o. S-5 Beach fill and periodic nourishment stabilized by groins. Groins or a groin field in the problem area would help hold a beach in front of existing development and prevent further losses of land. The construction of groins would have to be supplemented with nourishment so that adjacent beaches would not be starved of sand. For this reason, groins are considered as a method to help hold the fill in place and to reduce the periodic renourishment requirements.

p. S-6 Seawalls. The construction of additional concrete seawalls or improvements to and maintenance of the existing bulkheads/seawall would provide a significant degree of protection; however, this would be accomplished at the expense of a recreational beach, resulting in substantial economic loss to the area. Reflecting wave energy off the existing seawalls and bulkheads has resulted in a steepening of the offshore profiles with resulting hazardous bathing conditions due to increased undertow and runouts. However, to more fully determine the effects of hardfacing the shoreline, the seawall alternative will be considered at least through the intermediate alternative evaluation phase.

q. S-7 Beach fill with periodic nourishment and hurricane surge protection sand dune. This alternative would help protect the shoreline from storm damages by reducing high hazard coastal flooding areas to general still water flooding areas. Measures to prevent damages from hurricane-induced surges and wave runup could be provided for a relatively high degree of protection for the oceanfront structures located along the shoreline. To provide a complete system of protection against tidal flood damages in most coastal areas is technically possible. However, such protection is generally not economically justifiable, esthetically pleasing, or socially and environmentally acceptable. This alternative has been successfully demonstrated in the Miami area and is considered a viable alternative for reducing erosion and flooding damage in other areas.

r. S-8 Beach fill with periodic nourishment and hurricane surge protection - offshore breakwaters or submerged artificial reefs. This alternative would essentially provide the same benefits attributed to alternative S-7 above, but the construction of offshore breakwaters or submerged artificial reefs would materially reduce the periodic nourishment quantities required to maintain project dimension size during the economic life of the project. This alternative is considered economically and technically feasible based on the demonstrated

protective action of natural submerged reefs offshore of St. Lucie and Indian River Counties on the Florida east coast.

s. S-9 Nearshore berms. This alternative is similar to S-4 where dredged material from an adjacent inlet is used for shore protection. In this case however, the dredged material would be placed nearshore instead of onshore. This method is now possible due to improvements in dredging technology, allowing placement in shallow water (15 ft depth). Its low cost compared to onshore disposal could provide greater benefit. Placement will be a careful process so that hardbottom impacts will be minimized.

t. S-10 Beachfill with nearshore berms. This alternative is again similar to S-4 but will use nearshore disposal instead of onshore disposal. Use of nearshore berms will require less advance nourishment for the beachfill project.

u. S-11 Stabilization of beaches and dunes by vegetation. This alternative would provide beach grass and sand fences to the berm. The primary benefits from the provision of sand fences and beach grasses are derived from the quantity of sand saved and the ability of the works to provide stability to the berm. This alternative would result in a reduction of the quantity of periodic nourishment required. The addition of beach grass and sand fences would remove a small amount of dry beach away from recreational beach use. A variation of this alternative could be implemented at a later date in combination with beach fill if the formation of wind blown sand dunes and landward migration thereof become a problem. This has proven to be a successful alternative feature of nourishment projects in northeast Florida.

v. S-12 Feeder beach: Beach fills strategically located to nourish downdrift erosion problem areas. This concept entails utilizing disposal of maintenance dredging material, sand transfer plants, and truck hauls to provide for economical placement of material where it will nourish downdrift shores due to the predominate direction of littoral drift. Problem identification and data collection can be oriented towards providing the necessary information to formulate plans addressing this alternative on a regional perspective basis.

w. S-13 Relocation of structures. The relocation of the structures would allow the area to continue to erode and the land in this area would be lost until an equilibrium shoreline is reached. However, most structures within the area cannot be economically moved from the area which would be lost. In addition, implementation of this alternative

would result in the loss of valuable recreational beach and would necessitate the condemnation of the land and structures in highly developed areas. This alternative is always considered when evaluating the cost of structural alternatives.

x. S-14 Flood proofing of structures. Flood proofing of existing structures and regulation of flood plain and shorefront development are considered part of building code modifications.

y. S-15 Abandon or modify navigation projects. All inlets could be examined to determine if modification will improve efficiency in the transfer of sand and/or maintenance of navigation works. Removal or modification of jetties, sand transfer facilities, channel alignments and/or closure could be evaluated.

z. S-16 Sand tightening of jetties. Sand tightening will decrease permeability of the jetties and decrease sand transported into inlets. This will decrease maintenance dredging requirements.

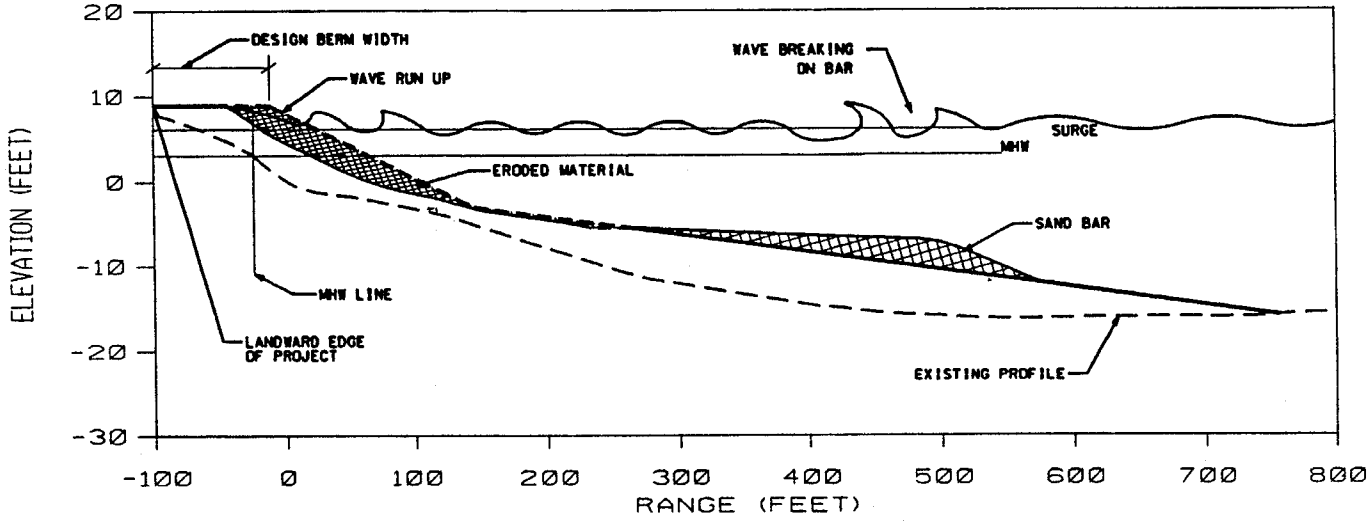
aa. S-17 Upgrading on construction of sand transfer plants for renourishment. Sand bypassing will introduce sediment into erosional areas decreasing renourishment volumes and intervals.

bb. S-18 Various combinations of above. Select features of the preceding structural solutions could be implemented collectively or in combination with the nonstructural alternatives. This alternative will therefore be carried forward int he formulation process.

