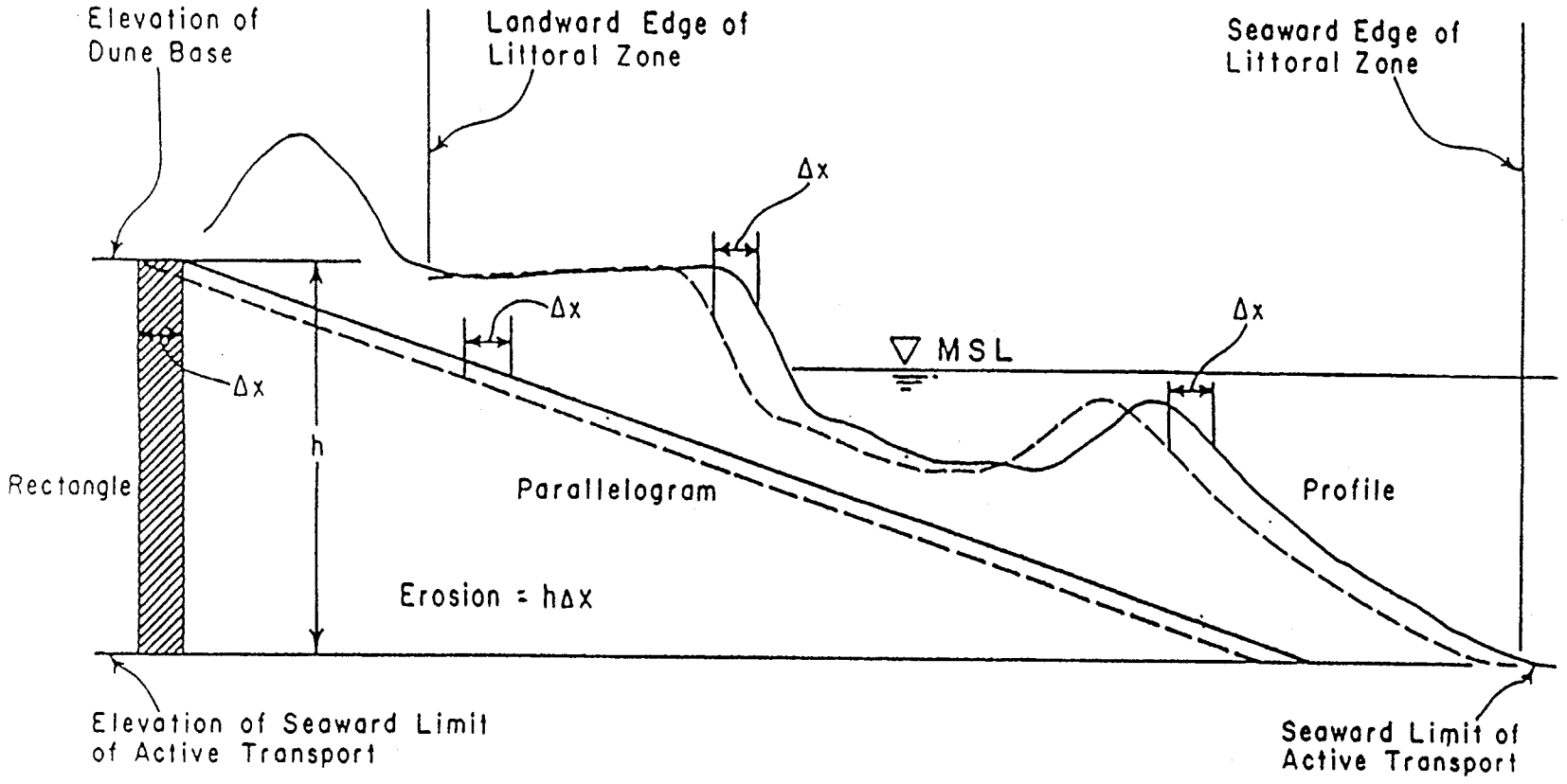
Figure 23
COAST OF FLORIDA STUDY - REGION III



Erosion within littoral zone during uniform retreat of an idealized profile.

provided by various beach fill design cross-sections were input to the SDM ($) model for with-project conditions.

230. The shoreline equilibrium profile extensions (from 20 to a maximum of 140-foot extensions were examined) are simulated by SDM, and the reduction in damages identified for the with project condition. Storm damage reduction (which includes the effects of long term equilibrium profile recession) is the difference between the expected annual damages under the without-project conditions minus the expected annual damages under the with-project conditions. Damages for the 50-year economic life of the project were determined (assuming with and without project conditions).

231. In determining the design cross-sections which generated the greatest net storm damage prevention benefits, the first step was to examine various fixed increments of berm (equivalent shoreline) extension. The equivalent shoreline extension providing the greatest net annual storm damage reduction benefit was chosen for more detailed examination. Location of hardgrounds were carefully assessed in an attempt to limit environmental impacts in the development of implementable project segments. The recommended plan was developed by adjusting berm width and/or the renourishment interval (advance nourishment) to reduce environmental impacts. Renourishment intervals were adjusted to optimize mobilization and demobilization costs of nearby adjacent separable project segments. The recommended NED plan was selected based on maximizing net average annual storm damage reduction benefits, modified to be environmentally sensitive and implementable plan by reducing environmental impacts to adjacent hardgrounds (see Figures 9 - 22). To determine design berm widths given in the final recommended plans, the volume from the equivalent equilibrium profile extension ($\triangle x$), was converted to the beach fill design sections by fitting the volume to the existing beach profiles. Project segments for North-end Palm Beach Island, Highland Beach, Deerfield/Hillsboro Beach, Pompano/Lauderdale-by-the-Sea, and Fort Lauderdale were adjusted to avoid hardbottom impacts.

232. Primary benefits for dune grassing, and nearshore berm placement are cost savings due to the reduction of beach fill volume necessary for advance nourishment. Construction of a STP at Lake Worth Inlet would result in cost savings to the O&M of the Federal navigation project at Lake Worth Inlet. These alternatives are discussed in the "Cost Savings" section.

Incidental Benefits

233. Recreation Benefits. The estimated recreational benefits attributable to the proposed beach protection projects contained in this report 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). Due to the existence of built and authorized projects which are found throughout the three county study area, the following analysis consists of two components. The first component is an estimation of recreation benefits associated with existing project conditions. The second component estimates the recreation benefits attributable to the projects recommended in this report.

234. 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 each of the counties in the Coast of Florida Region III Market Area under two different conditions for each of the two aforementioned components. The difference of the results of the two analyses establishes beach visitation 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 land loss prevention benefits to privately owned property.

235. The analysis centers on the comparison of total beach visits to the Coast of Florida Region III Market Area under two different conditions for both components. The first component, which estimates benefits attributable to existing conditions, involves comparing Pre-project conditions with Existing conditions. Pre-project conditions are defined as the beach condition prior to the implementation or authorization of a project. Existing conditions are defined as the current beach condition including projects currently in place or authorized for construction prior to the year 2000. Existing conditions are actually the "without project" condition.

236. The second component, which estimates recreation benefits associated with recommended projects compares With and Without project conditions. The With Project condition is the beach condition associated with the implementation of

the recommended projects. The Without Project condition, as previously mentioned, is synonymous with the existing condition; it is the current beach condition with the addition of any authorized but currently unconstructed projects expected to be built by the year 2000.

