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October 8, 2021

Circle K Florida
3802 Corporex Park Drive, Suite 200
Tampa, Florida 33619

Attention: Mr. Chris Roick
croick@circlek.com

Reference: **Geotechnical Exploration**
Circle K Store – Lake City
US Highway 90 & I-75
Lake City, Columbia County, Florida
UES Project No. 0730.2100190.0000
UES Docs Report No. 1905351

Dear Mr. Roick:

Universal Engineering Sciences (UES) has completed a geotechnical exploration at the above referenced site in Columbia County, Florida. The scope of our exploration was planned in conjunction with Schaffer Construction and authorized by you. This exploration was performed in general accordance with UES Proposal No. 1880491 dated June 29, 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 our estimates of the seasonal high groundwater level at the boring locations and geotechnical recommendations for foundation design, pavement design, and site preparation. *The site was found to be generally suitable for the proposed development construction following typical site preparation procedures presented in this report.*

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
Certificate of Authorization No. 549

VERONICA DE FREITAS LICENSE No. 84939 STATE OF FLORIDA PROFESSIONAL ENGINEER
10/8/2021

Veronica De Freitas, P.E.
Department Manager
Florida P.R. Registration No. 84939

Mark Hardy, P.E.
Regional Manager

UNIVERSAL ENGINEERING SCIENCES

GEOTECHNICAL EXPLORATION

CIRCLE K STORE – LAKE CITY
US HIGHWAY 90 & I-75
LAKE CITY, COLUMBIA COUNTY, FLORIDA

UES PROJECT NO. 0730.2100190.0000
UES DOCS REPORT NO. 1905351

PREPARED FOR:

Circle K Florida
3802 Corporex Park Drive, Suite 200
Tampa, Florida 33619

PREPARED BY:

Universal Engineering Sciences
9802 Palm River Road
Tampa, Florida 33619
(813)-470-5606

October 8, 2021

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APPENDICES

1.0 PROJECT DESCRIPTION

UES understands that the proposed project will include the construction of a new fueling station addition to an existing Circle K gas station and convenience store in Lake City, Florida. The new fueling station will be located north of the existing Circle K gas station, and will include a gas pump canopy, underground storage tanks (UST), and paved driveways. A boring location plan was prepared by UES and approved by Circle K's project manager prior to initiating this geotechnical exploration program.

Structural loading information was provided in Circle K's Geotechnical Investigation Work Scope document dated Revised February 24, 2020. We understand that structural loads will be carried by exterior load bearing walls having a maximum loading of 3.5 kips per linear foot (klf) and isolated interior columns with maximum loads of 60 kips. Floor loads are anticipated to be 175 psf.

No grading information was available at the time of this report. The geotechnical exploration and corresponding boring termination depths were based on the assumption that final site grades and finish floor elevations will be within ±2 feet of current grades. If grading information becomes available, please contact us so that we may revise the report accordingly.

Should any of the above information or assumptions made by UES be inconsistent with the planned development and construction, we request that you contact us immediately to allow us the opportunity to review the new information in conjunction with our report and revise or modify our engineering recommendations accordingly, as needed.

No site or project facilities/improvements, other than those described herein, should be designed using the soil information presented in this report. Moreover, UES will not be responsible for the performance of any site improvement so designed and constructed.

2.0 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 impact the proposed development,
- to provide our estimates of the seasonal high groundwater level at the boring locations and
- to provide geotechnical engineering recommendations for foundation design, pavement design, and site preparation.

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. We would be glad to provide you with a proposal for these services at your request.

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 35, Township 3 South, Range 16 East in Columbia County, Florida. More specifically, the site is located on the northwest of the intersection of US Highway 90 and I-75 as shown on the attached Figure B-1. At the time of drilling, the site consists of a vacant grassed field, north of an existing Circle K gas station.

3.1 SOIL SURVEY

There are one (1) native soil type mapped within the site area according to the USDA NRCS Soil Survey of Columbia County. A brief summary of the mapped surficial (native) 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)
8	Blanton fine sand, 0 to 5 percent slopes	A	Moderately well drained	3½ to 6

3.2 TOPOGRAPHY

According to information obtained from the United States Geologic Survey (USGS) "Lake City, Florida" quadrangle map, the native ground surface elevation across the site area is approximately +140 to +145 feet National Geodetic Vertical Datum (NGVD). 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 geotechnical exploration were as follows:

- Drilled four (4) Standard Penetration Test (SPT) borings within the proposed fueling station, UST pit area, canopy to depths of 10 to 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.
- Assessed the existing soil conditions with respect to the proposed construction.

- Prepared a report which documents the results of our exploration and analysis with geotechnical engineering recommendations.

5.0 FIELD EXPLORATION

The SPT soil borings were performed with a track mounted drilling rig. Horizontal and vertical survey control was not provided for the test locations prior to our field exploration program. 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. The indicated test locations should be considered accurate to the degree of the methodologies used. The approximate boring locations are shown in Appendix B.

The SPT borings, designated B-1 through B-4 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 to 10 feet to detect variations in the near surface soil profile and on approximate 5 feet centers thereafter.

6.0 SUBSURFACE 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 II. For detailed soil profiles, please refer to the attached boring logs.

TABLE II
GENERALIZED SOIL PROFILE

Typical Depth (feet, bls)		Soil Description	Range of SPT "N" Values (blows/ft)
From	To		
Surface	2	Loose to medium dense fine SAND [SP] to fine SAND with clay [SP-SP]	7 to 15
2	25*	Very loose to dense clayey SAND [SC] to firm CLAY with varying amounts of sand [CL]	3 to 40

* denotes maximum termination depth of the borings

7.0 GROUNDWATER CONDITIONS

7.1 EXISTING GROUNDWATER LEVEL

We measured the water levels in the boreholes on September 30, 2021 during drilling operations. The encountered groundwater levels at the boring locations ranged from approximately 3 to 3 ½ feet bls. The encountered water levels at the boring locations are shown on the individual boring logs in Appendix B. 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.

7.2 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.)
- Redoximorphic features (mottling, stripping, etc.)

