Ardaman & Associates, Inc.
Geotechnical, Environmental and
Materials Consultants

SUBSURFACE EXPLORATION REPORT
MANATEE BEND PARK
457 NE 77TH STREET ROAD
MIAMI, FL
FILE NO.: 13-2541
APRIL 11, 2013

OFFICES

Orlando, 8008 S. Orange Avenue, Orlando, Florida 32809, Phone (407) 855-3860
Bartow, 1525 Centennial Drive, Bartow, Florida 33830, Phone (863) 533-0858
Cocoa, 1300 N. Cocoa Blvd., Cocoa, Florida 32922, Phone (321) 632-2503
Fort Myers, 9970 Bavaria Road, Fort Myers, Florida 33913, Phone (941) 768-6600
Miami, 2608 W. 84th Street, Hialeah, Florida 33016, Phone (305) 825-2683
Port Charlotte, 740 Tamiami Trail, Unit 3, Port Charlotte, Florida 33954, Phone (941) 624-3393
Port St. Lucie, 460 Concourse Place NW, Unit 1, Port St. Lucie, Florida 34986, Phone (772) 878-0072
Sarasota, 78 Sarasota Center Blvd, Sarasota, Florida 34240, Phone (941) 922-3526
Tallahassee, 3175 W. Tharpe Street, Tallahassee, Florida 32303, Phone (850) 576-6131
Tampa, 3925 Coconut Palm Drive, Suite 115, Tampa, Florida 33619, Phone (813) 620-3389
West Palm Beach, 2511 Westgate Avenue, Suite 10, West Palm Beach, Florida 33409. Phone (561) 687-8200

MEMBERS:
A.S.F.E.
American Concrete Institute
American Society for Testing and Materials
Florida Institute of Consulting Engineers

Ardaman & Associates, Inc.
Geotechnical, Environmental and
Materials Consultants

April 11, 2013
File No.:13-2541

Mr. Tim Blankenship
Coastal Systems International, Inc.
464 South Dixie Hwy
Coral Gables, FL 33146

SUBSURFACE EXPLORATION REPORT
MANATEE BEND PARK
457 NE 77TH STREET ROAD
MIAMI, FL 33138

Ardaman & Associates, Inc. has completed the subsurface exploration and studies of the project site described in our proposal dated February 6, 2013. The work was requested and authorized by Mr. Tim Blankenship of Coastal Systems. We explored the general subsurface conditions in order to evaluate soil conditions in the dock area and provide recommendations for foundation design and site preparation. Our work included Standard Penetration Test (SPT) borings and visual engineering classification of the sampled soils.

The following sections of this report describe our explorations and explain our recommendations in greater detail. Our report has been prepared specifically for this project. It is intended for the exclusive use of Coastal Systems International, Inc their representatives and assigns. Our work has used methods and procedures consistent with local foundation engineering practices. No other warranty, expressed or implied, is made. We do not guarantee project performance in any respect, only that our work meets normal standards of professional care.

SITE SURFACE CONDITIONS

The project site is located at 457 NE 77th Street Rd, Miami, FL (Section 7, Township 53 S, Range 42 E). The site is part of the Manatee Bend Park. Vegetation observed on the site consists of grass and assorted trees.

PROJECT DESCRIPTION

No site plan for the proposed development was made available to use. We understand that the project will consist of the protection of the park's shoreline that may require sheet piling or rip rap in some sections. The length of the shoreline is about 400 ft.

FIELD EXPLORATION

To explore subsurface conditions at the site, one (1) Standard Penetration Test (SPT) borings was performed at the location shown on the Boring Location Plan in the Appendix. The SPT boring was completed to depths of 60 feet below grade. The work was performed in accordance with the procedures recommended in ASTM D-1586. A description of our drilling and testing procedures are included in the Appendix.

The boring location was laid out at the approximate location shown in our boring location plan. We estimate that the actual boring locations are within about 10 feet of the locations shown. If you need to know the boring locations more accurately, we recommend that you retain a surveyor.

Our drillers examined the soil recovered from the SPT sampler and maintained a log for each boring. The soil samples were taken to our laboratory where they were visually

classified by our engineer. The soil classifications and other pertinent data obtained from our explorations are reported on the boring logs in the Appendix.