237. Summary of the results and further detail on the recreational analysis are found in Appendix F.

Incremental Benefit Analysis

238. Incremental benefit analysis of the berm width adjustments to the existing authorized projects is found in Appendix F. Table 15 summarizes the justification of the existing authorized projects. Total average annual equivalent costs are compared with the benefits associated with the project for each alternative.

Preliminary Economic Justification

239. Tables 16 through 18 summarize the economic justification for the proposed beach fill and sand transfer plant (STP) projects by county. Annual costs and benefits for the directed 7.625 percent interest rate are displayed. O&M costs for the beach fill projects are approximately $40,000 per year. As was done in the incremental analysis, the total average annual equivalent costs are compared with the benefits associated with the project for each beach fill and STP alternative.

Cost Savings

240. Two methodologies were analyzed to increase cost savings for the NED beach fill projects: dune grassing, and the placement of nearshore berms. The additional volumes of beach quality sand onshore from the grassing and nearshore berms were deducted from advance nourishment for the projects. The cost savings from the reduction in advance nourishment was compared to the cost to implement the methodologies. Cost savings were realized by reducing the amount of required maintenance dredged material at Lake Worth Inlet by the construction of a new sand transfer plant (STP).

241. Dune Grassing. A reduction in periodic nourishment costs can be realized by planting beach grass and sea oats on the beach berm. Every COFS beach fill project has a potential benefit from dune grassing due to the prevention of wind blown sand losses and stabilization of the berm. Following 1986 renourishment of the Duval County Shore Protection Project, about 36,000 cubic yards of sand had accumulated above the design profile between 1986 and 1989

TABLE 15

CONSTRUCTED (EXISTING) SHORE PROTECTION PROJECTS
ECONOMIC ANALYSIS SUMMARY

Location	Upland Damage	Coastal Armor Damage	Backfill Damage	Prevention of Private Land Loss	Total Average Annual Benefits w/Project	Total Average Annual Costs	Net Annual Benefits	Benefit to Cost Ratio
PALM BEACH COUNTY								
Jupiter/Carlin (R-13 to R-19)								
w/o Project	$811,800	$11,600	$4,100	$128,900	$956,400	$658,500	$297,900	1.5
w/80' Project	$0	$0	$0	$0				
Ocean Ridge (R-152 to R-159)								
w/o Project	$381,700	$23,300	$5,000	$237,300	$647,300	$586,700	$60,600	1.1
w/60' Project	$0	$0	$0	$0				
Delray Beach (R-175 to R-188)								
w/o Project	$2,548,600	$97,600	$14,200	$231,400	$2,828,000	$569,000	$2,259,000	5.0
w/80' Project	$60,000	$3,400	$400	$0				
Boca Raton (R-205 to R-213)								
w/o Project	$278,700	$6,800	$1,300	$135,400	$422,200	$666,800	($244,600)	0.63
w/100' Project	$0	$0	$0	$0				
BROWARD COUNTY								
Pompano (R-26 to R-53)								
w/o Project	$25,029,100	$523,000	$70,300	$1,490,100	$25,712,500	$935,100	$24,777,400	27.5
w/60' Project	$1,400,000	$0	$0	$0				
J.U. Lloyd (R-86 to R-98) and Hollywood/Hallandale (R-101 to R-128)								
w/o Project	$6,599,500	$188,300	$34,500	$506,900	$6,483,600	$928,700	$5,554,900	7.0
w/100' Project	$840,700	$4,400	$500	$0				
DADE COUNTY								
Sunny Isles (R-7 to R-20)								
w/o Project	$3,676,000	$325,000	$29,600	$479,300	$4,302,200	$763,400	$3,538,800	5.6
w/60' Project	$189,300	$16,600	$1,800	$0				
Bal Harbour/Surfside/Miami Beach								
w/o Project	$36,339,300	$3,836,400	$464,400	$1,704,200	$41,930,400	$4,193,800	$37,736,600	10.0
w/100' Project	$413,900	$0	$0	$0				
Key Biscayne (R-96 to R-113)								
w/o Project	$1,875,500	$415,300	$92,000	$143,800	$2,494,400	$900,000	$1,594,400	2.8
w/60' Project	$27,300	$4,000	$900	$0				

TABLE 16

PALM BEACH COUNTY ALTERNATIVE PROJECTS
ECONOMIC ANALYSIS SUMMARY

Location	Upland Damage	Coastal Armor Damage	Backfill Damage	Prevention of Private Land Loss	Total Average Annual Benefits w/Project	Total Average Annual Costs	Net Annual Benefits	Benefit to Cost Ratio
Jupiter/Carlin (R-13 to R-19)			Period of Analysis 50 Years (2000-2050)					
					(From Table 15)			
w/o Project	$811,800	$11,600	$4,100	$128,900	$956,400	$658,500	$297,900	1.5
w/20' Project	$0	$0	$0	$0	$0	$0	$0	
w/40' Project	$0	$0	$0	$0	$0	$0	$0	
w/60' Project	$0	$0	$0	$0	$0	$0	$0	
w/80' Project	$0	$0	$0	$0	$0	$0	$0	
w/100' Project	$0	$0	$0	$0	$0	$0	$0	
Juno/Ocean Cay (R-27 to R-41)			Period of Analysis 50 Years (2000-2050)					
w/o Project	$4,061,800	$15,200	$2,000	$319,700				
w/20' Project	$479,800	$0	$0	$0	$3,918,900	$268,200	$3,650,700	14.6
w/40' Project	$87,200	$0	$0	$0	$4,311,500	$323,400	$3,988,100	13.3
w/60' Project	$13,800	$0	$0	$0	$4,384,900	$378,600	$4,006,300	11.6
w/80' Project	$700	$0	$0	$0	$4,398,000	$433,800	$3,964,200	10.1
w/100' Project	$0	$0	$0	$0	$4,398,700	$489,000	$3,909,700	9.0
Lake Worth Inlet STP (R-75 to R-78)			Period of Analysis 50 Years (2001-2050)					
w/o Project	$83,500	$600	$100	$205,700				
w/Project	$0	$0	$0	$0	$494,100	$385,700	$108,400	1.3
				(Includes $204,200 Maintenance Dredging Cost Savings)				
N. Palm Beach Island (R-76 to R-85)			Period of Analysis 50 Years (1998-2048)					
w/o Project	$708,900	$37,500	$9,600	$369,100				
w/20' Project	$0	$0	$0	$0	$1,125,100	$519,700	$605,400	2.2
w/40' Project	$0	$0	$0	$0	$1,125,100	$553,600	$571,500	2.0
w/60' Project	$0	$0	$0	$0	$1,125,100	$587,400	$537,700	1.9
w/80' Project	$0	$0	$0	$0	$1,125,100	$621,300	$503,800	1.8
w/100' Project	$0	$0	$0	$0	$1,125,100	$655,100	$470,000	1.7
Palm Beach Island (R-91 to R-105)			Period of Analysis 50 Years (1989-2039)					
w/o Project	$4,580,600	$400,100	$103,100	$413,200				
w/20' Project	$901,300	$39,400	$7,800	$0	$4,548,500	$751,000	$3,797,500	6.1
w/40' Project	$296,300	$4,400	$600	$0	$5,195,700	$825,000	$4,370,700	6.3
w/60' Project	$65,500	$0	$0	$0	$5,431,500	$898,600	$4,532,900	6.0
w/80' Project	$6,100	$0	$0	$0	$5,490,900	$972,300	$4,518,600	5.6
w/100' Project	$400	$0	$0	$0	$5,496,600	$1,046,000	$4,450,600	5.3
w/120' Project	$0	$0	$0	$0	$5,497,000	$1,119,700	$4,377,300	4.9
S. Palm Beach Island (R-116 to R-132)			Period of Analysis 50 Years (1998-2048)					
w/o Project	$2,753,900	$5,800	$2,800	$602,200				
w/20' Project	$0	$0	$0	$0	$3,364,700	$1,039,000	$2,325,700	3.2
w/40' Project	$0	$0	$0	$0	$3,364,700	$1,154,500	$2,210,200	2.9
w/60' Project	$0	$0	$0	$0	$3,364,700	$1,270,000	$2,094,700	2.6
w/80' Project	$0	$0	$0	$0	$3,364,700	$1,385,400	$1,979,300	2.4
w/100' Project	$0	$0	$0	$0	$3,364,700	$1,500,900	$1,863,800	2.2

