UNIVERSAL ENGINEERING SCIENCES

PRELIMINARY GEOTECHNICAL EXPLORATION

APOPKA – 42 ACRE RESIDENTIAL
SOUTH BINION ROAD & STATE ROAD 429 APOPKA,
ORANGE COUNTY, FLORIDA

UES PROJECT NO. 0130.2100195.0000
UES REPORT NO. 1872368

PREPARED FOR:

Bert E Roper & Barbara C Roper FLLLP

PREPARED BY:

Universal Engineering Sciences
3532 Maggie Boulevard
Orlando, Florida 32811
(407) 423-0504

June 2, 2021

UNIVERSAL
ENGINEERING SCIENCES
Consultants In: Geotechnical Engineering • Environmental Sciences
Geophysical Services • Construction Materials Testing • Threshold Inspection
Building Inspection • Plan Review • Building Code Administration

LOCATIONS:
- Atlanta, GA
- Chantilly, VA
- Daytona Beach, FL
- Fort Myers, FL
- Fort Pierce, FL
- Gainesville, FL
- Hagerstown, MD
- Jacksonville, FL
- Miami, FL
- Ocala, FL
- Orlando, FL (Headquarters)
- Palm Coast, FL
- Panama City, FL
- Pensacola, FL
- Rockledge, FL
- Sarasota, FL
- St. Petersburg, FL
- Tampa, FL
- Tifton, GA
- West Palm Beach, FL

June 2, 2021

Reference: **Preliminary Geotechnical Exploration**

South Binion Road & State Road 429
Apopka, Orange County, Florida
UES Project No. 0130.2100195.0000
UES Report No. 1872368

Dear Mr. Coil:

Universal Engineering Sciences, LLC (UES) has completed a preliminary geotechnical exploration at the above referenced site in Apopka, Florida. Our exploration was planned in conjunction with and authorized by you. Our exploration was performed in general accordance with UES Proposal No. 1854180 dated April 2, 2021 and generally accepted soil and foundation engineering practices. No other warranty, express or implied, is made.

The following report presents the results of our field exploration with a geotechnical engineering interpretation of those results with respect to the project characteristics as provided to us. We have included soil and groundwater conditions at the boring locations, potential constraints to site development, and a preliminary geotechnical assessment regarding the planned construction. *In general, the site was found to be suitable for the proposed development. However, additional exploration will be required to meet jurisdictional standards for final design.*

We appreciate the opportunity to have worked with you on this project and look forward to a continued association. Please do not hesitate to contact us if you should have any questions, or if we may further assist you as your plans proceed.

Respectfully Submitted,
UNIVERSAL ENGINEERING SCIENCES, LLC
Certificate of Authorization No. 549

Ricardo C. Kiriakidis, PhD., P.E.
Geotechnical Department Manager

ANDREW S. WILDEROTTER LICENSE NO. 65727 STATE OF FLORIDA PROFESSIONAL ENGINEER

Andrew S. Wilderotter, P.E.
Geotechnical Project Manager
Date: 6/2/2021
Florida Registration No. 65727

TABLE OF CONTENTS

LIST OF TABLES

APPENDICES

1.0 PROJECT DESCRIPTION

We understand that you are planning the purchase of the subject property for development of a 43-acre residential community in Apopka, Florida. At the time of our exploration, site development plans were not yet available. We have assumed that the development will consist of single-family residences, asphaltic surfaced roadways and dry stormwater ponds.

Please note that our exploration was preliminary in nature and conducted to acquire general subsurface information only. Once final site configuration information is available, a comprehensive geotechnical exploration will be required to provide final design recommendations. Note that the information obtained from this exploration is not sufficient to meet the industry standard of care for final design and permitting.

2.0 PURPOSE

The purposes of this preliminary exploration were:

- to explore the subsurface conditions at general locations and depths as directed by the client,
- to provide our estimates of the seasonal high groundwater level at the boring locations,
- to identify potential constraints to development and provide a preliminary geotechnical assessment regarding the planned construction for due diligence concerns.

This report presents an evaluation of site conditions on the basis of geotechnical procedures for site characterization. The recovered samples were not examined, either visually or analytically, for chemical composition or environmental hazards.

Our exploration was not designed to specifically address the potential for surface expression of deep geological conditions, such as sinkhole development related to karst activity. This evaluation requires a more extensive range of field services than those performed in this study. We would be pleased to conduct an exploration to evaluate the probable effect of the regional geology upon the proposed construction, if you so desire.

3.0 SITE DESCRIPTION

The subject site is located within Section 18, Township 21 South, Range 28 East in Orange County, Florida. More specifically, the site is located east of the South Binion Road and State Road 429 overpass, as shown on the attached Figures A-1 and B-1. At the time of drilling, the subject site was vacant and undeveloped. *The area along the western property line of the site were wooded, low and wet.*

3.1 SOIL SURVEY

There are three (3) native soil types mapped within the project boundary according to the USDA NRCS Soil Survey of Orange County. A brief summary of the mapped surficial soil type(s) is presented in Table I.

TABLE I
SUMMARY OF PUBLISHED SOIL DATA

Soil Symbol	Soil Type	Hydrologic Group	Drainage Characteristics	Depth of Published Seasonal High GWT (feet)
6	Candler fine sand, 5 to 12 percent slopes	A	Excessively drained	>6
9	**Canova muck**	A/D	Very poorly drained	0+
47	Tavares-Millhopper complex, 0 to 5 percent slopes	A	Moderately well drained	3½ to 6

The extreme western portions of the site are mapped as ***Canova Muck***. These areas typically consist of up to 2+ feet of surficial organic soils. Based on our understanding of the project, it is likely that that these organic soils are mapped outside of the proposed construction areas.

3.2 TOPOGRAPHY

According to information obtained from the United States Geologic Survey (USGS) the Apopka, Florida quadrangle map, the native ground surface elevation across the site area ranges from approximately +105 feet National Geodetic Vertical Datum (NGVD) within the eastern portions of the site down to +70 within the western portions. The site is generally located 1.2 miles to the northeast of Lake Apopka. Based on the USGS maps, the normal high water elevation for Lake Apopka is +66 feet NGVD, respectively. A copy of a portion of the USGS Map is included in Appendix A.

