REPORT OF
GEOTECHNICAL EXPLORATION

ALSDORF PARK IMPROVEMENTS
2901 NE 14TH STREET
POMPANO BEACH, FLORIDA

FOR

CORZO CASTELLA CARBALLO THOMPSON, P.A.
3996 NW 9TH AVENUE
FORT LAUDERDALE, FLORIDA 33309

PREPARED BY

NUTTING ENGINEERS OF FLORIDA, INC.
1310 NEPTUNE DRIVE
BOYNTON BEACH, FLORIDA 33426

ORDER NO: 12563.27

JUNE 2012

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June 21, 2012

Mr. Jeff Crews, P.E.
Corzo Castella Carballo Thompson, P.A.
3996 NW 9th Avenue
Fort Lauderdale, Florida 33309
Phone: 954-565-2113 Fax: 954-567-4079

Subject: Report of Geotechnical Exploration
Alsdorf Park Improvements
2901 NE 14th Street
Pompano Beach, Florida

Dear Mr. Crews:

Nutting Engineers of Florida, Inc. (NE), has performed a Limited Geotechnical Exploration for the various park improvements at the above referenced site in Pompano Beach, Florida. This exploration was performed in accordance with the authorization to proceed provided by Corzo Castella Carballo Thompson, P.A. dated June 7, 2012. The purpose of this exploration was to obtain information concerning the subsurface soil conditions at specific test locations in order to provide the soil stratum engineering properties and provide general site preparation and foundation design parameters for the support of the proposed improvements. This report presents our findings and recommendations.

PROJECT INFORMATION

We understand that plans for this project include the renovations of the existing boat ramp/docking area at the aforementioned park. These renovations include the construction of additional asphalt paved parking areas, expansion of existing boat dock areas, improvements of existing boat ramp areas, and general improvement/repair of the existing seawall system. We were provided a plan dated August 24, 2011 indicating the existing conditions along with the proposed improvements. The improvements consist of design of a new precast concrete wall, batter piles, and king piles for the seawall repair. It is our understanding that engineering for the seawall improvements will be performed by others; however general soils information provided in this report was needed for design purposes.

Based on this our office was requested to perform general subsurface exploration in order to provide information regarding probable soil conditions to be encountered.

SUBSURFACE EXPLORATION/GENERAL SUBSURFACE CONDITIONS

Soil Survey Maps

As part of the geotechnical exploration, we have reviewed available Soil Conservation Service (SCS) survey maps for Broward County. These SCS maps provide qualitative information about potential general shallow soil conditions in the project vicinity. This information was derived from approximately 6 ft. deep manual auger borings, aerial photo and surface feature interpretation at some point in the past (mid 1980's to early 1970's). The SCS data may or may not reflect actual current site conditions. A review of the Soil Survey for Broward County revealed that at the time the survey was conducted, the soils at the site were described as Urban land. This map unit consists of areas that are more than 70 percent covered by shopping centers, parking lots, large buildings, streets, and sidewalks, and other structures, so that the natural soils are not readily observable. These soils are best described as Hallandale, Margate, and Basinger series that have been altered by fill spread on the surface to an average thickness of approximately 12 inches. We note that the maximum depth of the survey is six feet.

We note that within the general vicinity of the project site are mappings of Arents, organic substratum-Urban land complex. These soils are described as nearly level, heterogeneous overburden material that has been either dredged from nearby waterways or imported from other areas and used as fill. The fill is approximately three feet thick, and is underlain by organic soils to a depth of six feet or more. We note that the maximum depth of the survey is six feet. **The potential for these types of soils to be present at the site should be anticipated.**

Subsurface Soil Exploration

In order to evaluate the subsurface soil conditions, we were requested to perform three Standard Penetration Test borings (ASTM D-1586) to depths of thirty feet below the existing ground surface. The borings were performed as close to the proposed seawall/boat ramp locations as site conditions would allow for. Samples were obtained continuously throughout the soil profile. The locations of the test borings are indicated on the attached test boring location plan. The test borings were located using approximate methods at the locations established by the client.

The drill technician maintained a field boring report, which indicates depth of each stratum, material type, blow counts, groundwater levels and other pertinent information. All samples were inspected in our laboratory and final test boring reports prepared. Copies of these reports are included in the appendix.