TABLE 16
(Continued)
PALM BEACH COUNTY ALTERNATIVE PROJECTS
ECONOMIC ANALYSIS SUMMARY

Location	Upland Damage	Coastal Armor Damage	Backfill Damage	Prevention of Private Land Loss	Total Average Annual Benefits w/Project	Total Average Annual Costs	Net Annual Benefits	Benefit to Cost Ratio
Ocean Ridge (R-152 to R-159)			Period of Analysis 50 Years (1989-2039)					
w/o Project	$381,700	$23,300	$5,000	$237,300				
w/20' Project	$0	$0	$0	$0				
w/40' Project	$0	$0	$0	$0	From Table 15)			
w/60' Project	$0	$0	$0	$0	$647,300	$586,700	$60,600	1.1
w/80' Project	$0	$0	$0	$0				
w/100' Project	$0	$0	$0	$0				
Delray Beach (R-175 to R-188)			Period of Analysis 50 Years (1998-2048)					
w/o Project	$81,700	$4,100	$500	$0				
w/20' Project	$26,300	$2,200	$400	$0	$57,400	$43,200	$14,200	1.3
w/40' Project	$100	$0	$0	$0	$86,200	$86,300	($100)	1.0
w/60' Project	$0	$0	$0	$0	$86,300	$129,500	($43,200)	0.7
w/80' Project	$0	$0	$0	$0	$86,300	$172,600	($86,300)	0.5
w/100' Project	$0	$0	$0	$0	$86,300	$215,800	($129,500)	0.4
Highland Beach (R-188 to R-205)			Period of Analysis 50 Years (1989-2039)					
w/o Project	$3,108,000	$86,700	$16,000	$78,200				
w/20' Project	$1,381,700	$5,800	$1,800	$0	$1,899,600	$1,006,000	$893,600	1.9
w/40' Project	$653,200	$1,800	$600	$0	$2,633,300	$1,073,700	$1,559,600	2.5
w/60' Project	$305,600	$1,800	$600	$0	$2,980,900	$1,141,400	$1,839,500	2.6
w/80' Project	$125,900	$0	$0	$0	$3,163,000	$1,209,200	$1,953,800	2.6
w/100' Project	$50,000	$0	$0	$0	$3,238,900	$1,276,900	$1,962,000	2.5
w/120' Project	$12,300	$0	$0	$0	$3,276,600	$1,344,600	$1,932,000	2.4
Boca Raton (R-205 to R-213)			Period of Analysis 50 Years (1989-2039)					
w/o Project	$278,700	$6,800	$1,300	$135,400				
w/20' Project	$0	$0	$0	$0				
w/40' Project	$0	$0	$0	$0	From Table 15)			
w/60' Project	$0	$0	$0	$0	$422,200	$666,800	($244,600)	0.6
w/80' Project	$0	$0	$0	$0				
w/100' Project	$0	$0	$0	$0				

TABLE 17

BROWARD COUNTY ALTERNATIVE PROJECTS
ECONOMIC ANALYSIS SUMMARY

Location	Upland Damage	Coastal Armor Damage	Backfill Damage	Prevention of Private Land Loss	Total Average Annual Benefits w/Project	Total Average Annual Costs	Net Annual Benefits	Benefit to Cost Ratio
Deerfield/Hills Beach (R-1 to R-25)			Period of Analysis 50 Years (2000-2050)					
w/o Project	$7,208,700	$57,800	$8,200	$959,900				
w/20' Project	$1,476,500	$3,400	$300	$0	$6,754,400	$573,500	$6,180,900	11.8
w/40' Project	$416,100	$0	$0	$0	$7,818,500	$689,000	$7,129,500	11.3
w/60' Project	$77,500	$0	$0	$0	$8,157,100	$804,500	$7,352,600	10.1
w/80' Project	$13,600	$0	$0	$0	$8,221,000	$920,000	$7,301,000	8.9
w/100' Project	$0	$0	$0	$0	$8,234,600	$1,035,400	$7,199,200	8.0
Pompano (R-26 to R-53)			Period of Analysis 50 Years (2000-2050)					
w/o Project	$1,089,500	$0	$0	$0				
w/20' Project	$286,900	$0	$0	$0	$802,600	$110,200	$692,400	7.3
w/40' Project	$56,400	$0	$0	$0	$1,033,100	$220,300	$812,800	4.7
w/60' Project	$7,900	$0	$0	$0	$1,081,600	$330,500	$751,100	3.3
w/80' Project	$300	$0	$0	$0	$1,089,200	$440,700	$648,500	2.5
w/100' Project	$0	$0	$0	$0	$1,089,500	$550,800	$538,700	2.0
Fort Lauderdale (R-53 to R-74)			Period of Analysis 50 Years (2000-2050)					
w/o Project	$1,985,600	$100	$0	$65,600				
w/20' Project	$643,700	$0	$0	$0	$1,407,600	$780,200	$627,400	1.8
w/40' Project	$146,400	$0	$0	$0	$1,904,900	$897,800	$1,007,100	2.1
w/60' Project	$25,000	$0	$0	$0	$2,026,300	$1,015,400	$1,010,900	2.0
w/80' Project	$1,800	$0	$0	$0	$2,049,500	$1,133,000	$916,500	1.8
w/100' Project	$0	$0	$0	$0	$2,051,300	$1,250,600	$800,700	1.6
J. U. Lloyd (R-86 to R-98)			Period of Analysis 50 Years (2000-2050)					
w/o Project	$0	$0	$0	$0	$0	$0	$0	
w/20' Project	$0	$0	$0	$0	$0	$0	$0	
w/40' Project	$0	$0	$0	$0	$0	$0	$0	
w/60' Project	$0	$0	$0	$0	$0	$0	$0	
w/80' Project	$0	$0	$0	$0	$0	$0	$0	
w/100' Project	$0	$0	$0	$0	$0	$0	$0	
Hollywood/Hallandale (R-101 to R-128)			Period of Analysis 50 Years (2000-2050)					
w/o Project	$793,100	$2,500	$200	$0				
w/20' Project	$459,000	$0	$0	$0	$336,800	$71,500	$265,300	4.7
w/40' Project	$236,300	$0	$0	$0	$559,500	$142,900	$416,600	3.9
w/60' Project	$95,900	$0	$0	$0	$699,900	$214,400	$485,500	3.3
w/80' Project	$32,400	$0	$0	$0	$763,400	$285,900	$477,500	2.7
w/100' Project	$13,200	$0	$0	$0	$782,600	$357,300	$425,300	2.2