4.0 SCOPE OF SERVICES

The services conducted by UES during our preliminary geotechnical exploration are as follows:

- Drilled ten (10) Standard Penetration Test (SPT) borings scattered throughout the subject site to a depth of 25 feet below existing land surface (bls).
- Secured samples of representative soils encountered in the soil borings for review, laboratory analysis and classification by a Geotechnical Engineer.
- Measured the existing site groundwater levels and provide an estimate of the seasonal high groundwater level at the boring locations.
- Conducted laboratory testing on selected soil samples obtained in the field to determine their engineering properties.
- Prepared a report which documents the results of our preliminary exploration and laboratory testing program with analysis.

5.0 FIELD EXPLORATION

The SPT soil borings were performed with an ATV mounted drilling rig. UES located the test borings by using the provided site plan, measuring from existing on-site landmarks shown on an aerial photograph, and by using handheld GPS devices. No survey control was provided at our boring locations. The indicated test locations should be considered accurate to the degree of the methodologies used. The approximate test locations are shown in Appendix B.

The SPT borings, designated B-01 through B-10 as shown on the attached Boring Location Plan in Appendix B, were performed in general accordance with the procedures of ASTM D 1586 “Standard Method for Penetration Test and Split-Barrel Sampling of Soils”. SPT sampling was performed continuously within the top 10 feet to detect variations in the near surface soil profile and on approximate 5 feet centers thereafter.

6.0 LABORATORY TESTING

The soil samples recovered from the test borings were returned to our laboratory and visually classified in general accordance with ASTM D 2487 “Standard Classification of Soils for Engineering Purposes” (Unified Soil Classification System). We selected representative soil samples from the borings for laboratory testing to aid in classifying the soils and to help to evaluate the general engineering characteristics of the site soils. The results of these tests are shown on the boring logs in Appendix B. A summary of the tests performed is shown in Table II.

TABLE II
LABORATORY METHODOLOGIES

Test Performed	Number Performed	Reference
Grain Size Analysis (#200 wash only)	10	ASTM D 1140 “Amount of Material in Soils Finer than the No. 200 (75 - µm) sieve”
Moisture Content	10	ASTM D 2216 “Laboratory Determination of Water (Moisture) Content of Soil by Mass”

7.0 SUBSURFACE SOIL CONDITIONS

The results of our field exploration and laboratory analysis, together with pertinent information obtained from the SPT borings, such as soil profiles, penetration resistance and groundwater levels are shown on the boring logs included in Appendix B. The Key to Boring Logs, Soil Classification Chart is also included in Appendix B. The soil profiles were prepared from field logs after the recovered soil samples were examined by a Geotechnical Engineer. The stratification lines shown on the boring logs represent the approximate boundaries between soil types, and may not depict exact subsurface soil conditions. The actual soil boundaries may be more transitional than depicted. A generalized profile of the soils encountered at our boring locations is presented in Table III. For detailed soil profiles, please refer to the attached boring logs.

TABLE III
GENERALIZED SOIL PROFILE

Typical Depth (feet, bls)		Soil Description	Range of SPT "N" Values (blows/ft)
From	To		
Surface	5½ to 13	Very loose to loose fine SAND [SP]	1 to 10
5½ to 13	25*	Loose to dense silty/clayey fine SAND [SC, SM, SC-SM]	9 to 46
* Denotes termination depth of borings			

8.0 GROUNDWATER CONDITIONS

8.1 EXISTING GROUNDWATER LEVEL

We measured the water levels in the boreholes on May 20 through 24, 2021 during drilling operations. No groundwater was encountered within the top 10 feet at any of the borings with the exception of B-10 where water was encountered at 9½ feet bls. Stabilized groundwater readings were not obtained due to the presence of hydraulically restrictive silty/clayey soils and the use of drilling fluids. Fluctuations in groundwater levels should be anticipated throughout the year, primarily due to seasonal variations in rainfall, surface runoff, and other factors that may vary from the time the borings were conducted.

8.2 SEASONAL HIGH GROUNDWATER LEVEL

Based on historical data, the rainy season in Central Florida is between June and October of the year. In order to estimate the seasonal high water level at the boring locations, many factors are examined, including the following:

- Measured groundwater level
- Drainage characteristics of existing soil types
- Current & historical rainfall data
- Natural relief points (such as lakes, rivers, wetlands, etc.)
- Man-made drainage systems (ditches, canals, retention basins, etc.)
- On-site types of vegetation
- Review of available data (soil surveys, USGS maps, etc.)

Based on the results of our field exploration and the factors listed above, we estimate that the seasonal high groundwater level at the boring locations should form as a transient perched condition above the silty/clayey layer or roughly about 5 to 12 feet bls. The estimated perched groundwater levels are shown on the individual logs in Appendix B.

It should be noted that the estimated seasonal high water levels provided should be considered accurate to approximately ±½ foot and do not provide any assurance that groundwater levels will not exceed these estimated levels during any given year in the future. Should the impediments to surface water drainage be present, or should rainfall intensity and duration, or total rainfall quantities, exceed the normally anticipated rainfall quantities, groundwater levels might exceed our seasonal high estimates. Further, it should be understood that changes in the

surface hydrology and subsurface drainage from on-site and/or off-site improvements could have significant effects on the normal and seasonal high groundwater levels.

9.0 PRELIMINARY GEOTECHNICAL ASSESSMENT

9.1 PRELIMINARY SITE PREPARATION

Based on the results of our exploration, the near surface soils at this site consist mostly of very loose to loose sands followed by loose to dense silty/clayey sands to a depth of 25 feet bls. Other than the surficial topsoils, no deep pockets of unsuitable soils including highly organic soils, buried debris and/or high plasticity clayey soils which would require significant removal or remediation were encountered our boring locations within the explored depths.

