freshwater Fish Commission and the National Marine Fisheries Service. Letters of concurrence have been received by the Service from those agencies and a copy of each may be found in the attachments section of the report.

Sincerely yours,


David L. Ferrell
Field Supervisor

cc:

EPA, Atlanta, GA

NMFS, Panama City, FL

FG&FWFC, Tallahassee, FL

FG&FWFC, Vero Beach, FL

DEP Tallahassee, FL

FWS, Jacksonville, FL

**Hutchinson Island
Martin County
Beach Nourishment Project**

**Fish and Wildlife
Coordination Act Report**

**Submitted to Jacksonville District
U.S. Army Corps of Engineers
Jacksonville, Florida**

**Prepared by: Charles W. Sultzman, Project Biologist
Approved by: David L. Ferrell, Field Supervisor**

**Vero Beach, Florida, Field Office
U.S. Fish and Wildlife Service
Vero Beach, Florida**

January, 1994

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EXECUTIVE SUMMARY

The Corps of Engineers (Corps) has requested a Fish and Wildlife Coordination Act Report from the U.S. Fish and Wildlife Service (Service) regarding the environmental impacts of a proposed beach nourishment project at Martin County, Florida. Sand fill for the project would be obtained from an offshore borrow area. Silt and clay content of the fill is approximately 10%. Biological surveys of the area by the Corps' contractors have shown that there are rock outcrop reefs immediately offshore of the beaches proposed for renourishment. U.S. Fish and Wildlife Service observations indicate that there are currently approximately 13 acres of nearshore reef within the project area; but, further quantification reef acreage through aerial photography and groundtruthing is warranted. Our observations also show that these reef areas currently provide habitat for a diverse community of fishes and invertebrates.

The Fish and Wildlife Service recommends that impacts to reefs at the southern end of the project be avoided. Remaining unavoidable impacts may be mitigated for with artificial reef construction if carefully designed and deployed. Careful design could reduce acreage ratio requirements for full habitat value replacement. The biological rationale supporting this mitigation recommendation is provided in the report.

At least one acre of designed reef should be deployed before sandpumping begins to provide alternative habitat for motile organisms displaced by the project. A subsequent study of population densities on the pilot reef should allow the Corps to estimate the appropriate acreage of mitigation required for full habitat value replacement. The Service estimates that an ineffective design may require as much as 2 acres of mitigation per acre of natural reef lost; an effective design could reduce mitigation acreage requirements by more than half.

A prior Biological Opinion on this project allowed for nest relocation of threatened and endangered sea turtles. To further minimize incidental take of sea turtles due to nest relocation, the Service now recommends that beach nourishment activities occur between November 1 and April 15, provided the beaches are surveyed for unhatched nests prior to beach fill deposit

I. INTRODUCTION

A Congressional Resolution adopted May 18, 1974 by the Public Works Committee authorized the Corps to conduct a beach erosion control study for Martin County. The Service has provided the Corps with several reports during the planning process. These reports addressed project impacts to marine habitats and nesting sea turtles at various design phases. A Feasibility Report with Final EIS was distributed in June, 1986. This report contained the Services' Biological Opinion, dated December 6, 1985, addressing project impacts to nesting sea turtles and a Fish and Wildlife Coordination Act Report which summarized Service input and discussed potential impacts to nearshore reefs. The Coordination Act Report also recommended that the project not be constructed during sea turtle nesting season, from April to November.

II. PROJECT DESCRIPTION

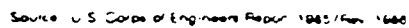
The presently considered project calls for the construction of a protective beach along a 4 mile reach of shore from DNR monument number R-1 at the north Martin County line to DNR monument R-27 (see Figure 1.). The berm, which would be constructed from 942,000 cubic yards of fill material, would be 35 feet wide at +8 ft. N.G.V.D. This would slope at 1 foot vertical to 8.5 feet horizontal shoreward of the intertidal zone. Waterward of this the slope would be 1 to 20 extending the fill approximately 700 ft. seaward of the current high tide line after settling (calculated from maps in Project Summary, Coastal Technology, 199-1). The fill material would be obtained from an area approximately one half mile offshore of the southern end of the proposed fill area.

III. DESCRIPTION OF STUDY AREA

Martin County is situated on the Atlantic coast of east-central Florida. Hutchinson Island is located in the northernmost part of the county on the Atlantic Ocean. West of this barrier Island is the Indian River which has inlets to the ocean approximately 1.5 miles to the south (St. Lucie Inlet) of the proposed project (See Figure 1) and 16 miles to the north (Ft. Pierce Inlet).

IV. FISH AND WILDLIFE RESOURCES

Fish and Wildlife habitats in the project area which could be affected by this beach erosion control project include the intertidal beach zone, borrow area, nearshore reefs and the supralittoral beach which serves as nesting habitat for at least three species of threatened and endangered sea turtles.



A. Community Descriptions

Intertidal Beach Zone. The beaches of Palm Beach County are typical of other east-central Florida beaches which are subject to the full force of ocean waves. These beaches usually have low species diversity, but populations of individual species are often very large. Species such as coquina clams, ghost crabs, annelid worms, mole crabs and sand drum are highly specialized to survive in this high energy environment.

Borrow Area. Numerous species of macro-invertebrates inhabit the proposed borrow area. These include, hydrozoan, bivalves, gastropods, annelids, crustaceans, sea cucumbers, brittlestars, etc. These will be unavoidably lost during dredging. However, this habitat is not unique and the area will likely recover within one year (Courtenay, et. al. 1974). Motile fauna expected to inhabit this area would include penaeid shrimp, callinectid crabs, flounder and sole. These species should easily avoid the dredge and no adverse effects to them are anticipated.

Nearshore Reefs. Coquina limestone reefs occur adjacent to and seaward of the project area. The first attempt to map the reefs was undertaken by Coastal Technology and Management, Inc. using aerial photography in 1991. Reef features were mapped with side scan sonar by C-systems, Inc., Broward County, in the spring of 1993. The two maps resulting from these efforts bear little resemblance to each other. The side scan reef maps have been found through extensive groundtruthing to be the more accurate. Copies of the side scan maps have been reduced in size and are presented as Appendix 1.

B. Important Species and Taxa

Epibiota

The most abundant and evident producers on the reefs are the algae. The exposed rock provides stable substrate for these organisms which, through photosynthesis, produce basic organic material on which much of the reef's food web is based. Carbon fixed far offsite is also concentrated on the reefs. Attached filter feeding organisms contribute to this organic base by trapping nutrient rich phytoplankton as it is swept past the reef by wave and wind generated currents. Sessile cnidaria such as anemones and stinging hydroids capture zooplankton and other larger organisms which drift to them.

Fishes and Motile Invertebrates.

In addition to the algal food which grows on the reefs, fish and motile invertebrates are attracted to the basic structure of the reef. The numerous crevices, holes, and undercut ledges provide refuge from larger predatory fish. It also provides a barrier to currents and substrate for attachment of demersile adhesive eggs.

Sea Turtles

The loggerhead turtle (Caretta caretta) 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 km on the average for some beaches in the northeast, southeast, and panhandle of Florida to over 600 nests per km on some stretches of beach in south Brevard County (Ehrhart and Witherington, 1986). The most recent estimate for total annual nesting effort in the southeastern U.S. is 58,000 nests based on aerial surveys conducted in 1983 (Murphy and Hopkins, 1984). The U.S. loggerhead nesting 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 other sea turtle species where nesting occurs largely outside the U.S. The loggerhead nesting season is from late April to August, with most nesting occurring in June and July.

Green turtle (Chelonia mydas) nesting within the U.S. occurs principally along east central Florida beaches. Nesting densities are much lower than for the loggerhead and range from 1-5 nests per km on most beaches within its major nesting range, to 13-20 nests per km on high density green turtle nesting beaches in south Brevard County and south Jupiter Island in Palm Beach County (Conley and Hoffman, 1986; Ehrhart and Witherington, 1986). Nesting occurs from May to September with the peak nesting occurring in July and August.

The leatherback (Dermochelys imbricata), rarely nests in the continental U.S. Eighty-nine leatherback nests were recorded on the 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 is centered in Palm Beach county but scattered nesting has been recorded on almost all Florida east coast county beaches with the most northerly record from Blackbeard Island, Georgia (Conley and Hoffman, 1986; Seyle, 1985).

The hawksbill (Eretmochelys imbricata) is a rare nester on southeastern U.S. beaches with only 1-2 nests recorded annually in Florida (Conley and Hoffman, 1986; Lund, 1985; McMurtray and Richardson, 1985). Nesting has been recorded for the months of June, July, August, and October and from Volusia, Martin, and Dade Counties (Dalrymple et. al., 1985; Lund 1985; McMurtray and Richardson, 1985).

V. FISH AND WILDLIFE SERVICE OBSERVATIONS

I. Mapping Efforts

Methods

The Service accompanied a Corps Biologist and representatives for Martin County on field trips to the project site on July 13-15 and July 19-21, 1993. Using the reef maps drawn by C-Systems, Inc., approximately 10 reef areas were located and measured. Edges of each reef area were buoyed and a range azimuth positioning system used to verify the shape and location of the feature depicted on the reef map. A search of the proposed fill area was also made in an effort to locate reef areas which did not appear on the reef map. Control sites for future monitoring of project impacts were located, buoyed and their coordinates recorded. On August 12, reef features depicted on the side scan maps were planimeted and the acreage of these features which lie within the proposed fill area calculated.

Results

Groundtruthing the side scan maps revealed pitfalls involved in drawing reef maps from aerial photography. During most of the field trips, the water was clear enough to allow individual rock outcrops to be located from the surface by boat. From the surface, however, some of the features appeared to differ in shape from the illustrations on the map. This, it was found, is because only the highest portions of the outcrops are overgrown with dark (red, brown or green) pigmented algae. These algal encrusted areas were easily seen through the water from the surface. Low relief rock areas are constantly scoured clean, bear no contrast to the surrounding sand and are not visible to the naked eye from the surface. Nor would they show up in an aerial photograph. Positive identification of these areas as hard bottom is only possible by close subsurface inspection.

Additional difficulty was found in attempting to identify map features because of the presence of large amounts of drift algae. Large dark areas were visible from the surface by boat but subsurface inspection revealed many of these areas to be unattached algae over sand bottom.

Because of these problems with photogrametric mapping, the Service believes that side scan mapping has been demonstrated to be most reliable means of delineating reef features. (See reduction of side scan maps in Appendix A.). The use of side scan in this and future projects of this type will allow the Service and the Corps to make the most accurate estimates of reef acreage.

Despite the greater accuracy of the side scan based maps, at least two reef areas are under represented on the maps. During groundtruthing, the Corps and Service divers found substantial reef area immediately east and north of R-16. This area is represented on the map by a cluster of north-south lines which appear to be a system of narrow ledges (See Appendix A). Actually, this is a solid reef area up to 75 ft. in width; only the seaward edge of which is shown. The second area found occurs approximately 300 feet seaward between DNR monuments R-22 through R-27. Again, this area is represented by a north-south line east of R-23 through 25 (Appendix A). In fact, the reef exceeds 100 feet in width in some places and encompasses several acres.

One additional reef area was located by the Service on August 26. This area lies off of the Jensen Public Beach access. It is not shown on the side scan maps. Poor water clarity did not enable the Service to estimate the acreage of this feature.

II. Biological Studies

Methods

Of the reef areas inspected during groundtruthing dives with the Corps Biologist and representatives for Martin County, the nearshore reef off of R-25 appeared to hold the greatest in numbers and variety of marine fishes and invertebrates. To more closely examine these areas, the Service made an underwater biological survey of the area east northeast of R-25 (Figure 2.). This survey was done on August 26, 1993. Two timed transects of 300' each were run parallel to the shoreline. The first was approximately 420 feet east of the limits of dune vegetation as determined by a Rangematik MK 5 rangefinder. The second was approximately 100 feet inshore of the first (See Figure 2.).

Fish counts were made, samples of epibenthic organisms were collected and photographs were taken along each transect. Prior to arrival at the site, the Service had intended to use the Bohnsak method of stationary sampling to quantify the fish population density. This methods involves picking sampling stations and counting all fish seen within a certain radius from the center. The recommended radius is 24 ft. (see Bohnsak, 1986). Upon arrival, seeing that underwater visibility only about 10 feet, it was decided that the number of fish seen at each station would be too low to adequately represent the population at large. Therefore, all fish seen while swimming along each transect were lumped into a single sample.

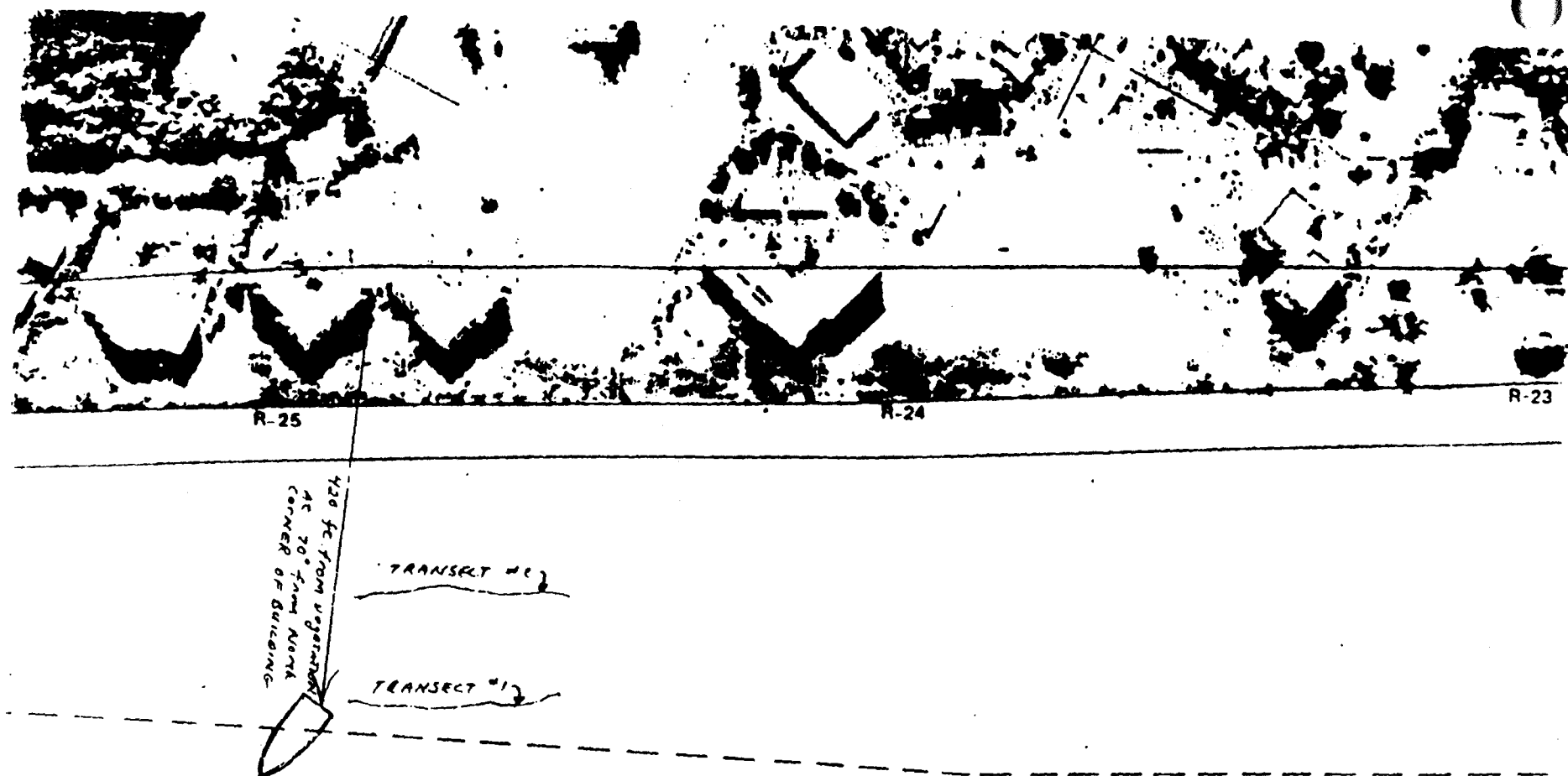
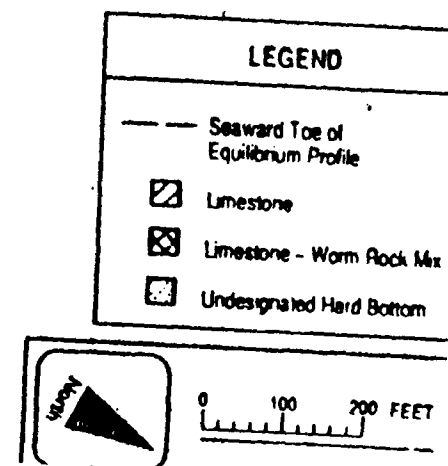


Figure 2. Transect Locations at R-25.



Results

The Service has attempted to illustrate this by providing the following data from transects 1 and 2. Photographs taken along transects 1 and 2 are shown in appendix 2. Table 1 below lists the organisms collected from the encrusting community in the subject area.

Table 1. Sessile Species and Commensals Collected Along Nearshore Transects at R-25.

Algae

Dictyota bartayresii
D. dichotoma
D. cervicornis
 unidentified dictyota species
Caulerpa taxifolia
C. sertularoides
C. cupressoides
C. prolifera
Padina sanctae-crucis
Halymenia floresia
Gracilaria tikvahiae
Hypnea musciformis
Halimeda goreau
Codium isthmocladum
C. intertextum
Ceramium sp.

Bryozoans

Bugula neritina
 unidentified white encrusting bryozoan (order Cheilostomata)

Sponges

Strongylacidon sp.
Speciospongia vesparium
Tedania ignis (?)

Tunicates

Botrylloides nigrum (?)

Ascidia nigra

Clavelina sp. (?)

unidentified tunicates

Polychaetes

unidentified feather duster worm (sabellidae)

Sabellastarte magnifica

Phragmatopoma lapidosa (reef building tube worm)

unidentified polychaetes

Cnidarians

Pterogorgia citrina (Yellow sea whip)

Halopteris carinata (Thread hydroid)

Sertularella speciosa (Branching hydroid)

Macrorhynchia philippina (stinging hydroid)

Muricea muricata (Spiny Muricea)

Campanularia sp. (wineglass hydroid)

unidentified red encrusting zooanthid

unidentified anemonies

Crustaceans

Stenorhynchus seticornis (arrow crab)

unidentified spider crab (Family Majidae)

unidentified hermit crab (Family Diogenidae)

Alpheus sp. (Brown snapping shrimp, Family Alpheidae)

unidentified skeleton shrimp

Jassa falcata (mottled tubemaker)

Gonobactylus oerstedii (swollen-claw squilla)

Panulirus argus (Spiny lobster)

unidentified barnacles

Echinoderms

Echinometra lacunter (rock boring urchin)

Lytechinus variegatus (variegated urchin)

Molluscs

Terebra dislocata (common atlantic auger)
Cerithidea costata (costate horn snail)
 unidentified dove snail (Family Columbelloidea)
 well (Family Nassariidae)

Over 60 species from 9 phyla were collected within the 45 minutes taken to complete the transects. The photographs in appendix 2 show the per cent coverage and allow the reader to estimate the approximate biomass of the encrusting community. However, it should be noted that the worm rock built by Phragmatopoma lapidosa dominates the sessile community in this area covering approximately 20% of the existing substrate along the transects.

The notion that there would be too few fish to count within the 10 foot radius allowed by water conditions at this nearshore reef area was erroneous. Stationary sampling would have been the preferred method because the large number of fish within the transect area at large overwhelmed the diver. Table 2 gives approximate numbers of species seen during the 45 minute time required to complete the both transects.

Table 2. Number and Species of Fish Seen on Nearshore Reefs off R-25, Martin County.

Transect 1	Transect 2
14 <u>Labrisoma nuchipinnis</u> (hairy blenny)	10 <u>L. nuchipinnis</u>
8 <u>Diplodus argenteus</u> (silver porgy)	20 <u>D. argenteus</u>
16 <u>Pomacentrus variabilis</u> (coco damselfish)	16 <u>P. variabilis</u>
20 unident. juvenile pomadasyidids (grunts)	40 juv. grunts
26 <u>Halichoeres bivittatus</u> (slippery dick)	25 <u>H. bivittatus</u>
1 <u>Archosargus probatocephalus</u> (sheepshead)	1 <u>A. probatocephalus</u>
28 <u>Lutjanus synagris</u> (lane snapper)	16 <u>L. synagris</u>
15 <u>Anisotremus virginicus</u> (porkfish)	10 <u>A. virginicus</u>
1 <u>Mulloides martinicus</u> (yellow goatfish)	1 <u>Ocyurus chrysurus</u> (yellowtail snapper)
1 <u>Pomacentrus dorsopunicans</u> (dusky damsel)	4 <u>Acanthurus chirurgus</u> (doctorfish)
1 <u>Pomacanthus paru</u> (French angelfish)	8 <u>Abudefduf saxatilis</u>

The upper eight species in Table 2 list the species which both transects share in common; the lower 6 species (separated by a space) are species found in only one transect. Two hundred eighty two individuals from 14 species were observed in 45 minutes. In addition, one stoplight parrot fish, one spotted scorpionfish, a nurse shark and one spotted moray were seen outside the limits of the transect lines in transit to and from the boat.

It is important to note that one of the most abundant fin fish counted is the lane snapper. The individuals observed were from 1 to 3 inches long (standard length). Adult lane snappers may reach 18 inches and are important to the recreational fishery of Martin County. At the time of this inspection, the reef area censused was serving as a nursery for these fish.

VI. DISCUSSION AND IMPACTS

Beach zone. Since sandy beaches are populated by small, short-lived organisms with great reproductive potential, in most instances these communities recover quickly from environmental disturbances. The impacts of this beach erosion project on the beach zone fauna will depend primarily on the quality of the nourishment material. Since silt within the sand proposed to be used for this project will eventually be winnowed out, the remaining material should be of similar composition to the natural beach, recovery of the beach fauna should occur in a few months.

Nearshore Reef Zone. Using the estimated limits of the equilibrium toe of fill depicted in the project description provided by Coastal Technology Inc. (1991), along with the side scan maps provided to us by the Corps of Engineers through C-Systems, Inc., the Service has determined that a minimum of 13 acres of nearshore reef will be buried by beach fill if this project is implemented as proposed. This figure includes an estimate of acreage for the two reef areas discovered by Corps and Service divers during groundtruthing. It does not include the reef area discovered by the Service off Jensen Public Beach. Precise delineation and acreage calculation of these reef areas remains to be completed.

The immediate effect of the depositing of fill according to current project plans will be the loss of most of the 13 acres of nearshore reef that lie within the project area. That which is not destroyed by burial will be degraded by an increase in scouring, turbidity and sedimentation. Some of the reef will eventually be re-exposed and become productive. However, without the project, additional reef acreage exposed by continued erosion would be added to the existing acreage. If the project is implemented, continued erosion will only re-expose a small fraction of reef acreage which now exists. The deficit of 13 acres of reef persists.

Sea Turtles. The project will result in an increase in nesting suitability for endangered and threatened sea turtles. Some adverse effects may still result during construction if the project is done during the nesting season. These include:

1. Scarp development at the edge of the beach fill, rendering the beach inaccessible to nesting turtles,
2. Entrapment of the hatchlings in the vehicle tracks,

3. Alterations in moisture levels or other aspects of the microhabitat within the nest cavity,
4. Alteration of unknown beach signature components which may disrupt nest site fidelity,
5. Compaction and cementation of beach sediments which causes reduced nesting success (nesting emergences/total emergence x 100), and aberrant nest cavity construction which in turn can result in broken eggs.

VII. MITIGATION

We estimate that, at a minimum, 13 acres of nearshore rock will be either buried or severely degraded by beach fill as a result of this project. Many of the habitat values lost by project construction are replaceable. This could be accomplished by providing new limestone substrate in the form of an artificial reef of equivalent surface area, if carefully planned and constructed.

Too often, artificial reefs are created without a clearly defined purpose and without sufficient planning. The United States has pursued an unsophisticated and frugal approach to artificial reef planning and construction. The use of scrap and discarded rubble, because of its low cost, is most commonly used (McGurrin, et. al., 1989) despite its inadequacy in providing suitable habitat for targeted species. In contrast, the Japanese have invested billions of dollars in developing techniques to create new habitat and increase seafood production (Grove, et. al., 1989; Sonu et. al., 1985). These efforts have been reported by Sheehy (1983), and Brock and Norris (1989) to have resulted in much more efficient reef technology. While costs per area of reef are higher, the increase in reef fish and epibenthic organism abundance per area over traditional U.S. reef technology (Sheehy, 1983; Brock and Norris, 1989) may offset this cost (Sato, 1985).

To correct the deficiencies in and fragmentation of the U.S. artificial reef program, the Secretary of Commerce was directed, under the provisions of the National Fishing Enhancement Act of 1984 to develop and publish a long-term National Artificial Reef Plan to promote and facilitate responsible and effective artificial reef use based on the best scientific information available. A working plan was published by the National Marine Fisheries Service in 1985 under the authorship of Richard B. Stone. To conform to the plan each project should have a clearly defined list of species targeted for habitat enhancement and user group intended to benefit. In this case, the largest user groups which we expect will incur losses by the project are local and vacationing snorkelers. Artificial reefs intended to mitigate for this project should keep benefits to these groups as the primary objective. This will require certain design features. The structures must provide a scenic, safe, and accessible replacement for the structure lost due to project impacts.

Some fundamental features which should be incorporated into the design are: 1) extensive unshaded horizontal surface area for the attachment and growth of gorgonians and macroalgae; 2) openings near the bottom, for Spiny lobster, depth of at least 2 ft. and height of no more than 1 ft.; 3) interstitial spaces of approximately 10 cubic ft.; 4) large overhanging ledges to provide shaded resting space for large fish; 5) numerous projections, crevices, and holes ranging in size from one to three inches in width and up to 1 foot in length (projections) and depth (holes and crevices) to provide refugia for small fish and for juvenile fishes, as well as to provide additional surface area for epibiotic growth.

Any structure intended to mitigate the loss of limestone substrate should, likewise, be built of limestone rather than concrete. To date, no comprehensive scientific study of substrate selectivity for epibenthic organisms on limestone versus other artificial reef building materials has been done. It may be that unnatural materials inhibit the settlement or growth of certain species of encrusting organisms. This could, in turn, alter the structure of the resulting associated fish community.

Limestone, however, cannot be formed into desired shapes like other material such as steel or concrete. A possible solution to the potential problems associated with substrate selectivity in fouling organisms while taking advantage of the moldability of concrete, would be to embed limestone rock in the surface of molded concrete pieces. If such pieces were to be constructed into a carefully designed artificial reef project of high relief, it may be possible to exceed the habitat values of the existing natural reef for certain species. This would reduce the acreage of mitigation needed to replace lost reef carrying capacity.

In our opinion, because of the low relief of much of the existing natural reef, a carefully planned artificial reef could reduce by as much as 50% mitigative reef acreage needed to recover impacted reef value. Final acreage calculations will have to await aerial mapping and groundtruthing of the two areas previously discussed. We would welcome the opportunity to work with Corps staff and that of Martin County in developing a suitable yet economical reef design and in monitoring the effectiveness of that design.

VIII. FISH AND WILDLIFE SERVICE RECOMMENDATIONS

The Fish and Wildlife Service recommends that the following be included in future project planning:

A. Project Design

1. The nourishment area should be shortened by approximately 2500 feet at the southern end. This would place the southern limit of the project at R-23 or in front of the Stuart Public Beach. This modification would eliminate impacts to the nearshore reefs which extend south of R-23 and reduce mitigation needs.

front of the Stuart Public Beach. This modification would eliminate impacts to the nearshore reefs which extend south of R-23 and reduce mitigation needs. Eventually, sand would be transported by natural littoral drift to beaches further south.

B. Reef Mitigation

1. A new set of aerial photographs of the nearshore should be taken and groundtruthed. A precise measurement of the reef area which will be buried by the project should then be made. Once this is done, final mitigation acreage necessary to compensate for this burial can be calculated.
2. We estimate that approximately 13 acres of reef will be buried. We recommend that at least 1 acre of artificial reef is deployed prior to project construction. This will provide an alternative refuge for some of the fish displaced by the project. In addition, with detailed monitoring of population densities on the initial reef deployed, the carrying capacity per acre of the designed reef could be estimated and the appropriate acreage ratio required for full habitat value replacement could be determined.
3. The artificial reef structure selected for mitigation for unavoidable impacts should be designed to provide habitat for species which are of interest to local SCUBA divers and snorkelers. Its surface should consist of limestone. Design features should include: a) extensive unshaded horizontal surface area; b) openings near the bottom for Florida lobster; d) interstitial spaces approximately 10 cubic feet; e) large overhanging ledges; f) numerous projections, crevices and holes.
4. Assuming that the artificial structure is carefully designed and will have approximately twice as much surface area per acre above the scour zone as the natural reef, we tentatively recommend a mitigation ratio of no less than 0.5 to 1, pending review of the final design and monitoring of a pilot reef (see 2 above). However, an ineffective design could require more acreage than existing natural reefs buried.
5. Surveys of the area of deployment of the designed reef should be made to ensure that it is placed on a solid foundation. There may be areas low relief rock just offshore of the fill area where scouring and periodic burial have reduced reef habitat values to near zero. Such area should be located and utilized for reef placement.

biomass, macroepifloral biomass and macroepifaunal biomass at the designed reef and at nearby natural reefs. Fin fish communities at both reef types should be censused and compared in number, species and biomass (estimated). Fish communities should also be compared at both reef types using similarity indexing. Sampling should take place once in each season for three years or until it is clear that community structure has stabilized.

8. The Fish and Wildlife Service should be funded by the Corps of Engineers to participate in the monitoring of the designed reefs. This will promote a better understanding of design effects on artificial reef communities and facilitate the development of an increasingly effective artificial reef strategy and better informed decision making for future Civil Works projects.
9. The reef mitigation plan described above should be included as a Federal project feature subject to cost-sharing (i.e. 60% Federal, 40% local) to defray the project sponsor's cost of mitigation.

C. Threatened and Endangered Sea Turtles

1. The Fish and Wildlife Service prepared a Biological Opinion addressing project impacts to threatened and endangered sea turtles on February 8, 1989 (see attachments). This opinion made allowances for relocation of sea turtle nests under Section 9 of the Endangered Species Act. The Service has recently recommended against this practice in our review of several Florida beach nourishment projects. Because there is some evidence that nest relocation may alter emergent sea turtle nest ratios, the Service recommends that the Corps not allow beach construction between November 1 and April 15, provided there are now unhatched nests found on the beaches following November.

Although this does not constitute a Biological Opinion described under Section 7 of the Endangered Species Act, it does fulfill the requirements of the Act, and no further action is required. If modifications are made in the project or if additional information involving potential impacts on listed species becomes available, please notify our office (407-562-3909).

IX. SUMMARY

The Corps of Engineers (Corps) has requested a Fish and Wildlife Coordination Act Report from the U.S. Fish and Wildlife Service (Service) regarding the environmental impacts of a proposed beach nourishment project at Martin County, Florida. Sand fill for the project would be obtained from an offshore borrow area. Silt and clay content of the fill is approximately 10%. Biological surveys of the area by the Corps' contractors have shown that there are rock outcrop reefs immediately offshore of the beaches proposed for renourishment. U.S. Fish and Wildlife Service observations indicate that further quantification reef acreage through aerial photography and groundtruthing is warranted, but that there are currently approximately 13 acres of nearshore reef within the project area. Our observations also show that these reef areas currently provide habitat for a diverse community of fishes and invertebrates.

The Fish and Wildlife Service recommends that impacts to reefs at the southern end of the project be avoided. Remaining unavoidable impacts may be mitigated for with artificial reef construction if carefully designed and deployed. Careful design could reduce acreage ratio requirements for full habitat value replacement. The biological rationale supporting this mitigation recommendation is provided in the report.

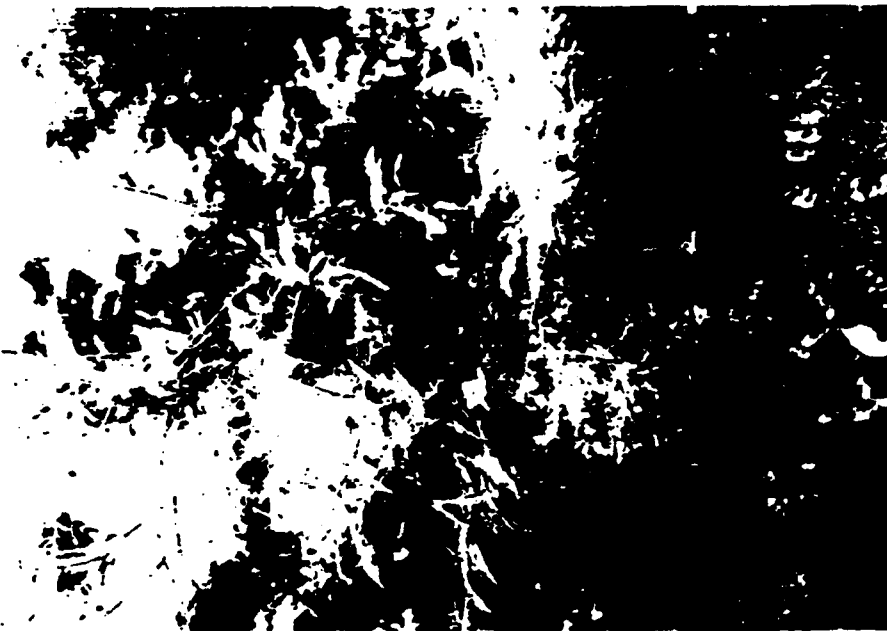
At least one acre of designed reef should be deployed before sandpumping begins to provide alternative habitat for motile organisms displaced by the project. A subsequent study of population densities on the pilot reef should allow the Corps to estimate the appropriate acreage of mitigation required for full habitat value replacement. The Service estimates that an ineffective design may require as much as 2 acres of mitigation per acre of natural reef lost; an effective design could reduce mitigation acreage requirements by more than half.

A prior Biological Opinion in 1989 on this project allowed for nest relocation of threatened and endangered sea turtles. To further minimize incidental take of sea turtles due to nest relocation, the Service now recommends that beach nourishment activities occur between November 1 and April 15, provided the beaches are surveyed for unhatched nests prior to beach fill deposit.

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Appendix B. Epibenthic Community



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ATTACHMENTS



United States Department of the Interior

FISH AND WILDLIFE SERVICE

P.O. BOX 2676

VERO BEACH, FLORIDA 32961-2676

February 8, 1989

Colonel Robert L. Herndon
District Engineer
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

Dear Colonel Herndon:

This represents the Biological Opinion of the U.S. Fish and Wildlife Service, (Service), in accordance with Section 7 of the Endangered Species Act (ESA), of 1973, as amended, regarding the proposed beach erosion control project on Hutchinson Island, Martin County, Florida (FWS Log Number 4-1-89-050). An official record of this consultation is on file in this office.

PROJECT DESCRIPTION

Approximately 942,000 cubic yards of sand would be dredged from an offshore borrow site and placed along 4 miles of beach on Hutchinson Island from the north Martin County line to 0.25 miles south of Stuart Public Beach. Sand grain size based on core borings averages 0.29mm from the offshore borrow material compared to 0.35mm natural beach material. Silt content approximates 6-7 percent by weight.

CONSULTATION HISTORY

On December 6, 1985, the Service provided a Biological Opinion (FWS Log No. 4-1-85-135) to the Corps on the proposed project. On October 20, 1988, the Service responded to a September 13, 1988, Corps request for comments to the Final Environmental Impact Statement for the proposed project. In this response the Service requested the Corps reintiate Section 7 consultation based on new information relative to beach nourishment impacts to sea turtles. The Corps reinitiated consultation with a November 17, 1988 letter to the Service.

BIOLOGICAL OPINION

Three species of sea turtles nest regularly on Florida beaches including the area to be affected by the present proposed activity. The biology of these sea turtles, especially as it relates to nesting of these species in Florida, has been documented in several past Biological Opinions to the Corps (FWS Log No. 4-1-88-251, October 4, 1988; FWS Log No. 4-1-87-149, May 14, 1987). The potential impacts of beach renourishment projects on nesting sea turtles has also been documented and discussed in these Biological Opinions.

Annual nesting activity for Hutchinson Island has averaged 137 loggerhead, 1.6 green, and 0.5 leatherback nests per kilometer between 1985-1987. Based on this information over 875 loggerhead, 10 green and 3 leatherback nests could be affected by the proposed activities.

The Corps indicates in its Biological Assessment that efforts will be made to conduct the proposed dredging and beach disposal outside the nesting season. The Corps has proposed a nest relocation program, should the work be conducted during the nesting season. Even with a nest relocation program, some nests will likely be missed and subsequently buried by the nourishment material or crushed by heavy equipment. In spite of the best intentions, or efforts by persons relocating nests, wind, rain, and tides can quickly obscure tracks and prevent workers from finding nests. Turtle activities also can often obscure nest locations making them difficult to find; especially if searchers are inexperienced or lack motivation. Impacts, such as increased false crawls, aberrant nests, and broken eggs, could occur subsequent to nourishment within the project area due to beach compaction.

Other potential adverse impacts to sea turtles have been discussed in recent Biological Opinions as noted above. The adverse effects resulting from the deposition of dredged material on the area could affect approximately 900 nests. This represents approximately two to three percent of annual nesting activity in Florida. It is our opinion therefore, that the proposed activity is not likely to jeopardize the continued existence of listed sea turtles. We do however believe that adverse impacts to sea turtles could result, particularly when viewed cumulatively in the context of other nourishment projects. The Reasonable and Prudent Measures provided with the Incidental Take Statement will reduce take and adverse impacts to sea turtles.

INCIDENTAL TAKE

Section 7(b)(4) of the Act requires that once a proposed agency action is found to be consistent with Section 7(a)(2) of the Act and the proposed action is likely to result in the take of some individuals of the listed species incidental to the action, the Service will issue a statement that specifies the amount or extent of the impact of such incidental taking. It also states that reasonable and prudent measures, coupled with terms and conditions to implement those measures, be provided to minimize such impacts. The Service must also specify procedures to be used to handle or dispose of any individual specimens taken. Reasonable and prudent measures are requirements of the action agency.

We have reviewed the biological information and other information relevant to this action and based on our review incidental take is authorized for all nests missed by a nest relocation program within the area included in the project boundary. This is inclusive of the direct impacts of nest burial or crushing and the indirect impacts of aberrant nests and broken eggs which result from sand compaction in nesting seasons subsequent to nourishment activities.

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the take.

1. Construction activities will not occur during the main portion of the sea turtle nesting season.
2. Nourished beaches will be tilled if compaction occurs.

Section 9 of the Endangered Species Act prohibits the taking of listed species without a special exemption. In order to be exempt from the prohibitions of Section 9 of the Act, the following terms and conditions, which implement the reasonable and prudent measures described above, must be complied with.

1. The sea turtle nesting season in this area is between March 1 and November 30. To minimize the need for nest relocation and, therefore, reduce the possibility of nest burial or crushing of missed nests, beach nourishment will be started after October 5 or completed before May 30 (preferably after November 5 or before May 1).
2. Nourished beaches will be plowed to a depth of at least 36 inches immediately following completion of beach nourishment if sand compaction is greater than 500 p.s.i. This must be accomplished within the time frame identified for nourishment completion in term and condition #1.
3. Nest relocation activities must begin 65 days prior to nourishment activities which occur within the nesting season (March 1 - November 30) or March 1, whichever is shorter.
4. Nest surveys and relocations will be conducted by personnel with prior experience and training in nest survey and relocation procedures, and with a valid Florida Department of Natural Resource permit. This is essential to reduce the number of missed nests.

5. Nests shall be relocated between sunrise and 10 a.m. each day, and the relocation will be to a nearby self-release beach hatchery in a secure setting and such that artificial lighting will not conflict with hatchling orientation.
6. A report describing the actions taken to implement the terms and conditions will be submitted to this office within 60 days of completion of the proposed project. This report will include dates of actual construction activities, names and qualifications of personnel involved in nest surveys and relocation activities, description and location of hatcheries, nest survey and relocation results and hatching success of nests.

In the event a turtle nest is dug up by beach construction activities the following procedures should be followed:

1. Immediately notify the Florida Department of Natural Resources permitted individual responsible for nest relocation on the project for removal of the nest to the beach hatchery. Before eggs are relocated the top of each egg will be marked with a non-toxic felt tip pen and individually and gently placed on 2-3 inches of moist sand in a rigid-walled container, being careful not to change the axis of the eggs. Eggs will be covered with a fine mesh nylon and then 2-3 inches of moist sand, shaded from the sun, and transported to the hatchery immediately. Eggs will be placed in the constructed nest chamber one at a time insuring that axis of the eggs remains the same.

CONSERVATION MEASURES

To further insure that the project will not affect sea turtles, we request that the Corps include the following conservation measures as conditions in the project plans.

1. Turtle nesting surveys should be conducted for 3 years following nourishment to gather better information on nest success, and hatchling success subsequent to future nourishment. Daytime surveys should be conducted a minimum of 6 days/week, and a sample of the nests should be marked to determine their fate. A sample of these nests should also be analyzed to determine hatching and emergence success. Details of this study should be coordinated with the Fish and Wildlife Service.

2. Sea oats or other appropriate dune vegetation should be planted on nourished beaches to enhance dune restoration. The Florida Department of Natural Resources, Division of Beaches and Shores, can provide technical assistance on the specifications for the design and implementation.
3. Lighting on offshore dredge equipment and beach equipment should be minimized by screening, or use of low pressure sodium lights, reducing intensity, or eliminating lighting where possible, to reduce adverse impacts to nesting turtles and hatchlings.

This completes consultation under Section 7 of the Act. If modifications are made in this project or if additional information becomes available relating to endangered species, reinitiation of consultations may be necessary.

Sincerely yours,


David L. Ferrell
Field Supervisor

cc:
FWE, Jacksonville, FL
FWE, Atlanta, GA
FWE, Washington, D.C.
DNR, St. Petersburg, FL
Molly Palmer, FDNR, Tallahassee, FL
Barbara Schroeder, FDNR, Stuart, FL
Chuck Oravetz, NMFS, St. Petersburg, FL

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ATTACHMENT B

CONCURRENCE LETTERS



FLORIDA GAME AND FRESH WATER FISH COMMISSION

RECEIVED
NOV 30 1993



MRS. GILBERT W. HUMPHREY
Micosukee

JOE MARLIN HILLIARD
Clewiston

J. BEN ROWE
Gainesville

JULIE K. MORRIS
Sarasota

QUINTON L. HEDGEPEETH, DD.
Miami

ALLAN L. EGBERT, Ph.D., Executive Director

110 43rd Avenue, S.W.
Vero Beach, Florida 32968
November 23, 1993

Mr. David L. Ferrell
U.S. Fish and Wildlife Service
P.O. Box 2676
Vero Beach, FL 32961-2676

RE: Draft Fish and Wildlife Coordination
Act Report for Hutchinson Island
Beach Renourishment Project, Martin
County

Dear Mr. Ferrell,

The Office of Environmental Services of the Florida Game and Fresh Water Fish Commission has reviewed the above referenced document and concurs with the report's findings and the recommendations. If we can be of further assistance, please do not hesitate to call.

Sincerely,

Stephen R. Lau
Biological Administrator

ENV 1-4-2
SL/MS/rs
hutch.fws



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
9450 Koger Boulevard
St. Petersburg, Florida 33702

October 18, 1993

RECEIVED
OCT 21 1993

David L. Ferrell
Field Supervisor
U.S. Department of the Interior
Fish and Wildlife Service
P.O. Box 2676
Vero Beach, Florida 32961-2676

Dear Mr. Ferrell:

The National Marine Fisheries Service (NMFS) has reviewed the Draft Fish and Wildlife Coordination Act Report for the proposed beach renourishment project at Hutchinson Island, Martin County, Florida. The report was submitted to us by cover letter dated September 21, 1993.

Based on the information included in the report, we concur with the Fish and Wildlife Service recommendations outlined in pages 13 - 15. We particularly support the recommendations to avoid impacts to reefs at the southern end of the project and to mitigate remaining impacts with artificial reef construction. While we also agree that acreage ratio requirements for the mitigation could be reduced by careful and appropriate artificial reef design, we wish to emphasize the importance of monitoring a pilot reef to ensure that sufficient mitigation is included in the project. Post construction monitoring of the created reefs would certainly be beneficial in future project evaluations, as indicated in recommendation B7.

Thank you for the opportunity to review this draft report. If we can provide additional assistance, please contact Ms. Shelley Du Puy of our Miami Field Office at 305/525-3352.

Sincerely,

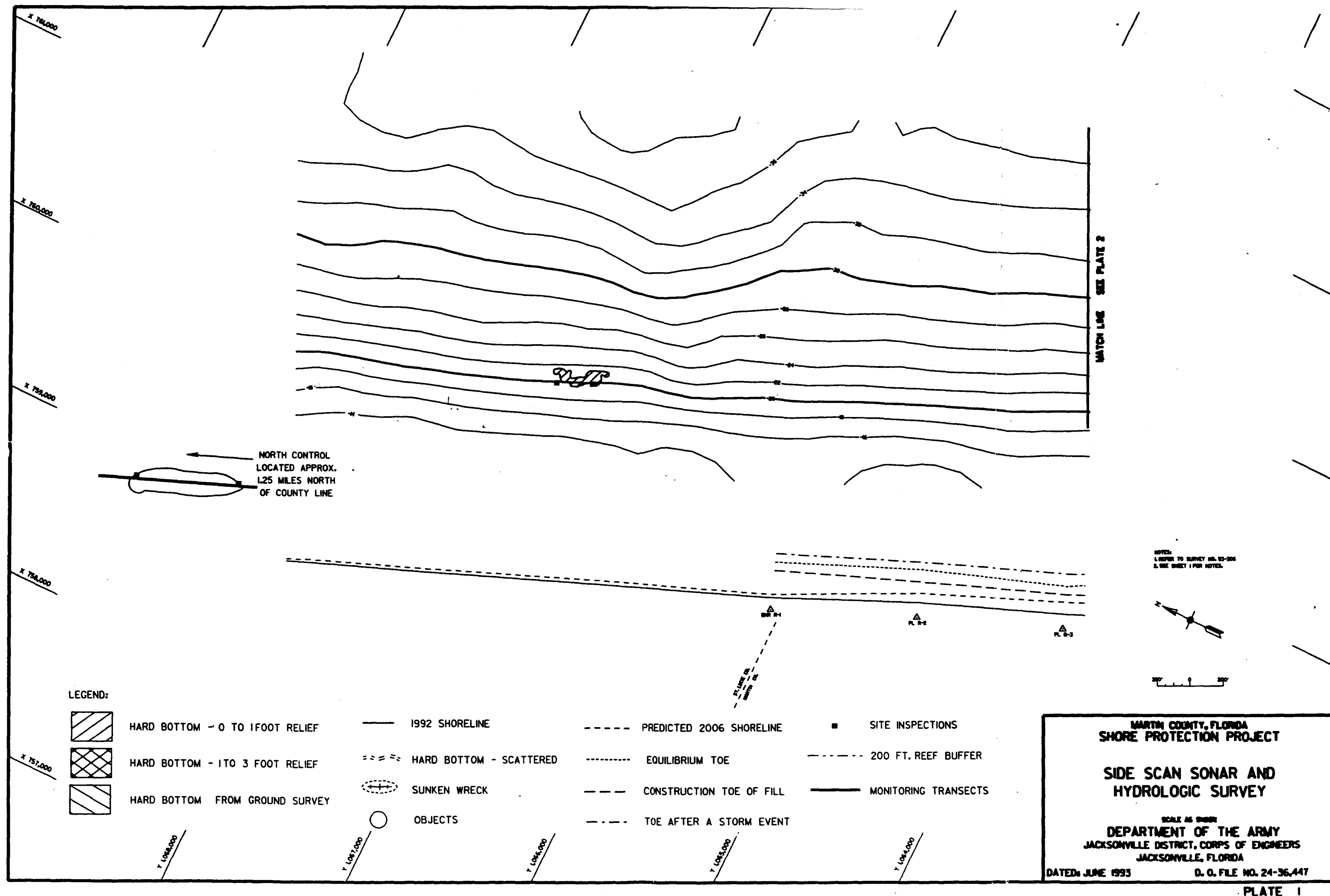
Shelley Du Puy

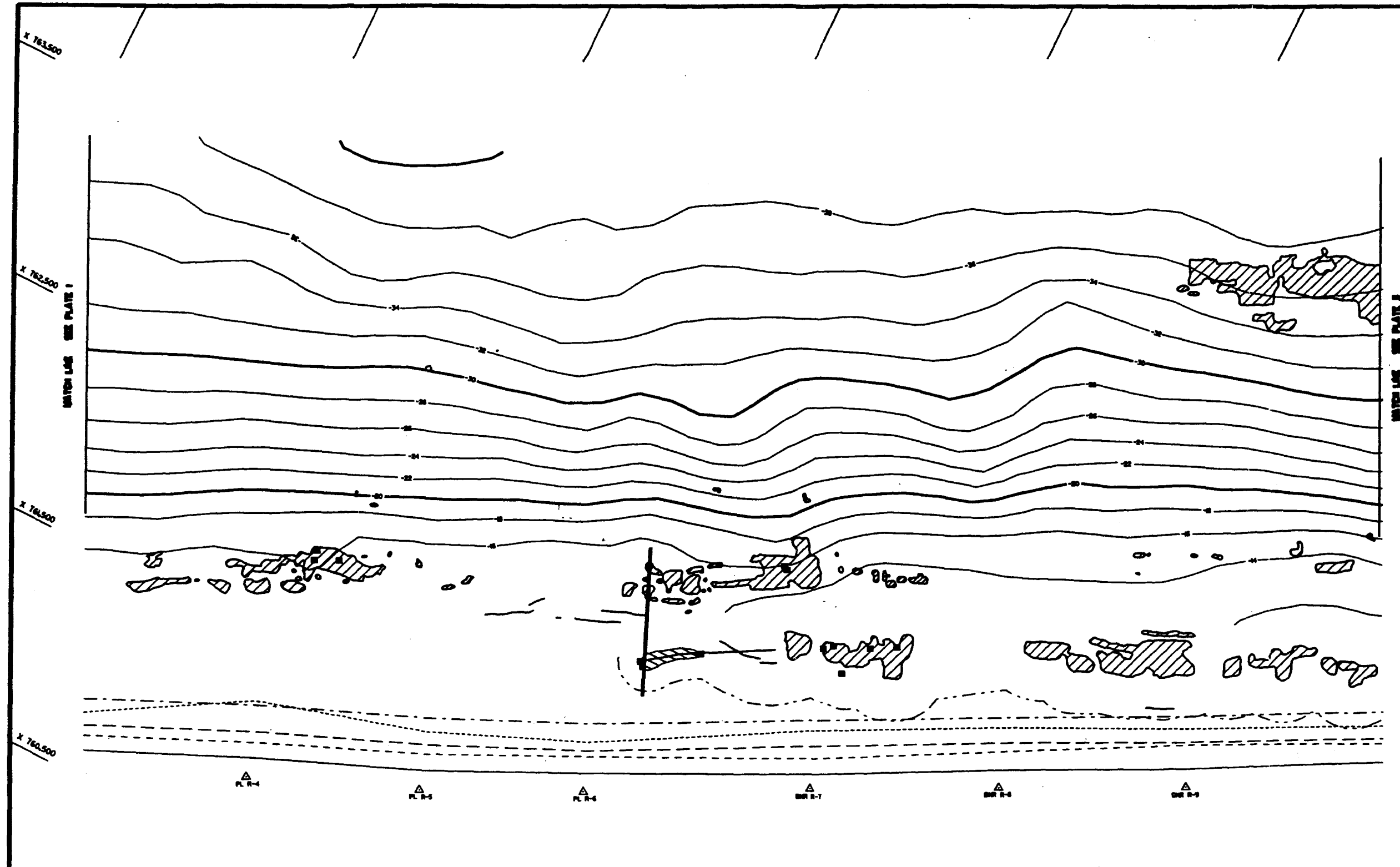
for Andreas Mager, Jr.
Assistant Regional Director
Habitat Conservation Division



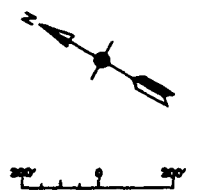
Appendix D

**Location of Hardbottom Habitat
Martin County Shore Protection Project
Hutchinson Island, Martin County, Florida**



















NOTES:
1. REFER TO SURVEY NO. 93-204
2. SEE SHEET 1 FOR NOTES.



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|  | HARD BOTTOM - 0 TO 1 FOOT RELIEF |  | 1992 SHORELINE |  | PREDICTED 2006 SHORELINE |  | SITE INSPECTIONS |
|  | HARD BOTTOM - 1 TO 3 FOOT RELIEF |  | HARD BOTTOM - SCATTERED |  | EQUILIBRIUM TOE |  | 200 FT. REEF BUFFER |
|  | HARD BOTTOM FROM GROUND SURVEY |  | SUNKEN WRECK |  | CONSTRUCTION TOE OF FILL |  | MONITORING TRANSECTS |
| | |  | OBJECTS |  | TOE AFTER A STORM EVENT | | |

MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

SIDE SCAN SONAR AND
HYDROLOGIC SURVEY

SCALE AS SHOWN
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

DATED: JUNE 1993

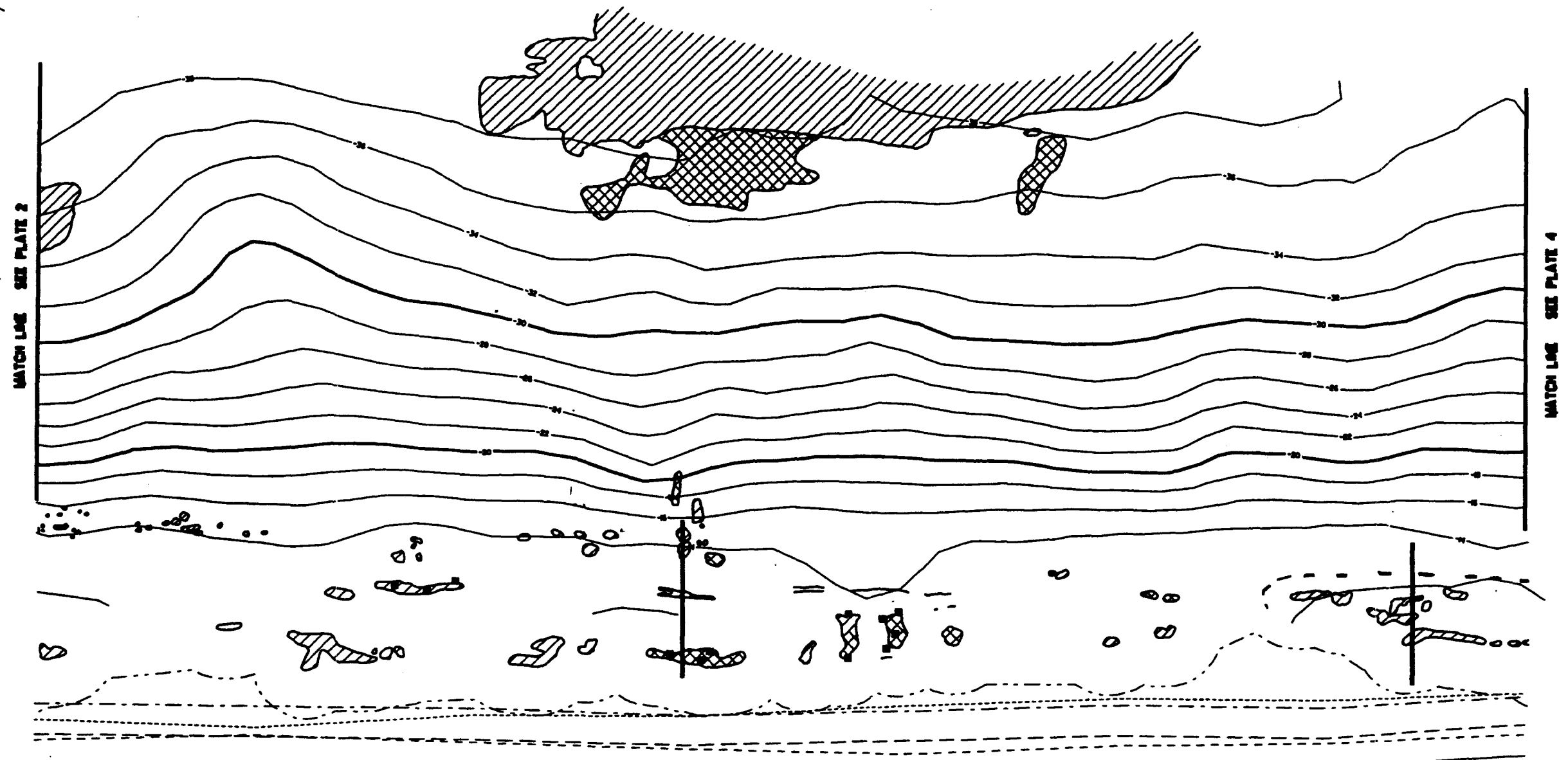
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





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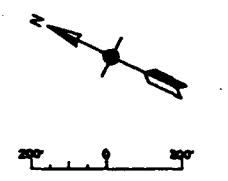


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|  HARD BOTTOM FROM GROUND SURVEY |  SUNKEN WRECK |  CONSTRUCTION TOE OF FILL |  MONITORING TRANSECTS |
| |  OBJECTS |  TOE AFTER A STORM EVENT | |

NOTES:
1. REFER TO SURVEY NO. 93-006
2. SEE SHEET 1 FOR NOTES.

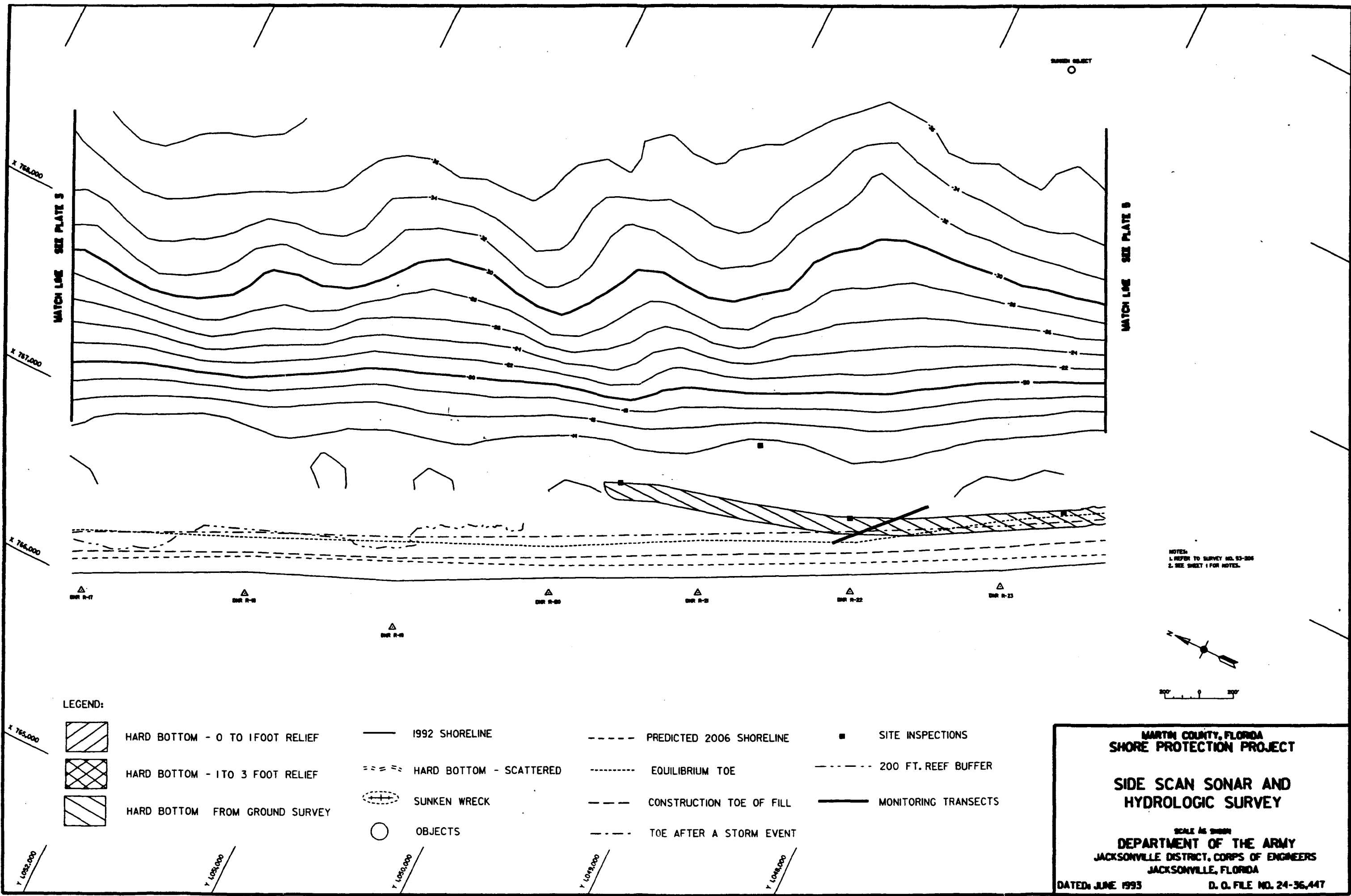


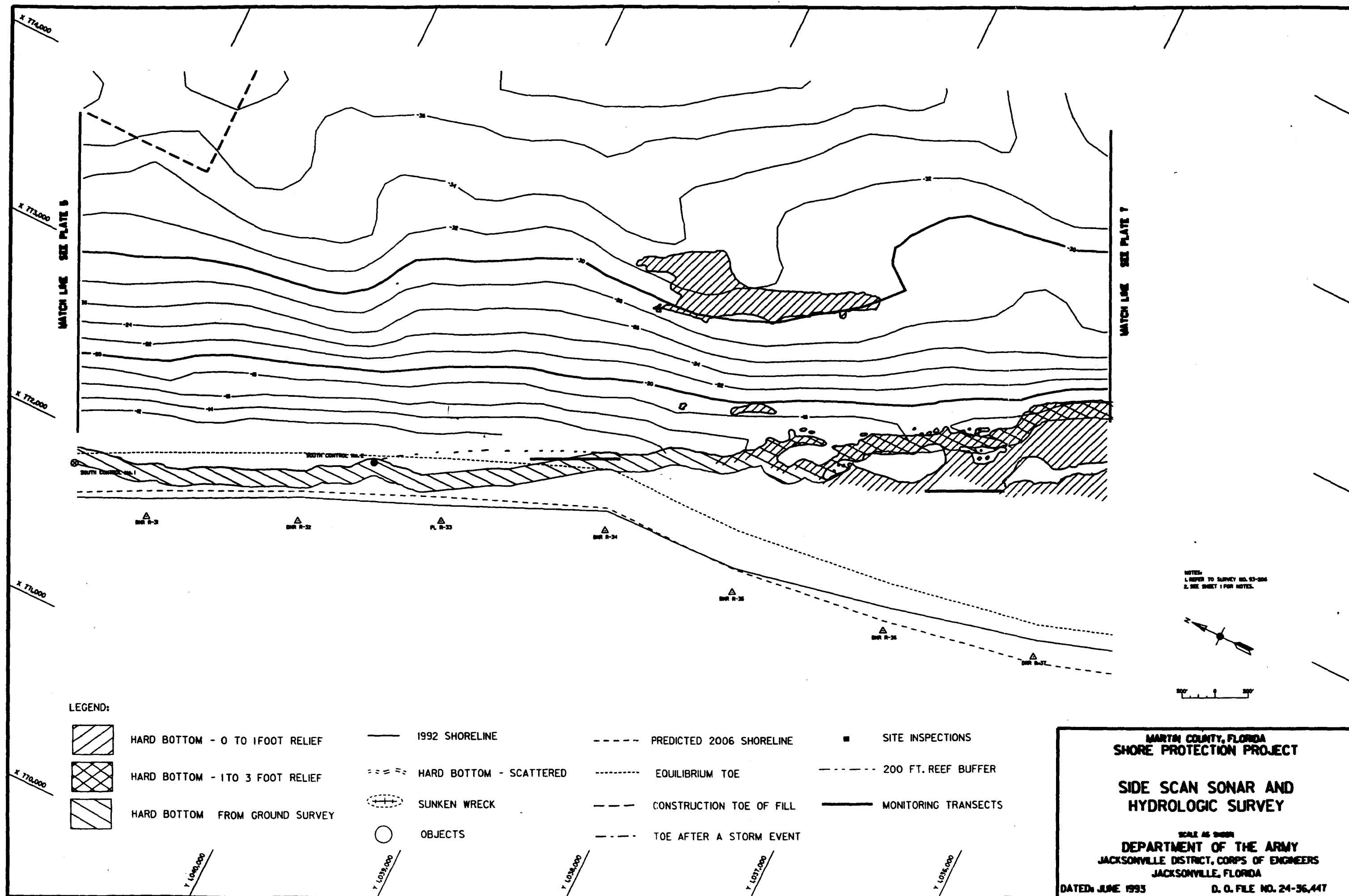
MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

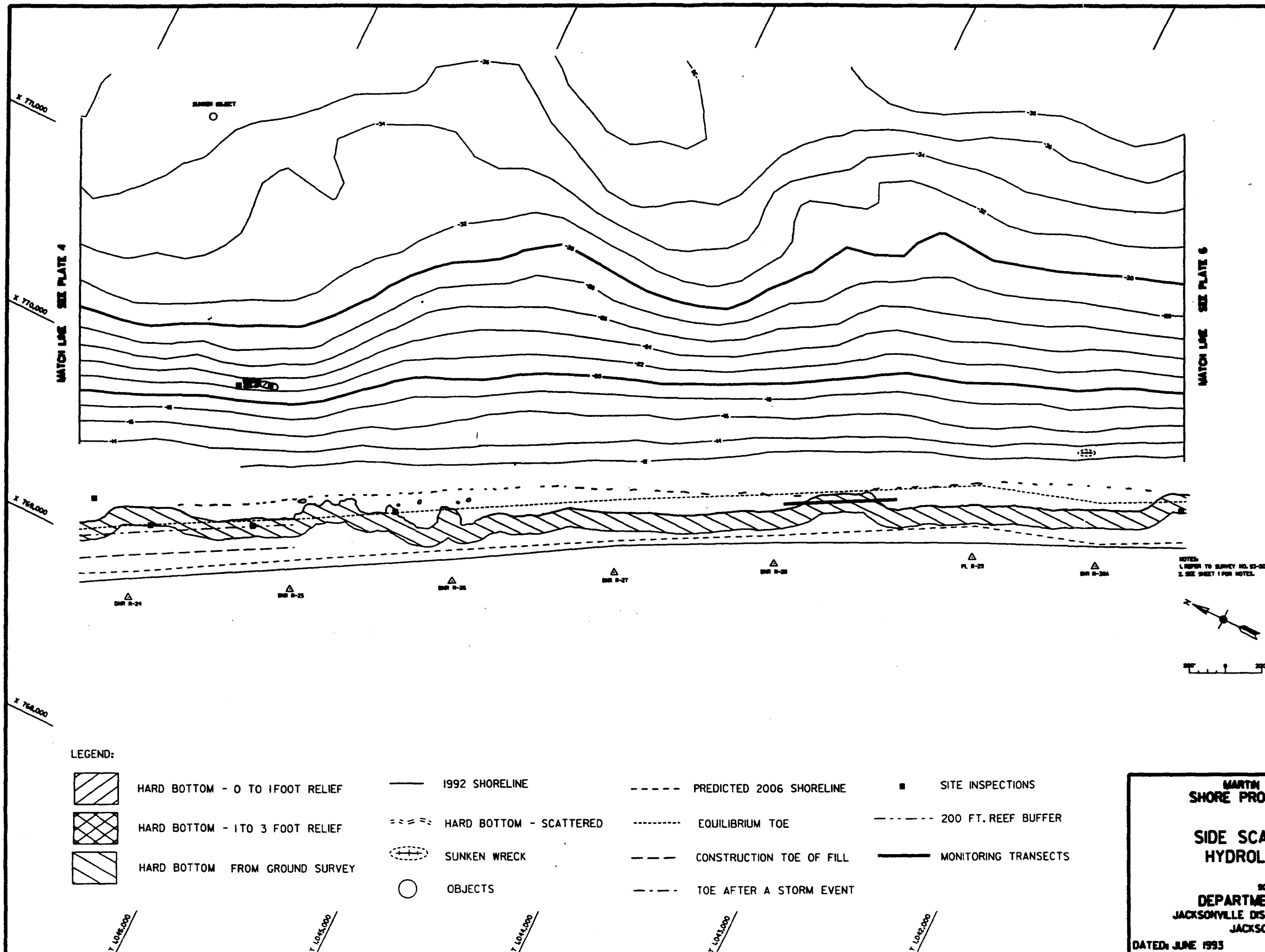
SIDE SCAN SONAR AND
HYDROLOGIC SURVEY

SCALE AS SHOWN
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

DATED: JUNE 1993 D. O. FILE NO. 24-36,447







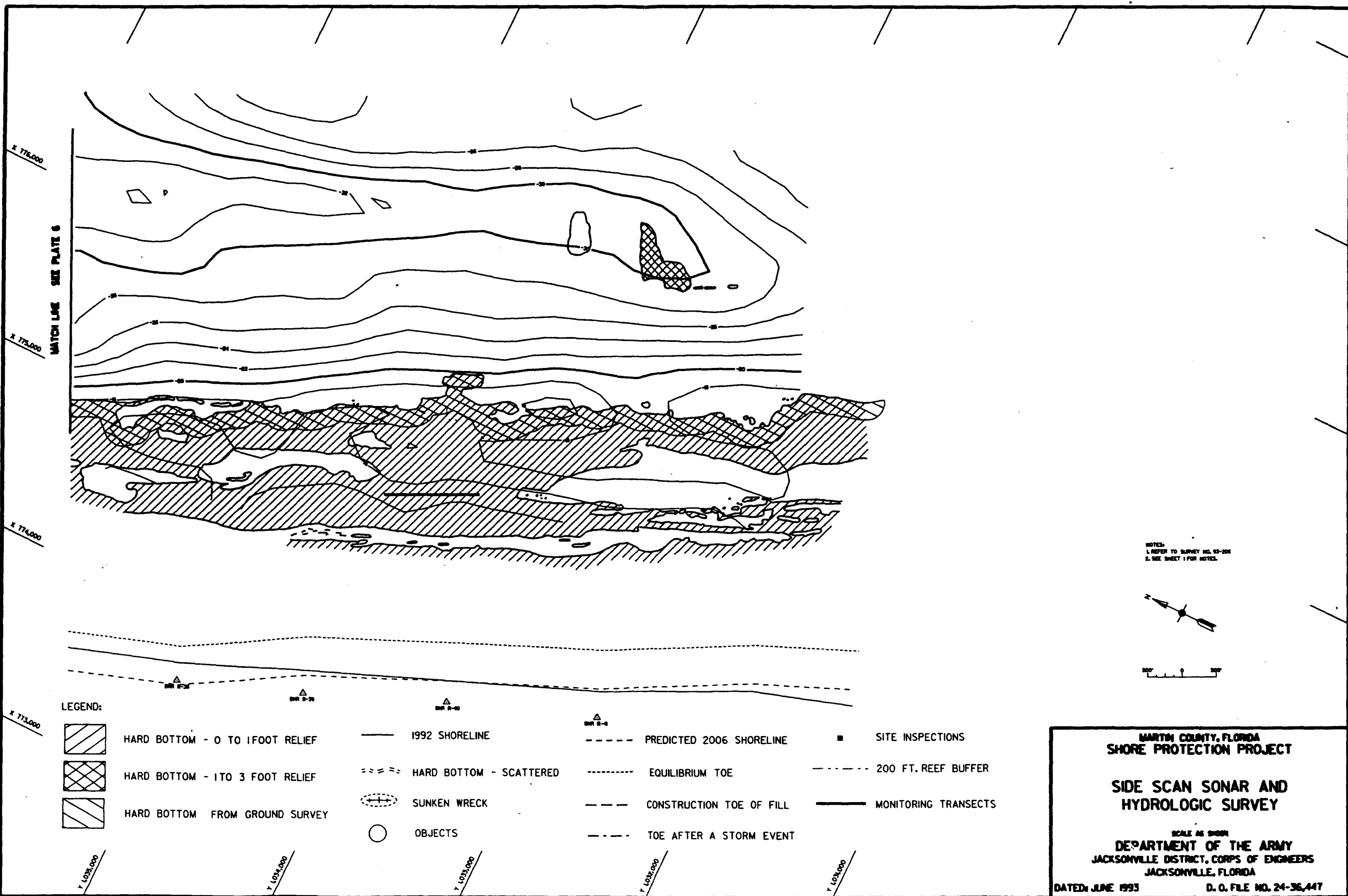
MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

**SIDE SCAN SONAR AND
HYDROLOGIC SURVEY**

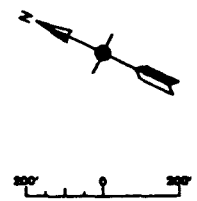
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JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

DATED: JUNE 1993

D. O. FILE NO. 24-36,447



NOTES:
1. REFER TO SURVEY NO. 93-206
2. SEE SHEET 1 FOR NOTES.



