



US ARMY CORPS  
OF ENGINEERS  
JACKSONVILLE DISTRICT

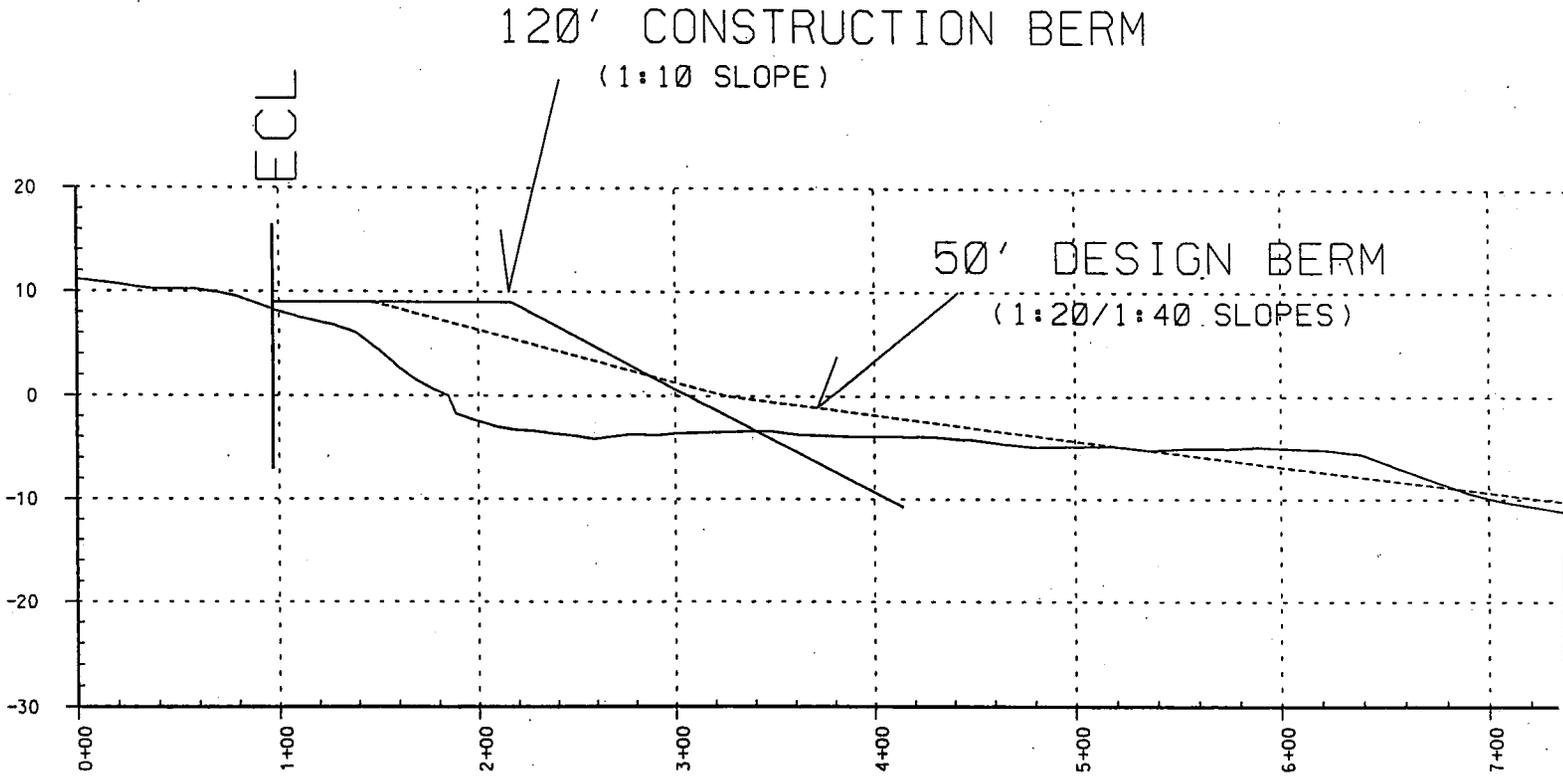
SHORE PROTECTION PROJECT  
DADE COUNTY, FLORIDA  
TYPICAL BEACH PROFILE  
HAUOVER BEACH PARK SEGMENT

CESAJ-EN-DL

DATE

SHEET NO.

ELEVATION IN FEET - MEAN LOW WATER



R-19

Figure 3. Typical Beach Profile.

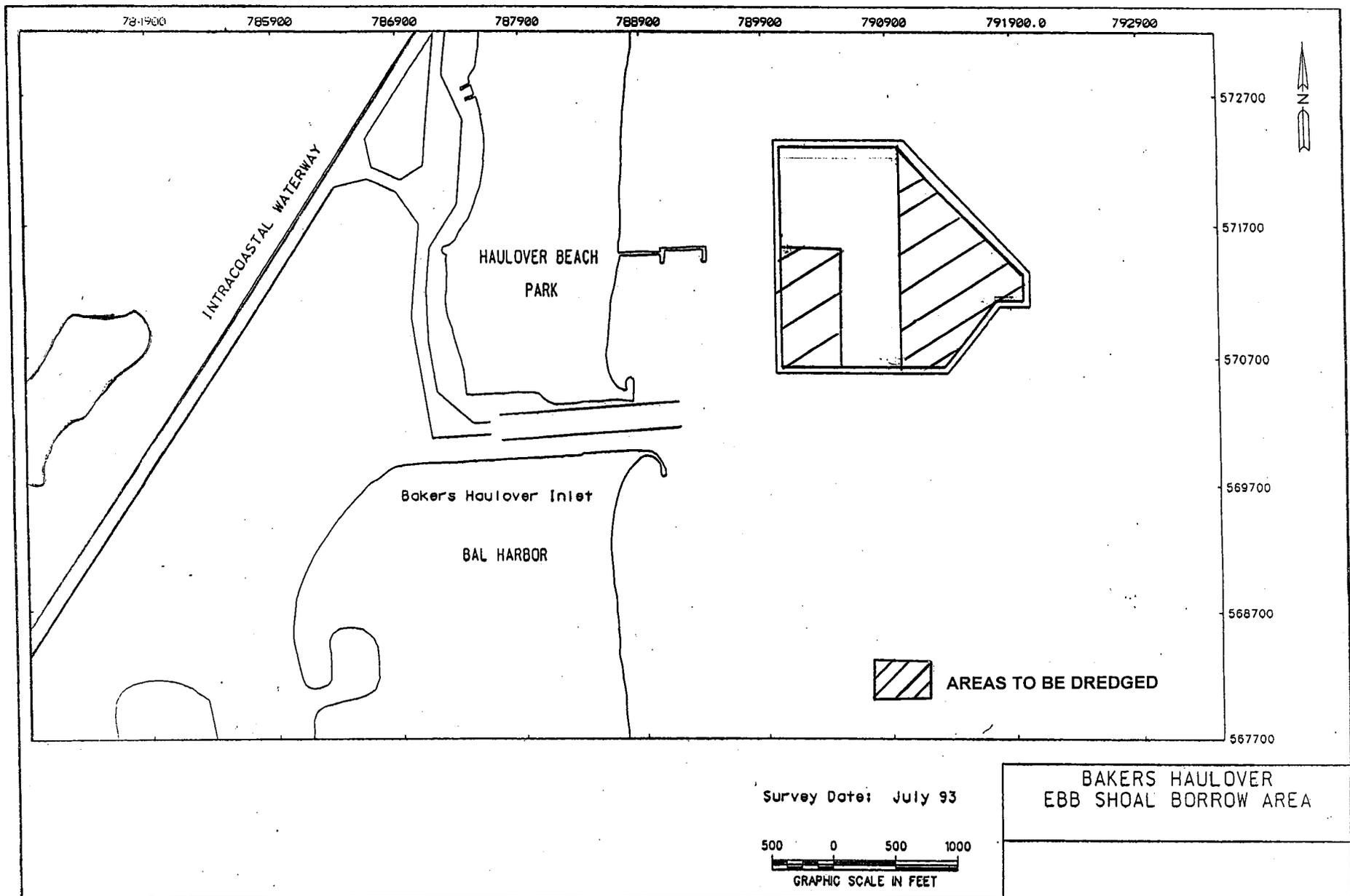


Figure 4. Potential borrow area at Baker's Haulover ebb shoal.