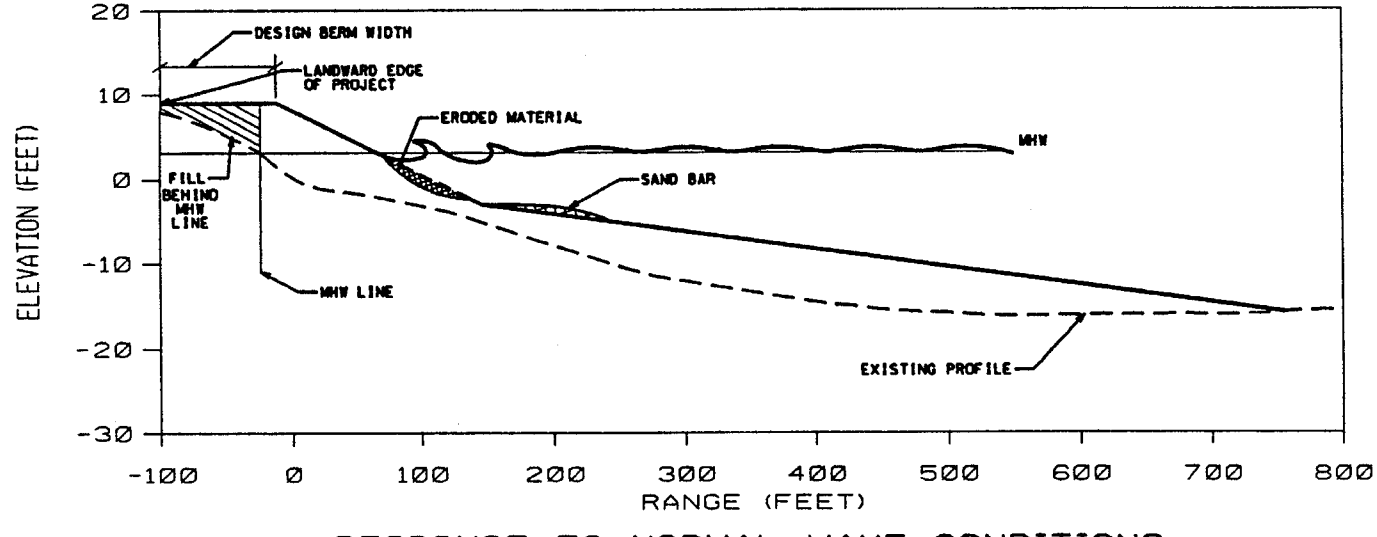
Intermediate Assessment of Alternatives

138. The previous paragraphs describing the solutions eliminated all but one non-structural and 7 structural alternatives. The no action plan (NS-1) is the single non-structural alternative to be carried throughout intermediate plan formulation for consideration and comparison. The structural alternative plans to be carried into the intermediate assessment include: beach fill with periodic nourishment (S-2) (a typical storm damage reduction project is seen in Figure 3), beach nourishment with maintenance material form updrift inlet (S-4), nearshore berms (S-9), beachfill with nearshore berms (S-10), stabilization of beaches and dunes by vegetation (S-11), abandon or modify navigation projects (S-15), sand tightening of jetties (S-16), and upgrading on construction of sand transfer plants for renourishment (S-17).

Figure 3
COAST OF FLORIDA STUDY-REGION 3



RESPONSE TO STORM WAVE CONDITIONS



RESPONSE TO NORMAL WAVE CONDITIONS

TYPICAL STORM DAMAGE REDUCTION PROJECT

139. In this phase of plan formulation, alternatives selected in the preliminary phase will be assessed using unit price cost estimates. Volumes calculated for beach fills were based on average profiles for the reach. These average profiles were developed using BMAP (Beach MorphologyAnalysis Package). Tables 11 through 13 summarizes the alternatives analyzed.

140. NED Plan Formulation. National economic development (NED) principles are utilized by the Federal government for the economic evaluation of all water resource projects. The NED principles articulate a framework to assist in making project scope and implementation decisions. For the purpose of Shore Protection in COFS, NED principles are used to determine the total net benefits of the project, both in its entirety and in incremental stages. From this information, the NED plan is formulated and net benefits are maximized.

141. The NED plan for the COFS shore protection projects has been developed in accordance with ER 1105-2-100 Section 6-1 by adopting the procedures and policies of the Water Resource Council's (WRC) Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, Chapter II - National Economic Development (NED) Benefit Evaluation Procedures (March 10, 1983).

142. NED Principles. National economic development (NED) is the increase in the net value of the national output of goods and services, expressed in monetary units. "Contributions to NED are the direct net benefits that accrue in the planning area and the rest of the nation. Contributions to NED include increases in the net value of those goods and services that are marketed, and also those that may not be marketed."(Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, p. 1, March 1983)

143. U.S. Army Corps of Engineers projects produce outputs which benefit the nation, but these projects also expend the nation's resources. The NED principle is used to determine which utilization of the nation's resources will produce the greatest benefits to the nation. As such, the NED principle is a matter of law, policy and interpretation rather than one of economic fact or theory, although it is a policy firmly rooted in economic theory.

144. The Water Resource Council (WRC) has established evaluation principles which are intended to ensure proper and consistent planning by Federal agencies. These principles, as defined in the "Economic and Environmental

Principles and Guidelines for Water and Related Land Resources Implementation Studies", are as follows:

Various alternative plans are to be formulated in a systematic manner to ensure that all reasonable alternatives are evaluated.

(a) A plan that reasonably maximizes net national economic development benefits, consistent with the Federal objective, is to be formulated. This plan is to be defined as the NED plan.

(b) Other plans which reduce net NED benefits in order to further address other Federal, State, local, and international concerns not fully addressed by the NED plan should also be formulated.

(c) Plans may be formulated which require changes in existing statutes, administrative regulations, and established common law, such required changes are to be identified.

(d) Each alternative plan is to be formulated in consideration of four criteria: completeness, effectiveness, efficiency, and acceptability. Appropriate mitigation of adverse effects is to be an integral part of each alternative plan.

(e) Existing water and related resources plans, such as State water resources plans, are to be considered as alternative plans if within the scope of the planning effort.

145. The planning process leads to the identification of alternative plans that could be recommended or selected. The culmination of the planning process is the selection of the recommended plan or the decision to take no action. The selection should be based on a comparison of the effects of alternative plans (ER 1105-2-100 Section 5-11.a). The basis for selection of the recommended plan should be fully reported (ER 1105-2-100 Section 5-11.b(4)). In presenting the NED plan, all reports must include appropriate information and data (ER 1105-2-100 Section 5-16.b). Concise, understandable displays are also helpful during the planning process and provide documentation in compliance with NEPA (ER 1105-2-100 Section 5-9.a.1).

146. Under the NED principle, the best, or NED, plan is the one that maximizes net benefits. The Corps traditionally expresses benefits and costs in monetary terms as equivalent annual values. Thus, maximizing annual net NED benefits is formally equivalent to selecting a plan with the maximum

equivalent annual benefits and maximum net present value (NPV). The plan recommending Federal action is to be the alternative plan with the greatest net economic benefit, which is also consistent with protecting the Nation's environment (Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, p. 1, March 1983).