Based on the results of our preliminary exploration, conventional site preparation is anticipated for this project. Typical site preparation will consist of root raking and stripping procedures to remove surface vegetation, roots, topsoils, and other deleterious materials, followed by densification of any loose subgrade soils and placement of compacted fill. Clearing and grubbing depths are anticipated to be about 6 to 12 inches. Deeper clearing and grubbing depths may be encountered in heavily vegetated and depressional areas where major root systems are encountered.

Based on the anticipated groundwater conditions, significant dewatering should not be necessary within a majority of this site to achieve the necessary excavation, backfilling and compaction requirements. However, some temporary dewatering may be necessary where perched groundwater is present within the upper 10 feet.

All fill/backfill should consist of clean sand with less than 12 percent soil fines and be free of organics, debris and other deleterious materials. Fill soils containing between 5 and 12 percent fines may require strict moisture control. The fill should be placed in maximum 12-inch loose, uniform lifts with each lift compacted to at least 95 percent of the Modified Proctor maximum dry density (ASTM D1557).

9.2 PRELIMINARY FOUNDATION DESIGN

We assume that the proposed construction will consist of typical single-family residential structures (maximum loadings of 50 kips per column and 4 kips/ft for structural walls). Assuming that the site is properly prepared, we anticipate that conventional, shallow spread footing or slab-on-grade foundations may be used to support the proposed structures. Based on the results of our preliminary exploration, adequate allowable net bearing pressures are anticipated for typical residential foundation design (i.e. 2,000 psf).

The foundations may bear on either the compacted suitable native soils or compacted structural fill. The bearing level soils should be densified to at least 95 percent of the maximum dry density as determined by ASTM D 1557 (Modified Proctor) to a depth of at least 2 feet below foundation level.

The minimum width recommended for an isolated column footing is 24 inches. For continuous wall or thickened edge monolithic slab footings, the minimum widths should comply with the current Florida Building Code (FBC), but under no circumstances should be less than 12 inches

in width. The base of all footings should bear at least 12 inches below finished grade elevation as required under the current FBC.

9.3 PRELIMINARY PAVEMENT DESIGN

We assume that the proposed roadways will consist of a flexible pavement section with typical residential traffic. For asphaltic pavements, we recommend using a three-layer section consisting of stabilized subgrade (sub-base), base course, and surface course. The roadways should be designed and constructed in accordance with Orange County and appropriate FDOT standards.

Sufficient separation will need to be maintained between the bottom of base course and the anticipated seasonal high groundwater level. Based on the anticipated seasonal high groundwater conditions, the separation requirements should not be an issue for pavements constructed at or above existing grades. The perched groundwater conditions will need to be considered during site grading. Where the site is cut near the silty/clayey soils, some undercutting or the installation of underdrains may be necessary depending on final grading.

9.4 PRELIMINARY STORMWATER POND DESIGN

Based on the results of our preliminary borings, conventional dry ponds appear to be the most feasible stormwater system at this site. The soils at our borings consisted generally of fine sands within the upper 5½ to 13 feet followed by silty/clayey sands to a depth of 25 feet bls. The upper sands are permeable whereas the underlying silty//clayey sands are relatively impermeable and should be considered the base of surficial aquifer in preliminary pond design. The estimated perched groundwater levels are shown on the logs in Appendix B. An effective porosity of 25 percent is estimated for the upper clean sands.

9.5 SUITABILITY OF EXCAVATED SOIL FOR USE AS FILL

The soils excavated from stormwater management areas are usually re-used as structural fill throughout the development. Table IV lists the suitability of excavated materials for use as structural fill based on percent fines content.

TABLE IV
SUITABILITY OF EXCAVATED MATERIAL FOR USE AS FILL

Designation	USCS Soil Classification	% Fines Passing No. 200 Sieve	Suitability for Use as Structural Fill
Group A	SP	0-5	Favorable, freely draining, “clean” sands
Group B	SP-SC, SP-SM	6-12	Suitable, will require aeration and moisture control
Group C	SM, SC, SM-SC	13-20	Poor, impedes infiltration, limit overall use, extremely sensitive to water, do not use in pavement or pond areas
Group D	SM, SC, SM-SC, CH, MH	>20	Very Poor, not recommended for structural fill, may be used as stabilizing material in pavement subgrade

TABLE IV
SUITABILITY OF EXCAVATED MATERIAL FOR USE AS FILL

Designation	USCS Soil Classification	% Fines Passing No. 200 Sieve	Suitability for Use as Structural Fill
Group E	PT, OL, SM-OL	Organic	Unsuitable, must be completely removed and replaced with Group A or B soils

Based on the results of our soil borings and laboratory testing program, the majority of the soils encountered at the borings consist of mostly of fine sands [SP] ("Group A") followed by silty/clayey fine sands [SM, SC, SC-SM] ("Groups C and D"). All fill materials should be free of organics, debris, and other deleterious materials.

Clean sandy soils (Group A) with less than 5 percent soil fines are best suited for fill usage, since they are typically free-draining and require minimal moisture control during placement and compaction. The sands with silt and clay (Group B), with contents of 6 to 12 percent soil fines, will require some extra care during placement and compaction. These soils are less freely-draining and might require aeration and drying prior to usage, during use in the rainy season, and when placed near the groundwater table. We recommend that imported fill material meet the Group A and Group B qualifications.

Soils classified as silty or clayey, Group C and D (greater than 12 percent fines), will impede infiltration and may cause a perched water condition. We do not recommend using these soils as structural fill material as they will require stringent moisture control during stockpiling, placement and compaction. They will also be problematic during compaction.

9.6 POTENTIAL CONSTRAINTS TO DEVELOPMENT

Based on our preliminary exploration, we have identified the following potential geotechnical constraints that could affect the schedule and costs associated with this project including:

- The seasonal high groundwater table at this site is estimated to form as a transient perched condition above the hydraulically restrictive silty/clayey sands. The perched condition should be used in preliminary grading design. If significant cuts are proposed, undercutting of the clayey soils or the use of underdrains may be necessary to alleviate the potential adverse effects of the perched water.

Although we have identified the preceding potential constraints due to subsurface conditions, we believe these issues can be managed through proper planning and design.

