UNIVERSAL ENGINEERING SCIENCES

SUBSURFACE EXPLORATION

Proposed Starbucks
Bayside Lakes SE
Palm Bay, Brevard County, Florida
Universal Project No. 0330.2300019.0000

March 28, 2023

PREPARED FOR:

Rock Ventures, LLC
145 Lincoln Avenue, Suite B
Winter Park, Florida 32789

PREPARED BY:

Universal Engineering Sciences, LLC
820 Brevard Avenue
Rockledge, Florida 32955
(321) 638-0808

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
- Daytona Beach
- Fort Myers
- Fort Pierce
- Gainesville
- Jacksonville
- Miami
- Ocala
- Orlando (Headquarters)
- Palm Coast
- Panama City
- Pensacola
- Rockledge
- Sarasota
- Tampa
- West Palm Beach
- Atlanta, GA
- Tifton, GA

March 28, 2023

Rock Ventures, LLC
145 Lincoln Avenue, Suite B
Winter Park, Florida 32789

Attention: Mr. Vino Kanhai

Reference: **Subsurface Exploration**
Proposed Starbucks
Bayside Lakes SE
Palm Bay, Brevard County, Florida
Universal Project No. 0330.2300019.0000

Dear Mr. Kanhai:

Universal Engineering Sciences, LLC (Universal) has completed a subsurface exploration at the above referenced site in Palm Bay, Brevard County, Florida. Our exploration was authorized by you, and was conducted as outlined in Universal's proposal No. 0330.0223.00021. This exploration was performed in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed 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 our estimates of the typical wet season high groundwater levels at the boring locations, and general engineering recommendations concerning site preparation procedures, foundation and pavement design parameters.

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.

Sincerely yours,
UNIVERSAL ENGINEERING SCIENCES, LLC.

BRAD FAUCETT LICENSE NO. 33123 STATE OF FLORIDA PROFESSIONAL ENGINEER

Brad Faucett
2023.03.28
13:39:16
-04'00'

Robert Smith, P.E.
Geotechnical Department Manager
Florida Professional Engineer No. 78130

Brad Faucett, M.S. P.E.
Regional Engineer
Florida Professional Engineer No. 33123

1 – Client – by email
UESDOCS - #2010129

TABLE OF CONTENTS

LIST OF TABLES

FIGURES

APPENDICES

EXHIBITS

1.0 INTRODUCTION

Universal Engineering Sciences, LLC (Universal) has completed a subsurface exploration for the proposed Starbucks in Palm Bay, Brevard County, Florida. Our exploration was authorized by Mr. Vino Kanhai of Rock Ventures, LLC (Client); and was conducted as outlined in Universal's proposal No. 0330.0223.00021. This exploration was performed in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

In addition to the current subsurface exploration, consideration of previous borings completed on the property (Universal project number: 0330.2200064.0000) were used for this report and relevant boring logs are included in Appendix B of this report. The approximate location of the relevant previous boreholes are shown on the attached Figure 1.

2.0 PROJECT DESCRIPTION

Universal understands from review of the information provided by the client that the proposed project will consist of a new Starbucks in Palm Bay, Florida. The facility will include a one-story building with associated parking/drive areas. It is assumed that storm water runoff will be captured by the retention pond system for the overall development.

We understand that the proposed construction will consist of a combination of reinforced concrete, masonry and steel framing. Based on similar projects it assumed that maximum loading conditions will be on the order of 20 to 30 kips per column, 3 to 4 kips per lineal foot for structural walls, and 100 pounds per square foot for on grade floor slabs.

We assume that the finished floor elevation of the proposed building will be roughly 1 to 2 feet above existing grades.

If any of the above information is incorrect or changes prior to construction, please contact Universal immediately so that we may revise the recommendations contained in this report, as necessary. In order to verify that our recommendations are properly interpreted and implemented, Universal should be allowed to review the final design and specifications prior to the start of construction.

3.0 PURPOSE

The purposes of this exploration were:

- to explore and evaluate the subsurface conditions at the site with special attention to potential problems that may hinder the proposed development,
- to provide our estimates of the typical wet season high groundwater levels at the boring locations,
- to provide geotechnical engineering recommendations for site preparation procedures, foundation and pavement design parameters.

820 Brevard Avenue, Rockledge, Florida 32955 (321) 638-0808 Fax (321) 638-0978
www.UniversalEngineering.com

4.0 SITE DESCRIPTION

The subject site is located within Section 20, Township 29 South, Range 37 East in Brevard County, Florida. More specifically, the site is located on the northwest side of Bayside Lakes SE in Palm Bay, Florida. At the time of drilling, the site consisted of forested land with medium to large trees and brush. Some hand clearing of paths was required to access the site with Universal's drilling equipment.

4.1 SOIL SURVEY

Two (2) primary soil types (pre-developmental) are mapped across the project site according to the Brevard County Soil Survey (BCSS) dated 1976 (updated using USDA-NCSS SSURGO and STATSGO Soil Survey). A brief description of these soils is provided below in Table I.

TABLE I
BCSS DESIGNATED SOIL TYPES

Soil Type (Map Symbol)	Brief Description
17 – EauGallie fine sand (Eg)	Nearly level, poorly drained soil on broad, low ridges in the flatwoods.
18 – EauGallie, Winder, and Rivera fine sand (Ew)	Soils in shallow ponds, sloughs and depressions in the flatwoods.

4.2 TOPOGRAPHY

According to information obtained from the United States Geologic Survey (USGS) Fellsmere NW, Florida quadrangle map; dated 2021; ground surface elevation (pre-developmental) across the site area is approximately +20 to +25 feet North American Vertical Datum (NAVD).

5.0 SCOPE OF SERVICES

The services conducted by Universal during our subsurface exploration program are as follows:

- Drill two (2) Standard Penetration Test (SPT) borings within the proposed building area to a depth of 20 and 25 feet below the existing land surface (bls).
- Secure samples of representative soils encountered in the soil borings for review, laboratory analysis and classification by a Geotechnical Engineer.
- Measure the existing site groundwater levels and provide an estimate of the typical wet season high groundwater levels.
- Conduct soil gradation and permeability tests on selected soil samples obtained in the field to determine their engineering properties.
- Assess the existing soil conditions with respect to the proposed construction.
- Prepared a report that documents the results of our subsurface exploration and analysis with geotechnical engineering recommendations.