Please note that the presence of hydraulically restrictive clayey sands (SC) encountered at depths on the order of 2 to 6 feet throughout the site may form a transient perched groundwater condition, especially after periods of heavy rainfall and/or irrigation. Perched groundwater levels can generally be expected to occur about 6 inches to 2 feet above the top of hydraulically restrictive soils, where present, if the groundwater table is unable to drain and/or percolate into a more pervious layer. It should be noted that undercutting of the hydraulically restrictive materials will impact the depth of the perched water table. The potential for groundwater to perch will be directly related to rainfall and irrigation amounts, as well as site grading. The potential for transient perched groundwater levels should be considered during the design of the site grades and during construction.

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 occur roughly 2 to 2 ½ feet bls or 6 inches above hydraulically restrictive clayey sand (SC), whichever comes first. The estimated seasonal high groundwater table at each boring location is shown on the attached boring 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 <u>not</u> 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.

8.0 SEISMIC SITE CLASSIFICATION

The project site is located within a municipality that employs the Florida Building Code (FBC) which has jurisdiction in the State of Florida. Since seismic design is not part of the FBC, we consulted the 2015 International Building Code® (IBC). As part of this Code, the design of structures must consider dynamic forces resulting from seismic events. These forces are dependent upon the magnitude of the earthquake event, as well as the properties of the soils that underlie the site. As part of the procedure to evaluate seismic forces, the Code requires the evaluation of the Seismic Site Class, which categorizes the site based upon the characteristics of the subsurface profile within the upper 100 feet of the ground surface.

To define the Site Class for this project, we first interpreted the results of SPT soil borings drilled within the project site and estimated appropriate soil properties below the base of the borings to a depth of 100 feet, as permitted by Section 1615.1.1 of the Code. The estimated soil properties were based upon our experience with subsurface conditions in the general site area.

Based upon the SPT N-values recorded during the field exploration and our experience in the vicinity of the subject site, the subsurface conditions within the site are consistent with the characteristics of a ***Site Class "D"*** as defined in Chapter 20 of ASCE 7.

9.0 FOUNDATION DESIGN RECOMMENDATIONS

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. The applicability of geotechnical recommendations is very dependent upon project characteristics such as improvement locations, and grade alterations. UES must review the final site and grading plans to validate all recommendations rendered herein.

Additionally, if subsurface conditions are encountered during construction, which were not encountered in the borings, report those conditions immediately to us for observation and recommendations.

9.1 STRUCTURAL AND GRADING INFORMATION

It is our understanding that the project will include the construction of a new fueling station addition to an existing Circle K gas station and convenience store in Lake City, Florida. We understand from Circle K's Geotechnical Investigation Work Scope document, the maximum loads will not exceed 60 kips for individual columns and 3.5 kips/ft for structural walls. Floor loads will not exceed 175 psf. We assume that the finished floor elevation of the new construction will be near existing grades.

Prior to finalizing any design, the structural/grading information outlined above should be confirmed by the project structural/civil engineer. This is crucial to our evaluation and estimates of settlements. If any of this information is incorrect or if you anticipate any changes, please inform UES immediately so that we may review and modify our recommendations as appropriate.

9.2 Analysis

Based on the results of the soil borings, the near surface soils within the proposed construction area appear to be mostly loose to medium dense sands [SP, SP-SM] to a depth of 2 to 6 feet, followed by very loose to dense clayey sands [SC] and firm clays [CL] extending to 25 feet. It is our opinion that proposed fueling station addition can be supported on properly designed and constructed shallow foundation systems. Provided that the site preparation recommendations outlined in this report are followed, the parameters outlined below may be used for foundation design.

9.3 Bearing Pressure

Provided our suggested site preparation procedures are followed, we recommend designing shallow footing foundations for a **maximum allowable net soil bearing pressure of 2,500 pounds per square foot (psf)**. The allowable net bearing pressure is that pressure that may be transmitted to the soil in excess of the minimum surrounding overburden pressure. The allowable bearing pressure should include dead load plus sustained live load. The foundations should be designed for the most unfavorable effects due to the combinations of loads specified in the FLBC.

9.4 Foundation Size

The minimum width recommended for an isolated column footing is 24 inches. For continuous wall or slab on grade foundations, the minimum footing width should comply with the current FLBC, but under no circumstances should be less than 12 inches. Even though the maximum allowable soil bearing pressure may not be achieved, these width recommendations should control the size of the foundations.

9.5 Bearing Depth

The base of all footings should be at least 12 inches below finished grade elevation in accordance with the FLBC. We recommend stormwater and surface water be diverted away from the proposed fueling station footprint area, both during and after construction, to reduce the possibility of erosion beneath the exterior footings.

9.6 Bearing Material

The bearing level soils should exhibit a density of 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** as described in this report. In addition to compaction, the bearing soils must exhibit stability and be free of "pumping" conditions.

9.7 Settlement Estimates

Post-construction settlement of the structures will be influenced by several interrelated factors, such as (1) subsurface stratification and strength/compressibility characteristics of the bearing soils to a depth of approximately twice the width of the footing; (2) footing size, bearing level, applied loads, and resulting bearing pressures beneath the foundation; (3) site preparation and earthwork construction techniques used by the contractor, and (4) external factors, including but not limited to vibration from off site sources and groundwater fluctuations beyond those normally anticipated for the naturally-occurring site and soil conditions which are present.

Our settlement estimates for the structures are based upon adherence to our recommended site preparation procedures presented in this report. Any deviation from these recommendations could result in an increase in the estimated post-construction settlement of the structures. Furthermore, should structural loads change from those assumed by us, greater settlements may be expected.

Due to the sandy nature of the surficial soils following the compaction operations, we expect the majority of settlement to be elastic in nature and occur relatively quickly, on application of the loads, during and immediately following construction. Using the recommended maximum allowable bearing pressure, the assumed maximum structural loads, and the field and laboratory test data which we have correlated into the strength and compressibility characteristics of the subsurface soils, **we estimate the total vertical settlement of the proposed structure to be on the order of 1 inch or less.**

Differential settlement results from differences in applied bearing pressures and the variations in the compressibility characteristics of the subsurface soils. Assuming our site preparation recommendations are followed, **we anticipate differential settlement of less than ½ inch.**

9.8 Floor Slabs

If required for new structures, a conventional floor slabs may be supported upon the compacted fill and should be structurally isolated from other foundation elements or adequately reinforced to prevent distress due to differential movements. For the slab design, we recommend using a subgrade modulus (k) of 100 pounds per cubic inch, which can be achieved by compacting the subgrade soils as recommended in this report. We recommend using a sheet vapor barrier (in accordance with Florida Building Code requirements) beneath the slab-on-grade to help control moisture migration through the slab.