The soil samples recovered from our explorations will be kept in our laboratory for 30 days, then discarded unless you request otherwise.

SUBSURFACE CONDITIONS

The boring logs in the Appendix present a detailed description of the soils encountered at the locations at the depths explored. The soil stratification shown on the boring logs is based on examination of recovered soil samples and interpretation of the driller`s field logs.

It indicates only the approximate boundaries between soil types. The actual transitions between adjacent soil strata may be gradual and indistinct.

The results of our test borings indicate the following general soil profile:

Depth Below Ground Surface (feet)	Description
0-2.5	Sand, loose
2.5-11	Limestone, poorly cemented
11-27	Sand, very loose to loose
27-43	Limestone, well cemented
43-60	Poorly cemented limestone

The above soil profile is outlined in general terms only. Please refer to the boring log for soil profile details.

GROUNDWATER CONDITIONS

Our drillers observed groundwater in the borehole at depths of 3.5 feet below the ground surface, as noted on the boring log. Fluctuations in the groundwater level on this site should be anticipated throughout the year due to tidal fluctuation.

DISCUSSIONS AND RECOMMENDATIONS

Areas of the shoreline may require protection using sheet piles. Sheet pile design and construction should consider that sheet piles may be installed through the upper layer of poorly cemented limestone. However, for this upper limestone layer, locally hard areas as well as areas with no cementation may be found along the shoreline alignment. Very hard drilling and refusal will likely be found at about 30 feet below existing grade where a well cemented limestone was found. Table 1 below presents our recommended geotechnical parameters for sheet pile design.

Soil Type	γ_{moist} (pcf)	$\gamma_{submerged}$ (pcf)	C (psf)	Friction Angle °	K_a -	K_p -
Sand loose	110	53	0	30°	0.333	3
Limestone, poorly cemented	115	58	0	36°	0.26	3.85
Limestone, well cemented,	N/A	60	10,000	-	-	-

CLOSURE

This report has been prepared in accordance with generally accepted local foundation engineering practice. The recommendations submitted herein are based on the data obtained from the soil borings presented in the Appendix and the assumed loading conditions previously described

This report may not account for all the possible variations that may exist between conditions observed in the borings and conditions at locations that were not explored. The nature and extent of any such variations may not become evident until construction is underway. If variations are then observed, we recommend that Ardaman & Associates, Inc. be requested to inspect the actual site conditions and, if necessary, re-evaluate the recommendations of this report.

In the event any changes occur in the design, nature or location of any project facilities, Ardaman & Associates, Inc. should be requested to review the conclusions and recommendations in this report. We also recommend that we be requested to review the final foundation drawings and earthwork specifications so that our recommendations may be properly interpreted and implemented in the contract documents.

It has been a pleasure to assist you on this phase of your project. Please contact us whenever we may be of service to you, and please call if you have any questions concerning this report.

ARDAMAN & ASSOCIATES, INC.

FL Certificate No. 0005950

4/11/13

Evelio Horta, Ph.D., P.E..G.E.