147. Sand Transfer Plants. The obsolete sand transfer plants (STP) at Lake Worth and South Lake Worth Inlets in Palm Beach County are outdated and insufficient in passing desired volumes of sand and at sufficient discharge distance south of the respective inlets. The Lake Worth Inlet STP was in operation from 1958 to 1990. The plant was severely damaged during the winter storms of 1990 and has not been operational since that time. The Town of Palm Beach, current owner of the plant is in the process of temporarily repairing the STP to provide some bypassing capacity. The pump has been replaced and a new pipeline has been drilled under the inlet.

148. The current STP configuration at LWI does not meet the design standards outlined in the 1958 authorization. The authorized design was for bypassing 100,000 cubic yards annually to a point 1,000 to 2,000 feet south of the inlet. Current plant deficiencies are caused by the limited sand trap size of the intake location, the limited radius of 40 feet of the intake boom, and the shortened outfall pipeline on the south side of the inlet, which results in sand discharge within 200 feet of the south jetty. These limitations result in little, if any, bypass of sand beyond the influence of Lake Worth Inlet.

149. The plant facilities at Lake Worth Inlet, with the exception of the engine and discharge line under the inlet, are now almost 40 years old. Northeast storms typically flood the pump house with seawater. There are cracks in the concrete foundation of the structure housing the pump equipment. Palm Beach County, which operates the plant, has reported annual operation and maintenance costs in excess of $350,000 when in operation, not including the costs for the recent improvements. There are little or no storm damage reduction benefits for operation of the existing plant due to its limited effectiveness described above.

150. It has been assumed that the discharge line for both plants will be placed under the inlet channel by directional drilling. This is an expensive technique, thus ensuring a conservative estimate of cost for justification purposes. The pipe to be used has been specifically designed not to require rotation since it has a thickened bottom lining. The detailed design of the Lake Worth Inlet and South Lake

Worth Inlet STP's require in-depth hydraulic analyses, beyond the scope of this study, and will be determined within Feature Design Memoranda (FDM) to be prepared during PED). Other construction alternatives, including discharge pipe routing and placement to reduce cost, will be considered during this phase.

151. In the 1988 Section 111, Definite Project Report, Palm Beach Harbor, Florida, it was determined that 45 percent of erosion downdrift of Lake Worth Inlet is directly attributable to the Palm Beach Harbor Navigation Project. This feasibility study has found that the erosion caused by the project is 67 percent (based on data and analysis in Appendix D). Cost-sharing will be based on mitigation for this increased erosion. South Lake Worth Inlet also has an adverse affect on downdrift shoreline, however, a Federal navigation project does not exist at that inlet.

Description of Intermediate Alternatives

152. Palm Beach County. Jupiter/Carlin. This 1.1 mile beachfill project located between DEP monuments R-13 and R-19 is authorized but as yet unconstructed. The optimal berm width is 20 feet at elevation +9.0 feet NGVD and slopes of 1:10 berm to MLW and 1:30 from MLW to existing bottom. The initial design volume is 513,000 cubic yards and the renourishment interval is 7 years. Two potential nearshore berm sites have been identified. However one site was eliminated due to the close proximity of a proposed borrow area. A potential dune component of the project will be analyzed further in the next report. An example of the methodology for the optimization of the berm width and nourishment interval will be discussed in the next section of the report, "Economics of Alternatives".

153. Riviera. The storm protection plan for this segment of Palm Beach County includes the construction of 5 offshore breakwater segments. This plan is being designed and proposed for the county by a consulting firm and is shown in Figure 4. The breakwaters will be constructed on top of existing hardbottom and as such would require the placement of armor stone only. Armor stone density would be 145 pcf, weight 7,000 lbs, and about 4 cubic feet in dimension. Considered breakwater lengths are 180 feet, 200 feet, 180 feet, 180 feet, and 200 feet. The breakwaters will be located about 1 to 1 1\2 miles north of Lake Worth Inlet (DEP monuments R-67 to R-69) and serve as an extension to a shallow hardbottom area which is shore-connected at the northern end. The breakwaters will be between about 150 to 375 feet offshore.

154. Riviera. This 1.7 mile new project area has a wide beach but is at a low elevation. A dune project is proposed and will be examined in detail in the next report for the area between DEP monuments R-66 and R-75. One potential nearshore berm site has been identified.

155. Lake Worth Inlet. The recommended plan for sand bypassing at Lake Worth Inlet (R-75-78) requires the construction of a new fixed pumping plant located north of the inlet. The bypassing plant includes:

a. A deposition area north of the north jetty,

b. An array of jet pumps suspended from a pier oriented perpendicular to the shoreline, or

c. A single jet pump deployed by a crane from the north jetty,

d. A clear water pump and pipeline providing water to the jet pumps,

e. An on shore pumphouse containing the clear water pump and a booster pump for transferring the dredged material past the inlet,

f. A slurry pit to ensure the proper ratio of solids to water, and

g. All associated pipe, valves, instruments, and controls required for operation of the system.

The discharge point for sand bypassing would be about 2,500 feet south of the south jetty. The system would be designed for a target bypassing rate of about 160,000 cubic yards per year. The detailed design for deployment of the jet pump eductors (whether pier or jetty) would be determined within a Feature Design Memorandum (FDM).

156. North Palm Beach Island. The 1.9 mile beach fill project located between DEP monuments R-76 and R-85 is authorized but as yet unconstructed. The optimal berm width is 20 feet at elevation +9.0 feet NGVD and slopes of 1:10 berm to MLW and 1:30 from MLW to existing bottom. The initial design volume is 468,000 cubic yards and the renourishment interval is 9 years. Mitigation for hardgrounds may be necessary in this area.

157. Palm Beach Island. The 2.7 mile beach fill project located between DEP monuments R-91 and R-105 is authorized but as yet unconstructed. The optimal berm width is 20 feet at elevation +9.0 feet NGVD and slopes of 1:10 berm to MLW

TABLE 11
PALM BEACH COUNTY - INTERMEDIATE PROJECT AREAS OF INTEREST
COAST OF FLORIDA STUDY - REGION III

POTENTIAL PROJECT	FDEP RANGE	PROJECT LENGTH	COMMENTS
1. JUPITER/JUNO Beach Fill and Dune; Nearshore Berm	R-13 - R-29	3.0 miles	Authorized Project, not constructed
2. RIVIERA Stablize Beach with Groin or Breakwater	R-67 - R-69	0.38 miles	New Project
3. RIVIERA Dune; Nearshore Berm	R-66 - R-75	1.7 miles	New Project
4. LAKE WORTH INLET Sand Transfer Plant	R-75 - R-78	0.57 miles	New Project
6. N. PALM BEACH ISLAND Beach Fill; Nearshore Berm	R-76 - R-85	1.9 miles	Authorized Project, not constructed
7. PALM BEACH ISLAND Beach Fill; Nearshore Berm	R-91 - R-105	2.7 miles	Authorized Project, not constructed
8. S. PALM BEACH ISLAND Beach Fill	R-116 - R-132	3.0 miles	Authorized Project, not constructed
9. S. LAKE WORTH INLET Sand Transfer Plant	R-151 - R-154	0.57 miles	New Project
10. OCEAN RIDGE Beach Fill; Nearshore Berm	R-152 - R-159	1.46 miles	Authorized Project, not constructed
11. DELRAY BEACH Beach Fill; Nearshore Berm	R-175 - R-188	2.65 miles	Authorized Project
12. HIGHLAND BEACH Beach Fill; Nearshore Berm	R-188 - R-205	3.2 miles	New Project
13. BOCA RATON Beach Fill; Nearshore Berm	R-205 - R-213	1.45 miles	Authorized Project