In addition, three 'Usual Open-Hole' exfiltration tests were performed, at locations established by the project civil engineer, in accordance with South Florida Water Management District specifications. The exfiltration tests were completed to depths of six feet.

Test Boring Results

In general, the test boring locations evaluated recorded a surface layer of asphalt and basecourse-like material in the upper one to two feet underlain by brown sand to a depth of five feet. From five to nine feet soft brown fibrous peat with some sand lenses with roots was encountered. Below the peat stratum loose to medium dense tan to brown sand was encountered to a depth of sixteen feet, underlain by medium hard tan limestone with some sand to a depth of twenty-seven feet. Below twenty-seven feet, medium dense brown sand was encountered to a depth of thirty feet, the maximum depth explored. Please see the enclosed soil classification sheet in the Appendix of this report for additional important information regarding these descriptions, the field evaluation and other related information.

Rock Formation Note:

Although not necessarily identified in the boring, it is possible that the weathered limestone encountered may extend to greater depths and be present in areas other than recorded in the test boring. Generally, rock in the South Florida area may include limestone or sandstone which have irregularities and discontinuities including vertical and horizontal solution features, varying surface and bottom elevations, and varying degrees of hardness. The rock features may also contain intervening sand and other material filled lenses. The standard penetration test boring executed in this evaluation was performed in accordance with the normal standard of care in this area. Despite this, this process may sometimes fail to detect the presence of rock strata by passing through solution features. Solution features can be very common in rock strata in Southeast Florida. Also given the brittle nature of some rock strata, rocks may readily shatter when hit by the split spoon. Despite this, these strata which may not be depicted in the soil boring logs may present significant resistance to excavation and pile installation. These solution features may result in variability in the final piling tip elevation as a function of pile diameter with smaller diameter pilings potentially extending to greater depth. Resistance to excavation may generate vibrations which may be perceived to or actually induce settlements in subject nearby structures. Pre and post condition surveys and vibration monitoring would be advantageous in such circumstances.

For these reasons, appropriate due care shall be exercised by contractors performing excavation operations in this area, utilizing local experience and test excavations if feasible. Buried debris may or may not be identified or adequately delineated by the soil boring. Test pit excavation can provide more insight into such conditions and rock lithology if present. Such conditions may be revealed during site development activities

(e.g. proof rolling, utility & foundation excavation activities) or other related activities. Should additional assurance be desired by the client, further subsurface investigation could be performed.

Laboratory Testing and Analysis

A representative soil sample was collected during the fieldwork and returned to the laboratory for testing. Specifically, one natural water content and one organic content test were performed on the dark brown fibrous peat and sand material encountered in borings B-1 and B-3 from approximately nine to nine feet. The natural water content was to range from 100 to 223 percent. This indicates that the soils are highly compressible. The organic content tests revealed that approximately 17 to 79 percent of the soil is made up of organic material. In general, fill placed beneath buildings and roadways should not have more than three to five percent organic material.

Exfiltration Results

Three 'Usual Open-Hole' exfiltration tests were performed in accordance with South Florida Water Management District (SFWMD) specifications to depths of six feet below the existing ground surface. The tests were performed in order to determine the hydraulic conductivity of the in situ subsurface soils to evaluate drainage requirements for the project. The hydraulic conductivity value was determined to range from 4.10×10^{-4} to 1.64×10^{-4} cubic feet per second, per square foot, per foot of head. Detailed soil descriptions and flow rates are presented in the Appendix.

Groundwater Information

The immediate groundwater level was measured at the boring location at the time of drilling. The groundwater level was encountered at approximate depths of four and a half feet below the existing ground surface.

The immediate depth to groundwater measurements presented in this report may not provide a reliable indication of stabilized or more long term depth to groundwater at this site. Water table elevations can vary dramatically with time through rainfall, droughts, storm events, flood control activities, nearby surface water bodies, tidal activity, pumping and many other factors. For these reasons, this immediate depth to water data should not be relied upon alone for project design considerations.

Further information regarding stabilized groundwater elevations at the site could be developed upon specific request. Additional evaluation might include monitoring of peizomenters, survey of the project area for evidence of current groundwater elevation influences such as wellfields, obvious construction dewatering, tidal activity, flood control canals and other surface water bodies.