10.0 FINAL GEOTECHNICAL EXPLORATION

Please note that this exploration was preliminary in nature, and was designed to help determine the presence of any near surface constraints which would significantly impact the intended development of the subject site, as well as affect the cost of construction. The information obtained from this exploration is not sufficient to meet the industry standard of care for final design.

We strongly recommended that the information obtained from this preliminary exploration be supplemented with a more comprehensive subsurface exploration once the building layouts and the site plan have been finalized. The foundations for the building and the pavement grades should be designed based on the information obtained from a comprehensive geotechnical exploration program.

This report has not been prepared to meet the full needs of design professionals, contractors, or any other parties. Any use of this report without the guidance of the geotechnical engineer who prepared it constitutes improper usage which could lead to erroneous assumptions, faulty conclusions, and other problems.

11.0 LIMITATIONS

This report has been prepared for the exclusive use of ***JCF Living*** for the specific project discussed in this report. No other site or project facilities should be designed using the soil information contained in this report. As such, UES will not be responsible for the performance of any other site improvements designed using the data in this report. This report should not be relied upon by unauthorized third parties without the expressed written consent of UES. Unauthorized third parties that rely upon the information contained herein without the expressed written consent of UES assume all risk and liability for such reliance.

The recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated on the Boring Location Plan and from other information as referenced. This report does not reflect any variations which may occur between the boring locations. The nature and extent of such variations may not become evident until the course of construction. If variations become evident, it will then be necessary for a re-evaluation of the recommendations of this report after performing on-site observations during the construction period and noting the characteristics of the variations.

Borings for a typical geotechnical report are widely spaced and generally not sufficient for reliably detecting the presence of isolated, anomalous surface or subsurface conditions, or reliably estimating unsuitable or suitable material quantities. Accordingly, UES does not recommend relying on our boring information for estimation of material quantities unless our contracted services ***specifically*** include sufficient exploration for such purpose(s) and within the report we so state that the level of exploration provided should be sufficient to detect anomalous conditions or estimate such quantities. Therefore, UES will not be responsible for any extrapolation or use of our data by others beyond the purpose(s) for which it is applicable or intended.

All users of this report are cautioned that there was no requirement for UES to attempt to locate any man-made buried objects or identify any other potentially hazardous conditions that may exist at the site during the course of this exploration. Therefore, no attempt was made by UES to locate or identify such concerns. UES cannot be responsible for any buried man-made objects or environmental hazards which may be subsequently encountered during construction that are not discussed within the text of this report. We can provide this service if requested.

During the early stages of most construction projects, geotechnical issues not addressed in this report may arise. Because of the natural limitations inherent in working with the subsurface, it is not possible for a geotechnical engineer to predict and address all possible problems. A Geotechnical Business Council (GBC) publication, "Important Information About This

Geotechnical Engineering Report" appears in Appendix C, and will help explain the nature of geotechnical issues.

Further, we present documents in Appendix C: Constraints and Restrictions, to bring to your attention the potential concerns and the basic limitations of a typical geotechnical report.