TABLE 12
BROWARD COUNTY - INTERMEDIATE PROJECT AREAS OF INTEREST
COAST OF FLORIDA STUDY - REGION III

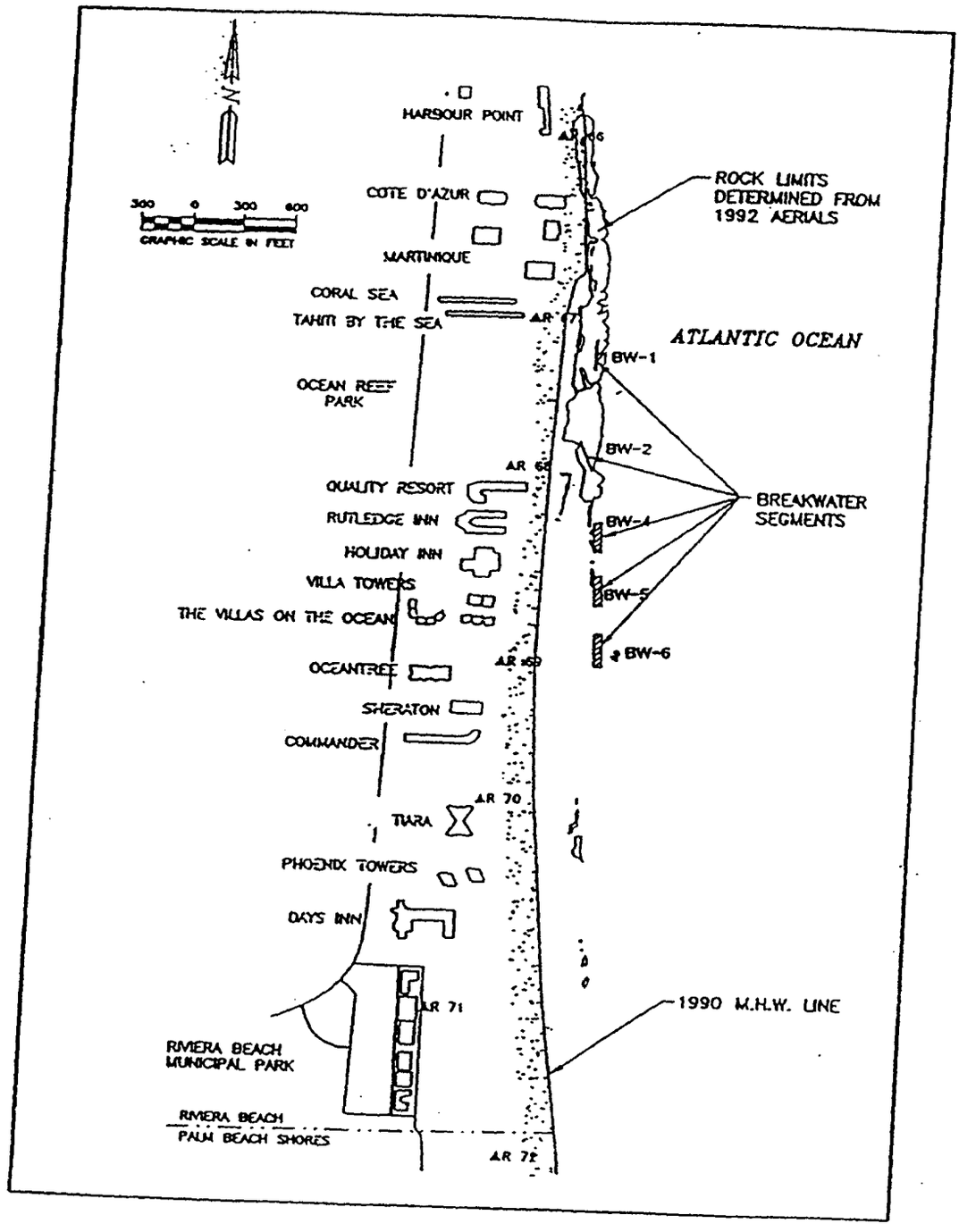
POTENTIAL PROJECT	FDEP RANGE	PROJECT LENGTH	COMMENTS
1. DEERFIELD BEACH Beach Fill	R-1- R-25	4.5 miles	New Project
2. HILLSBORO INLET Sand Trap Groin or Breakwater	R-25 - R-26	1000 feet	New Project
3. POMPANO, UNINC, LAUD.-BY-THE SEA Beach Fill; Nearshore Berm	R-26 - R-53	5.3 miles	Authorized Project
4. FORT LAUDERDALE Beach Fill; Dune; Nearshore Berm	R-53 - R-64	2.1 miles	New Project
5. PORT EVERGLADES Sand Transfer Plant	R-85 - R-88	0.57 miles	New Project
6. PORT EVERGLADES Spur and Breakwater	R-86	600 feet	New Project
7. J.U. LLOYD Beach Fill; Nearshore Berm	R-86 - R-98	2.3 miles	Authorized Project
8. DANIA Beach Fill	R-98 - R-101	0.6 miles	New Project
9. HOLLYWOOD/ HALLANDALE Beach Fill; Nearshore Berm	R-101 - R-128	5.3 miles	Authorized Project, not constructed

TABLE 13
DADE COUNTY - INTERMEDIATE PROJECT AREAS OF INTEREST
COAST OF FLORIDA STUDY - REGION III

POTENTIAL PROJECT	FDEP RANGE	PROJECT LENGTH	COMMENTS
1. GOLDEN BEACH Beach Fill	R-1- R-7	1.1 miles	New Project
2. SUNNY ISLES Beach Fill; Nearshore Berm	R-7 - R-20	2.5 miles	Authorized Project
3. BAKERS HAUL. INLET Sand Transfer Plant	R-26 - R-29	0.58 miles	New Project
4. BAL HARBOUR SURFSIDE, MIAMI BEACH Beach Fill; Dune; Nearshore Berm	R-27 - R-74	8.9 miles	Authorized Project
5. GOVERNMENT CUT Sand Tightening	R-74 - R-75	0.19 miles	New Project
6. KEY BISCAYNE Beach Fill and Dune	R-96 - R-113	3.2 miles	Authorized Project

FIGURE 4

RIVIERA BREAKWATER DESIGN
COAST OF FLORIDA STUDY - REGION III



BREAKWATER DESIGN PLAN VIEW

and 1:30 from MLW to existing bottom. The initial design volume is 994,000 cubic yards and the renourishment interval is 8 years. Three potential nearshore berm sites have been identified. However one site was eliminated due to possible wave focusing effects. Mitigation for hardgrounds may also be necessary in this area

158. South Palm Beach Island. The three mile beach fill project located between DEP monuments R-116 and R-132 is authorized but as yet unconstructed. The optimal berm width is 20 feet at elevation +9.0 feet NGVD and slopes of 1:10 berm to MLW and 1:30 from MLW to existing bottom. The initial design volume is 800,000 cubic yards and the renourishment interval is 6 years.