TABLE 18

DADE COUNTY ALTERNATIVE PROJECTS
ECONOMIC ANALYSIS SUMMARY

Location	Upland Damage	Coastal Armor Damage	Backfill Damage	Prevention of Private Land Loss	Total Average Annual Benefits w/Project	Total Average Annual Costs	Net Annual Benefits	Benefit to Cost Ratio
Golden Beach (R-1 to R-7) (Aragonite)				Period of Analysis 50 Years (1998-2048)				
w/o Project	$3,082,200	$428,800	$94,700	$154,900				
w/20' Project	$1,369,300	$84,400	$17,600	$0	$2,289,300	$1,353,500	$935,800	1.7
w/40' Project	$683,300	$41,200	$8,400	$0	$3,027,700	$1,465,000	$1,562,700	2.1
w/60' Project	$340,300	$20,200	$4,200	$0	$3,395,900	$1,576,700	$1,819,200	2.2
w/80' Project	$194,000	$11,600	$2,100	$0	$3,552,900	$1,687,800	$1,865,100	2.1
w/100' Project	$73,100	$3,400	$700	$0	$3,683,400	$1,799,700	$1,883,700	2.0
w/120' Project	$18,900	$1,400	$400	$0	$3,739,900	$1,911,200	$1,828,700	2.0
Sunny Isles (R-7 to R-20) (Aragonite)				Period of Analysis 50 Years (1989-2039)				
w/o Project	$536,100	$41,100	$3,800	$0				
w/20' Project	$212,900	$20,200	$2,100	$0	$345,800	$224,200	$121,600	1.5
w/40' Project	$75,600	$9,200	$700	$0	$495,500	$448,300	$47,200	1.1
w/60' Project	$13,300	$900	$200	$0	$566,600	$672,500	($105,900)	0.8
w/80' Project	$3,300	$0	$0	$0	$577,700	$896,800	($319,100)	0.6
w/100' Project	$100	$0	$0	$0	$580,900	$1,120,800	($539,900)	0.5
Bal Harbor/Surfside/Miami Beach				Period of Analysis 50 Years (1982-2032)				
w/o Project	$0	$0	$0	$0				
w/20' Project	$0	$0	$0	$0	$0	$0	$0	
w/40' Project	$0	$0	$0	$0	$0	$0	$0	
w/60' Project	$0	$0	$0	$0	$0	$0	$0	
w/80' Project	$0	$0	$0	$0	$0	$0	$0	
w/100' Project	$0	$0	$0	$0	$0	$0	$0	
Key Biscayne (R-96 to R-113) (Offshore				Period of Analysis 50 Years (2000-2050)				
w/o Project	$69,000	$7,100	$1,600	$0				
w/20' Project	$10,300	$1,300	$400	$0	$65,700	$46,800	$18,900	1.4
w/40' Project	$500	$0	$0	$0	$77,200	$93,500	($16,300)	0.8
w/60' Project	$0	$0	$0	$0	$77,700	$140,200	($62,500)	0.6
w/80' Project	$0	$0	$0	$0	$77,700	$187,000	($109,300)	0.4
w/100' Project	$0	$0	$0	$0	$77,700	$233,700	($156,000)	0.3

Note: This spreadsheet uses mean highwater extensions (ΔX). Costs Developed utilize the "Piggyback" option to distribute mobilization and demobilization costs.

in the project area. This corresponds to a dune formation or sand accretion rate of 1.6 cubic yards per foot per yearover the area. The grassing had performed well in preventing wind blown sand losses, and the formation of the dune had lowered the back beach areas susceptibility to flooding and wave damage (USAED Jacksonville, 1990). Since the wind roses in Region III are similar to the Duval County wind roses and the borrow sand for the beach fill projects are similar also, the 1.6 cubic yards per foot per year accretion rate is reasonable to use for Region III.

242. The plan for the dune grassing at each COFS beach fill project will also be similar to that used in the Duval project. The design parameters are:

a. 14 rows of plants 18" apart and 18" between rows. Plants shall have 10" minimum height. The first two rows on the western side will have Panic Grass followed by 12 rows of Sea Oats toward the ocean.

b. 3" of compost per plant.

c. 90 day maintenance period.

243. During the first three months following planting, the grasses will require watering and fertilization. The grass will require approximately a year to establish to a point where it can trap and control sand.

244. The MCACES cost estimate (See Appendix D) lists the unit cost to plant dunes as $14.50 per linear foot. The maintenance cost per year is $.25 per linear foot. This cost was calculated and annualized for each project modification. The summary of cost savings for each project is listed in Table 19.

245. Nearshore Berms. Nearshore placement of dredged material in the form of a berm can reduce erosional trends to the shore. This results in storm damage reduction, flood control, and recreation benefits. The dredged material is placed in the nearshore zone by split hull barge, submerged pipeline, or other available means in water depths and to crest elevations which will result in the modification of the local wave climate and/or nourishment of the beach profile. Berms can be classified as "stable" when designed to attenuate wave energy and "active" when placed to provide sediment to the littoral zone. The type of nearshore berm constructed depends upon depth of placement, crest elevation, limit to the significant wave motion, and the site specific incident wave climate. For further details on the nearshore berm alternative, see Appendix I.

246. The type of nearshore berm alternatives in Region III are the "active" berms. It was assumed all the material placed in the nearshore zone would move onshore due to its placement within depth of closure. The criteria used in potential sites were:

a) proximity to hardbottom (Site must be at least 200 feet from nearest hardbottom.)

b) placement must be between the 10 to 15 ft. (MLW) isobaths to ensure landward migration.

c) haul distance from borrow location or inlet to be dredged must be reasonable.

d) must be a Federal interest in cost sharing.

247. A list of 21 potential sites meeting the above criteria are in Appendix I (page I-6).

248. The Palm Beach Island (R-91-105) project modification was used as a sample project for cost savings. Any additional fill onshore migrating from the nearshore berm would mean less advance fill needed during renourishment. There are two potential berm sites in the nearshore off the project area. One from R-95 to R-96 and the other from R-97.5 to R-101.5 between 10 and 15 feet water depth. The total capacity for them both is 126,900 cubic yards. It is assumed the dredged material would come from Lake Worth Inlet every two years. It is also assumed that it would take one year for the dredged material to move completely onshore. Unit prices for placement of nearshore berms are found in Table 20. The cost savings analysis is found in Table 21.