GENERAL FOUNDATION RECOMMENDATIONS

Proposed New Pavement Areas

The test borings and exfiltration tests indicated that soft fibrous peat soils exist at depths of five to six and a half feet (with one location extending to nine feet) below the existing ground surface. The proposed new pavement areas may be constructed over the existing soil profile; however due to the presence of the compressible organic layer settlement of the pavement section may occur resulting in higher than normal bird-bathing, cracking, or other asphalt fatigue requiring additional frequency of maintenance. We note that one possible method to reduce the potential for birdbathing would be the placement of a geogrid system within the new asphalt areas; however this method will not arrest total settlement of the compressible organic layer.

The project owner should be made aware of these conditions in order to determine if an increased frequency of maintenance is acceptable or if other actions will be required. If additional information/recommendations are warranted feel free to contact our office so that we may provide discussions at that time. We recommend that discussions be held regarding the concrete boar ramp construction.

General Pavement Development: Pavement areas should be compacted to a minimum of 98 percent of the modified Proctor maximum dry density to a depth of at least 12 inches below the subgrade level. We recommend that stabilized subgrade having a minimum Limerock Bearing Ratio (LBR) of 40 be placed to a depth of approximately one foot below the base course. The base course will range from approximately 6 to 8 inches, and should have a minimum LBR of 100. Based on the soil borings performed, material within one to two feet of the pavement surface on site may be used in order to prepare the base and sub-base course. We note that additional testing would be needed to verify this, and the suitably of this material also depends on final pavement elevation relative to existing site elevations. We can provide more detailed pavement design recommendations including material types and thicknesses. Once additional information is available, the Project Civil Engineer will need to be consulted for additional details, plan preparation and pavement specifications.

Subsurface Soil Engineering Properties

In order to provide design parameters for the proposed retaining wall/sheet pile walls, the values given in the accompanying table should be consulted. The table is based on visual classification, empirical relationships and our experience with similar soil conditions. If more exact values are needed, we recommend that specific laboratory tests be performed. We note that the table provided anticipates that any surficial topsoil/silt soils will be removed and replaced with granular soils.

If conditions are encountered which are not consistent with the findings presented in this report, or if proposed construction is moved from the location studied, this office shall be notified immediately so that the condition or change can be evaluated and appropriate action taken.

GENERAL INFORMATION

Our client for this geotechnical evaluation was:

Mr. Jeff Crews, P.E.
Corzo Castella Carballo Thompson, P.A.
3996 NW 9th Avenue
Fort Lauderdale, Florida 33309

The contents of this report are for the exclusive use of the client and the client's design team for this specific project exclusively. Information conveyed in this report shall not be used or relied upon by other parties or for other projects without the expressed written consent of Nutting Engineers of Florida, Inc. This report discusses geotechnical considerations for this site based upon observed conditions and our understanding of proposed construction for foundation support. Environmental issues including (but not limited to), soil and/or groundwater contamination, environmental issues related to fill, methane, and other environmental considerations are beyond our scope of service for this project. As such, this report should not be used or relied upon for evaluation of environmental issues.

Benefit may be realized by the performance of exploratory test pits on the site to develop additional subsurface information. The client may wish to consider performance of test pits on this project to supplement information already developed.

Prior to initiating compaction operations, we recommend that representative samples of the structural fill material to be used and acceptable in-place soils be collected and tested to determine their compaction and classification characteristics. The maximum dry density, optimum moisture content, gradation and plasticity characteristics should be determined. These tests are needed for compaction quality control of the structural fill and existing soils, and to determine if the fill material is acceptable.

If conditions are encountered which are not consistent with the findings presented in this report, or if proposed construction is altered or moved from the location investigated, this office shall be notified immediately so that the condition or change can be evaluated and appropriate action taken.

The vibratory compaction equipment may cause vibrations that could be felt by persons within nearby buildings and could potentially induce structural settlements. Additionally, preexisting settlements may exist within these structures that could be construed to have

been caused or worsened by the proposed vibratory compaction after the fact. Pre- and post conditions surveys of these structures along with the vibration monitoring during vibratory compaction could be performed to better evaluate this concern. The contractor should exercise due care during the performance of the vibratory compaction work with due consideration of potential impacts on existing structures. If potential vibrations and impacts are not considered tolerable, then alternate foundation modification techniques should be considered.

Nutting Engineers of Florida, Inc. shall bear no liability for the implementation of recommended inspection and testing services as described in this report if implemented by others. Nutting has no ability to verify the completeness, accuracy or proper technique of such procedures if performed by others.