LEGEND:

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| | HARD BOTTOM - 0 TO 1 FOOT RELIEF | | 1992 SHORELINE | | PREDICTED 2006 SHORELINE | | SITE INSPECTIONS |
| | HARD BOTTOM - 1 TO 3 FOOT RELIEF | | HARD BOTTOM - SCATTERED | | EQUILIBRIUM TOE | | 200 FT. REEF BUFFER |
| | HARD BOTTOM FROM GROUND SURVEY | | SUNKEN WRECK | | CONSTRUCTION TOE OF FILL | | MONITORING TRANSECTS |
| | | | OBJECTS | | TOE AFTER A STORM EVENT | | |

**MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT**

**SIDE SCAN SONAR AND
HYDROLOGIC SURVEY**

SCALE AS SHOWN
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

DATED: JUNE 1993 D. O. FILE NO. 24-36,447

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APPENDIX B
ECONOMIC ANALYSIS

ECONOMIC ANALYSIS
APPENDIX B
MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT
GENERAL DESIGN MEMORANDUM

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**APPENDIX B
ECONOMIC ANALYSIS
MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT
GENERAL DESIGN MEMORANDUM**

PROJECT BENEFITS

B-1. Storm damage reduction projects generate both primary and incidental benefits. The primary tangible benefits of these projects include physical damages prevented, including damage to structural improvements, coastal armor, replacement of backfill, and prevention of loss of land. Incidental benefits generated by a storm damage reduction project would be those generated by increased recreational usage, and beneficial impacts to downdrift shores.

This appendix includes discussions of both primary benefits (i.e. storm damage prevention benefits) and incidental benefits (i.e. recreation benefits). Following those discussions, a summary of total project benefits and costs is provided.

- Engineering Regulation 1105-2-100 (The Planning Guidance Notebook) provides economic evaluation procedures to be used in all Federal water resources planning studies. The guidelines specified in the October 1989 draft of ER 1105-2-100 were observed in preparing this report. The Federally mandated project evaluation interest rate of 8 percent, an economic period of analysis of 50 years and October 1993 prices were used to evaluate economic feasibility.

PRIMARY BENEFITS - STORM DAMAGE PREVENTION BENEFITS

B-2. The first step in determining damage prevention benefits is to develop a relationship between shoreline recession and storm (surge) events. A number of studies of storm effects have identified the storm surge as the most important variable relating to beach profile retreat (Dean 1976, Richardson 1977, Hughes and Chiu 1981, Vellinga 1983, 1986). The rise in water level during a storm, or storm surge, develops as the result of the supposition of astronomical tide, wave setup, and meteorological (wind and pressure fields) surge. A change in water level does not in itself cause erosion, wave action is required. The most important wave parameter controlling beach profile change is the deep water wave height and wave steepness (the ratio of wave height to wave length). Other pertinent factors

include the beach grain size and mean beach slope. The first step in determining damage prevention benefits is to develop a relationship between shoreline recession and storm (surge) events.

STORM DAMAGE (\$) MODEL

B-3. Based on the use of a shoreline storm response model, a relationship can be developed between storm frequency and shoreline recession. By a combination of field examination and the use of aerial photography, a relationship between shoreline recession and damage to structures and development can be determined. The relationship between probability and damages can then be determined by tabulating total damage estimates for varying frequency storm events. Probability of occurrence for each event is defined on the basis that the storm event could be equaled or exceeded in a given year. The frequency-damage curve is then integrated to produce average annual damages for the 1993, (existing) condition.

The assessment of damages to existing development is based on conditions at the time of beach profile surveys. Due to continuing erosion and shoreline recession over time, future damages to development would be more severe with a given storm. Therefore, the shoreline recession-damage relationship is modified to accommodate the expected shoreline position in future years with respect to the reference shoreline. Future year damages are simulated by determining the location of the shoreline in future years using the historical erosion rate for the problem area. Future long-term recession is halted at the year when an existing seawall or protective structure is encountered. In some instances, future damages could be less if a coastal armor replacement index is selected which provides greater protection than the current coastal armor type. In addition, if a coastal armor type is selected which does not halt shoreline recession (i.e. the value of the structural improvement is not worth protection), and the future shoreline position exceeds the distance to full value,, then the structural improvement is condemned and removed from the data base at the year of condemnation.

Using this new information, a frequency-damage relationship is constructed for each year of the project life. The resulting estimates of expected damage are converted to an average annual equivalent basis using an interest rate of 8 percent for the 50-year period of analysis.

An analysis of with project storm damage is conducted similarly to without project storm damage. The average annual equivalent storm damage prevention benefit is the difference between the average annual equivalent value of the without and with project storm damage.

The Jacksonville District has developed an empirical computer model to simulate damages at existing and future years and compute average annual equivalent damages. This model is referred to as the Storm Damage (\$) Model (SDM). For the purposes of the SDM, storm damage is defined as the damage incurred by the temporary loss of a given amount of shoreline as a direct result of wave attack caused by a storm of a given magnitude and frequency. Damages or losses to developed shorelines include buildings, pools, patios, parking lots, roads, utilities, seawalls, revetments, bulkheads, replacement of lost backfill etc. Assumptions used in the development of an estimate of annual storm damages are as follows:

MODEL ASSUMPTIONS

B-4. * The relationship of probability to shoreline recession will remain constant with time.

* Damage to improvements will not occur until shoreline recession has exceeded the seaward edge of the improvement.

* When the shoreline recedes halfway through a structure, the structure is considered a total loss (i.e. a single family home).

* When the shoreline recedes halfway through a structure with more than two stories with deeply embedded piles (such as high-rise condominiums), the structural value of only the bottom two floors is considered lost.

* If a structure is less than one-half undermined, the damage was assumed to be equal to the product of the structural value available for damage calculations and the ratio of the horizontal distance eroded through the structure divided by the mid-point of the distance through the structure.

* All market values of improvements were estimated by using a version of the Cost Approach to Value known as Replacement Cost New Less Depreciation.

* Content damage was not evaluated in this report.

* Seawalls, revetments and other coastal armor halt all damage from given storm until failure. The structure is assumed lost when the volume of scour in front of the structure is sufficient to allow structural failure.

* Although shorefront areas continue to develop through time, damage

estimates are limited to existing buildings and structures.

- * Repair costs to the coastal armor and the cost of backfill are determined by current engineering estimates of replacement and/or repair costs of such work.

- * After structural failure, the shorefront development, roads, parking lots, etc. will be repaired to a condition similar to and in the same location as the pre-storm conditions.

Specific input to the SDM is discussed in the following paragraphs.

MODEL INPUT

B-5. EXISTING AND FUTURE SHORELINE POSITION. The assessment of damages to existing development is based on conditions at the time of the 1993 beach profile survey. Continuous erosion and shoreline recession results in reduced beach width and hence protective value between a structure and the reference shoreline. Therefore, future damages to development are expected to be more severe with a given storm in future time periods. Future year damages are simulated in the model by description of the location of the reference shoreline in future years, as shown in Table B-1. The location of the reference shoreline is based on the historical shoreline recession rate for the study area. Future recession is halted at the year an existing seawall or other protective coastal armor is encountered.

B-6. FREQUENCY-SHORELINE RECESSION RELATIONSHIP. Relationships between exceedance probability and recession for Martin County, is used as model input. The frequency-shoreline recession relationship for Martin County is shown in Table B-1.

B-7. COASTAL PROTECTIVE ARMOR. Field inspections were made in July 1993 to determine the type, general location and condition of coastal armor by lot in the study problem area. The coastal protective structures (or armor) were grouped and categorized as to level of protection provided, unit cost and damage factor, as shown in Table B-1. The level of protection provided by each armor type, based on the field inspection and engineering judgement, is the amount of shoreline recession each type of armor would prevent until failure. The unit replacement costs per linear foot are based on engineering cost estimates. The damage factor is the percent of armor repair/replacement needed after failure.

B-8. STRUCTURAL IMPROVEMENT VALUE. Estimates were developed for ocean-front improvements in the project area. The improvements include

single-family residential, multi-family residential and commercial structures. To determine structural values, the Jacksonville District Staff Appraiser utilized the Replacement Cost New Less Depreciation method. The Marshall/Swift and the Means construction cost handbooks were used to estimate Replacement Cost New of residential and commercial structures. The age-life depreciation method was then used to estimate accrued depreciation. Information in the County Property Appraiser's Office was also examined. The estimated values of the structural improvements are tabulated in Table B-2. The structures are listed in number sequence or description and corresponding monument number. The structures are listed in order from north to south, along with the nearest DNR survey monument, and can be identified on the selected plan plates. Engineering field inspections were made in July 1993 to determine the number of floors for each structure and to estimate the structural integrity of each building. Coastal Engineering Construction Manuals usually require that a multi-floor structure located on the beach be anchored properly and use deeply embedded piles. Foundation systems for mid- and high-rise structures are typically embedded deeply below existing ground to provide a safety margin against scour. This will limit damage susceptibility. It is assumed for this study that only the first two floors of multi-floor structures would be damaged. The other floors are expected to remain anchored to the columns. Structures of two stories or less are assumed to be on slabs or short post foundations which would incur damage up to the full structural values. In cases where structures were (1) greater than two floors in height and (2) had either garages or piles as ground floor structures, the structural value listed in Table B-2 was reduced to the value of just the bottom two floors and the number of floors was reduced to two so that the model would more accurately compute damages.

TABLE B-1

**STORM DAMAGE MODEL INPUT
MARTIN COUNTY, FLORIDA SHORE PROTECTION PROJECT**

YEAR	SHORE POSITION	YEAR	SHORE POSITION	YEAR	SHORE POSITION	YEAR	SHORE POSITION	YEAR	SHORE POSITION
1995	3.9	1996	5.2	1997	6.5	1998	7.8	1999	9.1
2000	10.4	2001	11.7	2002	13.0	2003	14.3	2004	15.6
2005	16.9	2006	18.2	2007	19.5	2008	20.8	2009	22.1
2010	23.4	2011	24.7	2012	26.0	2013	27.3	2014	28.6
2015	29.9	2016	31.2	2017	32.5	2018	33.8	2019	35.1
2020	36.4	2021	37.7	2022	39.0	2023	40.3	2024	41.6
2025	42.9	2026	44.2	2027	45.5	2028	46.8	2029	48.1
2030	49.4	2031	50.7	2032	52.0	2033	53.3	2034	54.6
2035	55.9	2036	57.2	2037	58.5	2038	59.8	2039	61.1
2040	62.4	2041	63.7	2042	65.0	2043	66.3	2044	67.6

EQUIVALENT PROFILE EXTENSION = 0 (Without Project Condition)

PROBABILITY	STORM INDUCED RECESSION
.010	212
.020	188
.050	159
.100	143
.200	127
.500	108

ARMOR INDEX	DESCRIPTION OF ARMOR	UNIT COST	LEVEL OF PROTECTION	DAMAGE FACTOR
1.	CON. WAVE RETURN SEAWL	260	75	1.00
2.	CONCRETE SHEET PILE -SM	289	75	1.00
3.	CONCRETE SHEET PILE -MD	316	80	1.00
4.	CONCRETE SHEET PILE -LG	335	85	1.00
5.	ROCK REVETMENT 2 TON	990	75	.40
6.	EMERGENCY SAND BAGGING	130	40	.50
7.	VARIABLE SEAWALL	259	70	1.00
8.	COLLAPSED SEAWL/RUBBLE	100	40	.50
9.	NO ACTION	0	0	.00

COST PER SQUARE UNIT OF BACKFILL AND VEGETATION = 1.15

TABLE B-2

MARTIN COUNTY, SHORE PROTECTION PROJECT
STORM DAMAGE MODEL INPUT TABLE

SITE DESCRIPTION	VALUE	WIDTH	FLOORS	DISTANCE TO ZERO VALUE	DISTANCE TO FULL VALUE	DISTANCE TO ARMOR	ARMOR INDEX	CONSTRUCTION INDEX
PRIVATE RESIDENCE	210200	110	2	150	190	80	9	6
CONDO 4	1144050	210	1	120	200	65	9	6
CONDO 4A	1144050	450	1	120	200	65	9	6
PRIVATE RESIDENCE	64875	190	1	105	140	90	9	6
UNDEVELOPED/ HIGHWAY	24000	450	1	470	530	400	9	5
COMMERCIAL	178150	230	2	280	340	100	9	6
PUBLIC PARKING LOT	62500	1050	1	230	350	220	9	6
CONCESSION STAND	11000	170	1	180	200	140	9	6
GEZEBO	3000	230	1	70	80	65	9	6
BATHHOUSE	5000	280	1	80	100	55	9	6
GAZEBO	3000	180	1	145	165	100	9	6
LIFEGUARD BUILDING	69625	670	1	150	170	100	9	6
HOTEL 2	989265	510	1	130	160	100	9	6
UNDEVELOPED/ HIGHWAY	45600	790	1	360	390	340	9	5
PRIVATE RESIDENCE	218550	130	1	100	160	55	9	6
PRIVATE RESIDENCE	186930	100	2	75	105	50	9	6
CONDO 5	267200	180	2	90	200	50	9	6
UNDEV PUBLIC/HIGHWAY	231200	4010	1	340	370	320	9	5
PRIVATE RESIDENCE	144625	100	2	70	80	60	9	6
GAZEBO	3000	110	1	65	75	50	9	6
CONDO 6	1454200	200	1	100	145	50	9	6
CONDO 6 POOL	15000	130	1	95	120	50	9	6
CONDO 6A	1454200	200	1	90	130	50	9	6
CONDO 6B	1454200	330	1	120	155	80	9	6
UNDEVELOPED/ HIGHWAY	31500	410	1	315	355	300	9	5
PRIVATE RESIDENCE	247500	80	2	65	90	60	9	6
CONDO 7	1273875	200	1	95	130	45	9	6
CONDO 7A	1273875	270	1	100	130	25	9	6
CONDO 8	2013567	300	2	80	140	50	9	6

TABLE B-2

**MARTIN COUNTY, SHORE PROTECTION PROJECT
STORM DAMAGE MODEL INPUT TABLE**

SITE DESCRIPTION	VALUE	WIDTH	FLOORS	DISTANCE TO ZERO VALUE	DISTANCE TO FULL VALUE	DISTANCE TO ARMOR	ARMOR INDEX	CONSTRUCTION INDEX
CONDO 8A	2013567	370	2	85	170	65	9	6
CONDO 8B	2013567	150	2	90	180	75	9	6
CONDO 9	1883700	120	2	90	175	90	9	6
CONDO 9A	1883700	120	2	150	200	80	9	6
CONDO 9B	1883700	150	2	160	200	75	9	6
UNDEV PUBLIC/HIGHWAY	34000	450	1	350	390	320	9	5
PRIVATE RESIDENCE	129825	210	2	85	95	75	9	6
PRIVATE RESIDENCE	133244	110	1	105	140	90	9	6
PRIVATE RESIDENCE	133244	130	1	85	105	80	9	6
UNDEVELOPED/ HIGHWAY	51000	680	1	410	450	400	9	5
CONDO 10	1582852	340	1	150	195	85	9	6
UNDEVELOPED/ HIGHWAY	17000	225	1	410	450	390	9	6
CONDO 11	1216925	190	1	115	200	110	2	2
CONDO 11A	1216925	135	1	90	160	60	2	2
CONDO 11 (CLUBHS)	25000	110	1	70	100	65	2	2
CONDO 12	567700	120	2	50	150	25	5	5
CONDO 12A	1605700	190	2	50	150	40	5	5
CONDO 13	1989750	440	1	80	175	75	3	3
CONDO 13 (CLUBHS)	20000	160	1	100	150	80	3	3
UNDEV PUBLIC/HIGHWAY	11000	150	1	390	430	370	9	5
CONDO 14	402204	140	1	75	150	50	5	5
UNDEVELOPED/ HIGHWAY	23000	410	1	430	460	410	9	6
PRIVATE RESIDENCE	416200	100	1	175	205	65	9	6
PRIVATE RESIDENCE	419225	120	1	155	200	55	9	6
PRIVATE RESIDENCE	405938	85	1	145	205	55	9	6
UNDEVELOPED/ HIGHWAY	61000	1080	1	460	490	430	9	6
PUBLIC PK GAZEBO	5000	230	1	130	150	70	9	6
PUBLIC BOATHOUSE	7000	300	1	90	100	80	9	6
PUBLIC PK CONCESS. STN D	8000	40	1	250	272	90	9	6

TABLE B-2

MARTIN COUNTY, SHORE PROTECTION PROJECT
STORM DAMAGE MODEL INPUT TABLE

SITE DESCRIPTION	VALUE	WIDTH	FLOORS	DISTANCE TO ZERO VALUE	DISTANCE TO FULL VALUE	DISTANCE TO ARMOR	ARMOR INDEX	CONSTRUCTION INDEX
PUBLIC PK GAZEBO	5000	175	1	85	95	80	9	6
PUBLIC RESTROOM	7000	100	1	170	190	85	9	6
LIFEGUARD TOWER	1000	400	1	100	110	95	9	6
CONDO 15 (POOL)	15000	80	1	140	170	70	9	6
CONDO 15	1784550	80	1	180	270	70	9	6
CONDO 16	8413000	500	1	170	280	80	9	6
CONDO 17	3212900	330	1	165	220	85	9	6
CONDO 18	2321100	220	1	170	280	90	9	6
CONDO 19	2392100	450	1	175	250	95	9	6
CONDO 20	3352000	230	1	180	220	90	9	6
CONDO 21	935200	180	1	145	150	100	9	6

B-9. PHYSICAL DIMENSIONS. The model requires the width for each distinct or different coastal development. This is usually the lot width as measured from the aerial photography. Using aerial photography flown in June 1992, distances from the reference shoreline (mean high water) to (1) the location of existing or future coastal armor, (2) to the face of the structure (zero value), and (3) to the point of full value were measured. The 1985 mean high water line was adjusted based on the 1993 beach profile survey prior to making measurements from the aerials. In the case of structural improvements such as single family homes or condominiums, the full value distance point is the mid-point or center of the structure. In the case of pools or utilities, the full value distance point is one foot beyond the face of the improvement. In the case of roads or patios, the full value distance point is the landward edge of the improvement.

B-10. MISCELLANEOUS INFORMATION. The existing coastal armor type is listed in the data base by lot and is identified in Table B-2 as the armor index. The armor index is cross-referenced in the model to the input or armor type shown in Table B-1. The construction index listed in Table B-2 is the type of coastal armor to be built when the existing coastal armor has failed. If no coastal armor exists (identified in Table B-1 as Dummy Field), the location of armor construction was determined based on adjacent coastal armor and engineering judgment. The cost of backfill and vegetation is also added to the model input (shown in Table B-1). The value 1.15 is the dollar price per cubic foot times the depth of backfill replacement (two foot uniform depth assumed for all storms).

DAMAGE PREVENTION BENEFITS.

B-11. Based on the assumptions and the data input discussed previously, the model computes damages for each foot of storm recession distance. These computations are performed for each lot and then summarized by ten foot increments as structural damage (\$s), armor damage (\$a), and backfill (\$b). Shoreline recession-damage tables for the Martin County beach areas, existing and future years, without and with project are shown in Tables B-3 and B-4. The assessment of damages to existing development is a function of the protection afforded by existing widths of beach and dunes. As a result of future erosion, damages to development in the future will tend to be more severe with a given storm due to the fact that the amount of beach protection between a structure and the shoreline will decrease with time. After the relationships between recession and damage are determined, relationships between probability and damage are then determined by assigning probabilities from the appropriate frequency-recession relationship shown in Table B-1. This computational process results in without and with project frequency-damage curves for the existing condition and each future

time increment analyzed. The frequency-damage relationships are integrated to produce average annual damages. Frequency-damage information and average annual damages for the without and with project conditions for authorized plan and modified plan are shown in Table B-5.

Shoreline movement is simulated by the model and average annual damages are computed for each year of the 50 year project life. These streams of average annual damages without and with the project for Martin County beach areas are appropriately amortized and discounted at the project interest rate of 8 percent. Average annual damage streams and average annual equivalent damage for Martin County Beach for both authorized and modified plans are presented in tables B-6, B-7 and B-8.

TABLE B-3
MARTIN COUNTY BEACHES
RETROSION-DAMAGE TABLE
WITHOUT PROTECT CONDITIONS (\$1,000)

RECESS (Feet)	1995 DAMAGE & EXISTING CONDITIONS				2005 DAMAGE & EXISTING CONDITIONS				2011 DAMAGE & EXISTING CONDITIONS				2025 DAMAGE & EXISTING CONDITIONS				2035 DAMAGE & EXISTING CONDITIONS				2045 DAMAGE & EXISTING CONDITIONS			
	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
350	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
450	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE B-3
MARTIN COUNTY BEACHES
RECESSION-DAMAGE TABLE
WITHOUT PROTECT CONDITIONS (91,000)

MOOFED PLAN RECESS (feet)	1995 DAMAGE B-EXISTING CONDITIONS			2005 DAMAGE B-EXISTING CONDITIONS			2015 DAMAGE B-EXISTING CONDITIONS			2025 DAMAGE B-EXISTING CONDITIONS			2035 DAMAGE B-EXISTING CONDITIONS			2045 DAMAGE B-EXISTING CONDITIONS			SUM		
	to	from	to	to	from	to	to	from	to	to	from	to	to	from	to	to	from	to	to	from	to
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
350	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
450	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B-4
North County Gasworks
Reclamation-Closure Table
With Project Closures (\$1,000)
in FOOT MEAS.

AUTHORIZED PLAN

PROCESS (Feet)	1995 WITH 36'-FOOT PROJECT			2005 WITH 36'-FOOT PROJECT			2010 WITH 36'-FOOT PROJECT			2015 WITH 36'-FOOT PROJECT			2020 WITH 36'-FOOT PROJECT			2025 WITH 36'-FOOT PROJECT			2030 WITH 35'-FOOT PROJECT			SUM		
	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
350	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
450	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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TABLE B-5

**Storm Damage Calculations
Frequency-Damage Relationships
Existing (1995) Conditions
Without Project**

**Martin County Beach
Damage (\$)**

AUTHORIZED PALM

<u>Frequency</u>	<u>Without Project</u>	<u>Without Project</u>	<u>With Project</u>	<u>With Project</u>
	(1995)	(2045)	(1995)	(2045)
100 Year	38,446,500	49,501,300	21,765,200	21,765,200
50 Year	28,848,000	46,637,400	14,946,800	14,946,800
25 Year	17,249,300	39,944,900	7,625,600	7,625,600
10 Year	13,249,300	34,315,800	3,768,600	3,768,600
5 Year	9,551,300	27,346,800	920,100	920,100
2 Year	4,649,500	18,165,400	150,100	150,100
Average Annual	5,947,300	17,862,100	1,208,800	1,208,800

MODIFIED PALM

<u>Frequency</u>	<u>Without Project</u>	<u>Without Project</u>	<u>With Project</u>	<u>With Project</u>
	(1995)	(2045)	(1995)	(2045)
100 Year	22,390,600	24,486,200	17,336,900	17,336,900
50 Year	19,971,800	24,137,700	12,967,800	12,967,800
25 Year	14,817,100	21,960,500	7,345,400	7,345,400
10 Year	11,971,800	20,392,100	3,663,900	3,663,900
5 Year	9,032,700	18,597,500	873,000	873,000
2 Year	4,530,000	15,135,317	143,100	143,100
Average Annual	5,417,600	12,894,000	1,114,700	1,114,700

TABLE B-6
MARTIN COUNTY
Average Annual Damage Summary

WITHOUT PROJECT (\$)

Year	Damage Upland Structures	Cost Backfill Vegetation	Damage Coastal Armor	Condemed Upland Structures	Modification Coastal Armor	Total Damages
1995	4780768	215157	91325		0	5,087,250
1996	5018833	220332	91325	0	0	5,330,490
1997	5140892	222898	91325	0	0	5,455,115
1998	5253111	225378	102611	0	0	5,581,100
1999	5476128	230412	110414	0	0	5,816,954
2000	5587636	232929	110414	0	0	5,930,979
2001	5702429	235408	110414	0	0	6,048,251
2002	5823585	237744	120842	0	0	6,182,181
2003	6056890	242508	127200	0	0	6,426,698
2004	6173687	244890	127200	0	0	6,545,777
2005	6291739	247246	127200	0	0	6,666,185
2006	6563952	251693	139308	0	0	6,954,953
2007	6716307	253850	139308	0	0	7,109,465
2008	6868661	256006	139308	0	0	7,263,975
2009	7174217	260093	139308	0	0	7,573,618
2010	7299234	261735	139308	0	0	7,700,277
2011	7424251	263377	139308	0	0	7,826,936
2012	7209252	267630	139308	0	35100	7,651,290
2013	7482860	270673	147357	0	0	7,900,890
2014	7614705	272244	175165	0	0	8,062,114
2015	7746550	273815	175165	0	0	8,195,530
2016	8010693	276949	175165	0	0	8,462,807
2017	8145764	278476	179933	0	0	8,604,173
2018	8282410	279905	190045	0	0	8,752,360
2019	8555702	282761	190045	0	0	8,028,508
2020	8690941	284190	190045	0	0	9,165,176
2021	8857287	285467	190045	0	0	9,332,799
2022	9038606	286637	190045	0	0	9,515,288
2023	9397510	288978	190045	0	0	9,876,533
2024	9571814	290148	190045	0	0	10,052,007
2025	9727848	291072	194163	0	0	10,213,083
2026	10055566	292544	194163	0	0	10,542,273
2027	10132078	295421	194163	0	26000	10,647,662
2028	10300570	296044	194163	0	0	10,790,777
2029	10635661	297241	215019	0	0	11,147,921
2030	10806592	297776	215019	0	0	11,319,387
2031	10661983	311374	215019	0	158600	11,346,976
2032	10853219	311222	215019	0	0	11,379,460
2033	11247873	310622	222603	0	0	11,781,098
2034	11452861	310248	222603	0	0	11,985,712
2035	11424259	315140	222603	0	79950	12,041,952
2036	11833207	313784	222603	0	0	12,369,594
2037	12035258	313091	233585	0	0	12,581,934
2038	12237309	312397	233585	0	0	12,783,291
2039	12619553	312884	233585	0	23400	13,189,422
2040	12801192	311995	233585	0	0	13,346,772
2041	12985028	311062	233585	0	0	13,529,675
2042	12419193	306709	276901	0	176800	13,179,603
2043	12798821	318915	233585	250500	0	13,601,821
2044	12990450	317277	233585	0	0	13,541,312

Average Annual
Equivalent
Damages
(50yrs @ 8%)

6,621,500

248,600

132,500

500

2,300

7,005,400

TABLE B-7
MARTIN COUNTY
AVERAGE ANNUAL DAMAGE SUMMARY

WITH PROJECT, 35-FOOT BERM (\$)

Year	Damage Upland Structures	Cost Backfill Vegetation	Damage Coastal Armor	Condemned Upland Structures	Modification Coastal Armor	Total Damages
1995	1092456	100653	15,647	0	0	1,208,756
1996	1092456	100653	15,647	0	0	1,208,756
1997	1092456	100653	15,647	0	0	1,208,756
1998	1092456	100653	15,647	0	0	1,208,756
1999	1092456	100653	15,647	0	0	1,208,756
2000	1092456	100653	15,647	0	0	1,208,756
2001	1092456	100653	15,647	0	0	1,208,756
2002	1092456	100653	15,647	0	0	1,208,756
2003	1092456	100653	15,647	0	0	1,208,756
2004	1092456	100653	15,647	0	0	1,208,756
2005	1092456	100653	15,647	0	0	1,208,756
2006	1092456	100653	15,647	0	0	1,208,756
2007	1092456	100653	15,647	0	0	1,208,756
2008	1092456	100653	15,647	0	0	1,208,756
2009	1092456	100653	15,647	0	0	1,208,756
2010	1092456	100653	15,647	0	0	1,208,756
2011	1092456	100653	15,647	0	0	1,208,756
2012	1092456	100653	15,647	0	0	1,208,756
2013	1092456	100653	15,647	0	0	1,208,756
2014	1092456	100653	15,647	0	0	1,208,756
2015	1092456	100653	15,647	0	0	1,208,756
2016	1092456	100653	15,647	0	0	1,208,756
2017	1092456	100653	15,647	0	0	1,208,756
2018	1092456	100653	15,647	0	0	1,208,756
2019	1092456	100653	15,647	0	0	1,208,756
2020	1092456	100653	15,647	0	0	1,208,756
2021	1092456	100653	15,647	0	0	1,208,756
2022	1092456	100653	15,647	0	0	1,208,756
2023	1092456	100653	15,647	0	0	1,208,756
2024	1092456	100653	15,647	0	0	1,208,756
2025	1092456	100653	15,647	0	0	1,208,756
2026	1092456	100653	15,647	0	0	1,208,756
2027	1092456	100653	15,647	0	0	1,208,756
2028	1092456	100653	15,647	0	0	1,208,756
2029	1092456	100653	15,647	0	0	1,208,756
2030	1092456	100653	15,647	0	0	1,208,756
2031	1092456	100653	15,647	0	0	1,208,756
2032	1092456	100653	15,647	0	0	1,208,756
2033	1092456	100653	15,647	0	0	1,208,756
2034	1092456	100653	15,647	0	0	1,208,756
2035	1092456	100653	15,647	0	0	1,208,756
2036	1092456	100653	15,647	0	0	1,208,756
2037	1092456	100653	15,647	0	0	1,208,756
2038	1092456	100653	15,647	0	0	1,208,756
2039	1092456	100653	15,647	0	0	1,208,756
2040	1092456	100653	15,647	0	0	1,208,756
2041	1092456	100653	15,647	0	0	1,208,756
2042	1092456	100653	15,647	0	0	1,208,756
2043	1092456	100653	15,647	0	0	1,208,756
2044	1092456	100653	15,647	0	0	1,208,756

Average Annual
Equivalent
Damages
(50yrs @ 8%)

1,092,500

100,700

15,600

0

0

1,208,800

TABLE B-8
MARTIN COUNTY
Average Annual Damage Summary

'Without Project, 35- FEET BERM (\$)

MODIFIED PLAN

Year	Damage Upland Structures	Cost Backfill Vegetation	Damage Coastal Armor	Condemned Upland Structures	Modification Coastal Armor	Total Damages
1995	1026718	72401	15647	0	0	1,114,766
1996	1026718	72401	15647	0	0	1,114,766
1997	1026718	72401	15647	0	0	1,114,766
1998	1026718	72401	15647	0	0	1,114,766
1999	1026718	72401	15647	0	0	1,114,766
2000	1026718	72401	15647	0	0	1,114,766
2001	1026718	72401	15647	0	0	1,114,766
2002	1026718	72401	15647	0	0	1,114,766
2003	1026718	72401	15647	0	0	1,114,766
2004	1026718	72401	15647	0	0	1,114,766
2005	1026718	72401	15647	0	0	1,114,766
2006	1026718	72401	15647	0	0	1,114,766
2007	1026718	72401	15647	0	0	1,114,766
2008	1026718	72401	15647	0	0	1,114,766
2009	1026718	72401	15647	0	0	1,114,766
2010	1026718	72401	15647	0	0	1,114,766
2011	1026718	72401	15647	0	0	1,114,766
2012	1026718	72401	15647	0	0	1,114,766
2013	1026718	72401	15647	0	0	1,114,766
2014	1026718	72401	15647	0	0	1,114,766
2015	1026718	72401	15647	0	0	1,114,766
2016	1026718	72401	15647	0	0	1,114,766
2017	1026718	72401	15647	0	0	1,114,766
2018	1026718	72401	15647	0	0	1,114,766
2019	1026718	72401	15647	0	0	1,114,766
2020	1026718	72401	15647	0	0	1,114,766
2021	1026718	72401	15647	0	0	1,114,766
2022	1026718	72401	15647	0	0	1,114,766
2023	1026718	72401	15647	0	0	1,114,766
2024	1026718	72401	15647	0	0	1,114,766
2025	1026718	72401	15647	0	0	1,114,766
2026	1026718	72401	15647	0	0	1,114,766
2027	1026718	72401	15647	0	0	1,114,766
2028	1026718	72401	15647	0	0	1,114,766
2029	1026718	72401	15647	0	0	1,114,766
2030	1026718	72401	15647	0	0	1,114,766
2031	1026718	72401	15647	0	0	1,114,766
2032	1026718	72401	15647	0	0	1,114,766
2033	1026718	72401	15647	0	0	1,114,766
2034	1026718	72401	15647	0	0	1,114,766
2035	1026718	72401	15647	0	0	1,114,766
2036	1026718	72401	15647	0	0	1,114,766
2037	1026718	72401	15647	0	0	1,114,766
2038	1026718	72401	15647	0	0	1,114,766
2039	1026718	72401	15647	0	0	1,114,766
2040	1026718	72401	15647	0	0	1,114,766
2041	1026718	72401	15647	0	0	1,114,766
2042	1026718	72401	15647	0	0	1,114,766
2043	1026718	72401	15647	0	0	1,114,766
2044	1026718	72401	15647	0	0	1,114,766

Average Annual
Equivalent
Damages
(50yrs @ 8%)

1,026,700

72,400

15600

0

0

1,114,700

Damages to various with project beaches were computed by increasing the pre-project beach width to the project beach width and repeating the recession-damage and frequency-damage computations. The total damages with the project are again represented by the area under the frequency-damage curves. Existing and future average annual damages were appropriately amortized and discounted at the project interest rate of 8 percent. The storm damage prevention benefits attributed to the project are the without-project damages minus the with-project damages. Average annual equivalent storm damage prevention benefits for the recommended plan are presented in Table B-9.

TABLE B-9

DAMAGE PREVENTION BENEFIT SUMMARY
(In \$, computed at 8 %)

Annual Expected Damage

<u>Alternative</u>	<u>Structures</u>	<u>Backfill</u>	<u>Armor</u>	<u>Total</u>	<u>Damages Prevented</u>
Without Project Conditions	6,621,500	248,600	132,500	7,005,400	0
With Project Conditions	1,092,500	100,700	15,600	1,208,800	5,796,600

MODIFIED PLANAnnual Expected Damage

<u>Alternative</u>	<u>Structures</u>	<u>Backfill</u>	<u>Armor</u>	<u>Total</u>	<u>Damages Prevented</u>
Without Project Conditions	5,742,100	166,100	135,500	6,043,500	0
With Project Conditions	1,026,700	72,400	15,600	1,114,700	4,888,600

SHORELINE STABILITY BENEFITS.

B-12. To determine the value of stabilizing the shoreline and preventing the loss of land to recession, the market value of the average annual area expected to be lost is estimated. This value was determined by Jacksonville District real estate appraiser as described in the following paragraphs.

The fair market value is defined as the amount in cash or equivalent that the property would be sold for by a knowledgeable and willing owner to a knowledgeable and willing buyer. Engineering Circular 165-2-149 requires that market value be determined based upon the value of nearshore land. Nearshore land is defined in the Engineering Circular as "land that is sufficiently removed from shore to lose it's significant increment of value because of it's proximity to the shore, when compared to adjacent parcels that are more distant from the shore." A gross estimate of ocean-front and near-shore lands were made by analyzing vacant land sales in the project area. Estimates of ocean-front lands are shown in Table B-10. Seven (7) vacant land sales were analyzed to estimate the market value of near-shore project land. All of the sales were located within the project limits (DNR #114-DNR #25 and are representative of the homogeneous neighborhood throughout the near-shore portions of the project. Average lot depth for the study area is approximately 300 feet. Comparable near-shore sales information for the project area are summarized in table B-11. The reported market value assigned to near-shore land is \$5.00 per square foot.

TABLE B-10
ESTIMATES OF LAND VALUE

<u>Category</u>	<u>Dollars per Front foot</u>	<u>Dollars per Square foot</u>
Oceanfront:		
Commercial and Multi-Family (Condo)	2,300	7.70
Nearshore		5.00

TABLE B-11
NEARSHORE SALES INFORMATION

<u>Sales Price</u>	<u>Size (Square Feet)</u>	<u>Unit Values (Square foot)</u>
\$ 65,000	14,520	\$4.48
70,000	22,643	3.09
253,500	59,000	4.30
548,180	133,400	4.10
100,000	14,707	6.80
86,500	14,530	5.95
339,000	64,900	5.22

Parks and commercial areas have the same value for both oceanfront and non-oceanfront lands. Values for the lands are furnished in a price per front foot and price per square foot. The market recognizes and purchases land based on the front foot value and accordingly, the price per square foot unit tends to be inconsistently increasing as the depth of the lot diminishes. The concept of nearshore land value assumes that lots that are sufficient in distance from the shoreline lose their "proximity to shore" value. However, non-oceanfront lands in the condominium and multi-family category have a higher nearshore land value. This is due to the heavily eroded nature of the shoreline and the subsequent lack of lot depth for oceanfront property.

The second step in the estimation shoreline stabilization benefits is the determination of the area of land which would be lost in the absence of the project over the period of evaluation. The historical recession rate of 1.3 per year for the Martin County Study area was coupled with the location of existing and expected future locations of coastal armor on a lot by lot basis, and the expected land lost over the fifty year period of analysis was determined. Table B-12 displays the loss of land calculations.

The final step in the estimation of these benefits is the multiplication of the market value of the land times the average annual area lost. Table B-12 also summarizes the value of lands lost for future years. The average annual equivalent value of the land lost to the total project area would be using the directed interest rate (8 percent).

Evaluation of benefits at Federally-owned and at non-Federal public shores must reflect the special use to which the shore is dedicated, and the value of output produced by that use. Normally, non-Federal public shores are dedicated to park and conservation areas, and the benefits for protection of such shores are based on the loss in recreation outputs. Loss of land area shown in Table B-12 was categorized into non-Federal public and private land areas. Figure B-1 depicts an idealized case of shore ownership. The private lands subject to erosion are the lands between the pre-project mean high water line and the existing or future line of coastal armor. Similarly, the public pre-project lands subject to erosion are the lands between the existing mean high water and the existing or future line of coastal armor. Construction of the project will prevent the loss of both public and private lands. The average annual private loss of land benefit for the authorized project is \$89,700; the average annual private loss of land benefit for the modified plan is \$83,200. (See Table B-13.)

MAXIMIZATION OF NET BENEFITS

B-13. It is required in the "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies", March, 1983, a comprehensive part of ER-1105-2-100, that various alternative plans are to be formulated in a systematic manner to ensure that all reasonable alternatives are evaluated. Another requirement is that a plan that reasonably maximizes net national economic development benefits should be formulated. The formulation of this alternative requires an analysis to determine what degree of shoreline protection will maximize net storm damage prevention benefits. Net storm damage prevention benefit functions are analyzed by evaluating average annual equivalent storm damage prevention benefits less the average annual equivalent costs, for an array of plans with different degrees of protection. The results are measures of economic efficiency and the respective maximum identifies the degree of protection at which net benefits are maximized. The projects evaluated provide both storm damage prevention and recreation benefits. Because project cost sharing requirements are different for storm damage prevention and recreation benefits, and because recreation is not a high priority output for budget purposes, net benefits are maximized without recreation benefits.

Table B-14 displays this matrix which includes benefits, costs, net benefits, and benefit-to-cost ratios at the current interest rate of 8 percent. It is clear from this table that a project width of 100 feet maximizes net storm damage prevention benefits. Table B-15 provides a detailed summary of benefits and costs of the recommended plan without recreation.

TABLE B-12

AUTHORIZED PROJECT

MARTIN COUNTY SHORE PROTECTION PROJECT
EXISTING AND FUTURE YEARS, LOSS OF LAND BENEFITS

MAP OR PROFILE DATE 1993
 BEGINNING OF PROJECT 1995
 INTEREST RATE DECIM 0.08000

DNR MONUMENT #	RATE	LOT LENGTH (FT)	PRE- PROJECT RECESSION 1993 TO 95 (FEET)	RECESSION FROM 1995 TO 2045 (FEET)	EXISTING BEACH WIDTH (1993) (FT)	EXISTING BEACH WIDTH (1990) (FT)	YEAR SHORELINE RECEDES TO COASTAL ARMOR	VALUE OF ** LANDS SUBJECT TO EROSION (PER/SQ FT)	BENEFITS
R1 #8	-1.3	110	-2.6	-65.0	78	75.4	58	\$5.00	\$715.00
R1 #9	-1.3	210	-2.6	-65.0	65	62.4	48	\$5.00	\$1,360.05
R1 #9a	-1.3	450	-2.6	-65.0	68	65.4	50	\$5.00	\$2,925.00
R2 #10	-1.3	190	-2.6	-65.0	88	85.4	68	\$5.00	\$1,235.00
R2 #11	-1.3	230	-2.6	-65.0	100	97.4	75	\$5.00	\$1,495.00
R3/4 SEATURTLE*	-1.3	450	-2.6	-65.0	105	102.4	79	\$5.00	\$2,925.00
R4/5 JENSEN*	-1.3	1,050	-2.6	-65.0	110	107.4	83	\$5.00	\$6,825.00
R4 #12	-1.3	170	-2.6	-65.0	75	72.4	56	\$5.00	\$1,105.00
R4 #12a	-1.3	230	-2.6	-65.0	65	62.4	48	\$5.00	\$1,489.58
R4 #13	-1.3	280	-2.6	-65.0	55	52.4	40	\$5.00	\$1,774.05
R5 #14	-1.3	180	-2.6	-65.0	100	97.4	75	\$5.00	\$1,170.00
R5 #15	-1.3	670	-2.6	-65.0	100	97.4	75	\$5.00	\$4,355.00
R6 #16	-1.3	510	-2.6	-65.0	105	102.4	79	\$5.00	\$3,315.00
R6 UNDEVEL	-1.3	790	-2.6	-65.0	95	92.4	71	\$5.00	\$5,135.00
R7 #17	-1.3	65	-2.6	-65.0	55	52.4	40	\$5.00	\$411.83
R7 #17a	-1.3	65	-2.6	-65.0	55	52.4	40	\$5.00	\$411.83
R7 #18	-1.3	100	-2.6	-65.0	50	47.4	36	\$5.00	\$622.57
R7 #19	-1.3	180	-2.6	-65.0	50	47.4	36	\$5.00	\$1,120.62
R7 #20	-1.3	100	-2.6	-65.0	62	59.4	46	\$5.00	\$644.90
R8-R11 BOB GRA.*	-1.3	2,005	-2.6	-65.0	70	67.4	52	\$5.00	\$13,032.50

TABLE B-12

MARTIN COUNTY SHORE PROTECTION PROJECT
EXISTING AND FUTURE YEARS, LOSS OF LAND BENEFITS (Continued)

MAP OR PROFILE DATE 1993
 BEGINNING OF PROJECT 1995
 INTEREST RATE DECIMAL 0.08000

DNR LOT MONUMENT #	RATE	LOT LENGTH (FT)	PRE- PROJECT RECESSION 1988 TO 90 (FEET)	RECESSION FROM 1990 TO 2040 (FEET)	EXISTING BEACH WIDTH (1988) (FT)	EXISTING BEACH WIDTH (1990) (FT)	YEAR SHORELINE RECEDES TO COASTAL ARM LINE	VALUE OF *** LANDS SUBJECT TO EROSION (PER SQ FT)	BENEFITS
R12U ALEX'S *	-1.3	2,005	-2.6	-65.0	70	67.4	52	\$5.00	\$13,032.50
R12 #21	-1.3	110	-2.6	-65.0	60	47.4	36	\$5.00	\$684.82
R12 #22	-1.3	200	-2.6	-65.0	51	48.4	37	\$5.00	\$1,251.30
R12 #23	-1.3	130	-2.6	-65.0	50	47.4	36	\$5.00	\$809.34
R12 #24	-1.3	200	-2.6	-65.0	60	47.4	36	\$5.00	\$1,245.14
R13 #25	-1.3	330	-2.6	-65.0	80	77.4	60	\$5.00	\$2,145.00
R13/14 BRYN MAWR*	-1.3	410	-2.6	-65.0	70	67.4	52	\$5.00	\$2,665.00
R13 #26	-1.3	80	-2.6	-65.0	60	57.4	44	\$5.00	\$513.35
R13 #27	-1.3	200	-2.6	-65.0	45	42.4	33	\$5.00	\$1,223.53
R14 #27a	-1.3	270	-2.6	-65.0	25	22.4	17	\$5.00	\$1,308.58
R14 STOKES *	-1.3	55	-2.6	-65.0	55	52.4	40	\$5.00	\$348.47
R14 #28	-1.3	245	-2.6	-65.0	50	47.4	36	\$5.00	\$1,525.29
R15 #28a	-1.3	370	-2.6	-65.0	65	62.4	48	\$5.00	\$2,396.28
R15 #29	-1.3	150	-2.6	-65.0	75	72.4	58	\$5.00	\$975.00
R15 #30	-1.3	120	-2.6	-65.0	75	72.4	58	\$5.00	\$780.00
R15 #30a	-1.3	120	-2.6	-65.0	80	77.4	60	\$5.00	\$780.00
R15 #30b	-1.3	150	-2.6	-65.0	45	42.4	33	\$5.00	\$917.65
R15 VIRGIN FOREST*	-1.3	450	-2.6	-65.0	80	57.4	44	\$5.00	\$2,887.60
R16 #31	-1.3	210	-2.6	-65.0	80	77.4	60	\$5.00	\$1,365.00
R16 #32	-1.3	110	-2.6	-65.0	90	87.4	67	\$5.00	\$715.00
R16 #33	-1.3	130	-2.6	-65.0	100	97.4	75	\$5.00	\$845.00
R16 VAC LOT	-1.3	680	-2.6	-65.0	400	397.4	306	\$5.00	\$4,420.00
R17 #34	-1.3	340	-2.6	-65.0	85	82.4	63	\$5.00	\$2,210.00
R17 VAC LOT	-1.3	225	-2.6	-65.0	390	387.4	298	\$5.00	\$1,462.50
R18 #35	-1.3	180	-2.6	-65.0	100	97.4	75	\$5.00	\$1,235.00
R18 #35a	-1.3	135	-2.6	-65.0	50	47.4	36	\$5.00	\$840.47
R18 #35b	-1.3	110	-2.6	-65.0	50	47.4	36	\$5.00	\$684.82
R18 #36	-1.3	120	-2.6	-65.0	38	35.4	27	\$5.00	\$697.22
R18 #36a & b	-1.3	190	-2.6	-65.0	38	35.4	27	\$5.00	\$1,103.93
R18 #37	-1.3	440	-2.6	-65.0	90	87.4	67	\$5.00	\$2,860.00

TABLE B-12

**MARTIN COUNTY SHORE PROTECTION PROJECT
EXISTING AND FUTURE YEARS, LOSS OF LAND-BENEFITS (Continued)**

MAP OR PROFILE DATE 1993
BEGINNING OF PROJECT 1995
INTEREST RATE DECIM 0.08000

DNR LOT MONUMEN #	RATE	LOT LENGTH (FT)	PRE- PROJECT RECESSION 1988 TO 90 (FEET)	RECESSION FROM 1990 TO 2040 (FEET)	EXISTING BEACH WIDTH (1988) (FT)	EXISTING BEACH WIDTH (1990) (FT)	YEAR SHORELINE RECEDES TO COASTAL ARM LINE	VALUE OF *** LANDS SUBJECT TO EROSION (PER/SQ FT)	BENEFITS
R19 #38	-1.3	160	-2.6	-65.0	90	87.4	67	\$5.00	\$1,040.00
R19 TIGER SHORES*	-1.3	150	-2.6	-65.0	70	67.4	62	\$5.00	\$975.00
R19 #39	-1.3	140	-2.6	-65.0	80	47.4	36	\$5.00	\$871.80
R19 VAC LOT	-1.3	410	-2.6	-65.0	410	407.4	313	\$5.00	\$2,665.00
R20 #40	-1.3	100	-2.6	-65.0	65	62.4	48	\$5.00	\$847.84
R20 #41	-1.3	120	-2.6	-65.0	55	52.4	40	\$5.00	\$760.31
R20 #42	-1.3	85	-2.6	-65.0	65	52.4	40	\$5.00	\$538.55
R21 STUART BEACH*	-1.3	1,080	-2.6	-65.0	50	47.4	36	\$5.00	\$8,723.73
R22 #43	-1.3	230	-2.6	-65.0	70	67.4	52	\$5.00	\$1,495.00
R22 #44	-1.3	300	-2.6	-65.0	85	82.4	63	\$5.00	\$1,950.00
R22 #44a	-1.3	40	-2.6	-65.0	90	87.4	67	\$5.00	\$260.00
R22 #45	-1.3	175	-2.6	-65.0	85	82.4	63	\$5.00	\$1,137.50
R22 #46	-1.3	100	-2.6	-65.0	85	82.4	63	\$5.00	\$850.00
R22 #47	-1.3	400	-2.6	-65.0	100	97.4	76	\$5.00	\$2,600.00
R23 #48	-1.3	80	-2.6	-65.0	70	67.4	52	\$5.00	\$520.00
R23 #48a & b	-1.3	80	-2.6	-65.0	70	67.4	52	\$5.00	\$520.00
R23 #49 & 50	-1.3	500	-2.6	-65.0	80	77.4	60	\$5.00	\$3,250.00
R24 #51	-1.3	330	-2.6	-65.0	85	82.4	63	\$5.00	\$2,145.00
R24 #52	-1.3	220	-2.6	-65.0	90	87.4	67	\$5.00	\$1,430.00
R25 #53	-1.3	450	-2.6	-65.0	95	92.4	71	\$5.00	\$2,925.00

TOTAL AVERAGE ANNUAL EQUIVALENT VALUE OF LANDS LOST = 139,100.05

*PUBLIC BEACHES & ACCESSES 49,414.80

VALUE LESS LAND USED FOR RECREATION 89,685.25

TOTAL PREVENTION OF LOST LAND CLAIMED (ROUNDED) \$89,700.00

TABLE B-13

MODIFIED PROJECT

**MARTIN COUNTY SHORE PROTECTION PROJECT
EXISTING AND FUTURE YEARS, LOSS OF LAND BENEFITS**

MAP OR PROFILE DATE 1993
 BEGINNING OF PROJECT 1995
 INTEREST RATE DECIMAL 0.08000

DNR MONUMENT #	RATE	LOT LENGTH (FT)	PRE- PROJECT RECESSION 1993 TO 95 (FEET)	RECESSION FROM 1995 TO 2045 (FEET)	EXISTING BEACH WIDTH (1993) (FT)	EXISTING BEACH WIDTH (1990) (FT)	YEAR SHORELINE RECEDES TO COASTAL ARMOR	VALUE OF ** LANDS SUBJECT TO EROSION (PER/SQ FT)	BENEFITS
R1 #8	-1.3	110	-2.6	-65.0	78	75.4	58	\$5.00	\$715.00
R1 #9	-1.3	210	-2.6	-65.0	65	62.4	48	\$5.00	\$1,360.05
R1 #9a	-1.3	450	-2.6	-65.0	68	65.4	50	\$5.00	\$2,925.00
R2 #10	-1.3	190	-2.6	-65.0	88	85.4	68	\$5.00	\$1,235.00
R2 #11	-1.3	230	-2.6	-65.0	100	97.4	75	\$5.00	\$1,495.00
R3/4 SEATURTLE*	-1.3	450	-2.6	-65.0	105	102.4	79	\$5.00	\$2,925.00
R4/5 JENSEN*	-1.3	1,050	-2.6	-65.0	110	107.4	83	\$5.00	\$6,825.00
R4 #12	-1.3	170	-2.6	-65.0	76	72.4	56	\$5.00	\$1,105.00
R4 #12a	-1.3	230	-2.6	-65.0	65	62.4	48	\$5.00	\$1,489.58
R4 #13	-1.3	280	-2.6	-65.0	55	52.4	40	\$5.00	\$1,774.05
R5 #14	-1.3	180	-2.6	-65.0	100	97.4	75	\$5.00	\$1,170.00
R5 #15	-1.3	670	-2.6	-65.0	100	97.4	75	\$5.00	\$4,355.00
R6 #16	-1.3	510	-2.6	-65.0	105	102.4	79	\$5.00	\$3,315.00
R6 UNDEVEL	-1.3	790	-2.6	-65.0	95	92.4	71	\$5.00	\$5,135.00
R7 #17	-1.3	65	-2.6	-65.0	55	52.4	40	\$5.00	\$411.83
R7 #17a	-1.3	65	-2.6	-65.0	55	52.4	40	\$5.00	\$411.83
R7 #18	-1.3	100	-2.6	-65.0	50	47.4	36	\$5.00	\$622.57
R7 #19	-1.3	180	-2.6	-65.0	50	47.4	36	\$5.00	\$1,120.62
R7 #20	-1.3	100	-2.6	-65.0	62	59.4	48	\$5.00	\$644.90
R8-R11 BOB GRA.*	-1.3	2,005	-2.6	-65.0	70	67.4	52	\$5.00	\$13,032.50

TABLE B-13

**MARTIN COUNTY SHORE PROTECTION PROJECT
EXISTING AND FUTURE YEARS, LOSS OF LAND BENEFITS (Continued)**

MAP OR PROFILE DATE 1993
BEGINNING OF PROJECT 1995
INTEREST RATE DECIM 0.08000

DNR LOT MONUMEN#	RATE	LOT LENGTH (FT)	PRE- PROJECT RECESSION 1988 TO 90 (FEET)	RECESSION FROM 1990 TO 2040 (FEET)	EXISTING BEACH WIDTH (1988) (FT)	EXISTING BEACH WIDTH (1990) (FT)	YEAR SHORELINE RECEDES TO COASTAL ARM LINE	VALUE OF *** LANDS SUBJECT TO EROSION (PER/SQ FT)	BENEFITS
R12U ALEX'S *	-1.3	2,005	-2.6	-65.0	70	67.4	52	\$5.00	\$13,032.50
R12 #21	-1.3	110	-2.6	-65.0	50	47.4	36	\$5.00	\$684.82
R12 #22	-1.3	200	-2.6	-65.0	51	48.4	37	\$5.00	\$1,251.30
R12 #23	-1.3	130	-2.6	-65.0	50	47.4	36	\$5.00	\$809.34
R12 #24	-1.3	200	-2.6	-65.0	50	47.4	36	\$5.00	\$1,245.14
R13 #25	-1.3	330	-2.6	-65.0	60	77.4	60	\$5.00	\$2,145.00
R13/14 BRYN MAWR*	-1.3	410	-2.6	-65.0	70	67.4	52	\$5.00	\$2,665.00
R13 #26	-1.3	80	-2.6	-65.0	60	57.4	44	\$5.00	\$513.35
R13 #27	-1.3	200	-2.6	-65.0	45	42.4	33	\$5.00	\$1,223.53
R14 #27a	-1.3	270	-2.6	-65.0	25	22.4	17	\$5.00	\$1,308.58
R14 STOKES *	-1.3	55	-2.6	-65.0	55	52.4	40	\$5.00	\$348.47
R14 #28	-1.3	245	-2.6	-65.0	50	47.4	36	\$5.00	\$1,525.29
R15 #28a	-1.3	370	-2.6	-65.0	65	62.4	48	\$5.00	\$2,396.28
R15 #29	-1.3	150	-2.6	-65.0	75	72.4	56	\$5.00	\$975.00
R15 #30	-1.3	120	-2.6	-65.0	75	72.4	56	\$5.00	\$780.00
R15 #30a	-1.3	120	-2.6	-65.0	80	77.4	60	\$5.00	\$780.00
R15 #30b	-1.3	150	-2.6	-65.0	45	42.4	33	\$5.00	\$917.65
R15 VIRGIN FOREST*	-1.3	450	-2.6	-65.0	60	57.4	44	\$5.00	\$2,887.60
R16 #31	-1.3	210	-2.6	-65.0	80	77.4	60	\$5.00	\$1,365.00
R16 #32	-1.3	110	-2.6	-65.0	90	87.4	67	\$5.00	\$715.00
R16 #33	-1.3	130	-2.6	-65.0	100	97.4	75	\$5.00	\$845.00
R16 VAC.LOT	-1.3	680	-2.6	-65.0	400	397.4	306	\$5.00	\$4,420.00
R17 #34	-1.3	340	-2.6	-65.0	85	82.4	63	\$5.00	\$2,210.00
R17 VAC.LOT	-1.3	225	-2.6	-65.0	390	387.4	298	\$5.00	\$1,462.50
R18 #35	-1.3	190	-2.6	-65.0	100	97.4	75	\$5.00	\$1,235.00
R18 #35a	-1.3	135	-2.6	-65.0	50	47.4	36	\$5.00	\$840.47
R18 #35b	-1.3	110	-2.6	-65.0	50	47.4	36	\$5.00	\$684.82
R18 #36	-1.3	120	-2.6	-65.0	38	35.4	27	\$5.00	\$697.22
R18 #36a & b	-1.3	190	-2.6	-65.0	38	35.4	27	\$5.00	\$1,103.93
R19 #37	-1.3	440	-2.6	-65.0	90	87.4	67	\$5.00	\$2,860.00

TABLE B-13

**MARTIN COUNTY SHORE PROTECTION PROJECT
EXISTING AND FUTURE YEARS, LOSS OF LAND BENEFITS (Continued)**

MAP OR PROFILE DATE 1993
 BEGINNING OF PROJECT 1995
 INTEREST RATE DECIM 0.08000

DNR LOT MONUMEN #	RATE	LOT LENGTH (FT)	PRE- PROJECT RECESSION 1988 TO 90 (FEET)	RECESSION FROM 1990 TO 2040 (FEET)	EXISTING BEACH WIDTH (1988) (FT)	EXISTING BEACH WIDTH (1990) (FT)	YEAR SHORELINE RECEDES TO COASTAL ARM LINE	VALUE OF *** LANDS SUBJECT TO EROSION (PER/SQ FT)	BENEFITS
R19 #38	-1.3	160	-2.6	-65.0	80	87.4	67	\$5.00	\$1,040.00
R19 TIGER SHORES*	-1.3	150	-2.6	-65.0	70	87.4	52	\$5.00	\$975.00
R19 #39	-1.3	140	-2.6	-65.0	50	47.4	36	\$5.00	\$871.60
R19 VAC.LOT	-1.3	410	-2.6	-65.0	410	407.4	313	\$5.00	\$2,685.00
R20 #40	-1.3	100	-2.6	-65.0	65	82.4	48	\$5.00	\$847.64
R20 #41	-1.3	120	-2.6	-65.0	55	82.4	40	\$5.00	\$760.31
R20 #42	-1.3	85	-2.6	-65.0	55	82.4	40	\$5.00	\$538.55
R21 STUART BEACH*	-1.3	1,080	-2.6	-65.0	50	47.4	36	\$5.00	\$6,723.73
R22 #43	-1.3	230	-2.6	-65.0	70	87.4	52	\$5.00	\$1,495.00
R22 #44	-1.3	300	-2.6	-65.0	85	82.4	63	\$5.00	\$1,850.00
R22 #44a	-1.3	40	-2.6	-65.0	90	87.4	67	\$5.00	\$280.00
R22 #45	-1.3	175	-2.6	-65.0	85	82.4	63	\$5.00	\$1,137.50
R22 #46	-1.3	100	-2.6	-65.0	85	82.4	63	\$5.00	\$650.00
R22 #47	-1.3	400	-2.6	-65.0	100	97.4	75	\$5.00	\$2,600.00
R23 #48	-1.3	80	-2.6	-65.0	70	87.4	52	\$5.00	\$520.00
R23 #48a & b	-1.3	80	-2.6	-65.0	70	87.4	52	\$5.00	\$520.00
R23 #49 & 50	-1.3	500	-2.6	-65.0	80	77.4	60	\$5.00	\$3,250.00

TOTAL AVERAGE ANNUAL EQUIVALENT VALUE OF LANDS LOST = 132,600.05

*PUBLIC BEACHES & ACCESSSES 49,414.80

VALUE LESS LAND USED FOR RECREATION 83,185.25

TOTAL PREVENTION OF LOST LAND CLAIMED (ROUNDED) \$83,200.00

TABLE B-14

MARTIN COUNTY ECONOMIC SUMMARY
Interest Rate 8.00 percent

	ANNUAL COST	ANNUAL STORM INDUCED DAMAGES					TOTAL DAMAGES	ANNUAL DAMAGES PREVENTED	BENEFITS
		DEVELOP MENT	BACKFILL	ARMOR	CONDEMN STRUCT	MODIFY ARMOR			
EXISTING CONDITIONS		\$6,621,500	\$248,600	\$131,500	\$500	\$2,300	\$7,004,400		
20 FOOT PROJECT	\$664,700	\$2,143,200	\$145,000	\$38,600	\$0	\$0	\$2,326,800	\$4,677,600	\$4,012,900
35 FOOT PROJECT	\$849,100	\$1,092,500	\$100,700	\$15,600	\$0	\$0	\$1,208,800	\$5,795,600	\$4,946,500
35 FOOT PROJECT(MODIFIED PLAN)	1/ \$953,700	\$1,026,700	\$72,400	\$15,600	\$0	\$0	\$1,114,700	2/ \$4,888,600	\$3,934,900
50 FOOT PROJECT	\$938,200	\$525,800	\$62,200	\$8,400	\$0	\$0	\$596,400	\$6,408,000	\$5,469,800
75 FOOT PROJECT	\$1,056,500	\$153,400	\$21,700	\$2,000	\$0	\$0	\$177,100	\$6,827,300	\$5,770,800
100 FOOT PROJECT	\$1,177,200	\$30,400	\$6,500	\$200	\$0	\$0	\$37,100	\$6,967,300	\$5,790,100
125 FOOT PROJECT	\$1,424,700	\$2,000	\$1,700	\$0	\$0	\$0	\$3,700	\$7,000,700	\$5,576,000

1. Annual cost includes environmental monitoring and lands and damages (LERRD) not included in other plans displayed.

2. Annual damages prevented for the modified project were derived from existing damages excluding damages to the 2000-foot length of beach which is authorized for renourishment, but not included in the modified plan.