159. Ocean Ridge. The 1.5 mile beach fill project located between DEP monuments R-152 and R-159 is authorized but as yet unconstructed. The optimal berm width is 60 feet at elevation +9.0 feet NGVD and slopes of 1:10 berm to MLW and 1:30 from MLW to existing bottom. The initial design volume is 462,000 cubic yards and the renourishment interval is 8 years. Two potential nearshore berm sites have been identified, but were eliminated.

160. Delray Beach. The 2.6 mile beach fill project located between DEP monuments R-175 and R-188 is authorized and constructed. The optimal berm width in the re-analysis of this project is 20 feet at elevation +9.0 feet NGVD and slopes of 1:20 berm to MLW and 1:30 from MLW to existing bottom. The initial design volume is 962,000 cubic yards and the renourishment interval is 10 years. One potential nearshore berm site has been identified.

161. Highland Beach. the 3.2 mile beach fill project located between DEP monuments R-188 and R-205 is a newly developed project. It would fill in a gap between two authorized projects lessening end losses. The optimal berm width in the analysis of this project is 25 feet at elevation +9.0 feet NGVD and slopes of 1:10 berm to MLW and 1:30 from MLW to existing bottom. The initial design volume is 782,000 cubic yards and the renourishment interval is 10 years. One potential nearshore berm site has been identified.

162. Boca Raton. The 1.5 mile beach fill project located between DEP monuments R-205 and R-213 is authorized and constructed. The optimal berm width in the re-analysis of this project is 20 feet at elevation +9.0 feet NGVD and slopes of 1:10 berm to MLW and 1:35 from MLW to existing bottom. The initial design volume is 484,000 cubic yards and the renourishment interval is 8 years. One potential nearshore berm site has been identified.

163. Broward County. Deerfield Beach. The 4.5 mile beach fill project located between DEP monuments R-1 and R-24 is a newly developed project. The optimal berm width in the analysis of this project is 20 feet at elevation +9.0 feet NGVD and slopes of 1:15 berm to MLW and 1:30 from MLW to existing bottom. The initial design volume is 1,782,000 cubic yards and the renourishment interval is 8 years.

164. Hillsboro Inlet. Navigation improvements are being considered for the outer channel at this inlet to provide advanced maintenance for the entrance channel. Two alternatives are being evaluated. The first is as designed and contained within a permit request by the local sponsor which proposes to dredge a fan/delta shaped entrance channel extending from the eastern limits of the existing jetties to the minus 15-foot contour, NGVD, a distance of about 1,550 feet. the seaward side of the new channel would be approximately 1,000 feet and the proposal is to dredge to minus 20 feet, NGVD, with a 2-foot over dredge allowable. About 75,000 and 140,100 cubic yards of sand and rock, respectively would be removed. Excavated sand would be placed wither on the beach within 2,000 feet south of the inlet (R-25 to R-27) or within a near-shore reach located about 4,000 to 6,000 feet south of the inlet (R-29 to R-31). The rock removed would be placed on an existing artificial reef approximately 3.75 miles north of the inlet in waters 60 to 70 feet deep (large diameter rocks) and 350 to 400 feet deep (small diameter rocks). The second navigation alternative would consist of deepening the existing locally maintained 200 foot wide entrance channel to -15 feet MLW extending from the eastern limits of the existing jetties to the -15 foot MLW contour. The depth of the widener would also be -15 feet MLW. Material removed would include about 80,100 cubic yards of sand and 23,250 cubic yards of rock. Disposal options would be identical to the first alternative.

165. Pompano/Lauderdale-By-The-Sea. The 5.3 mile beach fill project located between DEP monuments R-24 and R-53 is authorized and constructed. The optimal berm width in the re-analysis of this project is 20 feet at elevation +9.0 feet NGVD and slopes of 1:15 berm to MLW and 1:30 from MLW to existing bottom. The initial design volume is 1,917,000 cubic yards and the renourishment interval is 7 years. One potential nearshore berm site has been identified.

166. Fort Lauderdale. This 2.1 mile new project area is at a low elevation and experiences flooding during storms. A dune project is proposed and will be examined in detail in the next report for the area between DEP monuments R-53 and R-64. A beach fill will be analyzed in conjunction with the

dune. One potential nearshore berm site has been identified but was eliminated due to the potential for wave focusing.

167. Port Everglades. The recommended plan for sand bypassing at Port Everglades (R-85-88) requires the construction of a fixed pumping plant similar to Lake Worth Inlet located north of the inlet. This discharge point for sand bypassing would be about 1000 feet south of the south jetty.

168. Port Everglades. The inlet management plan for Port Everglades recommended the construction of two structures immediately south of the port's south jetty. The design includes a 150 foot jetty spur structure connected to the south side of the Port Everglades south jetty at an angle which is approximately parallel to the historical shoreline south of the inlet. In addition, a 300 foot long breakwater would be constructed along the same alinement as the jetty spur with a 150 foot gap between the spur and the breakwater. The jetty spur would be a rubble mound structure with a core, intermediate, and armor layers with a crest elevation of about +8.0 feet. The armor would be granite of a weight of 8 to 10 tons. Similarly, the detached breakwater would be similar structure but would only consist of layers of armor stone of 6 to 10 tons to an elevation of +5.0 feet. These structures are designed to reduce the chronic erosion immediately south of the harbor by disrupting the circulation patterns due to tidal associated with currents.

169. J.U. Lloyd. The 2.3 mile beach fill project located between DEP monuments R-86 and R-98 is authorized and constructed. The optimal berm width in the re-analysis of this project is 20 feet at elevation +10.0 feet NGVD and slopes of 1:15 berm to MLW and 1:30 from MLW to existing bottom. The initial design volume is 1,032,000 cubic yards and the renourishment interval is 5 years. One potential nearshore berm site has been identified.

170. Dania. The .6 mile beach fill project located between DEP monuments R-98 and R-101 is newly developed. A beach fill at Dania would fill in the gap between J.U. Lloyd and Hollywood/ Hallandale, two authorized projects. However, due to the small project length, the fill would be designed as a transition. The optimal berm width would transition between 20 and 45 feet with a transition berm height between elevation +10.0 feet and +7.0 NGVD and slopes of 1:15 berm to MLW and 1:40 from MLW to existing bottom.

171. Hollywood/Hallandale. The 5.3 mile beach fill project located between DEP monuments R-101 and R-128 is authorized and constructed. The optimal berm width in the re-analysis

of this project is 45 feet at elevation +7.0 feet NGVD and slopes of 1:15 berm to MLW and 1:45 from MLW to existing bottom. the initial design volume is 1,458,000 cubic yards and the renourishment interval is 7 years. One potential nearshore berm site has been identified.