10.0 PAVEMENT RECOMMENDATIONS

10.1 General

We understand that a combination of flexible asphaltic and rigid concrete pavement sections will be used on this project. We understand from Circle K's Geotechnical Investigation Work Scope document (dated Revised February 24, 2020) that the following ESALs should be used as the basis of pavement designs:

- Normal/Light Duty 250,000 ESALs
- Heavy Duty 1,800,000 ESALs
- Expected Pavement Service Life 20 years

In addition, the following assumptions have been made:

- Reliability of 85 percent

- Standard Deviation of 0.45
- Subgrade Resilient Modulus of 7,500 psi
- Initial Serviceability of 4.5
- Terminal Serviceability of 2.5

Our recommendations for minimum section thicknesses and subgrade preparation for both pavement types are listed in the following sections.

10.2 ASPHALTIC PAVEMENTS

10.2.1 Layer Components

Based on the results of our soil borings and review of the 2020 FDOT Flexible Pavement Design Manual, our minimum recommended pavement component thicknesses are presented in Table III.

TABLE III
MINIMUM ASPHALTIC PAVEMENT COMPONENT THICKNESSES

Service Level	Maximum Traffic Loading	Layer Component			Estimated Structural Number
		Surface Course (inches)	Base Course (inches)	Stabilized Subgrade (inches)	
Normal/ Light Duty	up to 250,000 E_{18}SAL	2	6	12	2.7
Heavy Duty	up to 1,800,000 E_{18}SAL	3	8	12	3.5

10.2.2 Stabilized Subgrade

We recommend that the stabilized subgrade materials immediately beneath the base course exhibit a minimum Limerock Bearing Ratio (LBR) of 40 as specified by FDOT compacted to at least 98 percent of the Modified Proctor maximum dry density (ASTM D 1557) value.

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 should be performed to full depth at a frequency of at least one (1) test per 10,000 square feet, or a minimum of 4 tests, whichever is greater.

10.2.3 Base Course

Based on the results of our exploration and our experience in the project area, limerock and crushed concrete are suitable base course materials for this project. However, local municipality standards may govern the use of crushed concrete use as an alternative base course material. We recommend the civil engineer consult with the local municipalities prior to selecting the base course material for this project.

For a limerock base, the base course should be compacted to a minimum density of 98 percent of the Modified Proctor maximum dry density and exhibit a minimum LBR of 100. The limerock material should comply with the latest edition of the Florida Department of Transportation (FDOT) Road and Bridge Construction specifications.

Recycled concrete aggregate (RCA) may provide a cost-effective alternative material in lieu of a limerock base course. Local availability, along with municipality standards, typically governs the use of crushed concrete use as an alternative base course material. The advantages of using RCA as a pavement base course include its high strength (stronger than limerock), resistance to groundwater related distress, and lack of reflection cracking caused by thermal expansion and contraction.

If a RCA base is used, the base course material should be sourced from an FDOT approved supplier. The base should be compacted to a minimum density of 98 percent of the Modified Proctor maximum dry density and exhibit a minimum LBR of 150. The base material should comply with the criteria listed in the latest edition of the FDOT Road and Bridge Construction Specifications.

Compaction testing of the base course should be performed to full depth at a frequency of at least one (1) test per 10,000 square feet.

10.2.4 Surface Course

For the pavements, we recommend that the surfacing consist of FDOT SuperPave (SP) asphaltic concrete. The surface course should consist of FDOT SP-9.5 fine mix for light-duty areas and FDOT SP-12.5 topped with SP-9.5 fine mix for heavy duty areas. The asphalt concrete should be placed within the allowable lift thicknesses for fine Type SP mixes per the latest edition of FDOT, Standard Specifications for Road and Bridge Construction.

The asphaltic concrete should be compacted to an average field density of 93 percent of the laboratory maximum density determined from specific gravity (G_{mm}) methods, with an individual test tolerance of **+2 percent and -1.2% of the design G_{mm}**. Specific requirements for the SuperPave asphaltic concrete structural course are outlined in the latest edition of FDOT, Standard Specifications for Road and Bridge Construction.

Note: If the Designer (or Contract Documents) limits compaction to the static mode only or lifts are placed one-inch thick, then the average field density should be 92 percent, with an individual test tolerance of + 3 percent, and -1.2% of the design G_{mm}.

After placement and field compaction, the wearing surface should be cored to evaluate material thickness and density. Cores should be obtained at frequencies of at least one (1) core per 10,000 square feet of placed pavement, or a minimum of two (2) cores per day's production.

10.2.5 Effects of Groundwater

One of the most critical influences on the pavement performance in Central Florida is the relationship between the pavement base course and the seasonal high groundwater level. Sufficient separation will need to be maintained between the bottom of base course and the anticipated seasonal high groundwater level. We recommend that the seasonal high groundwater and the bottom of the base course be separated by at least 12 inches for crushed concrete base course, and at least 18 inches for a limerock base course. ***Based on the groundwater conditions encountered, the separation should not be an issue for pavements constructed at existing grade.***

10.2.6 Landscape Areas

In the event that landscape areas adjacent to the pavements include large mounds (>1 foot) of poorly draining organic topsoils or silty/clayey sands, we recommend that landscape drains be provided to protect the roadway against adverse effects from over-irrigation or excess rainfall. Poorly draining silty and clayey material causes the irrigation and rainwater to perch and migrate laterally into the pavement components, which eventually compromises the integrity of the pavement section.

10.3 Concrete "Rigid" Pavements

Concrete pavement is a rigid pavement that is strong, durable and handles the heavy loads more effectively than asphalt pavement. We assume that concrete pavement may be used in the canopy, driveway and tank mat areas. In addition, concrete pavement is recommended under the dumpster area, and 10 feet in front of the trash enclosure, at a minimum.