FIGURE B-1

SHORE OWNERSHIP AND LANDS SUBJECT TO RECESSION

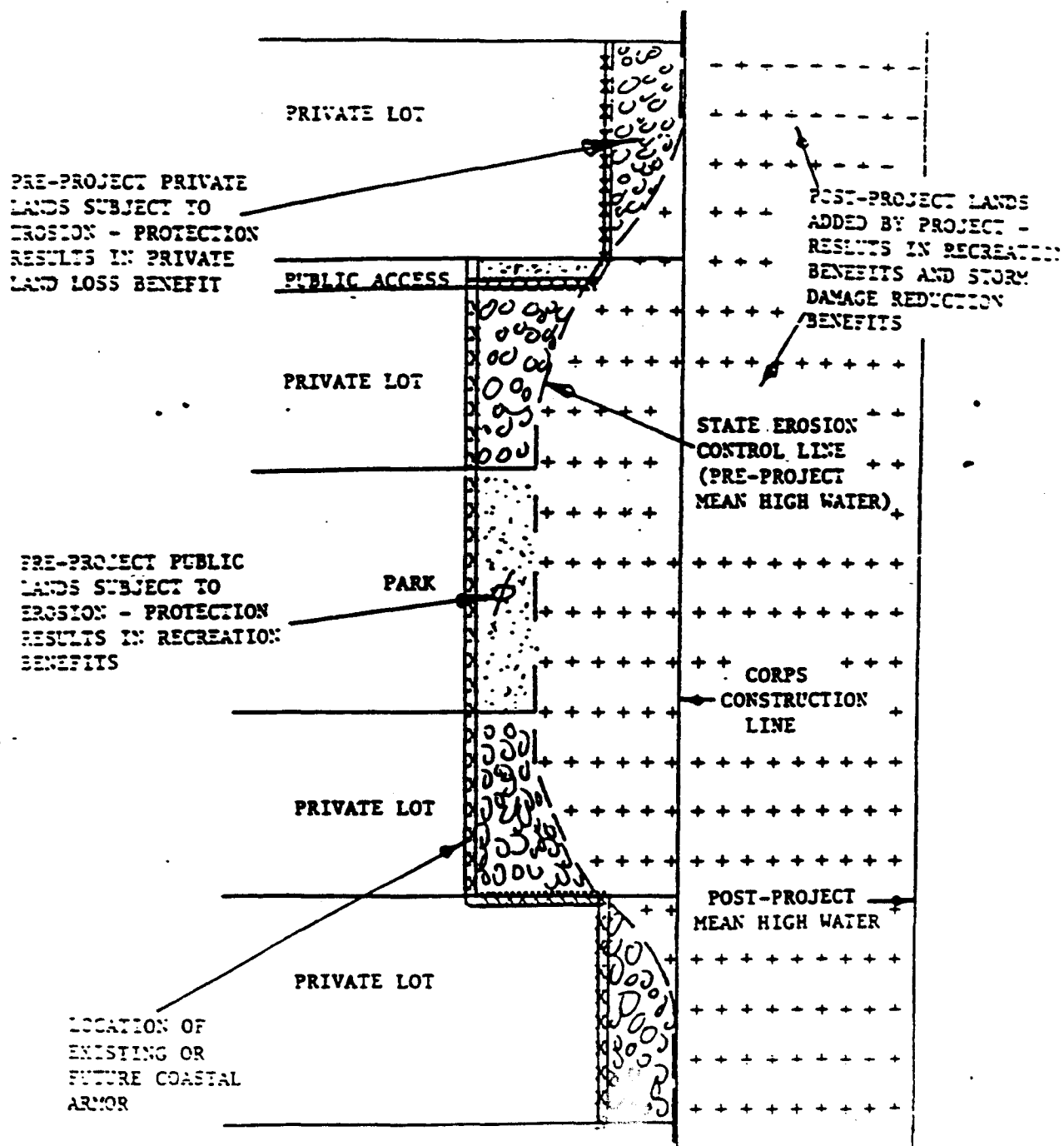


TABLE B-15

**RECOMMENDED PLAN SUMMARY, RECREATION BENEFITS EXCLUDED
MARTIN COUNTY**

(\$, using 8 Percent Interest Rate)

MODIFIED PLAN**PROJECT COST**

Total First Cost (Construction)	\$10,491,400
Interest During Construction	<u>396,400</u>
TOTAL INVESTMENT COST	\$10,887,800

Annual Investment Cost	890,000
Future Renourishment	<u>252,000</u>
TOTAL ANNUAL COST	\$ 1,142,000

PROJECT BENEFITS

Prevention Of Damage To Development	\$ 4,888,600
Loss Of Land	<u>83,200</u>
TOTAL PRIMARY BENEFITS	\$ 4,971,800

Net Primary Benefits	\$ 3,829,800
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Benefit-To-Cost Ratio	4.4:1
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RECREATION

B-14. The estimated recreational benefits attributable to the proposed beach protection project contained in this report are an updating of the analyses presented in the "Beach Erosion Control Study for Martin County, Florida" made by the Corps of Engineers in September, 1985 and revised in June, 1996. The benefits were determined using procedures based on those prescribed in the Manual of Procedures developed by the Water Resources Council and published in the December 1979 Federal Register (Volume 44, 242/Friday, December 1979).

Recreation benefits accrue from the preservation of or the increase in the use of shore front recreational facilities for beach activities which would be expected if beach conditions are improved. The methodology used in estimating recreation benefits entails determining the total beach visits to the Martin County Market Area under two different conditions, "With and Without" the project implemented. The difference of the results of the two analyses established beach visitors attributable to the considered work. Recreation benefits attributable to the considered works were determined by applying a value to the visits attributable to the new beach. The value of a beach visit was based on the results of analysis which utilized travel cost

methodology. No recreational benefits are claimed on privately owned land as this would duplicate damage prevention benefits to privately owned property and structures.

STUDY AREA

B-14. As related to analysis for recreation benefits, the principle study area is Martin County; however, visitors from other cities and counties in Florida and out of State also recreate in the study area. Out-of-State visitors to Martin County beaches are generally from western and central parts of the United States and other countries. The specific authorized project area extends along the Atlantic coast of Martin County, south from the northern boundry of the county line to a point of 2 miles north of Jupiter Inlet, for a distance of about 22 miles. The modified project area would extend a distance of approximately 21 ½ miles.

RECREATION DEMAND COMPUTATION

B-15. Data Sources and Use Standards - The Department of Natural Resources (DNR), Division of Recreation and Parks, concluded a study in 1970 to develop a comprehensive program for meeting Florida's outdoor recreation needs. In 1971, the State Comprehensive Outdoor Recreation Plan, (SCORP), entitled "Outdoor Recreation In Florida", was formally adopted by the Governor as the official outdoor recreation plan for the State of Florida. This report was updated and re-published in 1976, 1981, and 1989. This analysis relies upon use standards found in the 1976 report, projections found in the 1981 and 1989 reports, basic data gathering from county officials in the region, and statistical data used to produce the 1981 report. This information was used to derive and project total salt water beach participation and allocate this participation from region to county level. The statistical background data used to prepare the 1981 SCORP was purchased by contract from the DNR in 1983. This information is based upon a sample size of approximately 11,000 questionnaires on outdoor recreation and is used to derive the participation rates used in the study. The 1976 SCORP report states that each participant seeks at least 100 square feet of beach space for minimum comfort. In 1981, the use standard changed to 200 square feet. To maintain consistency of analysis methods with previous Corps reports, 100 square feet is utilized in this report. A turnover rate of two is utilized to account for the fact that the average beach visitor uses the beach for only one-half of a day, usually in the morning or in the afternoon. This means that twice the effective beach area and twice the effective parking capacity is available during a given day.

In a beach activity survey conducted by the DNR for the town of Jupiter Island in April, 1976, it was discovered that the average number of people per vehicle visiting the beaches was 3.91, with a range from one to ten people per vehicle. An average of four people per car is used in this analysis. Therefore, the number of people a parking area can support is equal to the number of cars the parking area can support multiplied by four multiplied by two.

B-16 Participation Rates - The SCORP report identifies the two sources of total beach use participation to be resident participation and tourist participation. These estimates of total participation are dependent upon estimates and projections of population and tourist activity. Participation rates are the accepted method of converting population and tourist projections to resident and tourist participation. In this report, county resident participation rates and State resident participation rates were computed from the supplemental statistical data mentioned above. The county participation rate is defined as the average number of times a county resident will participate in saltwater beach activities in his home county in a given year. The State participation rate is defined as the average number of times a resident of the state of Florida not located in Martin County will participate in saltwater beach activities in Martin county in a given year. Tourist participation rates were not available from the 1981 SCORP or the supplemental statistical information. Therefore, the DNR, Division of Recreation and Parks was contacted directly. A regional tourist participation rate was used for each county in region X. The tourist participation rate is defined as the average number of times a tourist visiting the State of Florida will participate in saltwater beach activities in the region in a given year. The State's definition of Region X includes, Martin County, Indian River County, Palm Beach County and St. Lucie County. Participation rates used in the study for residents and tourists are listed in Table B-16.

TABLE B-16**Resident and Tourist Participation Rates
Region X**

Region IX Counties	(1) County Resident Participation Rate	(2) State Resident Participation Rate	(3) Regional Tourist Participation Rate
Indian River	3.876	0.003	2.84
Martin	3.451	0.003	2.84
Palm Beach	2.825	0.048	2.84
St. Lucie	1.702	0.027	2.84

(1) This rate was computed from the 1989 SCORP statistical information.

(2) This rate was computed from the 1989 SCORP statistical information.

(3) This rate is equivalent to the State Tourist participation rate computed in the 1989 SCORP statistical information

B-17. Regional Demand The selected method utilizes the 1981 and 1989 SCORP reports to compute total resident and tourist regional participation. It was not possible to separate resident and tourist user occasions for region X using these reports. However, from the 1989 report, tourist user occasions for the State of Florida is 2.84 total user occasions. This percentage was used to compute total tourist user occasions for region X. Total user occasions are projected in the SCORP through the year 1995. Total user occasions through the period 2046 were projected in ten year increments using a linear least squares regression through the 1981 and 1989 SCORP information. Total regional demand, resident, and tourist demand for region X are shown in Table B-17.

TABLE B-17

**Total Regional Demand in User Occasions
Region X**

<u>Year</u>	<u>(1) SCORP Regional Resident Demand</u>	<u>(2) SCORP Regional Tourist Demand</u>	<u>(3) SCORP Total Regional Demand</u>
1987	5,503,249	6,392,751	11,896,000
1990	5,126,049	7,640,951	13,767,000
1995	7,075,894	11,945,324	19,021,218
1996	7,228,599	12,291,738	19,520,337
2006	8,788,603	15,118,838	23,907,441
2016	10,230,637	17,689,041	27,919,678
2026	11,382,402	19,634,835	31,017,237
2036	12,270,457	20,616,577	32,887,034
2046	12,942,632	21,647,406	34,590,038

1. University of Florida, Medium Population Projection, Table 1.84, 1988, Statistical Abstract.
2. Percentage of State Tourist Demand as a % of Total Demand is 2.84.
3. Linear Extrapolation through 1987, 1990, 1995 Projection from 1989 SCORP.

Allocation of Regional Demand to County Demand - Allocation of regional demand to the county level is accomplished using the 1981 SCORP report, current University of Florida county population projections, and conversations with representatives of three of the four county planning departments in the region. Based upon these data, the annual beach activity demand was determined utilizing the following relationships:

CD = (PcNc + PsNs + PtNt) K where:
 CD = County Beach activity demand
 Pc = Constant from the statistical background data for the 1981 SCORP. This is the participation rate for county residents.
 Ps = Constant from the statistical background data for the 1981 SCORP. This is the participation rate of residents from other Florida counties who recreate on Martin County beaches.
 Pt = Constant from Telephone conversations with the Division of Recreation and Parks. This is the tourist participation rate for Martin County.
 Nc = This is the county resident population.
 Ns = This is the State population less the County population.
 Nt = This is the County tourist population.
 K = This is a constant which expresses the ratio of the total published demand for Region X in the 1989 SCORP and the computed total demand using the expression above.

Current estimates of state population and the 1989 SCORP resident participation rate have been utilized to compute resident participation for the region. The most recent state and county population projections are provided by the University of Florida, Bureau of Economic Research, Florida Statistical Abstract, 1988. These projections have been extrapolated from the year 1996 to 2046. The University of Florida population projections were utilized throughout the analysis to insure consistency with the SCORP reports. Participation rates are

constant over the project life.

Sufficient information is not available from the DNR to compute tourist participation rates at county level. However, the Regional tourist participation rate received from the DNR is considered a good proxy for county participation because of the relative homogeneity of shore front counties in Region X. Therefore, the rate for Tourist user occasions was obtain by dividing county resident population then applying this rate to county resident population to obtain tourist user occasions assuming that the same rate for county residents participation in saltwater beach activities apply to tourist. The regional tourist participation rate was then used to estimate the number of tourists visiting each county in the region. Total participation for each county in the region for each 10 year increment of the project life was then computed. Each county was then allocated a percentage of the total Region X demand based upon these county totals. An example of the allocation of Region X participation in the year 2006 is shown in Table B-18.

Distribution of County Demand Within the Project Area - The Martin County study area is treated as one market area in this analysis. Projected attendance in the study area is proportioned to the project area beaches based upon the total square footage of beach available with and without project conditions. This least density usage approach insures proportional distribution of participation over the study area beaches. If one segment of beach is overcrowded, they all are overcrowded. The opposite is also true. This insures that a participant will find useable beach if it is available in the study area. No attractiveness indexes are used to distribute participation. While it is true that participants may exhibit a preference for a given park because of differences in access and beach facilities available and the more desirable beaches will be occupied first, the avoidance of overcrowding will be the dominant concern. With the authorized plan, additional public beach is created in the study area and excess demand can be accommodated at the various accesses.

TABLE B-18

Allocation of County Demand
Region X (Year 2006)

County	County Residents	(a)	State Population less County	(b)	Estimated Tourist	(c)	Total (a+b+c)	Adjusted SCORP Demand
		County Demand Residents		State Resident Demand		County Demand Tourists		
Indian River	130,000	656,200	16,913,200	50,700	503,400	1,297,500	1,984,500	2,017,100
Martin	149,300	753,500	16,893,900	50,700	523,700	1,249,200	2,053,400	2,087,100
Palm Beach	1,217,200	6,143,100	15,879,200	762,200	4,530,000	10,160,700	17,066,000	17,346,600
St. Lucie	233,300	1,177,500	16,809,800	453,900	551,400	785,600	2,416,900	2,456,700

As the beaches in the county erode throughout the project life, the allocation of demand to these beaches also changes to reflect the decreased amount of useable beach which varies in the study area under this condition. Likewise, one could expect a different distribution of participation with the proposed improvements which maintain and increase public areas for recreation at the project beaches. The analysis therefore provides a realistic and dynamic analysis of beach usage over time.

RECREATION SUPPLY COMPUTATION

B-18. Without Project - Information defining existing supplies of useable beach areas for Martin County is based upon 1993 aerial photographs. Existing supplies of useable public beach, beach lengths and erosion rates for the authorized project area are shown in Table B-19. Public areas were then eroded from 1993 to the beginning of the project life, in 1996, and then in 10 year increments throughout the 50 year project life. Erosion of public beach area throughout the project life without the proposed project is primarily dependent upon mean high water recession rates. The procedure used to calculate public beach at a given point in time is to multiply the annual mean high water erosion rate by the front footage of the park by the time increment. The area computed is subtracted from the remaining area in the preceding time increment if the beach is receding or added if the beach is accreting. In these areas, the supply of useable beach does not decrease until the bluffline reaches an obstruction which halts bluffline erosion. Without project supplies of useable public beach from 1996 to 2046 for the authorized plan is shown in Table B-20.

B-19. With Project - The total capacity of useable public beach with the plan alternative requires the following computations.

- a. The computation of the total area of beaches to be re-nourished.
This is dependent upon average project width.
- b. The deletion of all privately owned land in the re-nourishment area.
- c. The limitation of useable public beach to 1/4 of a mile in either direction from the nearest access point. The 1/4 mile limit is measured from the outlying boundaries of access strips or existing public parks.
- d. The addition of all public beach not re-nourished in the study area.

TABLE B-19
MARTIN COUNTY
RECREATIONAL BEACH INFRASTRUCTURE

<u>Full Services Public Beaches/Accesses</u>	<u>DNR #</u>	<u>Beach Length (feet)</u>	<u>M.H.W. Shore Front Wid. (Ft)</u>	<u>1993 Beach Area 1000) Sq. Feet</u>	<u>1971-1992 Recession Rate (Ft. Per Yr.)</u>
Glasscock/N. County	1	100	181	7,000	-0.7
SeaTurtle	3/4	1,060	170	111,300	-0.8
Jensen	4/5	1,450	154	159,500	-1.2
Bob Graham	9/10	1,900	161	133,300	-1.4
Alex's	12U	580	142	40,600	-1.4
Bryn Mawr	13/14	255	156	17,850	-2.4
Stokes	14/15	55	165	3,025	-1.9
Virginia Forest	16	260	207	15,600	-1.7
Tiger Shores	20	100	194	7,000	-2.2
Stuart	23	1,160	147	58,000	-3.1

End of Modified Project Area

Fletcher	27	100	201	10,000	0.0
House of Refuge	29	315	142	15,750	-2.9
Chastain	34	100	152	2,000	-0.4
Bath Tub Reef	35	1,125	163	78,750	-6.7

End of Authorized Project Area

Jupiter Island

Hobe Sound Nat'l Wildlife Refuge		2,470	50	123,500	-3.4
Hobe Sound County		200	156	31,200	-3.4

NOTE: Recession rates per year are based on 1971-1992 Historical study data.
The area of these beaches will change throughout the project life.

TABLE B-20

MARTIN COUNTY
WITHOUT PROJECT SUPPLY IN (SQFT)

	RECESSION PER YEAR MHW ESC LIM			1992	1996	2006	2016	2026	2036	2046	FF
	----	----	----	----	----	----	----	----	----	----	--
PARKS	---	---	---								
GLASSCOCK	-.7	.0	.0	7127.	6847.	6147.	5447.	4747.	4047.	3347.	100.00
SEA TURTLE	-.8	.0	.0	95663.	92271.	83791.	75311.	66831.	58351.	49871.	1060.00
JENSEN	-1.2	.0	.0	114566.	107606.	90206.	72806.	55406.	38006.	20606.	1450.00
BOB GRAHAM	-1.4	.0	.0	160152.	149512.	122912.	96312.	69712.	43112.	16512.	1900.00
ALEX'S BEACH	-1.4	.0	.0	37641.	34393.	26273.	18153.	10033.	1913.	0.	580.00
BRYN MAWR	-2.4	.0	.0	19331.	16883.	10763.	4643.	0.	0.	0.	255.00
STOKES	-1.9	.0	.0	3354.	2936.	1891.	846.	0.	0.	0.	55.00
VIRGINIA FOREST	-1.7	.0	.0	30041.	28273.	23853.	19433.	15013.	10593.	6173.	260.00
TIGER SHORES	-2.2	.0	.0	9107.	8227.	6027.	3827.	1627.	0.	0.	100.00
STUART	-3.1	.0	.0	62741.	48357.	12397.	0.	0.	0.	0.	1160.00
FLETCHER ACCESS	.0	.0	.0	8879.	8879.	8879.	8879.	8879.	8879.	8879.	100.00
HOUSE/REFUGE PARK	-2.9	.0	.0	15357.	11703.	2568.	0.	0.	0.	0.	210.00
CHASTAIN ACCESS	-.4	.0	.0	4641.	4481.	4081.	3681.	3281.	2881.	2481.	100.00
BATH TUB REEF	-6.7	.0	.0	84263.	54113.	0.	0.	0.	0.	0.	1125.00
HOBE SOUND REFUGE	-3.4	.0	.0	123500.	89908.	5928.	0.	0.	0.	0.	2470.00
HOBE SOUND BEACH	-3.4	.0	.0	31200.	28480.	21680.	14880.	8080.	1280.	0.	200.00
TOTAL MARTIN COUNTY				807563.	692869.	427396.	324218.	243609.	169062.	107869.	

The computation of useable public beach for with project for the modified plan is displayed in Table B-21. Square footages are then converted to the number of people per day that the public beach can support. This analysis is done for each park and access strip for each 10 year increment in the project life for the with and without project conditions. A 100 square foot area can support 2 people per day which means the effective public beach area is multiplied by 2 to compute people per day. The results of these calculations are displayed in Tables B-22, B-23.

B-18. Beach Accessibility Parking Constraints - Public beach is useable only if the public has access to it. Accessibility to the beach is determined by the number of public access points available and available parking, different modes of transportation available to the public, and the distance one could reasonably expect a beach participant to walk. Methods of transportation to the beach can be separated into walk-on participants, drive-on participants, and other modes including bicycling. Walk-on participants may be further defined into hotel-tourist participants and single and multi-family walk-on participants. Drive-on participants are defined as automobile and mass-transit participants. Parking constraints for the beach fill alternatives for with and without project are shown in Tables B-24 and B-25.

B-19. Demand Allocation Based Upon Supply - Park participation is derived by dividing the constrained supply of beach area for each park in people per day by the total supply for the study area. These percentages are used to allocate total parking constrained participation. The analysis is done in 10 year increments with and without the beach fill alternatives. The resulting participation is assigned to each park. Without and with project participation, or demand, is illustrated in Tables B-26 and B-27.

TABLE B-21

MARTIN COUNTY
WITH PROJECT SUPPLY IN (SQFT)

MODIFIED PLAN

	RECESSION PER YEAR MHW ESC LIM			1992 ----	1996 ----	2006 ----	2016 ----	2026 ----	2036 ----	2046 ----	FF --
PARKS -----											
GLASSCOCK	.0	.0	.0	7127.	18067.	18067.	18067.	18067.	18067.	18067.	100.00
SEA TURTLE	.0	.0	.0	95663.	180108.	180108.	180108.	180108.	180108.	180108.	1060.00
JENSEN	.0	.0	.0	114566.	222801.	222801.	222801.	222801.	222801.	222801.	1450.00
BOB GRAHAM	.0	.0	.0	160152.	305292.	305292.	305292.	305292.	305292.	305292.	1900.00
ALEX'S BEACH	.0	.0	.0	37641.	82321.	82321.	82321.	82321.	82321.	82321.	580.00
BRYN MAWR	.0	.0	.0	19331.	39811.	39811.	39811.	39811.	39811.	39811.	255.00
STOKES	.0	.0	.0	3354.	9084.	9084.	9084.	9084.	9084.	9084.	55.00
VIRGINIA FOREST	.0	.0	.0	30041.	53911.	53911.	53911.	53911.	53911.	53911.	260.00
TIGER SHORES	.0	.0	.0	9107.	19447.	19447.	19447.	19447.	19447.	19447.	100.00
STUART	.0	.0	.0	62741.	170679.	170679.	170679.	170679.	170679.	170679.	1160.00
FLETCHER ACCESS	.0	.0	.0	8879.	20119.	20119.	20119.	20119.	20119.	20119.	100.00
HOUSE/REFUGE PARK	-2.9	.0	.0	15357.	11703.	2568.	0.	0.	0.	0.	315.00
CHASTAIN ACCESS	-4.	.0	.0	4641.	4481.	4081.	3681.	3281.	2881.	2481.	100.00
BATH TUB REEF	-6.7	.0	.0	84263.	54113.	0.	0.	0.	0.	0.	1125.00
HOBE SOUND REFUGE	-3.4	.0	.0	123500.	89908.	5928.	0.	0.	0.	0.	2470.00
HOBE SOUND BEACH	-3.4	.0	.0	31200.	28480.	21680.	14880.	8080.	1280.	0.	200.00
TOTAL MARTIN COUNTY				807563.	1310325.	1155897.	1140201.	1133001.	1125801.	1124121.	

TABLE B-22
MARTIN COUNTY
WITHOUT PROJECT SUPPLY IN (PPD)

	1992	1996	2006	2016	2026	2036	2046	FF
	----	----	----	----	----	----	----	--
PARKS								

GLASSCOCK	143.	137.	123.	109.	95.	81.	67.	100.00
SEA TURTLE	913.	1845.	1676.	1506.	1337.	1167.	997.	1060.00
JENSEN	2291.	2152.	1804.	1456.	1108.	760.	412.	1450.00
BOB GRAHAM	3203.	2990.	2458.	1926.	1394.	862.	330.	1900.00
ALEX'S BEACH	753.	688.	525.	363.	201.	38.	0.	580.00
BRYN MAWR	387.	338.	215.	93.	0.	0.	0.	255.00
STOKES	67.	59.	38.	17.	0.	0.	0.	55.00
VIRGINIA FOREST	601.	565.	477.	389.	300.	212.	123.	260.00
TIGER SHORES	182.	165.	121.	77.	33.	0.	0.	100.00
STUART	1255.	967.	248.	0.	0.	0.	0.	1160.00
FLETCHER ACCESS	178.	178.	178.	178.	178.	178.	178.	100.00
HOUSE/REFUGE PARK	307.	234.	51.	0.	0.	0.	0.	315.00
CHASTAIN ACCESS	93.	90.	82.	74.	66.	58.	50.	100.00
BATH TUB REEF	1685.	1082.	0.	0.	0.	0.	0.	1125.00
HOBE SOUND REFUGE	2470.	1798.	119.	0.	0.	0.	0.	2470.00
HOBE SOUND BEACH	624.	570.	434.	298.	162.	26.	0.	200.00
TOTAL MARTIN COUNTY	16151.	13857.	8548.	6484.	4872.	3381.	2157.	

TABLE B-23

**MARTIN COUNTY
WITH PROJECT SUPPLY IN (PPD)**

MODIFIED PLAN

	1992	1996	2006	2016	2026	2036	2046	FF
	----	----	----	----	----	----	----	----
PARKS								

GLASSCOCK	143.	361.	361.	361.	361.	361.	361.	100.00
SEA TURTLE	1913.	3602.	3602.	3602.	3602.	3602.	3602.	1060.00
JENSEN	2291.	4456.	4456.	4456.	4456.	4456.	4456.	1450.00
BOB GRAHAM	3203.	6106.	6106.	6106.	6106.	6106.	6106.	1900.00
ALEX'S BEACH	753.	1646.	1646.	1646.	1646.	1646.	1646.	580.00
BRYN MAWR	387.	796.	796.	796.	796.	796.	796.	255.00
STOKES	67.	182.	182.	182.	182.	182.	182.	55.00
VIRGINIA FOREST	601.	1078.	1078.	1078.	1078.	1078.	1078.	260.00
TIGER SHORES	182.	389.	389.	389.	389.	389.	389.	100.00
STUART	1255.	3414.	3414.	3414.	3414.	3414.	3414.	1160.00
FLETCHER ACCESS	178.	402.	402.	402.	402.	402.	402.	100.00
HOUSE/REFUGE PARK	307.	234.	51.	0.	0.	0.	0.	315.00
CHASTAIN ACCESS	93.	90.	82.	74.	66.	58.	50.	100.00
BATH TUB REEF	1685.	1082.	0.	0.	0.	0.	0.	1125.00
HOBE SOUND REFUGE	2470.	1798.	119.	0.	0.	0.	0.	2470.00
HOBE SOUND BEACH	624.	570.	434.	298.	162.	26.	0.	200.00
TOTAL MARTIN COUNTY	16151.	26207.	23118.	22804.	22660.	22516.	22482.	

TABLE B-24

**MARTIN COUNTY
WITHOUT PROJECT SUPPLY IN (PPD)
PARKING CONSTRAINTS**

	1992	1996	2006	2016	2026	2036	2046	FF
	----	----	----	----	----	----	----	--
PARKS								

GLASSCOCK	264.	264.	264.	264.	264.	264.	264.	100.00
SEA TURTLE	720.	720.	720.	720.	720.	720.	720.	1060.00
JENSEN	1920.	1920.	1920.	1920.	1920.	1920.	1920.	1450.00
BOB GRAHAM	240.	240.	240.	240.	240.	240.	240.	1900.00
ALEX'S BEACH	1200.	1200.	1200.	1200.	1200.	1200.	1200.	580.00
BRYN MAWR	160.	160.	160.	160.	160.	160.	160.	255.00
STOKES	80.	80.	80.	80.	80.	80.	80.	55.00
VIRGINIA FOREST	176.	176.	176.	176.	176.	176.	176.	260.00
TIGER SHORES	208.	208.	208.	208.	208.	208.	208.	100.00
STUART	1160.	1160.	1160.	1160.	1160.	1160.	1160.	1160.00
FLETCHER ACCESS	96.	96.	96.	96.	96.	96.	96.	100.00
HOUSE/REFUGE PARK	256.	256.	256.	256.	256.	256.	256.	315.00
CHASTAIN ACCESS	240.	240.	240.	240.	240.	240.	240.	100.00
BATH TUB REEF	1104.	1104.	1104.	1104.	1104.	1104.	1104.	1125.00
HOBE SOUND REFUGE	696.	696.	696.	696.	696.	696.	696.	2470.00
HOBE SOUND BEACH	720.	720.	720.	720.	720.	720.	720.	200.00
TOTAL MARTIN COUNTY	9240.	9240.	9240.	9240.	9240.	9240.	9240.	

TABLE B-25

**MARTIN COUNTY
WITH PROJECT SUPPLY IN (PPD)
PARKING CONSTRAINTS**

MODIFIED PLAN

	1992	1996	2006	2016	2026	2036	2046	FF
	----	----	----	----	----	----	----	---
PARKS								

GLASSCOCK	264.	264.	264.	264.	264.	264.	264.	100.00
SEA TURTLE	720.	720.	720.	720.	720.	720.	720.	1060.00
JENSEN	1920.	1920.	1920.	1920.	1920.	1920.	1920.	1450.00
BOB GRAHAM	240.	240.	240.	240.	240.	240.	240.	1900.00
ALEX'S BEACH	1200.	1200.	1200.	1200.	1200.	1200.	1200.	580.00
BRYN MAWR	160.	160.	160.	160.	160.	160.	160.	255.00
STOKES	80.	80.	80.	80.	80.	80.	80.	55.00
VIRGINIA FOREST	176.	176.	176.	176.	176.	176.	176.	260.00
TIGER SHORES	208.	208.	208.	208.	208.	208.	208.	100.00
STUART	1160.	1160.	1160.	1160.	1160.	1160.	1160.	1160.00
FLETCHER ACCESS	96.	96.	96.	96.	96.	96.	96.	100.00
HOUSE/REFUGE PARK	256.	256.	256.	256.	256.	256.	256.	315.00
CHASTAIN ACCESS	240.	240.	240.	240.	240.	240.	240.	100.00
BATH TUB REEF	1104.	1104.	1104.	1104.	1104.	1104.	1104.	1125.00
HOBE SOUND REFUGE	696.	696.	696.	696.	696.	696.	696.	2470.00
HOBE SOUND BEACH	720.	720.	720.	720.	720.	720.	720.	200.00
TOTAL MARTIN COUNTY	9240.	9240.	9240.	9240.	9240.	9240.	9240.	

TABLE B-26

MARTIN COUNTY
WITHOUT PROJECT DEMAND
IN YEARLY USER OCCASIONS

	1996	2006	2016	2026	2036	2046	FF	--
	----	----	----	----	----	----	----	
PARKS								

GLASSCOCK	28996.	51984.	71819.	89781.	108563.	123264.	100.00	
SEA TURTLE	152456.	304444.	474660.	680875.	965723.	1325810.	1060.00	
JENSEN	406551.	762852.	959947.	1047905.	1019535.	758879.	1450.00	
BOB GRAHAM	50819.	101481.	158220.	226958.	321908.	441937.	1900.00	
ALEX'S BEACH	145651.	222185.	239347.	189756.	51317.	0.	580.00	
BRYN MAWR	33879.	67654.	61218.	0.	0.	0.	255.00	
STOKES	12434.	15992.	11155.	0.	0.	0.	55.00	
VIRGINIA FOREST	37267.	74420.	116028.	166436.	236066.	227340.	260.00	
TIGER SHORES	34841.	50969.	50459.	30772.	0.	0.	100.00	
STUART	204787.	104839.	0.	0.	0.	0.	1160.00	
FLETCHER ACCESS	20328.	40593.	63288.	90783.	128763.	176775.	100.00	
HOUSE/REFUGE PARK	49561.	21717.	0.	0.	0.	0.	315.00	
CHASTAIN ACCESS	18977.	34512.	48534.	62054.	77285.	91370.	100.00	
BATH TUB REEF	229163.	0.	0.	0.	0.	0.	1125.00	
HOBE SOUND REFUGE	147375.	50132.	0.	0.	0.	0.	2470.00	
HOBE SOUND BEACH	120610.	183343.	196193.	152819.	34337.	0.	200.00	
TOTAL MARTIN COUNTY	1693694.	2087115.	2450866.	2738140.	2943497.	3145374.		

TABLE B-27

MARTIN COUNTY
WITH PROJECT DEMAND
IN YEARLY USER OCCASIONS

MODIFIED PLAN

	1996	2006	2016	2026	2036	2046	FF
	----	----	----	----	----	----	--
PARKS							

GLASSCOCK	50265.	79749.	98106.	112052.	123205.	132360.	100.00
SEA TURTLE	137087.	217498.	267561.	305595.	336015.	360983.	1060.00
JENSEN	365564.	579994.	713496.	814920.	896039.	962621.	1450.00
BOB GRAHAM	45696.	72499.	89187.	101865.	112005.	120328.	1900.00
ALEX'S BEACH	228478.	362496.	445935.	509325.	560024.	601638.	580.00
BRYN MAWR	30464.	48333.	59458.	67910.	74670.	80218.	255.00
STOKES	15232.	24166.	29729.	33955.	37335.	40109.	55.00
VIRGINIA FOREST	33510.	53166.	65404.	74701.	82137.	88240.	260.00
TIGER SHORES	39603.	62833.	77295.	88283.	97071.	104284.	100.00
STUART	220862.	350413.	431070.	492348.	541357.	581584.	1160.00
FLETCHER ACCESS	18278.	29000.	35675.	40746.	44802.	48131.	100.00
HOUSE/REFUGE PARK	44565.	15515.	0.	0.	0.	0.	315.00
CHASTAIN ACCESS	17063.	24656.	27358.	27852.	26891.	24878.	100.00
BATH TUB REEF	206060.	0.	0.	0.	0.	0.	1125.00
HOBE SOUND REFUGE	132517.	35815.	0.	0.	0.	0.	2470.00
HOBE SOUND BEACH	108451.	130982.	110592.	68589.	11947.	0.	200.00
TOTAL MARTIN COUNTY	1693694.	2087115.	2450866.	2738140.	2943497.	3145374.	

B-20. Daily Demand - Historical patterns of beach use along the coast of Florida are characterized by user groups. These groups define how annual participation occurs within a given year. Daily attendance within the year reflects the climate or season which affects monthly participation. Daily attendance is also influenced by weekdays and weekends.

User groups were derived by ranking attendance records in descending order. Each day's attendance was divided by the attendance for the year to determine the percentage of yearly participation attributable to that day. To reduce the number of groups and simplify the computational process, groups with similar percentages were averaged. The net result was nineteen user groups representing 365 days in the year. These user groups are shown in Table B-28.

TABLE B-28
MARTIN BEACH COUNT 1984

<u>A</u> <u>Rank</u>	<u>B</u> <u>No. Days</u> <u>In Group</u>	<u>C</u> <u>Average Daily</u> <u>Attendance</u>	<u>D</u> <u>Average Daily</u> <u>% of Total (In %)</u>
1	1	11,000.00	3.544
2	1	9,500.00	3.061
3	1	5,000.00	1.611
4	1	4,500.00	1.450
5	3	4,000.00	1.289
6	3	3,500.00	1.128
7	1	3,100.00	0.999
8	8	2,993.75	0.965
9	4	2,500.00	0.806
10	1	2,250.00	0.725
Subtotal (24 ¹)			
11	25	2,004.00	0.646
12	3	1,800.00	0.580
13	6	1,466.67	0.473
14	18	1,194.44	0.385
15	35	975.71	0.314
16	40	771.25	0.249
17	71	539.08	0.174
18	58	330.17	0.106
19	<u>85</u>	121.35	0.039
Total 365			

¹The 24 days including those groups marked 1 through 10 represent peak daily demand for beach use.

DETERMINATION OF WILLINGNESS TO PAY - TRAVEL COST METHOD

B-21. The travel cost method was used to determine the value of a beach visit. The basic premise of the travel cost method (TCM) is that the per capita use of a recreation site will decrease as the out-of-pocket and time cost of traveling from place of origin to site increases. The value of a beach visit is determined by dividing the area under the cost of Travel versus Beach Activity Demand Curve by the total annual demand. The procedures which comprise the analysis are listed below and discussed in the following paragraphs.

- a. Considering the Martin County coast as mile 0, establish 2-mile-wide origin zones that lie equal distance to the coast.
- b. Establish population of each zone by use of 1990 census data.
- c. Establish per capita beach use rate in each zone.
- d. Establish mean round trip distance for each zone and establish a per capita use relationship (per capita participation rate versus mean round trip travel distance).
- e. Compute travel and opportunity costs per person for each zone for a given trip.
- f. Adjust travel and opportunity costs for round trip distance and compute "e" on a per mile basis for each zone.
- g. Average the values in each zone computed in "f" and equate to a price per person per mile.
- h. Calculate total demand from all zones as points on price-demand curve where price equal 0.0.
- i. Simulate moving the Martin County (Hutchinson Island) ocean coast seaward using 2, mile increments up to 22 miles.
- j. For each simulation estimate per capita participation from the per capita use relationship and compute estimated demand for each zone.
- k. For each simulation plot price versus demand on a composite demand curve.
- l. Estimate value of a beach visit by dividing the area under the curve enveloped by step i, j, and k by the total demand.

B-22. Origin Zones. Selection of the origin zones was based on the unique geography of the study area in which Martin County is located. An area with a radius of 22 miles was selected from a center point of the shorefront on Hutchinson Island and measured in 2-miles increments and identified by subzones as Inner(I), Middle (M), and Outer (O) and to keep the one way travel time within 1/2 hour in keeping with day users. In addition to Martin County, major portions of Indian River, St. Lucie, Okeechobee, Palm Beach, (all though small, Highlands and Glades) Counties are included in this area.

Considering the Martin County ocean beach area as mile 0, four 2-mile-wide zones lying equidistant to the nearest beach area were plotted on a large scale county map. The equidistance of the zones was maintained by drawing circles whose radius increased by 2-mile increments. The circles originate from the ocean beach area fronting the most direct access route from the mainland to Hutchinson and Jupiter islands and beaches. These access routes consists of the causeways to the islands. For better population grouping definition, each of the 2-mile-wide zones was subdivided into subzones which correspond to the Inner, Middle, and Outer with respect to location within the zone.

Population in each zone was tabulated based on 1990 census tract county maps. Tract numbers were identified and located on county road maps for Martin, St. Lucie, and Palm Beach counties. The methodology used to establish population groupings was as follows:

- a. The tract numbers were identified and located on the master map.
- b. Census data from Bureau of Economic Analysis were use to locate population by tract number.
- c. A compilation was made for each major zone. The tract population for each zone code was established. The compilation is summarized in Table B-29.

B-23. Zone Per Capita Use Rate. The average participation rates from the 1985 report were used along with the 1990 census tract population to calculate the number of people residing in each subzone and expected participation. Total population and participation for the study area were also calculated. Table B-29 displays those data.

B-24. Travel Distance Computation - Travel distance is of paramount importance when using the travel cost method as a proxy for willingness to pay for a beach visit. The utilization of zones allows the determination of a mean weighted average travel distance (MWATD). The MWATD for each zone was calculated by first taking the distance from the centroid of each participation block and multiplying it by the blocks population. The number thus obtained for each block was summated for each zone and this cumulative value was divided by the total zone population to obtain the MWATD. These distances in miles, are shown in Table B-29.

TABLE B-29

BEACH PARTICIPATION ZONE CHARACTERISTICS

ZONE	Distance (Miles)	Subzone	1990 SUBZONE Pop.	ZONE POP.	Zone Parti. Rate	Wgt. Avg. Rate	Estimated Visits	MWATD (Oneway)	MWATD (Roundtrip)
A	2	1 Inner	2,136	15,421	5.06	5.01	77,259	1.00	8.5
	4	1 Middle	13,285		5.00			3.00	
B	6	1 Outer	29,633	29,633	4.03	4.03	119,421	6.00	13.0
C	8	2 Inner	17,826	168,548	2.56	3.24	546,096	7.30	30.8
	10	2 Middle	31,130		2.98			9.40	
	12	2 Outer	26,710		3.80			11.20	
	14	3 Inner	20,789		4.20			13.00	
	16	3 Middle	10,267		4.20			15.00	
	18	3 Outer	19,347		4.20			17.00	
	22	4 Middle	42,479	168,548	2.24	3.24	546,096	21.00	30.8
TOTAL							742,776		

A per capita utilization curve which relates per capita participation and travel distance was created by drawing a smooth curve through the average participation rates computed for the four zones and their respective mean weighted round trip travel distances. A round trip travel distance of 30.8 miles was determined as the point where no further day beach use could be expected.

The cost of travel is comprised of the out-of-pocket travel cost and the opportunity cost of time. The travel cost per mile is determined as an average variable cost per mile. Costs of travel were re-evaluated in this study using costs which were extracted from the 1993 Edition of the American Automobile Association (AAA) Your Driving Costs. These costs are summarized in Table B-30.

TABLE B-30

AVERAGE VARIABLE COST TO OPERATE AN AUTOMOBILE
(Cents per mile)

<u>1990 Variable Cost</u>	<u>Large</u>	<u>Intermediate</u>	<u>Compact</u>	<u>Average</u>
Maintenance, Accessories, Parts and Tires	0.035	0.033	0.029	0.033
Gasoline and Oil	0.7	0.06	0.048	0.059
Total	0.105	0.093	0.077	0.092

The Opportunity cost of time is valued as one-third of the average hourly wage rate for adults and one-twelfth of the adult wage rate for children. The 1993 average rate of \$10.04 was derived from information published in the 1993 Florida Statistical Abstract for the state of Florida. Using the methodology shown in the December 1979 Principles and Standards, the adult's opportunity cost of time is \$3.35 (10.04/3) and the children's opportunity cost of time is \$0.84 cents (10.04/12). In this report, each automobile is occupied by four persons; considering a population comprised of 22 percent children and 78 percent adults, (1993 Florida Statistical Abstract) the average occupance of each automobile would be comprised of 3.12 adult and .88 children. The weighted opportunity cost of time per hour per visitor would be \$2.79 and would be computed as follows:

$$\frac{(.88 \times \$0.84) + (3.12 \times \$3.35)}{4} = \$2.79$$

The total cost of travel per beach visitor from the previously established origin zones is summarized by the following equation:

Total Cost of Travel = Out-of-Pocket Cost + Opportunity Cost of time
where,

$$\text{Out-of-Pocket Cost} = \frac{D \times CM}{4};$$

$$\text{Opportunity Cost of Time} = \frac{D \times CH}{4}; \text{ and}$$

D = total distance; CM = Cost per mile; CH = cost per hour

V = velocity; 4 = number of person per vehicle

B-25. Average Value of Travel. Values utilized for the overall trip cost, which include travel cost and opportunity cost of time were converted to a price per person per mile for each zone by dividing the trip cost per person by the mean weighted average round trip distance in that zone. Table B-31 illustrates the data used to determine the average cost (value) of travel. Price per person per mile computed for the zones are also shown in Table B-35. The difference in these values is mainly attributable to different travel times reflected in opportunity cost. Notice that 1 mile has been added to the commuting distance to allow for parking.

TABLE B-31
PER TRIP COSTS

zone	Round Trip MWATD (MI)	Parking (Plus) 1 Mile	Variable Auto ² (S)	Time ³ (Hrs)	Time Value ⁴ (S)	Total (S)	Trip Cost Person (S)	Log 10 Cents Per Person (S)
A	8.5	9.5	.87	.271	3.02	3.89	.97	1.987
B	13.0	14.0	1.29	.400	4.46	5.75	1.44	2.158
C	30.8	31.8	2.93	.909	10.14	13.07	3.27	2.515

² \$.092xMI.

³ MWATD/35 mph Average.

⁴ 4x \$2.79 x Time(hrs).

B-26. Value of Recreation - The travel cost method requires the analysis of small incremental increases in the price of participation to measure the quantity of use that would be demanded given these changes. This is equivalent to moving the project farther and farther from the potential users, requiring them to pay more and more in travel cost. It estimated that the average one way distance participants will travel to participate in beach activities is approximately 50 miles.

Estimated visitation was computed by multiplying the population of each zone by an appropriate participation rate from the per-capita utilization curve. The results were summed and entered as a line item in Table B-31. Costs were determined by computing a relationship between round trip travel distance which includes parking distance and the total trip cost per person shown in Table B-35. A demand curve which relates the expected visitation at varying price levels was plotted using information in Table B-36. The area under the curve represented the total value of the visits to the entire sample area. The computed value of these visits is \$1,810,350. The average value per visit is computed by dividing this value by the total number of visits in the sample area (742,800). The average value per visit is \$2.44, which will be used in the remaining analysis. The average cost per mile is computed to be \$0.092 per mile as indicated in table B-30

TABLE B-32

TRAVEL COST DEMAND CURVE POINTS

<u>Additional Cost</u>	<u>Estimated Visitation</u>
0.00	742,800
0.50	538,500
1.00	467,900
1.50	407,300
2.00	354,200
2.50	306,800
3.00	263,800
3.50	224,600
4.00	188,700
4.50	155,200
5.00	124,000
5.50	94,900
6.00	67,400
6.50	41,500
7.00	20,300
7.50	14,600
8.00	9,200
9.00	700
10.00	0

Area under demand curve = 1,522,712, thus;

Value Per Visit = $\frac{\$1,810,350}{742,800}$ = \$2.44 (per visit)

RECREATION DEMAND COMPUTATION

B-27. Method - Recreation benefits have been computed for each 10 year increment in the project life for the authorized and recommended plans. The procedure used to compute project benefits is shown in Tables B-33 the Martin County Market Area. The "Group Daily % of Total" column is the user group percentage of total annual demand attributable to a user group. Column 2 indicates the current participation which can be expected to be satisfied by the area of the beach without the project for a given user day. This is calculated by multiplying yearly participation without the project by the user day percentage. The result is total demand for this user group per day expressed as people per day. If this result is larger than the without

project condition supply in people per day, then the smaller value is entered and the remaining demand is unsatisfied. The unsatisfied demand for the group multiplied by the number of days in the group is entered in column 3. This value indicates in people per days the extent of overcrowding in the user group. Negative numbers indicate excess capacity.

The total participation for each group in people per day is displayed in column 4. This is determined by multiplying column 2 by the number of days. The number of participants in column 4 is multiplied by the value of a use visit to derive the total value of user visits without the project for a given group (column 6).

This procedure is also done with the authorized plan using with project supply and demand values. The difference between the without project and with project value of user visits is the benefit for a given user day group. The sum of the benefits computed for each user group is the annual recreational benefit attributable to the area in a specific year for a given alternative.

B-28. Computational Observations - On any given day in the project life, participation is allocated so that the density of usage is the same at all parks in the project area. A useful indicator of density is the constrained daily total participation expected per day divided by the useful supply of beach in people per day. When this demand-supply ratio (D/S) > 1 , there is overcrowding and excess demand. When, $D/S < 1$, all demand is satisfied and extra capacity exists. The Modified Plan increases useable beach area and decreases beach density so that on any given day, D/S with the project, ($D/S(WP)$), is less than D/S without the project ($D/S(WO)$). Whenever $D/S(WO) > 1$, all or part of a benefit for the reduction of overcrowding is claimed depending upon whether $D/S(WP)$ is less than or greater than 1. In addition, satisfied demand without the project may move to the project beaches also seeking least density whenever $D/S(WP) < 1$. In the extreme case when $D/S(WO) < 1$ and $D/S(WP) < D/S(WO)$, all participants have achieved minimum satisfaction without the project. In this case, there is no net benefit since willingness to pay does not vary among beaches in the project area. Therefore, negative benefits may occur at unimproved beaches which experience a decline in participation with a given plan. However, this decline is compensated for at other beaches.

Average Annual Benefits - Average annual benefits are displayed for the Martin County market area in 10 year increments. These benefits are amortized and discounted at 8 percent. Amortized benefits and average annual equivalent benefits are displays in Table B-34.

TABLE B-33

MARTIN COUNTY
CURRENT YEAR= 2006

GROUP DAILY % OF TOTAL	CURRENT (WO) PARTICIPATION (U)	XTRA DEMAND (WO)	TOTAL PART.	NO. DAYS	TOTAL WITHOUT VALUE	CURRENT (WP) PARTICIPATION (PA)	PA(DAYS) W(DAYS)	TOTAL WITH VALUE	TOTAL BENEFIT	XTRA DEMAND (WP)
3.54	4935.96	69031.	4935.96	1.	12043.74	6909.14	6909.14	16858.30	4814.56	67058.
3.06	4935.96	58951.	4935.96	1.	12043.74	6909.14	6909.14	16858.30	4814.56	56977.
1.61	4935.96	28687.	4935.96	1.	12043.74	6909.14	6909.14	16858.30	4814.56	26714.
1.45	4935.96	25327.	4935.96	1.	12043.74	6909.14	6909.14	16858.30	4814.56	23354.
1.29	4935.96	65901.	14807.88	3.	36131.23	6909.14	20727.42	50574.91	14443.68	59981.
1.13	4935.96	55820.	14807.88	3.	36131.23	6909.14	20727.42	50574.91	14443.68	49901.
1.00	4935.96	15914.	4935.96	1.	12043.74	6909.14	6909.14	16858.30	4814.56	13941.
.96	4935.96	121638.	39487.68	8.	96349.95	6909.14	55273.12	134866.40	38516.46	105852.
.81	4935.96	47545.	19743.84	4.	48174.98	6909.14	27636.56	67433.21	19258.23	39652.
.73	4935.96	10196.	4935.96	1.	12043.74	6909.14	6909.14	16858.30	4814.56	8222.
.65	4935.96	213670.	123399.00	25.	301093.60	6909.14	172728.50	421457.60	120364.00	164341.
.58	4935.96	21508.	14807.88	3.	36131.23	6909.14	20727.42	50574.91	14443.68	15588.
.47	4935.96	29617.	29615.76	6.	72262.46	6909.14	41454.84	101149.80	28887.35	17777.
.38	4935.96	55790.	88847.29	18.	216787.40	6909.14	124364.50	303449.40	86662.05	20273.
.31	4935.96	56615.	172758.60	35.	421531.00	6553.54	229374.00	559672.40	138141.40	-12446.
.25	4935.96	10438.	197438.40	40.	481749.80	5196.92	207876.70	507219.10	25469.31	-68489.
.17	3631.58	-92611.	257842.20	71.	629134.90	3631.58	257842.20	629134.90	.01	-232707.
.11	2212.34	-157970.	128315.80	58.	313090.60	2212.34	128315.80	313090.60	-.01	-272414.
.04	813.97	-350369.	69187.86	85.	168818.40	813.97	69187.86	168818.40	.01	-518089.
			1200676.00		2929650.00		1417691.00	3459167.00	529517.20	

NOTES:

W/O PROJECT CAPACITY (C) = 4936.
 WITH PROJECT CAPACITY (W) = 6909.
 YEARLY PARTICIPATION (WO) = 2087115.
 YEARLY PARTICIPATION (WP) = 2087115.
 USER DAY VALUE = 2.44
 YEARLY UNSATISFIED DEMAND (WO) = 886648.
 YEARLY UNSATISFIED DEMAND (WP) = 669633.

TABLE B-34
MARTIN COUNTY
AVERAGE ANNUAL BENEFIT SUMMARY
INDIVIDUAL PARK ANALYSIS @ 8.000 %

	1996	2006	2016	2026	2036	2046	AVG ANN
	----	----	----	----	----	----	-----
PARKS							

GLASSCOCK	43387.89	59206.83	71975.52	84792.05	98775.18	112024.50	61502.27
SEA TURTLE	-19685.51	-66863.88	-97146.65	-119021.60	-125868.40	-141703.00	-66866.98
JENSEN	-52494.69	-109525.20	62828.08	299386.70	582617.40	876898.30	12596.47
BOB GRAHAM	-6561.84	-22287.96	-32382.21	-39673.88	-41956.14	-47234.32	-22288.99
ALEX'S BEACH	171167.80	288921.10	418840.70	560819.90	709958.30	762400.90	325359.10
BRYN MAWR	-4374.56	-14858.64	25000.23	95101.27	98699.79	101653.50	10725.55
STOKES	6288.20	17605.85	32977.07	47550.63	49349.89	50826.73	21468.42
VIRGINIA FOREST	-4812.02	-16344.50	-23746.96	-29094.17	-30767.84	9082.33	-15807.54
TIGER SHORES	11622.48	32594.06	63155.36	98911.30	128309.70	132149.50	42982.36
STUART	45097.44	433611.40	648408.70	689484.10	715573.40	736987.60	400556.70
FLETCHER ACCESS	-2624.73	-8915.18	-12952.88	-15869.55	-16782.46	-18893.73	-8915.60
HOUSE/REFUGE PARK	-6399.43	-4769.62	.00	.00	.00	.00	-3696.11
CHASTAIN ACCESS	-2450.30	-7579.77	-9933.24	-10847.50	-10072.97	-9765.70	-6974.15
BATH TUB REEF	-29590.05	.00	.00	.00	.00	.00	-8323.95
HOBE SOUND REFUGE	-19029.33	-11010.25	.00	.00	.00	.00	-9729.61
HOBE SOUND BEACH	-15573.41	-40266.91	-40153.95	-26713.74	-4475.32	.00	-30234.68
TOTAL MARTIN COUNTY	113968.00	529517.40	1106870.00	1634826.00	2153361.00	2564427.00	702353.20

SUMMARY OF TOTAL PROJECT BENEFITS AND COSTS

B-29. The shore protection project for Martin County, Florida, will provide both storm damage reduction and recreation benefits. As discussed previously, both types of benefits have been evaluated on an average annual equivalent basis for a 50-year period of analysis and an interest rate of 8 percent. Comparison of those benefits with project costs on the same annual basis provides an indication of the economic feasibility of the project and an estimate of its net contribution to the objective of national economic development. Table B-35 summarizes total project costs and benefits, the benefit-to-cost ratio, and net annual benefits. As shown in the table, the project is economically justified with a benefit-to-cost ratio of 5.0:1 and would provide net annual benefits estimated at \$4,532,200.

TABLE B-35

SUMMARY OF COSTS AND BENEFITS 8.00 PERCENT INTEREST RATE

<u>PROJECT COST</u>	
Total First Cost (Construction)	\$10,491,400
Interest During Construction	<u>396,400</u>
TOTAL INVESTMENT COST	\$10,887,800
Annual Investment Cost	890,000
Future Renourishment (O&M)	<u>252,000</u>
TOTAL ANNUAL COST	\$ 1,142,000
<u>PROJECT BENEFITS</u>	
Storm Damage Reduction	\$ 4,971,800
Recreation	<u>702,400</u>
TOTAL ANNUAL BENEFITS	\$ 5,674,200
<u>BENEFIT:COST RATIO</u>	5.0:1
<u>NET ANNUAL BENEFITS</u>	\$ 4,532,200

331

326

Thu 09 Jun 1994

U.S. Army Corps of Engineers
PROJECT BMA306: Martin County, Florida - Shore Protection Project
Martin County Shore Protection Project
** PROJECT OWNER SUMMARY - LEVEL 1 (Rounded to 100's) **

TIME 15:52:14

SUMMARY PAGE 1

	QUANTITY UOM	CONTRACT	CONTING	TOTAL COST	UNIT COST
01 Contract 01 - 1,297,500 CY		8,186,600	1,548,800	9,735,500	
02 Contract 02 - Monitoring		180,600	36,100	216,700	
03 Contract 03 - Monitoring		180,600	36,100	216,700	
04 Contract 04 - Monitoring		180,600	36,100	216,700	
05 Contract 05 - Monitoring		180,600	36,100	216,700	
06 Contract 06 - Monitoring		180,600	36,100	216,700	
07 Contract 07 - 589,600 CY		3,495,000	699,000	4,194,000	
08 Contract 08 - 589,600 CY		3,495,000	699,000	4,194,000	
09 Contract 09 - 589,600 CY		3,495,000	699,000	4,194,000	
10 Contract 10 - 589,600 CY		3,495,000	699,000	4,194,000	
Martin County, Florida		23,069,600	4,525,400	27,595,100	

FOR OFFICIAL USE ONLY

Thu 09 Jun 1994

U.S. Army Corps of Engineers
 PROJECT BMA306: Martin County, Florida - Shore Protection Project
 Martin County Shore Protection Project
 ** PROJECT OWNER SUMMARY - LEVEL 2 (Rounded to 100's) **

TIME 15:52:14

SUMMARY PAGE 2

	QUANTITY	UOM	CONTRACT	CONTING	TOTAL COST	UNIT COST

01 Contract 01 - 1,297,500 CY						
01- A Construction Cost			6,393,600	1,278,700	7,672,400	
01- B Non-Construction Cost			1,793,000	270,100	2,063,100	
			-----	-----	-----	
Contract 01 - 1,297,500 CY			8,186,600	1,548,800	9,735,500	
02 Contract 02 - Monitoring						
02- A Construction Cost			157,000	31,400	188,400	
02- B Non-Construction Cost			23,600	4,700	28,300	
			-----	-----	-----	
Contract 02 - Monitoring			180,600	36,100	216,700	
03 Contract 03 - Monitoring						
03- A Construction Cost			157,000	31,400	188,400	
03- B Non-Construction Cost			23,600	4,700	28,300	
			-----	-----	-----	
Contract 03 - Monitoring			180,600	36,100	216,700	
04 Contract 04 - Monitoring						
04- A Construction Cost			157,000	31,400	188,400	
04- B Non-Construction Cost			23,600	4,700	28,300	
			-----	-----	-----	
Contract 04 - Monitoring			180,600	36,100	216,700	
05 Contract 05 - Monitoring						
05- A Construction Cost			157,000	31,400	188,400	
05- B Non-Construction Cost			23,600	4,700	28,300	
			-----	-----	-----	
Contract 05 - Monitoring			180,600	36,100	216,700	
06 Contract 06 - Monitoring						
06- A Construction Cost			157,000	31,400	188,400	
06- B Non-Construction Cost			23,600	4,700	28,300	
			-----	-----	-----	
Contract 06 - Monitoring			180,600	36,100	216,700	
07 Contract 07 - 589,600 CY						
07- A Construction Cost			3,039,000	607,800	3,646,800	

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 PROJECT BMA306: Martin County, Florida - Shore Protection Project
 Martin County Shore Protection Project
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	QUANTITY UOM	CONTRACT	CONTING	TOTAL COST	UNIT COST
07- B Non-Construction Cost		456,000	91,200	547,200	
Contract 07 - 589,600 CY		3,495,000	699,000	4,194,000	
08 Contract 08 - 589,600 CY					
08- A Construction Cost		3,039,000	607,800	3,646,800	
08- B Non-Construction Cost		456,000	91,200	547,200	
Contract 08 - 589,600 CY		3,495,000	699,000	4,194,000	
09 Contract 09 - 589,600 CY					
09- A Construction Cost		3,039,000	607,800	3,646,800	
09- B Non-Construction Cost		456,000	91,200	547,200	
Contract 09 - 589,600 CY		3,495,000	699,000	4,194,000	
10 Contract 10 - 589,600 CY					
10- A Construction Cost		3,039,000	607,800	3,646,800	
10- B Non-Construction Cost		456,000	91,200	547,200	
Contract 10 - 589,600 CY		3,495,000	699,000	4,194,000	
Martin County, Florida		23,069,600	4,525,400	27,595,100	

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U.S. Army Corps of Engineers
 PROJECT BNA306: Martin County, Florida - Shore Protection Project
 Martin County Shore Protection Project
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	QUANTITY	UOM	CONTRACT	CONTING	TOTAL COST	UNIT COST

01 Contract 01 - 1,297,500 CY						
01- A Construction Cost						
01- A/06 Fish and Wildlife Facilities						
01- A/06.03 Wildlife Facilities & Sanctuary						
01- A/06.03.73 Habitat and Feeding Facilities						
01- A/06.03.73/01 Monitoring			128,000	25,600	153,600	
Habitat and Feeding Facilities			128,000	25,600	153,600	
Wildlife Facilities & Sanctuary			128,000	25,600	153,600	
Fish and Wildlife Facilities			128,000	25,600	153,600	
01- A/17 Beach Replenishment						
01- A/17.00 Beach Replenishment						
01- A/17.00.01 Mob, Demob & Preparatory Work						
01- A/17.00.01/01 Mob, Demob & Preparatory Work			1,400,000	280,000	1,680,000	
Mob, Demob & Preparatory Work			1,400,000	280,000	1,680,000	
01- A/17.00.16 Pipeline Dredging						
01- A/17.00.16/01 Pipeline Dredging	1297500	CY	4,865,600	973,100	5,838,800	4.50
Pipeline Dredging			4,865,600	973,100	5,838,800	
Beach Replenishment			6,265,600	1,253,100	7,518,800	
Beach Replenishment			6,265,600	1,253,100	7,518,800	
Construction Cost			6,393,600	1,278,700	7,672,400	
01- B Non-Construction Cost						
01- B/01 Lands and Damages						
Lands and Damages			314,000	78,500	392,500	
01- B/30 Planning, Engineering and Design						

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	QUANTITY	UOM	CONTRACT	CONTING	TOTAL COST	UNIT COST
Planning, Engineering and Design			1,031,000	102,000	1,133,000	
01- B/31 Construction Management (S&I)						
Construction Management (S&I)			448,000	89,600	537,600	
Non-Construction Cost			1,793,000	270,100	2,063,100	
Contract 01 - 1,297,500 CY			8,186,600	1,548,800	9,735,500	
02 Contract 02 - Monitoring						
02- A Construction Cost						
02- A/06 Fish and Wildlife Facilities						
02- A/06.03 Wildlife Facilities & Sanctuary						
02- A/06.03.73 Habitat and Feeding Facilities						
02- A/06.03.73/01 Monitoring			157,000	31,400	188,400	
Habitat and Feeding Facilities			157,000	31,400	188,400	
Wildlife Facilities & Sanctuary			157,000	31,400	188,400	
Fish and Wildlife Facilities			157,000	31,400	188,400	
Construction Cost			157,000	31,400	188,400	
02- B Non-Construction Cost						
02- B/30 Planning, Engineering and Design						
Planning, Engineering and Design			12,600	2,500	15,100	
02- B/31 Construction Management (S&I)						
Construction Management (S&I)			11,000	2,200	13,200	
Non-Construction Cost			23,600	4,700	28,300	
Contract 02 - Monitoring			180,600	36,100	216,700	
03 Contract 03 - Monitoring						

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 Martin County Shore Protection Project
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	QUANTITY	UOM	CONTRACT	CONTING	TOTAL COST	UNIT COST

03- A Construction Cost						
03- A/06 Fish and Wildlife Facilities						
03- A/06.03 Wildlife Facilities & Sanctuary						
03- A/06.03.73 Habitat and Feeding Facilities						
03- A/06.03.73/01 Monitoring			157,000	31,400	188,400	
Habitat and Feeding Facilities			157,000	31,400	188,400	
Wildlife Facilities & Sanctuary			157,000	31,400	188,400	
Fish and Wildlife Facilities			157,000	31,400	188,400	
Construction Cost			157,000	31,400	188,400	
03- B Non-Construction Cost						
03- B/30 Planning, Engineering and Design						
Planning, Engineering and Design			12,600	2,500	15,100	
03- B/31 Construction Management (S&I)						
Construction Management (S&I)			11,000	2,200	13,200	
Non-Construction Cost			23,600	4,700	28,300	
Contract 03 - Monitoring			180,600	36,100	216,700	
04 Contract 04 - Monitoring						
04- A Construction Cost						
04- A/06 Fish and Wildlife Facilities						
04- A/06.03 Wildlife Facilities & Sanctuary						
04- A/06.03.73 Habitat and Feeding Facilities						
04- A/06.03.73/01 Monitoring			157,000	31,400	188,400	
Habitat and Feeding Facilities			157,000	31,400	188,400	

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 Martin County Shore Protection Project
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	QUANTITY	UOM	CONTRACT	CONTING	TOTAL COST	UNIT COST
Wildlife Facilities & Sanctuary	157,000		31,400	188,400		
Fish and Wildlife Facilities	157,000		31,400	188,400		
Construction Cost	157,000		31,400	188,400		
04- B Non-Construction Cost						
04- B/30 Planning, Engineering and Design						
Planning, Engineering and Design	12,600		2,500	15,100		
04- B/31 Construction Management (S&I)						
Construction Management (S&I)	11,000		2,200	13,200		
Non-Construction Cost	23,600		4,700	28,300		
Contract 04 - Monitoring	180,600		36,100	216,700		
05 Contract 05 - Monitoring						
05- A Construction Cost						
05- A/06 Fish and Wildlife Facilities						
05- A/06.03 Wildlife Facilities & Sanctuary						
05- A/06.03.73 Habitat and Feeding Facilities						
05- A/06.03.73/01 Monitoring	157,000		31,400	188,400		
Habitat and Feeding Facilities	157,000		31,400	188,400		
Wildlife Facilities & Sanctuary	157,000		31,400	188,400		
Fish and Wildlife Facilities	157,000		31,400	188,400		
Construction Cost	157,000		31,400	188,400		
05- B Non-Construction Cost						
05- B/30 Planning, Engineering and Design						
Planning, Engineering and Design	12,600		2,500	15,100		

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	QUANTITY	UOM	CONTRACT	CONTING	TOTAL COST	UNIT COST

05- B/31 Construction Management (S&I)						
Construction Management (S&I)			11,000	2,200	13,200	
Non-Construction Cost			23,600	4,700	28,300	
Contract 05 - Monitoring			180,600	36,100	216,700	

06 Contract 06 - Monitoring						
06- A Construction Cost						
06- A/06 Fish and Wildlife Facilities						
06- A/06.03 Wildlife Facilities & Sanctuary						
06- A/06.03.73 Habitat and Feeding Facilities						
06- A/06.03.73/01 Monitoring			157,000	31,400	188,400	
Habitat and Feeding Facilities			157,000	31,400	188,400	
Wildlife Facilities & Sanctuary			157,000	31,400	188,400	
Fish and Wildlife Facilities			157,000	31,400	188,400	
Construction Cost			157,000	31,400	188,400	

06- B Non-Construction Cost						
06- B/30 Planning, Engineering and Design						
Planning, Engineering and Design			12,600	2,500	15,100	

06- B/31 Construction Management (S&I)						
Construction Management (S&I)			11,000	2,200	13,200	
Non-Construction Cost			23,600	4,700	28,300	
Contract 06 - Monitoring			180,600	36,100	216,700	

07 Contract 07 - 589,600 CY						
07- A Construction Cost						
07- A/06 Fish and Wildlife Facilities						

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		QUANTITY UOM	CONTRACT	CONTING	TOTAL COST	UNIT COST

07- A/06.03 Wildlife Facilities & Sanctuary						
07- A/06.03.73 Habitat and Feeding Facilities						
07- A/06.03.73/01	Monitoring		128,000	25,600	153,600	
			-----	-----	-----	
	Habitat and Feeding Facilities		128,000	25,600	153,600	
			-----	-----	-----	
	Wildlife Facilities & Sanctuary		128,000	25,600	153,600	
			-----	-----	-----	
	Fish and Wildlife Facilities		128,000	25,600	153,600	
07- A/17 Beach Replenishment						
07- A/17.00 Beach Replenishment						
07- A/17.00.01 Mob, Demob & Preparatory Work						
07- A/17.00.01/01	Mob, Demob & Preparatory Work		700,000	140,000	840,000	
			-----	-----	-----	
	Mob, Demob & Preparatory Work		700,000	140,000	840,000	
07- A/17.00.16 Pipeline Dredging						
07- A/17.00.16/01	Pipeline Dredging	589600.00 CY	2,211,000	442,200	2,653,200	4.50
			-----	-----	-----	
	Pipeline Dredging		2,211,000	442,200	2,653,200	
			-----	-----	-----	
	Beach Replenishment		2,911,000	582,200	3,493,200	
			-----	-----	-----	
	Beach Replenishment		2,911,000	582,200	3,493,200	
			-----	-----	-----	
	Construction Cost		3,039,000	607,800	3,646,800	
07- B Non-Construction Cost						
07- B/30 Planning, Engineering and Design						
			-----	-----	-----	
	Planning, Engineering and Design		243,000	48,600	291,600	
07- B/31 Construction Management (S&I)						
			-----	-----	-----	
	Construction Management (S&I)		213,000	42,600	255,600	
			-----	-----	-----	
	Non-Construction Cost		456,000	91,200	547,200	

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	QUANTITY	UOM	CONTRACT	CONTING	TOTAL COST	UNIT COST
<hr/>						
Contract 07 - 589,600 CY			3,495,000	699,000	4,194,000	
<hr/>						
08 Contract 08 - 589,600 CY.						
08- A Construction Cost						
08- A/06 Fish and Wildlife Facilities						
08- A/06.03 Wildlife Facilities & Sanctuary						
08- A/06.03.73 Habitat and Feeding Facilities						
08- A/06.03.73/01 Monitoring			128,000	25,600	153,600	
Habitat and Feeding Facilities			128,000	25,600	153,600	
Wildlife Facilities & Sanctuary			128,000	25,600	153,600	
Fish and Wildlife Facilities			128,000	25,600	153,600	
08- A/17 Beach Replenishment						
08- A/17.00 Beach Replenishment						
08- A/17.00.01 Mob, Demob & Preparatory Work						
08- A/17.00.01/01 Mob, Demob & Preparatory Work			700,000	140,000	840,000	
Mob, Demob & Preparatory Work			700,000	140,000	840,000	
08- A/17.00.16 Pipeline Dredging						
08- A/17.00.16/01 Pipeline Dredging	589600.00	CY	2,211,000	442,200	2,653,200	4.50
Pipeline Dredging			2,211,000	442,200	2,653,200	
Beach Replenishment			2,911,000	582,200	3,493,200	
Beach Replenishment			2,911,000	582,200	3,493,200	
Construction Cost			3,039,000	607,800	3,646,800	
08- B Non-Construction Cost						
08- B/30 Planning, Engineering and Design						

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	QUANTITY UOM	CONTRACT	CONTING	TOTAL COST	UNIT COST
Planning, Engineering and Design		243,000	48,600	291,600	
08- 8/31 Construction Management (S&I)					
Construction Management (S&I)		213,000	42,600	255,600	
Non-Construction Cost		456,000	91,200	547,200	
Contract 08 - 589,600 CY		3,495,000	699,000	4,194,000	
09 Contract 09 - 589,600 CY					
09- A Construction Cost					
09- A/06 Fish and Wildlife Facilities					
09- A/06.03 Wildlife Facilities & Sanctuary					
09- A/06.03.73 Habitat and Feeding Facilities					
09- A/06.03.73/01 Monitoring		128,000	25,600	153,600	
Habitat and Feeding Facilities		128,000	25,600	153,600	
Wildlife Facilities & Sanctuary		128,000	25,600	153,600	
Fish and Wildlife Facilities		128,000	25,600	153,600	
09- A/17 Beach Replenishment					
09- A/17.00 Beach Replenishment					
09- A/17.00.01 Mob, Demob & Preparatory Work					
09- A/17.00.01/01 Mob, Demob & Preparatory Work		700,000	140,000	840,000	
Mob, Demob & Preparatory Work		700,000	140,000	840,000	
09- A/17.00.16 Pipeline Dredging					
09- A/17.00.16/01 Pipeline Dredging	589600.00 CY	2,211,000	442,200	2,653,200	4.50
Pipeline Dredging		2,211,000	442,200	2,653,200	
Beach Replenishment		2,911,000	582,200	3,493,200	

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 Martin County Shore Protection Project
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	QUANTITY	UOM	CONTRACT	CONTING	TOTAL COST	UNIT COST
Beach Replenishment			2,911,000	582,200	3,493,200	
Construction Cost			3,039,000	607,800	3,646,800	
09- B Non-Construction Cost						
09- B/30 Planning, Engineering and Design						
Planning, Engineering and Design			243,000	48,600	291,600	
09- B/31 Construction Management (S&I)						
Construction Management (S&I)			213,000	42,600	255,600	
Non-Construction Cost			456,000	91,200	547,200	
Contract 09 - 589,600 CY			3,495,000	699,000	4,194,000	
10 Contract 10 - 589,600 CY						
10- A Construction Cost						
10- A/06 Fish and Wildlife Facilities						
10- A/06.03 Wildlife Facilities & Sanctuary						
10- A/06.03.73 Habitat and Feeding Facilities						
10- A/06.03.73/01 Monitoring			128,000	25,600	153,600	
Habitat and Feeding Facilities			128,000	25,600	153,600	
Wildlife Facilities & Sanctuary			128,000	25,600	153,600	
Fish and Wildlife Facilities			128,000	25,600	153,600	
10- A/17 Beach Replenishment						
10- A/17.00 Beach Replenishment						
10- A/17.00.01 Mob, Demob & Preparatory Work						
10- A/17.00.01/01 Mob, Demob & Preparatory Work			700,000	140,000	840,000	
Mob, Demob & Preparatory Work			700,000	140,000	840,000	

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	QUANTITY UOM	CONTRACT	CONTING	TOTAL COST	UNIT COST
10- A/17.00.16 Pipeline Dredging					
10- A/17.00.16/01 Pipeline Dredging	589600.00 CY	2,211,000	442,200	2,653,200	4.50
Pipeline Dredging		2,211,000	442,200	2,653,200	
Beach Replenishment		2,911,000	582,200	3,493,200	
Beach Replenishment		2,911,000	582,200	3,493,200	
Construction Cost		3,039,000	607,800	3,646,800	
10- B Non-Construction Cost					
10- B/30 Planning, Engineering and Design					
Planning, Engineering and Design		243,000	48,600	291,600	
10- B/31 Construction Management (S&I)					
Construction Management (S&I)		213,000	42,600	255,600	
Non-Construction Cost		456,000	91,200	547,200	
Contract 10 - 589,600 CY		3,495,000	699,000	4,194,000	
Martin County, Florida		23,069,600	4,525,400	27,595,100	

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APPENDIX C
REAL ESTATE PLAN

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**REAL ESTATE PLAN
MARTIN COUNTY SHORELINE PROTECTION PROJECT, FLORIDA
GENERAL DESIGN MEMORANDUM**

1. NATURE OF REPORT.

This Real Estate Section is for the General Design Memorandum (GDM) portion of a proposed shoreline protection project located in Martin County, Florida and is a general discussion of real estate requirements for the proposed project, recommendations as to estates to be acquired, a gross appraisal of the necessary land and interests therein and other features considered desirable, in order to present all major real estate problems and to recommend solutions. This report is for planning purposes only and both the final real property acquisition lines and the estimate of value are subject to change, following approval of the GDM.