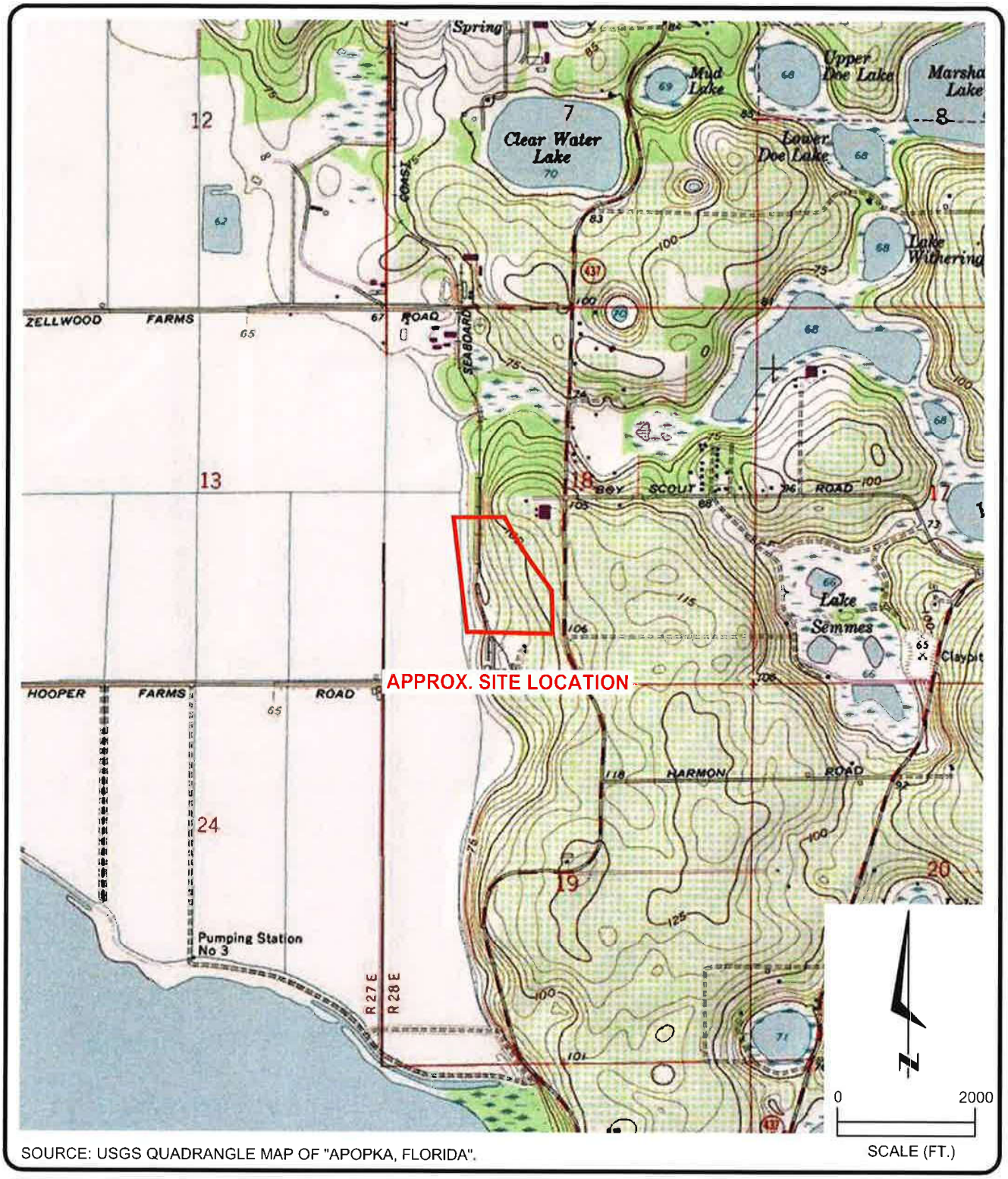
12.0 CLOSURE

We appreciate this opportunity to be of service as your geotechnical consultant on this phase of the project and look forward to providing follow up explorations and geotechnical engineering analyses as the project progresses through the design phase. If you have any questions concerning this report or when we may be of any further service, please contact us.

* * * * * * * * *

APPENDIX A

UNIVERSAL
ENGINEERING SCIENCES



SOURCE: USGS QUADRANGLE MAP OF "APOPKA, FLORIDA".

UNIVERSAL
ENGINEERING SCIENCES

PRELIMINARY GEOTECHNICAL EXPLORATION
- 43 ACRE RESIDENTIAL
SOUTH BINION ROAD & SR 429
APOPKA, ORANGE COUNTY, FLORIDA

USGS TOPOGRAPHIC MAP

DRAWN BY:	N.F.	**DATE:**	5 - 25 - 2021	**CHECKED BY:**	A.S.W.	**DATE:**	6 - 1 - 2021
SCALE:	AS SHOWN	**PROJECT NO:**	0130.2100195.0000	**REPORT NO:**	1872368	**PAGE NO:**	A-1

21-0302-01

APPENDIX B

UNIVERSAL
ENGINEERING SCIENCES

LEGEND

⊕ APPROX. STANDARD PENETRATION TEST BORING LOCATION (SPT) PERFORMED 5/20/2021 - 5/21/2021

0 350

SCALE (FT.)

N

AERIAL PHOTO SOURCE: GOOGLE EARTH

UNIVERSAL ENGINEERING SCIENCES

PRELIMINARY GEOTECHNICAL EXPLORATION - 43 ACRE RESIDENTIAL SOUTH BINION ROAD & SR 429 APOPKA, ORANGE COUNTY, FLORIDA

BORING LOCATION PLAN

DRAWN BY:	N.F.	**DATE:**	5 - 25 - 2021	**CHECKED BY:**	A.S.W.	**DATE:**	6 - 1 - 2021
SCALE:	AS SHOWN	**PROJECT NO:**	0130.2100195.0000	**REPORT NO:**	1872368	**PAGE NO:**	B-1

21-0302-01

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0130.2100195.0000
REPORT NO.:	1872368
PAGE:	B-2.1

PROJECT: PRELIMINARY GEOTECHNICAL EXPLORATION
- 43 ACRE RESIDENTIAL
ORANGE COUNTY, FLORIDA

CLIENT:

LOCATION: SEE BORING LOCATION PLAN

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED

BORING I.D.: **B-01** SHEET: **1 of 1**
SECTION: 18 TOWNSHIP: 21 RANGE: 28

G.S. ELEVATION (ft): N.S.
WATER TABLE (ft): >10
DATE OF READING: 5/21/2021
EST. SHGWT (ft): 12

DATE STARTED: 5/21/21
DATE FINISHED: 5/21/21
DRILLED BY: ORL - JB/JB/WR
TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG. CONT. (%)
0						Loose brown fine SAND [SP]						
		3-3-2	5			-- very loose						
		3-2-1	3			-- loose						
5		2-2-3	5				3	4				
		2-2-2	4			-- orange brown						
		2-2-3	5									
10		2-2-3	5									
				▽								
						Dense grey brown clayey fine SAND [SC]						
15		14-18-24	42									
						-- medium dense, grey orange brown						
20		6-12-13	25									
						Medium dense grey silty fine SAND [SM]						
25		10-12-16	28			BORING TERMINATED AT 25.0 FEET						
30												

W-11652.GPJ

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0130.2100195.0000
REPORT NO.:	1872368
PAGE:	B-2.2

PROJECT: PRELIMINARY GEOTECHNICAL EXPLORATION - 43 ACRE RESIDENTIAL ORANGE COUNTY, FLORIDA

BORING I.D.: **B-02** SHEET: **1 of 1**

SECTION: 18 TOWNSHIP: 21 RANGE: 28

CLIENT:

LOCATION: SEE BORING LOCATION PLAN

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED

G.S. ELEVATION (ft): N.S. DATE STARTED: 5/21/21

WATER TABLE (ft): >10 DATE FINISHED: 5/21/21

DATE OF READING: 5/21/2021 DRILLED BY: ORL - JB/JB/WR

EST. SHGWT (ft): 7 TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG. CONT. (%)
0						Loose brown fine SAND [SP]						
		3-4-4	8									
		3-2-3	5									
5		3-2-3	5									
		4-3-6	9	▽								
		11-14-18	32			Dense grey brown clayey fine SAND [SC]	25	11				
		15-19-22	41									
10												
						-- medium dense, grey orange brown						
15		6-7-10	17									
						Medium dense grey brown silty fine SAND [SM]						
20		4-5-9	14									
						-- loose						
25		4-5-5	10			BORING TERMINATED AT 25.0 FEET						
30												

W-11652.GPJ

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0130.2100195.0000
REPORT NO.:	1872368
PAGE:	B-2.3

PROJECT: PRELIMINARY GEOTECHNICAL EXPLORATION
- 43 ACRE RESIDENTIAL
ORANGE COUNTY, FLORIDA

BORING I.D.: **B-03** SHEET: **1 of 1**
SECTION: 18 TOWNSHIP: 21 RANGE: 28

CLIENT:

LOCATION: SEE BORING LOCATION PLAN

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED

G.S. ELEVATION (ft): N.S.
WATER TABLE (ft): >10
DATE OF READING: 5/21/2021
EST. SHGWT (ft): 11

DATE STARTED: 5/21/21
DATE FINISHED: 5/21/21
DRILLED BY: ORL - JB/JB/WR
TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG. CONT. (%)
0						Loose orange brown fine SAND [SP]						
		2-2-3	5									
		3-2-2	4									
5		3-2-3	5									
		3-3-3	6									
		3-3-2	5			Loose dark orange brown fine SAND with clay [SP-SC]						
10		4-3-4	7	▽			10	14				
						Dense grey light brown silty clayey fine SAND [SC-SM]						
15		11-15-18	33									
						-- medium dense						
20		5-6-9	15									
25		6-8-10	18			BORING TERMINATED AT 25.0 FEET						
30												

W-11652.GPJ

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0130.2100195.0000
REPORT NO.:	1872368
PAGE:	B-2.4

PROJECT: PRELIMINARY GEOTECHNICAL EXPLORATION
- 43 ACRE RESIDENTIAL
ORANGE COUNTY, FLORIDA

CLIENT:

LOCATION: SEE BORING LOCATION PLAN

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED

BORING I.D.: **B-04** SHEET: **1 of 1**
SECTION: 18 TOWNSHIP: 21 RANGE: 28

G.S. ELEVATION (ft):	N.S.	DATE STARTED:	5/21/21
WATER TABLE (ft):	>10	DATE FINISHED:	5/21/21
DATE OF READING:	5/21/2021	DRILLED BY:	ORL - JB/JB/WR
EST. SHGWT (ft):	5	TYPE OF SAMPLING:	ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG. CONT. (%)
0						Loose grey brown fine SAND [SP]						
		2-2-4	6			-- very loose, brown						
		2-1-2	3			-- medium dense orange brown						
5		2-4-8	12	▽		Dense orange brown silty clayey fine SAND [SC-SM]						
		14-18-23	41									
		9-19-20	39				26	14				
		12-13-19	32									
10												
						-- medium dense, grey brown						
15		3-5-8	13									
20		3-5-9	14									
						-- loose, grey green						
25		3-4-5	9			BORING TERMINATED AT 25.0 FEET						
30												

W-11652.GPJ

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0130.2100195.0000
REPORT NO.:	1872368
PAGE:	B-2.5

PROJECT: PRELIMINARY GEOTECHNICAL EXPLORATION - 43 ACRE RESIDENTIAL ORANGE COUNTY, FLORIDA

BORING I.D.: **B-05** SHEET: **1 of 1**
SECTION: 18 TOWNSHIP: 21 RANGE: 28

CLIENT:

LOCATION: SEE BORING LOCATION PLAN

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED

G.S. ELEVATION (ft): N.S.
WATER TABLE (ft): >10
DATE OF READING: 5/21/2021
EST. SHGWT (ft): 8.5

DATE STARTED: 5/21/21
DATE FINISHED: 5/21/21
DRILLED BY: ORL - JB/JB/WR
TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG. CONT. (%)
0						Loose orange brown fine SAND [SP]						
		3-2-2	4									
		3-2-2	4				3	3				
5		2-2-3	5			-- light brown						
		2-2-3	5									
		2-3-4	7	▽								
10		3-5-8	13			Medium dense grey orange brown clayey fine SAND [SC]						
15		10-14-16	30									
20		6-7-8	15			Medium dense grey brown silty fine SAND with seams of orange [SM]						
25		5-9-11	20			BORING TERMINATED AT 25.0 FEET						
30												

W-11652.GPJ

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0130.2100195.0000
REPORT NO.:	1872368
PAGE:	B-2.6

PROJECT: PRELIMINARY GEOTECHNICAL EXPLORATION - 43 ACRE RESIDENTIAL
ORANGE COUNTY, FLORIDA

BORING I.D.: **B-06** SHEET: **1 of 1**
SECTION: 18 TOWNSHIP: 21 RANGE: 28

CLIENT:

LOCATION: SEE BORING LOCATION PLAN

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED

G.S. ELEVATION (ft): N.S. DATE STARTED: 5/20/21
WATER TABLE (ft): >10 DATE FINISHED: 5/20/21
DATE OF READING: 5/20/2021 DRILLED BY: ORL - JB
EST. SHGWT (ft): 12 TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG. CONT. (%)
0						Loose light brown fine SAND [SP]						
		1-2-2	4			-- very loose						
		2-1-1	2									
5		1-1-1	2									
		1-1-1	2			-- loose						
		1-2-2	4									
		3-2-3	5									
10				▽								
						Dense grey orange brown silty fine SAND [SM]						
15		15-18-17	35									
						-- medium dense						
20		6-9-10	19				36	28				
25		8-12-13	25			BORING TERMINATED AT 25.0 FEET						
30												

W-11652.GPJ

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0130.2100195.0000
REPORT NO.:	1872368
PAGE:	B-2.7

PROJECT: PRELIMINARY GEOTECHNICAL EXPLORATION
- 43 ACRE RESIDENTIAL
ORANGE COUNTY, FLORIDA

CLIENT:

LOCATION: SEE BORING LOCATION PLAN

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED

BORING I.D.: **B-07** SHEET: **1 of 1**
SECTION: 18 TOWNSHIP: 21 RANGE: 28

G.S. ELEVATION (ft): N.S. DATE STARTED: 5/21/21
WATER TABLE (ft): >10 DATE FINISHED: 5/21/21
DATE OF READING: 5/21/2021 DRILLED BY: ORL - JB/JB/WR
EST. SHGWT (ft): 7.5 TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG. CONT. (%)
0						Loose brown fine SAND [SP]						
		4-3-3	6									
		2-3-3	6									
5		2-2-2	4			-- light brown						
		2-3-2	5	▽								
		4-6-4	10			Medium dense dark orange brown clayey fine SAND [SC]						
10		9-13-16	29				26	14				
						-- grey brown, with seams of orange						
15		9-11-9	20									
						Medium dense grey green silty fine SAND [SM]						
20		4-5-8	13									
						-- grey light brown orange						
25		6-9-5	14			BORING TERMINATED AT 25.0 FEET						
30												