249. As can be seen in Table 21, currently there is no cost savings in nearshore berm placement. This is due to the necessary use of special equipment to bring the dredged material close to shore. The existing equipment available for placing sand in 10 to 15 feet of water is too costly. Also, the State of Florida, the study sponsor, is very sensitive concerning sand resources, and does not want to "waste" beach quality sand. If shallow draft hopper dredge and/or barge costs are reduced, or with additional experience, additional project benefits can be derived by use of nearshore berms, this component may later become economically feasible. The nearshore berms have been carefully sized to contain anticipated dredged material disposal volumes from nearby inlets. The non-Federal interests may desire disposal of dredged materials at these sites in the future. The added cost to place sand in the nearshore disposal areas would be non-Federal, because this

TABLE 19
COST SAVINGS SUMMARY

No.	Project	Location	Total Initial Fill With Overfill (Cubic Yards)	Total Average Annual Equivelant Cost of Beach Fill	Total Initial Fill W/Overfill & Grassing (Cubic Yards)	Total Average Annual Equivelant Cost of Beach Fill w/Grassing	Cost Savings With Dune Grassing Per Year
		Palm Beach County					
1.	Jupiter/Carlin	R - 13 to R - 19	No Modification				
2.	Juno Beach/Ocean Cay	R - 27 to R - 41	737,900	$378,590	189,100	138,250	$240,340
3.	N. Palm Beach Island	R - 76 to R - 85	339,400	$567,990	238,600	497,111	$70,879
4.	Palm Beach Island	R - 91 to R - 105	1,025,700	$926,512	868,900	816,256	$110,256
5.	S. Palm Beach Island	R - 116 to R - 132	674,500	$1,040,632	495,300	829,010	$211,622
6.	Ocean Ridge	R - 152 to R - 159	No Modification				
7.	Delray Beach	R - 175 to R - 188	155,295	$43,156	* Incremental Analysis		$43,156
8.	Highland Beach	R - 188 to R - 205	1,900,430	$1,276,855	1,698,606	1,186,600	$90,255
9.	Boca Raton	R - 205 to R - 213	No Modification				
		Broward County					
10.	Deerfield/Hillsboro Beach	R - 1 to R - 25	1,055,820	$804,453	746,700	559,252	$245,201
11.	Pompano/Lauderdale-by-the-Sea	R - 26 to R - 53	600,000	$220,335	* Incremental Analysis		$220,335
12.	Fort Lauderdale	R - 53 to R - 74	858,193	$897,825	505,393	512,944	$384,881
13.	J. U. Lloyd	R - 86 to R - 98	No Modification				
14.	Hollywood/Hallandale	R - 101 to R - 128	720,000	$214,382	* Incremental Analysis		$214,382
		Dade County					
15.	Golden Beach	R - 1 to R - 7	534,660	$783,046	468,420	682,431	$100,615
16.	Sunny Isles	R - 7 to R - 20	146,700	$224,226	* Incremental Analysis		$224,226
17.	Bal Harbor, Surfside, Miami Beach	R - 27 to R - 74	No Modification				
18.	Key Biscayne	R - 101 to R - 113	106,660	$46,748	* Incremental Analysis		$46,748

No.	Project	Location	Cubic Yards Dredged w/o New Sand Transfer Plant for Years 2001-2050	Cubic Yards Dredged w/New Sand Transfer Plant for Years 2001-2050	Cubic Yards Saved w/New Sand Transfer Plant for Years 2001-2050	Total Average Annual Cost Savings
19.	Lake Worth Inlet (75% Reduction in N. Drift Shoaling)	R - 75 to R - 78	4,786,051	2,868,287	1,917,764	$204,230
	Lake Worth Inlet (50% Reduction in N. Drift Shoaling)	R - 75 to R - 78	4,786,051	3,507,544	1,278,507	$146,860

TABLE 20							
NEARSHORE BERM UNIT PRICES							
Coast of Florida Study - Region III							
	Mob & Demob *	Unit Price ** ($/cubic yard)	Production *** (cubic yards/month)		Quantity (cy)	Distance to D/A (ft)	TOTAL COST
PALM BEACH COUNTY							
Palm Beach Island	$400,000	4.45	237,000		2,694,000	30,000	12,388,300
BROWARD COUNTY							
Fort Lauderdale	$400,000	5.35	202,000		713,000	40,000	4,214,550
JU Lloyd	$400,000	6.15	175,000		589,000	50,000	4,022,350
Dania	$400,000	6.55	164,000		87,000	55,000	969,850
Hollywood/Hallandale	$400,000	3.00	363,000		766,000	10,000	2,698,000
DADE COUNTY	$400,000						
Golden Beach	$400,000	8.50	126,000		591,000	80,000	5,423,500
Sunny Isles	$400,000	7.65	140,000		430,000	70,000	3,689,500
Bal Harbor, Miami Beach	$400,000	6.85	157,000		191,000	60,000	1,708,350
Minimum Distance to D/A	$400,000	2.20					
*Mob & Demob includes all overhead plus 25% contingency.							
**Unit Prices include all overhead plus 25% contingency.							
***Assumes 1 medium size hopper dredge with half-load because of depth restrictions.							

TABLE 21
NEARSHORE BERM COST SAVINGS ANALYSIS
ESTIMATED RENOURISHMENT COST
BEACH FILL

Project & Item	Quantity	Unit	Unit Cost	Total Cost
Palm Beach Isl				
Mobilization & Demobilization		Lump Sum		$ 420,000
Fixed Costs		Lump Sum		100,000
Sand Fill	372,000	CY	$ 2.85	1,061,340
Environmental Monitoring	1.86	MO	23,000	42,826
Mthly Production Rt			= 200,000cy	
Req. mthly monitoring		= 372,000/200,000		= 1.86
			SUBTOTAL	$ 1,624,166
Contingencies @ 25%				406,042
			SUBTOTAL	$ 2,030,208
Supervision & Administration Engineering & Design @15%				304,531
			TOTAL	**$ 2,334,739**

ESTIMATED RENOURISHMENT COST
BEACH FILL WITH NEARSHORE BERM

Project & Item	Quantity	Unit	Unit Cost	Total Cost
Palm Beach Island				
Mobilization & Demobilization		Lump Sum		$ 420,000
Fixed Costs		Lump Sum		100,000
Sand Fill	256,000	CY	$ 2.85	729,600
Nearshore Berm	116,000	CY	4.45	516,200
Environmental Monitoring	1.28	MO	23,000	29,440
Mthly Prodtn Rt			= 200,000 cy	
Req. mthly monitoring		= 256,000/200,000		= 1.28
			SUBTOTAL	$ 1,795,240
Contingencies @ 25%				448,810
			SUBTOTAL	$ 2,244,050
Supervision & Administration Engineering & Design @15%				336,608
			TOTAL	**$ 2,580,658**

NET RENOURISHMENT COST DIFFERENCE

BEACH FILL	$ 2,334,739
BEACH FILL WITH NEARSHORE BERM	2,580,658
NET COST DIFFERENCE	**$ (245,919)**

cost outweighs the cost to place the material directly onshore. With the potential of a cost decrease with the onset of new technology for placement of dredged material nearshore, this alternative may be revisited in the future.

249a. Reduction in Navigation Project O&M Costs. Cost savings were estimated for reducing the amount of material to be removed in future years from the entrance channel for the Palm Beach Harbor Federal navigation project at Lake Worth Inlet. Additional information on the reduction in maintenance dredging required at Palm Beach Harbor is discussed in Appendix D.

249b. It has been estimated (Appendix D) that approximately 53.4 percent of the shoaling at Lake Worth Inlet is caused by north to south littoral drift. It was assumed that half of the shoal material caused by material entering the navigation channel around the north jetty would be intercepted by a new sand transfer system. An average of 25,570 cubic yards would be intercepted based on this assumption. Similarly, interception of 75 percent of the material entering into the channel around the north jetty would result in interception of an average of 38,355 cubic yards of material annually. The peak yardage intercepted under the 75 percent assumption would be 83,497 cubic yards.