PRU-SHEL DEV PARTNERSHIP III  
(ATTN: JERRY OREN)  
THE PALACE AT BAL HARBOUR  
10101 COLLINS AVE.  
BAL HARBOUR, FL 33154

SHERATON BAL HARBOUR BEACH RESORT  
JAIME VALDES, GENERAL MANAGER  
9701 COLLINS AVE.  
BAL HARBOUR, FL 33154

BALMORAL CONDOMINIUM  
PETE SOLER, GENERAL MANAGER  
9801 COLLINS AVE.  
BAL HARBOUR, FL 33154

SEA VIEW HOTEL INC.  
9909 COLLINS AVE.  
BAL HARBOUR, FL 33154

BAL HARBOUR TOWER CONDOMINIUM  
BILL GROVER, GENERAL MANAGER  
9999 COLLINS AVE.  
BAL HARBOUR, FL 33154

THE PALACE AT BAL HARBOUR CONDO  
ATTN: JERRY OREN  
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BRUCE FRENDAHL  
SOUTH FLORIDA FREE BEACHES  
P.O. BOX 330902  
COCONUT GROVE, FLORIDA 33133

BAL HARBOUR 101 CONDOMINIUM  
THOMAS HART, GENERAL MANAGER  
10155 COLLINS AVE.  
BAL HARBOUR, FL 33154

THE TIFFANY OF BAL HARBOUR CONDO  
GERALD ORANGE, GENERAL MANAGER  
10175 COLLINS AVE.  
BAL HARBOUR, FL 33154

PLAZA OF BAL HARBOUR CONDOMINIUM  
ORLANDO VEGA, GENERAL MANAGER  
10185 COLLINS AVE.  
BAL HARBOUR, FL 33154

BAL HARBOUR CLUB INC.  
10201 COLLINS AVE.  
BAL HARBOUR, FL 33154

KENILWORTH CONDOMINIUM  
ALAN SCHWEIGER, GENERAL MANAGER  
10205 COLLINS AVE.  
BAL HARBOUR, FL 33154

KENILWORTH HOUSE INC CO-OP  
10225 COLLINS AVE.  
BAL HARBOUR, FL 33154

CARLTON TERRACE CONDOMINIUM  
TONY LACKNER, GENERAL MANAGER  
10245 COLLINS AVE.  
BAL HARBOUR, FL 33154

HARBOUR HOUSE SOUTH  
ELIZABETH MERRILL, GENERAL MANAGER  
10275 COLLINS AVE.  
BAL HARBOUR, FL 33154

BARBARA WILLIAMS, TREASURER  
GOLDEN SHORES HOMEOWNERS ASSOC.  
330 191 TERRACE  
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SUNNY ISLES BEACH SOUTHERN DIST.  
16711 COLLINS AVENUE, # 303  
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DADE COUNTY  
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SHELDON J. SCHLESINGER, P.A.  
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FT. LAUDERDALE, FL 33316

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HAUOVER BEACH PRESERVATION SOC.  
8270 SW 149<sup>TH</sup> CT. #205  
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GOLDEN BEACH, FL 33160-2209

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229 OCEAN BLVD.  
GOLDEN BEACH, FL 33160-2209

DEBBIE SOBEL  
GOLDEN BEACH TURTLE WATCH  
172 GOLDEN BEACH DRIVE  
GOLDEN BEACH, FL 33160

CURRENT RESIDENT  
115 OCEAN BLVD.  
GOLDEN BEACH, FL 33160

ELIZABETH CAMPBELL  
135 OCEAN BLVD.  
GOLDEN BEACH, FL 33160

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18901 N BAY ROAD  
SUNNY ISLES BEACH, FL 33160

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155 OCEAN BLVD.  
GOLDEN BEACH, FL 33160-2208

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215 OCEAN BLVD.  
GOLDEN BEACH, FL 33160-2209

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275 OCEAN BLVD.  
GOLDEN BEACH, FL 33160-2209

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277 OCEAN BLVD.  
GOLDEN BEACH, FL 33160-2209

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GOLDEN BEACH, FL 33160-2209

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GOLDEN BEACH, FL 33160-2209

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GOLDEN BEACH, FL 33160-2209

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577 OCEAN BLVD.  
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317 OCEAN BLVD.  
GOLDEN BEACH, FL 33160-2211

BRUCE WEBER  
NAN BUSH  
325 OCEAN BLVD.  
GOLDEN BEACH, FL 33160-2211

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699 OCEAN BLVD.  
GOLDEN BEACH, FL 33160-2217

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355 OCEAN BLVD.  
GOLDEN BEACH, FL 33160-2211

ANTONIO & JEAN S. TIRONE  
365 OCEAN BLVD.  
GOLDEN BEACH, FL 33160-2211

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387 OCEAN BLVD.  
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GOLDEN BEACH, FL 33160-2213

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GOLDEN BEACH, FL 33160-2213

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GOLDEN BEACH, FL 33160-2217

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GOLDEN BEACH, FL 33160-2217

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GOLDEN BEACH, FL 33160-2217

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BLUE MIST RESORT MOTEL  
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SUNNY ISLES, FL 33160

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SEASHORE CLUB  
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SUNNY ISLES, FL 33160

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CARAVAN MOTEL  
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SUNNY ISLES, FL 33160

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VICTOR FARKAS  
19115 COLLINS AVE.  
SUNNY ISLES, FL 33160

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OCEAN ROC RESORT MOTEL  
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SUNNY ISLES, FL 33160

THUNDERBIRD RESORT HOTEL  
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ARTHUR CHERNOV  
TURNBERRY OCEAN CLUB  
18601 COLLINS AVE.  
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OFFICE OF THE REGIONAL DIRECTOR  
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HOUSING & URBAN DEVELOPMENT  
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ATLANTA GA 30303-3309 (2 CYS)

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SEVENTH COAST GUARD DISTRICT  
909 SE 1ST AVENUE  
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AGENCY  
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PORT SAINT LUCIE FL 34952-7551

FLORIDA DEPT OF ENV PROTECTION  
DIVISION OF STATE LANDS  
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WEST PALM BEACH FL 33416-5425

FLORIDA DEPT OF ENV PROTECTION  
MARINE RESEARCH INSTITUTE  
19100 SE FEDERAL HIGHWAY  
TEQUESTA FL 33469

FLORIDA DEPT OF ENV PROTECTION  
SOUTH FLORIDA DISTRICT  
P O BOX 15425  
WEST PALM BEACH FL 33416-5425

BUREAU OF SURVEY & MAPPING  
DIVISION OF STATE LANDS  
3900 COMMONWEALTH BLVD. MS 105  
TALLAHASSEE, FL 32399-3000

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3440 HOLLYWOOD BLVD SUITE 140  
HOLLYWOOD FL 33021

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DADE CO. DEPT OF NAT RESOURCES MGMT  
33 SW 2<sup>ND</sup> AVENUE SUITE 300  
MIAMI, FLORIDA 33130

MR BRIAN FLYNN  
DEPT OF ENVIRONMENTAL RESOURCE MGT  
33 S W 2ND AVENUE SUITE 300  
MIAMI FL 33130

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MIAMI FL 33128

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METRO DADE PLANNING DEPARTMENT  
STEPHEN P CLARK CENTER SUITE 1210  
MIAMI FL 33128

DR CHUCK PEDZOLDT DIRECTOR  
METRO DADE PARK & RECREATION DEPT  
50 S W 32 ROAD  
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METRO-DADE SEAPORT DEPARTMENT  
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MIAMI FL 32132