Excavations of five feet or more in depth should be sloped or shored in accordance with OSHA and State of Florida requirements.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein, have been presented after being prepared in accordance with general accepted professional practice in the field of foundation engineering, soil mechanics and engineering geology. No other warranties are implied or expressed.

We appreciate the opportunity to provide these services for you. If we can be of any further assistance, or if you need additional information, please feel free to contact us.

Sincerely,
NUTTING ENGINEERS OF FLORIDA, INC.

Richard C. Wohlfarth, P.E.
Director of Engineering

6/22/12

Christopher E. Gworek, P.E. #69947
Senior Engineer

Appendix:
- Boring Location Plan
- Test Boring Results
- Exfiltration Test Results
- Soil Properties Table
- Limitations of Liability
- Soil Classification Criteria

REP C3TS ALSDORF PARK BOAT RAMP POMPANO CFG

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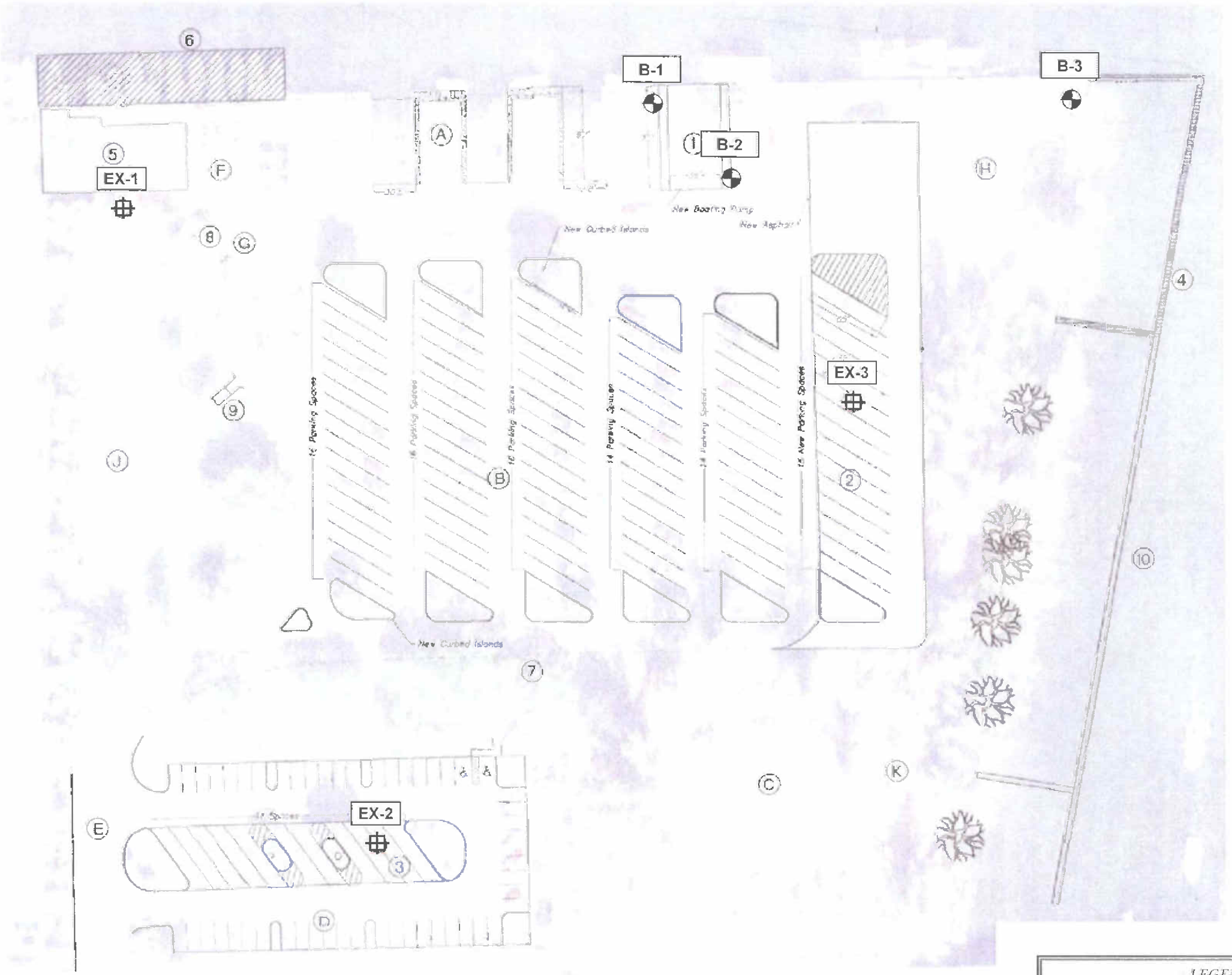
TABLE OF SOIL PROPERTIES
BORINGS B-1 TO B-3 (6/18/12)