2. AUTHORIZATION

Resolution adopted 18 May 1973 by the Committee on Public Works of the United States Senate which reads as follows:

Resolved, by the committee on public works of the United States Senate, that, in accordance with Section 110 of the River and Harbor Act of 1962, the Secretary of the Army is hereby requested to direct the Chief of Engineers, to make a survey of the Shores of Martin County, Florida, and such adjacent shores as may be necessary in the interest of beach erosion control, hurricane protection, and related purposes.

Further, construction of the Shoreline Protection project at Martin County described in House Document 2740A, the Water Resources Development Act (WRDA) of 1990, was authorized by the Chief of Engineers on November 20, 1989, in accordance with Section 101 of the Water Resources Development Act of 1990.

3. PROJECT LOCATION AND DESCRIPTION.

a. Project Location. The project for initial beach fill and periodic nourishment is located on a barrier island known as Hutchinson Island which is approximately 20 miles long, running North and South. Martin County is located on Florida's south central coast, 40 miles north of West Palm Beach, Florida and 100 miles north of Miami, Florida. The width of the island varies from over 100 yards to about one half mile. Hutchinson Island is located approximately six miles across from two causeway bridges

from the downtown areas of Stuart and Jensen Beach. The recommended plan for the beach fill and periodic nourishment runs along the northern 3.75 miles of shorefront in Martin County. The proposed project area runs from North to South, beginning at the county lines of Martin and St. Lucie at R-1, to approximately R-23 southward. The project includes an offshore borrow area for suitable quantities of sand material to use for beach fill. The borrow area is located 3000 feet offshore of southern Hutchinson Island and about 3 miles northeast of St. Lucie Inlet.

b. Project Description. The recommended plan provides for a protective and recreational beach along 3.75 miles of the northernmost shorefront of Hutchinson Island in Martin County. The plan of improvement for initial beach fill and periodic nourishment would restore the primary dune (between monuments R-1 and R-23) to a 20 foot wide crest at +13.6 mean low water (MLW) with a 1 vertical on 5 horizontal slope to the elevation of the berm; and provide a 35 foot wide berm (between monuments R-2 to R-21) at +9.1 feet MLW, with a 1 vertical on 8.5 horizontal foreshore slope to mean low water then a 1 vertical on 20 horizontal slope to the existing bottom. In order to maintain the protective beach, advance nourishment is included in the initial beach fill, and periodic nourishment would be provided at 11 year intervals to replace anticipated erosion losses.

A perpetual easement for Beach Renourishment, contained in paragraph 21.a., provides rights required along this beach front on the private land landward from the ECL to the landward construction line for initial beach fill, periodic renourishment, and dune renourishment, as well as making the area open to the public. This estate along with current County zoning regulations allows the local sponsor to prohibit public access to the dunes themselves. The costs of construction are cost shareable and administrative costs for lands are creditable in front of developed private lots where perpetual easements make the lands open to the public. However, in front of undeveloped private lands, the cost of construction and lands are 100% non-Federal as there is no Federal interest.

A temporary easement for Beach Nourishment and Work Area, contained in paragraph 21.b., is needed for lands landward of the Corps Construction Line or perpetual easements where sand placement may be necessary to avoid creating a gap between the toe of the dune and retaining walls or structures. All of these areas will be identified prior to land certification. All costs associated with these lands are 100% non-Federal responsibility.

Access to the project will be by sea, public streets and public recreation parks. A temporary easement for access, contained in paragraph 21.c., is provided if needed.

The Local Sponsor will obtain a Consent of Use from the State of Florida for the rights needed seaward of the Erosion Control Line (ECL) for initial beach fill and periodic renourishment along the 3.75 mile long beach area. The Consent of Use will also include the rights needed for the borrow site and any pipeline access. Refer to paragraph 21.d. for a description of Consent of Use.

4. INVOLVEMENT OF STATE AND FEDERAL AGENCIES.

Martin County Board of Commissioners, 2401 S.E. Monterey Road, Stuart, Florida 34996, is the local sponsor. It is recommended that the local sponsor be responsible for operation and maintenance of the project after construction. Any relocation or cost associated therewith of private property or private utilities will be the responsibility of the local sponsor.

The Corps of Engineers will act as the lead agency for implementation of the project.

The project will be implemented in coordination with Martin County Board of Commissioners, the local sponsor, throughout the design and construction phases of the project.

Prior to actual construction, the sponsor must provide certification that all necessary lands for the upcoming contract are available and suitable ownerships or easements have been obtained. Also, suitable records must be maintained by the sponsor on all costs associated with the project to assure proper credit.

5. ATTITUDE OF LANDOWNERS.

Landowners affected by the proposed project are very supportive of the shore protection project due to the severe erosion along the shoreline. The local news media has also been very supportive of the project.

6. GOVERNMENT-OWNED LAND.

There exists no Federal Government land within the proposed project area.

7. SPONSOR-OWNED LAND.

Approximately 10 acres of the proposed project land area is owned by Martin County. These existing areas consist of approximately nine recreation parks, beaches and public parking facilities open to the public. Refer to Table B-12, Page B-23, for names and locations of public beaches and accesses.

8. LOCAL SPONSORS LAND ACQUISITION AND FINANCIAL CAPABILITY.

The Martin County Board of Commissioners is empowered by Chapter 161.25 of the Florida Statutes to act as the County beach and shore preservation authority. Such powers include the authority to make contracts and enter into agreements, to acquire and hold lands and property by any lawful means, to exercise the power of eminent domain, and to construct, acquire, operate and maintain shore protection works and facilities. The County has the authority to tax property or issue bonds to meet the costs of the County beach and shore preservation program.

Martin County has experience in land acquisition however, they do not have the manpower to meet the acquisition schedule. The County has contracted a consulting firm to acquire all lands needed to support the project. The consulting firm has extensive experience in land acquisition for projects supported by state and federal funds. The firm is also very knowledgeable of the Federal rules and regulations for acquiring lands.

9. APPRAISAL INFORMATION.

a. Appraisal Report. The Gross Appraisal inspection was performed on November 18, 1993. The proposed project area contains 80 ownerships. The appraiser indicates that in no case are ownerships diminished in value after imposition of the proposed easements described in the following paragraph 21 of this report. Further, no land is physically lost or cut away by the project; no views would be blocked and existing coastal construction setback line would remain in place. No structures are taken and access is not restricted or reduced beyond its present restrictions. Section 33-72 of Martin County zoning ordinance, also known as the "Martin County Barrier Island Ordinance" states "it shall be a violation of this ordinance for any person to cross a dune within 500 feet of an elevated dune crossing, except by way of that elevated dune crossing." The county has constructed public walkovers at approximately every 1,000 feet throughout the project shoreline. (Refer to Real Estate Plates.)

b. Methodology Used in Appraisal. Both Federal and State of Florida rules of appraisal were used. Under the Federal rule, special benefits are offset against the entire just compensation award. Under the State of Florida rule, special benefits are offset against severance damages only. Under both rules the "before" and "after" method of appraisal is used.

c. Character. Martin County is one of the State's fastest growing areas. The six towns included in Martin County are Stuart, Palm City, Jensen Beach, Port Salerno, Indiantown and Hobe Sound. The economy is driven by retail, service, tourism, construction, government and agriculture. Martin County is located in an area known as the Treasure Coast. It contains 556 square miles with a population of approximately 103,000.

d. Present Use. Land uses in the proposed project area are single and multi-family residents, commercial (a realty office, the Hutchinson Island Inn) with State and County owned recreational areas intermixed.

e. Economic Conditions. There are no known economic conditions that might affect the value or use of the lands within the proposed project area in the foreseeable future.

f. Gross Estimate of Value. There is no diminution in value to the affected ownerships caused by the easement's restriction upon the owners ingress and egress by way of the dune. Imposition of the easements does not adversely affect value for reasons described in foregoing paragraph 7a. It is reasonable to conclude that the "after" value of the ownerships would be at least that of the "before" value, equaling zero just compensation under Federal rules. Due to the severe erosion of these lands, the value appears to be nominal. Therefore, the appraiser concludes zero value for the easements needed to support this project.

The local sponsor may incur costs when acquiring lands needed to support the project; however, crediting for this project will be based on Federal rules of valuation. The local sponsor is entitled to credit for the administrative costs associated with acquiring these lands but not for the purchase price of these lands.

10. RELOCATION ASSISTANCE (P.L. 91-646).

There will be no need to relocate any persons or businesses with this project's implementation.

11. RELOCATIONS.

There are no known utilities, roads, highways or railroads that will require relocation.

12. ACQUISITION/ADMINISTRATIVE COST ESTIMATES.

a. Federal:

Project Planning	\$ 10,000
Review of Acquisitions (80 @ \$250 ea)	20,000
Review of Appraisals (80 @ \$300 ea)	24,000
Review of Condemnations (10 @ \$2,000)	20,000
Real Estate Review of PCA	<u>2,000</u>

Total Federal Acquisition/Administrative Cost: \$ 76,000

b. Non-Federal

Acquisitions (80 @ \$1,000 ea)	\$ 80,000
Appraisals (80 @ \$600 ea)	48,000
Condemnations (est 10 @ \$10,000 ea)	100,000
Temporary/Licenses/Rights-of-Entry	5,000
Damage Claims	<u>5,000</u>

Total Non-Federal Acquisition/Administrative Cost \$238,000

13. RECREATION.

There are no recreational benefits in the proposed project except aesthetical enhancement of the beaches.

14. STRUCTURES AND FACILITIES.

There are no known structures or facilities that come within the purview of Section III of the Act of Congress approved July 3, 1958 (P.L. 85-500).

15. DISPOSAL OF FACILITIES.

Wood frame crossovers in the project area where the dunes will be enlarged may need to be removed. Replacement of private walkovers is the responsibility of the property owner. The local sponsor is responsible for replacing public walkovers since access to the beach is a prerequisite of this project.

16. MINERAL RIGHTS.

There exist no known minerals of value in the proposed project area.

17. STANDING TIMBER AND VEGETATIVE COVER.

Aerial maps indicate the presence of vegetative cover along the beach area of the proposed project. Discussions in meeting held on November 8, 1993 between Corps personnel and sponsor, indicated that the State of Florida prohibits removal of any grasses or vegetation on the dunes or beaches and no beach nourishment may be placed which would cover over any such vegetation.

18. MAPS.

Real Estate Project maps are shown on the plates located at the end of this appendix. The maps identify publically owned lands, the Erosion Control Line and the Corps Construction Line.

19. ESTIMATED COSTS OF LANDS, EASEMENTS, RIGHTS-OF-WAY AND RELOCATIONS (LERR) FOR THE PROJECT. (See attached Exhibit A for itemized Chart of Accounts)

1. Lands and Damages	0
(Perpetual Easements -	
Approximately 24 acres)	
Improvements	0
Severance	0
Minerals	0
2. Acquisition - Administrative Costs (Includes Corps	
Real Estate planning and monitoring costs)	
Federal	\$ 76,000
Non-Federal	\$238,000
3. PL 91-646	0
4. Contingencies (25%)	\$ 79,000
(Rounded to next thousand)	
TOTAL	\$393,000

20. HAZARDOUS TOXIC AND RADIOACTIVE WASTES (HTRW).

In accordance with ER-1165-2-132, an initial HTRW assessment appropriate for this study has been completed. No hazardous or toxic wastes have been identified in the proposed project area.

21. ESTATES TO BE ACQUIRED.

a. Perpetual Easement for Beach Renourishment A perpetual and assignable easement and right-of-way in, on over and across the hereinafter described land for use by Martin County, its representatives, agents, contractors, and assigns, to nourish, renourish, protect, operate and maintain a public beach thereon, including the right to provide use by the public; to deposit sand; to accomplish any alterations or contours on said land; to construct dunes and berms; to erect protective silt screens and fences; and to perform any other work necessary and incident to the construction and maintenance of the Martin County Shore Protection Project, together with the continuing right to clear and remove any brush, debris, vegetation, structures and obstructions which, in the opinion of the representatives of Martin County, may be detrimental to the project; and further excepting and reserving to the landowner the right to construct a wooden walkway access structure across said easement, provided that the manner of construction and location of the walkway is first approved in writing by the representatives of Martin County and reserving to the landowner all such rights and privileges as may be used and enjoyed without interfering with the use of the Project for the purposes authorized by Congress or abridging the rights and easements hereby acquired, provided that no excavation shall be conducted and no landfill placed on the land by the landowner and that no existing structures may be modified nor shall any additional structures be constructed on the land except as provided above. This easement is taken subject to existing easements for public roads and highways, public utilities, railroads and pipelines.

b. Temporary Beach Nourishment and Work Area Easement A temporary and assignable easement and right-of-way for the Beach Nourishment Project for Martin County, in, on, over and across (the land described in Schedule A) for a period not to exceed three years beginning _____, for use by the local sponsor, its representatives, agents, and contractors for beach nourishment/disposal and a work area including the right to move, store and remove equipment and supplies, and erect and remove temporary structures on the land and to perform any other work necessary and incident to the construction of the Beach Nourishment Project for Martin County, together with the right to trim, cut fell and remove therefrom all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the

landowners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

c. Temporary Access Road Easement. A temporary and assignable easement and right-of-way in, on, over, and across the land for a period not to exceed _____, for the location, construction, operation, maintenance, alteration, replacement and use of an access road and appurtenances thereto; together with the right to plant thereon trees, grass, shrubs and protect and control vegetation, to trim, cut, fell, remove, and dispose of any and all timber, trees, underbrush, obstructions, and other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the owners, their heirs and assigns, the right to use the surface of the land as access to their adjoining land; subject, however, to existing easements for public roads and highways, public utilities, railroads, and pipelines.

d. Consent of Use. The local sponsor acquires a Consent of Use from the State of Florida in lieu of an easement which allows placement of material seaward of the Erosion Control Line (ECL). The Consent of Use is issued when the Water Quality Certificate is approved by the Department of Environmental Protection and the ECL is approved by the Governor and Cabinet of the State of Florida.

The Consent to Use basically grants the rights to place sand on state owned submerged land in accordance with the beach nourishment plans submitted with the application for an erosion control line. Also included in this document is use of any submerged borrow areas and/or pipelines corridors. This document must be renewed with each renourishment contract.

22.

CHART OF ACCOUNTS

01 LANDS AND DAMAGES

01A00	PROJECT PLANNING	<u>\$10,000</u>
01B--	ACQUISITIONS	
01B20	BY LOCAL SPONSOR (LS)	<u>\$80,000</u>
01B40	REVIEW OF LS	<u>20,000</u>
01C--	CONDEMNATIONS	
01C20	BY LS	<u>100,000</u>
01C40	REVIEW OF LS	<u>20,000</u>
01E--	APPRAISALS	
01E30	BY LS	<u>48,000</u>
01E50	REVIEW OF LS	<u>24,000</u>
01G--	TEMPORARY PERMITS/LICENSES/RIGHTS-OF-ENTRY	
01G20	BY LS	<u>5,000</u>
01G60	DAMAGE CLAIMS	<u>5,000</u>
01M00	PROJECT RELATED ADMINISTRATION REAL ESTATE REVIEW OF PCA	<u>2,000</u>
01R--	REAL ESTATE PAYMENTS	
01R10	LAND PAYMENTS	
01R1B	BY LS	<u>0</u>
01R1D	REVIEW OF LS	<u>0</u>
01RX	CONTINGENCIES	<u>78,500</u>
TOTAL REAL ESTATE COSTS EXCLUDING CONTINGENCIES (RD)		<u>\$ 314,000</u>
TOTAL REAL ESTATE CONTINGENCIES COST (RD)		<u>\$ 79,000</u>
TOTAL PROJECT REAL ESTATE COST (RD)		<u>\$ 393,000</u>



Legend

- Public Land
- Corps Construction Line



Scale 1 : 1200
100 0 100
Scale in Feet

NOTE: PERPETUAL EASEMENT ON LANDS
BETWEEN THE CORPS CONSTRUCTION LINE AND
EROSION CONTROL LINE.

MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

REAL ESTATE PLANNING MAP

SCALE AS SHOWN



DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
PREPARED BY MARTIN COUNTY

May 1994

PLATE C-1



Legend

-  Public Land
 Corps Construction Line



Scale 1 : 1200



Scale in Feet

NOTE: PERPETUAL EASEMENT ON LANDS
BETWEEN THE CORPS CONSTRUCTION LINE AND
EROSION CONTROL LINE

MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

REAL ESTATE PLANNING MAP

SCALE AS SHOWN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
PREPARED BY MARTIN COUNTY

May, 1994

PLATE C-2

Legend

Public Land

--- Corps Construction Line



0 100 200
FEET

NOTE: PERPETUAL EASEMENT IN AND OUT
BETWEEN THE CORPS CONSTRUCTION LINE AND
EROSION CONTROL LINE

MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

REAL ESTATE PLANNING MAP

SCALE AS SHOWN

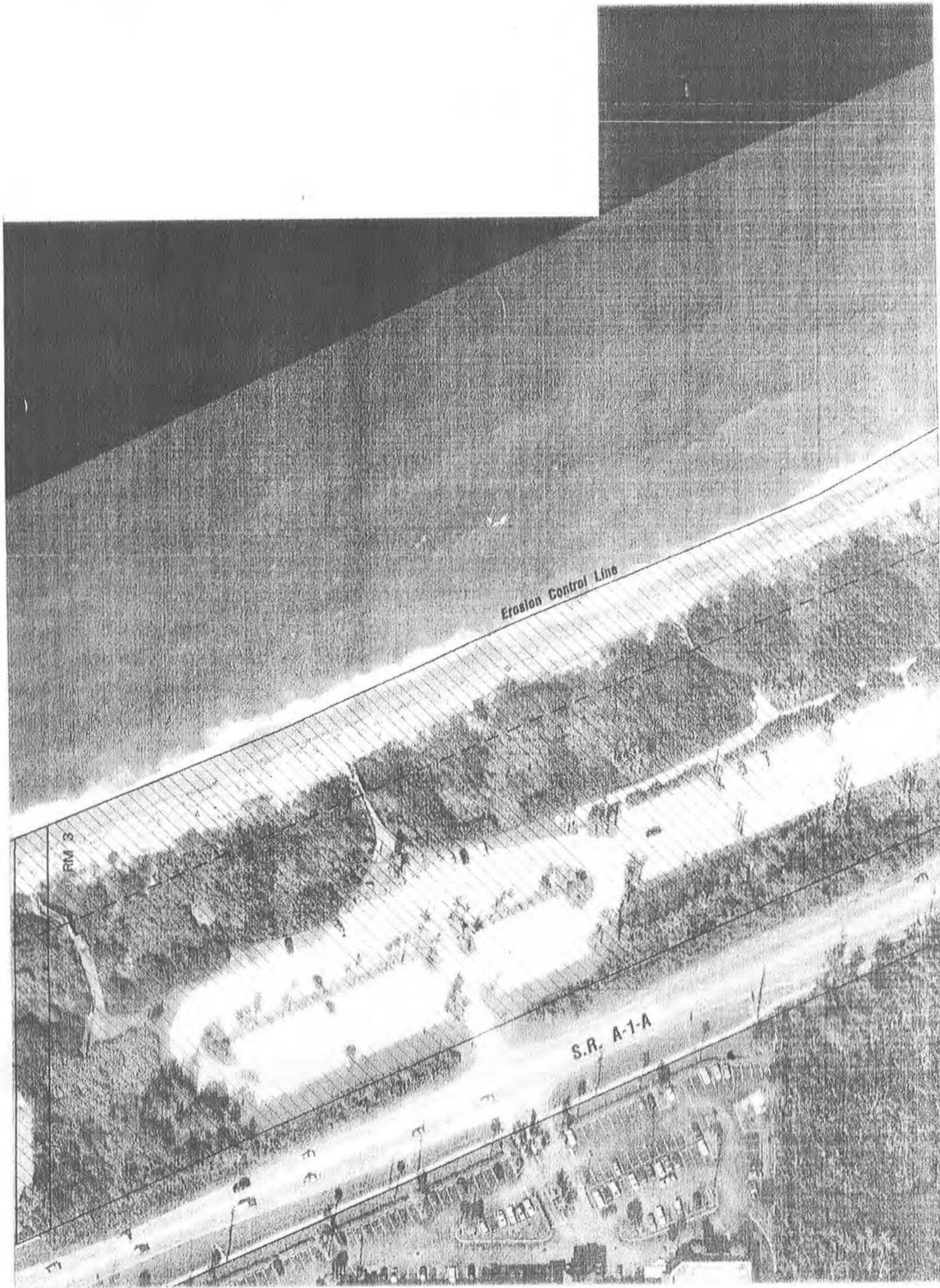
DEPARTMENT OF THE ARMY

ENGINEERS

FLORIDA



SECTION 10, TOWNSHIP 10N, RANGE 15E

PLATE 03



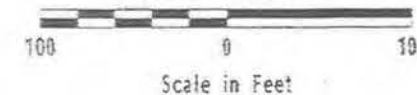


Legend

-  Public Land
-  Corps Construction Line



Scale 1 : 1200



NOTE: PERPETUAL EASEMENT ON LANDS
BETWEEN THE CORPS CONSTRUCTION LINE AND
EROSION CONTROL LINE.

MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

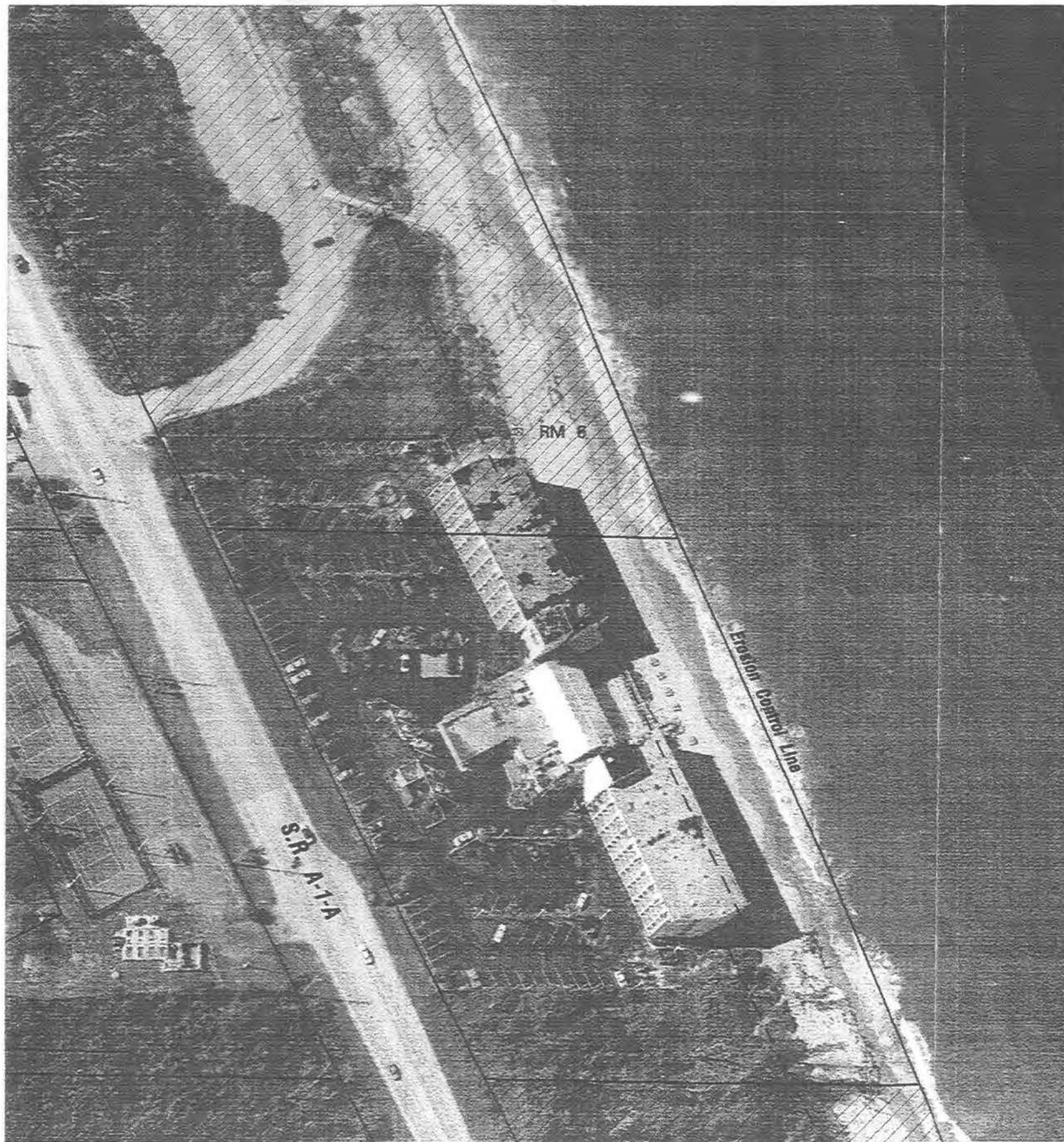
REAL ESTATE PLANNING MAP

SCALE AS SHOWN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
PREPARED BY MARTIN COUNTY

May, 1984

PLATE C-4



Legend



Public Land



Corps Construction Line



Scale 1 : 1200



Scale in Feet

NOTE: PERPETUAL EASEMENT ON LANDS
BETWEEN THE CORPS CONSTRUCTION LINE AND
EROSION CONTROL LINE.

MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

REAL ESTATE PLANNING MAP

SCALE AS SHOWN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA



PREPARED BY MARTIN COUNTY

May, 1994

PLATE C-5

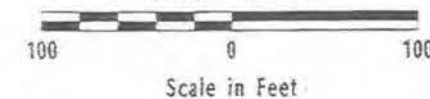


Legend

-  Public Land
 Corps Construction Line



Scale 1 : 1200



NOTE: PERPETUAL EASEMENT ON LANDS
BETWEEN THE CORPS CONSTRUCTION LINE AND
EROSION CONTROL LINE.

MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

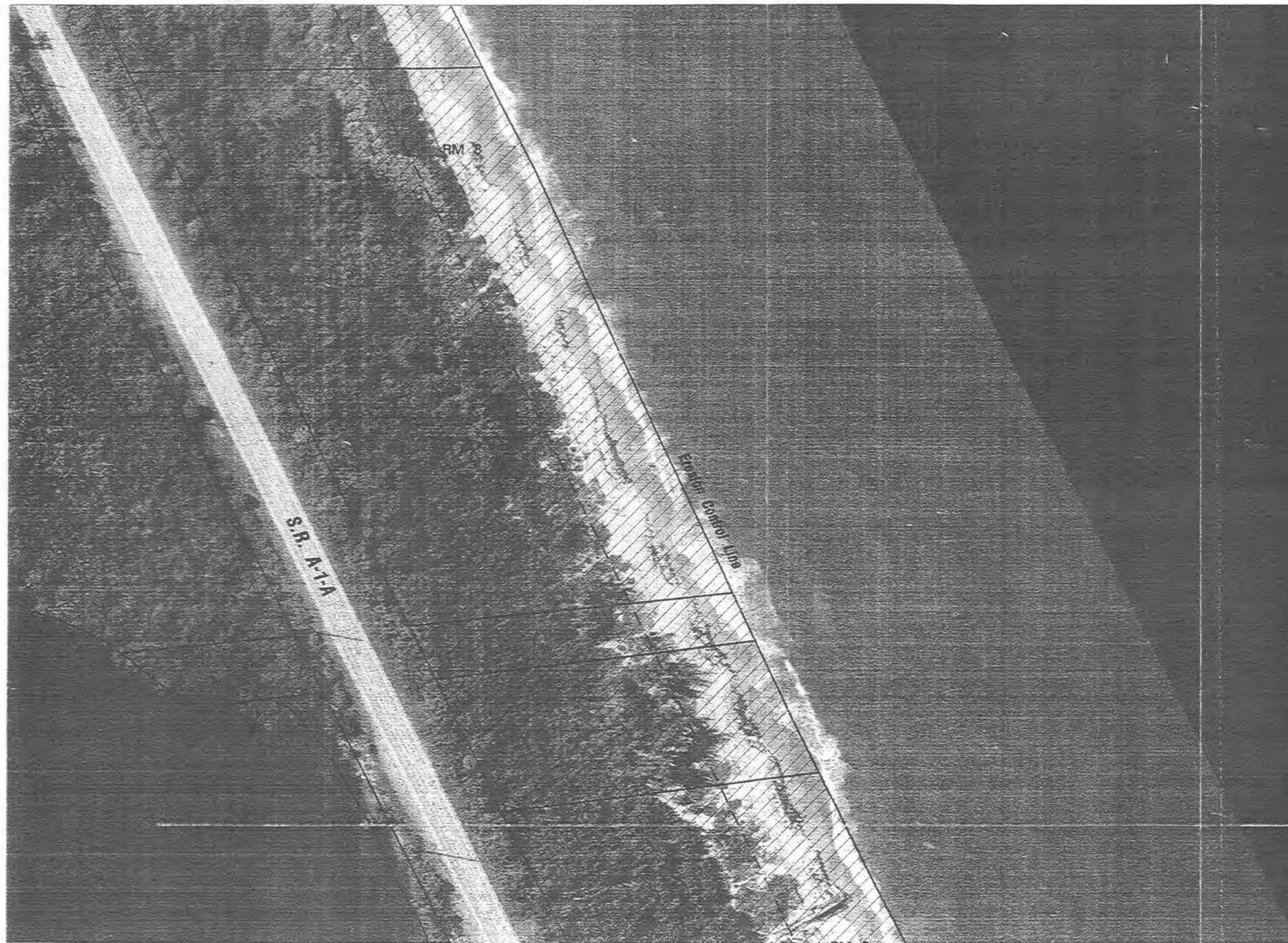
REAL ESTATE PLANNING MAP

SCALE AS SHOWN



DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
PREPARED BY MARTIN COUNTY

May, 1994


PLATE C-6



Legend

-  Public Land
 Corps Construction Line



Scale 1 : 1200

Scale in Feet

NOTE PERPETUAL EASEMENT ON LANDS
BETWEEN THE CORPS CONSTRUCTION LINE AND
EROSION CONTROL LINE.

MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

REAL ESTATE PLANNING MAP

SCALE AS SHOWN



DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
PREPARED BY MARTIN COUNTY

May, 1994

PLATE C-7



Legend

-  Public Land
 Corps Construction Line



Scale 1 : 1200
100 0 100
Scale in Feet

NOTE: PERPETUAL EASEMENT ON LANDS
BETWEEN THE CORPS CONSTRUCTION LINE AND
EROSION CONTROL LINE.

MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

REAL ESTATE PLANNING MAP

SCALE AS SHOWN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
PREPARED BY MARTIN COUNTY

May 1994

PLATE C-8

Legend

Public Land

--- Erosion Construction Line



NORTH



NOTE: PERPETUAL EASEMENT ON LANDS
BETWEEN THE CORPS CONSTRUCTION LINE AND
EROSION CONTROL LINE

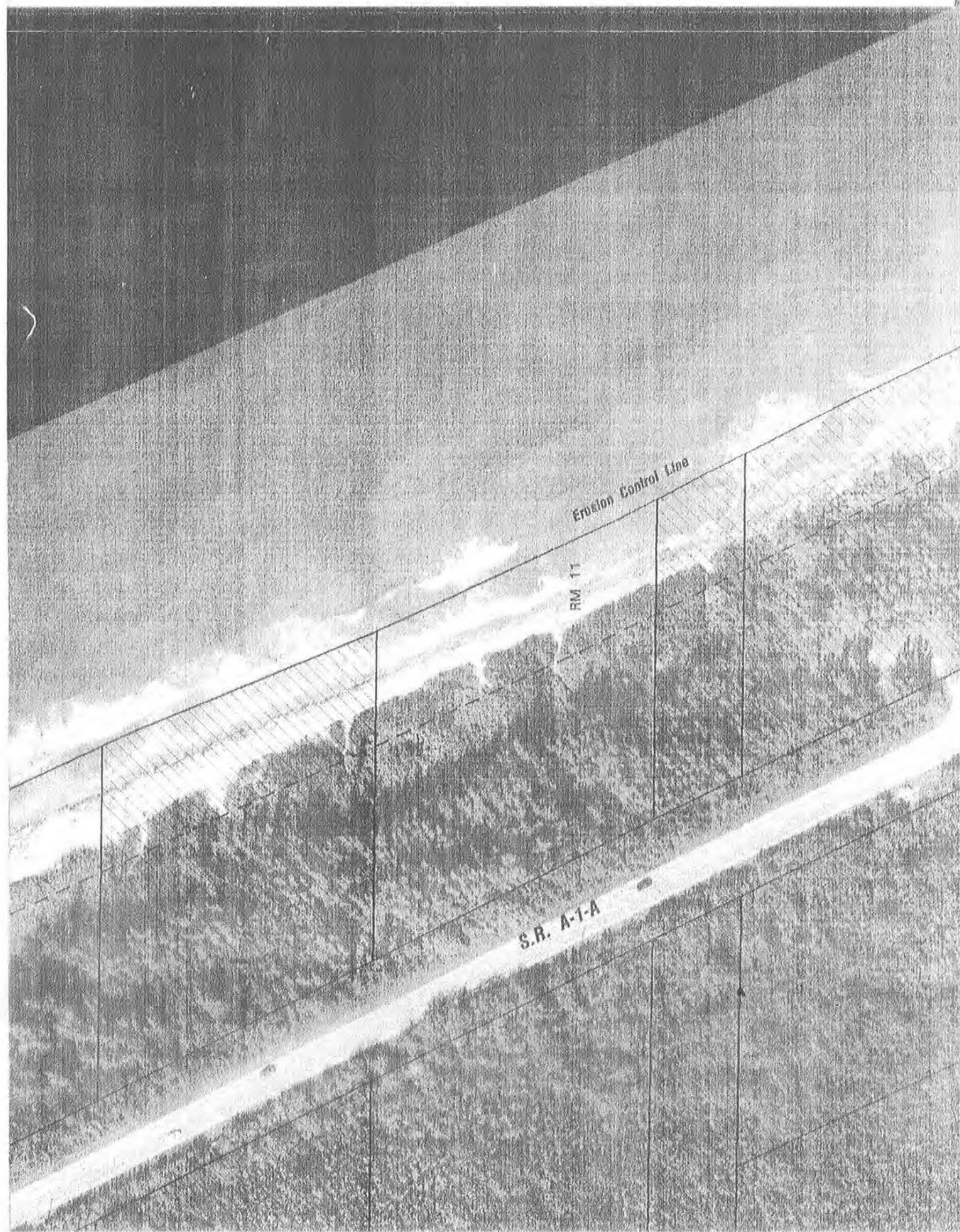
MARTIN COUNTY, FLORIDA
LANDS PROTECTION PROJECT

SEASIDE ESTATE PLANNING MAP

SCALE AS SHOWN



ENGINEERED BY THE ARMY
CORPS OF ENGINEERS
DAVENPORT, FLORIDA
DESIGNED BY MARTIN COUNTY

PLATE





Legend

-  Public Land
 Corps Construction Line



Scale 1 : 1200
100 0 100
Scale in Feet

NOTE: PERPETUAL EASEMENT ON LANDS
BETWEEN THE CORPS CONSTRUCTION LINE AND
EROSION CONTROL LINE.

MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

REAL ESTATE PLANNING MAP

SCALE AS SHOWN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

PREPARED BY MARTIN COUNTY

May, 1994

PLATE C-10

Legend

Public Land

Corps Construction Line



NORTH

Scale 1 : 1200



Scale in Feet

NOTE: PERPETUAL BASEMENT ON LANDS
BETWEEN THE CORPS CONSTRUCTION LINE AND
EROSION CONTROL LINE

MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

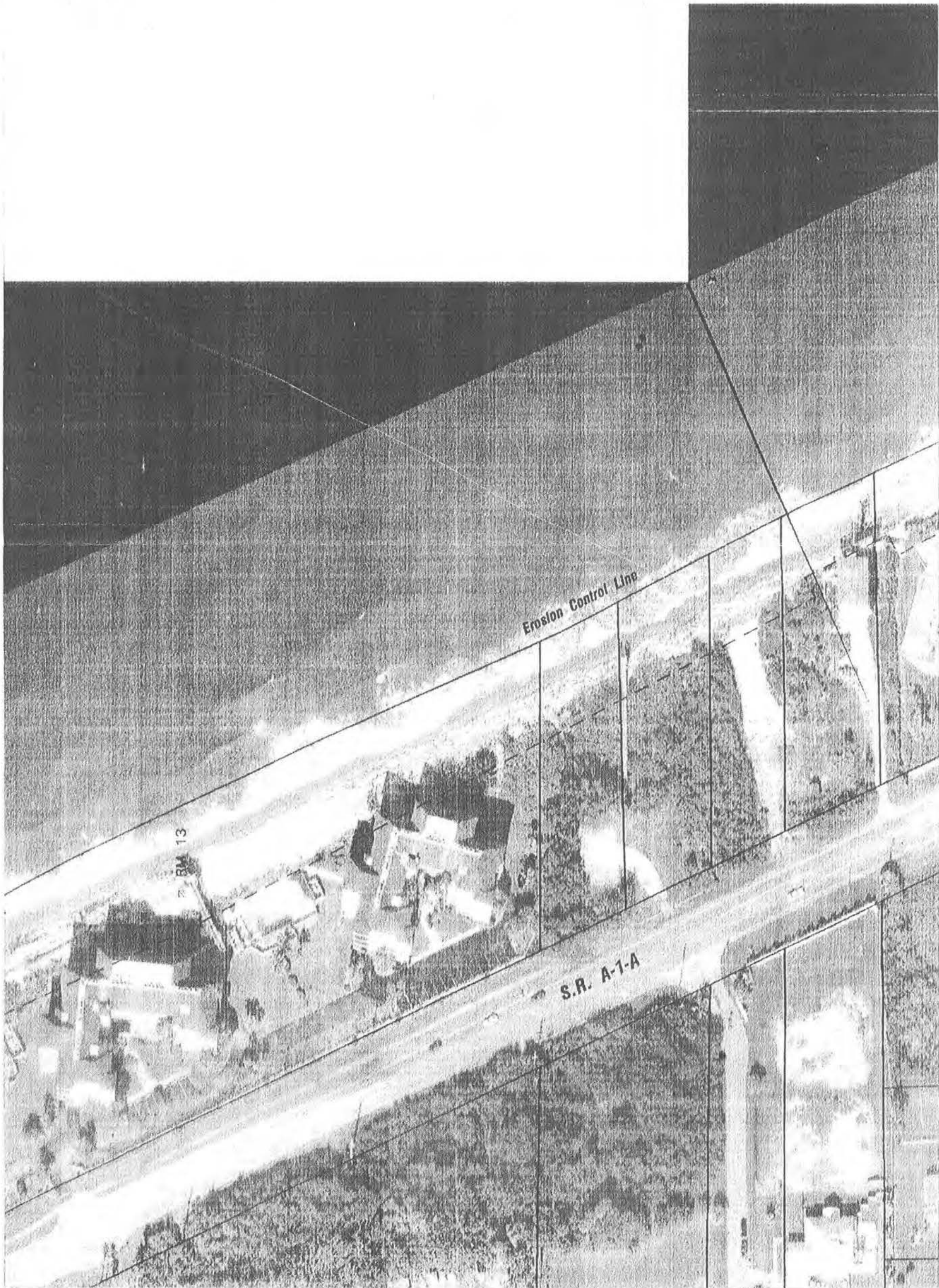
REAL ESTATE PLANNING MAP

SCALE AS SHOWN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

PREPARED BY MARTIN COUNTY

PLATE C-1



Legend

Public Land

Corps Construction Line



NOTE: PERPETUAL EASEMENT ON LANDS
BETWEEN THE CORPS CONSTRUCTION LINE AND
EROSION CONTROL LINE

MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

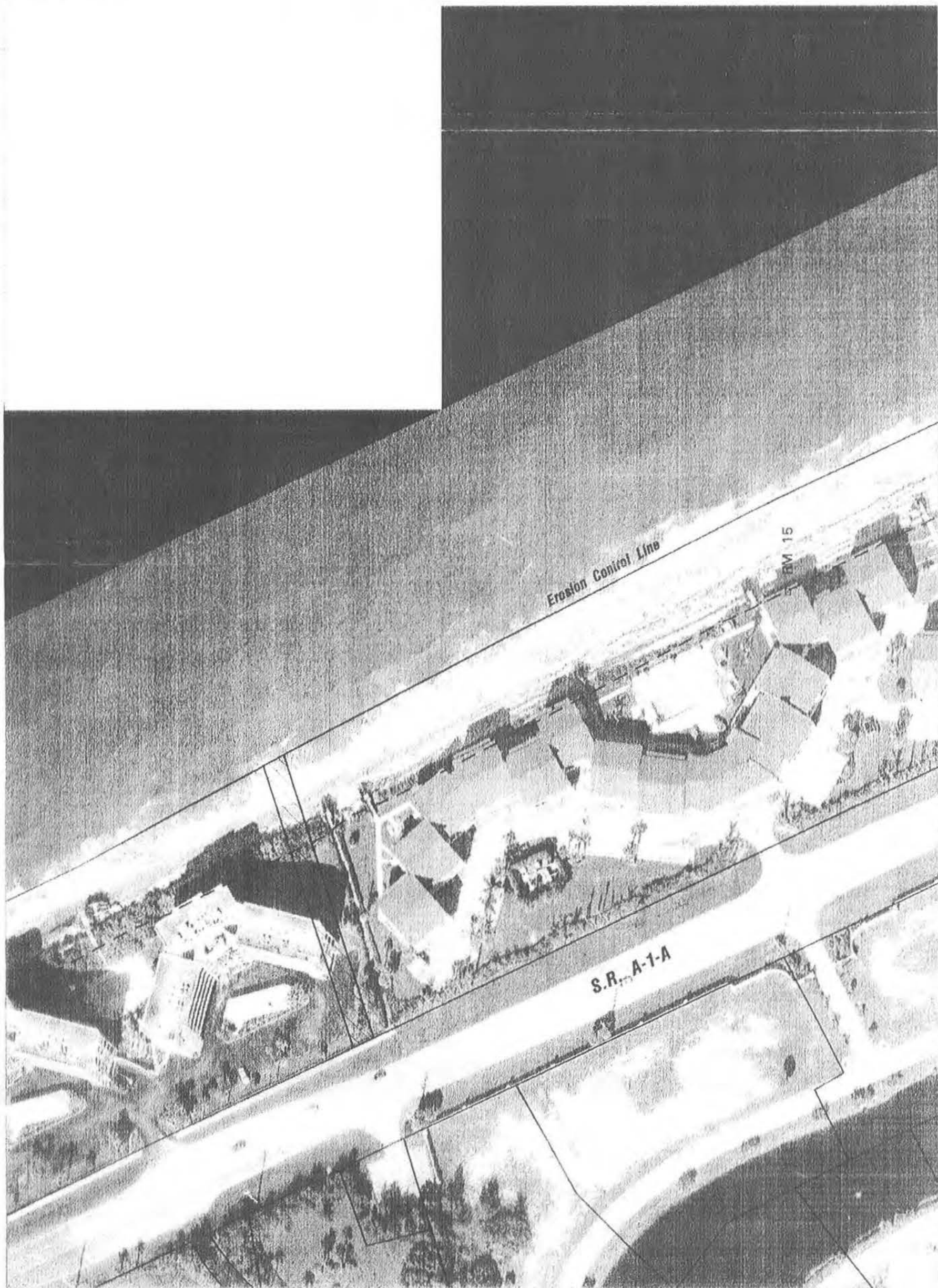
REAL ESTATE PLANNING MAP

SCALE AS SHOWN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

PREPARED BY MARTIN COUNTY

PLATE C-12



Legend

- Public Land
- Corps Construction Line



NOTES: EROSION BASEMENT ON LANDS
BETWEEN THE CORPS CONSTRUCTION LINE AND
EROSION CONTROL LINE.

MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

REAL ESTATE PLANNING MAP

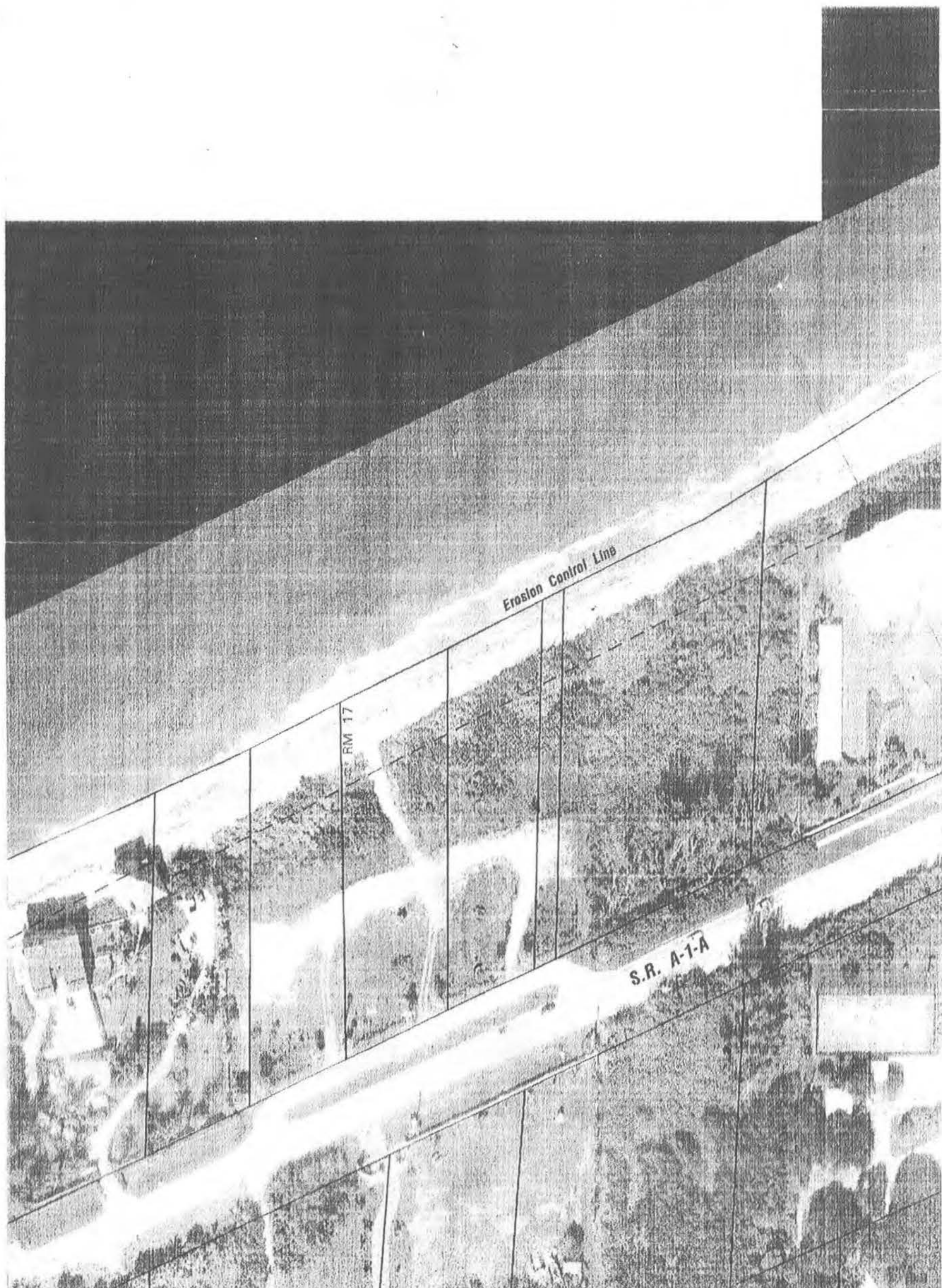
SCALE AS SHOWN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
PREPARED BY MARTIN COUNTY

PLATE C-13

May 1954





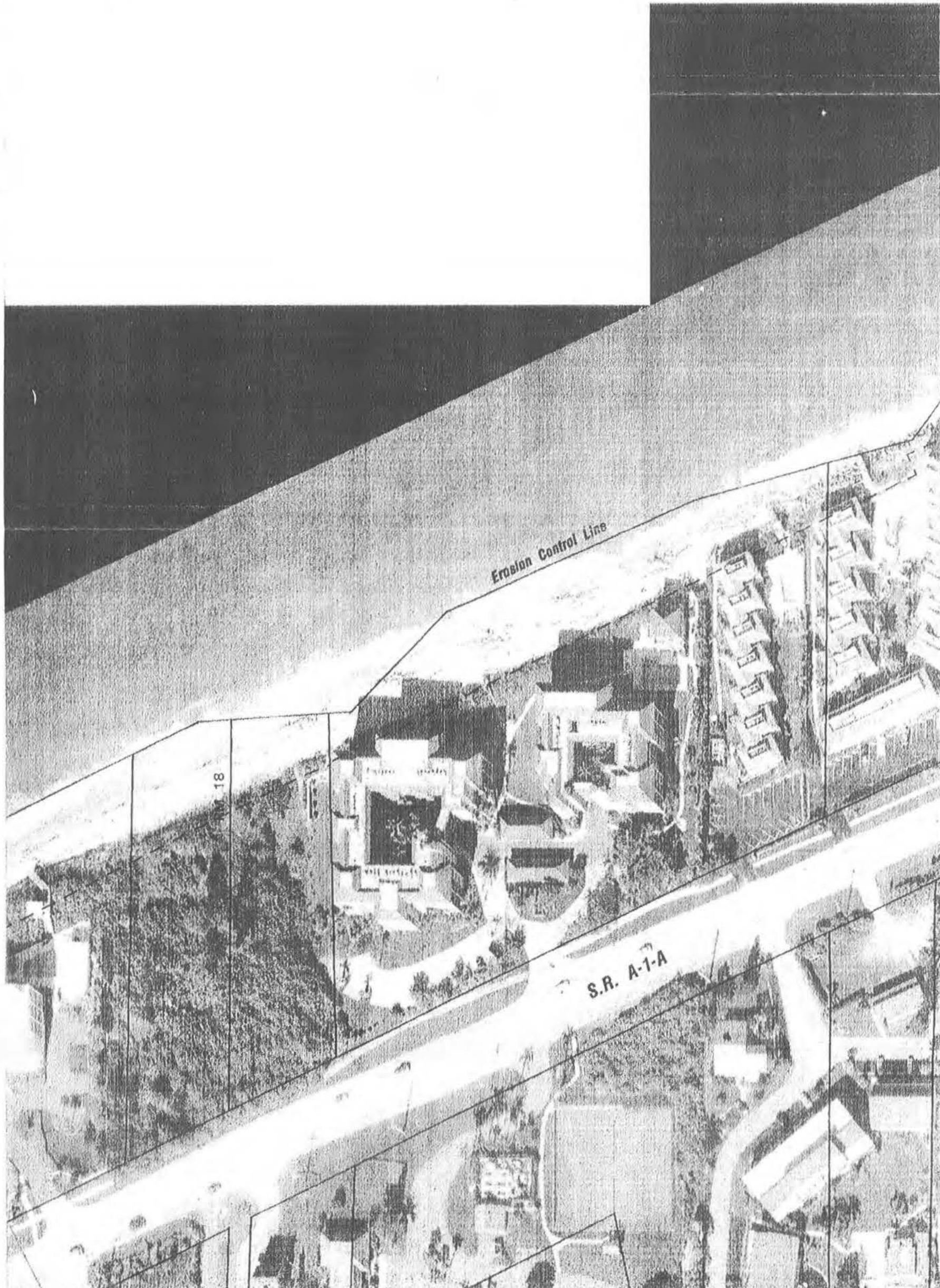
Public Land
--- Corps Construction Line



NOTE: PERPETUAL EASEMENT IN LANDS
BETWEEN THE CORPS CONSTRUCTION LINE AND
EROSION CONTROL LINE

REAL ESTATE PLANNING MAP

MARTIN COUNTY, FLORIDA
SHORE PROTECTION DISTRICT
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
ADVISORY BOARD
CORPS OF ENGINEERS
PLATE C-14



Legend

- Public Land
- After Construction Line



NOTES: PERPETUAL EASEMENT ON LANDS
BETWEEN THE CORPS CONSTRUCTION LINE AND
EROSION CONTROL LINE

MARTIN COUNTY, FLORIDA
FLOOD PROTECTION PROJECT

PLATE 2-47E PLANNING MAP

SCALE AS SHOWN

DESIGNED BY THE ARMY
ENGINEERS & DISTRICT CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

APPROVED BY MARTIN COUNTY

PLATE 2-47E

Legend

Public Land

Corps Construction Line



NORTH

Scale 1" = 200'

Scale in Feet

NOTE: PERPETUAL EASEMENT ON LANDS
BETWEEN THE CORPS CONSTRUCTION LINE AND
EROSION CONTROL LINE

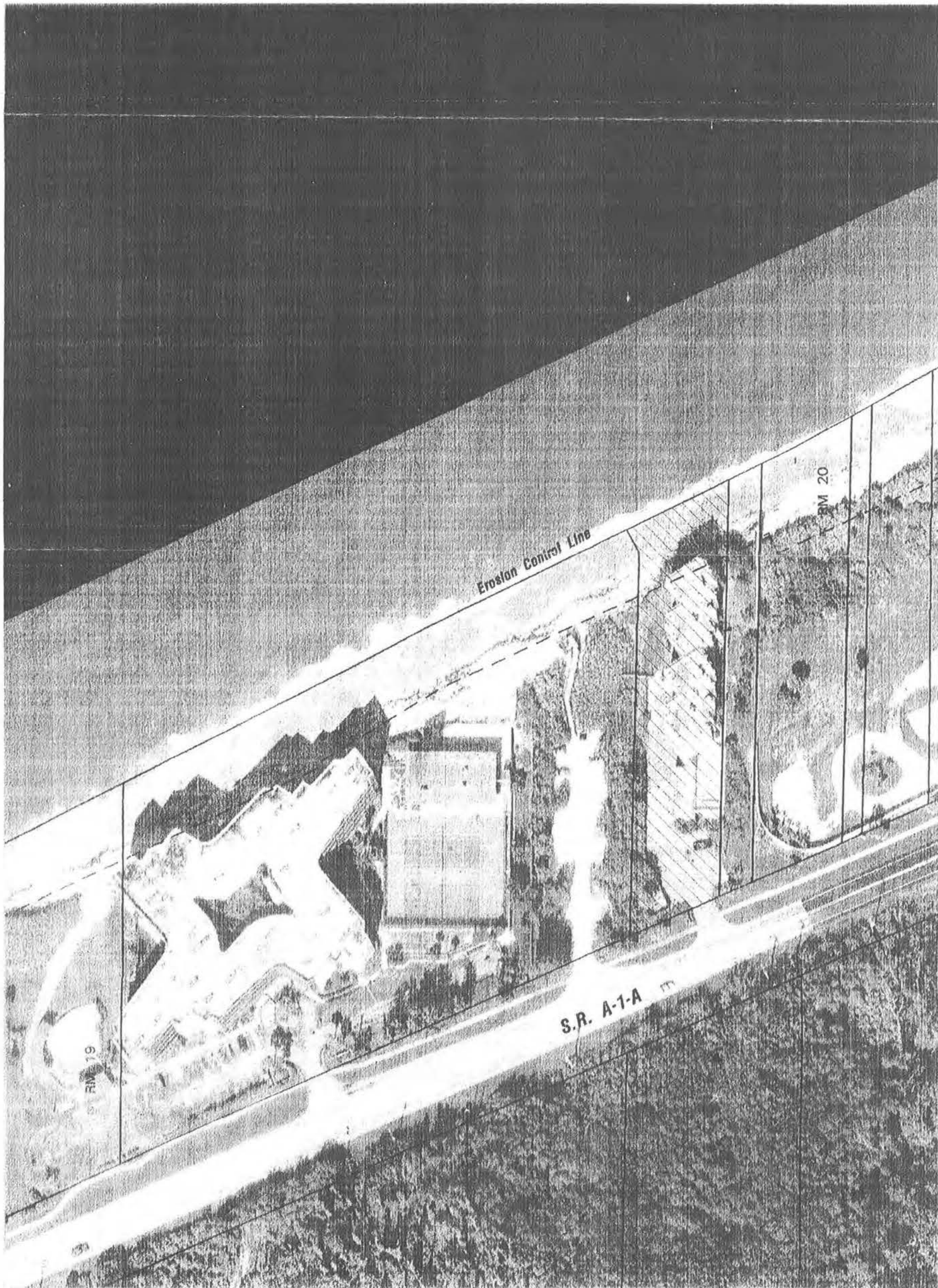
MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

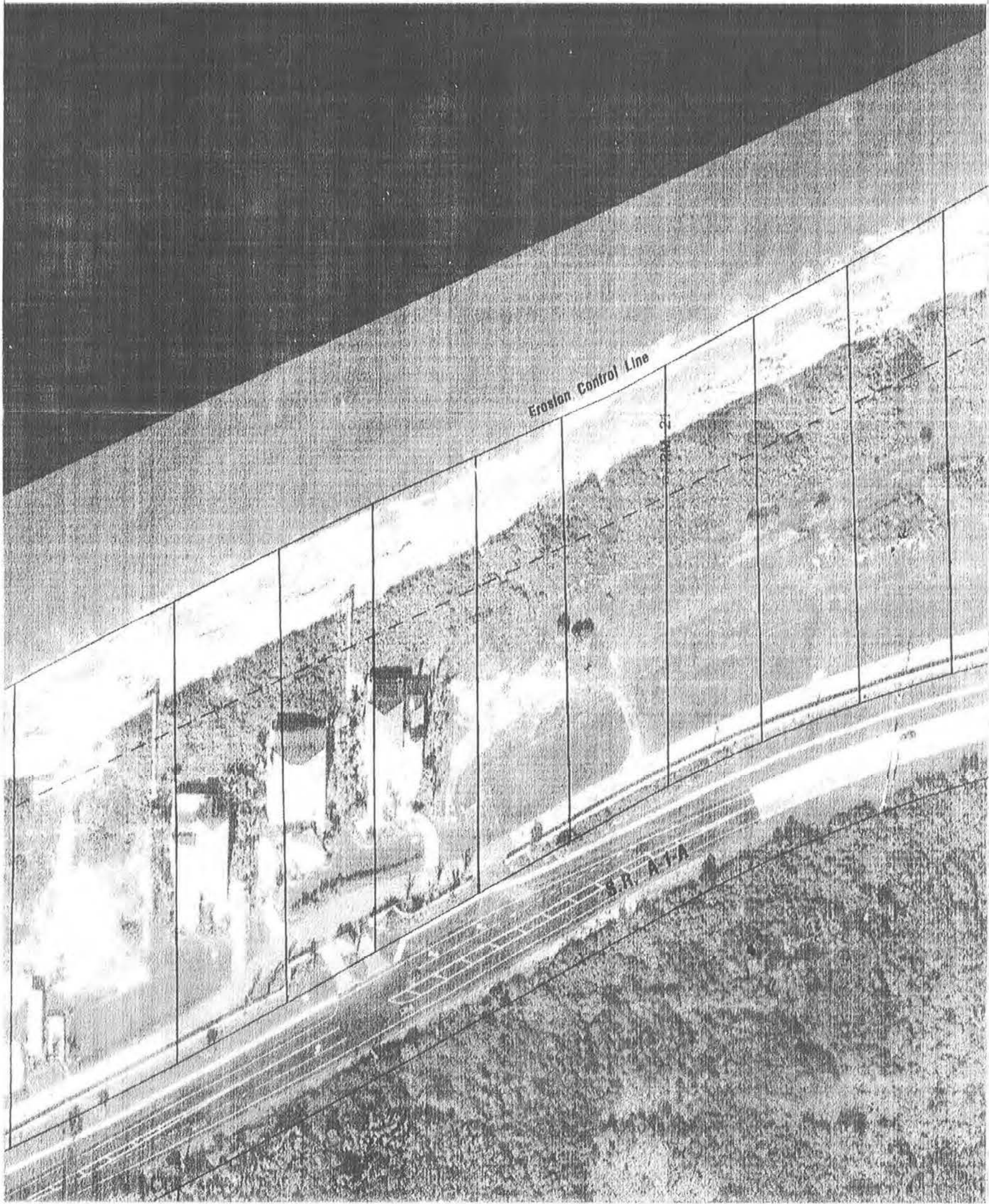
REAL ESTATE PLANNING MAP

SCALE AS SHOWN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

PREPARED BY MARTIN COUNTY
PLATE C-19





Legend

- Public Land
- Corps Construction Line



NOTE: PERPETUAL EASEMENT ON LANDS BETWEEN THE CORPS CONSTRUCTION LINE AND EROSION CONTROL LINE

MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

REAL ESTATE PLANNING MAP

SCALE AS SHOWN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
PREPARED BY MARTIN COUNTY

DATE 5-77

Legend

Public Land

Corps Construction Line



NOTE: PERPETUAL EASEMENT ON LANDS
BETWEEN THE CORPS CONSTRUCTION LINE AND
EROSION CONTROL LINE.

MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

REAL ESTATE PLANNING MAP

SCALE AS SHOWN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

PREPARED BY MARTIN COUNTY


934

PLATE C-8





Legend

 Public Land

 Corps Construction Line



Scale 1 : 1200

100 0 100

Scale in Feet

NOTE: PERPETUAL EASEMENT ON LANDS
BETWEEN THE CORPS CONSTRUCTION LINE AND
EROSION CONTROL LINE.

MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT

REAL ESTATE PLANNING MAP

SCALE AS SHOWN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
PREPARED BY MARTIN COUNTY

May, 1994

PLATE C-18

427

421

APPENDIX D

PERTINENT CORRESPONDENCE

MARSHAL L. WILCOX
District 1

JEFF KRAUSKOPF
District 2

JANET K. GETTIG
District 3

MAGGY MURCHALLA
District 4

CHARLENE HOAG
District 5

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996



PHONE (407) 288-5400

COUNTY OF MARTIN

STATE OF FLORIDA

June 9, 1994

ENG-CI-94-353L

Richard E. Bonner, P.E.
Deputy District Engineer for
Project Management
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

4-Mile Beach Renourishment
Martin County Project # 93E-CP-004

Dear Mr. Bonner:

This is in reference to the Martin County, Florida beach erosion control project. This letter reiterates Martin County's desire to act as the non-Federal sponsor of the 3.75 mile beach nourishment project as described in the General Design Memorandum (GDM) dated December 1993 (revised June 1994).

We have reviewed the GDM and understand and intend to provide the items of project cooperation, including the provision of lands easements, rights-of-way, relocations, and the non-Federal share of project costs. We understand that the items of project cooperation will be specifically set forth in a Project Cooperation Agreement (PCA), to be executed at a future date by the U.S. Army Corps of Engineers and Martin County.

The Martin County Board of County Commissioners is empowered by Chapter 161, Florida Statutes, to act as the county beach and shore preservation authority. The County has the authority to tax property or issue bonds to meet the costs of the county beach and shore preservation program.