6.0 LIMITATIONS

This report has been prepared in order to aid the client/engineer in the design of the proposed Starbucks at Bayside Lakes SE in Palm Bay, Florida. The scope is limited to the specific project and locations described herein. Our description of the project's design parameters represents our understanding of the significant aspects relevant to soil and foundation characteristics. In the event that any changes in the design or location of the structures as outlined in this report are planned, we should be informed so the changes can be reviewed and the conclusions of this report modified, if required, and approved in writing by Universal.

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 that 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. Due to variations that can occur on a site, especially a previously filled site, this report should not be used for estimating such items as cut and fill quantities.

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, Universal does not recommend relying on our boring information to negate presence of anomalous materials or 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 such anomalous conditions or estimate such quantities. Therefore, Universal 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 Universal to attempt to locate any manmade 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 Universal to locate or identify such concerns. Universal cannot be responsible for any buried manmade 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.

For a further description of the scope and limitations of this report, please review the document attached within Exhibit 1 "Important Information about Your Geotechnical Engineering Report" prepared by GBA/The Geoprofessional Business Association.

7.0 FIELD METHODOLOGIES

7.1 STANDARD PENETRATION TESTS

The two (2) recent SPT borings, designated SB1 and SB2 on the attached Figure No. 1, were performed in general accordance with the procedures of ASTM D 1586 (Standard Method for Penetration Test and Split-Barrel Sampling of Soils). The SPT drilling technique involves driving a standard split-barrel sampler into the soil by a 140 pound hammer, free falling 30 inches. The

820 Brevard Avenue, Rockledge, Florida 32955 (321) 638-0808 Fax (321) 638-0978
www.UniversalEngineering.com

number of blows required to drive the sampler 1 foot, after an initial seating of 6 inches, is designated the penetration resistance, or N-value, an index to soil strength and consistency.

The soil samples recovered from the split-barrel sampler were visually inspected and classified in general accordance with the guidelines of ASTM D 2487 (Standard Classification of Soils for Engineering Purposes [Unified Soil Classification System]).

The SPT soil borings were performed using a CME 45 ATV-mounted drilling rig using either rotary mud techniques or continuous flight augers to termination depth. The boring locations were located in the field using a handheld GPS receiver. Our boring locations should be considered only as accurate as implied by the methods of measurement used. The approximate boring locations are shown on the attached Figure No. 1, “Boring Location Plan”.

8.0 LABORATORY METHODOLOGIES

8.1 PARTICLE SIZE ANALYSIS

We completed #200 sieve particle size analyses on three (3) representative soil samples. These samples were tested according to the procedures listed ASTM D 1140 (Standard Test Method for Amount of Material in Soils Finer than the No. 200 Sieve). In part, ASTM D 1140 requires a thorough mixing the sample with water and flushing it through a No. 200 sieve until all of the particles smaller than the sieve size leave the sample.

The percentage of the material finer than the No. 200 sieve helps determines the textural nature of the soil sample and aids in evaluating its engineering characteristics. The percentage of materials passing the #200 sieve is shown on the attached boring log.

9.0 SOIL STRATIGRAPHY

9.1 GENERALIZED SOIL PROFILE

The results of our field exploration and laboratory analysis, together with pertinent information obtained from the recent SPT borings, such as soil profiles, penetration resistance and stabilized groundwater levels are shown on the boring logs included in Appendix A. The Key to Boring Logs, Soil Classification Chart is also included in Appendix A. The soil profiles were prepared from field logs after the recovered soil samples were examined by a Geotechnical Engineer.

820 Brevard Avenue, Rockledge, Florida 32955 (321) 638-0808 Fax (321) 638-0978
www.UniversalEngineering.com

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 the following Table II. For more detailed soil profiles, please refer to the attached boring logs.

TABLE II
GENERALIZED SOIL PROFILE

Depth Encountered (feet, bls)	Approximate Thickness (feet)	Soil Description
Surface	3 to 4	Fine sand [SP] or fine sand with silt [SP-SM], medium dense. However, it should be noted that previous borings completed within the Bayside Lakes development have encountered occasional fill materials within these depths.
3 to 4	8 to 9	Clayey fine sand [SC] and fine sand with clay [SP-SC], very loose to medium dense.
12	8+ to 13+	Fine sand with silt [SP-SM] and Clayey fine sand [SC] with varying amounts of shell, very loose to medium dense.

NOTE: [ ] denotes Unified Soil Classification system designation.
\+ indicates strata encountered at boring termination, total thickness undetermined.

10.0 GROUNDWATER CONDITIONS

10.1 Existing Groundwater Conditions

We measured the stabilized water levels in the current boreholes on March 22, 2023. The groundwater levels are shown on the attached boring logs. The groundwater level depth was noted to be at 5.4 feet bls at the boring locations. 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.

10.2 Typical Wet Season High Groundwater Levels

The typical wet season high groundwater level is defined as the highest groundwater level sustained for a period of 2 to 4 weeks during the "wet" season of the year, for existing site conditions, in a year with average normal rainfall amounts. Based on historical data, the rainy season in Brevard County, Florida is between June and October of the year. In order to estimate the wet season high water level at the boring locations, many factors are examined, including the following:

820 Brevard Avenue, Rockledge, Florida 32955 (321) 638-0808 Fax (321) 638-0978
www.UniversalEngineering.com

a. Measured groundwater level
b. Drainage characteristics of existing soil types
c. Season of the year (wet/dry season)
d. Current & historical rainfall data (recent and year-to-date)
e. Natural relief points (such as lakes, rivers, swamp areas, etc.)
f. Man-made drainage systems (ditches, canals, etc.)
g. Distances to relief points and man-made drainage systems
h. On-site types of vegetation
i. Area topography (ground surface elevations)

Groundwater level readings were taken on March 22, 2023. According to data from the Southeast Regional Climate Center and the National Weather Service, the total rainfall in the previous month of February for Central Brevard County was 2.0 inches, approximately 2.6 inches below the normal amount for the month of February. Rainfall for calendar year 2022 was 52.1 inches, about 1.4 inches above normal levels. Total precipitation in 2023 as of March 22 was approximately 3.2 inches, roughly 3.2 inches below the normal levels for this time period.

Based on this information and the factors listed above, we estimate that the typical wet season high groundwater levels at the boring locations will be approximately 2 feet above the existing measured level. Please note, however, that peak stage elevations immediately following various intense storm events, may be somewhat higher than the estimated typical wet season high levels.

Please note that due to the silt and clay contents of portions of the near surface soils at this site, we strongly suspect that there may be occasional isolated pockets of "perched" groundwater within the project area, particularly after periods of prolonged wet weather. Such temporary perched water table levels may be higher than the estimated wet season groundwater levels indicated above.