249c. The cost savings were determined by using the following procedures. The discussion below is based on assuming a 50 percent reduction in the amount of littoral material shoaling the channel from the north. The reduction in material is shown in Appendix D, Table D-16A. The calculations would be similar for the 75 percent assumption (Table D-16B). The reduction in the amount of dredged material in the year 2001 due to the new sand transfer plant is 55,665 cubic yards. Multiplying 55,665 cubic yards times $3.00 per cubic yard times 1.3 (the estimated engineering and design, supervision and administration rate) yields a cost savings in year 2001 of $217,100. Similar cost savings were calculated for all the future years where maintenance dredging is required. In some years, the volume of maintenance dredging is so low (less than 30,000 cubic yards) that a dredge would not be mobilized, saving $600,000 in mobilization and demobilization costs. These years are horizontally shaded in Tables D-16A and D-16B in Appendix D. When this occurs, the yardage in that particular year is added to the yardage for the following year prior to computing costs.

249d. Cost savings in future years were discounted using the present worth factor appropriate for the particular year of analysis. The present worth of the cost savings for the 50 year analysis period were summed. This sum was then

multiplied by the directed interest rate and amortization factor for 50 years to yield total average annual equivalent cost savings of $146,900 (assumes 50 percent of the north to south littoral drift is bypassed). Using similar calculations and the cubic yards saved from Table D16B, the total average annual equivalent cost savings is estimated to be $204,200 (assumes 75 percent of the north to south littoral drift is bypassed). The annual cost of the new sand transfer system is $385,700. Storm damage reduction benefits total $289,900. The benefit to cost ratios for the 50 and 75 percent assumptions are 1.13 and 1.28, respectively.

249e. Cross-shore studies of longshore transport rates were summarized recently by the Corps (EM 1110-2-1502, August 20, 1992). It was found that longshore transport seaward of the wave breakpoint was found to represent about 10 to 20 percent of the total transport. The north to south component of littoral drift at Lake Worth Inlet (from Figure D-25) is 128,000 cubic yards. Ten to 20 percent of this figure is 12,800 to 25,600 cubic yards. Therefore, an average of 102,400 to 115,200 cubic yards of sand would be available for bypassing landward of the wave breaking point annually.

249f. Since the new sand transfer plant has a design capacity of 160,000 cubic yards, the plant should be able to bypass up to 120,000 cubic yards without any difficulty. Interception of 75 percent of the material entering into the channel around the north jetty would result in bypassing an average of 38,355 cubic yards of material annually. The peak yardage bypassed under the 75 percent assumption would be 83,497 cubic yards. Therefore, the assumption that the plant will bypass at least 75 percent of the north to south component of littoral drift is a conservative one. The sand transfer system is still economically justified if the 50 percent assumption is used.

250. Due to current administrative policies, it was prudent to economically justify the Dania and South Lake Worth Inlet Sand Transfer Plant project segments by cost savings alone. If these project segments could decrease the renourishment costs of currently authorized projects, a benefit could be realized by the Federal government as shown in Table 22.

251. End losses to JU Lloyd and Hollywood/Hallandale were determined with and without the Dania project using the GENESIS model to determine cost savings. The sand transfer plant cost savings were based on target bypassing rates and decrease of the renourishment costs to the projects downdrift. Preliminary design costs were identical for the

TABLE 22

COST SAVINGS TO FEDERAL GOVERNMENT

	AVERAGE YEARLY END LOSS (cubic yard)
JU Lloyd	35,000
Hollywood/Hallandale (N. End)	36,000
Hollywood/Hallandale (S. End)	26,000

COST SAVINGS FROM DANIA

	RENOURISHMENT INTERVAL	END LOSS OVER RENOURISHMENT INTERVAL (cubic yard)	COST/ cubic yard		COST SAVINGS/ RENOURISHMENT INTERVAL
JU Lloyd	6	210,000	$4.43		$930,300
Hollywood/Hallandale (N. End)	6	216,000	$4.47		$965,520
				TOTAL	$1,895,820

COST SAVINGS FOR LIFE OF PROJECT	$15,166,560
TOTAL COST FOR DANIA	$12,839,998
TOTAL COST SAVINGS	$2,326,562

COST SAVINGS FROM SOUTH LAKE WORTH INLET STP

SAND TRANSFERRED/ YEAR	COST/ cubic yard	OCEAN RIDGE RENOURISHMENT INTERVAL	COST SAVINGS/ RENOURISHMENT INTERVAL
120,000	$3.08	8	$2,956,800

COST SAVINGS FOR LIFE OF PROJECT	$17,740,800
TOTAL COST FOR SOUTH LAKE WORTH STP	$4,605,600
TOTAL COST SAVINGS	$13,840,800

Lake Worth and South Lake Worth Inlet Sand Transfer Plants ($3,900,000). Yearly Operation and Maintenance costs were based on target bypassing rates of 160,000 cy and 120,000 cy for Lake Worth and South Lake Worth Inlets, respectively. This translates to O&M costs of $73,600 and $55,200 per year.

252. The Lake Worth Inlet Sand Transfer Plant is justified on reduction in maintenance dredging and shore protection benefits. The total average annual equivalent cost savings for reduced maintenance dredging at Palm Beach Harbor was estimated to be $204,200 (assumes 75 percent of the north to south littoral drift is bypassed). The annual cost of the new sand transfer system is $385,700. Storm damage reduction benefits for the shoreline south of the inlet total $289,900. Net benefits are $108,400 annually, and the benefit to cost ratio is 1.28. Since the construction and operation of a sand transfer system is complex, a feature design memorandum will be required. The report will properly develop and document the engineering and design studies performed during preconstruction, engineering and design and construction. The sand transfer system feature design memorandum will serve as the basis for preparing contract plans and specifications.

RECOMMENDED PLAN

PALM BEACH COUNTY

253. Recommend that the project for Palm Beach County, Florida from Martin County Line to Lake Worth Inlet and South Lake Worth Inlet to Broward County Line, authorized by the River and Harbor Act of 1962 (PL 87-874), be modified and herein after called the Palm Beach County, Florida Shore Protection Project. The following paragraphs describe components of the recommended project segments. Interdependency of the project segments in all three counties are shown in Table 23.

Jupiter Inlet to Lake Worth Inlet Project Segment:

254. Jupiter/Carlin. This existing 1.1 mile beach restoration and periodic nourishment project component is located between DEP monuments R-13 and R-19. The project consists of a beach restoration with a seven year nourishment interval. Initial construction of this project was completed during April 1995. Extension of Federal participation from 10 years from completion of construction to 50 years from the start of construction is recommended. Nearshore berms are not feasible in association with this project area due to the presence of nearshore hardgrounds.