Chapter 161 FS also provides for State financial assistance in funding beach erosion control and shore preservation projects. We intend to continue to make application to the Division of Beaches and Shores, Florida Department of Environmental Protection, for State funds for this project. The State is authorized to fund up to 75 percent of the non-Federal construction and maintenance costs for this project, subject to certain restrictions.

We are completing the details of our financial plan and will provide them to you at the earliest possible date. Please let this office know if there is anything further that is needed to proceed with this project.

Sincerely,


Donald E. Holloman, P.E.
County Engineer

DEH:LAW:bb
S:\cp\ci353l\law

cc: Peter Cheney, County Administrator

MARSHAL L. WILCOX
District 1

JEFF KRAUSKOPF
District 2

JANET K. GETTIG
District 3

MAGGY MURCHALLA
District 4

CHARLENE HOAG
District 5

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996



PHONE (407) 288-5400

COUNTY OF MARTIN

STATE OF FLORIDA

December 8, 1993
COM-94-MW-007

VIA FAX

Colonel Terrance Salt
District Engineer, Jacksonville District
U. S. Army Corps of Engineers
P. O. Box 4970
Jacksonville, Florida 32232-0019

REF: Martin County, Florida 4-Mile Beach
Renourishment Project #93E-CP-004


Dear Colonel Salt:

About November 19th, Mr. William Pullen representing the Martin County Chapter of the Florida Shore and Beach Preservation Association called your office and was directed to speak with Mr. Rick McMillan, Project Manager. The purpose of this call was to arrange an update and briefing for the Association as to the current status of the project and how the group can in anyway help the project to fruition.

I sincerely support such a meeting. The Association has suggested the following dates: December 13th Monday, 15th Wednesday, or 16th Thursday. Once a time and date are established they will confirm the location of the meeting, which will most likely be at one of the Martin County area hotels.

Please confirm the date and time with Mr. William Pullen, General Manager of the Holiday Inn Oceanside, 3793 NE Ocean Boulevard, Stuart, Florida 34957 (TELEPHONE 407-225-3000/FAX 407-225-1956).

Sincerely,


Marshal L. Wilcox
County Commissioner

WM/c

cc: Mr. Pullen, Martin County Chapter
Florida Shore & Beach Preservation Assoc.

431

424

MARSHAL L. WILCOX
District 1

JEFF KRAUSKOPF
District 2

JANET K. GETTIG
District 3

MAGGY MURCHALLA
District 4

CHARLENE HOAG
District 5

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fid m

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996

COUNTY OF MARTIN



PHONE (407) 288 5400

STATE OF FLORIDA

November 23, 1993

ENG-CI-94-066L

Mr. Richard Bonner
Deputy District Engineer for Programs & Project Management
USACOE - Jacksonville District
P.O. Box 4970
Jacksonville, Florida 32232-0019

Re: 4-Mile Beach Renourishment
Martin County Project #93E-CP-004

Dear Mr. Bonner:

On November 23, 1993 the Martin County Board of County Commissioners approved the United States Army Corps of Engineer's request to operate motorized all-terrain vehicles on selected beach/dune areas, through February, 1994 for beach surveys and placement of permanent survey monuments to continue design of this project. This approval does not release the USACOE from complying with any Florida Department of Environmental Protection permitting/work requirements.

Please have your on-site personnel coordinate these efforts with our beach supervisory Staff through Mr. Bill O'Brien, the County's Public Safety Director at 407-288-5693.

Please contact this office at 407-288-5927 with any further questions or comments.

Sincerely,

DE Holloman
Donald E. Holloman, P.E.
County Engineer

DEH:LAW:djs

cc: Bill O'Brien, Public Safety Director

BOARD OF COUNTY COMMISSIONERS AGENDA ITEM SUMMARY FORM

1. WORDING FOR AGENDA:

9-A-2

**4-MILE BEACH RENOURISHMENT
MARTIN COUNTY PROJECT #93E-CP-004
USACOE BEACH ACCESS REQUEST**

2. MEETING DATE: November 23, 1993

3. MEMO NO: ENG-CI-94-065M

4. PREVIOUS AGENDA ITEM: N/A

5. AGENDA PLACEMENT: Departmental

6. REQUESTOR'S NAME: D. Holloman

Estimated Time: 5 Minutes

7. EXECUTIVE SUMMARY:

The United States Army Corps of Engineers (USACOE) is requesting permission from the Martin County Board of County Commissioners (Board) to operate motorized vehicles on the beach areas, through February, 1994, for continuing design of the 4-Mile Beach Renourishment project.

8. BACKGROUND:

Fast-track design/permitting efforts with the USACOE and the Florida Department of Environmental Protection (FDEP) are continuing, to accelerate construction of this project to FY 94/95. The USACOE is requesting permission to operate all-terrain motorized vehicles within selected areas of the dunes and on the beaches through February, 1994, for beach surveys and placement of permanent survey monuments to continue these efforts.

In accordance with Martin County Code 33-72 (I) Special Barrier Island Regulations - Beach/Dune Protection; and Section 8-4, Coastal Management Element of the County's Comprehensive Plan, motorized vehicles are prohibited from operation on the beach and primary dune system. An exception is provided for emergency situations or as approved by special permit from the FDEP, and the Board.

Staff recommends this permission be granted. This approval will not release the USACOE from also obtaining the necessary FDEP approvals for this work.

9. RECOMMENDED ACTION:

Staff recommends the Board of County Commissioners approve the use of motorized vehicles on the beach areas by the USACOE, in accordance with Martin County Code 33-72 (I) Special Barrier Island Regulations - Beach/Dune Protection, and Section 8-4 of the Comprehensive Plan, through February, 1994 for work associated with the Martin County 4-Mile Beach Renourishment Project.

DEPT.	DIR	PSD	BZD	GMD	PWD	ENG	UTD	BUD	PRD	ACA	CTY ADM	CTY ATTY
X				X		X				X	X	X

X
JEP

X
LH

Lawton Chiles
GovernorFlorida Department of
Environmental ProtectionMarjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000Virginia B. Wetherell
Secretary

November 17, 1993

VIA FACSIMILE: (904) 232-1213

Rick McMillen
Office: CESAJ - DP - I
Department of the Army
Jacksonville Dist. Corp. of Engineer
P.O. Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. McMillen:

A permit is not required from this office to operate all-terrain vehicle (ATV) equipment seaward of the coastal construction control line providing:

1. An access point is available that will not adversely impact the dune or the vegetation thereon.
2. No operation of vehicles during night time hours.
3. All driving is performed at the wet sandy beach area.

This letter does not relieve any responsibility to comply with all applicable federal, state, county and municipal laws, ordinances or rules, nor does it relieve any responsibility to obtain any other license or permits which may be required by federal, state, county or municipal law. If you have any questions concerning this matter, please telephone me at (904) 487-4475.

Sincerely,

A handwritten signature in black ink, appearing to read "James D. Christie".

James D. Christie, Engineer II

JDC/ss



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

November 17, 1993

Programs and Project Management Division
Project Management Branch

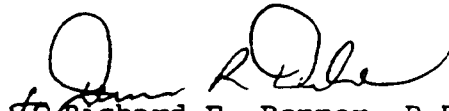
Mr. J.D. Christie
Division of Beaches and Shores
Mailstation 310
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Dear Mr. Christie:

This letter is to request a **NOTICE OF EXEMPTION** for use of all-terrain vehicle (ATV) equipment on the Martin County beaches. These vehicles are needed to assist in obtaining beach surveys required for the Martin County shore protection project.

Thank you for your assistance. If you need further information, please contact the project manager, Mr. Rick McMillen, at 904-232-1231.

Sincerely,


Richard E. Bonner, P.E.
Deputy District Engineer
for Project Management

MARSHAL L. WILCOX
District 1

JEFF KRAUSKOPF
District 2

JANET K. GETTING
District 3

MAGGY MURCHALLA
District 4

CHARLENE HOAG
District 5

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Ridm

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996

COUNTY OF MARTIN



PHONE (407) 288-1400

STATE OF FLORIDA

November 5, 1993

ENG-CI-94-0411

Mr. Richard Bonner, P.E.
Deputy District Engineer for
Project Management
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

Re: Martin County 4-Mile Beach Renourishment/Shore Protection
Martin County Project #93E-CP-004
Project Cooperation Agreement

Dear Mr. Bonner:

We have received Mr. Hal Graff's July 1, 1993 letter concerning the need to execute a Project Cooperation Agreement (PCA) for the Martin County Shore Protection Project. With the rapidly approaching 1994-95 construction schedule, it is important to prepare this agreement as soon as possible.

The County is committed to project construction in the 1994-95 FY, and understands that a 6-9 month period is anticipated for drafting and executing the agreement. Therefore, in accordance with Public Law 91-611 Section 221 of the Flood Control Act of 1970, Martin County requests that the USACOE begin work to draft the PCA document.

We are aware that the General Design Memorandum will be needed to finalize the cost-sharing requirements for the project, and that this information will also be a provision within the PCA. However, We do not believe this information should delay initiating preparation of the PCA.

Please contact me at 407-288-5927 if you need any further information, or if you would like to coordinate a meeting with the County pertaining to this matter.

Sincerely,

Donald E. Holloman, P.E.
County Engineer

DEH:LAW:djs

cc: Karyn Erickson, Applied Technology & Management

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**APPLIED TECHNOLOGY AND MANAGEMENT, INC.**

502 N.W. 75 STREET, SUITE 95
GAINESVILLE, FLORIDA 32607
TELEPHONE: (904) 375-8700 • FAX (904) 375-0995

August 13, 1993

Ms. Marlene Stern
Florida Department of
Environmental Protection
2600 Blair Stone Road
Tallahassee, Florida 32399

RE: Martin County Beach Nourishment Project
DEP File No. 432336109

Dear Marlene:

Attached please find our response to the RAI dated July 26, 1993, regarding the above referenced project. Please note that we are not yet able to provide a response to each item, however, these items will be addressed in subsequent submittals.

Please feel free to call me if you require clarification of any of these items.

Sincerely,

Janet K. Heam, P.E.

JKH/rkl

Attachments

cc: John Abendroth, FDEP (w/attachments)
Rick McMillen, USACOE (w/o attachments)
Don Holloman, Martin County (w/o attachments)
Lee Weberman, Martin County (w/o attachments)
Karyn Erickson, ATM (w/attachments)

**ATM'S RESPONSE TO
FDEP RAI DATED JULY 26, 1993**

Item 1: Please provide 8.5 by 11 inch plan view drawings of the project that show all of the following items:

- a. Erosion Control Line (ECL);
- b. DNR reference monuments;
- c. Existing mean high water line (if different from ECL);
- d. Construction toe of fill;
- e. Equilibrium toe of fill including the configuration of downdrift fill as far as it is expected to occur;
- f. Location of any stormwater outfalls, derelict structures or groins;
- g. Location of sediment samples discussed in Item 7; and
- h. Hardbottom within (landward) of the equilibrium toe (including downdrift fill) and at least 300 meters beyond the equilibrium toe of fill.

Response: Items 1b, 1c, 1d, and 1g were included in Sheets 2 through 5 of 31 in the original permit application. The survey work for Item 1a, the proposed ECL, is presently being conducted and will replace Item 1c in future submittals. Items 1e, 1f, and 1h are in preparation. Complete plan view drawings will be forwarded when all items have been completed.

Item 2: To the cross-sections, please add the equilibrium toe of fill and ECL.

Response: The equilibrium toe of fill and the ECL are in preparation. Complete cross-section drawings will be forwarded when this information is available.

Item 3: Please provide two sets of recent aerial photographs of the project area and indicate when the photographs were taken. On these photographs, please show the information requested in Question 1 and limits of public beaches.

Response: This item is in preparation.

Item 4: Please provide several representative cross sections of the borrow site that indicate existing and proposed contours; half of the cross sections should be oriented perpendicular to the shore and half parallel to the shore. These diagrams should be in 8.5 by 11 inch format, certified by a professional engineer, have appropriate scale bars (the vertical scale bars referenced to NGVD) and reference the Florida rectangular plan coordinate system.

Response: We are in the process of working with the USACOE to refine the limits of the borrow area. The requested representative cross sections will be forwarded when this analysis is complete.

Item 5: Please describe the construction methods that will be used for the project and provide a construction time table. This description also should include an estimate of the longevity of the renourished beach and the anticipated frequency of renourishment events.

ATM'S RESPONSE TO
FDEP RAI DATED JULY 26, 1993

Response: The method of construction is usually determined by the contractor. Specification of equipment types or methods by the Corps of Engineers may be seen as a restriction on bidders and is not done under normal circumstances. Contractors are required to meet all applicable State and Federal water quality standards and any special conditions of the Water Quality Certification regardless of equipment type or method used. Transportation of beach fill and placement of pipe will be determined by the contractor based on conditions at the time of construction. Once again, regardless of what equipment or method is used, the contractor must meet all applicable water quality standards.

Item 6: Please provide core boring logs and sediment grain size analysis from throughout the borrow area. Logs should extend at least two feet below the proposed bottom elevation. The depth of each visible horizon in the log should be reported relative to MSL and the material in each horizon classified according to the Unified Soil Classification System. Gradation curves should be produced from sieve analysis of each visible horizon in the core. Grain size distributions must be determined down to the standard unit 200 sieve size. Based on the sampling results, please provide an estimate of the volume of beach quality sand within the borrow area.

Response: Core boring logs and grain size analyses are attached. A summary of the sample locations (State Plane Coordinate System) is also included. Please note that the core boring logs for CB-M-2 and CB-M-22A cannot be located.

Item 7: Please provide sediment samples from the beach renourishment site. The samples should be collected to represent the range of substrate types present and to be used in a grain size compatibility analysis.

Response: In order to determine the composite grain-size characteristics for the native beach material on Hutchinson Island, a beach and nearshore sediment investigation was conducted. Samples were collected at designated elevations along eight transects running perpendicular to the shoreline. The FDNR monument locations included: R-1, R-4, R-7, R-11, R-15, R-20, and R-24. Samples were collected from the following elevations (in feet relative to NGVD): +10, +5, 0, -5, -10, -15, and, where possible, -20. The results of grain size analyses of the beach sand samples are attached.

Item 8: Please provide a compatibility analysis of the beach and borrow sands. Please include composite graphs of the grain size distribution of the beach and borrow materials in your analysis.

Response: The compatibility analysis and composite graphs will be prepared after the final borrow area configuration is determined. We are presently working with the USACOE to finalize the borrow area.

Item 9: Please provide an assessment of the biological resources at the beach site (including any nearby areas that may be affected by the project) and the borrow area (including any nearby areas that may be affected by removing the material). This assessment should include:

ATM'S RESPONSE TO
FDEP RAI DATED JULY 26, 1993

Item 9a. **Maps that identify the location and characterize the functions of any seagrass, other aquatic vegetation, rock outcrops, coral reefs, worm reefs, shellfish beds, sea turtle nesting sites, habitat used by endangered birds or beach mice, artificial reefs (or shipwrecks), and any other significant biological features within 300 meters of the beach or borrow areas. A description of methods used to locate and characterize resources must be provided. A side-scan survey of the borrow and fill areas and the area downdrift of the fill area where sedimentation is expected to occur must also be provided.**

Response: This item is in preparation.

Item 9b. **Benthic surveys of the renourishment and borrow areas that accurately describe the species present, relative density, and community structure within the areas. For this purpose, the benthic community should be defined as those organisms retained by a 500 micron sieve. At the borrow area, the epibenthic macrofauna must also be characterized. Please submit sampling plan for approval before beginning the field work.**

Response: Benthic sampling was conducted at the proposed project fill site, the project borrow area, and control areas in May/June 1990. A total of four transects were sampled for the benthic assessment. Two transects were within the limits of the proposed nourishment project at R-6 and R-19. In addition, two control transects were established- one to the north and one to the south of the nourishment boundaries. Along each transect, four sampling stations were established at regular intervals perpendicular to the beach face. Seven replicates were collected at each station.

Four stations corresponding to core boring locations were surveyed within the borrow area M-7, M-8, M-12, and M-16. Four control locations at M-3A, M-6, M-14, and M-21 were also surveyed. Seven replicates were collected at each station.

These samples are awaiting analysis. Per ATM's discussions with the DEP, the following samples will be analyzed:

Fill Area

South Control Transect: 3 stations, no more than 5 replicates;
Transect R-6: 3 stations, no more than 5 replicates; and
Transect R-19: 3 stations, no more than 5 replicates.

Borrow Area

Four borrow site stations, no more than 5 replicates.
Two control stations, no more than 5 replicates.

The results of the benthic sample analysis will be forwarded to the DEP when the analysis is complete.

**ATM'S RESPONSE TO
FDEP RAI DATED JULY 26, 1993**

Item 9c. **A general description of all commercial and recreational fisheries and the recreational skin and SCUBA diving within 1 mile of the beach and borrow sites. Please also discuss the extent to which nearshore rock outcrops are visited by divers and snorkelers.**

Response: A discussion on this item is attached.

Item 10: **Please indicate the amount of storm protection provided by the current beach and the amount expected to be provided by the new beach. This estimate also should include an approximate value of the public and private lands benefiting from the additional protection.**

Please submit the 1989 report by the Corps which updates the project recreation benefits, cost estimates and fill volumes. If additional analysis of benefits and fill have been done more recently, please submit that.

Response: The 1991 Economic Update is attached.

The existing beach provides little to no storm protection. The project as planned will provide protection from a 10 to 15-year storm event.

The value of properties provided storm protection benefits as calculated by the Corps includes only the first row ocean front structures (first two floors only). This approximate property value is \$64.4 million. The total value of property fronting the project area is \$125 million.

A March 1992 update to the Corps' 1989 report is attached.

Item 11. **Please provide detailed plans for protecting water quality and biological resources during construction. At a minimum, this plan should explicitly address turbidity controls and a discussion of the status of the sea turtle nest-relocation plan that has been submitted to DNR.**

Response: The construction contractor will be required to comply with all local, State, and Federal water quality standards and any special conditions of the Water Quality Certification. We are presently in the process of preparing a request for a water quality variance. The petition for variance will be submitted as soon as our analyses are complete.

Construction will not occur during turtle nesting season.

Item 12a: **Please provide a description of the beach's geologic history and any major periods of accretion or erosion.**

Response: This item is in preparation.

Item 12b: **Please provide information specifying current erosion rates and areas of influence.**

Response: This item is in preparation.

**ATM'S RESPONSE TO
FDEP RAI DATED JULY 26, 1993**

Item 12c: Please provide monthly wave direction, height, and energy.

Response: A summary of the local wave conditions is attached. This summary is excerpted from the draft inlet management plan for St. Lucie Inlet dated April 28, 1992.

Item 12d: Please provide monthly nearshore current speeds and directions.

Response: We are not aware of any current studies that provide information on nearshore currents within the project area, however, a summary of the current conditions in and around St. Lucie Inlet was prepared for the St. Lucie Inlet Management Plan. This summary (attached) is excerpted from the draft inlet management plan for St. Lucie Inlet dated April 28, 1992.

Item 12e: Please provide monthly littoral drift direction and volumes.

Response: A table summarizing monthly littoral drift based on Walton (1973) is attached.

Item 12f: Please provide location of any nodal points within the proposed nourishment area.

Response: There are no nodal points within the proposed nourishment area.

Item 12g: Please provide an estimate of the depth of closure if the borrow area is offshore of the beach in less than 25 feet of water.

Response: Nearly all of the borrow area is in 25 to 35 feet of water.

**APPLIED TECHNOLOGY AND MANAGEMENT, INC.**

502 N.W. 75 STREET, SUITE 95

GAINESVILLE, FLORIDA 32607

TELEPHONE: (904) 375-8700 • FAX (904) 375-0995

August 10, 1993

**Mr. Mickey Bryant, Administrator
Intergovernmental Coordination
Department of Environmental Protection
3900 Commonwealth Boulevard
Mail Station 46
Tallahassee, Florida 32399-3000**

RE: Martin County 4-Mile Beach Nourishment Project**Dear Mr. Bryant:**

I am writing to provide you with a status report on the Martin County Beach Nourishment Project. A current timeline schedule prepared jointly by Applied Technology and Management, Inc., (ATM) and the U.S. Army Corps of Engineers is attached for your review and comments. The timeline establishes critical milestones that must be met in order to assure that all work is completed to accomplish the accelerated 1994-95 construction time frame.

On behalf of Martin County, ATM is working closely with the U.S. Army Corps of Engineers to assist in completing all design work and environmental investigations that are required to complete the General Design Memorandum in December 1993. In addition, ATM is working concurrently with Robert Brock of the USACOE to formulate a hardbottom mitigation plan as well as to coordinate the County's responses to the BWRM completeness summaries.

Since our last meeting (December 1992), the USACOE and ATM coordinated investigations for characterization of the nearshore habitats, including benthic and fisheries communities. Specifically, this work included magnetometer surveys, side scan sonar surveys, hardbottom mapping, groundtruthing, and nearshore habitat characterization studies. These investigations were performed in close cooperation with representatives of the USFWS, DER, and DNR to determine the extent, character, and locations of hardbottom areas adjacent to the Project's fill and borrow areas in order to develop a plan for mitigating anticipated impacts to hardbottom habitats, fisheries and other coastal resources in the Project area.

ATM is presently working with Ms. Marlene Stern and Mr. John Abendroth of the Bureau of Wetland Resource Management (BWRM) to provide additional information to process the BWRM permit. The development of the draft hardbottom mitigation plan is expected to be completed in mid-August. ATM and the USACOE are planning to meet to discuss the completeness summaries, biological mitigation plan, and the final recommended project design (i.e., NED Plan) with representatives of the BWRM and the Division of Beaches and Shores (DBS) during the first week of September.

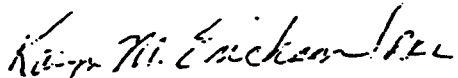
Martin County would like to arrange a meeting with you following the above-described agency meetings to discuss the County's application for Federal funds to construct this Project in the 1994-95 fiscal year. If a particular week is preferable to you, please advise me as soon as possible in order that we may coordinate arrangements for this meeting with the USACOE, BWRM, DBS, and Martin County.

Mr. Mickey Bryant, Administrator
August 10, 1993
Page 2

As you know, the Martin County Beach Nourishment Project is a top priority of the Martin County Board of County Commissioners, the State of Florida, and the U.S. Army Corps of Engineers. We greatly appreciate your continued cooperation and assistance in the execution of this important Project.

Sincerely,

APPLIED TECHNOLOGY AND MANAGEMENT, INC.


Karyn M. Erickson, P.E., Vice President

KME/rkl

Enclosure

cc: Don Holloman, County Engineer, Martin County
Richard McMillen, U.S. Army Corps of Engineers
Lonnie Ryder, Division of Beaches and Shores

USACOE AND ATM TASKS SCHEDULEMARTIN COUNTY SHORE PROTECTION PROJECTTask ItemStart-End DatesUSACOE

Obtain Structure and Land Values	April 5, 1993 -- May 5, 1993
Obtain Cost Estimates Alternatives	August 5, 1993 -- August 18, 1993
Side Scan Survey and Write-Up	May 19, 1993 -- July 4, 1993
Inspection of Hardbottoms	July 9, 1993 -- July 23, 1993
Storm Damage Model Preparation	July 29, 1993 -- August 3, 1993
Development of Mitigation Plan	July 29, 1993 -- August 12, 1993
Benthic and Fish Inventory	July 29, 1993 -- August 11, 1993
Damage Benefit Calculations	August 12, 1993 -- August 18, 1993
Evaluate Alternate Plans	August 19, 1993 -- August 25, 1993
Develop NED Plan	August 26, 1993 -- August 27, 1993
Determine Cost Sharing	August 26, 1993 -- September 9, 1993

DATES
shown
on DISTRICT
EXECUTIVE
SUMMARY
P. 1

RESPONSIBILITIES OF SOME OF THESE
ATM ACTIVITIES.

Respond to DEP-BWRM RAI #1	July 28, 1993 -- August 13, 1993
Review and Comments on Draft COE Mitigation Plan	August 16, 1993 -- August 25, 1993
Obtain Construction Easements	September 15, 1993 -- April 30, 1994
Prepare and Submit DSL-DSB Permit Applications	September 15, 1993 -- September 24, 1993
Meeting with DEP-BWRM to Discuss Hardbottom Mitigation Plan and Project Design	August 30, 1993 -- September 3, 1993
Refine Borrow Area and Meet with COE	September 13, 1993 -- September 17, 1993
Meeting with Mickey Bryant	September 13, 1993 -- September 17, 1993
Respond to DEP-BWRM RAI #2	September 15, 1993 -- September 30, 1993
Review Draft GDM	November 15, 1993 -- December 1, 1993
Coordinate GDM Review--Meet w/USACOE-SAD	January 1994
Obtain Final Approval of GDM from Chief of Army (Washington, D.C.)	March 1994
Complete DEP-BWRM Permit Processing	May 1994
Complete DEP-DBS Permit Processing	July 1994
Complete DEP-DSL Permit Processing	July 1994
Obtain PCA (Local Cooperative Agreement)	July 1, 1994 -- October 1, 1994
Prepare Construction Bidding Documents	October 1, 1994 -- November 30, 1994

SOME OF THE ACTIVITIES LISTED ARE SCHEDULED AND
THE TASKS w/ATM are SCHEDULED AND

**APPLIED TECHNOLOGY AND MANAGEMENT, INC.**

502 N.W. 75 STREET, SUITE 95

GAINESVILLE, FLORIDA 32607

TELEPHONE: (904) 375-8700 • FAX (904) 375-0995

July 8, 1993

Mr. Robert Brock
U.S. Army Corps of Engineers
Environmental Branch
P.O. Box 4970
Jacksonville, FL 3223209918

RE: Martin County Environmental Ground Truthing

Dear Robert,

It is our understanding that the groundtruthing of the side-scan survey for Hutchinson Island is scheduled to begin on Tuesday July 13, 1993 and proceed through July 23rd. In order for the County to arrange and pay for the proper-sized boat and equipment and to ensure adequate agency representation, we had previously requested a confirmation list of the individuals who are scheduled to dive, and a list of any dive equipment that must be rented. To date, neither the County nor ATM has been provided with this information. Because we have not heard from you and have not been able to contact you, ATM has made the following arrangements for next week's trip:

1. Morgan and Eklund Surveyors will provide positioning for the dives using their HYDRO positioning system. HYDRO is accurate to within three feet; this is substantially better than the accuracy of the GPS, which I understand to be within 2 to 5 meters. Morgan and Eklund will be setting the ground stations for the positioning system tomorrow, July 9th. In order to have sufficient lead time for this setup, we have had to assume that the first portion of the survey work will be conducted within the 4.5-mile project area beginning at the north Martin County line. Therefore, please plan your dives accordingly.
2. We have two dive boats for a total of nine work days- July 13-16 and July 19-23. Together the boats will accommodate a total of nine divers. If you anticipate more than nine divers on any particular day, please let us know as soon as possible so that we can look into arranging for a third boat. We are at present anticipating to have five divers on the first day of groundtruthing. This includes three divers from the USACOE, one diver from U.S. Fish and Wildlife, and Karyn Erickson from ATM. We are planning for a start time of 7:30 a.m. from the public boat ramp (Sandspruit Park) in Stuart.

Please note that no arrangements have been made for dive equipment rental.

In order for the surveyors and ATM to make your dives as productive and efficient as possible, we request that you provide as soon as possible a description of your dive plan (e.g., approximate state plane coordinate positions of dive sites and transect locations; number of groundtruthing sites; length, orientation, and number of transects; boundaries of area to be ground truthed, etc.). Rick McMillen is forwarding copies of the draft side scan survey maps to John Morgan in Vero Beach; it would be helpful for you to contact him at 407-569-2218 to discuss the approximate locations of your intended dives. By

Mr. Robert Brock
July 8, 1993
Page 2

knowing these locations in advance, the Morgan and Eklund crew can "pre-inspect" the areas and mark them with buoys for easy relocation later.

Finally, it is our present understanding that the U.S. Fish and Wildlife Service will be diving with you during the first and second week and that the Florida DEP will have at least one representative during the second week. We feel that it is also essential to have a representative from the Division of State Lands. Will a representative from State Lands be present for any of the dives?

I hope that these arrangements are satisfactory. I will be out of the office until Wednesday July 14, however, you can reach Karyn Erickson in Gainesville at 904-375-8700 to finalize these arrangements or if you have any questions.

Sincerely,

APPLIED TECHNOLOGY AND MANAGEMENT, INC.



Janet K. Hearn

JKH/saw

cc: Karyn Erickson, ATM
Lee Weberman, Martin County
Bonnie Dearborn, Martin County
Robert Cutcher, ATM
John Morgan, Morgan and Eklund
Rick McMillen, USACOE

VICE CHAIRMAN
MARSHAL L. WILCOX
District 1

CHAIRMAN
JEFF KRAUSKOPF
District 2

JANET K. GETTIG
District 3

MAGGY MURCHALLA
District 4

CHARLENE HOAG
District 5

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996

SUE B. WHITTLE • County Administrator

PHONE (407) 288-5422

COUNTY OF MARTIN

June 29, 1993



STATE OF FLORIDA

Mr. Richard Bonner, Deputy District Engineer
Programs and Project Management
P.O. Box 4970
Jacksonville, Florida 32202

Dear Mr. Bonner:

First, I want to thank you for all the help you have provided Martin County in obtaining the Congressional appropriations to date in the amount of \$600,000 towards the Martin County 4-Mile Beach Nourishment Project. These funds would not have been possible had the ACOE not provided us with necessary support throughout the Congressional appropriations process. We are very grateful for your help.

We appreciate your continued support on the project and are pleased that the FY '94 appropriations in the amount of \$282,000 has recently passed the House Appropriations Committee on Energy and Water and is on its way to the floor. In addition to the FY '95 funding to complete the PED portion of the project, we are asking our Congressmen to do an "add-on" to the FY '95 budget for the construction funds in the amount of \$6,167,757 in order to meet the expedited schedule that has been agreed upon by the various agencies involved in the project. We understand the ACOE is doing all that it can to assist us in this effort and we are very grateful for the ACOE's strong support.

Attached for your information are copies of correspondence sent to certain Members of the Florida Congressional Delegation and copied to the Florida Department of Natural Resources regarding this project.

As you know the 4-Mile Beach Nourishment Project on Hutchinson Island, Martin County is a top priority for the Martin County Board of County Commissioners. It is essential that we receive state and federal funding in 1994 in order to meet the expedited schedule. Our staff has been working very closely with the ACOE and the state agencies to achieve the necessary tasks in time to meet the required deadlines to accomplish an "add-on" to the federal budget.

Again, we thank you for all your help and will appreciate your continued strong support for the project. If there are any questions, please do not hesitate to contact us at SC 239-1357.

Yours truly,


Jeff Krauskopf,
Chairman

ADM-IG-93-142L

cc: Peter Cheney, Assistant County Administrator

Addendum:

Attached is another copy of Martin County's Resolution #92-11.11C requesting ACOE to assist in expediting the beach project.

VICE CHAIRMAN
MARSHALL L. WILCOX
District 1

CHAIRMAN
JEFF KRAUSKOPF
District 2

JANET K. GETTIG
District 3

MAGGY MURCHALLA
District 4

CHARLENE HOAG
District 5

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996

SUE B. WHITTLE • County Administrator

PHONE (407) 295-5422

COUNTY OF MARTIN

STATE OF FLORIDA

June 28, 1993

COM-93-CHR-034

The Honorable Porter Goss
United States House of Representatives
330 Cannon House Office Building
Washington, D.C. 20515

Dear Congressman Goss:

This correspondence is a request for your assistance in seeking federal funding for an important beach restoration project in Martin County. Being a coastal county in Florida it has become necessary to seek financial assistance in order to restore our beach for storm protection purposes. The situation has become so serious that it is necessary to expedite the beach construction schedule by one year. I am writing you at this time to ask for your assistance in getting construction funds in the amount of \$6,167,757 for Martin County's 4-mile beach nourishment project "added-on" to the federal budget for FY '95, and to inform you of the current and projected activities relating to our project.

Update Report

For the past several years Martin County has been seeking federal funding to construct a 4-Mile Beach Nourishment project on Hutchinson Island in Martin County. In November 1992 the Martin County Board of County Commissioners, representatives of state and federal agencies agreed there was a very serious need to expedite the construction of the project by one year, that is, to begin beach nourishment construction in November 1994 rather than 1995. The Board adopted a Resolution to that effect, a copy of the Resolution is attached. Since November, County staff has been working closely with the appropriate state and federal agencies in order to complete the necessary tasks in time to meet the expedited schedule.

Federal, State and County Support

The estimated total cost of the Martin County 4-Mile Beach Nourishment project is between \$ 13-15 million. To date, the federal government has appropriated \$600,000 towards the Preconstruction and Engineering Design (PED) portion of the project, and has placed \$282,000 into the federal FY '94 budget, also for the PED phase. The 1993 Florida Legislature appropriated \$421,592 towards preconstruction portion of the project to assist us in our accelerated schedule.

When the Florida Legislature meets in February/March 1994 for its Regular Legislative Session, Martin County will be requesting the State to appropriate its cost share for the beach construction in the amount of \$6,703,640. The Florida Department of Natural Resource has placed our beach project as its No. 1 "top priority" project for beach construction funds for this amount. It is crucial that the federal construction funds are "in place," that is, in the federal budget for FY '95 in order for the State to appropriate its share. This is very important because in a state/federally funded project the State requires that the Federal match be available before the State will appropriate its funds.

Goss, ADM-IG-93-139L

June 28, 1993

Page 2

On June 8 the Martin County Board of Commissioners adopted an ordinance to levy Special Beachfront Assessments to assure the availability of the County's source of funding as the local sponsor. Martin County's cost share is estimated at \$2,800,000.

Funding Glitch

Due to the Army Corps of Engineers' (ACOE) 2-year budget cycle and their policy and procedure rules, the ACOE will not have our beach construction funds in its FY '95 budget in time for the State to appropriate its funds. According to the ACOE, a project is not ready to be put into its budget until the project has been "completed and ready to go." Due to the serious efforts that the state agencies and the ACOE have been making to complete the necessary steps for receipt of construction funds, the Martin County 4-Mile Beach Nourishment project will *technically* be "ready to go" in time for the State to appropriate its share. That is, all the required work would have been completed by the state and federal agencies, except, for the final review by the ACOE's Headquarters. There is attached for you a graph which lays out the timelines for funding of the project on the accelerated schedule and the events that must occur for the project to begin construction in November 1994.

"Add-On" Assistance

Because our project will be *technically* completed in time for the State to appropriate its share of the construction funds, we are requesting members of our Congressional Delegation to pursue getting the project construction funds "added-on" to the federal budget for FY '95. Congressman Tom Lewis has agreed to initiate the "add-on." This will have to be accomplished in January-February 1994 to meet the State's required match. The ACOE has assured us the Project Design Document will have been completed by January 1994 and will be available to our Congressmen at that time. It is the document needed to assist in accomplishing the "add-on" to the federal budget for FY '95.

We will need your strong support to accomplish the "add-on," and are asking you to provide us with your help and assistance on this matter. We realize there will be a great deal of competition for the appropriated discretionary funds, which is why we know this cannot be achieved without your commitment to this effort. Bonnie Dearborn is planning to meet with you at your District office a to familiarize you with the project in the near future. Please do not hesitate to contact us if you have any questions regarding this project at 407-221-1357

Yours truly,


Jeff Krauskopf
Chairman

ADM-IG-93-139L

cc: Congressman Tom Lewis, District 16
Richard Bonner, Army Corps of Engineers
Kirby Greene, The Florida Department of Natural Resources
Peter Cheney, Acting County Administrator

JOE CHARVAT
MARSHAL L. WILCOX
District 1

JEFF KRAUSKOPF
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District 5

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996

SUE B. WHITFIELD • County Administrator

COUNTY OF MARTIN

June 28, 1993



STATE OF FLORIDA

COM-93-CHR-034

The Honorable Bob Graham
United States Senate
Washington, D.C. 20510

Dear Senator Graham:

This correspondence is a request for your assistance in getting construction funds in the amount of \$6,167,757 for Martin County's 4-mile beach nourishment project "added-on" to the federal budget for FY '95, and to update you on the current and projected activities relating to our project.

Update Report

In December 1992 Bonnie Dearborn, our Intergovernmental Specialist, met with your staff in Washington to advise you of Martin County's interest to expedite the 4-Mile Beach Nourishment project on Hutchinson Island in Martin County after the Martin County Board of County Commissioners, representatives of state and federal agencies agreed there was a very serious need to expedite the construction of the project by one year, that is, to begin beach nourishment construction in November 1994 rather than 1995. The Board adopted a Resolution to that effect, a copy of which was provided to your office. Since that time County staff has been working closely with the appropriate state and federal agencies in order to complete the necessary tasks in time to meet the expedited schedule.

Federal, State and County Support

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When the Florida Legislature meets in February/March 1994 for its Regular Legislative Session, Martin County will be requesting the State to appropriate its cost share for the beach construction in the amount of \$6,703,640. The Florida Department of Natural Resource has placed our beach project as its No. 1 "top priority" project for beach construction funds for this amount. It is crucial that the federal construction funds are "in place," that is, in the federal budget for FY '95 in order for the State to appropriate its share. This is very important because in a state/federally funded project the State requires that the Federal match be available before the State will appropriate its funds.

On June 8 the Martin County Board of Commissioners adopted an ordinance to levy Special Beachfront Assessments to assure the availability of the County's source of funding as the local sponsor. Martin County's cost share is estimated at \$2,800,000.

Graham, ADM-IG-93-137L

June 28, 1993

Page 2

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We will need your strong support to accomplish the "add-on," and are asking you to provide us with your help and assistance on this matter. We realize there will be a great deal of competition for the appropriated discretionary funds, which is why we know this cannot be achieved without your commitment to this effort.

We will assist you in every way we can. Please do not hesitate to contact us if you have any questions regarding this project at 407-221-1357

Yours truly,


Jeff Krauskopf
Chairman

ADM-IG-93-137L

cc: Congressman Tom Lewis, District 16
Richard Bonner, Army Corps of Engineers
Kirby Greene, The Florida Department of Natural Resources
Peter Cheney, Acting County Administrator

VICE CHAIRMAN
MARSHAL L. WILCOX
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District 5

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34906



P-016 407 289 5422

COUNTY OF MARTIN

June 28, 1993

STATE OF FLORIDA

COM-93-CHR-034

The Honorable Connie Mack
United States Senate
Washington, D.C. 20510

Dear Senator Mack:

This correspondence is a request for your assistance in getting construction funds in the amount of \$6,167,757 for Martin County's 4-mile beach nourishment project "added-on" to the federal budget for FY '95, and to update you on the current and projected activities relating to our project.

Update Report

In December 1992 I met with your staff in Washington to advise you of Martin County's interest to expedite the 4-Mile Beach Nourishment project on Hutchinson Island in Martin County after the Martin County Board of County Commissioners, representatives of state and federal agencies agreed there was a very serious need to expedite the construction of the project by one year, that is, to begin beach nourishment construction in November 1994 rather than 1995. The Board adopted a Resolution to that effect, a copy of which was provided to your office. Since that time County staff has been working closely with the appropriate state and federal agencies in order to complete the necessary tasks in time to meet the expedited schedule.

Federal, State and County Support

The estimated total cost of the Martin County 4-Mile Beach Nourishment project is between \$ 13-15 million. To date, the federal government has appropriated \$600,000 towards the Preconstruction and Engineering Design (PED) portion of the project, and has placed \$282,000 into the federal FY '94 budget, also for the PED phase. The 1993 Florida Legislature appropriated \$421,592 towards preconstruction portion of the project to assist us in our accelerated schedule.

When the Florida Legislature meets in February/March 1994 for its Regular Legislative Session, Martin County will be requesting the State to appropriate its cost share for the beach construction in the amount of \$6,703,640. The Florida Department of Natural Resource has placed our beach project as its No. 1 "top priority" project for beach construction funds for this amount. It is crucial that the federal construction funds are "in place," that is, in the federal budget for FY '95 in order for the State to appropriate its share. This is very important because in a state/federally funded project the State requires that the Federal match be available before the State will appropriate its funds.

On June 8 the Martin County Board of Commissioners adopted an ordinance to levy Special Beachfront Assessments to assure the availability of the County's source of funding as the local sponsor. Martin County's cost share is estimated at \$2,800,000.

Mack, ADM-IG-93-131L

June 28, 1993

Page 2

Funding Glitch

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We will need your strong support to accomplish the "add-on," and are asking you to provide us with your help and assistance on this matter. We realize there will be a great deal of competition for the appropriated discretionary funds, which is why we know this cannot be achieved without your commitment to this effort.

We will assist you in every way we can. Please do not hesitate to contact us if you have any questions regarding this project at 407-221-1357

Yours truly,


Jeff Krauskopf
Chairman

ADM-IG-93-131L

cc: Congressman Tom Lewis, District 16
Richard Bonner, Army Corps of Engineers
Kirby Greene, The Florida Department of Natural Resources
Peter Cheney, Acting County Administrator

MARSHAL L. WILCOX
District 1

JEFF KRAUSKOPF
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CHARLENE HOAG
District 5

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996

SUE B. WHITTLE - County Administrator

PHONE 407 266 5422

COUNTY OF MARTIN

June 28, 1993



STATE OF FLORIDA

COM-93-CHR-034

The Honorable Alcee L. Hastings
United States House of Representatives
2701 West Oakland Park Boulevard, Suite 200
Ft. Lauderdale, Florida 33311-1363

Dear Congressman Hastings:

First, I want to take a moment to congratulate you on your successful campaign to become a Member of Congress, and specifically a Member of Martin County's Congressional Delegation. As a Delegation Member, I am writing you at this time to ask for your assistance in getting construction funds in the amount of \$6,167,757 for Martin County's 4-mile beach nourishment project "added-on" to the federal budget for FY '95, and to update you on the current and projected activities relating to our project.

Update Report

For the past several years Martin County has been seeking federal funding to construct a 4-Mile Beach Nourishment project on Hutchinson Island in Martin County. In December 1992 Bonnie Dearborn, our Intergovernmental Specialist, attempted to meet with you or your staff in Washington. It was, however, a time of transition when new Members were not yet settled and, therefore, she was unable to meet with either you or your staff at that time to advise you of Martin County's interest to expedite the 4-Mile Beach Nourishment project.

In November 1992 the Martin County Board of County Commissioners, representatives of state and federal agencies agreed there was a very serious need to expedite the construction of the project by one year, that is, to begin beach nourishment construction in November 1994 rather than 1995. The Board adopted a Resolution to that effect, a copy of the Resolution is attached. Since November, County staff has been working closely with the appropriate state and federal agencies in order to complete the necessary tasks in time to meet the expedited schedule.

Federal, State and County Support

The estimated total cost of the Martin County 4-Mile Beach Nourishment project is between \$ 13-15 million. To date, the federal government has appropriated \$600,000 towards the Preconstruction and Engineering Design (PED) portion of the project, and has placed \$282,000 into the federal FY '94 budget, also for the PED phase. The 1993 Florida Legislature appropriated \$421,592 towards preconstruction portion of the project to assist us in our accelerated schedule.

When the Florida Legislature meets in February/March 1994 for its Regular Legislative Session, Martin County will be requesting the State to appropriate its cost share for the beach construction in the amount of \$6,703,640. The Florida Department of Natural Resource has placed our beach project as its No. 1 "top priority" project for beach construction funds for this amount. It is crucial that the federal construction funds are "in place," that is, in the federal budget for FY '95 in order for the State to appropriate its share.

Hastings, ADM-IG-93-136L

June 28, 1993

Page 2

This is very important because in a state/federally funded project the State requires that the Federal match be available before the State will appropriate its funds.

On June 8 the Martin County Board of Commissioners adopted an ordinance to levy Special Beachfront Assessments to assure the availability of the County's source of funding as the local sponsor. Martin County's cost share is estimated at \$2,800,000.

Funding Glitch

Due to the Army Corps of Engineers' (ACOE) 2-year budget cycle and their policy and procedure rules, the ACOE will not have our beach construction funds in its FY '95 budget in time for the State to appropriate its funds. According to the ACOE, a project is not ready to be put into its budget until the project has been "completed and ready to go." Due to the serious efforts that the state agencies and the ACOE have been making to complete the necessary steps for receipt of construction funds, the Martin County 4-Mile Beach Nourishment project will *technically* be "ready to go" in time for the State to appropriate its share. That is, all the required work would have been completed by the state and federal agencies, except, for the final review by the ACOE's Headquarters. There is attached for you a graph which lays out the timelines for funding of the project on the accelerated schedule and the events that must occur for the project to begin construction in November 1994.

"Add-On" Assistance

Because our project will be *technically* completed in time for the State to appropriate its share of the construction funds, we are requesting members of our Congressional Delegation to pursue getting the project construction funds "added-on" to the federal budget for FY '95. Congressman Tom Lewis has agreed to initiate the "add-on." This will have to be accomplished in January-February 1994 to meet the State's required match. The ACOE has assured us the Project Design Document will have been completed by January 1994 and will be available to our Congressmen at that time. It is the document needed to assist in accomplishing the "add-on" to the federal budget for FY '95.

We will need your strong support to accomplish the "add-on," and are asking you to provide us with your help and assistance on this matter. We realize there will be a great deal of competition for the appropriated discretionary funds, which is why we know this cannot be achieved without your commitment to this effort. Bonnie Dearborn is scheduled to meet with you at your District office on July 23 to familiarize you with the project. Please do not hesitate to contact us if you have any questions regarding this project at 407-221-1357

Yours truly,


Jeff Krauskopf
Chairman

ADM-IG-93-136L

cc: Congressman Tom Lewis, District 16
Richard Bonner, Army Corps of Engineers
Kirby Greene, The Florida Department of Natural Resources
Peter Cheney, Acting County Administrator

VICE CHAIRMAN
MARSHAL L. WILCOX
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BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996

SUE B. WHITTLE • County Administrator

PHONE (407) 288-5422

COUNTY OF MARTIN

June 28, 1993



STATE OF FLORIDA

COM-93-CHR-034

The Honorable Carrie Meek
United States House of Representatives
404 Cannon House Office Building
Washington, D.C. 20515

Dear Congressman Meek:

First, I want to take a moment to congratulate you on your successful campaign to become a Member of the Florida Congressional Delegation. You served Florida well as a Member of the Florida House of Representatives, and know that you will serve us even better as a member of Congress. I especially want to congratulate you on your appointment to the House Appropriation Committee, a feat most freshmen attempt but few succeed.

This correspondence is a request for your assistance in getting construction funds in the amount of \$6,167,757 for Martin County's 4-mile beach nourishment project "added-on" to the federal budget for FY '95, and to update you on the current and projected activities relating to our project.

Update Report

For the past several years Martin County has been seeking federal funding to construct a 4-Mile Beach Nourishment project on Hutchinson Island in Martin County. In December 1992 Bonnie Dearborn, our Intergovernmental Specialist, met with some members of our Congressional Delegation in Washington to advise Members of Martin County's interest to expedite the 4-Mile Beach Nourishment project. It was, however, a time of transition when new Members were not yet settled and, therefore, she was unable to meet with either you or your staff at that time.

In November 1992 the Martin County Board of County Commissioners, representatives of state and federal agencies agreed there was a very serious need to expedite the construction of the project by one year, that is, to begin beach nourishment construction in November 1994 rather than 1995. The Board adopted a Resolution to that effect, a copy of the Resolution is attached. Since November, County staff has been working closely with the appropriate state and federal agencies in order to complete the necessary tasks in time to meet the expedited schedule.

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Meek, ADM-IG-93-138L

June 28, 1993

Page 2

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Yours truly,

Jeff Krauskopf
Chairman

ADM-IG-93-136L

cc: Congressman Tom Lewis, District 16 Kirby Greene, Florida Dept. of Natural Resources
Richard Bonner, Army Corps of Engineers Peter Cheney, Acting Co. Administrator

Meek, ADM-IG-93-138L
June 28, 1993
Page 2

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Jeff Krauskopf
Chairman

ADM-IG-93-136L

cc: Congressman Tom Lewis, District 16 Kirby Greene, Florida Dept. of Natural Resources
Richard Bonner, Army Corps of Engineers Peter Cheney, Acting Co. Administrator

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BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996

SUE B. WHITTLE • County Administrator

PHONE (407) 299-5422

COUNTY OF MARTIN

June 28, 1993



STATE OF FLORIDA

COM-93-CH-034

The Honorable Tom Lewis
The U.S. House of Representatives
Room 2351 Rayburn HOB
Washington D.C. 20515

Dear Congressman Lewis:

This correspondence is in follow-up to the meetings and conversations that have taken place with your office over the past several months regarding Martin County's 4-Mile Beach Nourishment Project. This project, as you know, is Martin County's top priority project. Your assistance in getting construction funds in the amount of \$6,167,757 for Martin County's 4-mile beach nourishment project "added-on" to the federal budget for FY '95 is very important to us in order to meet the accelerated schedule that has been verbally agreed upon by the Martin County Board of County Commissioners, the state and federal agencies involved in the project.

Update Report

In December 1992 Bonnie Dearborn, our Intergovernmental Specialist, met with you in Washington to advise you of Martin County's interest to expedite the 4-Mile Beach Nourishment project on Hutchinson Island in Martin County after the Martin County Board of County Commissioners, and representatives of the state and federal agencies agreed there was a very serious need to expedite the construction of the project by one year, that is, to begin beach nourishment construction in November 1994 rather than 1995. The Board adopted a Resolution to that effect, a copy of which was provided to your office. Since that time County staff has been working closely with the appropriate state and federal agencies in order to complete the necessary tasks in time to meet the expedited schedule.

Federal, State and County Support

The estimated total cost of the Martin County 4-Mile Beach Nourishment project is between \$ 13-15 million. To date, the federal government has appropriated \$600,000 towards the Preconstruction and Engineering Design (PED) portion of the project, and has placed \$282,000 into the federal FY '94 budget, also for the PED phase. The 1993 Florida Legislature appropriated \$421,592 towards preconstruction portion of the project to assist us in our accelerated schedule.

When the Florida Legislature meets in February/March 1994 for its Regular Legislative Session, Martin County will be requesting the State to appropriate its cost share for the beach construction in the amount of \$6,703,640. The Florida Department of Natural Resource has placed our beach project as its No. 1 "top priority" project for beach construction funds for this amount. It is crucial that the federal construction funds are "in place," that is, in the federal budget for FY '95 in order for the State to appropriate its share. This is very important because in a state/federally funded project the State requires that the Federal match be available before the State will appropriate its funds.

Lewis, ADM-IG-93-135L
June 28, 1993
Page 2

On June 8 the Martin County Board of Commissioners adopted an ordinance to levy Special Beachfront Assessments to assure the availability of the County's source of funding as the local sponsor. Martin County's cost share is estimated at \$2,800,000.

Funding Glitch

Due to the Army Corps of Engineers' (ACOE) 2-year budget cycle and their policy and procedure rules, the ACOE will not have our beach construction funds in its FY '95 budget in time for the State to appropriate its funds. According to the ACOE, a project is not ready to be put into its budget until the project has been "completed and ready to go." Due to the serious efforts that the state agencies and the ACOE have been making to complete the necessary steps for receipt of construction funds on the expedited schedule, the Martin County 4-Mile Beach Nourishment project will *technically* be "ready to go" in time for the State to appropriate its share. That is, all the required work would have been completed by the state and federal agencies, except, for the final review by the ACOE's Headquarters. I have attached for you a graph which lays out the timelines for funding of the project on the accelerated schedule and the events that must occur for the project to begin construction in November 1994.

"Add-On" Assistance

Our project will *technically* be completed in time for the State to appropriate its share of the construction funds, which is also the time the "add-on" will be required. We especially need your help to initiate the "add-on" which has already been discussed with you and/or your staff on several occasions. This will have to be accomplished in January-February 1994 to meet the State's required match. The ACOE has assured us the Project Design Document will have been completed by January 1994 and will be available to you at that time. It is the document needed to assist in accomplishing the "add-on" to the federal budget for FY '95. Our Congressional Members are being advised of your initiative and requested to give you as much assistance as possible to make the "add-on" become a reality.

Realizing there will be a great deal of competition for the appropriated discretionary funded projects, we will do everything we can to assist you with the "add-on". We know this can only be achieved with a strong commitment by everyone involved. Please do not hesitate to contact us if you have any questions regarding this project. I can be reached at 407-288-5421 or -221-1357

Yours truly,



Jeff Krauskopf
Chairman

ADM-IG-93-135L

cc: Richard Bonner, Army Corps of Engineers
Kirby Greene, Florida Department of Natural Resources
Peter Cheney, Acting County Administrator

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1																			
2																			
3																			
4	FEDERAL/STATE STATUS																		
5	ACTION NEEDED																		
6		1993								1994									
7		To Date	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov
8	F-Appropriated PED Funds-600K																		
9	S-Appropriated PED Funds-421K																		
10	MC-Authorized Local Fund Source																		
11	F-Seek FY '94 PED Funds-282K																		
12	F-Approv FY '94 PED Funds-282K																		
13	F-Appropriate FY '94 PED Funds-282K																		
14	F-ACOE to FOMB FY '95-Final PED Funds																		
15	S-DER to FOMB, FPWP FY '95 Const-6M																		
16	S-FDNR budget Const-6M+																		
17	S-Gov Budget S Const-6M+																		
18	F-ACOE Testify Cong FY '95 Final PED Funds																		
19	S-FDER/FPWP FY '95 to Cong Const-6M																		
20	F-ACOE Complete Design Doc Const-6M																		
21	F-Cong Delg Seek "Add-On" Const-6M																		
22	1994 FL Legislative Session																		
23	F-Cong PreApprov "Add-On" Const-6M																		
24	F-Cong Approve FY '95 Final PED Funds																		
25	F-Cong Approve "Add-On" Const-6M																		
26	F-Appropriate FY '95 Final PED Funds																		
27	F-Appropriate Const-\$6,167,757																		
28	S-Appropriate Const-\$6,703,640																		
29	MC-Appropriate Const-\$2,800,000																		
30	Construction Begin																		
31																			
32	ACOE - Army Corps of Engineers	F-Federal																	
33	"Add On"-appropriation added to federal budget	FPWP-Florida Public Works Program																	
34	Const-Construction	FY '94 PED-282K																	
35	FDER-Department of Environmental Protection	FY '96 PED-263K																	
36	FDNR-Department of Natural Resources	MC-Martin County																	

FOMB- Federal Office of Management and Budget

PED- Preconstruction Engineering and Design Funds

S-State

FM- (\$6,167,757) Federal share Const Funds

SM- (\$6,703,640) State Share Const Funds

For readability

Funds Appropriated

Actual Construction

BEFORE THE BOARD OF COUNTY COMMISSIONERS
MARTIN COUNTY, FLORIDA

RESOLUTION NO. 92-11.11c

HUTCHINSON ISLAND BEACH NOURISHMENT PROJECT

WHEREAS, the shoreline of Hutchinson Island, Martin County Florida has experienced acute beach erosion from the St. Lucie County line and extending south for four miles into Martin County over the last several years due to severe weather conditions, and placing many properties of beach front property owners in serious jeopardy, and

WHEREAS, a stabilized dune system along the shoreline would provide the badly needed protection for the beach front property owners that would be established by the nourishment of the beach from the St. Lucie County line four miles south into Martin County, and

WHEREAS, the residents of Martin County and the Board of County Commissioners are in unanimous agreement to expedite the project as early as possible in order to prevent further shoreline erosion of the beach front properties, and

WHEREAS, the Martin County Board of County Commissioners and the residents of Martin County have pledged support for the beach nourishment project by agreeing to provide the necessary local share through ad valorem taxes and special assessments, and

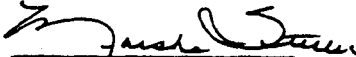
WHEREAS, continued erosion will only increase the costs of the project for the taxpayers, local, state and federal governments as well as cause increased anguish and despair to the shoreline property owners,

NOW, THEREFORE, BE IT RESOLVED that the Martin County Board of County Commissioners urgently requests the Army Corps of Engineers do everything they can to expedite the project by completing the PED portion of the project in time to accommodate a new construction start in FY 1995, and by working closely with the Florida Congressional Delegation, other Congressional Members, as well as all the state and federal agencies necessary to get the Hutchinson Island 4-mile beach nourishment project ready for construction in FY 1995.

DULY PASSED AND ADOPTED this 3rd day of November, 1992.

ATTEST;

BOARD OF COUNTY COMMISSIONERS
MARTIN COUNTY, FLORIDA

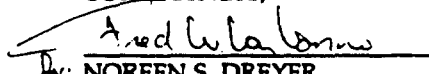


MARSHA STILLER, CLERK



MARY DAWSON, CHAIRMAN

APPROVED AS TO FORM AND
CORRECTNESS;


for NOREEN S. DREYER
COUNTY ATTORNEY

BEFORE THE BOARD OF COUNTY COMMISSIONERS
MARTIN COUNTY, FLORIDA

RESOLUTION NO. 92-11.11a

HUTCHINSON ISLAND BEACH NOURISHMENT PROJECT

WHEREAS, the shoreline of Hutchinson Island, Martin County Florida has experienced acute beach erosion from the St. Lucie County line and extending south for four miles into Martin County over the last several years due to severe weather conditions, and placing many properties of beach front property owners in serious jeopardy, and

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WHEREAS, the residents of Martin County and the Board of County Commissioners are in unanimous agreement to expedite the project as early as possible in order to prevent further shoreline erosion of the beach front properties, and

WHEREAS, the Martin County Board of County Commissioners and the residents of Martin County have pledged support for the beach nourishment project by agreeing to provide the necessary local share through ad valorem taxes and special assessments, and

WHEREAS, continued erosion will only increase the costs of the project for the taxpayers, local, state and federal governments as well as cause increased anguish and despair to the shoreline property owners,


NOW, THEREFORE, BE IT RESOLVED that the Martin County Board of County Commissioners urgently requests Members of the Martin County Congressional Delegation to assist Martin County in expediting the 4-mile beach nourishment project for construction in FY 1995 by directing the Army Corp of Engineers to complete the Preliminary Engineering and Design (PED) in time to accommodate the new construction start time frame, and to continually work closely with all the other state and federal agencies and congressional committees necessary to get the 4-mile beach nourishment project ready for construction in FY 1995.

DULY PASSED AND ADOPTED this 3rd day of November, 1992.

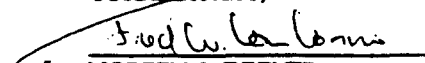
ATTEST;

BOARD OF COUNTY COMMISSIONERS
MARTIN COUNTY, FLORIDA


MARSHA STILLER, CLERK


MARY DAWSON, CHAIRMAN

APPROVED AS TO FORM AND
CORRECTNESS;


NOREEN S. DREYER
COUNTY ATTORNEY

FYI...

Rhr



FLORIDA DEPARTMENT OF STATE

Jim Smith
Secretary of State

DIVISION OF HISTORICAL RESOURCES

R.A. Gray Building

500 South Bronough

Tallahassee, Florida 32399-0250

Director's Office

(904) 488-1480

Telecopier Number (FAX)

(904) 488-3353

In Reply Refer To:
Susan Hammersten
Compliance Review
Section, DHR
(904) 487-2333

PPN: 931280

May 7, 1993

Mr. A.J. Salem, Chief
Planning Division
Environmental Resources Branch
USACOE, Jacksonville District
P.O. Box 4970
Jacksonville, Florida 32232-0019Re: Draft: A Cultural Resource Magnetometer Survey for a
Proposed Borrow Area, Martin County, Florida
Wes Hall, April, 1993

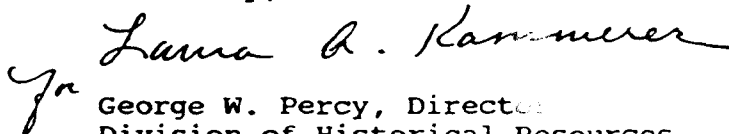
Dear Mr. Salem:

In accordance with the procedures contained in 36 C.F.R., Part 800 ("Protection of Historic Properties"), we have reviewed the referenced report, and find it to be complete and sufficient. We note that no magnetic anomalies indicative of historic resources were located during the survey.

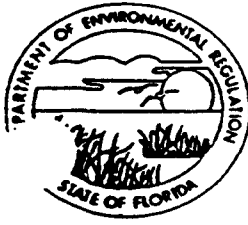
Therefore, on the basis of the negative findings, it is the opinion of this agency that the proposed offshore borrow areas for the Hutchinson Island Beach Renourishment project are unlikely to affect any properties listed, or eligible for listing, in the National Register. The project may proceed without further involvement with this agency.

If you have any questions concerning our comments, please do not hesitate to contact us. Your interest in protecting Florida's historic properties is appreciated.

Sincerely,

George W. Percy, Director
Division of Historical Resources
and
State Historic Preservation Officer

GWP/tsh



Florida Department of Environmental Regulation

Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400

Lawton Chiles, Governor

Virginia B. Weibull, Secretary

March 10, 1993

Mr. A. J. Salem, Chief
Planning Division
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

Dear Mr. Salem:

Martin County Shore Protection Project

In response to your letter of February 3, 1993, we would like the Corps to reconsider its position on the need for side-scan sonar for the nearshore area of the Martin County Shore Protection Project. We are encouraged that side-scan sonar will be used at the borrow area. However, this technology should also be applied to the beach restoration area. Our prior experience with the use of aerial photography to delineate hardbottom has been less than encouraging.

For projects on both the east and west coasts, our field biologists have identified significant and well colonized hardbottom features during site inspections which were not visible in aerial photographs. This has resulted in delays in the permitting process. For a project the size of that proposed in Martin County, such delays could be lengthy. We have not had this problem when hardbottom features have been mapped from side-scan sonar. In addition, we believe that side-scan sonar creates a product from which the acreage of individual hardbottom features can be more accurately measured than from aerial photographs. Finally, since side-scan sonar will be used to map hardbottom features at the borrow area, it would seem to incur minimal expense to conduct a survey of the beach area with equipment and a field crew which is already mobilized.

Mr. A. J. Salem, Chief
March 9, 1993
Page 2

I would appreciate your serious consideration of our request and thank you for notifying us of your intentions. If you would like to discuss this issue further, please contact Marlene Stern at 904/488-0130.

Sincerely,



Janet G. Llewellyn, Chief
Bureau of Wetland Resource
Management

cc: Robert J. Brock, Corps of Engineers
Bonnie Dearborn, Martin County
Don Holloman, Martin County

Mid-Atlantic Technology

P. O. Box 4067
Wilmington, North Carolina 28406-1067
919 762-6215

2 March 1993

Janice Adams
Archaeologist
Planning Division/CESAJ-PD-ER
Jacksonville District Office
U. S. Army Corps of Engineers
P. O. Box 4970
Jacksonville, Florida 32232-0019

Re: Management Summary -- A Cultural Resources Magnetometer
Survey for a Proposed Borrow Area Martin County, Florida.
Contract # DACW17-93-M-0621.

Dear Ms Adams:

The field investigations portion of the above referenced project were completed on 27 February. Historical background investigations are 90% complete. Preliminary historical findings indicate that there are no recorded shipwrecks in the immediate project area.

A Geometrics 866 proton precession magnetometer was used to collect data for the field investigations. Twenty four survey lines were conducted over the 8,700-by-3500-foot portion of the survey area. Seven survey lines were conducted over the 4500-by-1000-foot portion of the proposed borrow area. Parallel survey lines were run north/south and were spaced 45 meters apart. Magnetic data was collected every two seconds or approximately every 7 meters along the survey lines. Positioning and track line maintenance were carried out with the aid of a Motorola Mini-Ranger III microwave positioning system interfaced with an onboard computer navigation system. The onboard navigation system, consisted of a 386 computer equipped with a math co-processor and data interface board. Kent Navigation System software was used to constantly record

vessel position, maintain survey lines, and log incoming magnetometer data. The Kent Navigation Program updates and logs the vessel's position every second and logs magnetometer data every two seconds.

Field analysis of magnetic data indicates that there are no magnetic anomalies in the project area. Based on this preliminary analysis, no mitigative actions or further investigations will be recommended in the draft report.

Sincerely yours,

A handwritten signature in dark ink, appearing to read 'Wes Hall', is written over the typed name.

Wes Hall
Mid-Atlantic Technology

JLTM

February 23, 1993

Programs and Project Management Division
Project Management Branch

- Mr. Don Holloman, County Engineer
County Administrative Center
2401 S.E. Monterey Road
Stuart, Florida 34996

Dear Mr. Holloman:

This is a follow-up to your January 28, 1993, letter in which you had indicated that Applied Technology and Management, Inc. (ATM), would be obtaining the necessary construction permits. The enclosed items are provided to assist you and ATM in obtaining the necessary permits for construction of the Martin County Shore Protection Project. The descriptions of these items are as follows:

a. Aerial photographs of the project area are provided on mylar; a total of 21 mylar sheets. These aerial photographs were taken May 10, 1992. The scale is 1 inch = 100 feet.

b. Overlays for the aerial photographs are provided in ASCII format on diskette; a total of five 3-1/2 inch diskettes. These overlays provide a coordinate grid at 1 inch = 100 feet that is to be superimposed onto the mylars. The overlays were converted to an ASCII format so that they could be used on the CADD system. The Jacksonville District is equipped with Intergraph.

The District is aware of the Martin County Board of County Commissioners' desire to expedite construction of the shore protection project from a Fiscal Year (FY) 1996 to a FY 95 (November 1994) construction start. In order to meet the accelerated schedule, close coordination between Martin County, ATM, and the Jacksonville District will be needed in obtaining the construction permits. This close coordination is necessary to insure that material submitted in obtaining the permits is consistent with the information in the District's General Design

-2-

Memorandum (GDM). This coordination will also assist the District in addressing all of Martin County's needs in the GDM.

Should you have any questions, please contact the project manager, Mr. Rick McMillen, at 904-232-1231.

Sincerely,

SIGNED: Richard E. Bonner

Richard E. Bonner, P.E.
Deputy District Engineer
for Project Management

Enclosures

Copies Furnished: (w/o encls)

Ms. Bonnie Dearborn, County Administrative Center, 2401 S.E.
Monterey Road, Stuart, Florida, 34996

Ms. Karen Erickson, P.E., Applied Technology and Management
Inc., 502 N.W. 75 Street, Suite 95, Gainesville, Florida 32607

bcf: (w/o encls)
CESAJ-PD
CESAJ-EN

am 2/23/93

RMcMillen/CESAJ-DP-I

ts/3208 2/17

DDuke/CESAJ-DP-A

RBonner/CESAJ-DP



LAWTON CHILES
GOVERNOR

STATE OF FLORIDA

Office of the Governor

THE CAPITOL

TALLAHASSEE, FLORIDA 32399-0001

February 2, 1993

Mr. A. J. Salem
Chief, Planning Division
Department of the Army
Jacksonville District Corps
of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

RE: Preparation of a General Design Memorandum (GDM) for
Construction of a 4-Mile Section of Hutchinson Island -
Martin County Shore Protection Project - Martin County,
Florida

SAI: FL9212111882C

Dear Mr. Salem:

The Florida State Clearinghouse, pursuant to Presidential Executive Order 12372, Gubernatorial Executive Order 83-150, the Coastal Zone Management Act Reauthorization Amendments of 1990 and the National Environmental Policy Act, has coordinated a review of the above referenced project.

Pursuant to Presidential Executive Order 12372, the project will be in accord with State plans, programs, procedures and objectives when consideration is given to and action taken on the enclosed comments and requirements of our reviewing agencies.

The Department of Environmental Regulation (DER) requests that the following issues and concerns be fully addressed in the Environmental Assessment (EA): the EA should be based upon recent data; address the effects of an increase in the rate of erosion due to rising sea levels; address where the deposition of eroded beach fill is expected to occur and discuss the effects on benthic communities; provide a discussion on the environmental control measures that will be used to alleviate increased turbidity levels during the dredging process; and fully examine a comparative analysis of grain sizes from proposed borrow sites in order to select the site expected to generate the least amount of turbidity during the dredging process. The DER indicates that

Mr. A. J. Salem
Page Two

the EA should include a federal consistency determination as required by the Coastal one Management Act and 15 CFR 930, Subpart C, and be submitted to the State for review. Please refer to the enclosed DER comments.