11.0 LABORATORY RESULTS

11.1 PARTICLE SIZE ANALYSIS

The soil samples submitted for analysis were classified as fine sand with clay [SP-SC] and fine sand with silt [SP-SM]. The percentage of soil sizes passing the #200 sieve size are shown on the boring logs at the approximate depth sampled.

12.0 PROPOSED BUILDING

12.1 ANALYSIS

The majority of the surficial soils within the footprint of the proposed Starbucks are classified as fine sand [SP] and fine sand with silt [SP-SM]. Additionally, areas of possible fill have been noted on the property and further evaluation of the fill for suitability will be required during earthwork operations. Any fill material found to be very loose/soft or containing organics or overlying organics should be removed and replaced as directed by representatives of Universal in the field during earthwork operations as outlined in this report.

The removal of existing debris, deleterious fill, organic topsoil, root mats, and surface vegetation, along with other construction activities, will tend to further loosen the surficial soils to various depths. Therefore, densification of at least the upper 1 foot of the existing subsoils will be necessary. This will help create a soil mat capable of dissipating the building loads over any remaining loose strata at depth. We believe this can be effectively accomplished by compacting the soils with a large static roller or medium sized vibratory rollers, then filling to grade in compacted lifts as recommended in section 12.3 (Site Preparation Procedures) of this report.

The following recommendations are made based upon a review of the attached soil test data, our understanding of the proposed construction, and experience with similar projects and subsurface conditions. If the structural loadings, building locations or grading plans change from those discussed previously, we request the opportunity to review and possibly amend our recommendations with respect to those changes.

12.2 RECOMMENDATIONS

Provided our suggested site preparation procedures are followed, we recommend designing conventional, shallow spread footings foundations for a maximum allowable soil-contact pressure of up to 3,000 pounds per square foot (psf). Even though computed soil-contact pressures may not warrant it, strip and square footings should have minimum widths of at least 18 and 24 inches, respectively to prevent "shear punch" deformations. The base of all footings should be at least 18 inches below finished grade elevation, with the exception of a thickened-edge slab foundation system for which a minimum depth of 14 inches is acceptable.

Assuming existing soils and added structural fill soils are prepared and footings are designed according to our recommendations, we estimate maximum total vertical settlements of the structure will be less than 1 inch and maximum differential settlements will be less than ½ inch. Almost all of the expected settlement will take place as soon as the soil fill and structural loads have been applied to the densified existing sandy soil (and overlying sandy soil fill).

We recommend using a sheet vapor barrier, such as Visqueen, beneath the building slab-on-grade to help control moisture migration through the slab. Floor slabs can be supported upon the compacted fill and should be structurally isolated from other foundations elements or adequately reinforced to prevent distress due to differential movements.

We recommend that the project floor slab be designed using an assumed modulus of subgrade reaction of k = 150 pounds per cubic inch (pci). However, in no case should the floor slabs have a thickness of less than 6 inches where heavy loads are anticipated. In lightly loaded pedestrian walk areas, we recommend a minimum thickness of at least 4 inches be maintained.

12.3 SITE PREPARATION PROCEDURES

Following is a list of our recommended site preparation procedures to prepare the site for the proposed construction.

1. Strip the footprint of the proposed building, plus a minimum margin of at least ten feet beyond foundation lines, of vegetation, roots, topsoils, fill soils, debris, rubble, muck, etc. Any collapsible or leak prone utilities should be completely removed from within the location of the proposed building.

820 Brevard Avenue, Rockledge, Florida 32955 (321) 638-0808 Fax (321) 638-0978
www.UniversalEngineering.com

It has been our experience that the subsoils adjacent to previously developed areas sometimes contain pockets of buried rubble, muck, debris or other deleterious materials. Therefore, we strongly recommend that the stripped surface be observed and probed by representatives of Universal. Any deleterious matter remaining should be removed and replaced with select fine sand [SP] backfill.

2. Densify the exposed surficial soils, including the ten feet margin, to at least 95 percent of the Modified Proctor test maximum dry density (ASTM D 1557, Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))) to a depth of at least 12 inches below the stripped surface.

3. If vibratory equipment is used to compact fill, then we recommend using vibratory rollers weighing less than 1 ton within 20 feet of existing structures, less than 2 tons within distances of 20 to 40 feet, less than 6 tons between 40 to 100 feet, and up to 10 tons beyond 100 feet. The use of heavier equipment may damage existing neighboring structures. Otherwise, static rollers weighing more than 5 tons should be used.

4. Proof-roll the exposed subsurface soils under the observation of Universal, to locate any unforeseen soft areas of unsuitable soils, and to increase the density of the shallow loose fine sand soils. Each pass should overlap the proceeding pass by roughly 30 percent to insure complete coverage. If deemed necessary by Universal, in areas that continue to "yield", remove any deleterious materials and replace with a clean, compacted sand backfill [SP].

5. Depending upon weather conditions, or other factors, the addition or removal (dewatering) of water may be necessary to aid compactive efforts. Please note that there are some areas where the near surface soils contain varying quantities of silt and/or clay [SP-SM, SP-SC, SC]. Such soils tend to readily hold moisture and therefore, depending upon the variations in moisture contents, may require more stringent compactive efforts than clean fine sands [SP]. Additional passes with compaction equipment or over excavation and replacement in compacted layers may be necessary if the minimum density requirements are not achieved by the recommended equipment.

6. Within all of the building areas, fill to floor slab/pavement grade as necessary with select structural fill, placed in maximum 10 inch loose lifts; we recommend using sandy soils with less than 10% passing the #200 sieve size [SP, SP-SM, or SP-SC]. Each lift of structural fill should be densified to at least 95 percent of the Modified Proctor test maximum dry density of the soil (ASTM D 1557) and tested for compaction and approved before the placement of subsequent lifts.

7. Footing and utility excavations and other construction activities frequently disturb compacted subsoils to various depths; therefore, compaction beneath all floor slabs and footings should be verified to a depth of 1 foot immediately prior to the placement of reinforcing steel and concrete, and should meet at least 95 percent of the Modified Proctor test maximum dry density of the soil (ASTM D 1557).

8. Field density tests should be performed by Universal at appropriate times during earthwork operations in order to verify that the compaction requirements have been satisfied. These tests should be performed after compaction in the existing soils, after placement of each lift

of structural fill, within all footing excavations, and beneath all concrete slab-on-grade locations. Compaction tests should be performed at a frequency of not less than three tests per each foot of compacted increment as specified herein. In addition, we recommend that every column footing be tested with at least one test per every 50 linear feet of wall footing.