Depth (feet)	Description	Unit Weight (lb./cu.ft)		Angle of Internal Friction (Degrees)	Earth Pressure Coefficient		
		Saturated	Submerged		Passive	Active	At Rest
0-2'	Asphalt, BASECOURSE	120	58	32	3.25	0.31	0.47
2' – 5'	SAND	115	53	30	3.00	0.33	0.5
5' – 9'	PEAT, Some Sand with Roots	100	37.6	0	1.0	1.0	1.0
9' – 16'	SAND	115	53	32	3.25	0.31	0.47
16' – 27'*	LIMESTONE, Some Sand	135	72.6	33	3.39	0.295	0.46
27' – 30'	SAND	115	53	32	3.25	0.31	0.47

*Appearance of Limestone variations among test boring locations due to the naturally occurring porous nature of the limestone formation.

Appropriate Factors of Safety should be used in the foundation design.

Note: Groundwater (WT) encountered at a depth of 4.5 feet below existing ground surface at time drilling performed



- *LEGEND* -

APPROX. TEST BORING LOCATION

APPROX. EXFILTRATION LOCATION

N

NOT TO SCALE

PROJECT NO. 12563.27

C3TS
Alsdorf Park
2901 NE 14th Street
Pompano Beach, Florida

GEOTECHNICAL EXPLORATION

FIGURE 1

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Nutting Engineers of FLorida, Inc.
1310 Neptune Drive
Boynton Beach Fl., 33426
Telephone (561) 736 4900
Fax: (561) 737-9975

BORING NUMBER B-1

PROJECT NUMBER 12563.27

CLIENT C3TS

PROJECT NAME Alsdorf Park

PROJECT LOCATION 2901 NE 14th Street, Pompano Beach, Florida

DATE STARTED 6/18/12 COMPLETED 6/18/12

SURFACE ELEVATION REFERENCE Approx. @ Road Crown

DRILLING METHOD Standard Penetration Boring

GROUND WATER LEVELS:

LOGGED BY D. Tyson CHECKED BY C. Gworek

▽ AT TIME OF DRILLING 4.5 ft

APPROXIMATE LOCATION OF BORING As located on site plan

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	Blows	N-Value	▲ SPT N VALUE ▲ 10 20 30 40 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
0		ASPHALT, baserock	AU 1			
		Lt. tan quartz medium SAND and LIMESTONE fragments	AU 2			
		Brown quartz fine SAND				
5		▽	SS 3	1-1-1-1	2	▲
		Brown fibrous PEAT				
		Dk. tan quartz fine SAND, trace root fibers	SS 4	3-5-5-5	10	▲
			SS 5	7-8-9-10	17	▲
10		Lt. tan quartz fine SAND, trace root fibers	SS 6	7-7-7-8	14	▲
		Brown quartz fine SAND				
15			SS 7	5-6-7	13	▲
		Lt. tan LIMESTONE and SAND				
20			SS 8	4-5-7	12	▲
25			SS 9	16-16-5	21	▲
		Brown quartz fine SAND				
30			SS 10	3-6-7	13	▲
		Bottom of hole at 30.0 feet.				

TEST NUTTING BOREHOLE 1-C3TS - ASLDORF PARK.GPJ GINT US.GDT 6/20/12

Nutting Engineers of FLorida, Inc.
1310 Neptune Drive
Boynton Beach Fl., 33426
Telephone: (561) 736-4900
Fax: (561) 737 9975

BORING NUMBER B-2

PROJECT NUMBER 12563.27

CLIENT C3TS PROJECT NAME Alsdorf Park

PROJECT LOCATION 2901 NE 14th Street, Pompano Beach, Florida

DATE STARTED 6/18/12 COMPLETED 6/18/12 SURFACE ELEVATION REFERENCE Approx. @ Road Crown

DRILLING METHOD Standard Penetration Boring GROUND WATER LEVELS:

LOGGED BY D. Tyson CHECKED BY C. Gworek ▽ AT TIME OF DRILLING 4.5 ft

APPROXIMATE LOCATION OF BORING As located on site plan

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	Blows	N-Value	▲ SPT N VALUE ▲ 10 20 30 40 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
0		ASPHALT, baserock				
		Tan quartz medium SAND and LIMESTONE fragments	AU 1			
		Tan quartz fine SAND	AU 2			
5		▽	SS 3	3-2-2-2	4	▲
		Brown fibrous PEAT, some sand	SS 4	1-2-4-9	6	▲
			SS 5	6-7-11-13	18	▲
10		Lt. tan quartz fine SAND, trace root fibers	SS 6	10-11-12-14	23	▲
			SS 7	7-8-10	18	▲
15						
		Lt. tan LIMESTONE and SAND	SS 8	1-1-2	3	▲
20						
			SS 9	6-7-8	15	▲
25						
		Brown quartz fine SAND	SS 10	9-12-16	28	▲
30		Bottom of hole at 30.0 feet.				

TEST NUTTING BOREHOLE 1-C3TS - ASLDORF PARK.GPJ GINT US.GDT 6/20/12

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Boynton Beach Fl., 33426
Telephone: (561) 736-4900
Fax: (561) 737-9975

BORING NUMBER B-3

PROJECT NUMBER 12563.27

CLIENT C3TS PROJECT NAME Alsdorf Park

PROJECT LOCATION 2901 NE 14th Street, Pompano Beach, Florida

DATE STARTED 6/18/12 COMPLETED 6/18/12 SURFACE ELEVATION REFERENCE Approx. @ Road Crown

DRILLING METHOD Standard Penetration Boring GROUND WATER LEVELS:

LOGGED BY D. Tyson CHECKED BY C. Gworek ▽ AT TIME OF DRILLING 4.5 ft

APPROXIMATE LOCATION OF BORING As located on site plan

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	Blows	N-Value	▲ SPT N VALUE ▲ 10 20 30 40 / PL MC LL 20 40 60 80 / □ FINES CONTENT (%) □ 20 40 60 80
0		Brown quartz fine SAND	AU 1	2-3-4-4	7	▲
			AU 2	4-5-6-7	11	▲
5		▽	SS 3	5-6-2-2	8	▲
		Brown fibrous PEAT	SS 4	2-5-9-12	14	▲
		Dk. tan quartz fine SAND, some root	SS 5	4-4-5-8	9	▲
10		Lt. tan quartz fine SAND	SS 6	6-7-8-10	15	▲
			SS 7	6-7-7	14	▲
15						
		Lt. tan LIMESTONE and SAND	SS 8	6-9-14	23	▲
20						
			SS 9	4-5-7	12	▲
25						
		Brown quartz fine SAND	SS 10	4-5-5	10	▲
30		Bottom of hole at 30.0 feet.				

TEST NUTTING BOREHOLE 1-C3TS - ASLDORF PARK.GPJ GINT US.GDT 6/22/12

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Report of Exfiltration Test

Client:	C3TS	Order No	12563.27
Project:	Alsdorf Park	Report No	1
Location:	2901 NE 14th Street, Pompano Beach, Florida	Date:	6/18/12
Test:	Usual Open Hole Exfiltration Test		
Surface Elevation:	Approx. @ Road Crown	Water table from ground surface:	4.5'
Casing Diameter:	6"		
Tube Depth:	6'		

EXFIL NO. 1

Sample Location: Approx. as located on site plan

Material:		
	0-8"	ASPHALT, baserock
	8"-2'	Tan quartz medium SAND and LIMESTONE fragments
	2'-5'	Tan quartz fine SAND
	5'-6'	Brown fibrous PEAT, some sand

One Minute Increme	Pump Rate in Gal/Min
1	5.0
2	5.0
3	5.0
4	5.0
5	5.0
6	5.0
7	5.0
8	5.0
9	5.0
10	5.0

$K = 4.10 \times 10^{-4}$ cfs/ft^{2}ft.head

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Report of Exfiltration Test

Client:	C3TS	Order No	12563.27
Project:	Alsdorf Park	Report No	2
Location:	2901 NE 14th Street, Pompano Beach, Florida	Date:	6/18/12
Test:	Usual Open Hole Exfiltration Test		
Surface Elevation:	Approx. @ Road Crown	Water table from ground surface:	4.5'
Casing Diameter:	6"		
Tube Depth:	6'		