Please refer to the enclosed comments provided by the Department of State indicating that, prior to initiating any project related bottom disturbing activities within the borrow areas, they should be subjected to a professional magnetometer survey to locate and assess potential historic shipwreck sites. The DOS requests review of the resultant survey report in order to complete the process of reviewing the impact of this proposed project on historic resources.

The Department of Natural Resources (DNR) provides a list of information required for a successful project review including: side scan sonar survey of borrow, fill, and areas adjacent to the project site, south to Bathtub Reef; results of the geotechnical surveys as early as possible; analysis of the dispersion of silts from the fill material, in both onshore-offshore and longshore directions, with particular concern for long term effects on the worm rock reefs of Bathtub Reef; complete characterization of the nearshore habitat within the project area, including benthic and fisheries communities; and complete characterization of the coastal strand vegetation potentially affected by the construction of the design berm crest and its tie back to existing grade. The DNR maintains an interest in recreational resources in the project area, and any measures that may be taken to lessen project impacts. The DNR also expresses interest in proposals to mitigate unavoidable impacts to hardbottom, fisheries and other coastal resources of the project area. Please refer to the enclosed DNR comments.

The Department of Transportation (DOT) indicates that there are three DOT projects in the Adopted and Tentative Work Programs which may be affected by the proposed project. The DOT recommends early coordination with District 4 DOT staff to determine potential conflicts between the activities of the Department and the Corps, or interruption of normal traffic on State Road 1A, and to coordinate activities, maintenance of traffic, and determine any remedial actions necessary. Please refer to the enclosed DOT comments.

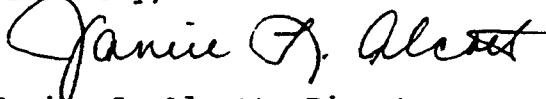
The federal agency did not provide a federal consistency determination for this project in accordance with 15 CFR 930, subpart C. However, the State has completed a review of the project information available at this time. Based on this information, the project at this stage is consistent with the Florida Coastal Management Program. Although the State does not

Mr. A. J. Salem
Page Three

object to the proposed work, we have identified several issues which must be resolved as the project progresses through later stages of planning, design and funding. As required by 15 CFR 930.34 and .37, at each major point of decision-making the federal agency is required to submit a consistency determination for the State's review. The format and content of the determination are described in 15 CFR 930.34 - .39. The State's continued agreement with this project will be based, in part, on adequate reconciliation of previously identified concerns.

This letter reflects your compliance with Presidential Executive Order 12372.

Sincerely,



Janice L. Alcott, Director
State Clearinghouse

JLA/bl

Enclosure(s)

cc: Department of Environmental Regulation
Department of State
Department of Natural Resources
Department of Transportation

VICE CHAIRMAN
MARSHALL L. WILCOX
District 1

CHAIRMAN
JEFF KRAUSKOPF
District 2

JANET K. GETTIG
District 3

MAGGY MURCHALLA
District 4

CHARLENE HOAG
District 5

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996

SUE B. WHITTLE • County Administrator

PHONE (407) 288-5422

COUNTY OF MARTIN

STATE OF FLORIDA

January 28, 1993
ADM-IG-93-71L



Richard E. Bonner, P.E.
Deputy District Engineer for
United States Army Corp of Engineers
Department of the Army
P.O. Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Bonner:

We have contracted with Applied Technology and Management, Inc. to coordinate closely with the USACE and the appropriate State agencies in preparing the necessary permitting for construction of the Martin County Shore Protection Project.

As you know this project is a top priority of the Martin County Board of County Commissioners and having Applied Technology coordinate the permitting, we believe will help the USACE and Martin County in meeting the accelerated schedule of a November 1994 construction time frame.

Yours truly,

Don Holloman
County Engineer

DH:BBD

cc: Martin County Board of County Commissioners
Sue Whittle, County Administrator
Karen Erickson, Applied Technology and Management, Inc.

VICE CHAIRMAN
MARSHAL L. WILCOX
District 1

CHAIRMAN
JEFF KRAUSKOPF
District 2

JANET K. GETTIG
District 3

MAGGY MURCHALLA
District 4

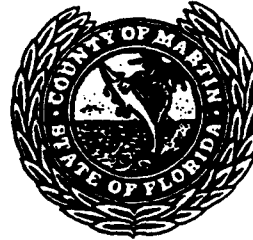
CHARLENE HOAG
District 5

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996

SUE B. WHITTLE • County Administrator

Phone: 408-266-5422

COUNTY OF MARTIN



STATE OF FLORIDA

January 28, 1993
ADM-IG-93-66L
COM-93CHR-014

Colonel Terrance C. Salt, District Engineer
United States Army Corp of Engineers
Department of the Army
P.O. Box 4970
Jacksonville, Florida 32232-0019

Dear Colonel Salt:

The Martin County Shore Protection Project is a top priority of the Martin County Board of County Commissioners. Completion of the project is crucial to the public safety of the citizens of Hutchinson Island. We have requested the project to be expedited by a year, that is, construction start for November 1994 rather than 1995.

To assist in funding the accelerated schedule, Martin County is requesting the 1993 Florida Legislature to appropriate \$470,259 for the planning, engineering, and design (PED) portion of the project. Martin County requests the USACE to accept the advanced funds (\$470,259) from Martin County as its local share in order for the USACE to complete the PED phase for this project and to meet the expedited schedule.

The total project benefits are joint benefits of storm damage prevention, economic, and recreational benefits. Based on the severity of the erosion and the potential dangers to property owners, it is clear that the storm damage prevention benefits far outweigh the recreation benefits of the total project benefits. A recent profile by the USACE resulted in a recommendation that an additional 300,000 cubic yards is needed to renourish the beach due to the average 62,000 cubic yard erosion loss that has taken place in the last three years. The recommendation clearly demonstrates the need to accelerate the program. In addition, the project also has a benefit to cost ratio of 1.9.

We realize acceptance of advanced funds must first be coordinated by the HGUSACE with the ASA (CW) and approved by the Appropriations Committees of the Congress. We are working closely with our Congressional Delegation on this project, who fully support the need to expedite the Hutchinson Island beach nourishment project. Attached is a copy of Resolution No. 92-11.11c unanimously passed by the Martin County Board of Commissioners urgently requesting the USACE to expedite the project to a November 1994 construction timeline. We appreciate your continued interest in the project.

Yours truly,

Jeff Krauskopf
Chairman

cc: Members of our Congressional Delegation
Martin County Legislative Delegation

Sue Whittle, County Administrator
Kay Curiel, President, FS&BPA

BEFORE THE BOARD OF COUNTY COMMISSIONERS
MARTIN COUNTY, FLORIDA

RESOLUTION NO. 92-11.11c

HUTCHINSON ISLAND BEACH NOURISHMENT PROJECT

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WHEREAS, the Martin County Board of County Commissioners and the residents of Martin County have pledged support for the beach nourishment project by agreeing to provide the necessary local share through ad valorem taxes and special assessments, and

WHEREAS, continued erosion will only increase the costs of the project for the taxpayers, local, state and federal governments as well as cause increased anguish and despair to the shoreline property owners,


NOW, THEREFORE, BE IT RESOLVED that the Martin County Board of County Commissioners urgently requests the Army Corps of Engineers do everything they can to expedite the project by completing the PED portion of the project in time to accommodate a new construction start in FY 1995, and by working closely with the Florida Congressional Delegation, other Congressional Members, as well as all the state and federal agencies necessary to get the Hutchinson Island 4-mile beach nourishment project ready for construction in FY 1995.

DULY PASSED AND ADOPTED this 3rd day of November, 1992.

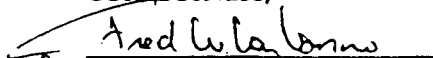
ATTEST;

BOARD OF COUNTY COMMISSIONERS
MARTIN COUNTY, FLORIDA


MARSHA STILLER, CLERK


MARY DAWSON, CHAIRMAN

APPROVED AS TO FORM AND
CORRECTNESS;


NOREEN S. DREYER
COUNTY ATTORNEY



FLORIDA DEPARTMENT OF NATURAL RESOURCES

Karjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399

January 11, 1993

Lawton Chiles
Governor
Jim Smith
Secretary of State
Bob Butterworth
Attorney General
Gerald Lewis
State Comptroller
Tom Gallagher
State Treasurer
Bob Crawford
Commissioner of Agriculture
Betty Castor
Commissioner of Education

RECEIVED

JAN 15 1993

Ms. Janice Alcott
State Clearinghouse
Office of Planning and Budget
Executive Office of the Governor
The Capitol
Tallahassee, Florida 32399-0001

STATE CLEARINGHOUSE

RE: Martin County 4-Mile Shore Protection Project, Environmental Assessment Scoping Request

SAI: FL9212111882C

Dear Ms. Alcott:

The Department of Natural Resources has completed its review of the above referenced document, and submits comments as requested. As the request is for the scoping of issues to be addressed in the preparation of an environmental study and General Design Memorandum for the above beach nourishment project, the document has not been reviewed for federal consistency under the provisions of the Florida Coastal Management Program.

On January 11, 1992, staff of this agency representing the Executive Office and the Divisions of Beach and Shores, Marine Resources, and State Lands, met with DER, the Corps and Martin County to discuss information required for a successful project review. Required information includes, but is not limited to:

1. Side scan sonar survey of borrow, fill, and areas adjacent to the project site, south to Bathtub Reef.
2. Results of the geotechnical surveys as early as possible.
3. An analysis of the dispersion of silts from the fill material, in both onshore-offshore and longshore directions, with particular concern for long term effects on the worm rock reefs of Bathtub Reef.
4. A complete characterization of the nearshore habitat within the project area, including benthic and fisheries communities.
5. A complete characterization of the coastal strand vegetation potentially affected by the construction of the design berm crest and its tie back to existing grade.

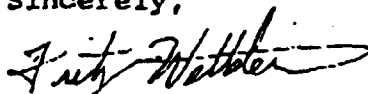
Letter to Alcott
SAI FL9212111882C
January 11, 1993
Page 2

The Department's submerged lands and coastal construction project review processes will detail additional information requirements through the application processes.

In addition to the physical and biological information listed above, to complete project review, the Department also maintains an interest in recreational resources in the project area, and any measures that may be taken to lessen project impacts. Among these general concerns are a desire to remove from the beach structures that do not now or when filled will not serve a valid public purpose. The Department is also interested in proposals on how the applicant intends to mitigate unavoidable impacts to hardbottom, fisheries and other coastal resources of the project area.

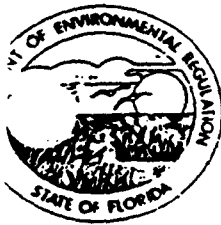
For questions or information regarding the Department's review of the scoping request for Martin County 4-Mile Shore Protection Project please contact me at 904/488-1555. Thank you for consideration of these comments and questions.

Sincerely,



John F. Wettstein
Senior Management Analyst

cc: Mike Ashe, BSLAP MS125
Ed Conklin, DMR MS200
Karyn Erickson, Applied Technology and Mgt.
Rick McMillan, CESAJ-PD
Neal Rogers, BCER MS310
Marlene Stern, DER-BWRM
Frank Votra, OES MS150



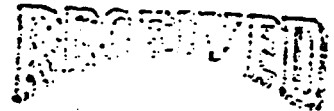
Florida Department of Environmental Regulation

Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400

Lawton Chiles, Governor

Carol M. Browner, Secretary

8 January 1993



JAN 12 1993

STATE CLEARINGHOUSE

Janice L. Alcott
Director, State Clearinghouse
Office of Planning and Budgeting
Budget Management and Planning Policy Unit
Executive Office of the Governor
The Capitol
Tallahassee, Florida 32399-0001

RE: COE, Preparation of the General Design Memorandum (GDM)
and Environmental Assessment (EA) for the Hutchinson
Island Shore Protection Project, Martin County
SAI: FL9212111882C

Dear Ms. Alcott,

The U.S. Army Corps of Engineers (COE) is gathering information concerning beach renourishment along 4 miles of Hutchinson Island in Martin county. The information collected will be used in the preparation of an Environmental Assessment (EA) for the project.

We request that the following issues and concerns be fully addressed in the EA:

1. The EA should be based upon recent data. Information from the 1985 and 1986 Feasibility Report/Environmental Impact Statement for the Martin County Beach Erosion Control Study may be out-of-date due to the dynamic nature of beach and coastal systems.
2. The EA should address the effects of an increase in the rate of erosion due to rising sea levels. If a constant erosion rate which does not account for sea level rise is used in extrapolating the expected loss of beach fill, the resulting derived value may underestimate the amount of fill needed for periodic renourishment. Moreover, a conservative estimate will also bias the benefit/cost ratio.

COE/Hutchinson Island Beach Restoration

8 January 1993

Page Two

3. The renourished beach will continue to be eroded over time, necessitating continued beach filling efforts. The EA should fully address where the deposition of eroded beach fill is expected to occur and discuss the effects on benthic communities. Bathtub Beach Reef, a unique ecological resource just south of the project area, should be specifically addressed in regard to detrimental effects that may occur from increased sedimentation in the water column and from drifting sand. Bottom communities in and adjacent to borrow sites should be included in the discussion on impacts to resources.
4. In regard to water quality, the EA should provide a discussion on the environmental control measures that will be used to alleviate increased turbidity levels during the dredging process. Moreover, a monitoring plan for the entire process should be included that is designed to check any violation of water quality standards according to Chapter 17-3, Florida Statutes.
5. A comparative analysis of grain sizes from proposed borrow sites should be fully examined in order to select the site expected to generate the least amount of turbidity during the dredging process.

Finally, the EA should include a federal consistency determination as required by the Coastal Zone Management Act and 15 CFR 930, Subpart C, and be submitted to the State for review. A reevaluation of the consistency of the project will be conducted during subsequent environmental documentation, design and permitting stages.

If you should have any questions regarding our comments, please call me at 488-0784.

Sincerely,



Susan Goggin
Environmental Specialist
Office of Intergovernmental Programs

SEG/s

cc: Marlene Stern, DER/Wetlands Resource Regulation
John Meyer, DER Southeast District

FLORIDALAWTON CHILES
GOVERNOR**DEPARTMENT OF TRANSPORTATION**B. G. WATTS
SECRETARY**PALM BEACH URBAN OFFICE**3111 SOUTH DOXE HIGHWAY, SUITE 112, WEST PALM BEACH, FLORIDA 33405
(407) 837-5290OFFICE OF
PLANNING

December 29, 1992

Ms. Janice Alcott
State Clearinghouse
Executive Office of the Governor
OPB-IGA
Room 411, Carlton Building
Tallahassee, Florida 32399-0001

RECEIVED
JAN 4 1993

STATE CLEARINGHOUSE

Dear Ms. Alcott:

SUBJECT: Intergovernmental Coordination
SAI No. FL 9212111882C
Martin County Shore Protection

There are three (3) Florida Department of Transportation projects in the Adopted and Tentative Work Programs which may be affected by the proposed project. The listed projects are bridge rehabilitation projects (WPI No. 4116236 and 4116235) at the span over the ICWW and the Evans Crary Bridge scheduled for FY 1993/94 in the Tentative Work Program; and, replacement of the Evans Crary Bascule Bridge with a fixed span (WPI No. 4116291) scheduled for design in FY 1993/94 and R/W Acquisition in FY 1996/97 in the Tentative Work Program.

The Corps of Engineers has provided no description of the proposed beach nourishment operations or the dates of construction, so potential conflict cannot be determined at this time.

It is recommended that at the earliest time, at least prior to programming construction of the improvements, the Corps of Engineers meet with District 4, FDOT staff (Bill Keating, Consultant Management) to determine potential conflict between the activities of the Department and the Corps, or interruption of normal traffic on SR A1A, and to coordinate activities, maintenance of traffic, and determine any remedial actions necessary.

Please contact Bill Keating of Consultant Management at FDOT, District 4 (305-524-8621), if there are any questions.

Ms. Janice Alcott
December 29, 1992
Page two

The proposed project will not negatively impact the coastal barrier island.

Sincerely,



John W. Anderson, AICP
Administrator, Palm Beach
Urban Office

JWA:mg

cc: Bill Keating
Gus Schmidt
Jamie Cochran
Clara Scott
Franklin Tse



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019
December 28, 1992

Programs and Project Management Division
Project Management Branch

Honorable Connie Mack
United States Senator
1342 Colonial Boulevard, Suite 27
Fort Myers, Florida 33907

Dear Senator Mack:

This is in response to your December 16, 1992, letter regarding the beach erosion problem on Hutchinson Island, as expressed in Ms. Roslyn Langley's letter. We are well aware of the erosion problem that the Martin County beaches on Hutchinson Island are currently experiencing. We also understand Ms. Langley's concern in expediting construction of the Martin County Shore Protection Project.

As you know, a shore protection project was authorized for the northern 4 miles of Hutchinson Island in Martin County by the Water Resources Development Act of 1990. Preconstruction, engineering and design (PED) is underway; and a General Design Memorandum (GDM) is 1 year away from completion. Once the GDM is completed, it will go through a review and approval process that typically takes 6 months. We expect to have the GDM approved June 1994. Plans and specifications, which are needed in order to award a construction contract, are scheduled for completion in fiscal year 1995. Under current policy, the GDM for the Martin County project has to be approved by June 1994 in order to be considered for fiscal year 1996 construction start. In order to be eligible for consideration as a fiscal year 1995 construction start, the GDM would have to be approved by June 1993. Unfortunately, the amount of time needed for GDM preparation, coordination, and review prevent us from meeting the June 1993 date.


We are aware of Martin County's efforts to expedite construction of this project. They have met with Congressman Lewis' staff regarding expediting construction of the project. Congressman Lewis has expressed a willingness to assist expediting construction of this project in any way possible.

-2-

We are currently maintaining close coordination with Martin County and are proceeding towards construction of the project as expediently as we can within our scheduling and funding limitations.

I hope this information is sufficient for your needs. If any additional information or assistance is needed, please call me or Mr. Richard Bonner, Deputy District Engineer for Project Management, at 904-232-2586.

Sincerely,


Terrence C. Salt
Colonel, U.S. Army
District Engineer

Copies Furnished:

Commander, U.S. Army Corps of Engineers (CECW-L)
Commander, South Atlantic Division (CESAD-PM)
Ms. Roslyn Langley, 1357 NE Ocean Boulevard, Apt 308,
Stuart, Florida 34996



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019
December 28, 1992

Programs and Project Management Division
Project Management Branch

Honorable Connie Mack
United States Senator
1342 Colonial Boulevard, Suite 27
Fort Myers, Florida 33907

Dear Senator Mack:

This is in response to your December 8, 1992, letter regarding the beach erosion problem on Hutchinson Island, as expressed in Ms. Caroline S. Haas' letter. We are well aware of the erosion problem that the Martin County beaches on Hutchinson Island are currently experiencing. We also understand Ms. Haas' concern in expediting construction of the Martin County Shore Protection Project.

As you know, a shore protection project was authorized for the northern 4 miles of Hutchinson Island in Martin County by the Water Resources Development Act of 1990. Preconstruction, engineering and design (PED) is underway; and a General Design Memorandum (GDM) is 1 year away from completion. Once the GDM is completed, it will go through a review and approval process that typically takes 6 months. We expect to have the GDM approved June 1994. Plans and specifications, which are needed in order to award a construction contract, are scheduled for completion in fiscal year 1995. Under current policy, the GDM for the Martin County project has to be approved by June 1994 in order to be considered for fiscal year 1996 construction start. In order to be eligible for consideration as a fiscal year 1995 construction start, the GDM would have to be approved by June 1993. Unfortunately, the amount of time needed for GDM preparation, coordination, and review prevent us from meeting the June 1993 date.

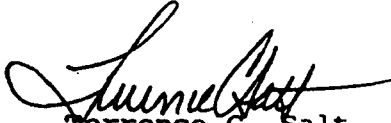
We are aware of Martin County's efforts to expedite construction of this project. They have met with Congressman Lewis' staff regarding expediting construction of the project. Congressman Lewis has expressed a willingness to assist expediting construction of this project in any way possible. We

-2-

are currently maintaining close coordination with Martin County and are proceeding towards construction of the project as expediently as we can within our scheduling and funding limitations.

I hope this information is sufficient for your needs. If any additional information or assistance is needed, please call me or Mr. Richard Bonner, Deputy District Engineer for Project Management, at 904-232-2586.

Sincerely,



Terrence C. Salt
Colonel, U.S. Army
District Engineer

Copies Furnished:

Commander, U.S. Army Corps of Engineers (CECW-L)
Commander, South Atlantic Division (CESAD-PM)
Ms. Caroline S. Haas, 1357 NE Ocean Boulevard, Suntide Apt 211,
Stuart, Florida 34996

487

480



**DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019
December 28, 1992**

REPLY TO
ATTENTION OF

**Programs and Project Management Division
Project Management Branch**

**Honorable Connie Mack
United States Senator
1342 Colonial Boulevard, Suite 27
Fort Myers, Florida 33907**

Dear Senator Mack:

This is in response to your December 8, 1992, letter regarding the beach erosion problem on Hutchinson Island, as expressed in Ms. Patricia McMaken Powell's letter. We are well aware of the erosion problem that the Martin County beaches on Hutchinson Island are currently experiencing. We also understand Ms. Powell's concern in expediting construction of the Martin County Shore Protection Project.

As you know, a shore protection project was authorized for the northern 4 miles of Hutchinson Island in Martin County by the Water Resources Development Act of 1990. Preconstruction, engineering and design (PED) is underway; and a General Design Memorandum (GDM) is 1 year away from completion. Once the GDM is completed, it will go through a review and approval process that typically takes 6 months. We expect to have the GDM approved June 1994. Plans and specifications, which are needed in order to award a construction contract, are scheduled for completion in fiscal year 1995. Under current policy, the GDM for the Martin County project has to be approved by June 1994 in order to be considered for fiscal year 1996 construction start. In order to be eligible for consideration as a fiscal year 1995 construction start, the GDM would have to be approved by June 1993. Unfortunately, the amount of time needed for GDM preparation, coordination, and review prevent us from meeting the June 1993 date.


We are aware of Martin County's efforts to expedite construction of this project. They have met with Congressman Lewis' staff regarding expediting construction of the project. Congressman Lewis has expressed a willingness to assist expediting construction of this project in any way possible. We

-2-

are currently maintaining close coordination with Martin County and are proceeding towards construction of the project as expediently as we can within our scheduling and funding limitations.

I hope this information is sufficient for your needs. If any additional information or assistance is needed, please call me or Mr. Richard Bonner, Deputy District Engineer for Project Management, at 904-232-2586.

Sincerely,



Terrence C. Salt
Colonel, U.S. Army
District Engineer

Copies Furnished:

Commander, U.S. Army Corps of Engineers (CECW-L)
Commander, South Atlantic Division (CESAD-PM)
Ms. Patricia McMaken Powell, 1357 NE Ocean Boulevard, Apt 313,
Stuart, Florida 34996



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

December 23, 1992

Programs and Project Management Division
Project Management Branch

Honorable Bob Graham
United States Senator
Post Office Box 3050
Tallahassee, Florida 32315

Dear Senator Graham:

This is in response to your November 25, 1992, letter regarding the beach erosion problem on Hutchinson Island, as expressed in Mr. James Barclay's letter. We are well aware of the erosion problem that the Martin County beaches on Hutchinson Island are currently experiencing. We also understand Mr. Barclay's concern in expediting construction of the Martin County Shore Protection Project.

As you know, a shore protection project was authorized for the northern 4 miles of Hutchinson Island in Martin County by the Water Resources Development Act of 1990. Preconstruction, engineering, and design (PED) is underway; and a General Design Memorandum (GDM) is one year away from completion. Once the GDM is completed, it will go through a review and approval process that typically takes six months. We expect to have the GDM approved by June 1994. Plans and specifications, which are needed in order to award a construction contract, are scheduled for completion in Fiscal Year (FY) 1995. Under the current policy, the GDM for the Martin County project has to be approved by June 1994 in order to request funding from Congress for an FY 1996 construction start. An FY 1995 construction start would require the GDM to be approved by June 1993. The amount of time needed for GDM preparation, coordination, and review prevent us from meeting the June 1993 date. Completion of PED, as well as an FY 1996 construction start, is subject to the availability of funds.

We are well aware of Martin County's efforts to expedite construction of this project. Martin County intends to request Federal and non-Federal construction funds for FY 1995. Also, Martin County has met with Congressman Lewis' staff regarding expediting construction of the project. Congressman Lewis has expressed a willingness to assist expediting construction of this project in any way possible. We are currently maintaining close

-2-

coordination with Martin County and are proceeding towards construction of the project as expediently as we can within our scheduling and funding limitations.

I do hope this information provides a sufficient response to your letter. If any additional information or assistance is needed, please call Mr. Richard Bonner, the Deputy District Engineer for Project Management, at 904-232-2586.

Sincerely,



Hal K. Alguire
Major, U.S. Army
Deputy District Engineer

Copies Furnished:

Commander, U.S. Army Corps of Engineers (CECW-L)
Commander, South Atlantic Division (CESAD-PM)
Mr. James Barclay, 1357 NE Ocean Blvd, #310, Stuart,
Florida 34996

491

484

Bob Graham
Florida

United States Senate
Washington, D.C.

Date 11/25/92

Colonel Terrence C. Salt
District Engineer
Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Enclosed is a letter from one of my constituents who has concerns which come under the jurisdiction of your agency.

I would appreciate your reviewing this situation and providing me with an appropriate response. Please direct your reply to:

Becky Liner
Office of Senator Bob Graham
Post Office Box 3050
Tallahassee, FL 32315

904/681-7726 422-6100

Your cooperation and assistance are appreciated.

With kind regards,

Sincerely,



United States Senator

Constituent's Name: *James and Inger Barclay*

Senator Bob Graham
44 West Flagler St.
Suite 1715
Miami, Fla., 33130

S. O. S.

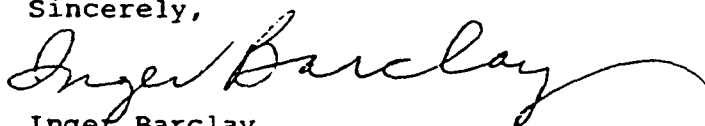
We on Hutchinson Island request your help without delay to get desperately needed beach renourishment sooner rather than later. "Keep off the dunes" signs are in storage because along the shoreline in many places, there simply are no dunes. Eroded beaches add to threats to properties formerly built in accordance with acceptable environmental standards. Increasingly restrictive environmental regulations tie the hands of individual owners to protect their, in many cases, one and only, year-round residences. Only general beach renourishment will do.

Beach renourishment for Martin County's Hutchinson Island was scheduled for Fy 1993, but now has been postponed to Fy 1996, a delay that could endanger not only present properties at risk, but also the sandy beaches that have been attracting tourists to Stuart for years.

Our State and County are ready to expedite beach renourishment, but the Corps of Engineers has to allocate money for the project first. The State and County are ready to complete the funding of it. Will you, Sir, please enlighten the Corps about the urgency of our need and move the project up one or two years? Time is of the essence. All levels of government, federal, state, and county, must synchronize their efforts to save our beaches now.

Thank you in advance for your efforts on our behalf.

Sincerely,



Inger Barclay
Apartment 310
1357 North East Ocean Blvd.
Stuart, Florida
34996

SENATOR BOB GRAHAM

SOUTH FLORIDA OFFICE

SunTide 310
1357 N.E.Ocean Blvd.
Stuart, Fl. 34996
November 10, 1992

Senator Bob Graham
44 West Flagler St.
Suite 1715
Miami. Fl. 33130

Today's newspaper headlines spotlight my area of concern.

The Palm Beach Post: "Wind, rain erode Treasure Coast Beaches."

The Stuart News: "Waves threaten beaches."

Both papers go on to cite the eroded shoreline, the toppled trees, the threatened homes, the closed beaches, as the latest evidence of what has developed into a serious situation on Hutchinson Island.

Where can you help?

Recommended relief - beach renourishment for the Martin County portion of Hutchinson Island - is losing ground. Originally targeted for FY 1993, it's now tentatively penciled in for FY 1996.

That's clearly too late. Come see the beaches. Talk with the owners. Each new storm adds to the list of threatened properties. Environmental restrictions limit individual owners to costly, inadequate, remedial measures. Only general beach renourishment offers real relief.

At a recent Martin County Commission meeting, I learned that the State and County are ready to go, but the process is a chain reaction:

1. The County doesn't allocate money until the State allocates money.
2. The State doesn't allocate money until the Corps of Engineers allocates money.
3. The Corps of Engineers balances need and pressure. We have the need. We lack the pressure. That's where you come in.

"If he pushes, we respond" said the Corps representative at the County Commission meeting.

Pressure from your office could move this project up one, perhaps even two years. But time is of the essence. Varying budget timetables for the Feds, the State, and the County must mesh to bring this about.

Please help!

Sincerely yours,


James C. Barclay



FLORIDA DEPARTMENT OF STATE

Jim Smith
Secretary of State

DIVISION OF HISTORICAL RESOURCES

R.A. Gray Building

500 South Bronough

Tallahassee, Florida 32399-0250

Director's Office

Telecopier Number (FAX)

(904) 488-1480

(904) 488-3353

PFN: 923682

December 21, 1992

STATE CLEARINGHOUSE

In Reply Refer To:
Susan Hammersten
Compliance Review
Section, DHR
(904) 487-2333

Ms. Janice L. Alcott, Director
State Clearinghouse-OPB
Executive Office of the Governor
Room 411, Carlton Building
Tallahassee, Florida 32399-0001

RE: SAI# FL9212111882C
Martin County Shore Protection Project, Hutchinson Island
Martin County, Florida

Dear Ms. Alcott:

In accordance with the provisions of Florida's Coastal Zone Management Act and Chapter 267, Florida Statutes, as well as the procedures contained in 36 C.F.R., Part 800 ("Protection of Historic Properties"), we have reviewed the above referenced project(s) for possible impact to historic properties listed, or eligible for listing, in the National Register of Historic Places.

It is the opinion of this office that the beach renourishment portion of the project will have no adverse effect on any properties listed or eligible for listing on the National Register. However, we feel that the borrow areas have the potential to contain significant historic shipwreck sites.

Since potentially significant historic sites may be present in the borrow areas, it is our determination that, prior to initiating any project related bottom disturbing activities within the borrow areas, they should be subjected to a professional magnetometer survey. The purpose of this survey will be to locate and assess potential historic shipwreck sites. This survey should be conducted under the direction of a professional underwater archaeologist. The resultant survey report must be forwarded to this agency in order to complete the process of reviewing the impact of this proposed project on historic resources.

Ms. Alcott
December 21, 1992
Page 2

If you have any questions concerning our comments, please do not hesitate to contact us. Your interest in protecting Florida's historic properties is appreciated.

Sincerely,

for *Laura R. Kammerer*
George W. Percy, Director
Division of Historical Resources
and

State Historic Preservation Officer

GWP/Hsh



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

December 23, 1992

Programs and Project Management Division
Project Management Branch

Honorable Connie Mack
United States Senator
1342 Colonial Boulevard, Suite 27
Fort Myers, Florida 33907

Dear Senator Mack:

This is in response to your November 23, 1992, letter regarding the beach erosion problem on Hutchinson Island, as expressed in Ms. Katherine McCullough's and Mr. James Barclay's letters. We are well aware of the erosion problem that the Martin County beaches on Hutchinson Island are currently experiencing. We also understand Ms. McCullough and Mr. Barclay's concern in expediting construction of the Martin County shore protection project.

As you know, a shore protection project was authorized for the northern 4 miles of Hutchinson Island in Martin County by the Water Resources Development Act of 1990. Preconstruction, engineering and design (PED) is underway; and a General Design Memorandum (GDM) is one year away from completion. Once the GDM is completed, it will go through a review and approval process that typically takes six months. We expect to have the GDM approved June 1994. Plans and specifications, which are needed in order to award a construction contract, are scheduled for completion in Fiscal Year (FY) 1995. Under the current policy, the GDM for the Martin County project has to be approved by June 1994 in order to request funding from Congress for an FY 1996 construction start. An FY 1995 construction start would require the GDM to be approved by June 1993. The amount of time needed for GDM preparation, coordination, and review prevent us from meeting the June 1993 date. Completion of PED, as well as an FY 1996 construction start, is subject to the availability of funds.


We are well aware of Martin County's efforts to expedite construction of this project. Martin County intends to request Federal and non-Federal construction funds for FY 1995. Also, Martin County has met with Congressman Lewis' staff regarding expediting construction of the project. Congressman Lewis has expressed a willingness to assist expediting construction of this

-2-

project in any way possible. We are currently maintaining close coordination with Martin County and are proceeding towards construction of the project as expediently as we can within our scheduling and funding limitations.

I do hope this information provides a sufficient response to your letter. If any additional information or assistance is needed, please call Mr. Richard Bonner, the Deputy District Engineer for Project Management, at 904-232-2586.

Sincerely,


Hal K. Alguire
Major, U.S. Army
Deputy District Engineer

Copies Furnished:

Commander, U.S. Army Corps of Engineers (CECW-L)
Commander, South Atlantic Division (CESAD-PM)
Mr. James Barclay, 1357 NE Ocean Blvd, #310, Stuart,
Florida, 34996
Ms. Katherine McCullough, 1357 NE Ocean Blvd, #120, Stuart,
Florida, 34996

CONNIE MACK
FLORIDA

United States Senate

WASHINGTON, DC 20510-0904

December 16, 1992

Col. Terrence C. Salt
Army Corps of Engineers
Jacksonville District
P.O. Box 4970
Jacksonville, Florida 32232-0019

Dear Col. Salt:

Enclosed please find correspondence from Ms. Roslyn Langley.

I would appreciate your advising me of your action in this matter and returning the letter with your reply. Please respond to my Fort Myers Regional Office, located at 1342 Colonial Blvd, Suite 27, Fort Myers, Florida 33907, (813) 275-6252.

Thank you for your prompt attention.

Sincerely,



Connie Mack
U.S. Senate

CM/alb
Enclosure



APPLIED TECHNOLOGY AND MANAGEMENT, INC.
502 N.W. 75 STREET, SUITE 95
GAINESVILLE, FLORIDA 32607
TELEPHONE: (904) 375-8700 • FAX (904) 375-0995

0260
Rd M.

MEMORANDUM

TO: DER - Marlene Stern
Ken Echternacht
Micky Bryant

DNR - David Arnold - Marine Resources
Al Devereaux - DBS
Mike Ashley - DSL
Kirby Green - State Funding

COE - Rick McMillen

County - Don Holloman - County Engineer
Karyn Erickson - ATM

FROM: Karyn M. Erickson, P.E., Vice President *KME/lex*
Applied Technology and Management, Inc.

DATE: December 14, 1992

RE: Martin County 4-Mile Beach Nourishment Project
Permit Pre-Application Meeting

Per our meeting of Monday, December 7, 1992, a permit pre-application meeting has been scheduled for January 11, 1993 at 10:00 am. The purpose of this meeting is to discuss the project's environmental information and potential project concerns with all regulatory agencies responsible for authorizing the construction permits.

The Corps is presently in the process of conducting baseline environmental and design studies for the PDE and GDM work and has agreed to work with the County to coordinate this effort with the initiation of the permit review process in order to satisfy concerns related to the project's environmental impacts and associated mitigation plans. The intent of the County is to accelerate the project design and permitting phases of the project in order to qualify for inclusion in the State's 1995 Fiscal Year Public Works Program Budget.

Rick McMillen, Project Manager for the USACOE, will coordinate with his project team to attend this meeting, as will Marlene Stern for FDER.

December 14, 1992
Page 2

Please advise me as to whom will participate from your office at this meeting. Also, let me know if you would like a copy of the Project's Coastal Engineering and Environmental Studies Report, which summarizes the baseline environmental studies conducted by the County to evaluate the various concerns expressed by FDER and FDNR regulatory review staff based on the USACOE's feasibility report (1984) for this project.

KME/rkl

cc: Micky Bryant, DER
Rick McMillen, COE
Doug Rosen, COE
Robert Brock, COE
Cynthia Murphy, COE
Mike Sole, DNR
Bill Whitfield, DNR
David Arnold, DNR
Fritz Wettstein, DNR
Ken Echemacht, DER
Bonnie Dearborn, Martin County

.C-09-1992 17:48 FROM APPLIED TECH INC

TO

19042321213 P.02

**APPLIED TECHNOLOGY AND MANAGEMENT, INC.**

502 N.W. 75 STREET, SUITE 95

GAINESVILLE, FLORIDA 32607

TELEPHONE: (904) 375-8700 • FAX (904) 375-0995

MEMORANDUM

TO: Rick McMillen, Project Manager
Martin County 4-Mile Beach Nourishment Project
USACOE, Jacksonville District

FROM: Karyn Erickson, P.E., Vice President *KME/rkl*
Applied Technology and Management, Inc.

DATE: December 8, 1992

RE: Scheduling for Agency Permit Pre-application Meeting
Martin County 4-Mile Beach Nourishment Project

Per our meeting on Monday, December 7, 1992, I have spoken with the DER staff responsible for the review of the project permits regarding scheduling of the above described meeting. Marlene Stern called to say that both she and Ken Echtermacht are available on January 11 or January 13, 1992, between 9 AM and Noon, to discuss the project's environmental information and potential project concerns.

Please coordinate with your project team concerning these alternate times to meet and respond via telephone or fax (904-375-0995) with respect to your availability on one or both dates. I would like your response by Friday afternoon (December 11th) in order to forward the meeting date to the other meeting participants.

Thank you for your help.

KME/rkl

73

Stuart, Florida
9 Decemver 1992

Senator Connie Mack
1342 Colonial Blvd.
Suite 27
Ft. Myers, Florida 33907

FORT MYERS
DEC 15 1992

Dear Senator Mack:

I reside at 1357 N. E. Ocean Blvd., Stuart,
Florida 34996.

This letter is written to ask for your good graces
in obtaining beach renourishment for Hutchinson Island
in Martin County, Florida.

As I write this letter beach erosion has already placed
several properties at serious risk on Hutchinson Island.
Current schedule for renourishment will most likely be too
late to prevent serious losses on Hutchinson Island.

Others, including the Corps of Engineers, have expressed
a willingness to advance the renourishment project.

It is my understanding that the State and the County are
ready to allocate matching funds if the Fed will advance
the renourishment date.

Time is of the essence to meet the budgeting deadlines
for the various Federal, State and County Agencies.

We earnestly solicit your help in obtaining the necessary
beach renourishment as soon as possible.

Respectfully,

Roslyn Langley

Roslyn Langley

Roslyn Langley
Apt 308
1357 N. E. Ocean Blvd.
Stuart, Florida 34996

503

496

CONNIE MACK
FLOF2DA

United States Senate

WASHINGTON, DC 20510-0904

December 8, 1992

Col. Terrence C. Salt
Army Corps of Engineers
Jacksonville District
P.O. Box 4970
Jacksonville, Florida 32232-0019

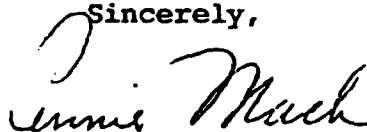
Dear Col. Salt:

Enclosed please find correspondence from Caroline S. Haas.

I would appreciate your advising me of your action in this matter and returning the letter with your reply. Please respond to my Fort Myers Regional Office, located at 1342 Colonial Blvd, Suite 27, Fort Myers, Florida 33907, (813) 275-6252.

Thank you for your prompt attention.

Sincerely,



Connie Mack
U.S. Senate

CM/alb
Enclosure

JAX DISTRICT DEC 1 1992 0700

November 25, 1992
 We desperately need help
 re newishment N. County
 line to Bathing Beach on
 Hittelman Island. We are
 good taxpayers.
 (Mrs.) Catherine S. Hogg
 Sunrise Apt 211
 1357 U.S. Ocean Blvd
 Stuart FL 34996
 Thank you



post card

FOR MRS.
 Catherine Hogg
 1357 U.S. Ocean Blvd.
 Suite 211
 Ft Myers -
 FL 33907

505

498

CONNIE MACK
FLORIDA

United States Senate

WASHINGTON, DC 20510-0904

December 8, 1992

Col. Terrence C. Salt
Army Corps of Engineers
Jacksonville District
P.O. Box 4970
Jacksonville, Florida 32232-0019

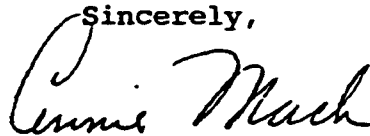
Dear Col. Salt:

Enclosed please find correspondence from Ms. Patricia McMaker Powell.

I would appreciate your advising me of your action in this matter and returning the letter with your reply. Please respond to my Fort Myers Regional Office, located at 1342 Colonial Blvd, Suite 27, Fort Myers, Florida 33907, (813) 275-6252.

Thank you for your prompt attention.

Sincerely,



Connie Mack
U.S. Senate

CM/alb
Enclosure

JAX DISTRICT 4001 100 07 04

OK
R.A.
R. J. M.
Copy provided
12/10/92

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996



COUNTY OF MARTIN

STATE OF FLORIDA

GROWTH MANAGEMENT DEPARTMENT

SUSAN F. ADAMS, Director

Phone (407) 288-5495 • Fax (407) 288-5432

December 7, 1992

Mr. Richard Bonner
US Army Corps of Engineers
400 West Bay Street
Jacksonville, FL 32232-0019

Re: Feasibility study of Martin County's Beach Nourishment Project.

Dear Mr. Bonner:

I would like to request a copy of the Corps of Engineers feasibility study of Martin County's Beach Nourishment project. After brief discussion with Mr. McMillen at the recent Beach Nourishment seminar in Stuart, he forwarded your name on to me in regard to acquiring this document.

I would like to review this information prior to the meeting in Tallahassee with the Dept. of Environmental Regulation, yourself and Martin County staff. This would allow me time to convey information regarding this project in the likely possibility of not being able to attend this meeting.

I appreciate your cooperation and courtesy with this request. Please feel free to contact me with any questions or comments regarding this information at (407) 288-5495. Thank You.

Sincerely Yours,

A handwritten signature in cursive script, reading "Mark M. Tamblyn".

Mark M. Tamblyn
Environmental Analyst

507

500

CONNIE MACK
FLORIDA

United States Senate

WASHINGTON, DC 20510-0904

December 1, 1992

Col. Terrence C. Salt
Army Corps of Engineers
Jacksonville District
P.O. Box 4970
Jacksonville, Florida 32232-0019

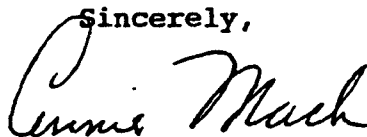
Dear Col. Salt:

Enclosed please find correspondence from Ms. Katherine McCullough.

I would appreciate your advising me of your action in this matter and returning the letter with your reply. Please respond to my Fort Myers Regional Office, located at 1342 Colonial Blvd, Suite 27, Fort Myers, Florida 33907, (813) 275-6252.

Thank you for your prompt attention.

Sincerely,



Connie Mack
U.S. Senate

CM/alb
Enclosure

JAX DISTRICT DEC 3 '92 07

Katharine McCullough
1357 NE Ocean # 120
Stuart, Fl. 34996

Senator Connie Mack

FORT MYERS

AB

Dear Senator,

NOV 27 1992

I am writing because of the
imminent dangers from the ocean to
the condominiums on the Jetty
Island, in Martin County. There are
many condos in trouble, and also
beach accesses, including Bathub.

■ If we have to wait until 1996
for a Beach Nourishment Program
it may be too late.

I attended a Martin County
Commissioners meeting recently.
The Army Corps of Engineers, as I
understood facts, have the funding
to go with a Beach nourishment
program from Bathub Beach north

to the Martin County line, and if they receive a yes they will schedule in the time frame of the Fiscal Year Apr. 1993 with work to be accomplished in 1994.

I am asking you Senator Mack to please consider our need and order a p ahead for the Fiscal Year '93-94 time frame. Martin County Commissioners are also behind this earlier date, according to my interpretation. I will look forward to a favorable reply from you.

Sincerely
Kathleen McElhough

FORT MYERS

DEC 01 1992

PATRICIA MC MAKEN POWELL
1357 N E OCEAN BLVD 313
STUART FL 34996

27 November 92

The Honorable Connie Mack
1342 Colonial Blvd. t
Suite 27
Ft. Myers FL 33907

Dear Senator Mack,

The beaches on Hutchinson Island (Martin County Florida) are in crisis!


As you undoubtedly know, the current schedule for beach re-nourishment is fiscal year 1996. That will be TOO LATE! Severe erosion along the coast has already occurred; and the Corps of Engineers has expressed a willingness to move the project up in the schedule, provided our elected officials, such as you, indicate support for doing so.

The State and County are ready to allocate matching funds if the Federal "Powers that be" advance the renourishment date.

Time is of the essence! Please bear in mind that all beaches are PUBLIC BEACHES. As you know, there are no private beaches; and I am sure you are aware that our beaches attract many tourists and that tourism is a large factor in Florida's economy.

Thank you in advance for helping us.

Sincerely,


Patricia McMaken Powell
Property owner and VOTER

511

504

CONNIE MACK
FLORIDA

United States Senate

WASHINGTON, DC 20510-0904

November 23, 1992

Col. Terrence C. Salt
Army Corps of Engineers
Jacksonville District
P.O. Box 4970
Jacksonville, Florida 32232-0019

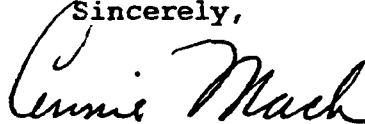
Dear Col. Salt:

Enclosed please find correspondence from James C. Barclay.

I would appreciate your advising me of your action in this matter and returning the letter with your reply. Please respond to my Fort Myers Regional Office, located at 1342 Colonial Blvd, Suite 27, Fort Myers, Florida 33907, (813) 275-6252.

Thank you for your prompt attention.

Sincerely,



Connie Mack
U.S. Senate

CM/alb
Enclosure

FORT MYERS

NOV 17 1992

ARB

Senator Connie Mack
1342 Colonial Blvd.
Suite 27
Ft. Myers, Fla., 33907

S. O. S.

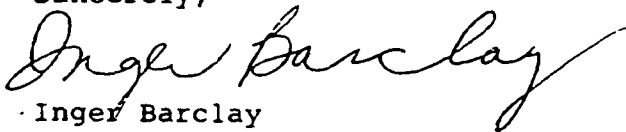
We on Hutchinson Island request your help without delay to get desperately needed beach renourishment sooner rather than later. "Keep off the dunes" signs are in storage because along the shoreline in many places, there simply are no dunes. Eroded beaches add to threats to properties formerly built in accordance with acceptable environmental standards. Increasingly restrictive environmental regulations tie the hands of individual owners to protect their, in many cases, one and only, year-round residences. Only general beach renourishment will do.

Beach renourishment for Martin County's Hutchinson Island was scheduled for Fy 1993, but now has been postponed to Fy 1996, a delay that could endanger not only present properties at risk, but also the sandy beaches that have been attracting tourists to Stuart for years.

Our State and County are ready to expedite beach renourishment, but the Corps of Engineers has to allocate money for the project first. The State and County are ready to complete the funding of it. Will you, Sir, please enlighten the Corps about the urgency of our need and move the project up one or two years? Time is of the essence. All levels of government, federal, state, and county, must synchronize their efforts to save our beaches now.

Thank you in advance for your efforts on our behalf.

Sincerely,



Inger Barclay
Apartment 310
1357 North East Ocean Blvd.
Stuart, Florida
34996

SunTide 310
1357 N.E.Ocean Blvd.
Stuart, Fl. 34996
November 10, 1992

FORT MYERS
NOV 18 1992

Senator Connie Mack
1342 Colonial Blvd.
Suite 27
Ft. Myers, Fl. 33907

Today's newspaper headlines spotlight my area of concern.

The Palm Beach Post: "Wind, rain erode Treasure Coast Beaches."

The Stuart News: "Waves threaten beaches."

Both papers go on to cite the eroded shoreline, the toppled trees, the threatened homes, the closed beaches, as the latest evidence of what has developed into a serious situation on Hutchinson Island.

Where can you help?

Recommended relief - beach renourishment for the Martin County portion of Hutchinson Island - is losing ground. Originally targeted for FY 1993, it's now tentatively penciled in for FY 1996.

That's clearly too late. Come see the beaches. Talk with the owners. Each new storm adds to the list of threatened properties. Environmental restrictions limit individual owners to costly, inadequate, remedial measures. Only general beach renourishment offers real relief.

At a recent Martin County Commission meeting, I learned that the State and County are ready to go, but the process is a chain reaction:

1. The County doesn't allocate money until the State allocates money.
2. The State doesn't allocate money until the Corps of Engineers allocates money.
3. The Corps of Engineers balances need and pressure. We have the need. We lack the pressure. That's where you come in.

"If he pushes, we respond" said the Corps representative at the County Commission meeting.

Pressure from your office could move this project up one, perhaps even two years. But time is of the essence. Varying budget timetables for the Feds, the State, and the County must mesh to bring this about.

Please help!

Sincerely yours,

James C. Barclay
James C. Barclay

C.S.
CS
RM
Palm



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

October 22, 1992

Programs and Project Management Division
Project Management Branch

Honorable Connie Mack
United States Senate
Attn: Mr. Scott Barnhart
Washington, D.C. 20510

Dear Senator Mack:

I regret that it has taken longer than usual to respond to your September 17, 1992, letter regarding the shore protection project on Hutchinson Island in Martin County. Our staff has been assisting with recovery efforts associated with Hurricane Andrew since August.

Your concern in regard to expediting the project is understood. We are aware of the situation that Martin County beaches are currently experiencing. We have been working closely with the county to expedite this project. However, there are significant environmental concerns related to turtle nesting along the proposed project shoreline that must be addressed. At this time, we do not see how addressing the environmental concerns and coordinating the reports that must be prepared in order to obtain construction funding can be accomplished in a shorter time period. However, we will continue to explore ways with the county to accelerate the schedule where possible.

Our office will maintain close coordination with the county on the preparation of the necessary documents and proceed towards construction of the project as expediently as we can within our scheduling and funding capabilities.


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-2-

I hope this information provides a sufficient response to your letter. If any additional information or assistance is needed, please call me or Mr. Richard Bonner, Deputy District Engineer for Project Management, at 904-232-2586.

Sincerely,


Terrence C. Salt
Colonel, U.S. Army
District Engineer

Copy Furnished:

Commander, U.S. Army Corps of Engineers (CECW-L)
Commander, South Atlantic Division (CESAD-PM)
Ms. Mary Dawson, Chairman, Martin County Board of County
Commissioners, 2401 S.E. Monterey Road, Stuart, Florida 34996

FRANK A. WACHA
District 1

JEFF KRAUSKOPF
District 2

Vice Chairman
WALTER W. THOM, JR.
District 3

MAGGY MURCHALLA
District 4

Chairman
MARY E. DAWSON
District 5

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996

SUE B. WHITTLE • County Administrator

PHONE (407) 288-5422

COUNTY OF MARTIN



STATE OF FLORIDA

October 22, 1992

ADM-IG-93-027L

Mr. Rick McMillian
Project Manager
Department of the Army
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. McMillian:

I appreciate your response to my request to attend the Martin County Board of Commissioners meeting on Tuesday, November 3 to discuss the status of the 4-Mile Beach Nourishment project on Hutchinson Island. The board item for the project is preset for 1:30 p.m. for discussion. The meeting location is the Martin County Administration Building at 2401 S.E. Monterey Road, Stuart, Florida 34996.

The main purpose of the item is to discuss the status of the project, the local, state and federal funding and construction schedules. I am enclosing a copy of the board item and the backup for you to review prior to the meeting.

Again, we are very pleased that you will be able to attend to inform the Board of the status of the beach project at the state level.

Yours truly,


Bonnie B. Dearborn
Intergovernmental Relations

cc: Martin County Board of County Commissioners
Sue Whittle, County Administrator
Al Silverman, V.P. FS&BPA

**BOARD OF COUNTY COMMISSIONERS
AGENDA ITEM SUMMARY FORM**

1. WORDING OF AGENDA 2. MEMO NUMBER: - 3. MEETING DATE:
Beach Nourishment ADM-IG-93-025M November 3, 1992
Project & Approval
of Correspondence
to Governor's Office

REGULAR X SPECIAL

4. PREVIOUS AGENDA ITEM:
A. YES X B. NO

Date and Agenda Number
10/20/92 7C2

5. AGENDA PLACEMENT: 6. REQUIREMENT/PURPOSE: 7. REQUESTOR'S NAME:
 CONSENT (specify) A. (ALL REQUESTS)
 PUBLIC HEARING STATUTE NAME Bonnie Deatborn
 REQUEST/PRESENTATION ORDINANCE DEPT. Administration
X DEPARTMENTAL BCC REQUEST B. (PUBLIC ONLY)
 COMMISSIONERS OTHER CITIZEN NAME
 NOTED ITEM (explain) CITIZEN PHONE
 OTHER

TIME REQUIRED:

8. BACKGROUND:

Due to the continued erosion along the Hutchinson Island shoreline residents are becoming more and more concerned for their properties and are very anxious to have the beach project accelerated for construction in 1994. At the present time, the project is scheduled for construction in 1996. This schedule has come about primarily as to, when Congress has approved appropriations for the project and the work schedules of the ACOE. Staff has been working with our Congressmen and the State to have the project accelerated by one year, that is 1995, rather than 1996. To assist us in this effort Congressman Tom Lewis has agreed to request construction appropriations out of sequence of the 2 year budget cycle and DNR has included in their 1993-94 Fixed Capital outlay budget that preliminary construction and design (PED) portion of Martin County Beach Nourishment project (State share \$470,259). This is significant since Martin County's schedule for state appropriation request was not scheduled until 1994. This clearly demonstrates the DNR's interest is assisting the County in getting its project moved forward. The PED appropriations must be approved by the 1993 Legislature.

Both the Army Corp of Engineers and the Florida Department of Natural Resources have been invited to come to the Board meeting of November 3 to give a status report of the project and to discuss the possibility of expediting the project to 1994, rather than 1995 or its current schedule of 1996.

In addition, Al Silverman, Vice President of the Martin County Chapter of the Florida Shore and Beach Preservation Association has invited a number of people to attend/speak at the Commission meeting of November 3 in support accelerating the project to 1994. (Attachment A-1)

Project Local Funding

The estimated \$12,500,000 project will be funded from a number of sources as follows:

Federal and State funding will contribute approximately 85% of project costs. The Local Sponsor (Martin County) will contribute the remaining project costs.

Prior discussions concerning the Local Sponsor share have included contributions from:

- * Island Residents
 - a. Beach Front Assessments
 - b. Other Resident Contributions (Hutchinson Island MSTU)
- * County-wide Contributions
 - a. Ad Valorem Taxes
 - b. Other County-wide Special Assessments
 - c. Impact/User Fees

Any "Assessments" will require preparation of an Ordinance to amend current County Codes allowing these types of assessments. It will also require decisions as to the type of assessments, e.g., front-foot, property value, or a combination thereof.

Project Federal/State Funding

For additional information there is included a copy of a memorandum providing a chronology of past events that staff has undertaken with Commission approval to expedite the proposed nourishment project on Hutchinson Island. (Attachment A-2) Subsequent activity is provided below.

In May 1992, staff met with DNR staff in Tallahassee to request their help in expediting our beach nourishment project. Their support would assist us in generating more federal support.

In July 1992, Bonnie Dearborn of Intergovernmental Relations met with Congressman Tom Lewis and both Senators Graham and Mack in Washington to request their help to expedite our beach nourishment project because of the accelerated erosion that has taken place over the past few years due to severe storm activity. (Follow-up correspondence to and from our Congressmen are attached). (Attachments B,C,D,E)

In September 1992, staff met with Karen Hogan, Congressman Tom Lewis' Aide, when she was in the District and again requested their help. Ms. Hogan already aware of the meeting with Congressman Lewis said it was a top priority of Congressman Lewis to work with the USACOE to get the project expedited by one year, that is, construction in 1995 rather than 1996.

September 1992 DNR informed Martin County that a request for (75%) or \$470,259 has been included in DNR's fixed capital budget for FY 93-94, which was approved by the Governor and Cabinet. The local share is (25%) or \$156,752. (Attachment F)

On October 2, 1992, the President signed the appropriations bill which included Martin County's appropriation request of \$20,000 for the second half of the pre-construction and design portion of the beach project. This completes the Federal funding request of \$650,000 for pre-construction and design work. The first \$350,000 was already appropriated by Congress last year.

On October 26, 1992, there will be a public hearing on the Governor's budget. A copy of a letter to the Governor's office from the Chairman of the Martin County Board of County Commissioners is attached (Attachment G) requesting the Governor to approve FDNR's fixed capital outlay budget request including Martin County's project funds. Also are copies of letters to members of Martin County's Legislative Delegation requesting them to contact the Governor's office on behalf of Martin County. (Attachments H,I) The Governor's budget will be presented to the Legislature in December.

Also included is a copy of a letter from USACOE informing the County construction would be delayed until 1996. (Attachment J-1)

In addition, there is a letter from the Chairman to USACOE informing them of our Congressmen's willingness to assist in getting our project accelerated by one year and requesting USACOE to coordinate a meeting with FDNR, FDER, USACOE and Federal environmental agencies to discuss environmental issues. (Attachment J-2)

9. RECOMMENDED ACTION:

Direct Staff to expedite the process to establish a special assessment district for beachfront property owners within the project.

10. RECOMMENDED APPROVAL:

DEPARTMENT DIRECTOR	PS	I/S	B&Z	GMD	PW	ENG	UT	BUDG PUR	COUNTY ADMIN.	COUNTY ATTY.
						X			X	

ATTACHMENT A-1

FLORIDA SHORE & BEACH PRESERVATION ASSOCIATION INC.
of MARTIN COUNTY: 2355 N.E. Ocean Blvd., Stuart, FL 34996

MEMBERS

• BOB WYHAM, Secretary/Chairman (Old Florida)
Ray Curdell, President
Al Silverman, Treasurer
Bob Douglas, President
Cheri E. Adkins, Secretary
Dave Jordan, Immediate Past
Betsy Kott, Treasurer
Bill Mathews, P.E.
Joe Galt, (Land Govt.)
Bill Pollock (Shelley Inc.)
Don Jacobson, Vice President
Linda Venable, Treasurer
P.O. Box 1000, Stuart, FL 34996

MEMBERS

692-1469
692-2218
692-4279
225-2114
225-2523
225-3671
692-1227
287-9971
334-6859
225-2721
225-3411

Low Commission
Post Mort. (407) 225-0641
Don Linsley 225-4441

Your sustained support will save Martin County PUBLIC BEACHES

MOST URGENT Beach Allert

The Martin Commission Meeting

Tuesday November 3rd 1992

Preset at 1:30 PM

At The Martin County Commission Chambers
Administrative Center
2401 SE Moneray Rd
Stuart, Florida

CRISIS ON THE BEACH !!!!!

INVITED SPEAKERS

Robert Dean, Dean of Oceanoghy, University of Florida

Karen Erickson, P.E., Applied Technology & Management
Daryl Hathaway

Thomas Campbell, P.E., Coastal Planning & Engineering

Michael Walters, P.E., Coastal Tech

Ross Witham, Research Scientist, U. of Miami

Robert Snyder, P.E., Snyder Oceangraphic Services

FRANK A. BACHA
ChairmanJEFF KRAUSCHOFF
ChairmanWALTER W. THOM, JR.
ChairmanMAGGY MURCHALLA
ChairmanWALTER J. JASON
Chairman

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34906

COUNTY OF MARTIN



STATE OF FLORIDA

August 17, 1992

IGG-92-201L

The Honorable Tom Lewis
The U.S. House of Representatives
Room 2351 Rayburn HOB
Washington D.C. 20515

ATTACHMENT B

Dear Congressman Lewis:

First, I want to let you know how much we appreciate the strong support and assistance you have already given to Martin County's 4-mile beach nourishment project on Hutchinson Island, Martin County, Florida. I also want to thank you for taking the time to meet with me on such short notice while I was vacationing in Washington D.C. on Friday, July 31. We are very grateful for your interest and willingness to help us expedite the construction of the beach nourishment project by one year, i.e., begin construction in 1995 rather than 1996 as is currently scheduled by the Army Corps of Engineers (ACOE).

I have been informed that the ACOE has recently completed a beach profile of the project area and comparing it to the 1989 beach profile study the ACOE is now recommending that an additional 300,000 cubic yards is needed due to the average 62,000 cubic yard erosion loss that has taken place in the last three years. This additional information clearly demonstrates the beach is eroding at a faster rate than was anticipated and the need to accelerate the project becomes more crucial.

In our discussion in Washington, I told you that Martin County had received correspondence in March from Richard E. Bonner, Deputy District Engineer for Project Management of the ACOE informing us that, although the current schedule for completion of the preconstruction phase of the beach nourishment project will be completed by September 1995, that due to the 2-year budget cycle the expenditure of construction funds will not be available until FY 96. I also told you of the concerns the County has for the residents of that area whose residences are in jeopardy due to the acute beach erosion that has occurred along Hutchinson Island hence, the need to expedite the project. This situation was brought on by the severe storm conditions that took place last fall/winter. Condominiums that are now in jeopardy have required additional coastal armoring for their protection, a practice we reluctantly support due to the adverse affects the armoring has on turtle nesting and

*Similar letters
Also sent to
Singer
Graham & Mack
Rf.*

T. Lewis, IGG-92-201L
August 17, 1992
Page 2

destruction of the recreational beach. In some cases, however, residents have lost their pools from their yards and their property is in serious danger.

I also related to you, that at our request the ACOE did investigate two roadway sites on Hutchinson Island just south of the project site that had experienced severe erosion from storm activity, to determine their eligibility for ACOE funding to do corrective work. Although these two sites are not located within the immediate project area, the beach nourishment project would provide added protection to these road sites since the dunes that ultimately protect the road sites would be enhanced by the downdrift movement of sand as it moves southward along the shoreline. Due to other factors, however, the ACOE concluded the sites were not eligible for funding.

We realize the time schedules for these projects are dictated by the appropriations and legislative process as well as the implementation of the various phases. We are very concerned, however, that continued erosion of the beaches will cause undue hardship to those residents whose properties are being severely threatened.

We need your help in expediting the project hopefully by one year. I have enclosed copies of correspondence to and from the ACOE that I told you I would send to you which may help you and your staff in working with the ACOE in accelerating the project. I believe you said Karen Hogan of your staff is handling this assignment. This mission is very important to the residents of Martin County. We know, however, that we cannot succeed in getting the project moved ahead without your strong support. If there is anything else we can do to assist you in this matter, please do not hesitate to contact my office at (407) 221-1357.

Yours truly,

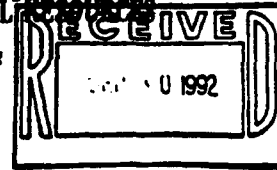

Bonnie B. Dearborn
Intergovernmental Relations

cc: Honorable Members of the Martin County Board of Commissioners
Sue Whittle, County Administrator
Robert Denison, Director of Parks & Recreation



FLORIDA DEPARTMENT OF NATURAL RESOURCES

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399



Leaton Chiles
Governor
Jim Smith
Secretary of State
Bob Butterworth
Attorney General
Gerald Lewis
State Comptroller
Tom Gallagher
State Treasurer
Bob Crawford
Commissioner of Agriculture
Betty Castor
Commissioner of Education

September 24, 1992

ATTACHMENT F

Mr. Richard Noyes
Martin County
County Administrative Center
2401 S.E. Monterey Road
Stuart, Florida 34996

RE: Martin County 4-Mile Restoration and Design, PRO-MAR-94-32

Dear Mr. Noyes:

We are pleased to inform you that the Florida Governor and Cabinet, at its meeting of September 15, 1992, approved the Department's FY 93-94 fixed capital outlay budget request for the projects referenced on the funding request summary forms enclosed. The Department will now submit its budget request to the Florida Legislature for funding consideration.

If we may be of any assistance to you, or if you have any questions regarding the appropriations process, please contact Bill Whitfield, Bill Wilkinson or me at (904)487-1262.

Sincerely,

Lonnie L. Ryder
Environmental Administrator
Office of Beach Management
Division of Beaches and Shores

LLR/bc

FRANK A. WACHA

JEFF GRAUBROOK

WALTER W. THOM JR.

MAGGY MURCHALLA

MAATE DAWSON

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34906

COUNTY OF MARTIN



STATE OF FLORIDA

ADM-16 93-204

October 14, 1992

ATTACHMENT G

The Honorable Lawton Chiles
The Governor of the State of Florida
PL 05 the Capitol
Tallahassee, Florida 32399-0001

Dear Governor Chiles:

As Chairman of the Martin County Board of County Commissioners I am requesting your approval and support for the Department of Natural Resources' fixed capital outlay budget request for Fiscal Year 1993-94. Included in the FDNR's budget is an item that is extremely important to Martin County. It is a request for \$470,259 (Federal share \$432,667 and Local share of \$156,752) for the Preconstruction Engineering Design portion of a very badly needed 4-mile beach nourishment project on Hutchinson Island. The budget reference is known as Martin County 4-Mile Restoration and Design, PRO-MAR-94-32. To date the project has received \$650,000 from the federal government to fund its share of the General Design Memorandum portion of the project.

Governor Chiles, over the past several months there has been accelerated beach erosion due to the severe storm conditions. As a result the properties of several residents are in jeopardy. Resulting from a recently completed beach profile by the USACOE it is recommending that an additional 300,000 cubic yards is needed to renourish the beach due to the average 62,000 cubic yard erosion loss that has taken place in the last three years, which clearly demonstrates the need to get the project done as soon as possible. We respectfully request that you include in your budget the PED funding for this greatly needed project. Without your help we will be unable to begin construction of the beach in a timely manner and provide the much needed storm protection to the residents of Hutchinson Island.

Please give this project your support for FY 93-94.

Yours truly,

Mary Dawson
Chairman

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34906

COUNTY OF MARTIN



ATTACHMENT J-2

STATE OF FLORIDA

COM-MD-93-003L

October 20, 1992

Richard E. Bonner, P.E.
Deputy District Engineer for
Project Management
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Bonner:

On September 2, 1992, Martin County staff met with Congressman Lewis' staff concerning expediting the timetable for the Martin County Beach Nourishment Project. Congressman Lewis and his aides expressed a willingness to assist this project in any way possible. Both Martin County and Congressman Lewis are aware of the pressure that the Jacksonville District is under with the disaster recovery duties that it has undertaken in the aftermath of Hurricane Andrew. Congressman Lewis said that he would introduce an out of sequence appropriation for the construction of this project for fiscal year 1995 if the Corps can have the PED for the project completed in time for this construction timeframe. He also indicated that his office would work with the Jacksonville District to provide you with the resources and political support that you require to continue your efforts to expedite this project.

Martin County intends to request construction funding from the State through the Department of Natural Resources Beach Erosion Control Assistance Program and Federal funding through the Florida Public Works Program for fiscal year 1995. The application for funding through these programs starts in January, 1993. In order to apply for either program; Martin County, the Florida Department of Environmental Regulation, the Federal environmental agencies need to meet with the Jacksonville District to determine the environmental issues that will need to be addressed during the permitting phase of this project. A side benefit of this activity will be to provide front end input into the planning process to ensure that the permitting phase of this project will proceed smoothly. This meeting should take place no later than November 1992 so that agencies will have adequate time to provide written comments before funding applications are completed.

Page 2
COM-MD-93-003L
October 20, 1992

Martin County would appreciate your office coordinating the meeting described in the paragraph above. Further, if there is anything that Martin County or Congressman Lewis can do to assist you in your efforts on the Martin County Beach Nourishment Project, please do not hesitate to contact us.

Thank you for your attention to these matters.