TABLE 23
COAST OF FLORIDA STUDY-REGION III
INTERDEPENDENCE OF SEPARABLE ELEMENTS

POTENTIAL PROJECT	DNR MON. RANGE	PROJECT LENGTH	DEPENDENCY	JUSTIFIED W/O DEPENDENCY?	COMMENTS
PALM BEACH COUNTY					
1. JUPITER/CARLIN Beach Fill	R-13-19	1.1 miles	Dependent	Yes	Existing Project with potential interdependency with Juno/Ocean Cay
2. JUNO/OCEAN CAY Beach Fill; Nearshore Berm	R-27-41	2.75 miles	Dependent	Yes	Existing Project with potential interdependency with Jupiter/Carlin
3. LAKE WORTH INLET Sand Transfer Plant	R-75-78	0.57 mile	Dependent	Yes	New project with potential interdependency with N. Palm Beach Island
4. NORTH-END PALM BEACH I. Beach Fill; Nearshore Berm	R-76-R-85	1.95 miles	Dependent	Yes	New project with potential interdependency with Palm Beach Island and South-End PBI
5. PALM BEACH ISLAND Beach Fill; Nearshore Berm	R-91-R-105	3.1 miles	Dependent		New project with potential interdependency with North-End PBI and South-End PBI
6. S. PALM BEACH ISLAND Beach Fill; Nearshore Berm	R-116-132	3.0 miles	Dependent	Yes	New project with potential interdependency with N. Palm Beach I. and Palm Beach I.
7. SOUTH LAKE WORTH INLET Sand Transfer Plant	R-152-156	.76 miles	Dependent	Yes	New project with potential interdependency with Ocean Ridge
8. OCEAN RIDGE Beach Fill; Nearshore Berm	R-152-159	1.46 miles	Dependent	Yes	Existing Project with potential interdependency with S. Lake Worth STP
9. DELRAY BEACH Beach Fill; Nearshore Berm	R-175-188	2.65 miles	Dependent	Yes	Existing Project with potential interdependency with Highland Beach
10. HIGHLAND BEACH Beach Fill; Nearshore Berm	R-188-203.5	3 miles	Dependent	Yes	New Project with potential interdependency with Delray Beach
11. BOCA RATON Beach Fill; Nearshore Berm	R-205-213	1.45 miles	Independent	Yes	Renourishment interval precludes interdependency

TABLE 23 (CONTINUED)
COAST OF FLORIDA STUDY-REGION III
INTERDEPENDENCE OF SEPARABLE ELEMENTS TABLE 22

POTENTIAL PROJECT	DNR MON. RANGE	PROJECT LENGTH	DEPENDENCY	JUSTIFIED W/O DEPENDENCY?	COMMENTS
BROWARD COUNTY					
1. Deerfield/Hillsboro Beach Beach Fill	R1-24	4.4 miles	Independent	Yes	Renourishment interval precludes interdependency
2. POMPANO, UNINC., LAUD.-BY-THE-SEA Beach Fill; Nearshore Berm	R-24-53	5.2 miles	Independent	Yes	Renourishment interval precludes interdependency
3. FORT LAUDERDALE Beach Fill	R-53-74	4 miles	Independent	Yes	Location of project precludes interdependency
4. J.U. LLOYD Beach Fill; Nearshore Berm	R-86-98	2.3 miles	Dependent	Yes	Existing Project with potential interdependency with Dania and Hollywood/Hall.
5. DANIA Beach Fill	R-98-101	0.6 mile	Dependent	No	New Project with potential interdependency with JU Lloyd and Hollywood/Hall.
6. HOLLYWOOD/ HALLANDALE Beach Fill; Nearshore Berm	R-101-128	5.3 miles	Dependent	Yes	Existing Project with potential interdependency with JU Lloyd, Dania and Golden Beach

TABLE 23 (CONTINUED)
COAST OF FLORIDA STUDY-REGION III
INTERDEPENDENCE OF SEPARABLE ELEMENTS

POTENTIAL PROJECT	DNR MON. RANGE	PROJECT LENGTH	DEPENDENCY	JUSTIFIED W/O DEPENDENCY?	COMMENTS
DADE COUNTY					
1. GOLDEN BEACH Beach Fill; Nearshore Berm	R-1-7	1.1 miles	Dependent	Yes	New Project with potential interdependency with Hollywood/Hallandale
2. SUNNY ISLES Beach Fill; Nearshore Berm	R-7-20	2.65 miles	Independent	Yes	Renourishment interval precludes interdependency
3. BAL HAR., SURFSIDE, MIAMI BCH. Beach Fill; Nearshore Berm	R-27-74	9.3 miles	Independent	Yes	Renourishment interval precludes interdependency
4. KEY BISCAYNE	R-101-113	2.3 miles	Independent	Yes	Location of project and Ren. Interval precludes interdependency

255. Ocean Cay/Juno. This 2.75 mile project component is currently authorized for periodic nourishment as needed and justified. The recommended modification includes adding initial restoration by construction of a design beach with a 55 foot berm, and periodic nourishment between DEP monuments R-27 and R-41. The renourishment interval is seven years. The equilibrium toe of fill, including initial fill plus advance nourishment, is 300 feet. Mitigation for approximately 1.7 acres of hardground impact may be necessary in association with this project component. A nearshore berm site, away from potential hardground impact, has also been identified for use as an alternative maintenance dredged material disposal site. Extension of Federal participation from 10 years from completion of construction to 50 years from the start of construction of this project component is also recommended.

Lake Worth Inlet to South Lake Worth Inlet Project Segment:

256. Recommend that the project for Palm Beach County, Florida for Lake Worth Inlet to South Lake Worth Inlet (Palm Beach Island) authorized in 1958 (PL 85-500) be deauthorized. The following project components for Palm Beach Island would be added as project modifications to the Palm Beach County, Florida (1962) project. Extension of Federal participation from 10 years from completion of construction to 50 years from the start of construction is also recommended for each project component.

257. Lake Worth Inlet. The recommended plan for Lake Worth Inlet requires the construction of a new fixed sand transfer plant to be located north of the inlet with three discharge points located along the dry beach 750, 1,250 and 1,750 feet south of the south jetty on Palm Beach Island. This system would be designed for a target bypassing rate of about 160,000 cubic yards per year to the south, across the inlet, through a 12-in pipeline.

258. The recommended plan for the sand bypassing plant would include:

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

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

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

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

f. An drilled tunneled pipeline under the inlet from north of the north jetty to the south side of the south jetty, and

g. All associated pipe, valves, instruments, and controls required for operation of the system, including three remote controlled discharge valves located within the first 2,250 feet south of the south jetty.

The detailed sand transfer plant design would be determined within a Feature Design Memorandum (FDM) to be prepared during PED.

259. North-end Palm Beach Island. The 1.95 mile beach restoration and periodic nourishment project component located between DEP monuments R-76 and R-85 is authorized (1958), but not constructed. The optimal berm width is 10 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 project design volume is 100,000 cubic yards with a 190 foot toe of fill. The recommended renourishment interval is 4 years. The distance to the equilibrium toe of fill, including initial fill plus advance nourishment, is 281 feet with a total volume of 239,400 cubic yards. Mitigation for approximately 18 acres of hardground impact may be necessary in association with this project segment. Nearshore berms are not feasible in association with this project component due to the presence of nearshore hardgrounds.

260. Palm Beach Island (Mid-town). The 3.1 mile beach restoration and periodic nourishment project component located between DEP monuments R-91 and R-105 is authorized (1958), but not constructed. The optimal berm width 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 project design volume is 568,400 cubic yards with a 390 foot toe of fill. The recommended renourishment interval is 4 years. The distance to the equilibrium toe of fill, including initial fill plus advance nourishment is 455 feet with a total volume of 1,025,7800 cubic yards. Mitigation for approximately 3.65 acres of hardground impact may be necessary in association with this project component. Three potential nearshore berm sites have been identified for use as an alternative maintenance dredged material disposal site for the Federal navigation project at Palm Beach Harbor.

261. South-end Palm Beach Island. This 3.25 mile beach restoration and periodic nourishment project component located between DEP monuments R-116 and R-132 is authorized (1958), but not constructed. The optimal berm width is 35 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 project design volume is 248,900 cubic yards with a 350 foot toe of fill. The recommended renourishment interval is 4 years. The distance to the equilibrium toe of fill, including initial fill plus advance nourishment, is 432 feet with a total volume of 674,500 cubic yards. Mitigation for approximately 5.4 acres of hardground may be necessary in association with this project component.