13.0 PROPOSED PAVEMENTS

13.1 ANALYSIS – NEW PAVEMENT AREAS

For the new parking areas and drives on this project, we recommend using either a rigid concrete pavement or a flexible asphaltic pavement section. Flexible pavements combine the strength and durability of several layer components to produce an appropriate and cost-effective combination of locally available construction materials. Concrete pavement is a rigid pavement that transfers much lighter wheel loads to the subgrade soils than a flexible asphalt pavement; therefore, requiring less subgrade preparation than a comparable flexible pavement section.

Densification of the loose, surficial sands will be required in all parking and drive areas, in order to both help ensure an adequate subgrade capacity and to limit subsequent settlements due to traffic vibrations. Within the parking/drive areas, we recommend that the surficial soils be proof rolled with a heavy piece of equipment, such as a fully loaded tandem axle dump truck, under the observation of Universal personnel. Any areas that exhibit instability under rolling should be examined by Universal for possible removal and replacement with compacted clean fine sands [SP].

All pavement subgrade soils should be compacted to at least 95 percent of the Modified Proctor test maximum dry density (ASTM D 1557, Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 to-lbf/ft^3 (2,700 kN-m/m^3))) to a depth of at least 2 feet below bottom of base course levels, or the full depth of new fill and the top 12 inches of existing subgrade soils, whichever is greater.

All root laden soils, vegetation, muck, debris, foundations, existing pavements, and other deleterious materials, should be completely removed from the proposed pavement areas, including a 7 feet margin beyond the edges of the proposed parking lots & drives (where possible). Any collapsible or leak prone utility lines remaining within the new pavement areas should either be completely removed or grouted closed.

All pavement area fill should consist of select sand backfill placed in 12 inch lifts with each lift compacted to at least 95 percent of the Modified Proctor test maximum dry density (ASTM D 1557). We recommend using sandy soils with less than 10% passing the #200 sieve size [SP, SP-SM, or SP-SC].

Depending on weather conditions and other factors, the addition or removal (dewatering) of water may be necessary to aid compactive efforts. If vibratory equipment is used for compaction, then we recommend using vibratory rollers weighing less than 1 ton within 20 feet of existing structures, less than 2 tons between 20 and 40 feet, less than 6 tons between 40 to 100 feet, and up to 10 tons beyond 100 feet. <u>The use of heavier vibratory equipment may cause damage to existing nearby structures.</u>

Subsurface soils including the ten feet margin should be densified to at least 95 percent of the Modified Proctor test maximum dry density (ASTM D 1557, Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))) to at least 12 inches below the stripped surface.

13.2 Recommendations – New Pavement Areas

13.2.1 Asphaltic (Flexible) Pavements

Standard duty pavement areas are defined as having car and pickup truck loading conditions. Heavy duty areas are defined as having delivery, storage, and garbage truck loading conditions along with service drives.

Assuming a) the subgrade soils are compacted to 95 percent of Modified Proctor test maximum dry density (ASTM D 1557) with a design LBR value of 40 (after stabilization), b) a 20-year design life, c) terminal serviceability index (P_t) of 2, d) reliability of 90 percent, and e) total equivalent 18-kip single axle loads (E_{18}SAL) of 50,000, we recommend the minimum design shown in the following Table III, for a standard duty asphalt pavement.

TABLE III
MINIMUM STANDARD DUTY ASPHALT/LIMEROCK PAVEMENT

Pavement Layer	Thickness	Minimum Requirements
Asphalt Wearing Surface FDOT SP-12.5 or SP-9.5	1.5 Inch Minimum	Mix to be approved by Universal. The mix should be compacted to at least 90% of the maximum theoretical density.
Limerock, Cemented Coquina, or Recycled Concrete Base	6 Inch Minimum	98% Modified Proctor test maximum dry density, Limerock Bearing Ratio (LBR) of at least 100. (150 for recycled concrete)
Stabilized Subbase Course	8 Inch Minimum	98% Modified Proctor test maximum dry density, stabilized to a Limerock Bearing Ratio (LBR) of at least 40.

Assuming the above factors for standard duty pavements apply to heavy-duty pavements where heavy trucks such as fire trucks, delivery and refuse collection vehicles would traverse (i.e. loadings of up to 150,000 E_{18}SALs), we recommend using the design in the following Table IV for minimum heavy-duty pavement areas.

820 Brevard Avenue, Rockledge, Florida 32955 (321) 638-0808 Fax (321) 638-0978
www.UniversalEngineering.com

TABLE IV
MINIMUM HEAVY DUTY ASPHALT/LIMEROCK PAVEMENT

Pavement Layer	Thickness	Minimum Requirements
Asphalt Wearing Surface FDOT SP-12.5 or SP-9.5	2 Inch Minimum	Mix to be approved by Universal. The mix should be compacted to at least 90% of the maximum theoretical density.
Limerock, Cemented Coquina, or Recycled Concrete Base	8 Inch Minimum	98% Modified Proctor test maximum dry density, Limerock Bearing Ratio (LBR) of at least 100. (150 for recycled concrete)
Stabilized Subbase Course	12 Inch Minimum	98% Modified Proctor test maximum dry density, stabilized to a Limerock Bearing Ratio (LBR) of at least 40.

Please note that the asphaltic wearing surface for both heavy and light duty areas should have a “fine” gradation classification with a mix which is limited to a maximum of 20% reclaimed asphalt pavement (RAP).

We recommend designing asphaltic pavements with at least 18 inches of clearance between the bottom of the pavement base course and the estimated typical wet season groundwater level. A thorough testing and inspection program should be incorporated during the pavement construction.

Stabilized subgrade can be imported materials or a blend of on-site and imported materials. If a blend is proposed, we recommend that the contractor perform a mix design to find the optimum mix proportions. Compaction testing of the stabilized subgrade, and the subsequent limerock base course material should be performed to full depth at a minimum of at least four test locations. After placement and field compaction, the wearing surface should be cored to evaluate material thickness and to perform laboratory densities of the asphaltic surfacing.

In parking lots, for extended life expectancy of the surface course, we recommend applying a coal tar emulsion sealer at least six months after placement of the surface course. The seal coat will help patch cracks and voids, and protect the surface from damaging ultraviolet light and automobile liquid spillage. Please note that applying the seal coat prior to six months after placement may hinder the “curing” of the surface course, leading to its early deterioration.