Sincerely,



Mary E. Dawson
Chairman

MD/BD/lm

cc: Congressman Tom Lewis
Sue Whittle, County Administrator
Robert Denison, Parks and Recreation Director
Bonnie Dearborn, Intergovernmental Specialist
Donald Holloman, County Engineer

FRANK A. WACHA
District 1

JEFF KRAUSKOPF
District 2

Vice Chairman
WALTER W. THOM, JR.
District 3

MAGGY MURCHALLA
District 4

Chairman
MARY E. DAWSON
District 5

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996

SUE B. WHITTLE • County Administrator

COUNTY OF MARTIN



PHONE (407) 286 5422

STATE OF FLORIDA

COM-MD-93-003L

October 20, 1992

Richard E. Bonner, P.E.
Deputy District Engineer for
Project Management
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Bonner:

On September 2, 1992, Martin County staff met with Congressman Lewis' staff concerning expediting the timetable for the Martin County Beach Nourishment Project. Congressman Lewis and his aides expressed a willingness to assist this project in any way possible. Both Martin County and Congressman Lewis are aware of the pressure that the Jacksonville District is under with the disaster recovery duties that is has undertaken in the aftermath of Hurricane Andrew. Congressman Lewis said that he would introduce an out of sequence appropriation for the construction of this project for fiscal year 1995 if the Corps can have the PED for the project completed in time for this construction timeframe. He also indicated that his office would work with the Jacksonville District to provide you with the resources and political support that you require to continue your efforts to expedite this project.

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Page 2
COM-MD-93-003L
October 20, 1992

Martin County would appreciate your office coordinating the meeting described in the paragraph above. Further, if there is anything that Martin County or Congressman Lewis can do to assist you in your efforts on the Martin County Beach Nourishment Project, please do not hesitate to contact us.

Thank you for your attention to these matters.

Sincerely,



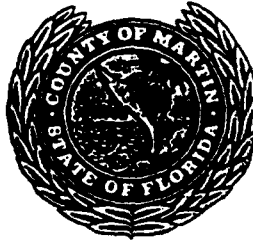
Mary E. Dawson
Chairman

MD/BD/lm

cc: Congressman Tom Lewis
Sue Whittle, County Administrator
Robert Denison, Parks and Recreation Director
Bonnie Dearborn, Intergovernmental Specialist
Donald Holloman, County Engineer

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C.S.

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996

COUNTY OF MARTIN**STATE OF FLORIDA**

Parks & Recreation Dept.
Robert Denison, Director

2980 S.E. Dixie Hwy.
Stuart, Florida 34997
Phone (407) 288-5690
Recreation (407) 221-1418

September 28, 1992

Richard E. Bonner, P.E.
Deputy District Engineer for
Project Management
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

FILE: MS-LT-92-267.1

Dear Mr. Bonner:

On September 2, 1992 Martin County staff met with Congressman Lewis's staff concerning expediting the timetable for the Martin County Beach Nourishment Project. Congressman Lewis and his aides expressed a willingness to assist this project in any way possible. Both Martin County and Congressman Lewis are aware of the pressure that the Jacksonville District is under with the disaster recovery duties that it has undertaken in the aftermath of Hurricane Andrew. Congressman Lewis said that he would introduce an out of sequence appropriation for the construction of this project for fiscal year 1995 if the Corps can have the PED for the project completed in time for this construction timeframe. He also indicated that his office would work with the Jacksonville District to provide you with the resources and political support that you require to continue your efforts to expedite this project.

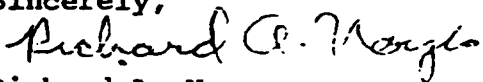
Martin County intends to request construction funding from the State through the Department of Natural Resources Beach Erosion Control Assistance Program and Federal funding through the Florida Public Works Program for fiscal year 1995. The application for funding through these programs starts in January, 1993. In order to apply for either program; Martin County, the Florida Department of Natural Resources, the Florida Department of Environmental Regulation, the Federal environmental agencies need to meet with the Jacksonville District to determine the environmental issues that will need to be addressed during the permitting phase of this project. A side benefit of this activity will be to provide front end input into the planning process to ensure that the permitting phase of this project will proceed smoothly. This meeting should take place no later than November, 1992 so that agencies will have adequate time to provide written comments before funding applications are completed.

PAGE TWO
MS-LT-92-267.1

Martin County would appreciate your office coordinating the meeting described in the paragraph above. Further, if there is anything that Martin County or Congressman Lewis can do to assist you in your efforts on the Martin County Beach Nourishment Project.

Thank you for your attention to these matters.

Sincerely,



Richard A. Noyes
Superintendent of Beaches and Waterways

cc: Congressman Tom Lewis
Sue Whittle, County Administrator
Robert F. Denison, Parks and Recreation Director
Bonnie Dearborn, Intergovernmental Specialist
Ron Jacobstien, FSBPA Martin County Chapter
Donald Holloman, County Engineer

RAN/kh



DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

June 11, 1992

REPLY TO
ATTENTION OF
Programs and Project Management Division
Project Management Branch

Mr. Richard A. Noyes
Superintendent of Beaches and Waterways
2980 SE. Dixie Highway
Stuart, Florida 34997

Dear Mr. Noyes:

This is in response to your May 5, 1992, letter regarding the shore protection project that was authorized for the northern 4 miles of Hutchinson Island in Martin County by the Water Resources Development Act of 1990.

Our office shares in your concern regarding the proposed construction start date of FY 1996. However, our recent experience on receiving approval of the General Design Memorandums (GDM) for the Manatee and Sarasota County shore protection projects, coupled with the requirement of having an approved GDM prior to requesting construction funds under the current budget process, will not allow us to schedule construction prior to FY 1996. Under the current 2-year budget process, the GDM for the Martin County project has to be approved by June 1994 in order to request funding from Congress for FY 1996 construction. A FY 1995 construction start would require GDM approval by June 1993. The amount of time required for GDM preparation and coordination and review required by our headquarters and other agencies (state and Federal) will not allow us to meet the June 1993 date.

Funding for preconstruction, engineering, and design (PED) is not a problem for this project. The review process which was previously mentioned is the determinant for this PED process.

Regarding the U.S. Army Corps of Engineers coordination meeting referenced in your letter, staff at our headquarters prefer that the technical review conference (TRC) not be held until significant work has been accomplished on the GDM. The early summer TRC would be premature as the District will be involved in data gathering and early stages of GDM preparation. The county's concern in regard to expediting the PED process and funding for the project is understood. Our office will maintain close coordination with the county on the preparation of

-2-

the necessary documents and proceed towards construction of the project as expediently as we can within our scheduling and funding capabilities.

I hope this information is sufficient for your needs. If you need additional information, please call Mr. Michael Schultz at 904-232-2112.

Sincerely,

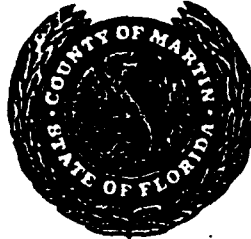


Richard E. Bonner, P.E.
Deputy District Engineer
for Project Management

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996

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COUNTY OF MARTIN



STATE OF FLORIDA

Parks & Recreation Dept.
Robert Denison, Director

2980 S.E. Dixie Hwy.
Stuart, Florida 34997
Phone (407) 288-5690
Recreation (407) 221-1418

• June 11, 1992

FILE: MS-LT-92-186.1

Don Keirn, Planning Manager
Southeast Florida Field Office
Department of Natural Resources
Division of State Lands
7400 H. South Georgia Avenue
West Palm Beach, Florida 33405

Dear Sir:

Martin County and the United States Army Corps of Engineers are working toward construction of a 23,000 foot beach nourishment project on the north end of Hutchinson Island in the County. The project consists of hydraulically dredging 1 million cu. yds. of sand from an offshore borrow site and placing it on the beach. Design features include reconstruction of the historical dune, a 35 foot storm protection berm and an 85' wide recreational beach. This project is expected to be built in 1995. The USACOE has just initiated work on the General Design Memorandum.

* NO
FY 96

Martin County is interested in determining your office's requirements to obtain easements for the project area, erosion control line, borrow site and anything else your office has jurisdiction over pertaining to a beach nourishment project. Please send information on this subject to the address listed above. Feel free to contact me at Suncom 239-5690 or (407) 288-5690.

Thank you for your assistance in this matter.

Sincerely,

Richard A. Noyes

Richard A. Noyes
Superintendent of Beaches and Waterways

cc: Robert F. Denison, Parks and Recreation Director
cc: Mike Schultz
AN/kh

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996



COUNTY OF MARTIN

STATE OF FLORIDA

ENGINEERING DEPARTMENT

PHONE (407) 288-5927

Donald E. Holloman, P.E.
DIRECTOR

SUNCOM 239-5927
FAX 288-5432

April 23, 1992

EN/CI-92L-281

Colonel Terrence Salt
Commander and District Engineer
United States Army Corps of Engineers
Jacksonville District
P.O. Box 4970
Jacksonville, FL 32232-0019

Re: Martin County

Dear Colonel Salt:

We would very much appreciate an opportunity to meet with you to discuss, and perhaps visit, some Martin County sites of mutual interest and concern. We have heard that you may be in this area sometime during May, and it is our hope that you can arrange to spend some time with us then.

If your plans do not include a trip to Martin County in May, is there another time that we could arrange such a meeting?

Areas of concern include:

- 1) Two (2) roadway projects - MacArthur Boulevard and South Beach Road, where erosion is creating a public safety hazard
- 2) Beach Renourishment Project
- 3) St. Lucie Inlet
- 4) Maintenance Dredging at Crossroads
- 5) Okeechobee Park

Martin County

Page 2

EN/CI-92L-281

I look forward to meeting you. A call to my office for myself, Ms. Kim Roden, or Mr. Lee Weberman will quickly facilitate arrangements for a meeting which I feel would be most beneficial to Martin County as well as the Army Corps.

Sincerely,



Donald E. Holloman, P.E.
County Engineer

DEH/JL/pmr

cc: County Commissioners, Martin County
Sue B. Whittle, County Administrator
Robert Denison, Director, Parks Department
Richard Noyes, Superintendent of Beaches & Waterways
James Spurgeon, Town Manager, Town of Jupiter Island

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996

COUNTY OF MARTIN



STATE OF FLORIDA

ENGINEERING DEPARTMENT

PHONE (407) 288-5927

Donald E. Holloman, P.E.
DIRECTOR

SUNCOM 239-5927
FAX 288-5432

March 12, 1992

EN/CI-92L-224

Colonel Terrence Salt
District Engineer
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

Re: Request for Investigation of Severe Erosion
1) MacArthur Boulevard, 2) South Beach Road

Dear Colonel Salt:

Martin County would like to request an investigation of two (2) beach sites within the County which have experienced severe erosion, causing damage to roadways which provide evacuation routes and adversely influencing public safety.

The two (2) sites are:

- 1) The northern most end of Bathtub Reef Park on MacArthur Boulevard. Further description can be provided by Mr. Richard Noyes, Superintendent of Beaches and Waterways, Martin County, (407) 288-5690.
- 2) Just south of 383 South Beach Road on Jupiter Island. This area is between Range 109 - 110, the DNR identifying markers from the Coastal Construction Control Line map. Further description can be provided by Mr. James Spurgeon, Town Manager, Town of Jupiter Island, (407) 546-5011.

Please advise us as to the results of your investigation, what funding is available, and when corrective work can be implemented. We are extremely concerned about the impact of this erosion on these vital roadways, and appreciate your prompt attention to this matter.

Severe Erosion

Page 2

EH/CI-92L-224

If you have any questions and/or to have someone from Martin County meet you at the sites, please contact Ms. Jill Lutes, Capital Projects Coordinator, of this office, Suncom 239-5927, or local, (407) 288-5927.

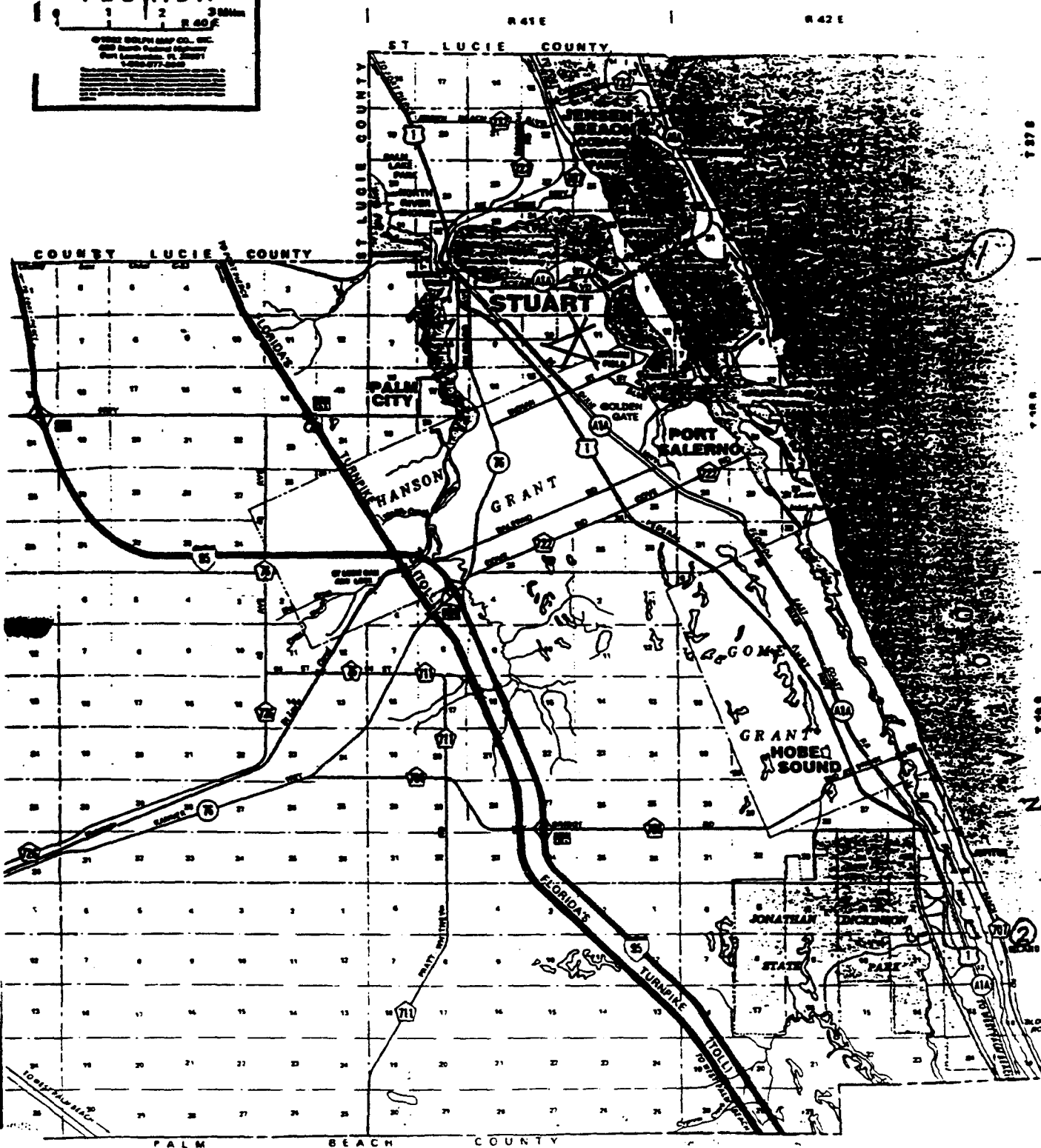
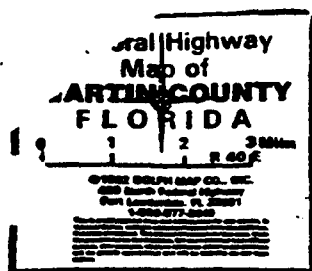
Sincerely,



Donald E. Holloman, P.E.
County Engineer

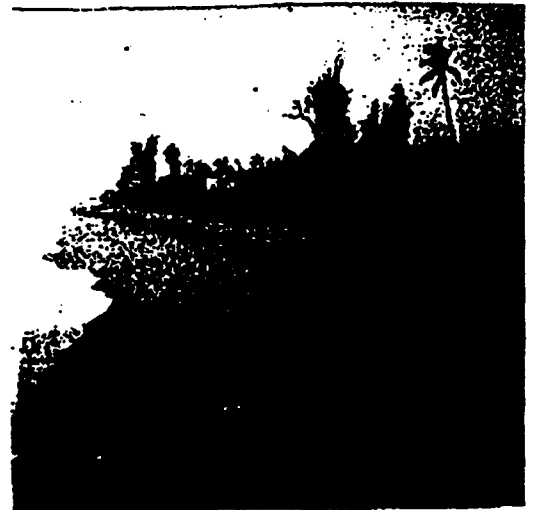
DEH/JL/pmr

cc: County Commissioners, Martin County
Sue B. Whittle, County Administrator, Martin County
James Spurgeon, Town Manager, Town of Jupiter Island
Robert Denison, Director, Parks Department, Martin County
Richard Moyes, Superintendent of Beaches & Waterways, Martin County





02-12-92
SOUTH SIDE OF
NORMAN
NO. ELEVATION



02-12-92 - FROM
NORMAN TO BOIES.
SOUTH ELEVATION 383 SOUTH BEACH
JUPITER ISLAND



02-12-92 - WOBST
IN BACK GROUND.
WEST ELEVATION 383 So. Beach
JUPITER ISLAND



02-12-92 SOUTH
SIDE OF NORMAN
NORTH ELEVATION 383 So Beach
JUPITER ISLAND

Post-It™ brand fax transmittal memo 7671		# of pages 1
To: Mike Smith	From: Dennis Hargrove	
Carry Corp of Eng	Chmn of Jupiter Is.	
Dept.	Phone #	
	407-546-5011	
Fax #	Fax #	
1-904-791-2251	407-546-6228	



DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019
March 6, 1992

REPLY TO
ATTENTION

Programs and Project Management Division
Project Management Branch

Ms. Sue B. Whittle
County Administrator
2401 SE. Monterey Road
Stuart, Florida 34996

Dear Ms. Whittle:

This is in response to your February 7, 1992, letter regarding the shore protection project that was authorized for the northern 4 miles of Hutchinson Island in Martin County by the Water Resources Development Act of 1990.

Our office appreciates your concern for expediting the preconstruction engineering and design (PED) process. We intend to utilize all available information to the extent practicable during PED. This will include the consultant's reports on the environmental and geotechnical studies that have already been provided by Martin County and the data from the Coast of Florida Erosion and Storm Effects study. It is currently anticipated that the Coast of Florida study would be initiating a feasibility study along that region of the Atlantic coast during the timeframe that the Plans and Specifications (P&S) are being prepared for this project. Therefore, data from the study may not be available for use during PED.

The current schedule for completion of PED is for preparation of an economic update, a General Design Memorandum (GDM), and P&S by September 1995. The GDM is needed to update the project to current site conditions and current Federal guidelines, in order to prepare for construction. The P&S are needed in order to advertise a construction contract. It is anticipated that the GDM can be completed and approved by the latter part of 1993 with the provision of additional funds in FY 93. P&S would be initiated in FY 94 and completed in FY 95 with additional funds. A capability to expend construction funds would not be expressed under the normal budget process until after approval of the GDM. Since the budget cycle is 2 years ahead of the current fiscal year, the expenditure of construction funds would not be anticipated until FY 96 based upon approval of the GDM in the latter part of 1993 or early in FY 94. The initiation of construction would be subject to the availability of funds.

The county's concern in regard to expediting the PED process and funding for the project is understood. Our office will maintain close coordination with the county on the preparation of

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534

-2-

the necessary documents and proceed towards construction of the project as expediently as we can within our scheduling and funding capabilities.

I hope this information is sufficient response for your needs. If you need additional information, please call Mr. Charles Stevens at 904-791-2113.

Sincerely,



Richard E. Bonner, P.E.
Deputy District Engineer
for Project Management

MAR 02 1992

Programs and Project Management Division
Project Management Branch

Mr. Richard C. Higgins, Jr.
1550 NE. Ocean Boulevard
Hutchinson House #203C
Stuart, Florida 34996

Dear Mr. Higgins:

This is in regard to your January 18, 1992, letter regarding shore protection for Martin County, Florida. Congress, by means of the Water Resources Development Act of 1990, authorized a shore protection project for the northern 4 miles of Martin County on Hutchinson Island. We have recently initiated preconstruction engineering and design (PED) for this project. PED includes the preparation of a General Design Memorandum (GDM) and plans and specifications (P&S). The GDM is a report that updates the project scope, cost, environmental considerations, etc. to current site conditions and guidelines. P&S must be prepared in order to advertise a construction contract and are scheduled for completion by September 1995. A capability to expend construction funds would not be expressed under the normal budget process until after approval of the GDM.

The groin referenced in your letter will be evaluated as part of P&S preparation to determine whether any modification will be needed for safety reasons. If you need additional information, please call Mr. Charles Stevens, the project manager, at 904-791-2113.

Sincerely,

SIGNED: Richard E. Bonner

Richard E. Bonner, P.E.
Deputy District Engineer
for Project Management

MSchultz/CESAJ-DP-I
le/3137 2/14, 28
CStevens/CESAJ-DP-I
DDuke/CESAJ-DP-A
RBonner/CESAJ-DP



DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019
February 24, 1992

REF: TO
ATTENTION: D.

Programs and Project Management Division
Project Management Branch

Honorable Tom Lewis
House of Representatives
Rayburn House Office Building
Washington, DC 20515

Dear Mr. Lewis:

This is in response to your January 16, 1992, letter regarding the shore protection project that was authorized for 4 miles on Hutchinson Island in Martin County by the Water Resources Development Act of 1990. As discussed in the January 7, 1992, letter from Ms. Mary Dawson, our office has initiated Preconstruction Engineering and Design (PED) for the project.

The current schedule for completion of PED is for preparation of an economic update, a General Design Memorandum (GDM), and Plans and Specifications (P&S) by September 1995. The GDM is needed to update the project to current site conditions and current Federal guidelines in order to prepare for construction. The P&S are needed in order to advertise a construction contract.

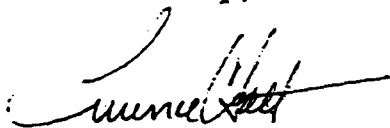
Our FY 92 work allowance provided \$310,000 to initiate PED. It is anticipated that the GDM can be completed and approved by the latter part of 1993 with the provision of additional funds in FY 93. P&S would be initiated in FY 94 and completed in FY 95 with additional funds. A capability to expend construction funds would not be expressed under the normal budget process until after approval of the GDM.

The county's concern in regard to expediting the PED process and funding for the project is understood. Our office will maintain close coordination with the county on the preparation of the necessary documents and proceed towards construction of the project as expediently as we can within our scheduling and funding capabilities. As discussed in your letter and in a telephone conversation between Ms. Ann Decker of your office and Mr. Charles Stevens of our office on February 11, 1992, we will be glad to send a representative to Martin County to discuss their concerns.

- 2 -

I hope this information provides a sufficient response to your letter. If any additional information or assistance is needed, please call me or Mr. Richard Bonner, Deputy District Engineer for Project Management, at 904-791-2586.

Sincerely,



Terrence C. Salt
Colonel, U.S. Army
District Engineer

Copy Furnished:

Commander, U.S. Army Corps of Engineers (CECW-L)
Commander, South Atlantic Division (CESAD-PM)
Ms. Mary Dawson, Chairman, Martin County Board of County
Commissioners, 2401 S.E. Monterey Road, Stuart, Florida 34996



REPLY TO
ATTENTION 3F

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

February 24, 1992

Programs and Project Management Division
Project Management Branch

Honorable Bob Graham
United States Senator
ATTN: Ms. Becky Liner
Post Office Box 3050
Tallahassee, Florida 32315

Dear Senator Graham:

This is in response to your January 29, 1992, letter regarding the shore protection project that was authorized for 4 miles on Hutchinson Island in Martin County by the Water Resources Development Act of 1990. As discussed in the January 7, 1992, letter from Ms. Mary Dawson, our office has initiated Preconstruction Engineering and Design (PED) for the project.

The current schedule for completion of PED is for preparation of an economic update, a General Design Memorandum (GDM), and Plans and Specifications (P&S) by September 1995. The GDM is needed to update the project to current site conditions and current Federal guidelines in order to prepare for construction. The P&S are needed in order to advertise a construction contract.

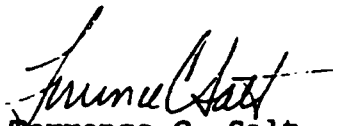
Our FY 92 work allowance provided \$310,000 to initiate PED. It is anticipated that the GDM can be completed and approved by the latter part of 1993 with the provision of additional funds in FY 93. P&S would be initiated in FY 94 and completed in FY 95 with additional funds. A capability to expend construction funds would not be expressed under the normal budget process until after approval of the GDM.

The county's concern in regard to expediting the PED process and funding for the project is understood. Our office will maintain close coordination with the county on the preparation of the necessary documents and proceed towards construction of the project as expediently as we can within our scheduling and funding capabilities.

- 2 -

I hope this information provides a sufficient response to your letter. If any additional information or assistance is needed, please call me or Mr. Richard Bonner, Deputy District Engineer for Project Management, at 904-791-2586.

Sincerely,


Terrence C. Salt
Colonel, U.S. Army
District Engineer

Copy Furnished:

Commander, U.S. Army Corps of Engineers (CECW-L)
Commander, South Atlantic Division (CESAD-PM)
Ms. Mary Dawson, Chairman, Martin County Board of County
Commissioners, 2401 S.E. Monterey Road, Stuart, Florida 34996



DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019
February 12, 1992

Handwritten notes and initials: "C. J. P. M. S. M. A. S. 2/19/92"

REPLY TO
ATTENTION OF

Programs and Project Management Division
Project Management Branch

Mr. Richard Noyes
Superintendent of Beaches and Waterways
2401 N. Federal Highway
Stuart, Florida 34996

Dear Mr. Noyes:

This is in response to your January 6, 1992, letter regarding the shore protection project that was authorized for Martin County on Hutchinson Island by the Water Resources Development Act of 1990.

Our office appreciates your assistance and the update you provided on the existing conditions along the project area during the November 13, 1991, design conference in Jacksonville. The Memorandum for the Record for the design conference will be sent to you as soon as it is approved by our headquarters. We intend to utilize all available information to the extent practicable during preconstruction engineering and design (PED) of the project. Thank you for the consultant's reports on the environmental and geotechnical studies that you have already provided for our use. Please contact Mr. Michael Dupes of our office at 904-791-2325 to determine whether the digitized environmental data you mentioned in your letter can be utilized during the preparation of the design documents for the project.

As discussed with Mr. Charles Stevens of our office on February 6, 1992, the current schedule for completion of PED is for preparation of an economic update, a General Design Memorandum (GDM), and Plans and Specifications (P&S) by September 1995. The GDM is needed to update the project to current site conditions and current Federal guidelines in order to prepare for construction. The P&S are needed in order to advertise a construction contract.

310,000

In FY 92 our work allowance provided ~~\$350,000~~ to initiate PED. The current estimate of the funding that will be needed to complete PED is \$300,000 in FY 93 for completion of the GDM, \$100,000 in FY 94 to initiate the P&S, and \$200,000 in FY 95 to complete the P&S. This schedule and cost estimate is subject to change as we proceed towards construction.


-2-

It is anticipated that the GDM can be completed and approved by the latter part of 1993. After approval of the GDM, initiation of construction is dependent upon congressional funding.

The county's concern in regard to expediting the PED process and funding for the project is understood. Our office will maintain close coordination with the county on the preparation of the necessary documents and proceed towards construction of the project as expediently as we can within our scheduling and funding capabilities.

I hope that this information is sufficient for your needs. If you need additional information, please call Mr. Charles Stevens at 904-791-2113.

Sincerely,


Richard E. Bonner, P.E.
Deputy District Engineer
for Project Management

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996



Robert Denison, Director

PARKS DEPARTMENT
2980 S.E. Dixie Hwy.
Stuart, Florida 34997

Phone (407) 281

October 14, 1991

File: MS-LT-92-014.1

Charlie Stevens, Project Manager
U.S. Army Corp of Engineers
Jacksonville District
CESHA-DP-1
P.O. Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Stevens:

Enclosed are copies of the Summary Report and the Coastal Engineering and Environmental Studies for the Martin County 4 Mile Beach Nourishment Project. These studies were commissioned by the Martin County Board of Commissioners to explore indepth the environmental issues surrounding this project and establishing the baseline preproject conditions within the project area.

There is still a baseline turbidity monitoring study that has not been completed but will be sent to you once it is delivered.

These documents are for the use of your office. If you have any questions, please contact this office at the above phone number.

Sincerely,

Richard A. Noyes

Richard A. Noyes
Superintendent of Beaches and Waterways

ENCLOSURES ALREADY
Provided to Dr. Atm
10/23/91

M. J. L.

cc: Robert F. Denison, Parks Director

RAN/kh

FRANK A. WACHA
District 1JEFF KRAUSKOPF
District 2WALTER W. THOM, JR.
District 3Chairman
MAGGY HURCHALLA
District 4Vice Chairman
MARY E. DAWSON
District 5BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996

JOSEPH R. GRASSIE • County Administrator

PHONE (407) 288-5422

COUNTY OF MARTIN



STATE OF FLORIDA

October 10, 1991

File: CO-92-MH-12A

Richard E. Bonner, P. E.
Deputy District Engineer for
Project Management
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Bonner,

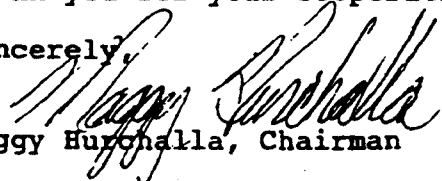
Martin County has been approached to provide correspondence to the Martin County Chapter of the Florida Shore and Beach Preservation Association that pertains to the 4 Mile Beach Nourishment Project on Hutchinson Island. At the regular meeting of the Board of County Commissioners on September 24, 1991, the Board voted to request that your office copy this organization directly with any correspondence pertaining to this project and send it to:

The Martin County Chapter
Florida Shore and Beach Preservation Assn.
c/o 2355 Northeast Ocean Blvd.
Stuart, FL 34996

Please contact Richard Noyes, Superintendent of Beaches and Waterways in the Parks and Recreation Department if you require further information.

Thank you for your cooperation in this matter.

Sincerely,


Maggy Hurchalla, Chairman

cc: Frank A. Wacha, County Commissioner
Sue Whittle, County Administrator
David Collier, Assistant County Administrator
Kay Curiel, President, Martin County Chapter FSBPA

RFD/RAN/kh

GSV
MS
mml 9/19/91

September 12, 1991

**Programs and Project Management Division
Project Management Branch**

**Mr. Richard A. Noyes
Superintendent of Beaches and Waterways
2401 SE. Monterey Road
Stuart, Florida 34996**

Dear Mr. Noyes:

This is in response to your June 17, 1991, letter regarding the shore protection project that was authorized for the northern 4 miles of Martin County on Hutchinson Island by the Water Resources Development Act of 1990. As you know, the FY 92 budget contains \$350,000 to initiate Preconstruction Engineering and Design (PED) for this project. However, no work can begin until a work allowance is provided by our higher authority. At present, it is anticipated that PED may be initiated around November 1991. Additional funds will be required to complete PED.

When the FY 92 work allowance is provided, our office will initiate preparation of the General Design Memorandum (GDM), which is a report that updates the project to current site conditions and current Federal guidelines in order to prepare for construction. In addition, PED includes preparation of the Plans and Specifications (P&S) that are needed in order to advertise a construction contract. The initiation of construction will depend upon the availability of funds.

Our office will coordinate the schedule for completion of the GDM with Martin County when the FY 92 work allowance is provided. In general, a GDM requires about 2 years to complete. During the second year, P&S can sometimes be initiated when funds are available and the GDM is nearing completion. However, sufficient review of the GDM has to be accomplished prior to initiating the P&S. The P&S usually require about 1 year to complete. A Local Cooperation Agreement (LCA) will also have to be executed prior to advertisement of the construction contract. Advertisement and award of the contract generally require a total of 2 months after approval of the GDM, P&S, and execution of the LCA.

We will be glad to hold a meeting either at our District office or at your office when PED is initiated. In order to

- 2 -

determine the scope of the field work that will need to be accomplished during PED, we will coordinate with Martin County to ensure that the data acquired by the county since completion of the feasibility report in 1985 is utilized to the maximum extent practicable. At the present time, planning for the non-Federal source of the project's construction cost is an important item that the county may want to continue to pursue.

I hope that this information is sufficient for your needs. If you need additional information, please call Mr. Charles Stevens at 904-791-2113.

Sincerely,

~~Joseph R. Burns~~

Richard E. Bonner, P.E.
Deputy District Engineer
for Project Management

Joseph R. Burns
Executive Assistant

CStevens/CESAJ-DP-I
le/3137 9/5
DDuke/CESAJ-DP-A
EMiddleton/CESAJ-EN
RBonner/CESAJ-DP



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

June 24, 1991

Programs and Project Management Division
Project Management Branch

Honorable Connie Mack
United States Senator
1342 Colonial Boulevard
Suite 27
Fort Myers, Florida 33907

Dear Senator Mack:

This is in response to your June 3, 1991, letter regarding the shore protection project that was authorized for Hutchinson Island in Martin County by the Water Resources Development Act of 1990. As discussed in our March 7, 1991, letter to Mrs. Maggy Hurchalla, a copy of which is enclosed, our office is prepared to initiate Preconstruction Engineering and Design (PED) when Federal funds are provided. The President's FY 92 budget included \$350,000 to initiate PED. As you know, work can not begin until the Congressional appropriations committee includes this in an appropriations bill and a work allowance is provided by our higher authority.

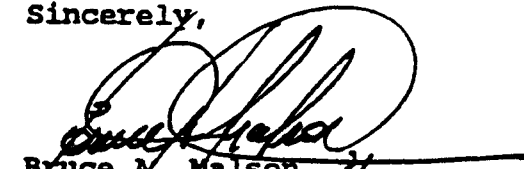
When funds are provided for the initiation of PED, our office will coordinate a schedule for completion of the General Design Memorandum (GDM) with the Martin County Board of County Commissioners. The GDM is a report that updates the project to current site conditions and current Federal guidelines in order to prepare for construction. In addition, PED includes preparation of the Plans and Specifications that are needed in order to advertise a construction contract. The initiation of construction will depend upon the availability of funds.

A Local Cooperation Agreement (LCA) will be required to be executed between Martin County, acting as the local sponsor, and the Assistant Secretary of the Army for Civil Works (ASA(CW)) prior to construction. A financing plan for provision of the non-Federal share of the project's cost will be needed from Martin County and will be part of the LCA package that is forwarded to the ASA(CW). These documents will be prepared when the GDM is nearing completion. All that is needed from Martin County at this time is a letter indicating their continued support for and willingness to cost share in the project. This information was provided in their March 26, 1991, letter and is satisfactory for our purposes.

-2-

I hope that this information provides a sufficient response to your letter. If any additional information or assistance is needed, please call me or my Deputy for Project Management, Mr. Richard Bonner, at 904-791-2586.

Sincerely,



Bruce A. Malson
Colonel, U.S. Army
District Engineer

Enclosure

Copy Furnished (w/Encl):
Commander, U.S. Army Corps of Engineers (CECW-L)
Commander, South Atlantic Division (CESAD-PM)

Copy Furnished (wo/Encl):
Mrs. Maggy Hurchalla
Chairman, Martin County
Board of County Commissioners
2401 S.E. Monterey Road
Stuart, Florida 34996

APR 22 1991

Programs and Project Management Division
Project Management Branch

Ms. Marjorie Belcher
Performance 500 Properties
500 N. Federal Highway
Stuart, Florida 34994

Dear Ms. Belcher:

This is in response to your February 19, 1991, letter regarding the shore protection project that was authorized for the northern four miles of Martin County on Hutchinson Island by the Water Resources Development Act of 1990. The President's FY 92 budget included \$350,000 to initiate Preconstruction Engineering and Design (PED). However, no work can begin until the Congressional Appropriations Committee includes this in an appropriations bill and a work allowance is provided by our higher authority. At present there is no schedule for the initiation of construction of the project.

When PED funds are provided, our office will prepare the General Design Memorandum (GDM), which is a report that updates the project to current site conditions and current Federal guidelines in order to prepare for construction. In addition, PED includes preparation of the Plans and Specifications that are needed in order to advertise a construction contract. The initiation of construction will depend upon the availability of funds. Our office will coordinate the schedule for completion of the GDM with the Board of County Commissioners, the local sponsor for the project, as soon as PED funds are provided.

The authorized project features consist of a beach fill cross section that includes: restoration of the primary dune width of 20 feet at an elevation of +12 feet Mean Sea Level (MSL), a 35 foot wide berm at +8 feet MSL, and a foreshore slope of 1 vertical on 8.5 horizontal (1V:8.5H) to mean low water, then 1V:20H to the existing bottom. In addition, approximately eight years of advanced nourishment would be placed in front of the design cross section during initial construction as part of the construction profile.

I hope that this information is sufficient for your needs. If you need additional information, please call Mr. Charles Stevens at 904-791-2740.

Sincerely,

SIGNED: Dennis R. Duke
Richard E. Bonner, P.E.
Deputy District Engineer
for Project Management

CStevens/CESAJ-DP-I
DDuke/CESAJ-DP-A
RBonner/CESAJ-DP

MAY-02-1991 10:10 FROM PARKS DEPARTMENT

TO 8-9047911213

P.02

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996

FILE COPY**COUNTY OF MARTIN****STATE OF FLORIDA**

Robert Denison, Director
April 22, 1991

PARKS DEPARTMENT
2980 S.E. Dixie Hwy.
Stuart, Florida 34997

Phone (407) 288-5690
File: MS-IT-91-148

Stan Tait, President
Florida Shore and Beach Preservation Association
864 East Park Avenue
Tallahassee, Florida 32301

Dear Stan:

Enclosed are abstracts for two talks:

1. Comprehensive Beach Management
2. The Political Process of a Beach Nourishment Project

The second talk is designed to kick off a series of talks by Applied Technology and Management, Mote Marine Laboratories Dr. Thomas Curtis, and the Army Corps of Engineers on the Proposed 4 Mile Beach Nourishment Project in Martin County.

Please contact this office if these topics are of interest for the annual meeting or if you have any questions or concerns.

Sincerely,

A handwritten signature in dark ink, appearing to read "Rich Noyes", is written over the typed name.

Richard A. Noyes
Superintendent of Beaches and Waterways

cc: Robert F. Denison, Parks Director

Enclosures

RAN/kh

MAY-02-1991 10:11 FROM PARKS DEPARTMENT

TO 8-9047911213

P.03

ABSTRACTCOMPREHENSIVE BEACH MANAGEMENT

SPEAKER: Richard A. Noyes
Superintendent of Beaches and Waterways
Martin County Parks Department
2980 S. E. Dixie Hwy.
Stuart, Florida 34997 Phone: (407) 288-5690

This paper discusses beach management from a comprehensive perspective. It explores the major activities of beach management:

1. Growth management and strategic policy.
2. Beach operations including safety, security and maintenance.
3. Public facility development and coastal engineering.

Each one of these activities is broken out into its component parts so that each sub program can be examined and common management problems can be identified across disciplines. The paper discusses in detail the interrelation of all aspects of beach management and the resources available that can be shared by each player in a beach program.

FILE: MS91.019

MAY-02-1991 10:11 FROM PARKS DEPARTMENT

TO 8-9047911213

F.04

ABSTRACT**THE POLITICAL PROCESS OF A BEACH NOURISHMENT PROJECT**
A CASE STUDY IN MARTIN COUNTY

SPEAKER: Richard A. Noyes
Superintendent of Beaches and Waterways
• Martin County Parks Department
2980 S. E. Dixie Hwy.
Stuart, Florida 34997 Phone: (407) 288-5690

This talk is intended to lead into a panel discussion of the Martin County proposed 4 Mile Beach Nourishment Project. This talk will provide the overview of the political and staff process chosen to evaluate and campaign the beach erosion control alternatives and specifically look at the environmental, economic, regulatory, and political aspects of getting a Federal beach nourishment project off the ground. Other panel members will discuss the specific findings of the environmental study, economic study, Feasibility Study and inlet management study that all interrelate in Martin County.

FILE: ME91020

559

552

FRANK A. WACHA
District 1

JEFF KRAUSKOPF
District 2

WALTER W. THOM, JR.
District 3

Chairman
MAGGY MURCHALLA
District 4

C.S.
Vice Chairman
MARY E. DAWSON
District 5

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996

JOSEPH R. GRASSIE • County Administrator

COUNTY OF MARTIN



PHONE (407) 288-5422

STATE OF FLORIDA

March 26, 1991

File: CO-91-MH-313A

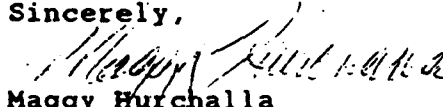
Richard E. Bonner, P. E.
Deputy District Engineer for
Project Management
Jacksonville District Corps of Engineers
P. O. Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Bonner:

This letter indicates Martin County's support of the Proposed 4 Mile Beach Nourishment Project and its willingness to cost share in the design and construction of this project as approved unanimously by the Board at the regular meeting of the Board of County Commissioners on March 26, 1991.

Please let this office know if there is anything further that is needed to proceed with this project.

Sincerely,


Maggy Murchalla
Chairman

cc: Florida Congressional Delegation

RAN/kh

MAR 7 1991

**Programs and Project Management Division
Project Management Branch**

**Mrs. Maggy Hurchalla
Chairman
Martin County Board of County Commissioners
2401 S.E. Monterey Road
Stuart, Florida 34996**

Dear Mrs. Hurchalla:

This is in regard to the shore protection project that was authorized for Hutchinson Island in Martin County by the Water Resources Development Act of 1990. As discussed during the County Commission meeting on January 22, 1991, by Mr. Charles Stevens of our office, we are prepared to initiate Preconstruction Engineering and Design (PED) when Federal funds are provided. The President's FY 92 budget included \$350,000 to initiate PED. However, no work can begin until the Congressional appropriations committee includes this in an appropriations bill and a work allowance is provided by our higher authority.

When PED funds are provided, our office will prepare the General Design Memorandum (GDM), which is a report that updates the project to current site conditions and current Federal guidelines in order to prepare for construction. In addition, PED includes preparation of the Plans and Specifications that are needed in order to advertise a construction contract. The initiation of construction will depend upon the availability of funds.

At the initiation of PED we will coordinate a schedule for field data collection and completion of the GDM with your office. The field data to be collected during the first fiscal year that PED funds are provided will include a beach profile survey and additional borrow source information. These data will be incorporated into the economic analyses for the GDM.

A Local Cooperation Agreement (LCA) will be required to be executed between Martin County, acting as the local sponsor, and the Assistant Secretary of the Army for Civil Works (ASA(CW)) prior to construction. A financing plan for provision of the non-Federal share of the project's cost will be needed from Martin County. It will be part of the LCA package that is forwarded to the ASA(CW). The non-Federal share of PED cost is based upon the final cost sharing percentage associated with the project and is included in the cost of construction. The non-Federal share of the PED cost is provided along with the non-Federal share of the construction cost for that year during the first year of construction.

-2-

Enclosed is a copy of the "Sponsor's Partnership Kit", which is a document prepared by the Corps of Engineers to familiarize local sponsors with implementation of projects.

At this time a letter is needed from the Martin County Board of County Commissioners indicating support for implementation of the project, and expressing a willingness to cost share in PED and construction of the project as the local sponsor.

I hope that this information will assist you in understanding the process that is underway for implementation of the project for Martin County. If you need additional information please call me at 904-791-2586, or Mr. Stevens, the project manager, at 904-791-2740.

Sincerely,

SIGNED: Richard E. Bonner

Richard E. Bonner, P.E.
Deputy District Engineer
for Project Management

Enclosure

Copy Furnished (w/encl):

Mr. Joseph R. Grassie
County Administrator
2401 S.E. Monterey Road
Stuart, Florida 34996

Ms. Bonnie Dearborn
Intergovernmental Relations
2401 S.E. Monterey Road
Stuart, Florida 34996

Mr. Richard A. Noyes
Director, Division of Marine Safety
Martin County Parks Department
2980 S.E. Dixie Highway
Stuart, Florida 34997

bcf:
CESAJ-EN-HC
CESAJ-PD
CESAJ-RE

FRANK A. WACHA
District 1

Chairman
TOM HIGGINS
District 2

Vice-Chairman
THOMAS G. KENNY, III
District 3

MAGGY MURCHALL
District 4

JOHN W. HOLT, JR.
District 5

BOARD OF COUNTY COMMISSIONERS
50 Kindred Street • Stuart, Florida 33497

ROBERT M. OLDLAND • County Administrator

PHONE (305) 283-6760

COUNTY OF MARTIN



STATE OF FLORIDA

CO-85-TJH-2
October 2, 1985

Colonel Charles T. Myers, III
District Engineer
U.S. Army Corps of Engineers
400 W. Bay Street
Jacksonville, FL 32232-0019

Dear Colonel Myers;

This is in reference to the draft feasibility report and environmental impact statement for beach erosion control in Martin County, Florida as provided for review by letter dated July 17, 1985 and as presented by the Corps of Engineers to the Martin County Commission at Public Meeting on August 27, 1985.

At this meeting the Commission authorized this letter of intent to comply with the items of local cooperation listed in the referenced report and presentation, following a presentation by our Staff on the report recommendations.

It is understood that the items of local cooperation will be specifically set forth with mutual accord in an agreement to be executed at a future date by the U.S. Army Corps of Engineers and Martin County. Such agreement shall be made contingent upon Congressional authorization and subject to the availability of funds for Martin County.

Sincerely,

Thomas J. Higgins
Chairman

TJH:RHO/kl

cc: A.J. Salem, Chief, Planning Division, Corps of Engineer
Board of County Commissioners
County Administrator
County Attorney
Public Works Director

Appendix E

**Proposed Hardbottom Monitoring
and Mitigation Plan**

**Martin County Shore Protection Project
Hutchinson Island, Martin County, Florida**

PROPOSED HARDBOTTOM MONITORING AND MITIGATION PLAN

I. INTRODUCTION

Aerial photographs, side scan sonar surveys, and underwater visual assessments utilizing SCUBA have shown that coquina limestone outcrops and hardened structures built by the marine bristle worm, *Phragmatopoma lapidosa*, are found scattered throughout the Martin County portion of Hutchinson Island extending from the northern county line southward to the St. Lucie Inlet. The majority of this hardbottom habitat begins just offshore in approximately 8.0 feet (2.4m) of water and extends eastward to approximately 20.0 feet (6.1m) of water (refer to Appendix D). An interagency group of environmental scientists representing the U.S. Army Corps of Engineers (Corps), U.S. Fish and Wildlife Service (FWS), Florida Department of Environmental Protection (DEP), and Martin County Growth Management Department (County) made a series of underwater inspections of the area in July, 1993. The purpose of these inspections was primarily to ascertain the accuracy of the side scan sonar maps and to generalize many of the hardbottom reef tracts as they pertain to apparent biological productivity (and ecological importance).

A direct negative impact associated with beach nourishment projects is the possibility that these hardbottom areas may be completely buried from the placement of sand onto the eroded project beach. An indirect but equally important negative impact associated with placing sand onto an eroded beach is the possibility that the hardbottom habitat seaward of the project beach may be subjected to increases in turbidity, sedimentation, and resuspension of sediment into the water column. The degree to which these hardbottom areas may be impacted depends upon the type of geological material (% silt) settling on them, the physical dynamics of the area (such as waves and currents), the relief of the hardbottom habitat, the composition of the hardbottom habitat (limestone vs. living rock such as worm rock or scleractian corals), and the amount of encrusting or sessile organisms attached to the hardened structures.

The intertidal and nearshore waters along the project beach are very dynamic and possess high wave energy that routinely produces high turbidity, sedimentation, scouring, and periodically buries nearshore low relief hardbottom habitat. Such physically dynamic nearshore oceanographic conditions make assessing changes to the hardbottom habitat along the project area extremely difficult. Natural conditions found in this area tend to make turbid conditions and bottom scouring a routine occurrence. Furthermore, much of the low relief limestone habitat in shallow water is subjected to continual burial and re-

exposure depending upon the physical conditions at the time.

Based upon previous underwater assessments, a portion of the nearshore hardbottom habitat is not considered "ecologically important" and should not be subject to any mitigation requirements. These low relief (less than 1.0 feet/0.3m) limestone outcrop areas are ephemeral in nature and support little or no encrusting or sessile organisms due to constant sand scouring. Because of the lack of food resources, few if any fish are observed around these areas. An attempt to locate and "classify" these areas will be undertaken prior to beach nourishment construction. The purpose of this classification is to determine which hardbottom areas contain permanent and significant biological communities and would therefore be "ecologically important" and subject to any future monitoring and mitigation efforts. This classification will be arrived at by an interagency team of environmental scientists assessing each reef tract with the aid of a classification form that is attached at the end of this Appendix.

In order to accurately document the permanency and biological productivity of the hardbottom habitat that may be subjected to possible impacts from the beach nourishment project, it is essential to undertake a thorough pre- and post-construction monitoring plan. By statistically comparing data collected within the project area to baseline conditions outside the project area (control stations), it may be possible to attribute any increases in turbidity, sedimentation rates, and scouring events to the placement of sand onto the eroding project beach. With the aid of computer models, coastal engineers currently estimate that the beach nourishment project will not directly impact (bury) any hardbottom habitat adjacent to the fill area.

It is anticipated that the gradual flow of sand from the project beach south towards the St. Lucie Inlet over a period of years will not pose any secondary impacts to the hardbottom areas located south of the project area (approximately between monuments R-23 and R-42). Whether or not these areas are actually impacted or not will be quantitatively assessed with the aid of an extensive and thorough monitoring program.

II. MONITORING PLAN

A total of nine (9) transects will be placed across hardbottom areas. The exact locations of these transects can be seen in Appendix D. The location of these sampling transects within and just south of the project area is also included at the end of this Appendix. Of the nine transects, one is located north of the project area, four within the project area, and four south of the project area. The criteria for sampling selection

was cumulative number of reef tracts present, distance (west to east) from mean high water, and distance from project area (north-south). The locations of these transects are expected to be sensitive to seaward shifts of sand as the renourished beach reaches equilibrium with the surrounding topography as well as any sand transported south due to longshore drift.

Assessing the hardbottom habitat within the possible influence of the beach fill project will consist of undertaking the following:

- a. changes in overall **sedimentation levels** will be quantified by installing a PVC stake adjacent to a selected hardbottom area and measuring from a predetermined measuring point down to the sediment surface. This will determine the changes (height) in bottom sediment levels over time. All appropriate safety measures will be undertaken to ensure that the stake will not present any hazard to swimmers or surfers.
- b. natural and project induced changes in **suspended solids** will be quantified by installing sediment traps/tubes one meter off the bottom as well as taking secchi depths from a boat during each sampling visit. A turbidimeter will be used to assess turbidity conditions *in situ*.
- c. important **physiochemical parameters** such as water temperature, salinity, and dissolved oxygen will be measured during each sampling trip.
- d. any change to **encrusting organisms** or **sessile algae** will be quantified utilizing a slight variation of the photogrammetric belt quadrat method. Briefly, this technique involves selecting 0.5m² permanent quadrat stations along a 30m transect line. By analyzing underwater photographs of permanent quadrats, changes in abundance, biodiversity, and percent coverage will be quantified. Only those areas that presently have encrusting or sessile organisms on them will be selected.
- e. along the 30m transect line used for photogrammetric assessment, a **fish census** utilizing a modified *Bohnsack-Bannerot Stationary Visual Census Technique* will be undertaken. This technique will allow information such as abundance, diversity, and estimated fish biomass to be collected during each sampling visit. A video will also be shot along the transect line.
- f. a quantitative as well as qualitative list of **epibenthic macroinvertebrates** will be established along the 30m transect line.
- g. interstation and intrastation **statistical comparisons** will be made in relation to control stations established north

and south of the project area. SAS along with a one-way ANOVA and t-test will be used to statistically compare pre- and post-project variables.

Just seaward of the projected equilibrium toe of fill influence (see Appendix D), there are numerous large sandy areas. It is these sandy areas adjacent to living worm rock habitat that will be the location for any future hardbottom mitigation requirements. The type of material to be used depends entirely on what type of material is available at that time as well as the location of the material that becomes available from. Every effort will be made to place flat and smooth clean concrete or limestone on sandy areas adjacent to existing worm rock. It is expected that the flat hard material will settle in the sand and allow for the remainder of the material to be placed on top of a hard substrate. An appropriate amount of various sized and shaped materials will be placed on this flat bedding material. By placing irregularly shaped material on top of itself, the amount of refuge space available to juvenile and cryptic species is increased. It is estimated that this material will be colonized by the adjacent sabellariid larvae as well as a variety of encrusting and sessile invertebrates. The hardbottom material will be brought to the area and dropped into the water by barge.

Pre- and post-monitoring by a selected contractor(s) will monitor selected areas approximately six (6) times per year (weather permitting) for a total of two years. The locations of these samplings transects are found in Appendix D. Past renourishment projects have indicated that infauna invertebrates along with motile species usually return to pre-construction abundances within two years after construction. Scientists from the Corps, FWS, National Marine Fisheries Service (NOAA), DEP, County, and the Florida Oceanographic Society will be invited by the selected contractor to participate in the monitoring activities prior to each field trip. Quarterly sampling will be undertaken to ascertain the level of seasonal variability. Two (2) additional sampling events will be taken just before and just after a "storm event" to assess changes attributed to the dynamic conditions found within the project area. It is important to note that physical conditions will be measured to determine what conditions were present that designated it as a storm event.

An annual report listing data collected and discussion of results to date and any possible trends will be produced. A final report will be written which assesses pre- and post-project variability and describes what impact, if any, the placement of sand on the beach may have had on adjacent biological resources.

CHARACTERIZATION OF HARDBOTTOM HABITAT
MARTIN COUNTY SHORE PROTECTION PROJECT
HUTCHINSON ISLAND, MARTIN COUNTY, FLORIDA

REEF TRACT LOCATION :

GENERAL HABITAT CHARACTERIZATION (POINTS ASSIGNED)

REEF RELIEF

0 : < 1 FOOT

3 : 1-3 FEET

5 : > 3 FEET

POINTS

ENCrustING/SESSILE ORGANISMS

0 : < 10% COVERAGE

3 : 10% - 50% COVERAGE

5 : > 50%

POINTS

EPIFAUNAL ABUNDANCE

0 : SCARCE (#^s/unit)

3 : MEDIUM (#^s/unit)

5 : PLENTIFUL (#^s/unit)

POINTS

FISH ABUNDANCE

0 : SCARCE (#^s/unit)

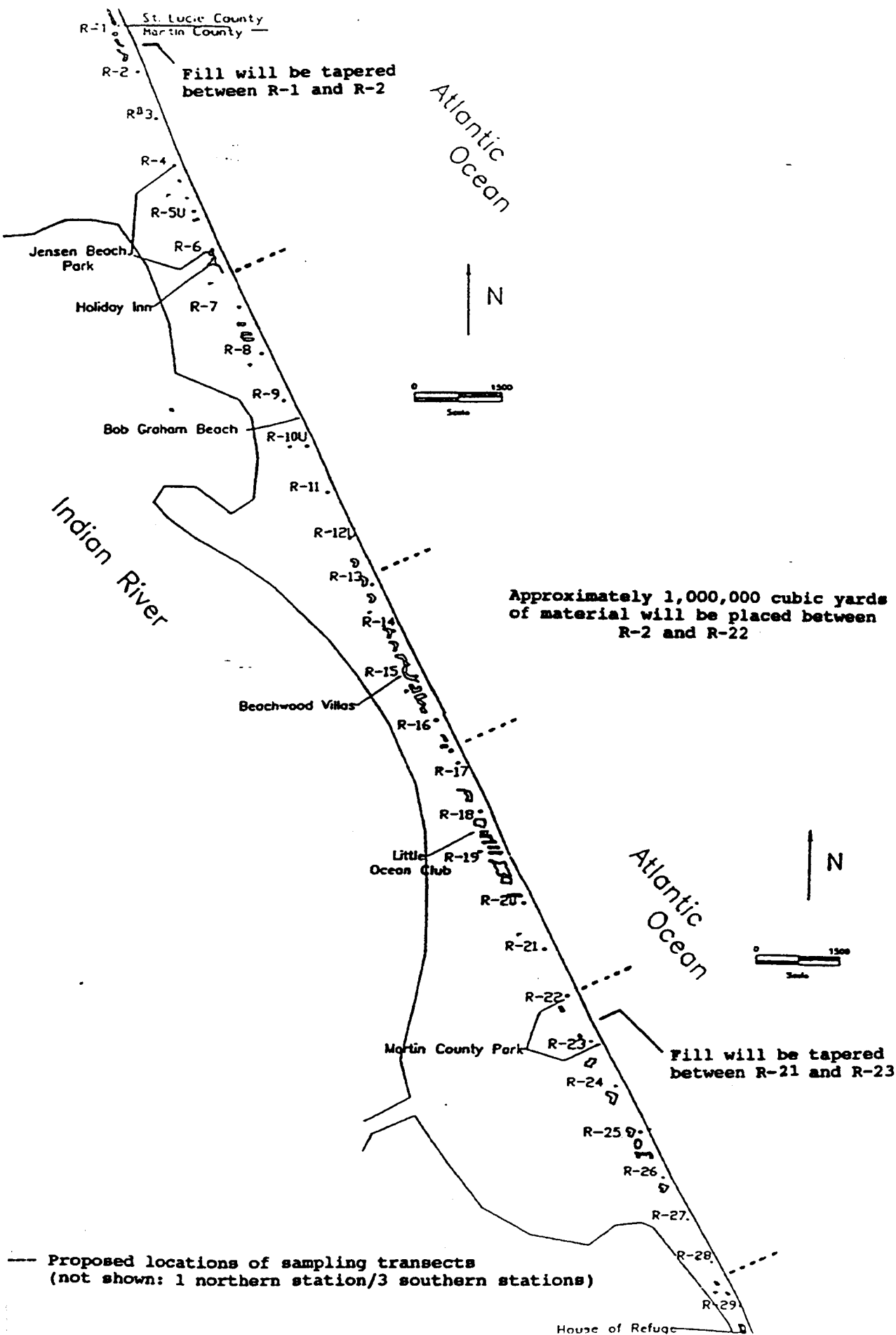
3 : MEDIUM (#^s/unit)

5 : PLENTIFUL (#^s/unit)

POINTS

AVERAGE =

REMARKS :



Appendix F

Relevant Correspondence

**Martin County Shore Protection Project
Hutchinson Island, Martin County, Florida**

MARSHAL L. WILCOX
District 1

JEFF KRAUSKOPF
District 2

JANET K. GETTIG
District 3

MAGGY MURCHALLA
District 4

CHARLENE HOAG
District 5

BOARD OF COUNTY COMMISSIONERS
2401 S.E. Monterey Road • Stuart, Florida 34996

COUNTY OF MARTIN



PHONE (407) 288-5400

STATE OF FLORIDA

June 9, 1994

ENG-CI-94-352L

Richard E. Bonner, P.E.
Deputy District Engineer for
Project Management
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

4-Mile Beach Renourishment Project
Martin County Project # 93E-CP-004

Dear Mr. Bonner:

This letter indicates Martin County's support for the reduction in the length of the beach nourishment project, and increasing the taper at the southern end. We agree with the Districts efforts to avoid direct environmental impacts to the hardgrounds at the southern end of the project. By these actions, we believe the District has developed an environmentally acceptable plan from the Federal, State, and local governments prospective.

Please let this office know is there is anything further that is needed to proceed with this project.

Sincerely,


Donald E. Holloman, P.E.
County Engineer

DEH:LAW:bb
s:\cipc352l.law

cc: Peter Cheney, County Administrator



Lawton Chiles
Governor

Florida Department of Environmental Protection

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Virginia B. Wetherell
Secretary

May 3, 1994

A. J. Salem, Chief
Planning Division
Department of the Army
Jacksonville District Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Salem:

Thank you for your letter providing a content and discussion summary of the meeting held on January 25, 1994, between Robert Brock, John Abendroth, and Mike Sole. In general, the contents of the document are an accurate depiction of the discussions held between our staff. However, I would like to point out some clarifications on a couple of issues.

Item number 1 identifies that the equilibrium toe line is considered accurate at this time. However, the Bureau of Wetland Resource Management has requested clarification of the projected equilibrium toe of fill for this project. The local sponsor's agent has submitted revised drawings which depict the construction toe of fill in a similar location as the projected equilibrium toe of fill in the "draft" General Design Memorandum for this project. Please contact Mr. John Abendroth of the Bureau of Wetland Resource Management for further information on this issue.

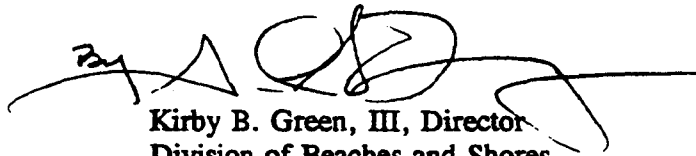
Item number 12 identifies the use of a nutrient "jump start" in dune plantings. This is presently considered to be acceptable in specific locations in which interaction with marine turtles is not considered to occur. More specifically, placing a form of compost, landward of the dune crest where marine turtle nesting activity is not anticipated, is acceptable.

Regarding item number 14, a post and rope fence should be used in regions where significant pedestrian activity is anticipated (such as public parks and accesses). Placing these structures along the entire project area may result in increased interaction with marine turtles, and upon significant storm events, increased waterborne debris. Appropriate locations for use should be further identified.

Mr. A. J. Salem
May 3, 1994
Page Two

Again, thank you for your letter and cooperation on this project. If you have any questions, or I can be of any assistance, please contact me at (904)487-4469 or the letterhead address, Mail Station 300.

Sincerely,

A handwritten signature in black ink, appearing to read "Kirby B. Green, III", with a long horizontal line extending to the right.

Kirby B. Green, III, Director
Division of Beaches and Shores

by Andrew S. Grayson

cc: John Abendroth
Michael Sole
Karyn Erickson (Applied Technology and Management, Inc.)
Donald Holloman, (County Engineer, Martin County)

April ²⁰/₄, 1994

Planning Division
Environmental Branch

Mr. Kirby Green
Florida Department of
Environmental Protection
Division of Beaches and Shores
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-2400

Dear Mr. Green:

On January 25, 1994, John Abendroff and Michael W. Sole of the DEP met with Robert J. Brock of my staff to discuss the Draft Environmental Assessment (DEA) of the Martin County Shore Protection Project. We were pleased that the meeting produced a productive and open exchange of ideas between biologists and a greater understanding of the information that was contained in the DEA. According to our notes of the meeting, several points were discussed and conclusions formulated. We have enclosed a list of those items for your review.

In order to ensure accuracy of what was discussed and concluded, we request a letter of concurrence from your office indicating that our recollection of the meeting is accurate. Please feel free to enclose any comments that you may have concerning the environmental discussions.

We thank you for your time and we look forward to working with your office to successfully implement the Martin County Project.

Sincerely,

A. J. Salem
Chief, Planning Division

Enclosures

Copy furnished:

Michael Sole, Florida Department of Environmental Protection
John Abendroff, Florida Department of Environmental Protection
Donald Holloman, County Engineer, County of Martin
Karyn Erickson, Applied Technology and Management, Inc.

**ENVIRONMENTAL DISCUSSIONS/AGREEMENTS
MARTIN COUNTY SHORE PROTECTION PROJECT
HUTCHINSON ISLAND, MARTIN COUNTY, FLORIDA**

1. The equilibrium toe line (line of closure) as estimated by the Corps must be considered accurate at this time.
2. The Corps will taper the beach fill between DEP monuments R-21 to R-23. No beach fill will be placed south of R-23.
3. A protective dune will be constructed between DEP monuments R-1 and R-23.
4. Standard precautions described in Section 9.00 of the DEA will be implemented to protect the West Indian manatee (*Trichechus manatus*).
5. Only low (< 10%) silt, beach compatible sand will be placed on the project beach.
6. Aerial photographs of the nearshore habitat along the project beach will be taken just before the project commences and annually (same time of year) for three (3) years after the project is completed.
7. It is currently estimated that no direct impacts (burial) of nearshore hardbottom habitat will occur. Therefore, no advance mitigation of hardbottoms is appropriate at this time.
8. There may be secondary impacts from increased sedimentation and turbidity to hardbottom areas seaward of the project beach as well as south towards the St. Lucie Inlet. To describe and quantify what secondary impacts, if any, occur to hardbottom habitat as a result of this beach nourishment project, a thorough multi-year (3 years) monitoring plan will be undertaken.
9. Monitoring data will be evaluated by an interagency (Corps, NMFS, FWS, DEP, County) team of scientists on an annual basis. These meetings will determine if and how much hardbottom habitat has been impacted due to the beach nourishment project. This annual meeting will also determine if further monitoring is justified and appropriate and if any modifications to the monitoring plan (contract) needs to be implemented.
10. The timing of the biological monitoring activities should be closely associated with post-project beach profile surveys.
11. If any future mitigation is appropriate, the mitigated material should closely resemble (relief, configuration, location) that of the impacted habitat.

12. Salt-tolerant vegetation should be a component of the sand dune restoration portion of the project.

13. A nutrient "jump start" for the salt tolerant vegetation in the form of compost is acceptable provided the compost is not spread over the entire area.

14. A rope fence will be constructed to keep the public away from the newly planted dune vegetation.

15. All dredging and beach nourishment activities must be undertaken between November 1st and April 15th, only.



DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

December 10, 1992

Environmental Branch
Planning Division

TO ADDRESSES ON THE ATTACHED LIST:

It is the intent of the Jacksonville District, U.S. Army Corps of Engineers, to prepare a General Design Memorandum (GDM) for construction of a 4-mile section of Hutchinson Island. The development of the Martin County Shore Protection Project is in response to a resolution adopted May 18, 1973 by the Committee on Public Works of the U.S. Senate. This particular project was authorized in the Water Resources Development Act of 1990. A brief description of the project is attached.

An Environmental Assessment (EA) is currently being prepared to provide updated environmental information on the project since completion of the revised Feasibility Report and Environmental Impact Statement (EIS) was published in June 1986. The EA will incorporate environmental information obtained from a study of the proposed project area that was undertaken in the summer and fall of 1990.

Please assist the Corps of Engineers in planning and evaluating the environmental impacts of the proposed project. We welcome your views, comments and information about resources, study objectives and important features within the described study area, as well as suggested improvements. Letters of comment or inquiry should be directed within thirty (30) days of the date of this letter to the letterhead address, attention of Planning Division, Environmental Coordination Section.

Sincerely,

A handwritten signature in cursive script, appearing to read "A. J. Salem".

A. J. Salem
Chief, Planning Division

Enclosures



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
9450 Koger Boulevard
St. Petersburg, Florida 33702

January 7, 1993

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

Dear Mr. Salem:

This is in response to your December 10, 1992 request for comments regarding the Martin County Shore Protection Project. The project involves renourishment of approximately 4.0 miles of beach adjacent to the Atlantic Ocean along Hutchinson Island in Martin County, Florida.

The Habitat Conservation Division has no comment to provide regarding the proposed project as it pertains to impacts on fishery habitats. However, issues regarding endangered species for which the National Marine Fisheries Service is responsible are addressed by our Protected Species Management Branch at the letterhead address above. If we can be of further assistance, please contact Mr. David N. Dale of our Panama City Branch Office at 904/234-5061.

Sincerely,

Andreas Mager, Jr.
Assistant Regional Director
Habitat Conservation Division

CC:
F/SEO2



November 3, 1992

Planning Division
Environmental Branch

Mr. Charles A. Oravetz, Chief
Protected Species Management Branch
National Marine Fisheries Service
9450 Koger Boulevard
St. Petersburg, Florida 33702

Dear Mr. Oravetz:

Pursuant to the Endangered Species Act, as amended, the Corps of Engineers, Jacksonville District is requesting a list of any species or their critical habitat either listed or proposed for listing that may be present in the study area (see enclosed map) ~~for the~~ for the shore protection project at Hutchinson Island, Martin County, Florida. Previous consultation under the Act was initiated with your office on April 4, 1985.

The point of contact for this project is Robert J. Brock at 904-232-2389.

Sincerely,

A. J. Salem
Chief, Planning Division

Enclosure



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Region
9450 Koger Boulevard
St. Petersburg, FL 33702

November 16, 1992 F/SE013:TLD

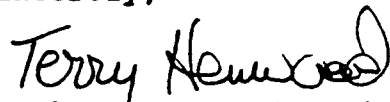
Mr. A. J. Salem
Chief, Planning Division
U.S. Dept. of the Army
Jacksonville District, COE
Post Office Box 4970
Jacksonville, FL 32232-0019

Dear Mr. Salem:

This responds to your letter of November 3, 1992, requesting information on endangered and threatened species under the jurisdiction of the National Marine Fisheries Service (NMFS) which might occur in the vicinity of the proposed shore protection project at Hutchinson Island, Martin County, Florida. The enclosed list contains species under NMFS purview that may occur in the marine environment off the Florida coast. No critical habitat for species under NMFS jurisdiction has been designated in that area, nor has critical habitat been proposed.