W-11652.GPJ

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0130.2100195.0000
REPORT NO.:	1872368
PAGE:	B-2.8

PROJECT: PRELIMINARY GEOTECHNICAL EXPLORATION
[redacted] - 43 ACRE RESIDENTIAL
ORANGE COUNTY, FLORIDA

BORING I.D.: **B-08** SHEET: **1 of 1**
SECTION: 18 TOWNSHIP: 21 RANGE: 28

CLIENT:

LOCATION: SEE BORING LOCATION PLAN

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED

G.S. ELEVATION (ft): N.S. DATE STARTED: 5/24/21
WATER TABLE (ft): >10 DATE FINISHED: 5/24/21
DATE OF READING: 5/24/2021 DRILLED BY: ORL - JB/JB/WR
EST. SHGWT (ft): 8 TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG. CONT. (%)
0						Loose brown fine SAND [SP]						
		3-2-3	5									
		3-3-3	6			-- light brown						
5		4-3-3	6									
		3-2-2	4									
		2-3-3	6	▽								
		3-4-5	9			Loose grey orange brown clayey fine SAND [SC]						
10												
						-- medium dense, grey brown orange						
15		7-10-9	19				48	23				
						Medium dense grey brown silty fine SAND with seams of orange [SM]						
20		6-9-10	19									
		7-10-9	19									
25						BORING TERMINATED AT 25.0 FEET						
30												

W-11652.GPJ

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0130.2100195.0000
REPORT NO.:	1872368
PAGE:	B-2.9

PROJECT: PRELIMINARY GEOTECHNICAL EXPLORATION
- 43 ACRE RESIDENTIAL
ORANGE COUNTY, FLORIDA

BORING I.D.: **B-09** SHEET: **1 of 1**
SECTION: 18 TOWNSHIP: 21 RANGE: 28

CLIENT:

LOCATION: SEE BORING LOCATION PLAN

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED

G.S. ELEVATION (ft): N.S. DATE STARTED: 5/10/21
WATER TABLE (ft): >10 DATE FINISHED: 5/10/21
DATE OF READING: 5/20/2021 DRILLED BY: ORL - JB/JB/TA
EST. SHGWT (ft): 12 TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG. CONT. (%)
0						Very loose light brown fine SAND [SP]						
		2-1-2	3									
		1-1-1	2									
5		1-0-1	1									
		1-1-1	2			-- loose						
		1-2-2	4									
10		1-2-2	4				3	5				
				▽								
						Medium dense grey silty fine SAND [SM]						
15		5-8-11	19									
						-- grey orange brown						
20		9-11-12	23									
						-- dense						
25		11-16-17	33			BORING TERMINATED AT 25.0 FEET						
30												

W-11652.GPJ

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0130.2100195.0000
REPORT NO.:	1872368
PAGE:	B-2.10

PROJECT: PRELIMINARY GEOTECHNICAL EXPLORATION
- 43 ACRE RESIDENTIAL
ORANGE COUNTY, FLORIDA

CLIENT:

LOCATION: SEE BORING LOCATION PLAN

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED

BORING I.D.: **B-10** SHEET: **1 of 1**
SECTION: 18 TOWNSHIP: 21 RANGE: 28

G.S. ELEVATION (ft): N.S. DATE STARTED: 5/24/21
WATER TABLE (ft): 9.5 DATE FINISHED: 5/24/21
DATE OF READING: 5/24/2021 DRILLED BY: ORL - JB/JB/WR
EST. SHGWT (ft): 8 TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG. CONT. (%)
0						Loose brown fine SAND [SP]						
		2-3-4	7									
		3-3-3	6			-- very loose						
5		2-2-1	3			-- light brown						
		2-2-1	3									
		2-1-1	2	▽								
		2-1-1	2	▼		-- brown	5	23				
10						Dense grey light brown clayey fine SAND with seams of orange [SC]						
		12-23-23	46									
15												
						-- medium dnese, grey light brown						
20		6-6-7	13									
						Medium dense grey light brown silty fine SAND with seams of orange [SM]						
25		3-5-11	16			BORING TERMINATED AT 25.0 FEET						
30												

W-11652.GPJ

UNIVERSAL ENGINEERING SCIENCES

KEY TO BORING LOGS

SYMBOLS AND ABBREVIATIONS

SYMBOL	DESCRIPTION
N-Value	No. of Blows of a 140-lb. Weight Falling 30 Inches Required to Drive a Standard Spoon 1 Foot
WOR	Weight of Drill Rods
WOH	Weight of Drill Rods and Hammer
	Sample from Auger Cuttings
	Standard Penetration Test Sample
	Thin-wall Shelby Tube Sample (Undisturbed Sampler Used)
RQD	Rock Quality Designation
	Stabilized Groundwater Level
	Seasonal High Groundwater Level (also referred to as the W.S.W.T.)
NE	Not Encountered
GNE	Groundwater Not Encountered
BT	Boring Terminated
-200 (%)	Fines Content or % Passing No. 200 Sieve
MC (%)	Moisture Content
LL	Liquid Limit (Atterberg Limits Test)
PI	Plasticity Index (Atterberg Limits Test)
NP	Non-Plastic (Atterberg Limits Test)
K	Coefficient of Permeability
Org. Cont.	Organic Content
G.S. Elevation	Ground Surface Elevation

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS More than 50% retained on the No. 200 sieve*	GRAVELS 50% or more of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		GRAVELS WITH FINES	GM	Silty gravels and gravel-sand-silt mixtures
			GC	Clayey gravels and gravel-sand-clay mixtures
	SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS 5% or less passing No. 200 sieve	SW**	Well-graded sands and gravelly sands, little or no fines
			SP**	Poorly graded sands and gravelly sands, little or no fines
		SANDS with 12% or more passing No. 200 sieve	SM**	Silty sands, sand-silt mixtures
			SC**	Clayey sands, sand-clay mixtures
FINE-GRAINED SIOLS 50% or more passes the No. 200 sieve*	SILTS AND CLAYS Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diamicaceous fine sands or silts, elastic silts
			CH	Inorganic clays or clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
			PT	Peat, muck and other highly organic soils