We understand from Circle K's Geotechnical Investigation Work Scope document (dated Revised 02-24-20) that the following ESALs should be used as the basis of pavement designs:

- Normal/Light Duty 250,000 ESALs
- Heavy Duty 1,800,000 ESALs
- Expected Pavement Service Life 20 years

In addition, the following assumptions have been made:

- Concrete Elastic Modulus of 4,000,000 psi
- Concrete Modulus of Rupture of 650 psi
- Reliability of 85 percent
- Standard Deviation of 0.45
- Modulus of Subgrade Reaction of 100 pci
- Initial Serviceability of 4.5
- Terminal Serviceability of 2.5

We recommend preparing the proposed concrete pavement areas as recommend in Section 13.0 of this report with the following stipulations:

1. The subgrade immediately beneath the concrete should be compacted to at least 98 percent of the Modified Proctor maximum dry density (ASTM D 1557) value.

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 seasonal high groundwater level by at least 12 Inches.

Based on the results of the soil borings and review of the FDOT Rigid Pavement Design Manual, we recommend using the minimum design shown in Table IV for concrete pavements.

TABLE IV
MINIMUM CONCRETE PAVEMENT THICKNESSES

Service Level	Minimum Pavement Thickness	Maximum Control Joint Spacing	Recommended Saw Cut Depth
Normal/Light Duty	6 inches	12 feet x 12 feet	2 inches
Heavy Duty	8 inches	14 feet x 14 feet	2-2/3 inches

We recommend using concrete with a minimum 28-day compressive strength of at least 4,000 pounds per square inch and contain fiber reinforcement. Layout of the Saw cut control joints should form square panels, and the depth of Saw cut joints should be ⅓ of the concrete slab thickness.

We recommend allowing UES 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.

Specimens to verify the compressive strength of the pavement concrete should be obtained for at least every 50 cubic yards, or at least once for each day's placement, whichever is greater.

11.0 EARTH RETAINING WALLS

At this time, Universal **is not** aware of any planned retaining walls at the site. The following recommendations are provided in the event low-level (i.e. less than 4 feet) walls are required.

Earth pressures on retaining walls are influenced by the structural design of walls, conditions of wall restraint, construction methods, and the strength of the materials being restrained. The most common conditions assumed for earth retaining wall design are the active and at-rest conditions.

Active conditions apply to relatively flexible earth retention structures, such as freestanding walls, where some movement and rotation may occur to mobilize shear strength. Walls which are rigidly restrained should be designed for the at-rest condition. However, if the walls will be backfilled before they are braced, they should also be designed to withstand active earth pressures as self-supporting cantilever walls. The wall designer must select the appropriate earth pressure based upon site and design constraints.

Development of the full active earth pressure case requires a magnitude of horizontal wall movement that often cannot be tolerated or cannot occur due to the rigidity of the wall and other design restrictions such as the impact on adjacent structures. In such cases, walls are often designed for either the at-rest condition or a condition intermediate of the active and at-rest conditions, depending on the amount of permissible wall movement.

Passive earth pressure represents the maximum possible pressure when a structure is pushed against the soil, and is used in wall foundation design to help resist active or at-rest pressures. Because significant wall movements are required to develop the passive pressure, the total calculated passive pressure is usually reduced by one-half for design purposes.

Our recommendations assume that the ground surface behind the earth retaining structures is level and that native or imported soils consisting of relatively clean sandy soils containing less than 12 percent passing the No. 200. We recommend that the soils selected for use as backfill be tested as specified prior to commencement of wall construction. Recommended soil parameters for design of earth retaining structures have been presented in Table V below.

TABLE V
LATERAL EARTH PRESSURE DESIGN PARAMETERS (LEVEL BACKFILL)*

Design Parameter	Recommended Value
At-rest Earth Pressure Coefficient, Ko	0.50
Active Earth Pressure Coefficient, Ka	0.33
Passive Earth Pressure Coefficient, Kp	3.0
Moist Unit Soil Weight (pcf)	115 for SP, SP-SM
Submerged Unit Weight of Soil (pcf)	52
Coefficient of Friction (sliding)	0.4
Angle of Internal Friction, ϕ	30

Table Notes:
* For sloping backfill the table values must be adjusted.
**Hydrostatic pressure should be accounted for based on seasonal high water table estimates and other site drainage
considerations

Positive wall drainage must be provided for all earth retaining structures to prevent the build-up of excess hydrostatic pressures. These drainage systems can be constructed of open-graded washed stone isolated from the soil backfill with a geosynthetic filter fabric and drained by perforated pipe, or with one of several wall drainage products made specifically for this application.

Lateral earth pressures arising from surcharge loading (i.e. traffic loading, building/structure loads, etc.) should be added to the above earth pressures to determine the total lateral pressure. Additional consideration must also be given for sloped backfill at the top of the wall. In each circumstance the earth pressures for active and at-rest conditions will increase based upon the amount of surcharge and angle above horizontal of the sloped backfill. Retaining walls should also be analyzed for both internal and global stability.

12.0 SITE PREPARATION

We recommend normal, good practice site preparation procedures for the new construction areas. These procedures include: stripping/clearing of the site to remove existing improvements, vegetation, roots, organic topsoils, debris, etc. Following stripping, the exposed subgrade soils should be proof-rolled, and all subgrade and subsequent fill/backfill soils should be properly densified. A more detailed description of this work is presented in this section.

1. Prior to construction, existing underground utility lines and other below grade structures within the construction area should be located. Provisions should be made to relocate interfering utilities to appropriate locations. It should be noted that if underground improvements are not properly removed or plugged, they may serve as conduits for subsurface erosion which may lead to excessive settlement of overlying structures.

2. Strip the proposed construction limits of vegetation, topsoil, existing improvements, roots, debris and other deleterious materials within and 5 feet beyond the perimeter of the new construction areas. Expect clearing and grubbing to depths of 6 to 12 inches. Deeper clearing and grubbing depths should be anticipated within the developed areas to remove buried improvements. We strongly recommend that the stripped/excavated surfaces be observed and probed by representatives of UES.

3. Proof-roll the exposed subsurface soils under the observation of UES, to locate any soft areas of unsuitable soils, and to increase the density of the shallow loose fine sand soils. If deemed necessary by UES, in areas that continue to "yield", remove any deleterious materials and replace with a clean, compacted sand backfill.

4. Place fill as necessary. All fill 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. Place fill in maximum 12-inch loose, uniform lifts and compact each lift at least 95 percent of the Modified Proctor maximum dry density.

5. Within the at-grade (or below grade) foundation areas, subgrade compaction of at least 95 percent of the Modified Proctor should be achieved to a depth of at least 2 feet below bottom of foundation/slab levels.