We recommend that all materials used in pavement construction comply with the latest edition of the Florida Department of Transportation, Standard Specifications for Road and Bridge Construction. Universal should be allowed to review and comment on the final asphalt pavement design.

13.2.2 Concrete (Rigid) Pavements

Concrete pavement is a rigid pavement that transfers much lighter wheel loads to the subgrade soils than a flexible asphalt pavement. We recommend site preparation procedures as listed in the previous report sections and using select fill [SP, SP-SM, or SP-SC], densified to at least 95 percent of Modified Proctor test maximum dry density (ASTM D 1557) without additional stabilization, with the following stipulations.

820 Brevard Avenue, Rockledge, Florida 32955 (321) 638-0808 Fax (321) 638-0978
www.UniversalEngineering.com

1. Subgrade soils must be densified to at least 95 percent of Modified Proctor test maximum dry density (ASTM D 1557) for a depth of at least 2 feet, or the full depth of new fill, whichever is greater, prior to placement of concrete.

2. The surface of the subgrade soils must be smooth, and any disturbances or wheel rutting corrected prior to placement of concrete.

3. The subgrade soils must be moistened prior to placement of concrete.

4. Concrete pavement thickness should be uniform throughout, with exception to the thickened edges (curb or footing).

5. The bottom of the pavement should be separated from the estimated typical wet season groundwater level by at least 1 foot.

Based on slab thickness for standard duty concrete pavements are based on the subgrade soils densified to 95 percent of Modified Proctor test maximum dry density we recommend using the design shown in the following Table V for standard duty (loadings of up to 50,000 E_{18}SALs) concrete pavements.

TABLE V
MINIMUM STANDARD DUTY (UNREINFORCED) CONCRETE PAVEMENT

Minimum Pavement Thickness	Maximum Control Joint Spacing	Minimum Saw Cut Depth
6 Inches	12 Feet x 12 Feet	1-1/4 Inches

Our recommendations on slab thickness for heavy-duty concrete pavements (loadings of up to 150,000 E_{18}SALs) are based on the same factors as above. Our recommended minimum design for heavy-duty concrete pavement is shown in the following Table VII.

TABLE VII
MINIMUM HEAVY DUTY (UNREINFORCED) CONCRETE PAVEMENT

Minimum Pavement Thickness	Maximum Control Joint Spacing	Minimum Saw Cut Depth
7 Inches	14 Feet x 14 Feet	1-3/4 Inches

We recommend using concrete with a minimum 28-day compressive strength of at least 4000 pounds per square inch. Layout of the Saw cut control joints should form square panels, and the depth of Saw cut joints should be at least ¼ of the concrete slab thickness.

We recommend allowing Universal to review and comment on the final concrete pavement design, including section and joint details (type of joints, joint spacing, etc.), prior to the start of construction.

For further details on concrete pavement construction, please reference the "Guide to Jointing of Non-Reinforced Concrete Pavements" published by the Florida Concrete and Products Association, Inc., and "Building Quality Concrete Parking Areas", published by the Portland Cement Association.

Compaction testing of the subgrade soils should be performed to the full depths recommended herein at a minimum of at least four locations. Cylinder specimens to verify the compressive strength of the pavement concrete should be obtained for at least every 50 cubic yards, or at least one set for each day's placement, whichever is greater.

14.0 SEWER AND UTILITY LINES

14.1 GENERAL RECOMMENDATIONS

We assume that proposed sewer and other utility lines at the site may have invert elevations roughly 2 to 4 feet below existing grades. Based on the results of the soil borings and our general knowledge of the area, we believe there may be occasional soft/loose pockets or cemented rock layers at this invert level. <u>If encountered, such deleterious layers should be over excavated and replaced with approved backfill or open graded gravel.</u>

14.2 SITE PREPARATION PROCEDURES

The following is our recommended procedures to prepare the site soils for construction of the proposed utility lines.

1. If necessary, install a dewatering system capable of maintaining a groundwater level at least 2 feet below bottom of pipe level.

2. Excavate and install the proposed utility lines. Any deleterious soils or cemented rock layers encountered at pipe bedding level should be examined by representatives of Universal for possible removal and replacement with clean fine sands [SP] as previously discussed. All replacement soils should be compacted to at least 98 percent of the Modified Proctor test maximum dry density (ASTM D1557) with small vibratory plates or rollers.

3. Backfill to grade with sandy soils with less than 10% passing the #200 sieve size [SP, SP-SM, or SP-SC], placed in 12 inch loose lifts with each lift compacted, with vibratory rollers or plates weighing less than 4 tons, to at least 98 percent of the Modified Proctor test maximum dry density (ASTM D 1557).

Backfill above and around thrust blocks should consist of clean fine sands [SP] compacted at least 98 percent of Modified Proctor test maximum dry density (ASTM D1557). For a design criteria, we recommend using an allowable passive earth pressure coefficient of K_p=3.0.

15.0 DEWATERING

Based on the water level conditions encountered, control of the groundwater may be required to achieve the necessary excavation, construction, backfilling and compaction requirements presented in the preceding sections. If dewatering becomes necessary and regardless of the method(s) used, we suggest drawing down the water level at least 2 feet below the bottom of the excavations to preclude "pumping" and/or compaction-related problems with the foundation

820 Brevard Avenue, Rockledge, Florida 32955 (321) 638-0808 Fax (321) 638-0978
www.UniversalEngineering.com

and/or subgrade soils. The actual method(s) of dewatering should be determined by the contractor.

Dewatering should be accomplished with the knowledge that the permeability of soils decreases with increasing silt [M] and/or clay [C] content. Therefore, a clayey fine sand [SC] is less permeable than a fine sand [SP]. The fine sand, fine sand with clay and clayey fine sand [SP, SP-SC and SC] soil types can usually be dewatered by well pointing.

It should be noted that the typical wet season groundwater levels previously listed may be temporarily exceeded during any given year in the future. Should impediments to surface water drainage exist on the site, or should rainfall intensity and duration, or total rainfall quantities exceed the normally anticipated rainfall quantities, groundwater levels may exceed our seasonal high estimates. We recommend positive drainage be established and maintained on the site during construction. We further recommend permanent measures be constructed to maintain positive drainage from the site throughout the life of the project. We recommend that the contract documents provide for determining the depth to the groundwater table just prior to construction, and for any required remedial dewatering.