South Lake Worth Inlet to Boca Raton Inlet Segment:

262. South Lake Worth Inlet. The recommended plan for South Lake Worth Inlet requires the construction, operation and maintenance of a new sand transfer plant to be located north of the inlet with one discharge point located approximately 2,000 feet south of the south jetty. This system would be designed for a target bypassing rate of about 120,000 cubic yards per year. The design would be similar to the Lake Worth Inlet sand transfer plant and would similarly be determined within a Feature Design Memorandum (FDM) during PED studies.

263. Ocean Ridge. The 1.35 mile beach restoration and periodic nourishment project component located between DEP monuments R-152 and R-159 is authorized (1962), but not constructed. This project is scheduled for construction by Palm Beach County during 1996. 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 770,000 cubic yards and includes 8 years of advance nourishment. The annual advance nourishment is 62,600 cubic yards. Two nearshore berm sites, however, have been recommended as potential dredged material disposal sites. Extension of federal participation from 10 years from completion of construction to 50 years from the start of construction is recommended.

264. Delray Beach. The recommended 2.7 mile beach restoration and periodic nourishment project component located between DEP monuments R-175 and R-188 is authorized and constructed. This project is recommended for modification with an additional 20 feet optimal berm width at elevation +9.0 feet NGVD and slopes of 1:20 berm to MLW and 1:30 from MLW to existing bottom. The recommended additional design volume is 155,300 cubic yards with a 290 foot equilibrium toe of fill. No hardgrounds exist in the vicinity of this project so no mitigation will be required.

Although this project component is a considerable distance from either inlet, an extensive nearshore berm site offshore of this project component is recommended as a potential dredged material disposal site. The Delray project has been extended to 50 years of Federal participation by Assistant Secretary of Army (Civil Works) under Section 934.

265. Highland Beach. The 3.4 mile beach restoration and periodic nourishment project component located between DEP monuments R-188 and R-205 is a modification to the authorized (1962) periodic nourishment project. It would fill in a gap between two authorized projects for lessening end losses. The optimal berm width of this project component is 120 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 project design volume is 1,017,450 cubic yards with a 350 foot toe of fill. The recommended renourishment interval is 7 years. The distance to the equilibrium toe of fill, including initial fill plus advance nourishment, is 450 feet with a total volume of 1,900,430 cubic yards. Mitigation for approximately 1.9 acres of hardground may be necessary for this project component. One nearshore berm site has been identified offshore of this project coastline. Extension of Federal participation from 10 years from completion of construction to 50 years from the start of construction is recommended.

266. Boca Raton. The 1.65 mile beach restoration and periodic nourishment project component located between DEP monuments R-205 and R-213 is authorized and constructed. Extension of Federal participation from 10 years from completion of construction to 50 years from the start of construction is recommended. Another recommended modification to this project component is a nearshore berm site as an alternative maintenance dredged material disposal site.

Other Palm Beach County Project Segment Alternatives:

267. As previously discussed, specific recommendations for the 1.9 miles of northern the Palm Beach County shoreline, north of Jupiter Inlet, will be addressed in the Region IV COFS study. In addition to the above specific project components, periodic nourishment as necessary and justified is an existing project feature for Palm Beach County, Florida. No modification of this project feature is recommended for the economic life of the project. Dune grassing, as necessary and justified is also recommended for the Palm Beach County shoreline as a cost effective project feature.

BROWARD COUNTY

Boca Raton Inlet (Palm Beach County) to Hillsboro Inlet (Broward County) Segment:

268. Deerfield Beach/Hillsboro Beach (Segment I). The 4.4 mile beach restoration and periodic nourishment project segment located between DEP monuments R-1 and R-24 is authorized, but not constructed. The optimal berm width is 30 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 project design volume is 746,700 cubic yards with a 300 ft toe of fill. The recommended renourishment interval is 7 years. The distance to the equilibrium toe of fill, including initial fill plus advance nourishment, is 406 feet with a total volume of 1,055,820 cubic yards. Mitigation for approximately 4.65 acres of hardground may be necessary in association with this project segment. A nearshore berm dredged material disposal site has been identified and recommended offshore this project shoreline. It is also recommended that Federal participation in this project segment be extended from 10 years from completion of construction to 50 years from the start of construction.

269. Hillsboro Inlet. Navigation improvements are being considered for the outer channel at this inlet to provide additional advanced maintenance for the entrance channel as part of the Hillsboro Inlet, Florida, Federal navigation project. Two alternatives are being evaluated. One alternative is as designed and contained within a permit request by the sponsor. The other is an alternative designed by Jacksonville District. The recommendations for this navigation project will be addressed in a separate navigation report which will address related potential impacts to the adjacent shorelines.

Hillsboro Inlet to Port Everglades Inlet Segment (Segment II):

270. Pompano/Lauderdale-By-The-Sea. The 5.2 mile beach restoration and periodic nourishment project component located between DEP monuments R-24 and R-53 is authorized and constructed. This project is recommended for modification with an additional 35 feet optimal berm width at elevation +9.0 feet NGVD and slopes of 1:20 berm to MLW and 1:30 from MLW to existing bottom. The recommended additional design volume is 600,000 cubic yards with a resulting equilibrium toe of fill of 365 feet. Mitigation for approximately 12.25 acres of hardground may be necessary in association with this project segment modification. A nearshore berm dredged material disposal site has been identified and recommended off this project shoreline.

Extension of Federal participation in this project segment from 10 years from the completion of construction to 50 years from the start of construction is also recommended.

271. Fort Lauderdale. This 4.0 mile project segment area located between DEP monuments R-53 to R-74 is authorized for periodic nourishment. A beach restoration and periodic nourishment project component modification is recommended. The recommended optimal berm width 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 project design volume is 466,700 cubic yards. The recommended renourishment interval is 6 years. The distance to the equilibrium toe of fill, including initial fill plus advance nourishment, is 500 ft with a total volume of 858,193 cubic yards. Federal participation to 50 years from the start of construction of this project component is recommended. Mitigation for approximately 8.1 acres of hardground impact may be necessary in association with this project component. Nearshore berms are not feasible in association with this project component due to the presence of nearshore hardgrounds.

Port Everglades Inlet (Broward County) to Bakers Haulover Inlet (Dade County):

Broward County (Segment III):

272. Segment III of the Broward County project includes two authorized beach restoration and periodic nourishment project sections, J. U. Lloyd and Hollywood/Hallandale. Extension of Federal participation to the 50 year economic life of these projects was approved by Assistant Secretary of Army (Civil Works) under Section 934 in September 1992.

273. J.U. Lloyd. The 2.3 mile beach restoration and periodic nourishment project component located between DEP monuments R-86 and R-98 is authorized and constructed. The optimal berm width in the re-analysis of this project remains at 100 feet at elevation +10 feet NGVD and slopes of 1:15 berm to MLW and 1:30 from MLW to existing bottom. The design volume, including initial fill and advance nourishment is 1,032,000 cubic yards. The renourishment interval is 6 years. The only recommended modification to this project segment is a nearshore berm site as an alternative maintenance dredged material disposal site.

274. Hollywood/Hallandale. The 5.25 mile beach fill project located between DEP monuments R-101 and R-128 is authorized and constructed. This project is recommended for modification with an additional 50 feet optimal berm width at elevation +7.0 feet NGVD and slopes of 1:15 berm to MLW