6. Within the pavement areas, the upper 12 inches of subgrade beneath the base course or concrete slabs (sub-base) should be stabilized and compacted to at least 98 percent of the Modified Proctor maximum dry density.

7. Test the subgrade and each lift of fill for compaction at a frequency of not less than one test per 2,500 square feet in the building areas and one test per 10,000 square feet in the pavement areas, with a minimum of 4 tests in each area.

8. Prior to the placement of reinforcing steel and concrete, verify compaction within the footing trenches to a depth of 2 feet. We recommend testing every column footing and at least one test every 100 feet of wall footing, with a minimum of 4 tests per building. Re-compaction of the foundation excavation bearing level soils, if loosened by the excavation process, can typically be achieved by making several passes with a walk-behind vibratory sled or jumping jack.

Stability of the compacted soils is essential and independent of compaction and density control. If the near surface soils or the structural fill experience "pumping" conditions, terminate all earthwork activities in that area. Pumping conditions occur when there is too much water present in the soil-water matrix. Earthwork activities are actually attempting to compact the water and not the soil. The disturbed soils should be dried in place by scarification and aeration prior to any additional earthwork activities.

Vibrations produced during vibratory compaction operations at the site may be significantly noticeable within 100 feet and may cause distress to adjacent structures if not properly regulated. Provisions should be made to monitor these vibrations so that any necessary modifications in the compaction operations can be made in the field before potential damages occur. UES can provide vibration monitoring services to help document and evaluate the effects of the surface compaction operation on existing structures. It is recommended that large vibratory rollers remain a minimum of 50 feet from existing structures. Within this zone, the use of a static roller or small hand guided plate compactors is recommended.

13.0 UST PIT AREA – GENERAL COMMENTS

We assume the excavation for the proposed UST pit area will be on the order of 10 to 20 feet below the ground surface. Based on the results of Boring B-1 (performed within the proposed pit area), the subsoils at this level appear to be very loose to medium dense clayey sands (SC). Based on the subsurface conditions encountered, it is our opinion the subgrade soils are suitable for supporting the proposed underground tanks.

The groundwater table was encountered at a depth of 3½ feet bls at the UST tank pit location. Temporary dewatering will be necessary to achieve the necessary excavation and compaction within the tank area. Excavation procedures should conform to the OSHA regulations (Please see section 16.0 of this report).

After the excavation for the tanks is complete, we recommend that the bottom of the excavation be compacted by small hand guided equipment to achieve at least 95 percent of the Modified Proctor maximum dry density (ASTM D-1557) to a depth of 1 foot. If the bottom of excavation is unstable due to excessive fines and/or wet conditions, graded aggregate (FDOT 57 stone) can be placed in 3 to 6 inch lifts in the bottom of the over-excavation with compaction equipment (i.e. jumping jack) until a firm, non-yielding subgrade is achieved. Pea gravel or approved free-draining bedding soils should be placed below tanks in accordance with tank manufacturer's specifications.

After completion of the tank installation, backfill should be placed in uniform 12 inch (or less) lifts and compacted to at least 95 percent of Modified Proctor Test maximum dry density (ASTM D 1557), with small hand guided equipment. Backfill should consist of clean sand with less than 12 percent soil fines and be free of organics, debris and other deleterious materials.

When the fluid level within the fuel tank structure is maintained at or above the surrounding groundwater level, no net buoyancy will occur. However, when these structures are drained for maintenance or as fluid levels fluctuate within the tanks, a positive means of uplift protection may be necessary, depending on the future groundwater levels in order to prevent hydrostatic uplift forces moving the tank. Since groundwater was encountered near and above the bottom of the pit we recommend this protection be added several ways this can be accomplished include the following:

- Addition of dead weight to the structure.
- Mobilizing the dead weight of the soil surrounding the structure through extension of footings outside the perimeter of the structure.
- Use of a permanent gravity or mechanical dewatering system that is operated only when the structure is to be drained.

14.0 DEWATERING AND EXCAVATION CONSIDERATIONS

Based on the groundwater level conditions encountered, temporary dewatering will be required for the successful construction of this project. Where excavations will extend only a few feet below the groundwater table, a sump pump may be sufficient to control the groundwater table. Deeper excavations may require well points and/or sock drains to control the groundwater table. Regardless of the method(s) used, we recommend drawing down the water level at least 2 feet below the bottom of the excavation. The actual method(s) of dewatering should be determined by the contractor. The design and discharge of the dewatering system must be performed in accordance with applicable regulatory criteria (i.e. water management district, etc.) and compliance with such criteria is the sole responsibility of the contractor.

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. 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 workman safety within excavations is the sole responsibility of the contractor.

15.0 CONSTRUCTION RELATED SERVICES

We recommend the owner retain UES 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 and pavement subgrades by monitoring earthwork operations and performing quality assurance tests of the placement of compacted structural fill courses.

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.

16.0 LIMITATIONS

This report has been prepared for the exclusive use of ***Circle K Florida*** and other designated members of their design/construction team associated with the proposed construction 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 improvement designed using the data in this report.

This report should not be relied upon for final design recommendations or professional opinions 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.