172. Dade County. Golden Beach. The 1.1 mile beach fill project located between DEP monuments R-1 and R-7 is a newly developed project. It would fill in a gap between two authorized projects (in two different counties) decreasing end losses. The optimal berm width in the analysis of this project is 70 feet at elevation +8.2 feet NGVD and slopes of 1:10 berm to MLW and 1:30 from MLW to existing bottom. The initial design volume is 408,000 cubic yards and the renourishment interval is 6 years. Two potential nearshore berm sites have been identified. One has been eliminated due to potential wave focusing.

173. Sunny Isles. The 2.5 mile beach fill project located between DEP monuments R-7 and R-20 is authorized and constructed. The optimal berm width in the re-analysis of this project is 40 feet at elevation +8.2 feet NGVD and slopes of 1:10 berm to MLW and 1:30 from MLW to existing bottom. The initial design volume is 607,000 cubic yards and the renourishment interval is 4 years. One potential nearshore berm site has been identified.

174. Bakers Haulover Inlet. The recommended plan for sand bypassing at Bakers Haulover Inlet (R-26-29) requires the construction of a fixed pumping plant similar to Lake Worth Inlet located north of the inlet. The discharge point for sand bypassing would be about 1000 feet south of the south jetty.

175. Bal Harbour, Surfside, Miami Beach. The 8.9 mile beach fill project located between DEP monuments R-27 and R-74 is authorized and constructed. The optimal berm width in the re-analysis of this project is 60 feet at elevation +8.2 feet NGVD and slopes of 1:10 berm to MLW and 1:30 from MLW to existing bottom. The initial design volume is 3,732,000 cubic yards and the renourishment interval is 3 years. Four potential nearshore berm sites has been identified. The dune component of this project will be analyzed in the next report.

176. Government Cut. To sand tighten the north jetty (R-74, excavation will be required to construct a stable foundation for the increased width of the rebuilt cross-section. Excavation will be required to either -4 feet MLW, or until buried armor stone is encountered, whichever occurs first. If no armor stone is encountered, an 18-inch bedding layer will be placed, and armor stone will be placed in a

layer at least 2 stones thick. The displaced armor stone will be used first, then supplemented by 1,980 tons of new 2-ton armor stone (165 lb/ft 3 minimum). The armor layer above the core will be chinked and grouted also, in order to create an impermeable barrier to elevation +12.0 MLW. The final crest width will be 15 feet, at an elevation of +12 feet MLW. Side slopes will be 1 vertical on 1.5 horizontal. The total quantities of new materials are as follows:

a. Displaced Existing Armor Stone. Approximately 4,465 tons of existing armor stone will be excavated and stockpiled next to the jetty, then replaced as the structure is rebuilt.

b. New Armor Stone. Assuming 165 lb/ft3 minimum unit weight, 25 percent voids, and 10 percent waste, 1,980 tons of new 2-ton armor stone will be required.

c. New Bedding/Core/Chinking Stone. This type of stone will be used in four areas: placement below MLW along the excavated jetty centerline, construction of a foundation at -4 feet MLW to support the increased width of the jetty, construction of the sand-tight core, and chinking above the core. Locally available stone may be used. Assuming a unit weight of 140 lb/ft3, plus 10 percent waste, 374 tons will be required to construct the foundation layer for the new armor stones. An additional 410 tons of stone will be placed to -3 feet MLW by pressure-washing. Construction of the impermeable core will require 1,852 tons, and chinking above the core will require 315 tons. Total weight of stone required is 2,951.

177. Key Biscayne. The 3.2 mile beach fill project located between DEP monuments R-96 and R-113 is authorized and constructed. The optimal berm width in the re-analysis of this project is 45 feet at elevation +5.3 feet NGVD and slopes of 1:14 berm to MLW and 1:30 from MLW to existing bottom. The initial design volume is 332,000 cubic yards and the renourishment interval is 5 years. A potential dune component of this project will be considered in the next report.

178. Two structural alternatives, Riviera Groin or Breakwater (R-67-69) and Port Everglades spur and breakwater (R-86) analyzed during the intermediate assessment of alternatives were determined to be beyond the scope of this study. They will not be further analyzed. Two sand transfer plant alternatives, Port Everglades (R-85) and Bakers Haulover Inlet (R-26) were also not studied further due to the inadequate supply of sediment to transfer. The sediment budget for these two inlets are discussed in Appendix D.

179. The beach fill alternative at Riviera (R-66-75) was determined to be unfavorable due to its localized nature. The erosional hot spot covers a very small portion of the project area. Periodic nourishment is authorized and should be used to fill in the hot spot as it occurs.

DETAILED ALTERNATIVE PLANS

180. In the final phase of plan formulation, the development and assessment of detailed alternative plans is undertaken. Detailed benefits have been computed. MCACES cost estimates, including the costs of lands, easements, rights-of-way and mitigation, have also been computed. This detailed information may be found in Appendix D.

Detailed Assessment of the No Action Plan

181. This alternative assumes that the erosion in the study area will continue with no solutions or remedial measures being constructed, except for those in response to emergency situations. Local efforts to stop the storm and erosion damage have been limited to construction and repair of coastal armor. These efforts have not provided the desired level of storm protection.

182. This option avoids any undesirable effects that may be associated with construction of the selected plan. However, if steps are not taken to counteract the erosion and provide an appropriate level of storm damage protection, continuing erosion and recession of the shoreline will occur with subsequent loss of valuable property and damage to structural improvements along the shoreline. A summary of environmental impacts of the no action plan is presented in the Environmental Impact Statement which follows the main text of this report.

Description of Detailed Alternatives

183. Detailed alternatives are described in the following section in geographic order from north to south. The discussion is grouped by littoral cell (beach reaches between two inlets), generally considered as a project segment. In those cases where two counties are involved within the same littoral cell, i.e., Boca Raton Inlet to Hillsboro Inlet and Port Everglades Inlet to Bakers Haulover Inlet, the project alternatives are discussed on a county basis.

184. Figures 5 - 8 illustrate the various project segments and project components on a regional scale. Figures 9 - 22 illustrate the recommended project footprints at a more detailed scale also illustrating identified nearshore