Senior Geotechnical Engineer

FL Reg. No. 46625

SITE PLAN
and
BORING LOGS

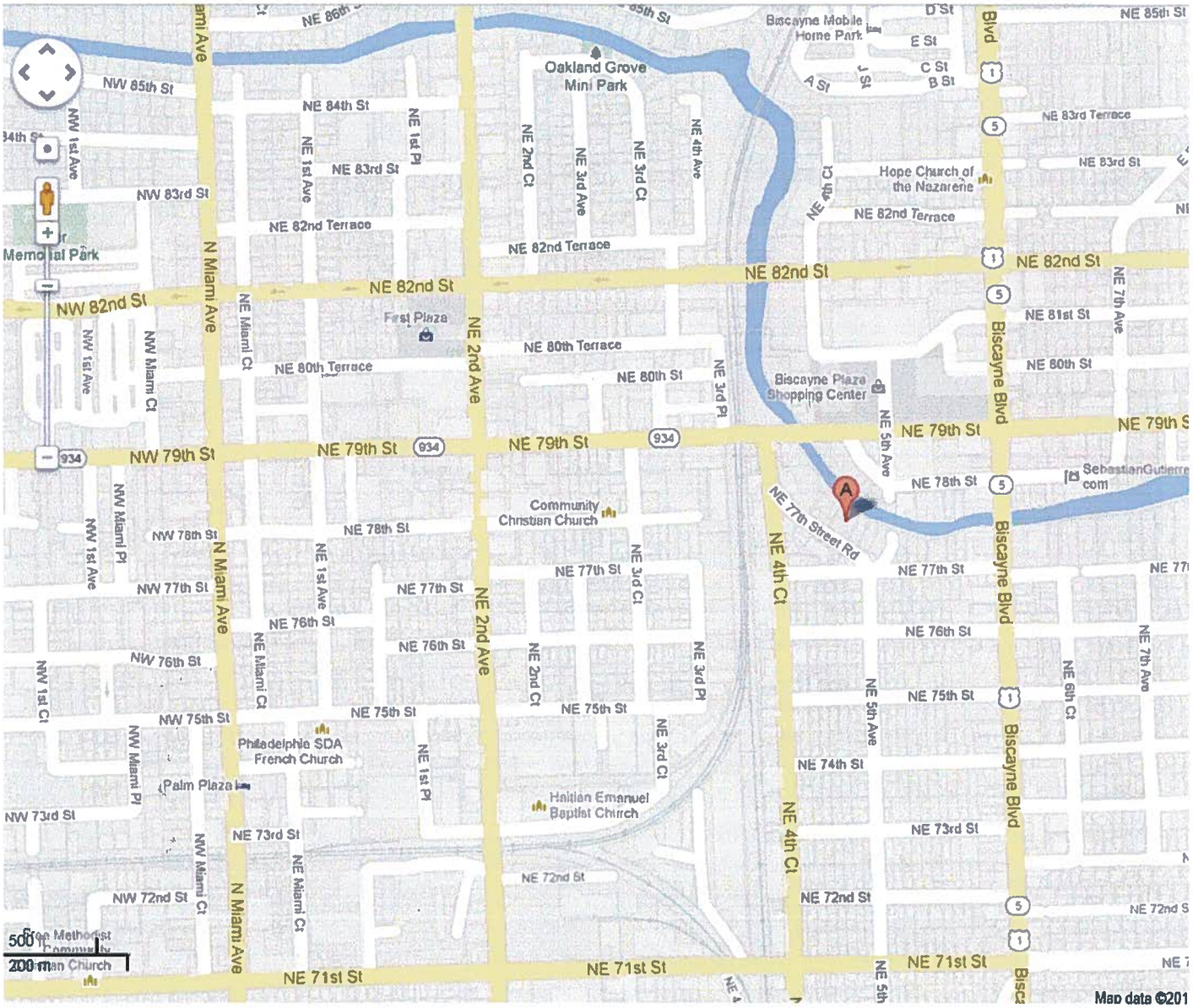


Figure 1. General Site Location Map.

Figure 2. Boring Location Sketch

APPENDIX

STANDARD PENETRATION TEST BORING LOGS

Our borings describe subsurface conditions only at the locations drilled and at the time drilled. They provide no information about subsurface conditions below the bottom of the boreholes. At locations not explored, surface conditions that differ from those observed in the borings may exist and should be anticipated.

The information reported on our boring logs is based on our drillers' logs and on visual examination in our laboratory of disturbed soil samples recovered from the borings. The distinction shown on the logs between soil types is approximate only. The actual transition from one soil to another may be gradual and indistinct.

The groundwater depth shown on our boring logs is the water level the driller observed in the borehole when it was drilled. These water levels may have been influenced by the drilling procedures, especially in borings made by rotary drilling with bentonitic drilling mud. An accurate determination of groundwater level required long-term observation of suitable monitoring wells. Fluctuations in groundwater levels throughout the year should be anticipated.

The absence of a groundwater level on certain logs indicates that no groundwater data is available. It does not mean that no groundwater will be encountered at the boring location.