DIRECTOR  
PUBLIC WORKS DEPT CITY OF MIAMI BEACH  
1700 CONVENTION CENTER DRIVE  
MIAMI BEACH FL 33149

MAYOR  
CITY OF MIAMI BEACH  
1700 CONVENTION CENTER DRIVE  
MIAMI BEACH FL 33139

CITY MANAGER  
CITY OF MIAMI BEACH  
1700 CONVENTION HALL CENTER  
MIAMI BEACH FL 33139

CITY MANAGER  
CITY OF SOUTH MIAMI  
6130 SUNSET DRIVE  
SOUTH MIAMI FL 33143

MAYOR  
CITY OF SOUTH MIAMI  
6130 SUNSET DRIVE  
SOUTH MIAMI FL 33143

MAYOR  
CITY OF MIAMI  
3500 PAN AMERICAN DRIVE  
MIAMI FL 33133

CITY MANAGER  
CITY OF MIAMI  
3500 PAN AMERICAN DR  
MIAMI FL 33133

MAYOR  
CITY OF NORTH MIAMI  
776 N E 125 STREET  
NORTH MIAMI FL 33161

CITY MANAGER  
CITY OF NORTH MIAMI BEACH  
17011 NE 19 AVENUE  
NORTH MIAMI BEACH FL 33162

CITY MANAGER  
CITY OF KEY BISCAYNE  
85 WEST MACINTYRE STREET  
KEY BISCAYNE FL 33149

MAYOR  
VILLAGE OF KEY BISCAYNE  
85 WEST MACINTYRE STREET  
KEY BISCAYNE FL 33149

MAYOR  
INDIAN CREEK VILLAGE  
50 INDIAN CREEK ISLAND  
INDIAN CREEK VILLAGE FL 33154

MAYOR  
CITY OF MIAMI SHORES  
10050 N E 2<sup>ND</sup> AVENUE  
MIAMI SHORES FL 33138

MAYOR  
CITY OF WEST MIAMI  
901 S W 62<sup>ND</sup> AVENUE  
WEST MIAMI FL 33144

MAYOR  
TOWN OF GOLDEN BEACH  
ONE GOLDEN BEACH DR  
GOLDEN BEACH FL 33160

TOWN MANAGER  
TOWN OF GOLDEN BEACH  
ONE GOLDEN BEACH DRIVE  
GOLDEN BEACH FL 33160

TOWN MANAGER  
TOWN OF SURFSIDE  
9293 HARDING AVENUE  
SURFSIDE FL 33154

MAYOR  
TOWN OF SURFSIDE  
9293 HARDING AVENUE  
SURFSIDE FL 33154

VILLAGE MANAGER  
VILLAGE OF BAL HARBOUR  
655 96<sup>TH</sup> STREET  
BAL HARBOUR FL 33154

MAYOR  
VILLAGE OF BAL HARBOR  
655 96 STREET  
BAL HARBOR FL 33154

TOWN MANAGER  
TOWN OF BAY HARBOR ISLAND  
9665 BAY HARBOR TERRACE  
BAY HARBOR ISLAND FL 331543

MAYOR  
TOWN OF BAY HARBOR ISLAND  
9655 BAY HARBOR TERRACE  
BAY HARBOR ISLAND FL 33154

MAYOR  
NORTH BAY VILLAGE  
7903 EAST DRIVE  
NORTH BAY VILLAGE FL 33141

CHAIRMAN  
AMERICAN LITTORAL SOCIETY  
75 VIRGINIA BEACH DR  
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AMERICAN LITTORAL SOCIETY (BHNI)  
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SOUTHEASTERN NAT RES CENTER  
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FLORIDA WILDLIFE FEDERATION  
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RASMAS  
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FLORIDA CHAPTER  
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TALLAHASSEE FL 32308

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CONSERVATION CHAIRMAN  
SIERRA CLUB  
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SIERRA CLUB MIAMI GROUP  
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MIAMI BEACH, FLORIDA 33239

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OLSEN AND ASSOCIATES, INC.  
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UNITED STATES SENATE  
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MIAMI FL 33130

THE HONORABLE CONNIE MACK  
UNITED STATES SENATE  
777 BRICKELL AVENUE 704  
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OAKLAND PARK FL 33311

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U S HOUSE OF REPRESENTATIVES  
25 WEST FLAGLER STREET SUITE 1015  
MIAMI FL 33130

THE HONORABLE ILENA ROS-LEHTINEN  
U S HOUSE OF REPRESENTATIVES  
5757 BLUE LAGOON DRIVE SUITE 240  
MIAMI FL 33126

THE HONORABLE E CLAY SHAW  
U S HOUSE OF REPRESENTATIVES  
1512 E BROWARD BOULEVARD SUITE 101  
FORT LAUDERDALE FL 33301

THE HONORABLE LINCOLN DIAZ-BALART  
U S HOUSE OF REPRESENTATIVES  
8525 N W 53RD TERRACE SUITE 102  
MIAMI FL 33166

THE HONORABLE PETER DEUTSCH  
U S HOUSE OF REPRESENTATIVES  
10100 PINES BOULEVARD  
PEMBROKE PINES FL 33025

HONORABLE RON SILVER  
FLORIDA STATE SENATE  
12000 BISCAYNE BLVD SUITE 411  
MIAMI FL 33181

HONORABLE GUSTAVO BARREIRO  
FLORIDA HOUSE OF REPRESENTATIVES  
1454 S FIRST STREET, SUITE 100  
MIAMI, FLORIDA 33135

HONORABLE ELAINE BLOOM  
FLORIDA HOUSE OF REPRESENTATIVES  
300 71ST STREET SUITE 504  
MIAMI BEACH FL 33141-3038

HONORABLE JOHN F COSGROVE  
FLORIDA HOUSE OF REPRESENTATIVES  
201 WEST FLAGLER STREET  
MIAMI FL 33130-1510

**APPENDIX D**

**GEOTECHNICAL INFORMATION**

**BAKERS HAULOVER INLET EBB SHOAL BORROW AREA**

MEMORANDUM FOR RECORD

SUBJECT: Dade County SPP, 2nd Renourishment, Bakers Haulover Inlet Ebb Shoal Borrow Area.

1. Bakers Haulover Inlet Ebb Shoal Borrow Area is 2000 feet offshore and just northeast of Bakers Haulover Inlet. The borrow area is located in 10 to 20 feet of water.
2. The borrow area occupies approximately half of Bakers Haulover Inlet ebb shoal. The final design was selected to leave a shoal and resulting wave refraction to minimize the impact to the adjacent shore processes. The shoal seems to be anchored on its north end by shallow rock at the location of core boring CB-ND-49, two feet below the sand surface. No excavation is to be performed in this area, and the remaining shoal will still be anchored by this shallow rock.
3. The hardgrounds east of the Bakers Haulover Inlet Ebb Shoal Borrow Area were mapped using high resolution side scan sonar for the Coast of Florida Study. The results of the remote sensing survey were ground truthed by Corps of Engineers, DERM and U.S. Fish and Wildlife biologist divers. No hardgrounds were located within the borrow area, and no hardgrounds occur within 500 feet of the eastern tip of the borrow area.
4. The permit limits of the borrow area extend 50 feet beyond the construction limits of the borrow area.
5. The excavation elevation shown on the drawings is a minimum of 2 feet above undesirable material.
5. The material to be excavated is generally light gray to tan, poorly graded shelly sand with a trace of silt and gravel sized shell fragments. The silt content is shown in the table below.

PERCENT SILT

Sieve Size	200 Sieve 0.074 mm	230 Sieve 0.063 mm
Range	0.2 - 13.3%	0.2 - 12.3%
Average	2.7 %	2.4 %

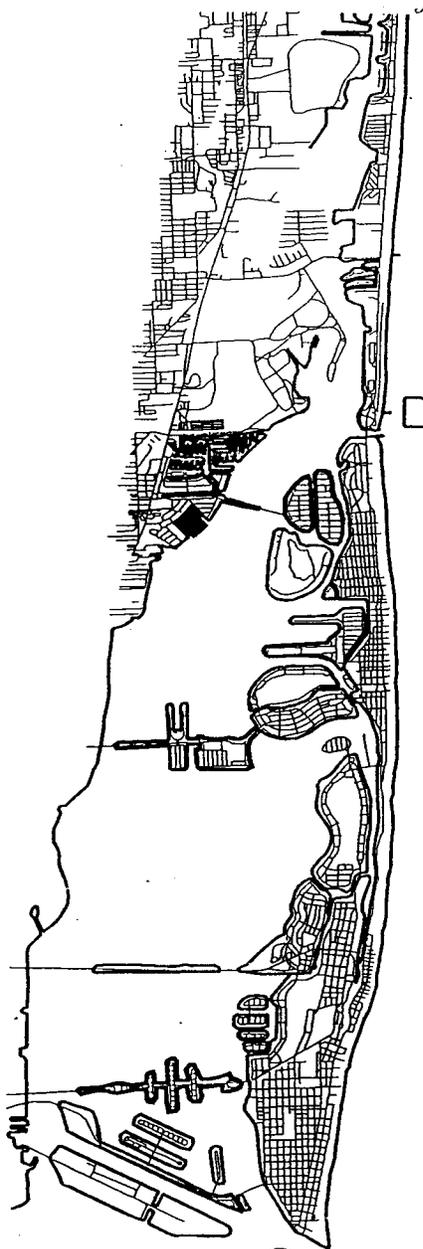
6. The composite mean grain size of the borrow area is 0.89 phi (0.54 mm) with a phi standard deviation of 1.09 phi. Using Bakers Haulover Inlet Ebb Shoal Borrow Area for Bal Harbor beach nourishment would require an overfill ratio ( $R_a$ ) of 1.0 with a renourishment factor ( $R_j$ ) of 0.49. This borrow material represents

a high quality beach nourishment sand source with a very low silt content.

7. Carbonate rock fragment **do not** occur within this borrow area. Rock removal will not be required.

8. Enclosed are maps of the Bakers Haulover Inlet Ebb Shoal Borrow Area showing location and construction limits, table of laboratory results of the borrow area only, composite sample statistics and composite frequency and cumulative gradation curve plots. Detail maps, laboratory data and core boring logs have been previously provided.