EXFIL NO. 2

Sample Location: Approx. as located on site plan

Material:		
	0-8"	ASPHALT, baserock
	8"-2'	Tan quartz medium SAND and LIMESTONE fragments
	2'-5'	Tan quartz fine SAND
	5'-6'	Brown fibrous PEAT, some sand

One Minute Increme	Pump Rate in Gal/Min
1	3.0
2	3.0
3	3.0
4	3.0
5	3.0
6	3.0
7	3.0
8	3.0
9	3.0
10	3.0

$K = 2.46 \times 10^{-4}$ cfs/ft^{2}ft.head

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Report of Exfiltration Test

Client:	C3TS	Order No	12563.27
Project:	Alsdorf Park	Report No	3
Location:	2901 NE 14th Street, Pompano Beach, Florida	Date:	6/18/12
Test:	Usual Open Hole Exfiltration Test		
Surface Elevation:	Approx. @ Road Crown	Water table from ground surface:	4.5'
Casing Diameter:	6"		
Tube Depth:	6'		

EXFIL NO. 3	One Minute Increme	Pump Rate in Gal/Min
	1	2.0
	2	2.0
Sample Location: Approx. as located on site plan	3	2.0
	4	2.0
	5	2.0
Material: 0-8" ASPHALT, baserock	6	2.0
8"-2' Tan quartz medium SAND and LIMESTONE fragments	7	2.0
	8	2.0
2'-5' Tan quartz fine SAND	9	2.0
5'-6' Brown fibrous PEAT, some sand	10	2.0

$K = 1.64 \times 10^{-4}$ cfs/ft^{2}ft.head

LIMITATIONS OF LIABLILITY

WARRANTY

We warranty that the services performed by Nutting Engineers of Florida, Inc. are conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession in our area currently practicing under similar conditions at the time our services were performed. ***No other warranties, expressed or implied, are made.*** While the services of Nutting Engineers of Florida, Inc. are a valuable and integral part of the design and construction teams, we do not warrant, guarantee or insure the quality, completeness, or satisfactory performance of designs, construction plans, specifications we have not prepared, nor the ultimate performance of building site materials or assembly/construction.

SUBSURFACE EXPLORATION

Subsurface exploration is normally accomplished by test borings; test pits are sometimes employed. The method of determining the boring location and the surface elevation at the boring is noted in the report. This information is represented in the soil boring logs and/or a drawing. The location and elevation of the borings should be considered accurate only to the degree inherent with the method used and may be approximate.

The soil boring log includes sampling information, description of the materials recovered, approximate depths of boundaries between soil and rock strata as encountered and immediate depth to water data. The log represents conditions recorded specifically at the location where and when the boring was made. Site conditions may vary through time as will subsurface conditions. The boundaries between different soil strata as encountered are indicated at specific depths; however, these depths are in fact approximate and dependent upon the frequency of sampling, nature and consistency of the respective strata. Substantial variation between soil borings may commonly exist in subsurface conditions. Water level readings are made at the time and under conditions stated on the boring logs. Water levels change with time, precipitation, canal level, local well drawdown and other factors. Water level data provided on soil boring logs shall not be relied upon for groundwater based design or construction considerations.

LABORATORY AND FIELD TESTS

Tests are performed in *general* accordance with specific ASTM Standards unless otherwise indicated. All criteria included in a given ASTM Standard are not always required and performed. Each test boring report indicates the measurements and data developed at each specific test location.

ANALYSIS AND RECOMMENDATIONS

The geotechnical report is prepared primarily to aid in the design of site work and structural foundations. Although the information in the report is expected to be suificient for these purposes, it shall not be utilized to determine the cost of construction nor to stand alone as a construction specification. Contractors shall verify subsurface conditions as may be appropriate prior to undertaking subsurface work.

Report recommendations are based primarily on data from test borings made at the locations shown on the test boring reports. Soil variations commonly exist between boring locations. Such variations may not become evident until construction. Test pits sometimes provide valuable supplemental information that derived from soil borings. If variations are then noted, the geotechnical engineer shall be contacted in writing immediately so that field conditions can be examined and recommendations revised if necessary.