*Based on the material passing the 3-inch (75 mm) sieve
** Use dual symbol (such as SP-SM and SP-SC) for soils with more than 5% but less than 12% passing the No. 200 sieve

RELATIVE DENSITY
(Sands and Gravels)
Very loose – Less than 4 Blow/Foot
Loose – 4 to 10 Blows/Foot
Medium Dense – 11 to 30 Blows/Foot
Dense – 31 to 50 Blows/Foot
Very Dense – More than 50 Blows/Foot

CONSISTENCY
(Silts and Clays)
Very Soft – Less than 2 Blows/Foot
Soft – 2 to 4 Blows/Foot
Firm – 5 to 8 Blows/Foot
Stiff – 9 to 15 Blows/Foot
Very Stiff – 16 to 30 Blows/Foot
Hard – More than 30 Blows/Foot

RELATIVE HARDNESS
(Limestone)
Soft – 100 Blows for more than 2 Inches
Hard – 100 Blows for less than 2 Inches

MODIFIERS

These modifiers Provide Our Estimate of the Amount of Minor Constituents (Silt or Clay Size Particles) in the Soil Sample
Trace – 5% or less
With Silt or With Clay – 6% to 11%
Silty or Clayey – 12% to 30%
Very Silty or Very Clayey – 31% to 50%

These Modifiers Provide Our Estimate of the Amount of Organic Components in the Soil Sample
Trace – Less than 3%
Few – 3% to 4%
Some – 5% to 8%
Many – Greater than 8%

These Modifiers Provide Our Estimate of the Amount of Other Components (Shell, Gravel, Etc.) in the Soil Sample
Trace – 5% or less
Few – 6% to 12%
Some – 13% to 30%
Many – 31% to 50%

APPENDIX C

UNIVERSAL
ENGINEERING SCIENCES

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/ or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GEOTECHNICAL BUSINESS COUNCIL
of the Geoprofessional Business Association

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@geoprofessional.org www.geoprofessional.org

CONSTRAINTS & RESTRICTIONS

The intent of this document is to bring to your attention the potential concerns and the basic limitations of a typical geotechnical report.

WARRANTY

Universal Engineering Sciences has prepared this report for our client for his exclusive use, in accordance with generally accepted soil and foundation engineering practices, and makes no other warranty either expressed or implied as to the professional advice provided in the report.

UNANTICIPATED SOIL CONDITIONS

The analysis and recommendations submitted in this report are based upon the data obtained from soil borings performed at the locations indicated on the Boring Location Plan. This report does not reflect any variations which may occur between these borings.

The nature and extent of variations between borings may not become known until excavation begins. If variations appear, we may have to re-evaluate our recommendations after performing on-site observations and noting the characteristics of any variations.

CHANGED CONDITIONS

We recommend that the specifications for the project require that the contractor immediately notify Universal Engineering Sciences, as well as the owner, when subsurface conditions are encountered that are different from those present in this report.

No claim by the contractor for any conditions differing from those anticipated in the plans, specifications, and those found in this report, should be allowed unless the contractor notifies the owner and Universal Engineering Sciences of such changed conditions. Further, we recommend that all foundation work and site improvements be observed by a representative of Universal Engineering Sciences to monitor field conditions and changes, to verify design assumptions and to evaluate and recommend any appropriate modifications to this report.

MISINTERPRETATION OF SOIL ENGINEERING REPORT

Universal Engineering Sciences is responsible for the conclusions and opinions contained within this report based upon the data relating only to the specific project and location discussed herein. If the conclusions or recommendations based upon the data presented are made by others, those conclusions or recommendations are not the responsibility of Universal Engineering Sciences.

CHANGED STRUCTURE OR LOCATION

This report was prepared in order to aid in the evaluation of this project and to assist the architect or engineer in the design of this project. If any changes in the design or location of the structure as outlined in this report are planned, or if any structures are included or added that are not discussed in the report, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions modified or approved by Universal Engineering Sciences.

USE OF REPORT BY BIDDERS

Bidders who are examining the report prior to submission of a bid are cautioned that this report was prepared as an aid to the designers of the project and it may affect actual construction operations.

Bidders are urged to make their own soil borings, test pits, test caissons or other investigations to determine those conditions that may affect construction operations. Universal Engineering Sciences cannot be responsible for any interpretations made from this report or the attached boring logs with regard to their adequacy in reflecting subsurface conditions which will affect construction operations.

STRATA CHANGES

Strata changes are indicated by a definite line on the boring logs which accompany this report. However, the actual change in the ground may be more gradual. Where changes occur between soil samples, the location of the change must necessarily be estimated using all available information and may not be shown at the exact depth.

OBSERVATIONS DURING DRILLING

Attempts are made to detect and/or identify occurrences during drilling and sampling, such as: water level, boulders, zones of lost circulation, relative ease or resistance to drilling progress, unusual sample recovery, variation of driving resistance, obstructions, etc.; however, lack of mention does not preclude their presence.

WATER LEVELS

Water level readings have been made in the drill holes during drilling and they indicate normally occurring conditions. Water levels may not have been stabilized at the last reading. This data has been reviewed and interpretations made in this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, tides, and other factors not evident at the time measurements were made and reported. Since the probability of such variations is anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based upon such assumptions of variations.

LOCATION OF BURIED OBJECTS

All users of this report are cautioned that there was no requirement for Universal Engineering Sciences to attempt to locate any man-made buried objects during the course of this exploration and that no attempt was made by Universal Engineering Sciences to locate any such buried objects. Universal Engineering Sciences cannot be responsible for any buried man-made objects which are subsequently encountered during construction that are not discussed within the text of this report.

TIME

This report reflects the soil conditions at the time of exploration. If the report is not used in a reasonable amount of time, significant changes to the site may occur and additional reviews may be required.

UNIVERSAL
ENGINEERING SCIENCES