Doug Rosen, PG



Sunny Isles

Haulover Beach  
Park

▶ Bakers Haulover Inlet  
Ebb Shoal Borrow Area

Bal Harbour

Surfside

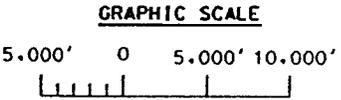
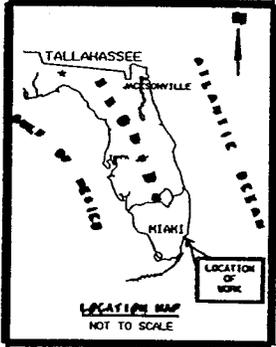
Miami Beach

▬ ROCK  
DISPOSAL  
AREA

Government  
Cut

A T L A N T I C O C E A N

LOCATION MAP



▶ BORROW AREA  
SGC-2

▶ BORROW AREA  
SGC EXTENSION

DADE COUNTY SHORE PROTECTION PROJECT  
PROJECT MODIFICATION, SUNNY ISLES

LOCATION MAP



US ARMY CORPS  
OF ENGINEERS  
JACKSONVILLE DISTRICT

SCALE: AS SHOWN

CESAJ-EN-GG

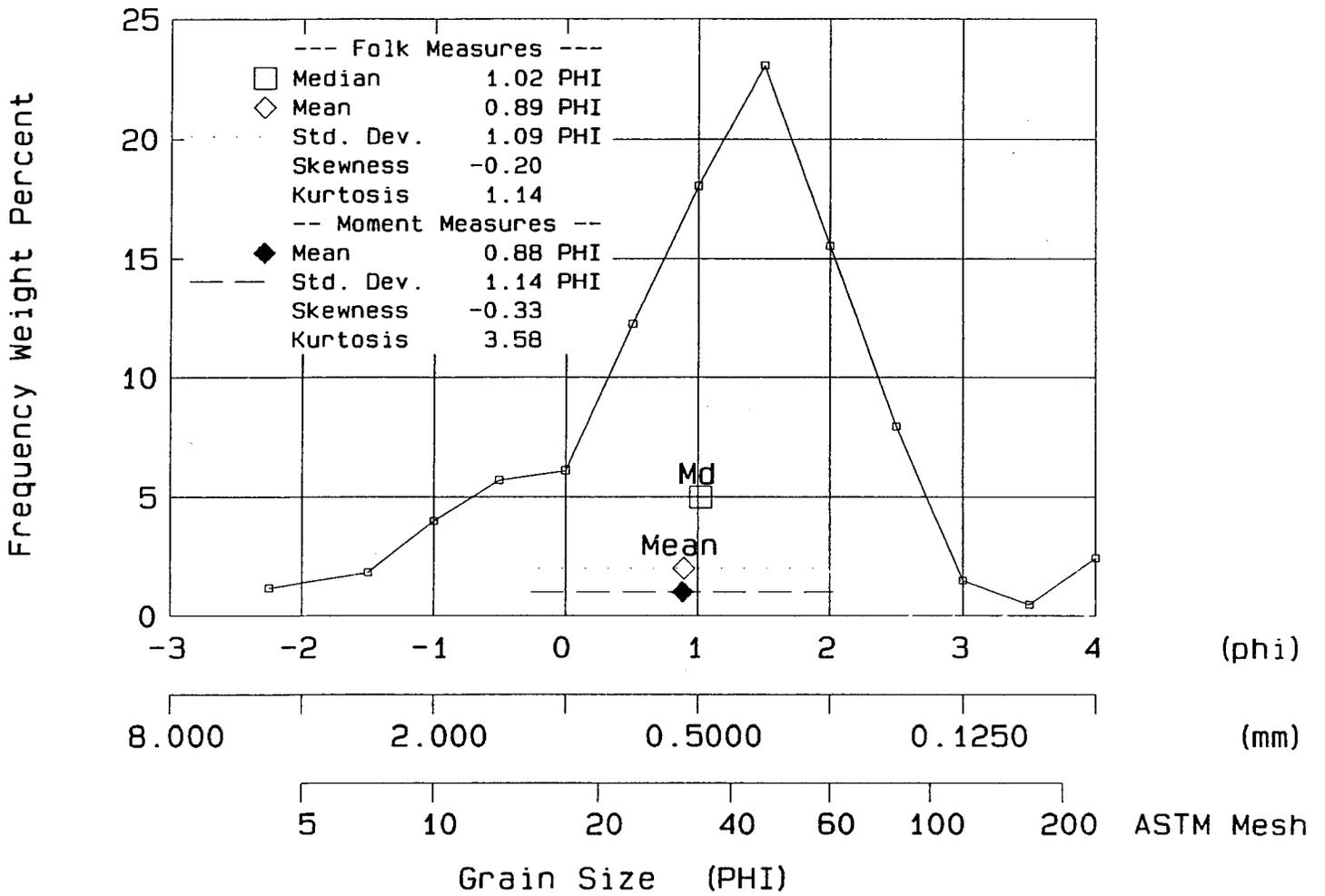
DATE:

SHEET NO.:

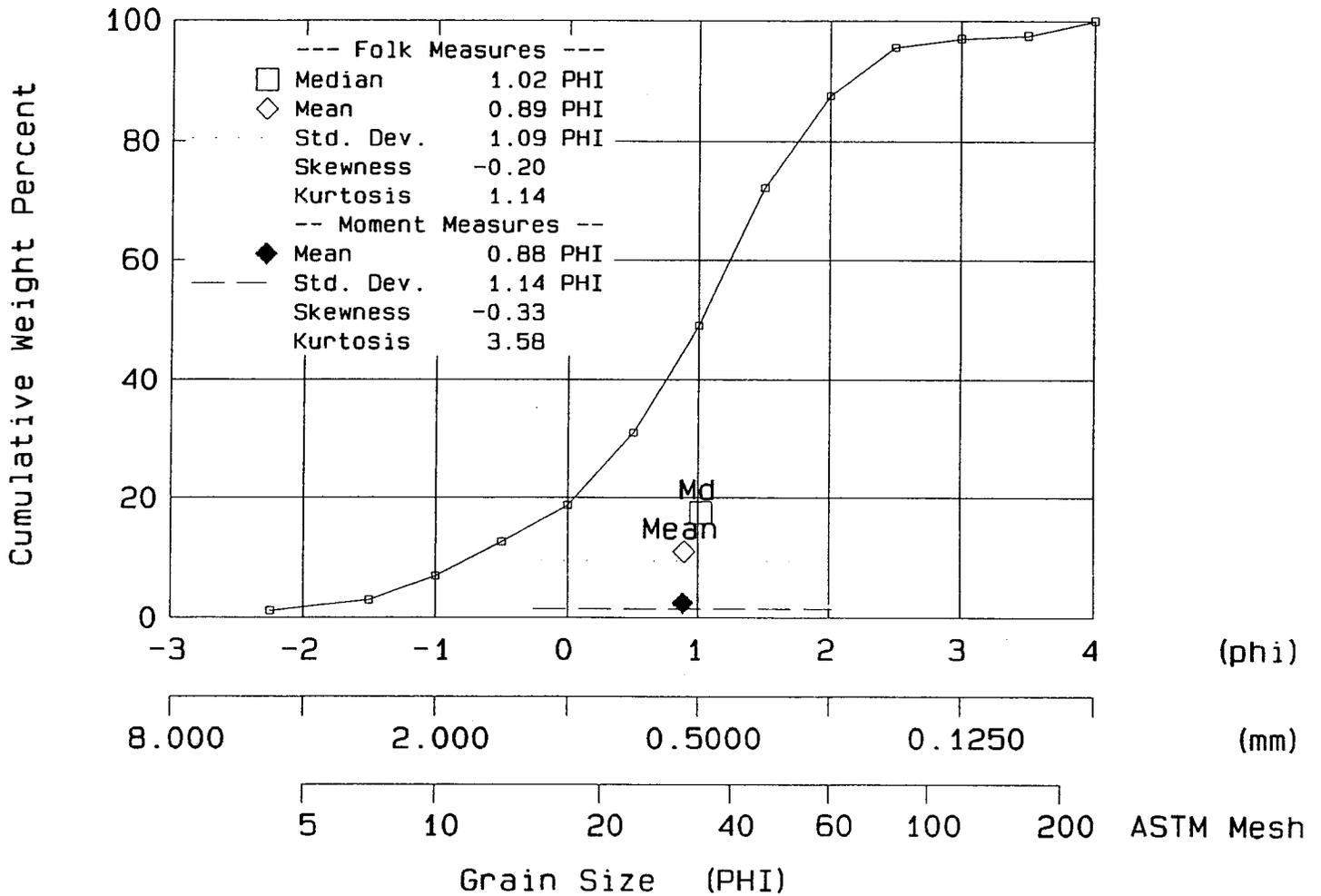


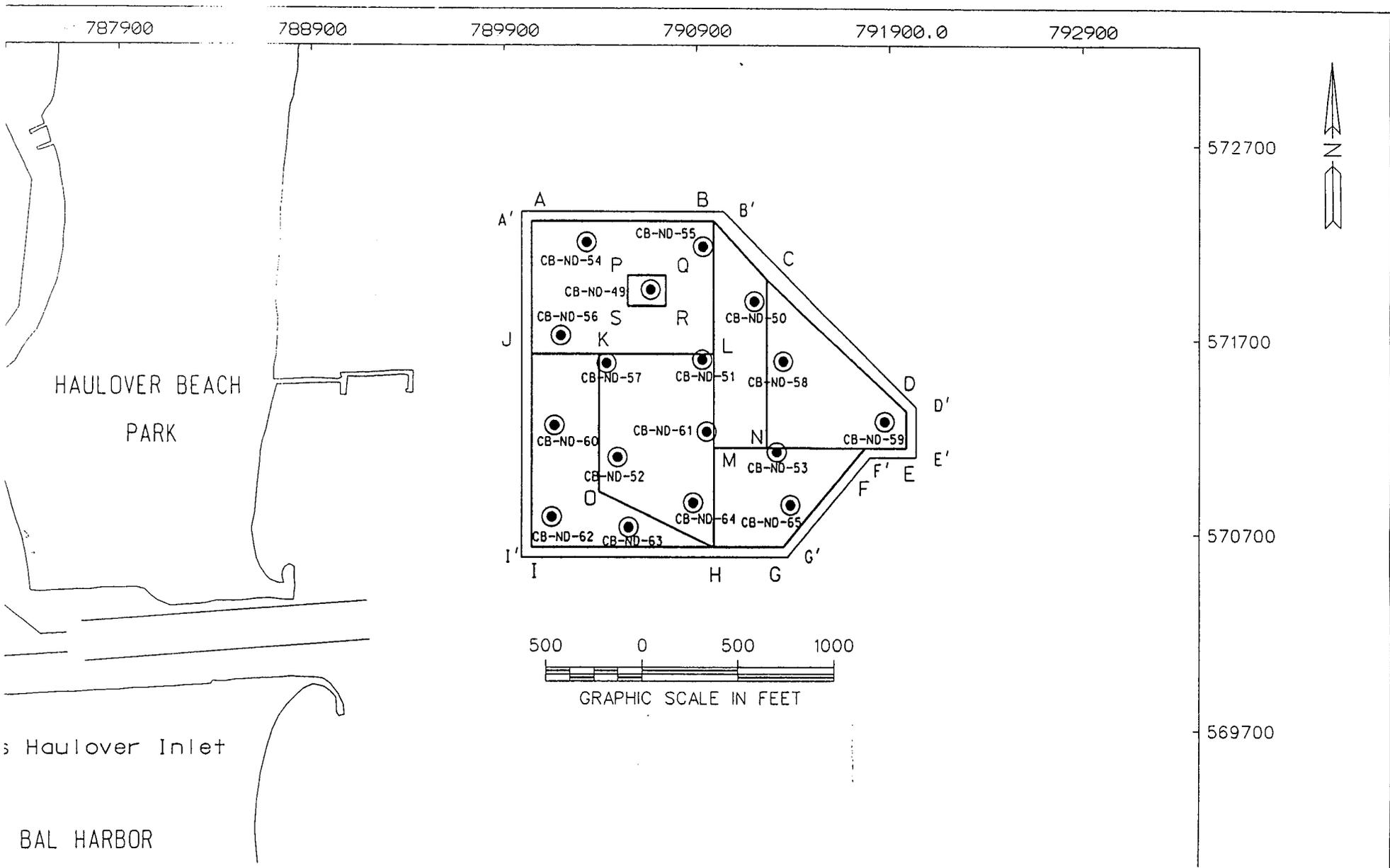


Dade Co. Spp. Bakers Haulover Inlet Ebb Shoal B/  
 Composite: BHIES



Dade Co. Spp. Bakers Haulover Inlet Ebb Shoal B/  
Composite: BHIES





**APPENDIX E**

**PHYSICAL AND BIOLOGICAL MONITORING PROGRAM**

**\*\*\* DRAFT \*\*\***

Miami-Dade Co. Haulover Renourishment Monitoring Plan

April 30, 2002 Pg. 1

**HAULOVER BEACH RENOURISHMENT;  
MIAMI-DADE COUNTY EROSION CONTROL PROJECT**

**Physical and Biological Monitoring Program For Miami-Dade County, Florida,  
Beach Erosion Control And Hurricane Protection:  
BAL HARBOR/HAULOVER BEACH RENOURISHMENT**

Submitted by  
Miami-Dade County Department of Environmental Resources Management

as partial fulfillment of special provisions of the  
U.S. ARMY CORPS OF ENGINEERS PLANS AND SPECIFICATION

and special conditions of  
FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION (FDEP)  
Joint Coastal Permit # 0126527-001-JC

**MONITORING PROGRAM COMPONENT OUTLINE**

**I. BIOLOGICAL MONITORING.**

- I.1 Monitoring Stations.
- I.2 Monitoring Frequency.
- I.3 Sampling Regime and procedures.
  - I.3.1 Quantitative Biological Surveys.
  - I.3.2 Qualitative Surveys.

**II. SEDIMENT AND SEDIMENTATION MONITORING.**

- II.1 Sedimentation Deposition Rates.
- II.2 Reef Sediment Accumulation Surveys.
- II.3 Indicators Of Impending Or Imminent Sediment Impacts.
- II.4 Sediment Violations.

**III. VISUAL SURVEYS OF HABITATS ADJACENT TO THE BORROW AREA**

- III.1

**IV. DREDGE SLURRY PIPELINE CORRIDOR CORAL PROTECTION AND IMPACT ASSESSMENT.**

- IV.1

**V. FILL MATERIAL ANALYSIS, COMPACTION AND BEACH TILLING.**

- V.1 Compaction Monitoring.
- V.2 Weekly Grain Size Analysis Of Beach Fill.

**V. SEA TURTLE MONITORING AND NEST RELOCATION PROGRAM.**

- VI.1 Daily Beach Surveys For Nesting Activities.
- VI.2 Nest Relocation Program.
- VI.3 Escarpment Leveling.

**VII. HYDROGRAPHIC SURVEYS AND BEACH FILL PERFORMANCE.**

- VII.1 Scope Of Hydrographic Survey Plan.
- VII.2 Monitoring Plan Objectives.
- VII.3 Monitoring Plan Components.

**VIII. REPORTING.**

- VIII.1
- VIII.2
- VIII.3
- VIII.4
- VIII.5
- VIII.6

## DESCRIPTION OF MONITORING COMPONENTS

**I.0. BIOLOGICAL MONITORING.** The biological monitoring will utilize a BACI (Before-After-Control-Impact) Design. This design establishes Monitoring stations with randomly selected sites within an area of probable impact, and in areas of similar habitat outside the region of possible impact, for comparisons prior to and after conduct of the project. The inclusion of the "control" locations allows for correction of differences noted in the pre/post evaluations, for variations or differences that were not specifically associated with the project (i.e., storm effects, regional habitat disruptions).

**I.1 MONITORING STATIONS.** Minimally three biological monitoring stations will be established for this project. Two will be adjacent to, and one distant from, the borrow area. The sand source (borrow area) to be used for this project is located just north of the Haulover jetty (Figure 1) in approximately 15 to 30 feet of water. Extensive north/south expanses of hardbottom reefs occur in the general region of the borrow source. Continuous hardbottom reef areas are located approximately 700' to the east of the borrow area, and small isolated patch reefs and low-density soft coral and sponge (LD SC/Sp) habitat are found 350' east of the borrow area as well. Borrow area monitoring station location will be selected based on the neighboring hardground reef lines or significant habitat and known local current patterns, so that selected sites will represent the anticipated areas with highest probability of impact (relative to distance and current direction).

- A. A minimum of three stations will be established adjacent to the borrow area. Two "reference" or comparison stations will be positioned minimally 5 miles south of the borrow area in areas with similar water depths and based on qualitative assessment, show similar composition and densities of biological community components. Each station will be set (marked) by fixing a randomly selected "Station Reference Point" on the reef edge.
- B. Each Station will be comprised of five randomly placed 2.1 m X 2.0 m quadrats (total sample area of 21.0 m<sup>2</sup>/site) for determination of benthic community components. The quadrat location will allow for determination of any impacts across the entire reef tract.
  - a. The location of each of the quadrats will be determined by randomly choosing a distance and direction from the reference point (max distance = 100 m or one-half the width of the reef at the reference point, whichever is less).
  - b. Each quadrat will be oriented normal to the prevailing direction of the reef tract (i.e., N/S), marked with an iron bar, and all have corner points marked with stainless steel pins to allow precise relocation.
    - i. Each quadrat will be subdivided into six 1.0 m X 0.7 meter subplots, to aid in photogrammetric analysis of the quadrat.
    - ii. Each subplot will be marked with stainless steel pins to allow precise relocation.