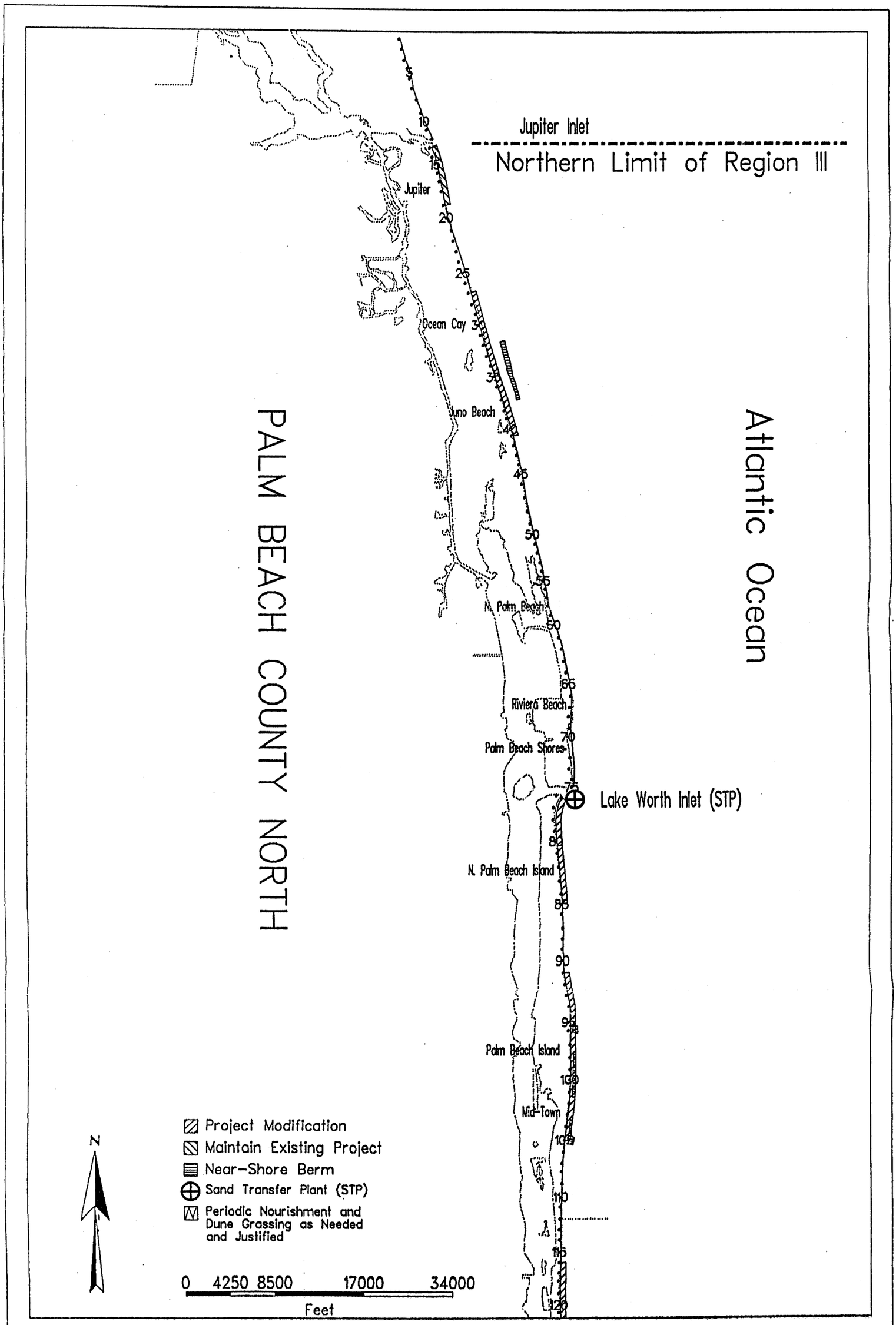


Figure 5 Palm Beach County Project Alternatives, North

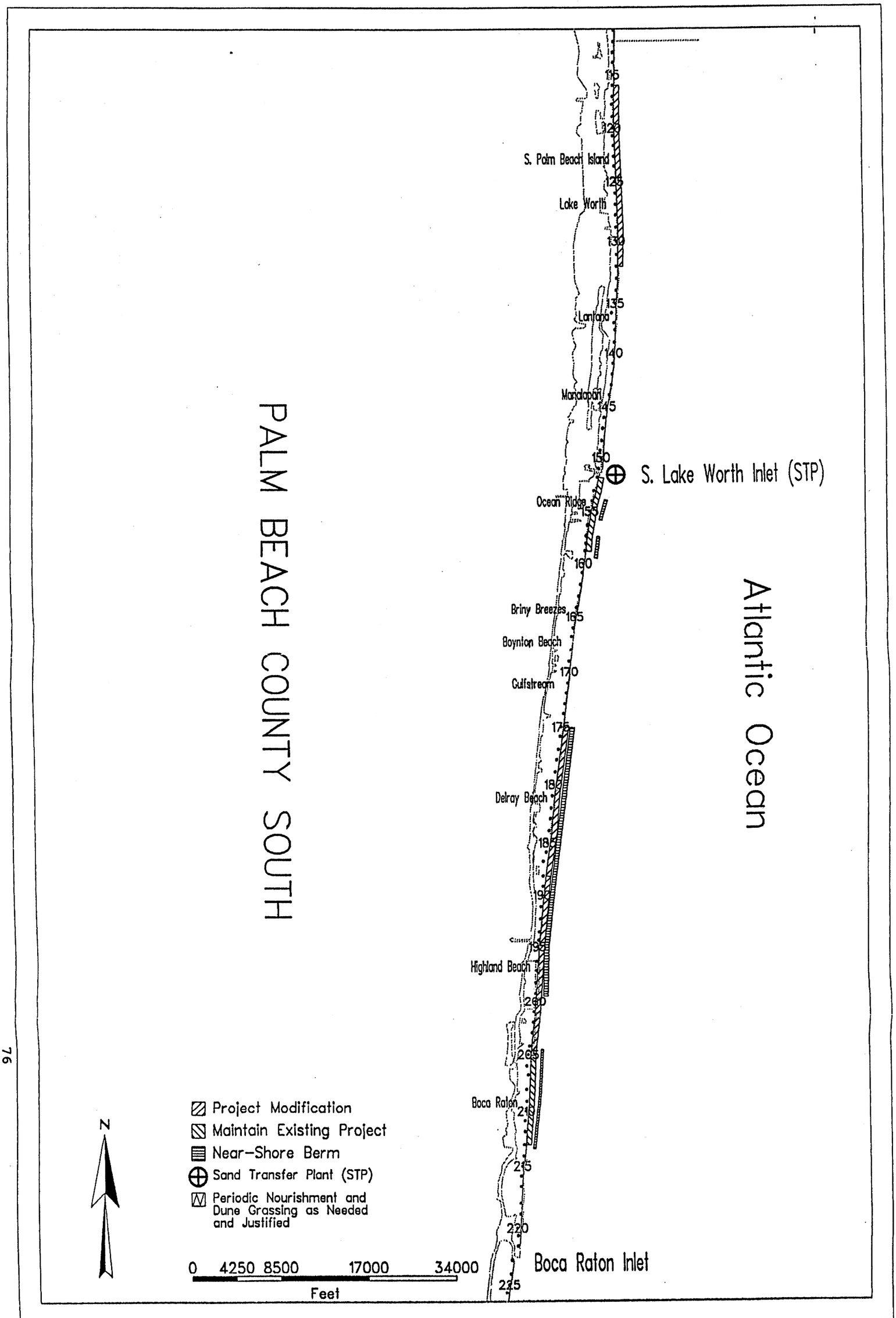


Figure 6 Palm Beach County Project Alternatives, South