* * * * * * * * *

APPENDIX A

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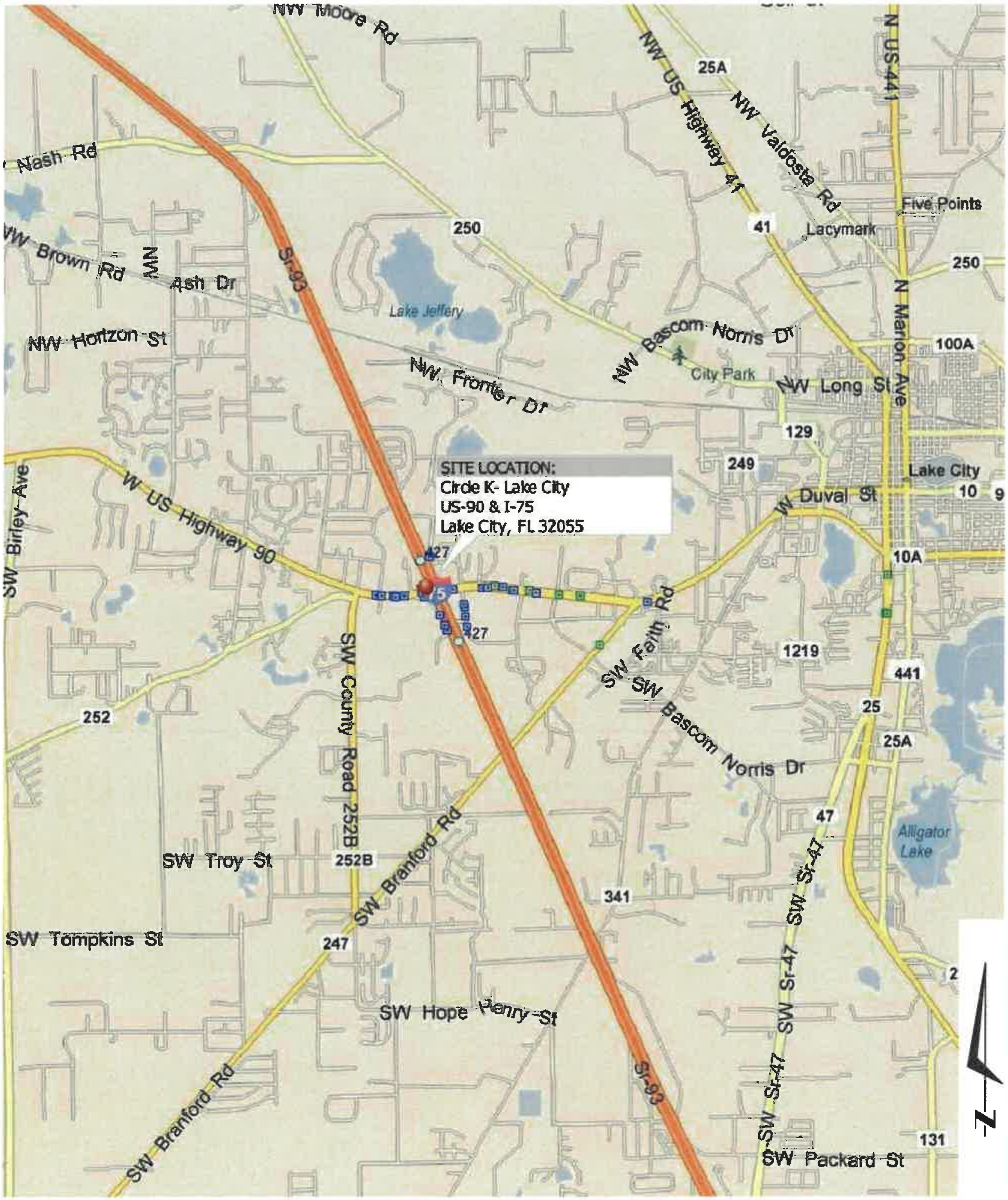


CIRCLE K - LAKE CITY
US HIGHWAY 90 & I-75
LAKE CITY, COLUMBIA COUNTY, FLORIDA

UNIVERSAL ENGINEERING SCIENCES

SITE LOCATION MAP

CLIENT: CIRCLE K STORES, INC		DRAWN BY: SC	DATE: SEP. 8, 2021
SCALE:	PROJECT NO: 0730.2100190	REVIEWED BY: VD	APPENDIX: A