**I.2. MONITORING FREQUENCY.** The sampling frequency for each monitoring task is summarized in Table 1. Each site will be visited quarterly for complete quantitative or qualitative photographic surveys.

- A. Quantitative assessments will be conducted minimally once prior to, once immediately after completion of project construction and every six months thereafter for a minimum of two years.
- B. Qualitative assessments will be conducted three months after the post construction quantitative survey, and every six months thereafter until completion of the monitoring program.

I.3. *SAMPLING REGIME AND PROCEDURES.* The quantitative and qualitative sampling procedures and techniques are described below.

I.3.1 Quantitative Biological Surveys of monitoring stations will occur once prior to construction, once immediately following and every six months thereafter.

- A. Benthic community structure will be quantitatively evaluated at each monitoring station using a photogrammetric technique. The technique will include 35 mm digital photography and ground-truthing (mapping) of each station during each quantitative sampling.
  - 1. Density, frequency and diversity of hard-corals, soft corals, sponges, other noted benthic invertebrates and algae will be determined during quantitative surveys via mapping of 1.0 m X 0.7 m subplots of the 2.0 m X 2.1 m quadrats (six subplots per quadrat). All hard corals will be measured (major and minor axis) to allow determination of hard coral coverage.
  - 2. All photography and mapping will be conducted by qualified biologists utilizing SCUBA. All hard and soft corals, and common sponges and algae will be field identified to the lowest possible taxonomic rank. Voucher specimens may be taken, outside of the sampling quadrat, for unknown organisms and identified in the laboratory.
  - 3. Each subplot will be photographed using an underwater camera (i.e., Nikon 990 in a Ikelite housing) and strobe, mounted on a prefabricated "framer". The framer will hold and position the camera and strobe for optimal resolution of the subplot area. The photographs will be used to verify the percent of cover of hard corals. Further, the photographs will serve as documentation of the benthic community components within the subplots.
- B. Water Quality. Profiles of the water column will be conducted at each biological monitoring station, in 3 m depth increments (i.e., surface, 3 m, 6 m, 9 m, etc.), from the surface to the bottom for the parameters listed below. A single sampling assemblage consisting of a multi-sensor array, light sensor and water sampling tube, will be lowered into the water to insure simultaneous sampling of measured parameters and collection of water samples for laboratory analysis.
  - 1. Light levels will be measured using a Li-Cor® dual sensor array (one surface, one underwater sensor). Surface and at-depth photon flux densities will be recorded with a Li-Cor® LI-1000 datalogger. Light measurement units will be  $\mu\text{E}/\text{m}^2/\text{s}$  (of PAR).
  - 2. Turbidity levels will be determined on samples collected during the Water Quality Profiling (minimally for the surface, mid depth and bottom samples). Samples will

be read on a laboratory calibrated Lamotte® portable turbidity meter (or equivalent) and recorded in NTU's (Nephelometric Turbidity Units).

3. Temperature, pH, salinity, dissolved oxygen and oxidation-reduction potential will be measured using a Hydrolab® "Surveyor-IV" multi-sensor data logger.
4. Nutrient levels (ammonia, organic nitrogen [NO<sub>x</sub>], and total phosphate) will be determined for the top, mid-level and bottom samples. Analysis will be conducted as per the D.E.R.M. Laboratory Comprehensive Quality Assurance Plan (FDEP Tracking # 870238G).

- C. Fish Populations of the hard-bottom habitats will be estimated via the Bohnsack and Bannerot (1986) Technique. A minimum of 6 replicates per station will be used to estimate the species composition, abundance and biomass of the fish population.

### I.3.2 Qualitative Surveys of biological monitoring stations (Three months post-construction and every six months thereafter).

- A. Visual surveys and photographic documentation. Each station will be assessed visually for any abnormal or unusual characteristics. Each of the five quadrats at each station will be photographed using the techniques as described for the quantitative surveys, to document the interim status of the monitoring sites. Ground-truthing of the sites will not be conducted during these surveys, however, divers will note any obvious alterations or changes in the general hard-bottom habitat.
- B. Water Quality. Light penetration and water quality profiles, as described for the quantitative sampling, will be conducted during the Qualitative Survey period.

## II. SEDIMENTATION AND SEDIMENT MONITORING.

II.1 *SEDIMENT DEPOSITION RATES* The comparative rates of sediment deposition on hard-bottoms adjacent to the borrow area and comparison sites will be assessed on a quarterly bases.

- A. Relative sediment deposition rates will be measured via sediment traps located at the reef edge proximal to the borrow area. Minimally triplicate traps will be used to estimate the relative sediment "fallout" from the water column. The traps will sample 0.5 m above the reef bottom.
- B. A minimum of five sediment deposition stations will be established. A sediment collection array will be placed at the following locations (Figure 1):
  1. On the reef adjacent to the biological monitoring stations located midway along the borrow area (minimum of 2 stations).
  2. 0.25 mile north of the northern limit of the borrow area.
  3. 0.25 mile south of the southern limit of the borrow area.
  4. On the reef adjacent to the biological monitoring control station.

C. Sediment arrays will be collected as described below to determine deposition rates. Rates will be expressed in milligrams sediment per square-centimeter per day (mg/cm<sup>2</sup>/day).

1. During Construction
  - a. During periods with no indications of sediment stress on the hardgrounds, samples will be collected biweekly.
  - b. During periods with any level of sediment stress, samples will be collected weekly.
2. Pre-/Post-Construction. Samples will be collected during quantitative and qualitative samplings (i.e., quarterly).

II.2 *REEF SEDIMENT DEPTH/ACCUMULATION.* The depth of sediment on the reef areas will be measured at, and adjacent to the fixed sediment deposition stations. Reef sediment depth measures will be recorded at fixed stations and from random measures taken in the area around the sediment deposition arrays.

- A. At each monitoring site the sediment depth will be assessed by three means.
  1. Random Measures. At each sediment deposition station, 15 random measures of the sediment depth will be taken on the reef surface during each assessment in the immediate area of the fixed station (measurements will exclude crevasses, depressions and gullies). Measures will be made with a ruler graduated in mm. Measures will be recorded to the nearest mm.
  2. Biological Monitoring Station Sub-quadrat Measures (semi-annual). At each biological monitoring station quadrat, a measure of the sediment depth will be taken at the corners of each sub-quadrat. Measures will be made with a ruler graduated in mm. Measurements will be recorded to the nearest mm.
- B. During the construction phase each station will be visited minimally on a weekly basis. If excessive levels are detected (See Sections II.3 and II.4), assessments of sediment levels will be conducted no less than 2 times a week until the sediment levels return to acceptable levels.
- C. The random measures will be averaged and, along with the fixed station measures, compared to previous sampling levels to determine accumulation rates. Measures taken at the biological stations will be used to correlate sediment levels with any documented biotic community changes.

II.3 *INDICATORS OF IMPENDING OR IMMINENT SEDIMENT IMPACTS.* Possible or imminent sediment impacts refer to identification of conditions or observations that indicate benthic organisms are being, or have been stressed by factors other than natural events. Thus, indications of possible impact will be based on comparative observations between borrow area locations and the "control" or comparison sites. In the event that an indication(s) of pending or imminent impact to benthic community components are documented during the construction surveys, the FDEP and the ACOE will be notified immediately of the possibility of violation of sediment levels on the reefs. Notification will be by phone, radio, e-mail or fax, and followed by a written report to be submitted within 24 hours, or on the next work day if the indicators are noted on a weekend or holiday. Indicators of possible of imminent impact include but are not limited to:

- A. Standing sediment on hard corals, soft corals, sponge or other organisms that is not removed by normal currents or wave action.
- B. Excessive mucus on hard corals, without indications of bleaching.
- C. Excessively extruded polyps (e.g., sediment removal process).
- D. Mottling of color of benthic organisms (soft corals, algae, sponges, etc).

II.4 *SEDIMENTATION VIOLATIONS*. In the event that irreversible impacts (i.e., organism or organism tissue death) to benthic community components are documented during the construction phase surveys, the FDEP and the ACOE will be notified immediately of the possibility of a violation of sediment levels on the reefs and impact to the benthic reef community. Notification will be by phone, radio, e-mail or fax, and followed by a written report to be submitted within 24 hours, or on the next working day. Should a violation be noted on a weekend or holiday, DERM will attempt to notify the ACOE Project Engineer and the FDEP "on-call" officer (if one is so designated). If no FDEP, "on-call" officer is designated, then notification will be given as soon as possible on the next business day. A violation will be defined as a significant build-up of sediment sufficient to cause any one or more of the following conditions:

- A. A frequency of observed bleaching (partial or complete) of hard coral colonies, significantly above the level found at the control stations.
- B. Excessive mucus produced by hard corals to remove sediment from their surface, resulting in binding of sediments and transport of bound sediments off the coral's surface and subsequent accumulation of the sediments at the base of the coral head. Such accumulations have been seen to initiate a "self burial" process, causing death of the lower tissue of the coral head.
- C. Covering of benthic community components (i.e., sponge, algae) by sediment for sufficient time or sufficient sediment so as to note death or degradation (i.e., bleaching, pigmentation changes) of the underlying organisms.