If you have any questions, please contact Terry Henwood, Fishery Biologist, at 813/893-3366.

Sincerely,

for 

Charles A. Oravetz, Chief
Protected Species Management
Branch

Enclosure



August 27, 1993

Planning Division
Environmental Branch

Mr. Charles A. Oravetz, Chief
Protected Species Management Branch
National Marine Fisheries Service
9450 Koger Boulevard
St. Petersburg, Florida 33702-2496

Dear Mr. Oravetz:

The Jacksonville District, U.S. Army Corps of Engineers, is currently preparing a General Design Memorandum (GDM) for construction of the Martin County Shore Protection Project at the southern end of Hutchinson Island, Martin County, Florida. It is anticipated that approximately 942,000 cubic yards of beach compatible material obtained from an adjacent offshore borrow area will be placed along a 4 mile (6.4km) segment of eroded beach.

Pursuant to Section 7(a) of the Endangered Species Act, please find enclosed the Biological Assessment (BA) addressing the concerns of the threatened and endangered species under the purview of the National Marine Fisheries Service. The U.S. Army Corps of Engineers has determined that the proposed actions will not adversely impact any listed species under NMFS jurisdiction. We base this determination on the information presented in the enclosed BA and summarized in the environmental commitments listed in Section 6 on page 8.

We request your concurrence on the above determination. If you have any questions or need any further assistance, please contact Robert J. Brock at 904-232-2389.

Sincerely,

A. J. Salem
Chief, Planning Division

Enclosures



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
9450 Koger Boulevard
St. Petersburg, FL 33702

September 15, 1993 F/SE013:LFS

Mr. A. J. Salem
Chief, Planning Division
Department of the Army
Jacksonville District Corps of
Engineers
P. O. Box 4970
Jacksonville, FL 32232-0019

Dear Mr. Salem:

This responds to your August 27, 1993, letter regarding the placement of approximately 942,000 cubic yards of beach compatible material along a 4 mile (6.4km) segment of eroded beach area at the end of Hutchinson Island, Martin County, Florida. A Biological Assessment (BA) was submitted pursuant to Section 7 of the Endangered Species Act of 1973 (ESA).

We have reviewed the BA and concur with your determination that populations of endangered/threatened species under our purview would not be adversely affected by the proposed action.

This concludes consultation responsibilities under Section 7 of the ESA. However, consultation should be reinitiated if new information reveals impacts of the identified activity that may affect listed species or their critical habitat, a new species is listed, the identified activity is subsequently modified or critical habitat determined that may be affected by the proposed activity.

If you have any questions please contact Terry Henwood, Fishery Biologist, at 813/893-3366.

Sincerely yours,

Terry Henwood
for Andrew J. Kemmerer
Regional Director

cc: F/SE02
F/PR2



November 3, 1992

Planning Division
Environmental Branch

Mr. David Ferrell
Field Supervisor
U.S. Fish and Wildlife Service
P.O. Box 2676
Vero Beach, Florida 32961-2676

Dear Mr. Ferrell:

Pursuant to the Endangered Species Act, as amended, the Corps of Engineers, Jacksonville District is requesting a list of any species or their critical habitat either listed or proposed for listing that may be present in the study area (see enclosed map) ~~for the~~ for the shore protection project at Hutchinson Island, Martin County, Florida. Previous consultation under the Act was initiated with your Jacksonville office on April 4, 1985 (FWS Log No. 4-1-85-135).

The point of contact for this project is Robert J. Brock at 904-232-2389.

Sincerely,

A. J. Salem
Chief, Planning Division

Enclosure



United States Department of the Interior
FISH AND WILDLIFE SERVICE
P.O. BOX 2676
VERO BEACH, FLORIDA 32961-2676

December 16, 1992

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


Att: Planning Division

Dear Mr. Salem:

This letter responds to your November 3, 1992 letter concerning Federally- listed endangered or threatened wildlife and plants potentially present in and around the site for the shore protection project at Hutchinson Island, Martin County. Our Geographical Information System (GIS) indicates that sea turtles may nest along beaches in this area. Enclosed is a list of Federally threatened or endangered species which may be present in Martin County. This list does not include State listed species. The Florida Game and Freshwater Fish Commission should be contacted to identify State listed species potentially present at the nourishment and borrow area locations.

If you have any questions please contact Jane Tutton of my staff at 407-562-3909.

Sincerely Yours,


David L. Ferrell
Field Supervisor

enclosure

cc
FWS, Atlanta, GA

August 27, 1993

Planning Division
Environmental Branch

Mr. David L. Ferrell, Field Supervisor
U.S. Fish and Wildlife Service
P.O. Box 2676
Vero Beach, Florida 32961-2676

Dear Mr. Ferrell:

The Jacksonville District, U.S. Army Corps of Engineers (Corps), is currently preparing a General Design Memorandum (GDM) for construction of the Martin County Shore Protection Project at the southern end of Hutchinson Island, Martin County, Florida. It is anticipated that approximately 942,000 cubic yards of beach compatible material obtained from an adjacent offshore borrow area will be placed along a 4 mile (6.4km) segment of eroded beach.

Pursuant to Section 7(a) of the Endangered Species Act, please find enclosed the Biological Assessment (BA) addressing the concerns of the threatened and endangered species under the purview of the U.S. Fish and Wildlife Service. While the project is expected to commence during the winter months, it is probable that some beach construction activities will still be ongoing at the beginning of the sea turtle nesting season. Although the BA addresses the various environmental commitments required of the contractor to ensure the safety of nesting sea turtles, we realize that despite good intentions, a 100% confidence interval does not exist to guarantee no impacts will occur. Because of this, the Corps has determined that the authorized project may affect nesting sea turtles, and, therefore requests that formal consultation with the Service be initiated.

Please provide your Biological Opinion, within 90 days as specified in Section 7(b) (1) of the Endangered Species Act. If you have any questions or require additional information, please contact Robert J. Brock at 904-232-2389.

Sincerely,

A. J. Salem
Chief, Planning Division

Enclosures

February 2, 1993

Planning Division
Environmental Branch

Ms. Marlene Stern
Florida Department of
Environmental Regulation
Division of Water Management
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Dear Ms. Stern:

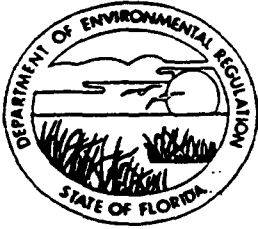
In response to the environmental concerns expressed at the January 11, 1993, meeting in Tallahassee, a contract to undertake a side scan sonar survey for the proposed borrow area offshore of Hutchinson Island is currently being reviewed. We have concluded that a side scan sonar survey is not necessary for the nearshore zone seaward of the project area, as aerial photographs taken in 1990 clearly show the location of the hardbottom areas that existed at that time. These hardbottom areas have been ground-truthed by divers and the exact location of the hardbottom areas can be found in a 1991 Summary Report that was prepared by Applied Technology and Management. Furthermore, it is very difficult to interpret relief and rugosity from a sonogram.

Consequently, we will conduct an underwater study to determine the physical characteristics of the nearshore hardbottom habitat. This information will be more accurate than conventional side scan methods and will be used to produce a hardbottom monitoring and mitigation plan.

Please contact Robert J. Brock in the Environmental Branch at 904-232-2389 if additional information is desired.

Sincerely,

A. J. Salem
Chief, Planning Division



Florida Department of Environmental Regulation

Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400

Lawton Chiles, Governor

Virginia B. Wetherell, Secretary

March 10, 1993

Mr. A. J. Salem, Chief
Planning Division
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

Dear Mr. Salem:

Martin County Shore Protection Project

In response to your letter of February 3, 1993, we would like the Corps to reconsider its position on the need for side-scan sonar for the nearshore area of the Martin County Shore Protection Project. We are encouraged that side-scan sonar will be used at the borrow area. However, this technology should also be applied to the beach restoration area. Our prior experience with the use of aerial photography to delineate hardbottom has been less than encouraging.

For projects on both the east and west coasts, our field biologists have identified significant and well colonized hardbottom features during site inspections which were not visible in aerial photographs. This has resulted in delays in the permitting process. For a project the size of that proposed in Martin County, such delays could be lengthy. We have not had this problem when hardbottom features have been mapped from side-scan sonar. In addition, we believe that side-scan sonar creates a product from which the acreage of individual hardbottom features can be more accurately measured than from aerial photographs. Finally, since side-scan sonar will be used to map hardbottom features at the borrow area, it would seem to incur minimal expense to conduct a survey of the beach area with equipment and a field crew which is already mobilized.

Mr. A. J. Salem, Chief
March 9, 1993
Page 2

I would appreciate your serious consideration of our request and thank you for notifying us of your intentions. If you would like to discuss this issue further, please contact Marlene Stern at 904/488-0130.

Sincerely,



Janet G. Llewellyn, Chief
Bureau of Wetland Resource
Management

cc: Robert J. Brock, Corps of Engineers
Bonnie Dearborn, Martin County
Don Holloman, Martin County



FLORIDA DEPARTMENT OF STATE

Jim Smith
Secretary of State

DIVISION OF HISTORICAL RESOURCES

R.A. Gray Building
500 South Bronough

Tallahassee, Florida 32399-0250

Director's Office

Telecopier Number (FAX)

(904) 488-1480

(904) 488-3353

PFN: 931280

May 7, 1993

In Reply Refer To:
Susan Hammersten
Compliance Review
Section, DHR
(904) 487-2333

Mr. A.J. Salem, Chief
Planning Division
Environmental Resources Branch
USACOE, Jacksonville District
P.O. Box 4970
Jacksonville, Florida 32232-0019

Re: Draft: A Cultural Resource Magnetometer Survey for a
Proposed Borrow Area, Martin County, Florida
Wes Hall, April, 1993

Dear Mr. Salem:

In accordance with the procedures contained in 36 C.F.R., Part 800 ("Protection of Historic Properties"), we have reviewed the referenced report, and find it to be complete and sufficient. We note that no magnetic anomalies indicative of historic resources were located during the survey.

Therefore, on the basis of the negative findings, it is the opinion of this agency that the proposed offshore borrow areas for the Hutchinson Island Beach Renourishment project are unlikely to affect any properties listed, or eligible for listing, in the National Register. The project may proceed without further involvement with this agency.

If you have any questions concerning our comments, please do not hesitate to contact us. Your interest in protecting Florida's historic properties is appreciated.

Sincerely,

George W. Percy
George W. Percy, Director
Division of Historical Resources

and
State Historic Preservation Officer

GWP/Hsh

October 14, 1993

Planning Division
Environmental Branch

Mr. David L. Ferrell
U.S. Fish and Wildlife Service
Ecological Service Division
P.O. Box 2676
Vero Beach, Florida 32961-2676

Dear Mr. Ferrell:

We have reviewed the Hutchinson Island, Martin County, Florida, *Draft Fish and Wildlife Coordination Act Report* and have several comments:

The U.S. Fish and Wildlife Service (Service) states that the incidental take of relocating sea turtles contained in the February 8, 1989, Biological Opinion has been changed and that the Martin County Project should be constructed outside of the sea turtle nesting season (approximately March 1 - November 30) in this area of Florida. Although we are well aware of the importance of Hutchinson Island to nesting sea turtles, we feel prohibiting any dredging and beach disposal during the months of March and April is not scientifically justified by current nesting data for the area.

For the southern portion of Hutchinson Island from the St. Lucie/Martin County line south to the St. Lucie Inlet, sea turtle nesting data supplied by Applied Biology, Inc. shows that between 1985-1990 (6 years), the cumulative total of sea turtle nests for this approximate 7 mile (11.2km) stretch of beach during the month of March is two (Tables 1-3). This means that there is only a 33% probability that even one nest will be found in any given year during the month of March anywhere within the entire Martin County portion of Hutchinson Island. It is important to note that the project is contained within the northern 4 mile (6.4km) portion of this stretch (Figure 1). Even if one nest is found during the month of March, we do not know from the nesting data that is available to this office if that nest is even within the boundaries of the project area as approximately 38% of the nests laid in the Martin County portion of Hutchinson Island are outside the project area (Tables 4-6). Similarly, there have been 35 nests recorded for the entire Martin County portion of Hutchinson Island between the county line and the St. Lucie Inlet during the month of April during the six year period 1985-1990 for an average of 5.8 nests per year (Tables 1-3). Although we certainly agree that Hutchinson Island is a "high density" nesting area, we don't feel that it is particularly unique during the months of March and April as only 0.003% of the overall total of 12,760 nests were successfully laid during these two months.

-2-

Because of the importance of this area for nesting sea turtles, the U.S. Army Corps of Engineers (Corps) commits to doing everything possible to construct the project beach during the winter months. Currently, it is anticipated that the earliest dredging and beach construction can take place will be December 1994. Under favorable weather conditions, it is estimated that it will take approximately 4 months to complete the Martin County project (through the month of March). Based on available scientific data and allowing for some unforeseen weather delays, dredging and placing beach fill on the beach during the months of March and April (at least the first half) is not an unreasonable request. Nourishment activities during the months of March and April are essential if successful completion of the project is to occur in the current expedited time frame.

Currently, the Corps is redesigning the beach fill for the southern 2,000 feet (606m) of the authorized project to significantly reduce the estimated environmental impact to these hardbottom areas. It is noted that the habitat between R-23 and R-25 has abundant marine life and high biodiversity. However, this area is not a "representative" sample of the hardbottom habitat seaward of the project beach. A large undetermined amount of hardbottom areas along the project area are ephemeral and lacks any encrusting or sessile organisms due presumably from sand scouring and periodic burial. This should be noted in the Final CAR.

We request that the Final CAR take into account the above cited information. In a letter dated August 23, 1993, we reinitiated consultation under Section 7 as requested in your Draft CAR. Based on information provided here and in our Biological Assessment, the Corps requests that the conditions prohibiting construction during the sea turtle nesting season from March 1 - November 30 be revised to May 1 - November 30. The technical study manager in the Environmental Branch is Robert J. Brock.

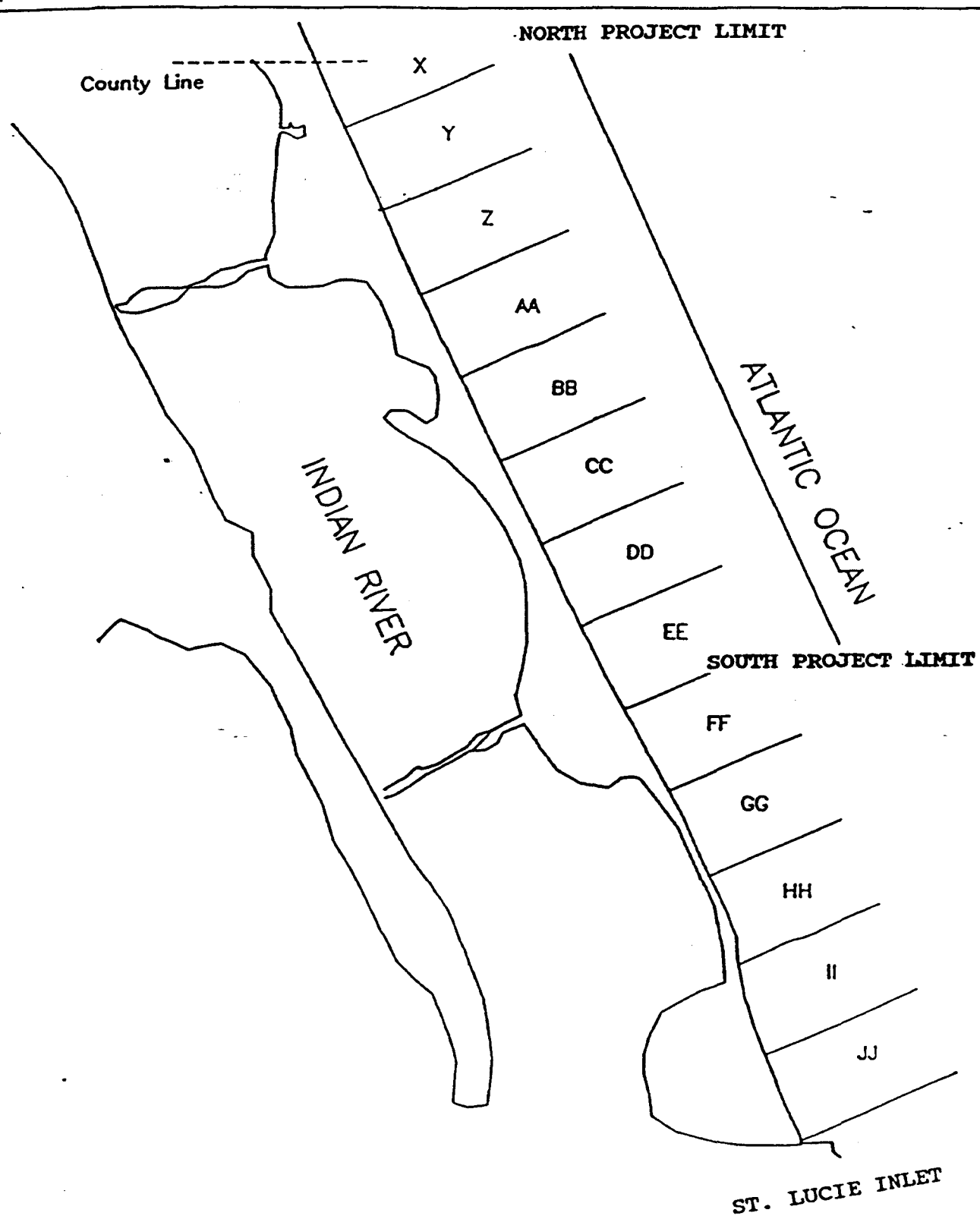
Sincerely,

A. J. Salem
Chief, Planning Division

Enclosure

**SUMMARY OF SEA TURTLE NESTING DATA (1985-1990)
ST. LUCIE/MARTIN COUNTY LINE TO ST. LUCIE INLET
HUTCHINSON ISLAND, MARTIN COUNTY, FLORIDA**

- there was a cumulative total of 25 loggerhead (*Caretta caretta*), 0 green (*Chelonia mydas*), and 12 leatherback (*Dermochelys coriacea*) sea turtle nests laid from the St. Lucie/Martin County line to the St. Lucie Inlet during the 6 year period 1985-1990 for the entire Martin County portion of Hutchinson Island. Of that, a cumulative total of 2 nests were laid in March (average of 0.33/yr.) with the remaining 35 (average of 5.8/yr.) in April.
- the earliest nest recorded between these years was March 14 (in 1985) for the leatherback (*D. coriacea*) and April 19 (in 1990) for the loggerhead (*C. caretta*).



**Figure 1. GENERAL LOCATION MAP
OF THE SEA TURTLE MONITORING ZONES ON
HUTCHINSON ISLAND**



Applied Technology and
Management, Inc.

IX. SUMMARY

The Corps of Engineers (Corps) has requested a Fish and Wildlife Coordination Act Report from the U.S. Fish and Wildlife Service (Service) regarding the environmental impacts of a proposed beach nourishment project at Martin County, Florida. Sand fill for the project would be obtained from an offshore borrow area. Silt and clay content of the fill is approximately 10%. Biological surveys of the area by the Corps' contractors have shown that there are rock outcrop reefs immediately offshore of the beaches proposed for renourishment. U.S. Fish and Wildlife Service observations indicate that further quantification reef acreage through aerial photography and groundtruthing is warranted, but that there are currently approximately 13 acres of nearshore reef within the project area. Our observations also show that these reef areas currently provide habitat for a diverse community of fishes and invertebrates.

The Fish and Wildlife Service recommends that impacts to reefs at the southern end of the project be avoided. Remaining unavoidable impacts may be mitigated for with artificial reef construction if carefully designed and deployed. Careful design could reduce acreage ratio requirements for full habitat value replacement. The biological rationale supporting this mitigation recommendation is provided in the report.

At least one acre of designed reef should be deployed before sandpumping begins to provide alternative habitat for motile organisms displaced by the project. A subsequent study of population densities on the pilot reef should allow the Corps to estimate the appropriate acreage of mitigation required for full habitat value replacement. The Service estimates that an ineffective design may require as much as 2 acres of mitigation per acre of natural reef lost; an effective design could reduce mitigation acreage requirements by more than half.

5. A prior Biological Opinion in 1989 on this project allowed for nest relocation of threatened and endangered sea turtles. To further minimize incidental take of sea turtles due to nest relocation, the Service now recommends that beach nourishment activities occur between November 1 and April 15, provided the beaches are surveyed for unhatched nests prior to beach fill deposit.

FLA. COAST. MGMT.

TEL:904-487-2899

Mar 10 94 15:29 No.012 P.02



STATE OF FLORIDA
DEPARTMENT OF COMMUNITY AFFAIRS

2740 CENTERVIEW DRIVE • TALLAHASSEE, FLORIDA 32399-2100

LAWTON CHILES
Governor

LINDA LOOMIS SHELLEY
Secretary

March 9, 1994

Mr. A. J. Salem
Chief, Planning Division
Department of the Army
Jacksonville District Corps
of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

RE: Beach Erosion Control Projects - Draft Environmental
Assessment - Martin County Shore Protection Project -
Hutchinson Island, Martin County, Florida
SAI: FL9401051562C

Dear Mr. Salem:

The Florida State Clearinghouse, pursuant to Presidential Executive Order 12372, Gubernatorial Executive Order 93-194, the Coastal Zone Management Act, 16 U.S.C. §§ 1451-1464, as amended, and the National Environmental Policy Act, 42 U.S.C. §§ 4321, 4331-4335, 4341-4347, as amended, has coordinated a review of the above-referenced project.

The State of Florida has completed its review of the federal consistency determination provided for the above-referenced project. Based on the information available at this time and the enclosed comments provided by our reviewing agencies, the state agrees that at this stage, the project is consistent with the Florida Coastal Management Program. However, our reviewing agencies have identified certain issues, as enclosed, which should be addressed by the applicant prior to any subsequent review of this project. Pursuant to 15 CFR 930.34 and 930.37, the applicant is required to prepare a consistency determination at each major decision point in the project for the state's

FLA. COAST. MGMT.

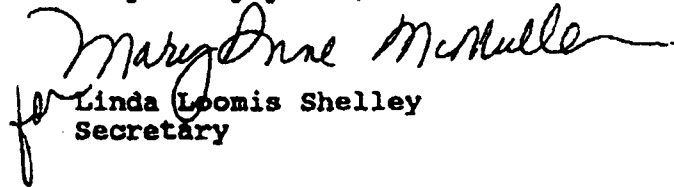
TEL:904-487-2899

Mar 10 94 15:29 No.012 P.03

Mr. A. J. Salem
March 9, 1994
Page Two

review. The state's continued agreement with the project will be based, in part, on the adequate resolution of the concerns identified in all previous reviews of the project.

Very truly yours,


for Linda Loomis Shelley
Secretary

LLS/jx

Enclosures

cc: Susan Goggin, Department of Environmental Protection
George Percy, Department of State



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

JUN 21 1994

Colonel Terrance R. Salt
District Engineer, Jacksonville
P.O. Box 4970
Jacksonville, FL 32232

Attn: Mr. A. J. Salem

Subject: Environmental Assessment (EA) for Martin County Shore
Protection Project, Hutchinson Island, Martin County,
FL

Dear Colonel Salt:

Pursuant to Section 309 of the Clean Air Act, EPA, Region IV has reviewed the subject document which describes the environmental consequences of placing approximately 1.0 M cubic yards along a 4 mile reach which encompasses Jensen and Stuart Public Beaches. An offshore borrow area located approximately 3000 feet from the beach will provide the necessary fill material. On the basis of two visual inspections of this area there does not appear to be significant coverage by hardbottom habitat although various invertebrate communities are present.

⑥ The project has been modified to reduce the primary impacts to nearshore hardbottom habitat at its southern terminus by tapering the beach fill. Nonetheless, some hardbottom habitat will be immediately inundated by the proposed fill and require mitigation. Further, the amount of sand which is being continually resuspended in the water column by wave action will be augmented by this fill material. Hence, it is reasonable to expect that burial of low relief coquina limestone rock, scouring of encrusting and sessile organism, and episodes of increased turbidity will all increase in frequency from the current levels. Ascertaining the effects of this additional material in the intertidal and nearshore zone would be very difficult and its importance has been called into question.

⑦ However, we do believe that some significant offshore/down-drift rock habitats could be adversely affected by this increased sand moving off the nourished beach. This additional material could result in adverse secondary impacts at all trophic levels since the fill effectively occurs in an instantaneous fashion while achieving equilibrium requires time. This lapse and its consequences will need to be monitored/evaluated for importance during the mitigation determination for both the offshore and down-drift rock habitats. If the monitoring results ascertain that these habitats are, in fact, adversely affected, additional mitigation will be necessary.

Thank you for the opportunity to comment. If we can be of further assistance in this matter, Dr. Gerald Miller (404-347-3776) will serve as initial point of contact.

Sincerely,

A handwritten signature in cursive script, reading "Heinz Mueller".

Heinz J. Mueller, Chief
Environmental Policy Section
Federal Activities Branch

Response to the USACOE Draft Environmental Assessment
for
Martin County Shore Protection Project
Hutchinson Island, Martin County, Florida

This is written to support the position of the USACOE that construction should be allowed during the November 30 through May 1 (letter from A. J. Salem to Mr. David L. Ferrell, dated October 14, 1993).

In addition to the rational as outlined in the above letter, the USFWS should take into consideration the position statements made by Interior Secretary Bruce Babbitt (Cedar-Southworth, 1993). Secretary Babbitt stated "I want very much to bring the Agencies of the Department together in a process in which we can make decisions by agreement that are for the common good. We ought to be able to formulate a common view -- It's not how many acres for the Agency -- it's how do we do this in the public interest."

The common good, in this case, is to have suitable nesting beaches for sea turtles and, at the same time provide the public with increased beach use area that also protects upland property, both private and public, from erosion damage.

There is evidence that nest relocation is a viable method of protection sea turtle nests from harm (Wyneken, et al, 1988). The success of beach nourishment during sea turtle nesting seasons while using nest relocation has been well documented by projects within the Town of Jupiter Island (e.g, Anon., 1991).

While concern has been expressed about skewed sex ratios occurring in relocated nests, highly skewed sex ratios can occur in nature (Mrosovsky and Provancha, 1988). Sex ratios of oceanic sea turtle populations are not easily studied and it is unknown of whether or not something approaching a 1 to 1 ratio exists. In any case, the total number of nests needing relocation during this project, even if extended through May, would represent such a very small percentage of Florida's nesting population that it would not adversely impact sex ratios in the wild.

As discussed in the DEA, the nests that would need to be relocated during nourishment extending into mid-April would be very low. Movement of this small number of nests will not threaten the species' with extinction.

Additionally, if nourishment were to be done on this section of Hutchinson Island through the month of May, limited numbers of nests should require relocation. A four month project starting in December should provide significant amounts of nearly completed beach by May, where nests could be left in situ.

References

Anon. 1992. Jupiter island beach restoration project 1991. Project Completion Report, April 1992: i-ii + 1-54. Gahagan & Bryant Associates.

Cedar-Southworth, D. 1993. MMS welcomes new Interior Secretary Bruce Babbitt. Today USFWS/MMS, 2(3):1-4.

Mrosovsky, N. and J. Provancha. 1988. Sex ratios of loggerhead sea turtles hatching on a Florida beach. Can. J. Zool., 67(10):2533-2539.

Wyneken, J., T. J. Burke, M. Salmon, and D. K. Pedersen. 1988. Egg failure in natural and relocated sea turtle nests. Journal of Herpetology, 22(1):88-96.



**UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE**

Southeast Regional Office
9450 Koger Boulevard
St. Petersburg, Florida 33702

February 7, 1994

Colonel Terrence C. Salt
District Engineer, Jacksonville District
Department of the Army, Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Dear Colonel Salt:

The National Marine Fisheries Service (NMFS) has reviewed the Draft Environmental Assessment (DEA) for the Martin County Shore Protection Project at Hutchinson Island, Martin County, Florida. The draft is dated December 1993.

(8) The DEA adequately addresses potential project impacts to marine fisheries resources for which the NMFS has stewardship responsibility. We support the decision to shorten the length of the project to significantly reduce direct impacts to hard bottom habitat. We also concur that 1:1 mitigation in the form of artificial reef construction would adequately compensate for the anticipated direct impacts to 0.5 acre of hardbottom habitat, provided the artificial structures are designed with sufficient surface irregularity and relief. Such structures should be installed prior to initiating the shore protection project to provide a retreat for motile organisms in the project area.

Thank you for the opportunity to review this DEA. Please continue to apprise us as project plans progress. We would also appreciate receiving copies of monitoring results in the event the project is implemented. If we can provide further assistance, please contact Ms. Shelley Du Puy of our Miami Field Office at 305/595-8352.

Sincerely,

Edwin Koppner

✶ Andreas Mager, Jr.
Assistant Regional Director
Habitat Conservation Division





Lawton Chiles
Governor

Florida Department of Environmental Protection

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Virginia B. Wetherell
Secretary

7 March 1994

Suzanne Traub-Metlay
State Clearinghouse
Office of Planning and Budgeting
Executive Office of the Governor
The Capitol
Tallahassee, Florida 32399-0001

RECEIVED
MAR 9 1994

Florida Coastal
Management Program

RE: U.S. Corps of Engineers/Draft Environmental Assessment for
the Martin County Shore Protection Project, Hutchinson
Island
SAI: FL9401051562C

Dear Ms. Traub-Metlay:

The Department has reviewed the Draft Environmental Assessment (DEA) for the Martin County Shore Protection Project. The proposed project involves the placement of approximately 1,000,000 cubic yards of beach-compatible material along a 4.2 mile stretch of Hutchinson Island.

The Department's Division of Wetland Resource Management has very recently received a Completeness Summary Response regarding Martin County's permit application for this project (permit #432336109). This response is currently under review by wetland resource staff. In addition, the Division of Beaches and Shores has received a letter from Martin County requesting a coastal construction permit. Division staff have responded that Martin County must submit a formal application for a coastal construction permit.

⑨ At this time, the Department has no objections to the project as proposed. However, the specific details of the project, including the monitoring and mitigation plans, will be addressed during the permitting process.

The Department's permitting review will serve as the state's final federal consistency review for purposes of compliance with the Coastal Zone Management Act. Any questions regarding permit status should be addressed to John Abendroth at (904)488-0130 and Mike Sole at (904)487-1262.



FLORIDA DEPARTMENT OF STATE

Jim Smith
Secretary of State

DIVISION OF HISTORICAL RESOURCES

R.A. Gray Building
300 South Bronough

Tallahassee, Florida 32399-0250

Director's Office

Telecopier Number (FAX)

(904) 488-3480

(904) 488-3353

RECEIVED

JAN 25 1994

Florida Coastal
Management Program

January 21, 1994

Ms. Janice L. Hatter, Director
State Clearinghouse
Executive Office of the Governor
Room 1603, The Capitol
Tallahassee, Florida 32399-0001

In Reply Refer To:
Denise M. Breit
Historic Sites
Specialist
(904) 487-2333
Project File No. 940061

RE: Cultural Resource Assessment Request
SAI# FL9401051562C
Martin County Shore Protection Project - Hutchinson Island
Martin County, Florida

Dear Ms. Hatter:

In accordance with the provisions of Florida's Coastal Zone Management Act and Chapter 267, Florida Statutes, as well as the procedures contained in 36 C.F.R., Part 800 ("Protection of Historic Properties"), we have reviewed the referenced project(s) for possible impact to historic properties listed, or eligible for listing, in the National Register of Historic Places, or otherwise of historical or architectural value.

A review of the Florida Site File indicates that no significant archaeological or historical sites are recorded for or likely to be present within the project area. Furthermore, because of the project location and/or nature it is unlikely that any such sites will be affected. Therefore, it is the opinion of this office that the proposed project will have no effect on historic properties listed, or eligible for listing, in the National Register of Historic Places, or otherwise of historical or architectural value. The project is also consistent with the historic preservation laws of Florida's Coastal Management Program.

FLA. COAST. MGMT.

TEL:904-487-2899

Mar 10 94 15:31 No.012 P.06

Ms. Hatter
January 21, 1994
Page 2

If you have any questions concerning our comments, please do not hesitate to contact us. Your interest in protecting Florida's historic properties is appreciated.

Sincerely,

for *Laura A. Kammerer*
George W. Percy, Director
Division of Historical Resources
and

State Historic Preservation Officer

GWP/Bdb

xc: Jasmine Raffington, FCMP-DCA



U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

ATLANTA REGIONAL OFFICE, REGION IV
Richard B. Russell Federal Building
75 Spring Street, S.W.
Atlanta, Georgia 30303-3388

January 6, 1994

Mr. A. J. Salem
Chief, Planning Division
Environmental Branch
Jacksonville District Corps of Engineers
Department of the Army
P. O. Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Salem:

This refers to your letter dated December 29, 1993, transmitting the draft Environmental Assessment for the Martin County Shore Protection Project, Hutchinson Island, Florida.

Our review indicates there will be no significant adverse impact on any HUD programs as a result of this project.

Thank you for the opportunity to review and comment on your proposed project.

Very sincerely yours,

A handwritten signature in cursive script, reading "Warren J. Howze".

Warren J. Howze
Director
Program Support Division, CPD

FLORIDA SHORE & BEACH PRESERVATION ASSOCIATION INC. of MARTIN COUNTY: 2355 N.E. Ocean Blvd., Stuart, FL 34996

DIRECTORIAL

	Salmonella	at home
V. Ross Whitham, Executive Chairman (Mr. Turtle)		682-1469
Kay Curiel, President	(407)-287-1777	225-2218
Al Silverman, Tax-Payers Com.	(407)	682-4229
Bob Douglas, Finance	(407)	225-2122
Claire E. Atkinson, Secretary	(407)	225-2625
Betty Neale, Treasurer	(407)	682-2277
Bill Mathers, P.E.	(407)-287-6325	287-6971
Joe Colla, Local Govt.	(407)	234-6659
Bill Pullen (Holiday Inn)	(407)-225-3000	
Joe Jacobstein, Vice President	(407)	225-2721
Linda Vanisia, Tourism Com.	(407)	225-2413

Law Committee:
Pat Bart (407) 225 0641
Bob Lincoln

25-4661

FSBPA: *The First, Ecology Award 91. **Member Of The Year 91. ***Member Of The Year 91

January 12, 1994

Mr. A.J. Salem, Chief, Planning Division
U.S. Army Corp of Engineers - Jacksonville District
P.O. Box 4970
400 West Bay Street
Jacksonville, FL 32232 - 0019

Re: Draft Environmental Assessment - December 29, 1993:
Martin County Shore Protection Project
Hutchinson Island, Martin County, Florida

Dear Mr. Salem:

Thank you for including The Martin County Chapter of the Florida Shore & Beach Preservation Assn. on your list to respond with comments on the Martin County Beach Preservation Project. Our group is a dedicated advocate of the project and its sponsor, the Martin County Commission.

We are most fortunate to have Ross Whitham both as a Director and our Honoree Chairman. He is well qualified both academically and by first-hand experience with turtles, to provide supplemental environmental suggestions on the authorized project. We concur with his suggestion to provide safe and economical turtle nest relocation during the construction of the authorized project. Please see the enclosed:

Response to the USACOE Draft Environmental Assessment
for
Martin County Shore Protection Project
Hutchinson Island, Martin County, Florida

Thank you for your continued help,
Sincerely


Al Silverman, Director

c.c./C FSBPA: Ross Whitham, Kay Curiel, and FSBPA: Stan Tait

FLA. COAST. MGMT.

TEL:904-487-2899

Mar 10 94 15:31 No.012 P.07

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JAN 14 1994

Date: 01/06/94

Comment Due Date: 01/20/94

SAI# FL9401051562C

Florida Coastal
Management Program
LOCAL/OTHER

STATE AGENCIES

OPB POLICY UNITS

<input type="checkbox"/>	Agriculture
<input type="checkbox"/>	Board of Regents
<input type="checkbox"/>	Commerce
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<input type="checkbox"/>	Education
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<input type="checkbox"/>	Revenue & Eco. Ana
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RECEIVED

JAN 10 1994

MARINE FISHERIES
COMMISSION

The attached document requires a Coastal Zone Management Act/Florida Coastal Management Program consistency evaluation and is categorized as one of the following:

- ☐ Federal Assistance to State or Local Government (15 CFR 930, Subpart F). Agencies are required to evaluate the consistency of the activity.
- ☒ Direct Federal Activity (15 CFR 930, Subpart C). Federal agencies are required to furnish a consistency determination for the State's concurrence or objection.
- ☐ Outer Continental Shelf Exploration, Development or Production Activities (15 CFR 930, Subpart E). Operators are required to provide a consistency certification for state concurrence/objection.

☐ Federal Licensing or Permitting Activity (15 CFR 930, Subpart D). Such projects will only be evaluated for consistency when there is not an analogous state license or permit.

SEE REVERSE SIDE FOR INSTRUCTIONS AND ADDRESSES FOR RETURN MAILING.

To: State Clearinghouse

EO. 12372

Federal Consistency

Executive Office of the Governor-OPB

Florida Coastal Management Director
Department of Community Affairs

☒ No Comment

☐ Comments Attached

☐ Not Applicable

☒ No Comment/Consistent

☐ Consistent/Comments Attached

☐ Inconsistent/Comments Attached

☐ Not Applicable

From:

Division/Bureau: MFC

Reviewer: [Signature]

Date: 1/17/94

FLA. COAST. MGMT.

TEL:904-487-2899

Mar 10 94 15:32 No.012 P.08

Date: 01/06/94

Comment Due Date: 01/20/94

SAT# FL9401051582C

STATE AGENCIES

LOCAL/OTHER

OPB POLICY UNITS

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<input checked="" type="checkbox"/> Marine Fish Comm
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<input type="checkbox"/> Trans Disad. Comm
<input type="checkbox"/> DER District

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<input type="checkbox"/> Health & Human Srv
<input type="checkbox"/> Revenue & Eco. Ana
<input type="checkbox"/> SCH
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RECEIVED

JAN 26 1994

Florida Coastal
Management Program

The attached document requires a Coastal Zone Management Act/Florida Coastal Management Program consistency evaluation and is categorized as one of the following:

- ☐ Federal Assistance to State or Local Government (15 CFR 930, Subpart F). Agencies are required to evaluate the consistency of the activity.
- ☒ Direct Federal Activity (15 CFR 930, Subpart C). Federal agencies are required to furnish a consistency determination for the State's concurrence or objection.
- ☐ Outer Continental Shelf Exploration, Development or Production Activities (15 CFR 930, Subpart E). Operators are required to provide a consistency certification for state concurrence/objection.

☐ Federal Licensing or Permitting Activity (15 CFR 930, Subpart D). Such projects will only be evaluated for consistency when there is not an

SEE REVERSE SIDE FOR INSTRUCTIONS AND ADDRESSES FOR RETURN MAILING.

To: State Clearinghouse, Executive Office of the Governor-OPB

EQ 12372

Federal Consistency

Florida Coastal Management Director
Department of Community Affairs

☒ No Comment☒ No Comment/Consistent☐ Comments Attached☐ Consistent/Comments Attached☐ Not Applicable☐ Inconsistent/Comments Attached☐ Not Applicable

From:

Division/Bureau: FDOT - DIST 4 PLAN -

Reviewer: [Signature]

Date: 1/20/94

APPENDIX 3

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

FORM 524
STATE TRANSPORTATION PLANINTERGOVERNMENTAL COORDINATION AND REVIEW
ROUTING SHEET

DATE: 1/10/94

TO: Norm Feder, D1; Aage Schroder, D2; Marvin Stufkey, D3; Joe Yeabeck, D4; Jim Kimbler,
D5; Servando Parapar, D6; David Twiddy, D7; B. Ashbaker, Leroy Irwin

SAU: 9401051562C

Application Transmitted:

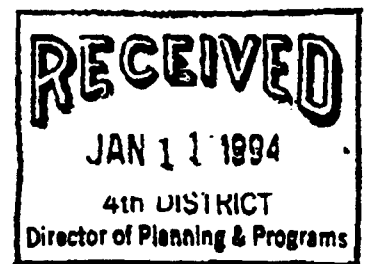
St. Lucie County Shore Protection

Date Response Due to the Clearinghouse: 1/20/94

Please review and comment regarding the attached application in accordance with Department Procedure 525-010-205-b. A letter of response to the Director of the Clearinghouse and this routing sheet should be completed and returned as directed in the procedure.

The following criteria, as appropriate to the project, should be used to evaluate the application and develop your comments:

- Florida Transportation Plan
- Adopted Work Program
- Transportation Improvement Plan (TIP)
- Right of Way Preservation and Advanced Acquisition
- Transit Development Program
- MPO Comprehensive Transportation Plan and 20 year Transportation Plan
- Florida Rail System Plan
- Florida Aviation System Plan
- Local Airport Master Plan
- Florida Seaport Mission Plan
- Environment Commitments
- Unified Planning Work Program
- Level of Service
- Access Management



If comments are warranted based on other criteria, they should be included.

Work Program Item Number: VA (if applicable).

POYNICE S. VAUGHN

Chief Office CAR Coordinator - MS 228

TYPE: General Aviation Rail Seaports Environ
Transit

ENCLOSURE

75

254

APPENDIX A

ENGINEERING DESIGN AND COST ESTIMATES

**APPENDIX A
ENGINEERING DESIGN AND COST ESTIMATES
MARTIN COUNTY, FLORIDA
SHORE PROTECTION PROJECT
GENERAL DESIGN MEMORANDUM**

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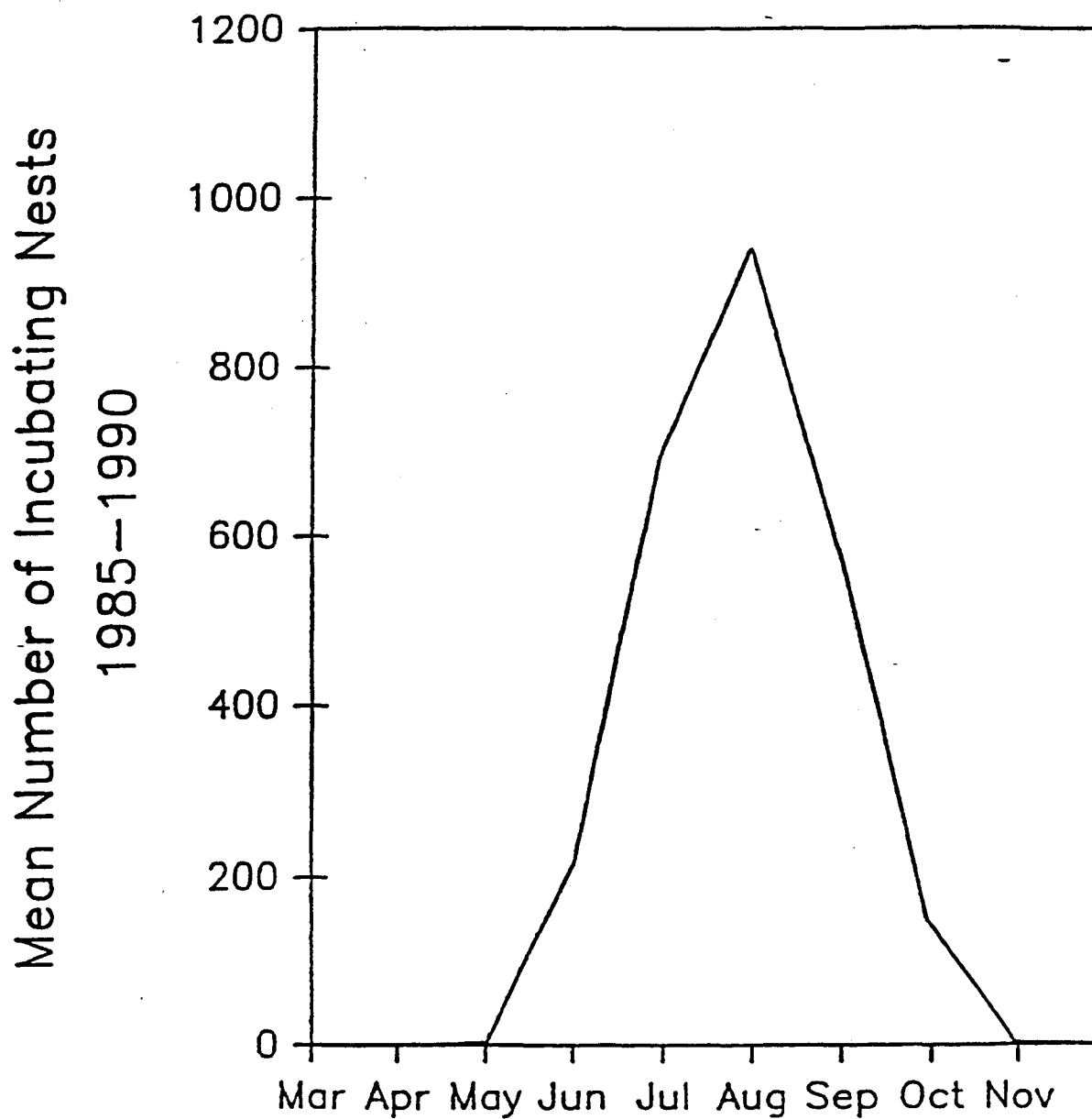


Figure 2. ESTIMATE OF MEAN NUMBER OF INCUBATING TURTLE NESTS THROUGH TIME FOR THE SOUTH HUTCHINSON ISLAND RESTORATION AREA, BASED ON 1985-1991 MONITORING DATA

Source: Mote Marine Laboratory, Inc., 1991.



**Applied Technology and
Management, Inc.**

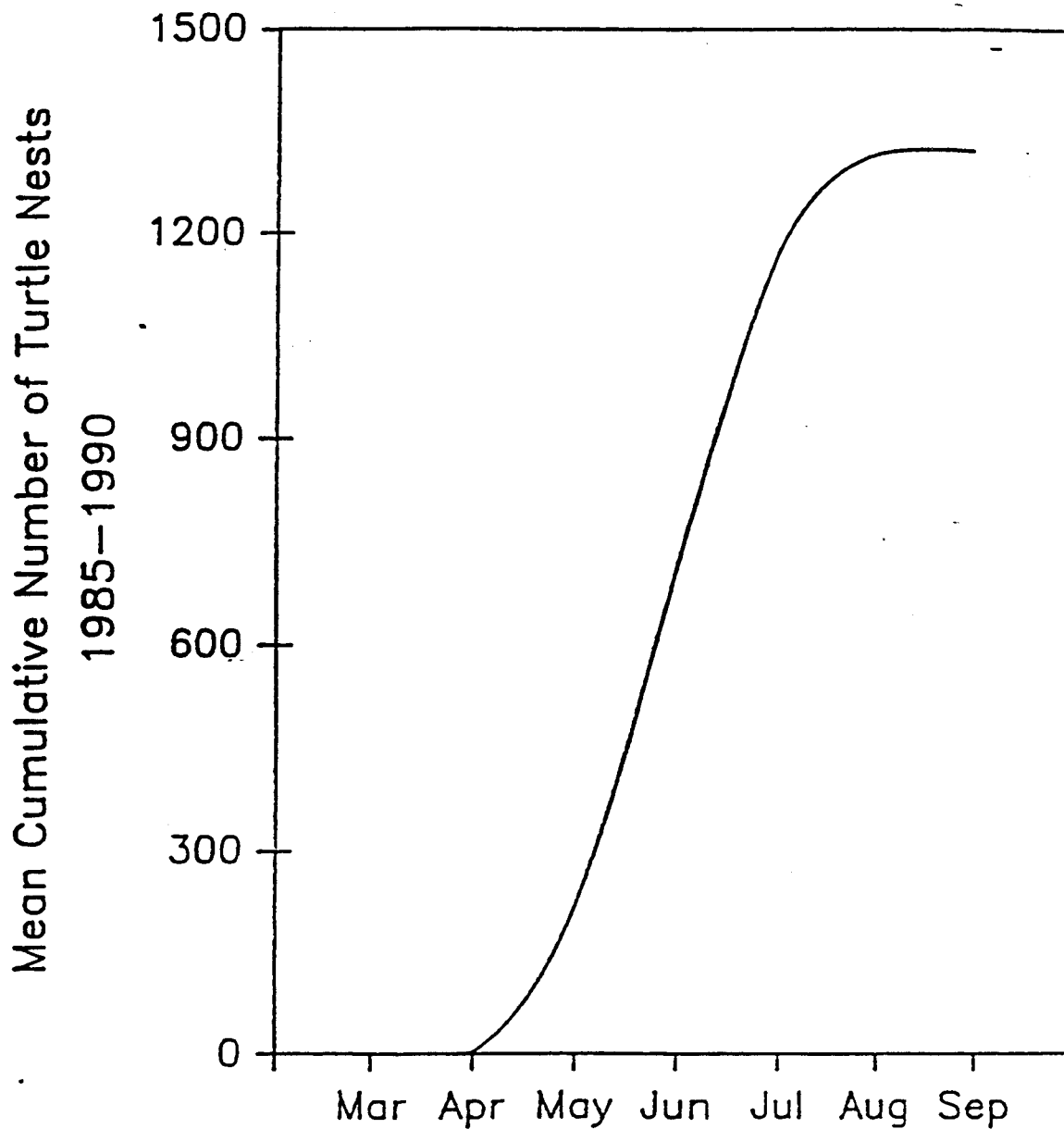


Figure 3. MEAN CUMULATIVE NUMBER OF TURTLE NESTS (FOR ALL SPECIES) FOR SOUTH HUTCHINSON ISLAND RESTORATION AREA, BASED ON 1985-1990 MONITORING YEARS

Source: Mote Marine Laboratory, Inc., 1991.



Applied Technology and
Management, Inc.

Table 1. Sea Turtle Nesting Data for the Loggerhead Turtle (*Caretta caretta*) for Hutchinson Island, Martin County, Florida: Survey Areas X Thru Inlet

Year	MONTH							Total
	March	April	May	June	July	Aug	Sept	
1985	0	2	386	827	657	217	1	2090
1986	0	2	302	892	717	177	9	2099
1987	0	0	232	663	710	317	11	1933
1988	0	0	249	840	784	185	3	2061
1989	0	4	380	613	723	216	0	1936
1990	0	17	491	866	762	703	1	2340
TOTAL	0	25	2040	4701	4353	1315	25	12459
MEAN	0.0	4.2	340.0	783.5	725.5	219.2	4.2	2076.5
STD	0.00	5.90	89.36	105.87	40.34	46.18	4.26	135.83
MIN	0	0	232	613	657	177	0	1933
MAX	0	17	491	892	784	317	11	2340

Source: Applied Biology, Inc., Stuart, Florida.

Table 2. Sea Turtle Nesting Data for the Green Turtle (*Chelonia mydas*) for Hutchinson Island, Martin County, Florida: Survey Areas X Thru Inlet

Year	MONTH							Total
	March	April	May	June	July	Aug	Sept	
1985	0	0	0	7	12	11	1	31
1986	0	0	0	4	13	8	2	27
1987	0	0	0	6	16	22	4	48
1988	0	0	0	3	14	13	3	33
1989	0	0	0	8	13	12	0	33
1990	0	0	0	15	28	17	0	60
TOTAL	0	0	0	43	96	83	10	232
MEAN	0.0	0.0	0.0	7.2	16.0	13.8	1.7	38.7
STD	0.00	0.00	0.00	3.89	5.51	4.52	1.49	11.56
MIN	0	0	0	3	12	8	0	27
MAX	0	0	0	15	28	22	4	60

Source: Applied Biology, Inc., Stuart, Florida.

Table 3. Sea Turtle Nesting Data for the Leatherback Turtle (*Dermochelys coriacea*) for Hutchinson Island, Martin County, Florida: Survey Areas X Thru Inlet

Year	MONTH							Total
	March	April	May	June	July	Aug	Sept	
1985	1	1	7	4	0	0	0	13
1986	0	0	2	3	0	0	0	5
1987	0	0	6	5	1	0	0	12
1988	1	0	5	8	0	0	0	14
1989	0	6	7	2	2	0	0	17
1990	0	3	3	1	1	0	0	8
TOTAL	2	10	30	23	4	0	0	69
MEAN	0.3	1.7	5.0	3.8	0.7	0.0	0.0	11.5
STD	0.47	2.21	1.91	2.27	0.75	0.00	0.00	3.95
MIN	0	0	2	1	0	0	0	5
MAX	1	6	7	8	2	0	0	17

Source: Applied Biology, Inc., Stuart, Florida.

Table 4. Sea Turtle Nesting Data for the Loggerhead Turtle (*Caretta caretta*) for Hutchinson Island, Martin County, Florida: 1985-1990.

Survey, Area	YEAR						TOTAL	MEAN	STD	MIN	MAX
	1985	1986	1987	1988	1989	1990					
X	151	131	137	140	162	177	898	149.7	15.83	131	177
Y	209	222	180	226	218	230	1285	214.2	16.64	180	230
Z	94	85	98	134	130	142	683	113.8	22.12	85	142
AA	176	202	160	157	168	183	1046	174.3	15.22	157	202
BB	139	155	128	178	177	176	951	158.5	20.32	128	178
CC	194	185	160	93	93	150	875	145.8	40.11	93	194
DD	141	179	142	165	156	185	968	161.3	18.84	141	185
EE	172	132	143	194	110	181	932	155.3	29.39	110	194
SUBTOTAL	1276	1291	1146	1287	1214	1424					
MEAN	159.5	161.38	143.25	160.88	151.75	178.00					
STD	33.9	41.61	23.18	37.80	37.22	24.68					
FF	155	147	124	150	119	132	827	137.8	13.58	119	155
GG	207	196	178	155	174	215	1125	187.5	20.56	155	215
HH	133	96	118	118	104	157	721	120.2	20.09	96	157
II	179	190	121	163	159	193	1005	167.5	24.30	121	193
JJ	127	166	232	176	152	208	1061	176.8	34.72	127	232
INLET	13	13	14	17	14	11	82	13.7	1.80	11	17
TOTAL	2090	2099	1933	2061	1936	2340	12459				
TOTAL *	2077	2086	1919	2044	1922	2329	12377				
MEAN *	159.80	160.50	147.60	157.20	147.80	179.20	952.10				
STD *	32.35	39.58	33.55	32.74	33.72	27.60	155.71				
MIN *	94	85	98	93	93	132	683				
MAX *	209	222	232	218	218	230	1285				
FIRST	APR 29	APR 29	MAY 02	MAY 04	APR 26	APR 19					
LAST	SEP 08	SEP 12	SEP 15	SEP 12	SEP 04	SEP 14					

*Excluding Inlet

Source: Applied Biology, Inc., Stuart, Florida.

Table 5. Sea Turtle Nesting Data for the Green Turtle (*Chelonia mydas*) for Hutchinson Island, Martin County, Florida: 1985-1990.

Survey Area	YEAR						TOTAL	MEAN	STD	MIN	MAX
	1985	1986	1987	1988	1989	1990					
X	1	0	3	1	1	3	9	1.5	1.12	0	3
Y	0	1	2	2	0	2	7	1.2	0.90	0	2
Z	1	0	2	0	1	2	6	1.0	0.82	0	2
AA	5	1	6	1	7	7	29	4.8	2.19	1	7
BB	10	0	11	5	6	10	45	7.5	2.99	3	11
CC	4	0	6	7	1	5	27	4.5	1.89	1	7
DD	5	0	10	4	13	9	51	8.5	3.10	4	13
EE	2	2	4	1	2	5	15	2.5	1.50	1	5
SUBTOTAL	28	22	44	21	31	43					
MEAN	3.50	2.75	5.50	2.63	3.88	5.38					
STD	3.04	3.07	3.24	2.29	4.20	2.87					
FF	0	2	0	5	2	3	12	2.0	1.73	0	5
GG	1	2	2	6	0	11	22	3.7	3.77	0	11
HH	1	1	0	0	0	2	4	0.7	0.75	0	2
II	0	0	2	0	0	0	1	0.2	0.37	0	1
JJ	1	0	1	1	0	1	4	0.7	0.47	0	1
INLET	0	0	0	0	0	0	0	0.0	0.00	0	0
TOTAL	31	27	48	33	33	60	232				
TOTAL *	31	27	48	33	33	60	232				
MEAN *	2.4	2.1	3.7	2.5	2.5	4.8	17.8				
STD *	2.79	2.62	3.45	2.41	3.73	3.45	15.46				
MIN *	0	0	0	0	0	0	1				
MAX *	10	10	11	7	13	11	51				
FIRST	MAR 14	MAY 03	MAY 03	MAR 26	MAR 30	APR 10					
LAST	JUN 29	JUN 15	JUL 20	JUN 26	JUL 17	JUL 03					

*Excluding Inlet

Source: Applied Biology, Inc., Stuart, Florida.

Table 6. Sea Turtle Nesting Data for the Leatherback Turtle (*Dermochelys coriacea*) for Hutchinson Island, Martin County, Florida: 1985-1990.

Survey Area	YEAR						TOTAL	MEAN	STD	MIN	MAX
	1985	1986	1987	1988	1989	1990					
X	2	0	0	1	0	1	3	0.5	0.76	0	2
Y	0	1	0	1	2	2	6	1	0.82	0	2
Z	0	0	0	1	1	0	2	0.3	0.47	0	1
AA	2	1	0	1	3	0	7	1.2	1.07	0	3
BB	1	0	3	1	2	0	7	1.2	1.07	0	3
CC	1	0	3	1	0	1	6	1	1	0	3
DD	2	0	0	3	0	2	7	1.2	1.21	0	3
EE	2	2	4	3	5	1	17	2.8	1.34	1	5
SUBTOTAL	10	4	10	11	13	7					
MEAN	1.25	0.50	1.25	1.38	1.63	0.88					
STD	0.83	0.71	1.64	0.99	1.65	0.78					
FF	1	1	1	3	1	1	8	1.3	0.75	1	3
GG	0	0	1	0	3	0	4	0.7	1.11	0	3
HH	1	0	0	0	0	0	1	0.2	0.37	0	1
II	1	0	0	0	0	0	1	0.2	0.37	0	1
JJ	0	0	0	0	0	0	0	0	0	0	0
INLET	0	0	0	0	0	0	0	0	0	0	0
TOTAL	13	5	12	14	17	8	69				
TOTAL *	13	5	12	14	17	8	69				
MEAN *	1	0.4	0.9	1.1	1.3	0.6	5.3				
STD *	0.78	0.62	1.38	1.14	1.54	0.74	4.27				
MIN *	0	0	0	0	0	0	0				
MAX *	2	2	4	3	5	2	17				
FIRST	MAR 14	MAY 03	MAY 03	MAR 26	MAR 30	APR 10					
LAST	JUN 29	JUN 15	JUL 20	JUN 26	JUL 17	JUL 03					

*Excluding Inlet

Source: Applied Biology, Inc., Stuart, Florida.



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

December 29, 1993

Planning Division
Environmental Branch

TO ADDRESSES ON THE ENCLOSED LIST:

The Jacksonville District, U.S. Army Corps of Engineers, proposes to place approximately 1,000,000 cubic yards of beach compatible material onto an eroded beach beginning from just south of the St. Lucie County/Martin County line (monument R-2) and extending southward approximately 3.75 miles (6.00 km) to just south of Stuart Public Beach Park (monument R-22). The beach fill will be tapered between monuments R-1 and R-2 as well as R-22 and R-23. The beach compatible material will be obtained from an offshore borrow area located approximately 4,000 feet (1212 m) offshore of the southern end of the project beach and approximately 3.0 miles (4.8 km) northeast of the entrance to St. Lucie Inlet.

The attached Draft Environmental Assessment (DEA) was prepared to provide supplemental environmental information on the authorized project since the completion of the 1986 General Design Memorandum, 1991 Coastal Engineering and Environmental Studies Report, and 1993 interagency field investigations.

We welcome your views and comments about the information contained in the DEA as well as any suggested improvements. Letters of comment or inquiry should be addressed to the letterhead address to the attention of the Planning Division, Environmental Coordination Section and received by this office within forty-five (45) days of the date of this letter.

Sincerely,

A. J. Salem
Chief, Planning Division

Enclosures

Appendix G

**Comments and Responses
to the Draft Environmental Assessment**

**Martin County Shore Protection Project
Hutchinson Island, Martin County, Florida**

RESPONSE TO COMMENTS

Comments were received from the U.S. Fish and Wildlife Service (via the CAR), U.S. Department of Housing and Urban Development, U.S. Environmental Protection Agency, National Marine Fisheries Service (NOAA), Florida Department of Community Affairs, Florida Department of Environmental Protection, Florida Division of Historical Resources, and Florida Shore & Beach Preservation Association of Martin County. Comments are sequentially numbered on the attached correspondences, and responses are as follows:

U.S. Fish and Wildlife Service Final Coordination Act Report dated January, 1994.

COMMENT: The nourishment area should be shortened by approximately 2500 feet at the southern end to eliminate impacts to nearshore reefs; a new set of aerial photographs of the nearshore should be taken and groundtruthed; it is estimated that approximately 13 acres of reef will be buried; an artificial reef should be designed to provide habitat for species of interest to local SCUBA divers and snorklers; and the Service recommends that beach nourishment activities occur between November 1 and April 15.

RESPONSE: Martin County (the non-Federal sponsor) and the U.S. Army Corps of Engineers (Corps) have agreed to taper the last 2,000 feet of beach fill between State monuments R-23 and R-25. This modification eliminates the need for mitigation of any direct impacts as none are now anticipated. Aerial photographs taken over time will highlight the natural variability of sand movement in this area due to naturally dynamic conditions that are present off Hutchinson Island as well as to provide assistance in assessing the movement of beach fill material. The U.S. Fish and Wildlife Service (Service) based the 13 acre adverse impact to hardbottom habitat estimate on 1990 beach surveys and estimated limits of the equilibrium toe of fill provided by Coastal Technology, Inc., in 1991. Utilizing the most recent (1992) beach surveys and computer models that estimate the seaward extent of the equilibrium toe of fill, the Corps currently estimates that there will be no direct impact to any hardbottom habitat from implementation of the modified project. If mitigation of hardbottom habitat is later found to be justified from analysis of the hardbottom monitoring data, it is Corps policy to provide like and in-kind mitigation whenever feasible. By using irregularly shaped and sized hardened material such as concrete or limestone for any possible mitigation, mitigated habitat will contain various crevices, holes, ledges, and desired interstitial spaces. The Corps commits to turtle monitoring and nest relocation, if necessary, beginning on March 1 and continuing until April 15.

U.S. Environmental Protection Agency correspondence dated January 21, 1994.

COMMENT: Some hardbottom habitat will be immediately inundated by the proposed fill and require mitigation; some significant offshore/downdrift rock habitats could be adversely affected by increased sand moving off the nourished beach and this increased material could result in adverse secondary impacts at all trophic levels.

RESPONSE: The project has been further modified so that no inundation of hardbottom habitat by beach fill is expected. Some significant offshore and downdrift rock habitats could be adversely affected by increased sand moving off the nourished beach. To determine what impacts, if any, moving sand has on offshore/downdrift hardbottom habitat, the Corps has proposed a thorough quantifiable multi-year monitoring study of randomly selected hardbottom habitat areas. An interagency group of scientists will review the data and will ascertain what impacts, if any, have occurred to hardbottom habitat and associated flora and fauna. If the results of the monitoring indicate that hardbottom habitat has been adversely impacted, then appropriate mitigation will be performed.

National Marine Fisheries Service (NOAA) correspondence dated February 7, 1994.

COMMENT: NOAA supports the decision to shorten the length of the project to significantly reduce direct impacts to hardbottom habitat; any appropriate mitigation in the form of artificial reefs should be constructed using a 1:1 ratio; any artificial structure should be installed prior to initiating the shore protection project to provide a retreat for motile organisms in the project area.

RESPONSE: See responses to the U.S. Fish and Wildlife Service comments.

Florida Department of Environmental Protection correspondence dated March 7, 1994.

COMMENT: The Department has no objections to the project as proposed at this time. Specific details of the project will be assessed and addressed during the permitting process.

RESPONSE: The Corps will work closely with the Florida Department of Environmental Protection during the permitting process to address the specific details of the monitoring and mitigation plans.

Some fundamental features which should be incorporated into the design are: 1) extensive unshaded horizontal surface area for the attachment and growth of gorgonians and macroalgae; 2) openings near the bottom, for Spiny lobster, depth of at least 2 ft. and height of no more than 1 ft.; 3) interstitial spaces of approximately 10 cubic ft.; 4) large overhanging ledges to provide shaded resting space for large fish; 5) numerous projections, crevices, and holes ranging in size from one to three inches in width and up to 1 foot in length (projections) and depth (holes and crevices) to provide refugia for small fish and for juvenile fishes, as well as to provide additional surface area for epibiotic growth.

Any structure intended to mitigate for the loss of limestone substrate should, likewise, be built of limestone rather than concrete. To date, no comprehensive scientific study of substrate selectivity for epibenthic organisms on limestone versus other artificial reef building materials has been done. It may be that unnatural materials inhibit the settlement or growth of certain species of encrusting organisms. This could, in turn, alter the structure of the resulting associated fish community.

Limestone, however, cannot be formed into desired shapes like other material such as steel or concrete. A possible solution to the potential problems associated with substrate selectivity in fouling organisms while taking advantage of the moldability of concrete, would be to embed limestone rock in the surface of molded concrete pieces. If such pieces were to be constructed into a carefully designed artificial reef project of high relief, it may be possible to exceed the habitat values of the existing natural reef for certain species. This would reduce the acreage of mitigation needed to replace lost reef carrying capacity.

In our opinion, because of the low relief of much of the existing natural reef, a carefully planned artificial reef could reduce by as much as 50% mitigative reef acreage needed to recover impacted reef value. Final acreage calculations will have to await aerial mapping and groundtruthing of the two areas previously discussed. We would welcome the opportunity to work with Corps staff and that of Martin County in developing a suitable yet economical reef design and in monitoring the effectiveness of that design.

VIII. FISH AND WILDLIFE SERVICE RECOMMENDATIONS

The Fish and Wildlife Service recommends that the following be included in future project planning:

A. Project Design

1. The nourishment area should be shortened by approximately 2500 feet at the southern end. This would place the southern limit of the project at R-23 or in front of the Stuart Public Beach. This modification would eliminate impacts to the nearshore reefs which extend south of R-23 and reduce mitigation needs.

front of the Stuart Public Beach. This modification would eliminate impacts to the nearshore reefs which extend south of R-23 and reduce mitigation needs. Eventually, sand would be transported by natural littoral drift to beaches further south.

B. Reef Mitigation

1. A new set of aerial photographs of the nearshore should be taken and groundtruthed. A precise measurement of the reef area which will be buried by the project should then be made. Once this is done, final mitigation acreage necessary to compensate for this burial can be calculated.
2. We estimate that approximately 13 acres of reef will be buried. We recommend that at least 1 acre of artificial reef is deployed prior to project construction. This will provide an alternative refuge for some of the fish displaced by the project. In addition, with detailed monitoring of population densities on the initial reef deployed, the carrying capacity per acre of the designed reef could be estimated and the appropriate acreage ratio required for full habitat value replacement could be determined.
3. The artificial reef structure selected for mitigation for unavoidable impacts should be designed to provide habitat for species which are of interest to local SCUBA divers and snorkelers. Its surface should consist of limestone. Design features should include: a) extensive unshaded horizontal surface area; b) openings near the bottom for Florida lobster; d) interstitial spaces approximately 10 cubic feet; e) large overhanging ledges; f) numerous projections, crevices and holes.
4. Assuming that the artificial structure is carefully designed and will have approximately twice as much surface area per acre above the scour zone as the natural reef, we tentatively recommend a mitigation ratio of no less than 0.5 to 1, pending review of the final design and monitoring of a pilot reef (see 2 above). However, an ineffective design could require more acreage than existing natural reefs buried.
5. Surveys of the area of deployment of the designed reef should be made to ensure that it is placed on a solid foundation. There may be areas low relief rock just offshore of the fill area where scouring and periodic burial have reduced reef habitat values to near zero. Such area should be located and utilized for reef placement.