The geotechnical report states our understanding as to the location, dimensions and structural features proposed for the site. ***Any significant changes of the site improvements or site conditions must be communicated in writing to the geotechnical engineer immediately*** so that the geotechnical analysis, conclusions, and recommendations can be reviewed and appropriately adjusted as necessary.

CONSTRUCTION OBSERVATION

Construction observation and testing is an important element of geotechnical services. The geotechnical engineer's field representative (G.E.F.R.) is the "owner's representative" observing the work of the contractor, performing tests and reporting data from such tests and observations. ***The geotechnical engineer's field representative does not direct the contractor's construction means, methods, operations or personnel.*** The G.E.F.R. does not interfere with the relationship between the owner and the contractor and, except as an observer, does not become a substitute owner on site. The G.E.F.R. is responsible for his/her safety, but has no responsibility for the safety of other personnel at the site. The G.E.F.R. is an important member of a team whose responsibility is to observe and test the work being done and report to the owner whether that work is being carried out in general conformance with the plans and specifications. The enclosed report may be relied upon solely by the named client.

SOIL AND ROCK CLASSIFICATION CRITERIA

SAND/SILT

N-VALUE (bpf)	RELATIVE DENSITY
0 – 4	Very Loose
5 – 10	Loose
11 – 29	Medium
30 – 49	Dense
>50	Very dense
100	Refusal

CLAY/SILTY CLAY

N-VALUE (bpf)	UNCONFINED COMP. STRENGTH (tsf)	CONSISTENCY
<2	<0.25	v. Soft
2 – 4	0.25 – 0.50	Soft
5 – 8	0.50 – 1.00	Medium
9 – 15	1.00 – 2.00	Soft
16 – 30	2.00 – 4.00	v. Stiff
>30	>4.00	Hard

ROCK

N-VALUE (bpf)	RELATIVE HARDNESS	ROCK CHARACTERISTICS
N≥ 100	Hard to v. hard	Local rock formations vary in hardness from soft to very hard within short vertical and horizontal distances and often contain vertical solution holes of 3 to 36 inch diameter to varying depths and horizontal solution features. Rock may be brittle to split spoon impact, but more resistant to excavation.
25≤ N ≤ 100	Medium hard to hard	
5≤ N ≤ 25	Soft to medium hard	

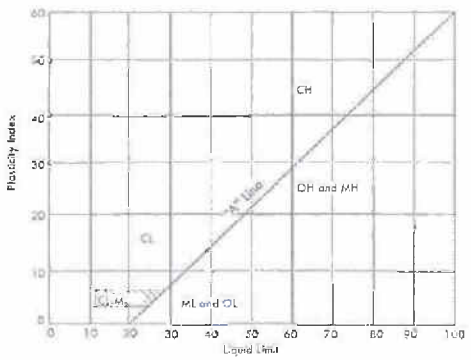
PARTICLE SIZE

Boulder	>12 in.
Cobble	3 to 12 in.
Gravel	4.76 mm to 3 in.
Sand	0.074 mm to 4.76 mm
Silt	0.005 mm to 0.074 mm
Clay	<0.005 mm

DESCRIPTION MODIFIERS

0 – 5%	Slight trace
6 – 10%	Trace
11 – 20%	Little
21 – 35%	Some
>35%	And

Major Divisions			Group Symbols	Typical names	Laboratory classification criteria
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than five percent.....GW, GP, SW, SP. More than 12 percent.....GM, GC, SM, SC. 5 to 12 percent.....Borderline cases requiring dual systems.** $C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW
		Gravels with fines (Appreciable amount of fines)	GW* d / u	Silty gravels, gravel-sand silt mixtures	Atterberg limits below "A" line or P.I. less than 4
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
			SP	Poorly graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
		Sands with fines (Appreciable amount of fines)	SM* d / u	Silty sands, sand-silt mixtures	Not meeting all gradation requirements for SW
			SC	Clayey sands, sand-clay mixtures	Atterberg limits below "A" line or P.I. less than 4
Fine-grained soils (More than half of material is smaller than No. 200 sieve size)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual system.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	Atterberg limits above "A" line with P.I. more than 7
			OL	Organic silts and organic silty clays of low plasticity	
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
			CH	Inorganic clays of high plasticity, fat clays	
			OH	Organic clays of medium to high plasticity, organic silts	
	Highly organic soils		PT	Peat and other highly organic soils	



Plasticity Chart