If a violation is found, DERM will initiate an assessment to determine the extent of impact to biological communities. DERM will monitor the sediment level after a violation, minimally twice a week to determine the point in time when the sediment level has decreased to within 0.5 cm from initial datum.

Any biological impact assessment will focus around the information in hand from DERM's Biological Monitoring Stations which are adjacent to the borrow area. Other sites can be added if it appears that the impact is significantly greater in areas distant to the existing biological monitoring stations.

### III. VISUAL SURVEYS OF HABITATS ADJACENT TO THE BORROW AREA .

III.1. *VISUAL SURVEYS OF HARDBOTTOM REEFS AND SIGNIFICANT HABITAT ADJACENT TO THE BORROW AREA.* Visual assessment of the condition and status of the benthic community has been found to be the best method for eliminating or minimizing impact to the reef community. Visual surveys of hardground and significant habitat adjacent to the borrow area will be conducted minimally on a semi-weekly (twice weekly) basis. During the survey, a qualified biologist using scuba, and assisted with diver propulsion vehicles, will visually inspect these areas that are adjacent to the borrow area. The biologist will note the general level of sediment and watch for indications sediment impact, as described above.

- A. At least one of the weekly surveys will be conducted by a DERM biologist with a degree in Marine Biology or related field and minimum of 5 years experience in impact characterization and assessment.
- B. The second weekly survey may be conducted by a qualified DERM biologist with knowledge and experience in marine organism identification and benthic monitoring of the offshore reef areas.
- C. Surveys of the hardground areas will be incorporated into the sedimentation monitoring as described in Section II of this plan.

#### **IV. DREDGE SLURRY PIPELINE CORRIDOR HARD CORAL PROTECTION.**

IV.1 *HARD CORAL PROTECTION MEASURES.* The dredge slurry pipeline corridor is over sand throughout it's length from the borrow area to the fill zone. Due to this fact, hard coral protection and impact assessment will not be required for this project.

#### **V. BEACH FILL COMPACTION AND SEDIMENT ANALYSIS.**

V.1. *COMPACTION MONITORING.* Compaction monitoring of the in-place beach fill will be conducted in accordance with the permit conditions timeline. A cone penetrometer, equivalent to that used by Nelson (1988) will be used for each assessment. Based on the results of the penetrometer analysis, the beach areas will be tilled to a depth of 36 inches prior to the start of each turtle nesting season during the period of this monitoring plan. The FDEP and the U.S. Fish and Wildlife Service will be consulted when the tilling criteria given in Section V.B. are present.

- A. Penetrometer analysis of the beach fill areas will be conducted along lines perpendicular to the shoreline, at 500 foot intervals, throughout the length of the beach fill segments.
  - 1. Two stations per line will be established with the first station one-third the distance between the dune (or seawall) and the mean high water line, and the second station two-thirds the distance between the dune (or seawall) and the mean high water line.
  - 2. Triplicate readings will be made at three depths (6, 12 and 18 inches) at each station.
- B. Tilling Criteria. Tilling of the beach fill will occur at the following times:
  - 1. Along the entire length of filled beach following completion of the placement and grading of fill material, and

Tilling will occur along those segments of the beach where adjacent sampling lines have cone penetrometer readings exceeding 500 CPU (cone penetrometer units), at the same depth.

V.2 *WEEKLY GRAIN SIZE ANALYSIS OF BEACH FILL.* Grab samples of beach fill will be collected weekly for grain size analysis. Three samples will be collected along the length of beach on which fill was placed during the preceding week. All samples will be dry sifted with a minimum of six standard sized screens. All procedures will follow ASTM procedures for “dry” determination of grain size.

## VI. SEA TURTLE MONITORING.

The Sea Turtle monitoring may be subcontracted during construction by the selected contractor, however, Dade County D.E.R.M. will ensure that Sea Turtle Monitoring is conducted in a manner which meets the criteria and conditions established in the above referenced permits and existing FDEP Protected Species permit.

VI.1 *DAILY BEACH SURVEYS FOR NESTING ACTIVITIES.* If the beach nourishment project will be conducted during the marine turtle nesting season (May 1 through October 30), daily early morning surveys for sea turtle nests shall occur beginning May 1 or 65 days prior to project initiation (whichever is later), and continue through September 30. The project area will be surveyed each morning to check for sea turtle nesting activity. These activities will be conducted by an individual approved and permitted by the FDEP for such activities. As per special condition in the FDEP Protected Species Permit for Miami-Dade County beaches, all nests found on Miami-Dade County beaches are relocated into a protective hatchery. Mr. Jim Hoover (Miami-Dade Parks and Recreation Dept.- Haulover Park) is the FDEP permitted sea turtle monitor for all of Dade County (excluding Golden Beach and Virginia Key) and manages the count’s sea turtle hatchery and nest relocation program. The contractor will contact and coordinate all sea turtle monitoring needs and requirements with the permitted individual.

- A. All nest surveys and egg relocations shall only be conducted by personnel with prior experience and training in nest survey and egg relocation procedures and duly authorized to conduct such activities through a valid permit issued by the Department.
- B. Relocations will be conducted prior to 9 AM each day. Construction activity shall not occur in any location prior to the completion of necessary sea turtle protection measures.
- C. Report on all nesting activity and marine turtle protection measures taken during construction shall be provided for the initial nesting season following the completion of construction and for a minimum of three additional nesting seasons. Monitoring shall include daily surveys and additional measures for sea turtle protection authorized by the Department. Reports shall be submitted to the Department no later than 30 days after completion of all monitoring activities, and shall include daily report sheets showing all activity including nesting success rates, hatching success of all relocated nests, dates of construction, and names of all personnel involved in nest surveys and relocation. All such personnel shall be qualified as noted above.

VI.3 *ESCARPMENT LEVELING.* Visual surveys for escarpments along the project area will be made immediately after completion of the beach nourishment project, and prior to May 1 for three

consecutive years. Results of the surveys shall be faxed to the Bureau of Protected Species Management (850) 921-4369, prior to any action being taken. Escarpments that interfere with sea turtle nesting or measuring 18 inches high or higher and 100 feet long or longer will be leveled to the natural contour within 24 hours of their discovery. The Department shall be contacted immediately if subsequent reformation of the escarpments that can interfere with sea turtle nesting or that exceed 18" in height for greater than 100' occurs during the nesting and hatching season to determine the appropriate action to be taken. An annual report summarizing escarpment surveys and corrective action taken shall be submitted to the Department and the Service.

VI.4 *NOTIFICATION*. If an unmarked sea turtle nest or a dead, injured, or sick turtle is discovered during construction activities the sea turtle permit holder and the Bureau of Protected Species Management will be notified immediately such that appropriate conservation measures can be taken.

## VII. HYDROGRAPHIC MONITORING PLAN.

VII.1. *SCOPE OF THE PLAN*: This is presented to document Miami-Dade County's comprehensive, long-term monitoring plan for assessment of the performance of the Dade County Beach Erosion Control and Hurricane Surge Protection Project, inclusive of the 10.5 miles of Beach restored from 1975 to 1982, 2.5 miles of Sunny Isles Beach restored in 1988 and segments of Key Biscayne (approximately from reference monument DA-R7 through DA-R113).

### VII.2. *MONITORING PLAN OBJECTIVES*:

- A. Insure a spatially and temporally consistent beach survey program on an annual basis over the full length of the Dade County Beach Erosion Control and Hurricane Surge Protection Project.
- B. Establish a comprehensive beach profile database, which will provide for easy data access and will be compatible with all existing State and federal agency database and GIS applications.
- C. Provide greater flexibility than the current project-specific survey schedule to allow for the assessment of acute erosion events due to storms or other causes.

### VII.3. *MONITORING PLAN COMPONENTS*:

- A. Annual Project Surveys. This component will consist of project-wide profile surveys at approximately 1000 ft intervals extending from the north Dade County line to the southern tip of Key Biscayne, inclusive of Golden Beach, Fisher Island, and Virginia Key. Survey profiles will be referenced to specific monuments (DNR Reference Monuments R1 – R113). The profiles will extend from a position landward of the monument sufficient to include existing dune features or other topographic features located on the beach proper out to a

distance of 2,500 feet seaward, or closer, whichever is greater. Elevations will be determined minimally at 25 ft intervals along the full length of the profile. In addition, 1":300' controlled aerial photographs will be provided of the coast over the entire project length and provided to FDEP in a reproducible format.