STANDARD PENETRATION TEST BORINGS

The Standard Penetration Test is a widely accepted method of testing foundation soils in place. The N-Value obtained from the test has been correlated empirically with various soil properties. These empirical correlations allow satisfactory estimates to be made of how the soil is likely to behave when subjected to foundation loads. Tests are usually performed in the boreholes at intervals of five feet. In addition, our Firm performs tests continuously in the interval directly below the expected foundation bearing grade where the soils will be most highly stressed.

Boreholes where Standard Penetration Tests will be performed are drilled with a truck-mounted CME 45A drill rig. The boreholes are advanced by rotary drilling with a winged bit that makes a hole about three inches in diameter. A bentonitic drilling mud is recirculated in order to remove the cuttings and support the walls of the borehole. The drag bit is specially modified to direct the mud upward and reduced disturbance of the soil ahead of the bit.

Occasionally, running or squeezing ground is encountered that cannot be stabilized by the drilling mud alone. In addition, drilling mud may be lost into the soil or rock strata that are unusually pervious. In such cases, flush-coupled steel casing with an outside diameter of about 3.5 inches is driven as a liner for the borehole.

After the borehole has been advanced to the depth where a Standard Penetration Test will be performed, the soil sampler used to run the test is attached to the end of the drill rods and lowered to the bottom of the borehole. The testing procedure used conforms closely to the methods recommended in ASTM D-1586. The sampler used has a split-barrel 24 inches long and an outside diameter of 2.0 inches. It is driven into the ground below the bottom of the borehole using a hammer that weighs 140 pounds and falls 30 inches. The driller records the number of hammer blows need to advance the sampler the second and third six-inch increments constitutes the test result; that is, the N-Value at the depth. The test is completed after the sampler has been driven not more than 24 inches or when refusal is encountered, whichever occurs first. Refusal occurs when 50 hammer blows advance the sampler six inches or less. After the test is completed, the sampler is removed from the borehole and opened.

The driller examined and classified the soil recovered by the sampler. He places representative soil specimens from each test in closed glass jars and takes them to our laboratory. In the laboratory, additional evaluations and tests are performed, if needed. The driller's classifications may be adjusted, if necessary, to conform more closely to the United Soil Classification systems, ASTM D-2487. Jar samples are retrained in our laboratory for sixty days, then discarded unless our clients request otherwise.

After completion of a test boring, the water level in the borehole is recorded.

KEY TO SYMBOLS

Symbol Description

Strata symbols

 Sand

 Limestone

Misc. Symbols

 Water table at boring completion

 Boring continues

Soil Samplers

 Standard penetration test

Notes:

1. Exploratory borings were drilled on 4/2/13 using a 6-inch diameter continuous HSA auger.

2. Boring locations were taped from existing features and elevations extrapolated from the final design schematic plan.

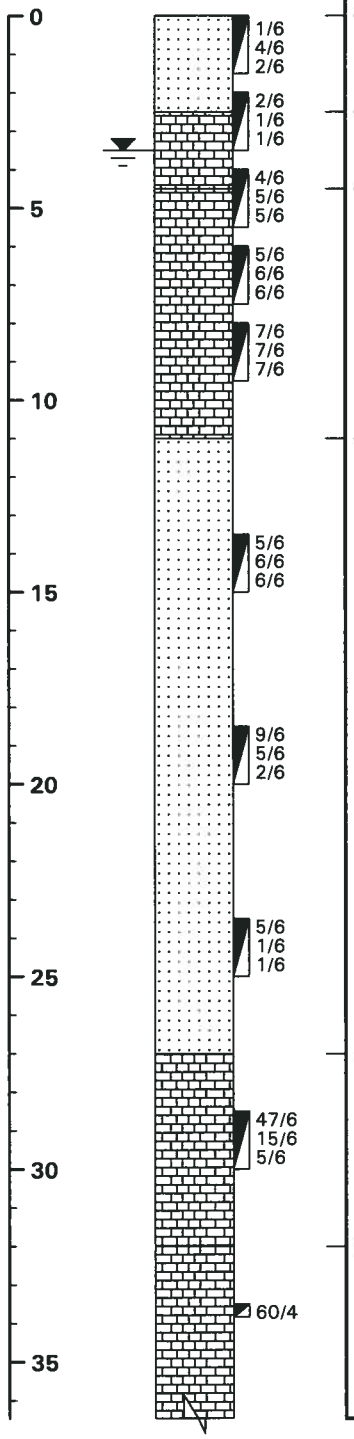
3. These logs are subject to the limitations, conclusions, and recommendations in this report.