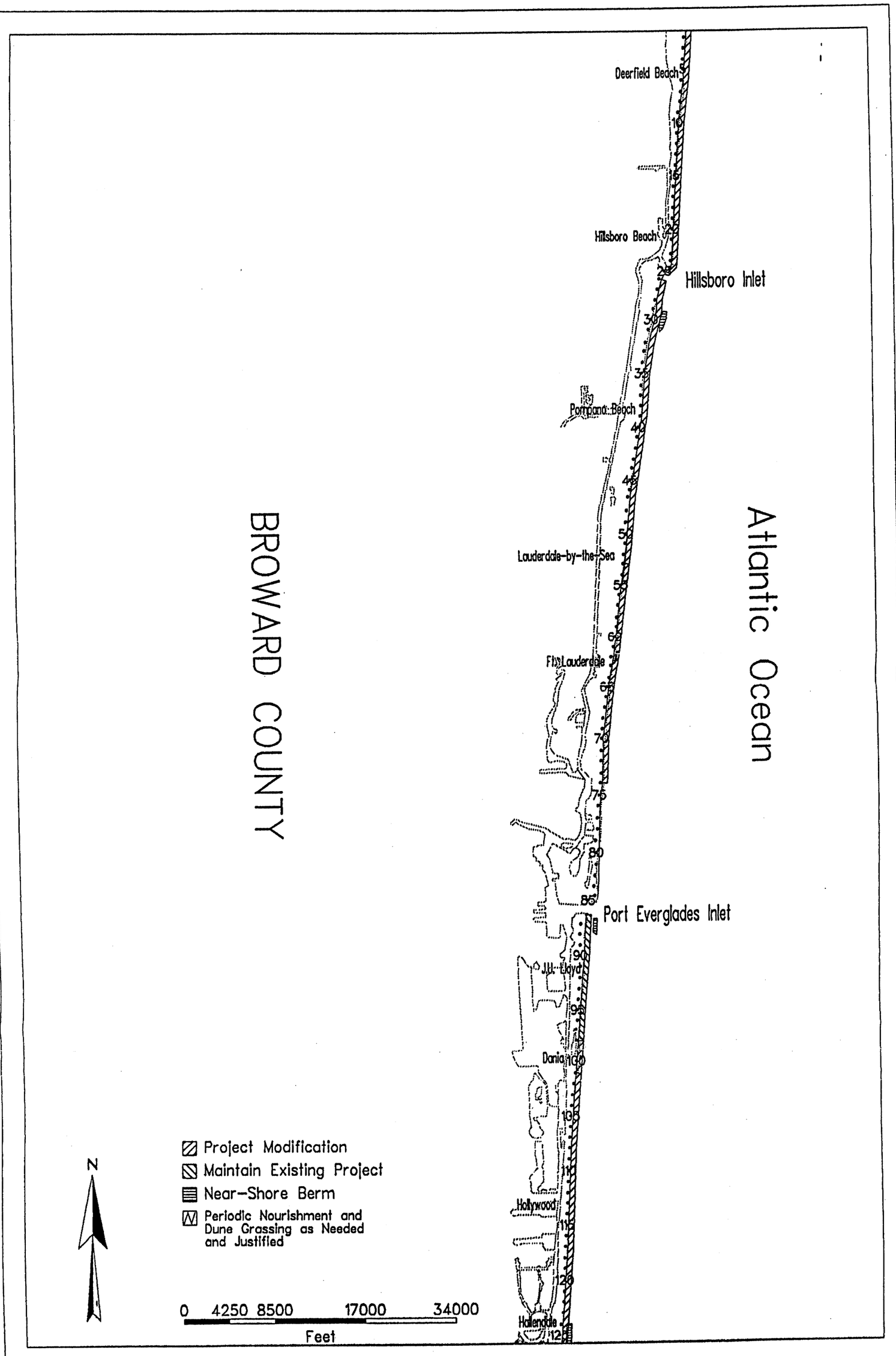


Figure 7 Broward County Project Alternatives

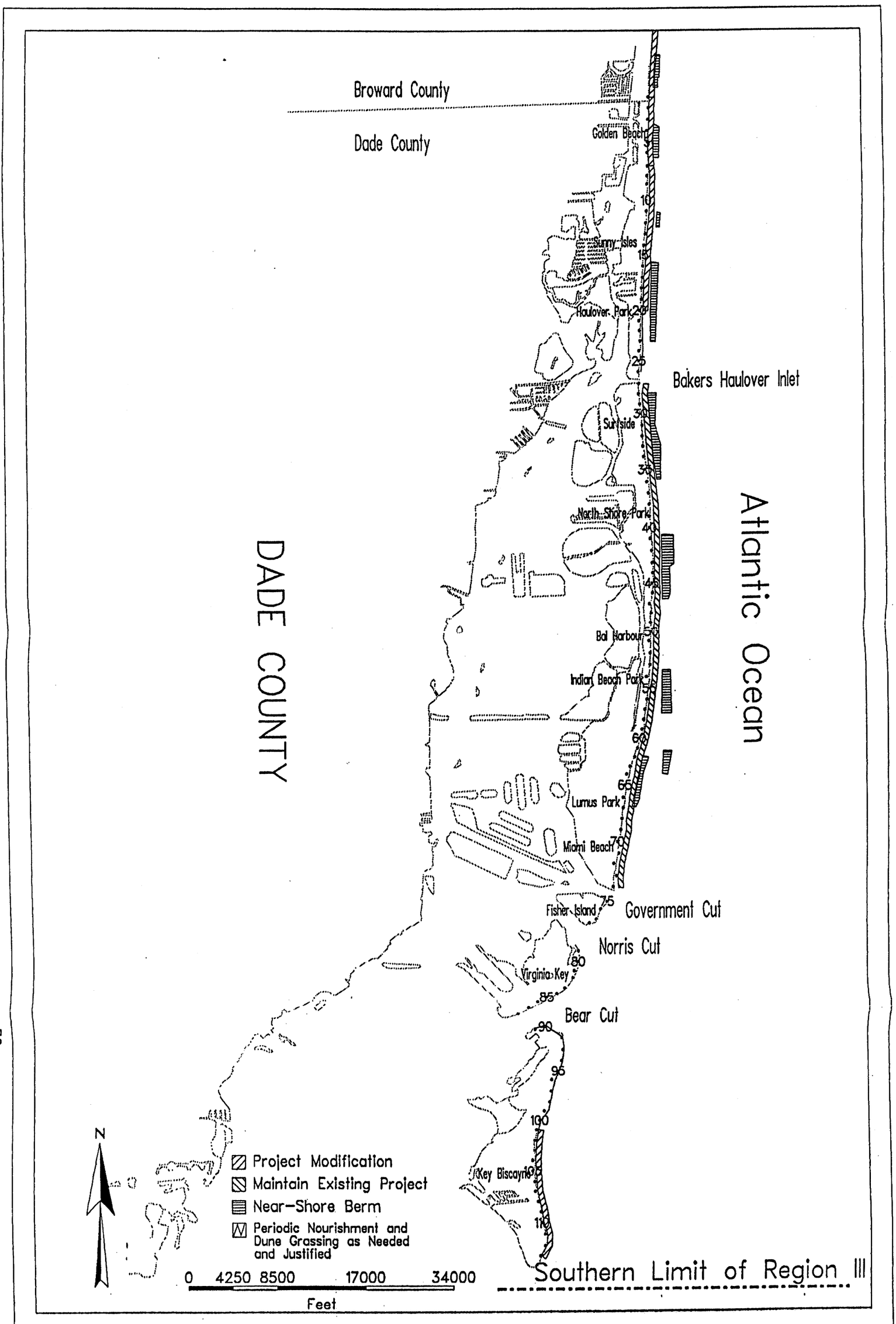


Figure 8 Dade County Project Alternatives