16.0 EXCAVATIONS

Excavations should be sloped as necessary to prevent slope failure and to allow backfilling. As a minimum, temporary excavations below 4-foot depth should be sloped in accordance with OSHA regulations (29 CFR Par 1926) dated October 31, 1989. Where lateral confinement will not permit slopes to be laid back, the excavation should be shored in accordance with OSHA requirements. During excavation, excavated material should not be stockpiled at the top of the slope within a horizontal distance equal to the excavation depth. Provisions for maintaining worker safety within excavations is the sole responsibility of the contractor.

17.0 SPECIAL CONSIDERATIONS

Vibrations produced during vibratory compaction operations at the site may be significantly noticeable within 100 feet and may cause settlement distress of adjacent structures if not properly regulated. Therefore, provisions should be made to monitor these vibrations by Universal so that any necessary modifications in the compaction operations can be made in the field before potential damages occur. In addition, the conditions of the existing adjacent structures should be ascertained and documented prior to vibratory operations. Slight cosmetic damage (e.g. hairline cracks in stucco, plaster, or masonry) may occur in conjunction with compaction operations.

Please note that occasional cemented (coquina) rock layers were encountered below a depth of roughly 3 feet bls within some areas of the project, perhaps forming dense boulders and/or ledges. More extensive rock layers may exist between boring locations and within unexplored areas of the site. Where cementation is the greatest, these layers may hinder excavation with typical backhoes or similar equipment.

If these rock strata are excavated within borrow areas, clumps/boulders greater than 3 inches in diameter should be either removed or broken up, prior to inclusion within structural fills at the site.

820 Brevard Avenue, Rockledge, Florida 32955 (321) 638-0808 Fax (321) 638-0978
www.UniversalEngineering.com

18.0 CLOSURE

The soil and groundwater conditions encountered during our subsurface exploration of the property and the results of the laboratory analysis identified no geotechnical issues that will significantly hinder development of the proposed project, as we currently understand it, using conventional construction practices. Standard methods of surficial stripping, excavation, proof rolling, compaction and backfilling should adequately prepare the site.

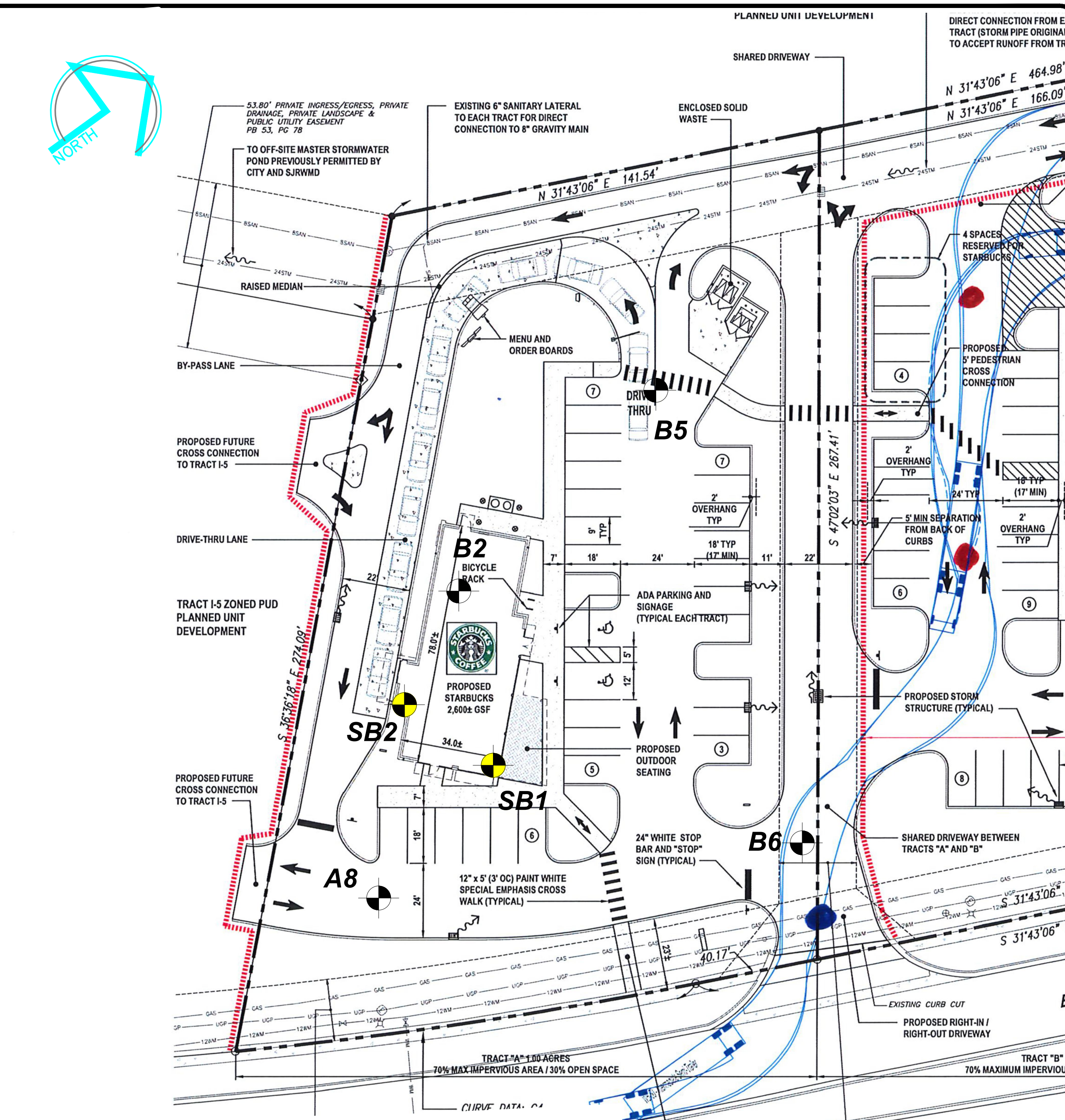
The geotechnical engineering design does not end with the advertisement of the construction documents. The design is an on-going process throughout construction. Because of our familiarity with the site conditions and the intent of the engineering design, we are most qualified to address site problems or construction changes, which may arise during construction, in a timely and cost-effective manner.

We recommend the owner retain the Universal Rockledge office to provide inspection services during the site preparation procedures for confirmation of the adequacy of the earthwork operations. Field tests and observations include verification of foundation subgrades by monitoring proof-rolling operations and performing quality assurance tests of the placement of compacted structural fill and pavement courses.