CIRCLE K - LAKE CITY
US HIGHWAY 90 & I-75
LAKE CITY, COLUMBIA COUNTY, FLORIDA

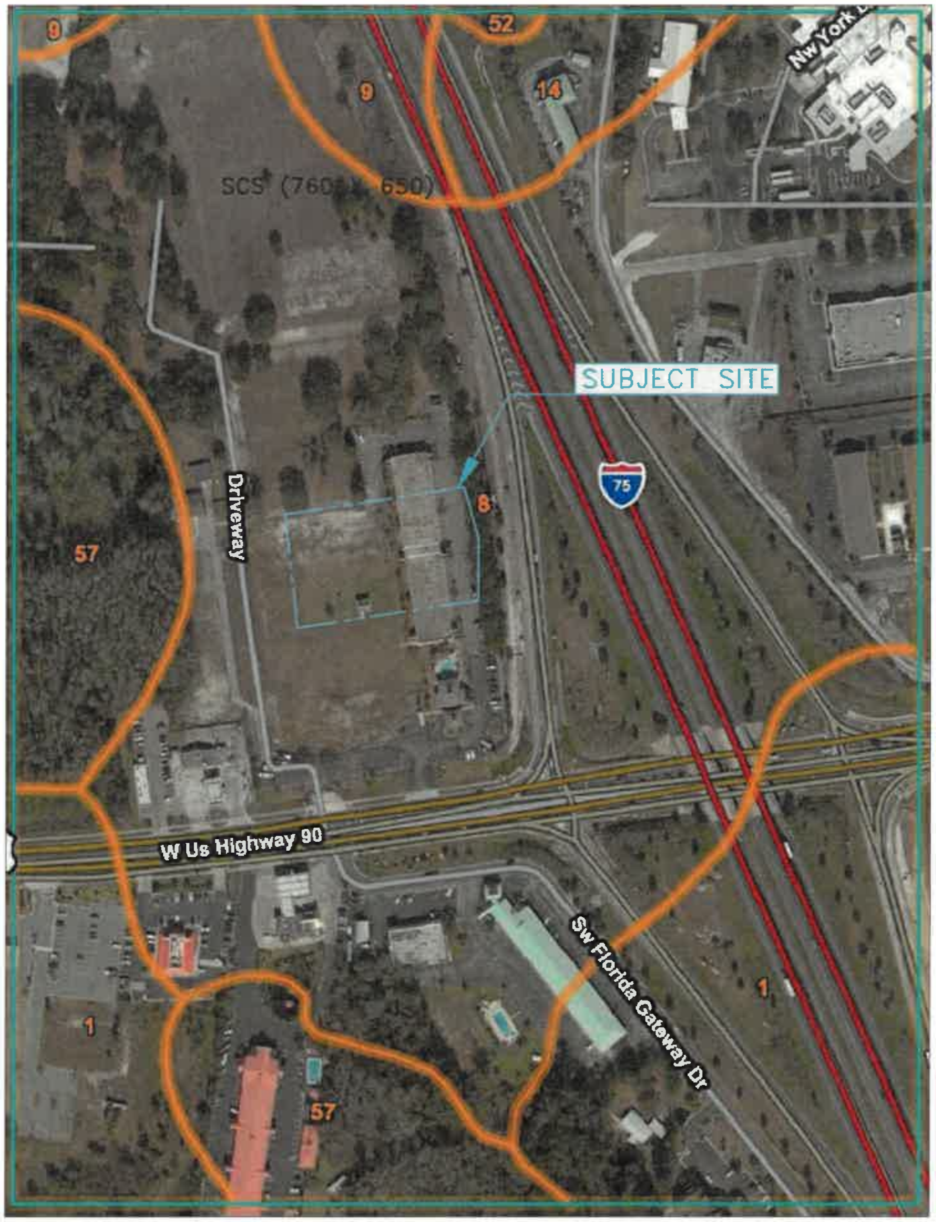
SITE AERIAL PHOTOGRAPH

UNIVERSAL ENGINEERING SCIENCES

CLIENT: CIRCLE K STORES, INC		DRAWN BY: SC	DATE: SEP. 8, 2021
SCALE:	PROJECT NO: 0730.2100190	REVIEWED BY: VD	APPENDIX: A

CIRCLE K - LAKE CITY US HIGHWAY 90 & I-75 LAKE CITY, COLUMBIA COUNTY, FLORIDA			
SITE TOPOGRAPHIC MAP			
CLIENT: CIRCLE K STORES, INC		DRAWN BY: SC	DATE: SEP. 8, 2021
SCALE:	PROJECT NO: 0730.2100190	REVIEWED BY: VD	APPENDIX: A

UNIVERSAL ENGINEERING SCIENCES



Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Albany fine sand, 0 to 5 percent slopes	16.9	19.4%
8	Blanton fine sand, 0 to 5 percent slopes	55.6	63.7%
9	Blanton fine sand, 5 to 8 percent slopes	2.2	2.5%
14	Bonneau fine sand, 5 to 8 percent slopes	2.9	3.3%
52	Plummer fine sand, depressional	0.1	0.2%
57	Surrency fine sand	9.6	11.0%
Totals for Area of Interest		87.3	100.0%

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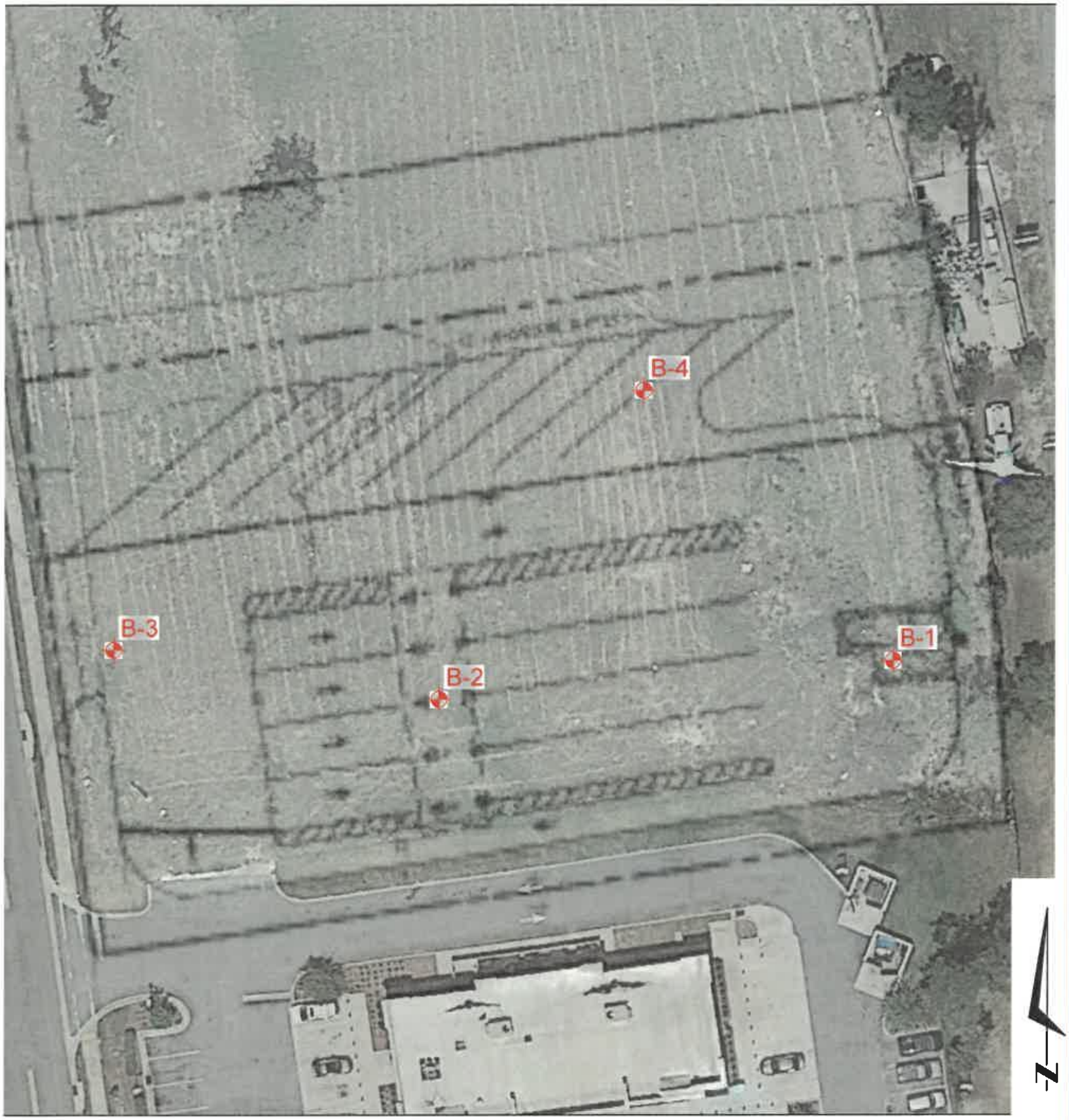
CIRCLE K - LAKE CITY
US HIGHWAY 90 & I-75
LAKE CITY, COLUMBIA COUNTY, FLORIDA

SOIL SURVEY MAP

CLIENT: CIRCLE K STORES, INC		DRAWN BY: SC	DATE: SEP. 8, 2021
SCALE:	PROJECT NO: 0730.2100190	REVIEWED BY: VD	APPENDIX: A