4. Results of tests conducted on samples (If any) recovered are reported on the logs.
N value represents the Standard penetration resistance in blows per foot.

SOIL TEST BORING SYMBOLIC LOGS

BORING 1

Project: **City of Miami Park, 457 NE 77th ST Rd, Miami, FL**
Date: **4/2/13** File No.: **113-13-48-2541**
Boring Location: **SEE PLAN**
Casing: **Full length** Elev.: **N/A**
Drill Method: **SPT/CASING** Driller: **JLJ/EG**
Depth of Water Table ▼ : **3.5'** Date Checked: **4/2/13**



ELEVATION / DEPTH	SOIL DESCRIPTION	SAMPLE No.	SPT "N" VALUE
	SAND, loose, fine grained, with some organics, brown	1	6
	LIMESTONE, very poorly cemented, rusty red	2	2
			10
	LIMESTONE, white	3	12
			14
	SAND, medium dense to loose, fine grained, with few cemented fragments, light green	4	12
		5	7
		6	2
	LIMESTONE, with pockets of sand, pale brown	7	20
	LIMESTONE, well cemented, grey	8	
	REFUSAL		60

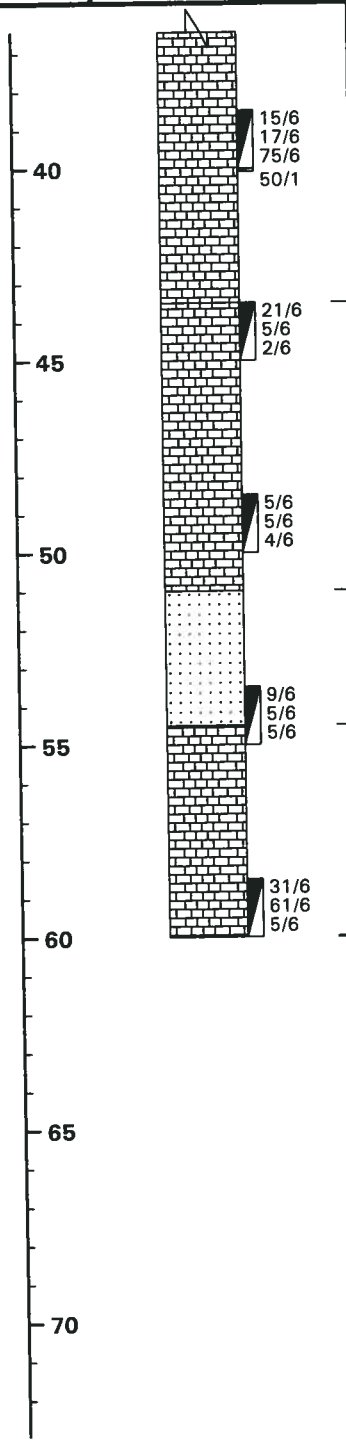
Notes:

Ardaman & Associates, Inc.

SOIL TEST BORING SYMBOLIC LOGS

BORING 1

Project: **City of Miami Park, 457 NE 77th ST Rd, Miami, FL**
Date: **4/2/13** File No.: **113-13-48-2541**
Boring Location: **SEE PLAN**
Casing: **Full length** Elev.: **N/A**
Drill Method: **SPT/CASING** Driller: **JLJ/EG**
Depth of Water Table ▼ : **3.5'** Date Checked: **4/2/13**



ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	SOIL DESCRIPTION	SAMPLE No.	SPT "N" VALUE
		LIMESTONE, well cemented, grey	9	92
		REFUSAL		50
		LIMESTONE, very poorly cemented, with large pockets of sand, light green	10	7
			11	9
		SAND, very fine grained, with few cemented fragments	12	10
		LIMESTONE, well cemented, grey	13	66

Notes:

Ardaman & Associates, Inc.