* * * * * * *

820 Brevard Avenue, Rockledge, Florida 32955 (321) 638-0808 Fax (321) 638-0978
www.UniversalEngineering.com

FIGURES



LEGEND:

- *STANDARD PENETRATION TEST BORING*
- *PREVIOUS TEST BORING*

UNIVERSAL ENGINEERING SCIENCES

PRPOSED STARBUCKS
BAYSIDE LAKES BOULEVARD SE
PALM BAY, BREVARD COUNTY, FLORIDA

BORING LOCATION PLAN

DRAWN BY: RS	DATE: MARCH 27, 2023	CHECKED BY: BF	DATE: MARCH 27, 2023
SCALE: 1" = 50'	PROJECT NO: 0330.2300019.0000		PAGE NO: FIGURE 1

APPENDIX A

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.: 0330.2300019.0000
REPORT NO.:
APPENDIX: A

PROJECT: BAYSIDE LAKES STARBUCKS
BAYSIDE LAKES NE
PALMBAY, FLORIDA

BORING DESIGNATION: **SB1** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

CLIENT:
LOCATION: SEE BORING LOCATION PLAN
REMARKS:

G.S. ELEVATION (ft):
WATER TABLE (ft): 5.4
DATE OF READING: 3/22/2023
EST. W.S.W.T. (ft):

DATE STARTED: 3/21/23
DATE FINISHED: 3/21/23
DRILLED BY: PM, PG
TYPE OF SAMPLING:

DEPTH (FT.)	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./ DAY)	ORG. CONT. (%)
0				**fine SAND with silt**, brown, [SP-SM]	12.1	9.6				
	4-8-9	17								
	8-8-6	14		**clayey fine SAND**, brown, [SC]						
	3-5-5	10								
5			▼	**fine SAND with clay**, gray, [SP-SC]						
	4-3-3	6								
	2-2-2	4			11.1	12.5				
	1-1-1	2		**clayey fine SAND**, grey, [SC]						
10										
				fine SAND with silt and broken shell, gray, [SP-SM]						
	3-4-5	9								
15										
				clayey fine SAND with broken shell, grey, [SC]						
	1-P-1	1								
20										
				fine SAND with silt and broken shell, gray, [SP-SM]						
	9-9-6	15								
25				BORING TERMINATED AT 25' P - DENOTES PENETRATION WITH ONLY WEIGHT OF DRIVE HAMMER						
30										

BL3

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.: 0330.2300019.0000
REPORT NO.:
APPENDIX: A

PROJECT: BAYSIDE LAKES STARBUCKS
BAYSIDE LAKES NE
PALMBAY, FLORIDA

BORING DESIGNATION: **SB2** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

CLIENT:
G.S. ELEVATION (ft):
DATE STARTED: 3/21/23
LOCATION: SEE BORING LOCATION PLAN
WATER TABLE (ft): 5.4
DATE FINISHED: 3/21/23
REMARKS:
DATE OF READING: 3/22/2023
DRILLED BY: PM, PG
EST. W.S.W.T. (ft):
TYPE OF SAMPLING:

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						**fine SAND**, brown, [SP]						
		4-6-6	12									
		6-8-8	16									
		4-5-6	11			**clayey fine SAND**, brown, [SC]						
5				▼								
		4-3-4	7			**fine SAND with clay**, gray, [SP-SC]	9.4	17.6				
		2-1-1	2									
		1-P-1	1			**clayey fine SAND**, grey, [SC]						
10												
						fine SAND with silt and broken shell, gray, [SP-SM]						
		5-3-8	11									
15												
						clayey fine SAND, trace of broken shell, grey, [SC]						
		1-1-1	2									
20						BORING TERMINATED AT 20' P - DENOTES PENETRATION WITH ONLY WEIGHT OF DRIVE HAMMER						
25												
30												

BL3

APPENDIX B

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.: 0330.2200064.0000
REPORT NO.:
APPENDIX: A

PROJECT: BAYSIDE LAKES PRELIMINARY
BAYSIDE LAKES BOULEVARD SE
PALM BAY, FLORIDA

BORING DESIGNATION: **B2**
SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

CLIENT:
LOCATION: SEE BORING LOCATION PLAN
REMARKS:

G.S. ELEVATION (ft):
WATER TABLE (ft): 5.4
DATE OF READING: 5/9/2022
EST. W.S.W.T. (ft):

DATE STARTED: 5/6/22
DATE FINISHED: 5/6/22
DRILLED BY: JL, PG
TYPE OF SAMPLING:

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	PI	K (FT./ DAY)	ORG. CONT. (%)
0						**fine SAND**, brown, [SP]						
		7-5-5	10									
		6-8-6	14									
		4-6-6	12			**fine SAND with clay**, gray, [SP-SC]						
5				▼								
		6-5-5	10				10.4	18.4				
		3-4-4	8									
						clayey fine SAND, grey, [SC]						
		2-2-2	4									
10												
						fine SAND with silt and broken shell, gray, [SP-SM]						
		7-7-9	16									
15						BORING TERMINATED AT 15'						
20												

BL3

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0330.2200064.0000
REPORT NO.:	
APPENDIX:	A

PROJECT: BAYSIDE LAKES PRELIMINARY
BAYSIDE LAKES BOULEVARD SE
PALM BAY, FLORIDA

BORING DESIGNATION: **B5** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

CLIENT:
LOCATION: SEE BORING LOCATION PLAN
REMARKS:

G.S. ELEVATION (ft):
WATER TABLE (ft): N/E
DATE OF READING: 5/9/2022
EST. W.S.W.T. (ft):

DATE STARTED: 5/5/22
DATE FINISHED: 5/5/22
DRILLED BY: JL, PG
TYPE OF SAMPLING:

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						**fine SAND with silt**, brown, [SP-SM] (Possible Fill)						
		5-7-10	17									
		7-7-5	12									
						fine SAND with clay, gray, [SP-SC]						
		6-5-7	12									
5												
		6-8-5	13									
						BORING TERMINATED AT 7' N/E DENOTES GROUNDWATER TABLE NOT ENCOUNTERED						
10												
15												
20												

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0330.2200064.0000
REPORT NO.:	
APPENDIX:	A

PROJECT: BAYSIDE LAKES PRELIMINARY
BAYSIDE LAKES BOULEVARD SE
PALM BAY, FLORIDA

BORING DESIGNATION: **B6** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

CLIENT:
LOCATION: SEE BORING LOCATION PLAN
REMARKS:

G.S. ELEVATION (ft):
WATER TABLE (ft): N/E
DATE OF READING: 5/9/2022
EST. W.S.W.T. (ft):

DATE STARTED: 5/6/22
DATE FINISHED: 5/6/22
DRILLED BY: JL, PG
TYPE OF SAMPLING:

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						**fine SAND**, brown, [SP]						
		7-7-7	14									
		8-6-5	11									
						clayey fine SAND, trace of broken shell and occasional cemented rock layers, brown, [SC]						
		4-4-3	7									
5												
		3-3-3	6									
						clayey fine SAND with broken shell, grey, [SC]						
						BORING TERMINATED AT 7' N/E DENOTES GROUNDWATER TABLE NOT ENCOUNTERED						
10												
15												
20												

BL3

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0330.22000120.0000
REPORT NO.:	
APPENDIX:	A

PROJECT: BAYSIDE LAKES BOULEVARD
PALM BAY, FLORIDA

BORING DESIGNATION: **A8**   SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

CLIENT: SEE BORING LOCATION PLAN
LOCATION:
REMARKS:

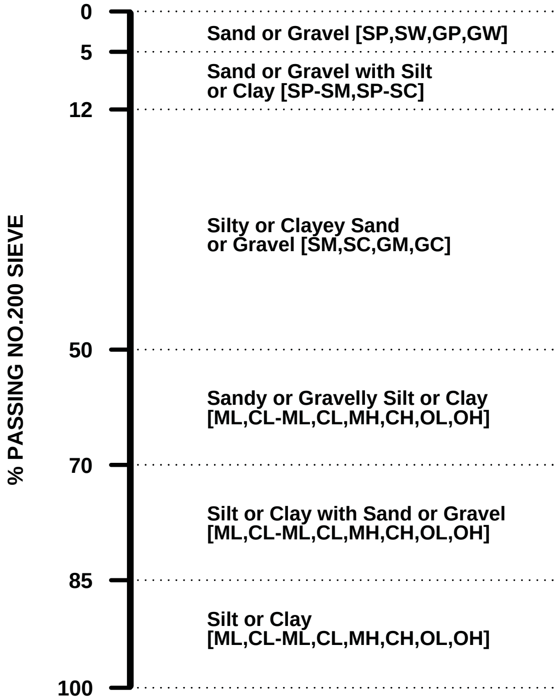
G.S. ELEVATION (ft):
WATER TABLE (ft): 5.9
DATE OF READING: 8/5/2022
EST. W.S.W.T. (ft):

DATE STARTED: 8/4/22
DATE FINISHED: 8/4/22
DRILLED BY: PM, PG
TYPE OF SAMPLING:

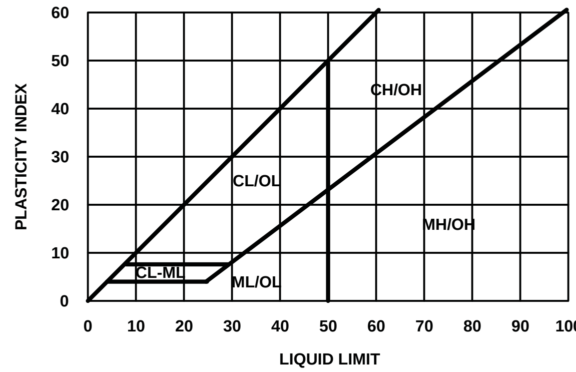
DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS		K (FT./ DAY)	ORG. CONT. (%)
									LL	PI		
0						**fine SAND**, brown, [SP]						
		4-9-9	18									
		11-11-9	20									
		9-7-5	12			**clayey fine SAND**, grey, [SC]						
5												
		4-5-7	12	▼								
		7-7-7	14			**clayey fine SAND with broken shell and occasional cemented rock layers**, grey, [SC]						
		7-7-8	15									
10						BORING TERMINATED AT 10'						
15												
20												

KEY TO BORING LOGS

SOIL CLASSIFICATION CHART*



UNIVERSAL ENGINEERING SCIENCES, INC.



PLASTICITY CHART

GROUP NAME AND SYMBOL

COARSE GRAINED SOILS

WELL-GRADED SANDS [SW]

POORLY-GRADED SANDS [SP]

POORLY-GRADED SANDS WITH SILT [SP-SM]

POORLY-GRADED SANDS WITH CLAY [SP-SC]

SILTY SANDS [SM]

CLAYEY SANDS [SC]

SILTY CLAYEY SANDS [SC-SM]

WELL-GRADED GRAVELS [GW]

POORLY-GRADED GRAVELS [GP]

POORLY-GRADED GRAVELS WITH SILT [GP-GM]

POORLY-GRADED GRAVELS WITH CLAY [GP-GC]

SILTY GRAVELS [GM]

CLAYEY GRAVELS [GC]

FINE GRAINED SOILS

INORGANIC SILTS SLIGHT PLASTICITY [ML]

INORGANIC SILTY CLAY LOW PLASTICITY [CL-ML]

INORGANIC CLAYS LOW TO MEDIUM PLASTICITY [CL]

INORGANIC SILTS HIGH PLASTICITY [MH]

INORGANIC CLAYS HIGH PLASTICITY [CH]

HIGHLY ORGANIC SOILS

ORGANIC SILTS/CLAYS LOW PLASTICITY [OL]**

ORGANIC SILTS/CLAYS MEDIUM TO HIGH PLASTICITY [OH]**

PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS [PT]**

IN ACCORDANCE WITH ASTM D 2487 - UNIFIED SOIL

* CLASSIFICATION SYSTEM.

** LOCALLY MAY BE KNOWN AS MUCK.

RELATIVE DENSITY

(SAND AND GRAVEL)

VERY LOOSE - 0 to 4 Blows/ft.
LOOSE - 5 to 10 Blows/ft.
MEDIUM DENSE - 11 to 30 Blows/ft.
DENSE - 31 to 50 Blows/ft.
VERY DENSE - more than 50 Blows/ft.

CONSISTENCY

(SILT AND CLAY)

VERY SOFT - 0 to 2 Blows/ft.
SOFT - 3 to 4 Blows/ft.
FIRM - 5 to 8 Blows/ft.
STIFF - 9 to 16 Blows/ft.
VERY STIFF - 17 to 30 Blows/ft.
HARD - more than 30 Blows/ft.

NOTES:
8* - DENOTES DYNAMIC CONE PENETROMETER (DCP) VALUE
R - DENOTES REFUSAL TO PENETRATION
P - DENOTES PENETRATION WITH ONLY WEIGHT OF DRIVE HAMMER
N/E - DENOTES GROUNDWATER TABLE NOT ENCOUNTERED

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

EXHIBIT 1

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.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in 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.

Geotechnical-Engineering 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 given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives 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 this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- 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. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include 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.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering 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 subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL
BUSINESS
ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org