APPENDIX B

UNIVERSAL
ENGINEERING SCIENCES



LEGEND

B-2 Approximate SPT boring location

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CIRCLE K - LAKE CITY
US HIGHWAY 90 & I-75
LAKE CITY, COLUMBIA COUNTY, FLORIDA

BORING LOCATION PLAN

CLIENT: CIRCLE K STORES, INC		DRAWN BY: SC	DATE: SEP. 8, 2021
SCALE:	PROJECT NO: 0730.2100190	REVIEWED BY: VD	APPENDIX: B

UNIVERSAL ENGINEERING SCIENCES
9802 Palm River Road
Tampa, Florida 33619
(813) 740-8506

BORING LOG

PROJECT NO.: 0730.2100190
APPENDIX:
PAGE: 1

PROJECT: Circle K - Lake City
US Highway 90 & 1-75
Lake City, Columbia County, Florida

ENGINEER: Veronica De Freitas, P.E.

CLIENT: Circle K Store, Inc

LOCATION: SEE BORING LOCATION PLAN

REMARKS:

BORING DESIGNATION: **B-1** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

ELEVATION:
WATER TABLE (ft): 3.5
DATE OF READING: 9/30/2021
EST. W.S.W.T. (ft):

DATE STARTED: 9/30/2021
DATE FINISHED: 9/30/2021
DRILLED BY: Universal Engineering
TYPE OF SAMPLING: SPT

DEPTH (ft)	SAMPLE	BLOWS PER 6"	N (bpf)	SPT-N vs DEPTH (bpf) 0 25 50	GWT	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	PL	PI	ORG (%)
0							Light gray sand (SP)						
2	X	3-7-8-10	15				Brown clayey sand (SC)						
3.5					▼								
4	X	3-2-2-2	4										
6	X	2-4-4-7	8										
8	X	5-8-11-10	19				Light brown clayey sand (SC)						
10	X	11-12-15-13	27										
12							Brown clayey sand (SC)						
15	X	6-7-8	15										
17							Light brown clayey sand (SC)						
20	X	6-8-13	21										
25	X	6-10-22	32				Boring terminated at 25 ft.						

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BORING LOG

PROJECT NO.: 0730.2100190
APPENDIX:
PAGE: 2

PROJECT: Circle K - Lake City
US Highway 90 & 1-75
Lake City, Columbia County, Florida
ENGINEER: Veronica De Freitas, P.E.
CLIENT: Circle K Store, Inc
LOCATION: SEE BORING LOCATION PLAN
REMARKS:

BORING DESIGNATION: **B-2** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:
ELEVATION:
WATER TABLE (ft): 3.0
DATE OF READING: 9/30/2021
EST. W.S.W.T. (ft):
DATE STARTED: 9/30/2021
DATE FINISHED: 9/30/2021
DRILLED BY: Universal Engineering
TYPE OF SAMPLING: SPT

DEPTH (ft)	BLOWS PER 6"	N (bpf)	DESCRIPTION	-200 (%)	MC (%)	LL	PL	PI	ORG (%)
0			Gray sand (SP)						
	3-3-4-5	7							
			Brown clayey sand (SC)						
	4-2-2-2	4							
5									
	1-1-2-4	3							
	3-11-20-24	31							
10	16-20-20-17	40							
			Bronw clay with sand (CL-CH)						
15	2-2-3	5							
20	2-2-2	4	Boring terminated at 20 ft.						

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(813) 740-8506

BORING LOG

PROJECT NO.: 0730.2100190
APPENDIX:
PAGE: 3

PROJECT:	Circle K - Lake City US Highway 90 & 1-75 Lake City, Columbia County, Florida	BORING DESIGNATION:	B-3
		SHEET:	1 of 1
		SECTION:	
		TOWNSHIP:	
		RANGE:	
ENGINEER:	Veronica De Freitas, P.E.	ELEVATION:	
		DATE STARTED:	9/30/2021
CLIENT:	Circle K Store, Inc	WATER TABLE (ft):	3.0
		DATE FINISHED:	9/30/2021
LOCATION:	SEE BORING LOCATION PLAN	DATE OF READING:	9/30/2021
		DRILLED BY:	Universal Engineering
REMARKS:		EST. W.S.W.T. (ft):	
		TYPE OF SAMPLING:	SPT

DEPTH (ft)	SAMPLE	BLOWS PER 6"	N (bpf)	SPT-N vs DEPTH (bpf) 0 25 50	GWT	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	PL	PI	ORG (%)
0							Dark bown sand with clay (SP-SC)						
		4-6-6-8	12				Brown sand (SP)						
					▼								
		4-7-7-11	14										
5													
		2-6-11-10	17				Brownish gray sandy clay (CL)						
		2-3-3-4	6				Brown clayey sand (SC)						
10		5-6-12-11	18				Boring terminated at 10 ft.						

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Tampa, Florida 33619
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BORING LOG

PROJECT NO.:	0730.2100190
APPENDIX:	
PAGE:	4

PROJECT: Circle K - Lake City
US Highway 90 & 1-75
Lake City, Columbia County, Florida

ENGINEER: Veronica De Freitas, P.E.

CLIENT: Circle K Store, Inc

LOCATION: SEE BORING LOCATION PLAN

REMARKS:

BORING DESIGNATION: **B-4**

SHEET: **1 of 1**

SECTION:

TOWNSHIP:

RANGE:

ELEVATION:

WATER TABLE (ft): 3.0

DATE OF READING: 9/30/2021

EST. W.S.W.T. (ft):

DATE STARTED: 9/30/2021

DATE FINISHED: 9/30/2021

DRILLED BY: Universal Engineering

TYPE OF SAMPLING: SPT

DEPTH (ft)	SAMPLE	BLOWS PER 6"	N (bpf)	SPT-N vs DEPTH (bpf) 0 25 50	GWT	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	PL	PI	ORG (%)
0							Light gray sand (SP)						
		4-7-8-6	15				Brown clayey sand (SC)						
					▼								
		3-5-6-11	11										
5													
		2-3-12-11	15				Brownish orange sand with clay (SP-SC)						
		4-6-10-10	16										
10		8-11-15-9	26				Boring terminated at 10 ft.						

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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.

GBC 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.

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