- B Project Specific Monitoring of Haulover beach fill area. New renourishment sites along the project length will have additional interim surveys, which will be conducted midway between the annual surveys for a period of time in accordance with the permit conditions, to better assess fill adjustment and project performance.
- C Post Storm Monitoring. Surveys will be conducted to assess the erosional effects of major storms or other acute erosion events. The timing and extent of these surveys will be determined jointly by Dade County, FDEP and the Corps of Engineers. These surveys would serve to complement, not duplicate, any storm effects assessments that may be underway by other agencies.
- D Erosion Triggers and Mitigation of Adverse Impacts. Prior to the Department issuing a Notice to Proceed, the county shall provide a plan proposing criteria by which potential adverse shoreline impacts shall be evaluated and mitigated, including specific thresholds which will trigger mitigation of adverse impacts. The mitigation plan shall include time frames for evaluating impacts, along with specific mitigation actions, up to and including the removal of the breakwater structures.

## VIII. REPORTING OF MONITORING DATA AND RESULTS

VIII.1 *BIOLOGICAL MONITORING AND SEDIMENTATION RATES.* Dade County DERM will submit semi-annual descriptive summary reports of the biological monitoring conducted for that period. Such reports will provide:

1. Date and personnel conducting the monitoring.
2. A descriptive summary of the monitoring conducted.
3. Any deviations from the prescribed monitoring program.
4. Available reduced data for that quarterly monitoring.
5. Any data not previously submitted for prior reporting periods.

VIII.2 *SEDIMENT ACCUMULATION AND SEDIMENT COMPACTION.* Reports of the sediment levels on the hardbottom areas adjacent to the borrow area will be submitted on a bi-weekly basis during the construction phase of the project. The report will include:

1. Date, time and personnel conducting the survey,
2. A descriptive summary of the sediment conditions on the hardbottom adjacent to the borrow area and the general health status of the benthic communities in the region as it relates to sedimentation.
3. A map of the borrow area and adjacent hardbottoms showing:
  - a. The location of the fixed sediment stations and the areas of hardbottom surveyed,

- b. location and depth of any elevated levels of sediment on the hardbottom.

If indications of impacts (as described in Section III. above) are documented, the FDEP will be notified immediately by phone or fax, and a report will be forwarded within 24 hours.

VIII.3 *BEACH FILL COMPACTION.* Measures of the beach fill compaction will be submitted quarterly with the descriptive summary report for the biological monitoring.

VIII.4 *BEACH FILL SEDIMENT ANALYSIS.* Reports on the grain size analysis of material placed on the beach will be forwarded to the FDEP within one week of sampling. Reports will include:

1. Date, time and personnel conducting the survey.
2. A map of the segment of beach to be restored showing:
  - a. The location of the area filled during the specified week.
  - b. Locations from which the sediment samples were taken within that week's filled area.

VIII.5 *SEA TURTLE MONITORING.*

Reports detailing activities relative to the Sea Turtle monitoring and nest relocation activities will be forwarded to the FDEP:

1. Within 60 days of the completion of construction.
2. By December 31 of each year following construction.

VIII.6 *HYDROGRAPHIC PROFILES.*

1. Annual Reports. An annual report assessing the performance of the project over the prior year will be provided. The report will provide a discussion of erosion/accretion trends documented by the survey program for the entire project with a specific emphasis on recently renourished areas. Specific problem areas will be identified and possible solutions discussed.
2. Storm Monitoring Reports. A report detailing and analyzing the results from Post-Storm hydrographic monitoring conducted during the previous year will be submitted with the annual reports.
3. Data Format. Data will be provided to FDEP on 3.5" High Density diskettes within 14 days of the completion of survey activities and data compilation. DBASE IV files based on the FDEP developed MITS (Monument Information Tracking System) format will be utilized to allow direct compatibility with existing FDEP databases as well as those of the FDEP/Corps of Engineers Coast of Florida Study.

Table 1. Proposed Quarterly Biological and Sediment Monitoring Program sampling periodicity, conducted in association with the Haulover beach renourishment.\*

PC-Q#	Photo.	G-T	Light Profile	Turb.	Water Quality	Sed. Meas.	Fish Surveys	Sand Compact	Grain size
Pre-Const.	X	X	X	X	X	X	X	X	X
Const.			X	X		X			X
Post- Const. (PC-Q1)	X	X	X	X	X	X	X	X	X
PC-Q2	X		X	X	X	X			
PC-Q3	X	X	X	X	X	X	X	X	
PC-Q4	X		X	X	X	X			
PC-Q5	X	X	X	X	X	X	X	X	
PC-Q6	X		X	X	X	X			
PC-Q7	X	X	X	X	X	X	X	X	
PC-Q8	X		X	X	X	X			

\* Photo. = Benthic community station photography; G-T = Ground-truthing of photography; Sed. Meas. = Sedimentation deposition rate analysis and Sediment depth measures; Sand Comp. = Penetrometer compaction measures; Turb. = Turbidity; PC-Q# = Post-Construction quarter number.

Compaction tests (cone penetrometer) will be conducted after final grading of the beach fill, and at the beginning of each quarter thereafter for three years from the time of final grading.

Tilling of beach fill will be conducted on an "as needed" bases, when indicated by the compaction tests and after consultation with the FDEP and the U.S. Fish & Wildlife Service

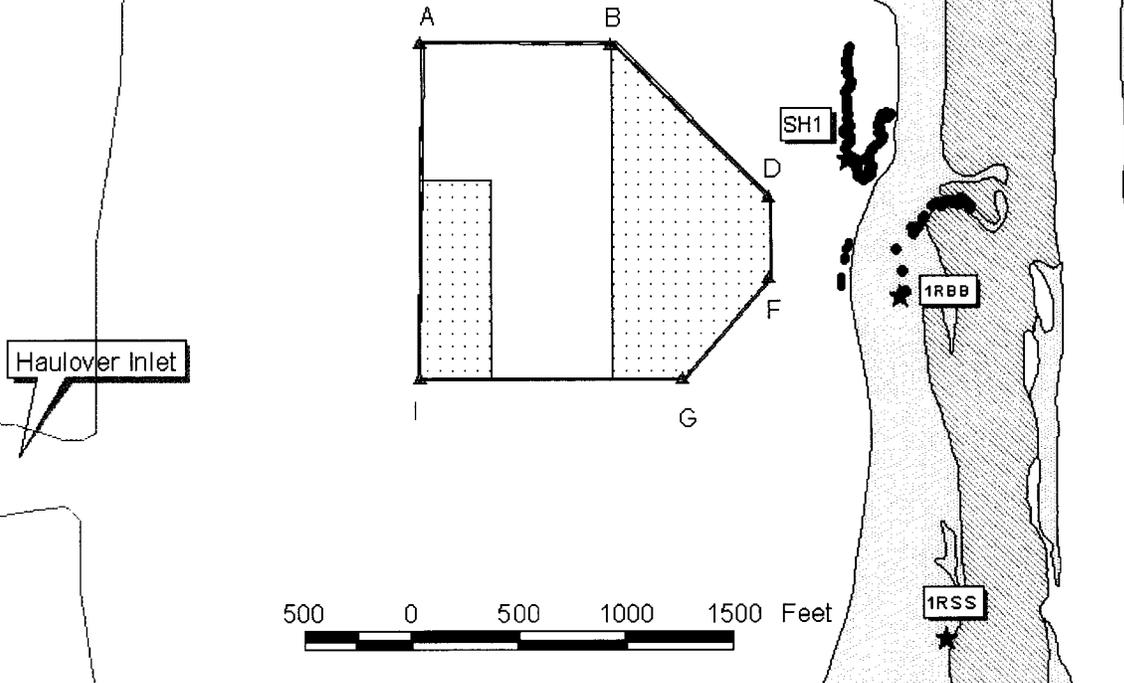


**Haulover Renourishment  
Proposed Borrow Area  
Monitoring Sites**



USACE Borrow Area Corner Points

- A) X=790,040 Y=572,310
- B) X=790,989 Y=572,309
- D) X=791,775 Y=571,539
- F) X=791,775 Y=571,139
- G) X=791,351 Y=570,633
- I) X=790,040 Y=570,633



- ★ Proposed Monitoring Sites
- Reef Edge Trace
- Significant Habitat Trace
- Low Relief Reef (COFS '92)
- ▨ High Relief Reef (COFS '92)
- ∕ Shoreline
- Dredge Boundary
- ▤ Proposed Dredge Area

Point	Easting	Northing
1RSN	792586	573641
SH1	792348	572117
1RBB	792444	571054
1RSS	792661	569320
1RBC	791938	544766



Note: Proposed monitoring sites 1RBB and 1RBC will be both sediment and biological monitoring stations. The remaining sites will be sediment monitoring stations only.

**\*\*\* DRAFT \*\*\***

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Figure 1. Location of the Borrow Area relative to the offshore hard-ground areas and approximate center points for the Benthic Community and Sediment Accumulation Monitoring Stations.