

**GEOTECHNICAL EXPLORATION**

US-441 S NEW CONSTRUCTION  
4993 US-441, OKEECHOBEE, FLORIDA 34974

UES PROJECT No. 3330.2200178.0000

**PREPARED FOR:**

Index Companies  
211 Commerce Way Suite A  
Jupiter, Florida 33458

Attn: Mr. Ray Knight

**PREPARED BY:**

Universal Engineering Sciences  
607 NW Commodity Cove  
Port St. Lucie, Florida 34986  
(772) 924-3575

September 22, 2022

Consultants in: Geotechnical Engineering • Environmental Sciences  
• Construction Materials Testing • Threshold Inspection



# UNIVERSAL ENGINEERING SCIENCES

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

September 22, 2022

Ray Knight  
**Index Companies**  
211 Commerce Way, Suite A  
Jupiter, Florida 33458  
Phone: (904) 708-8107

**Subject: Report of Geotechnical Exploration**  
**US-441 S New Construction**  
**4993 US-441, Okeechobee, Florida 34974**  
**UES Project No. 3330.2200178.0000**

Dear Mr. Knight:

Universal Engineering Sciences (UES) has completed the subsurface exploration and geotechnical engineering evaluation for the above referenced project in accordance with the geotechnical and engineering service agreement for this project. The scope of services was completed in general accordance with our Geotechnical Engineering Proposal No. 22-9608.00 dated June 17, 2022, planned in conjunction with and authorized by you.

## **EXECUTIVE SUMMARY**

The purpose of our subsurface exploration was to classify the nature of the subsurface soils and general geomorphic conditions at the site and evaluate their impact upon the proposed construction. This report contains the results of our subsurface exploration and our engineering interpretations of these with respect to the project characteristics described to us, including providing recommendations for foundation design, pavement design, site preparation, and earthwork construction.

Per our recent telephone discussions and email correspondence with you, UES understands that you are considering purchasing the vacant parcel located west of the existing gas station at 4993 US-441 in Okeechobee, Florida. We have been informed that the existing gas station will be demolished and a new one-story building with the associated pavement areas. UES has been provided with an untitled site plan showing the possible layout of the proposed new construction on the property and the location of the requested soil borings.

Additional details and specific structural loads were not provided to UES. For the foundation recommendations presented in this report, we assumed a maximum wall loading of 4 kips per linear foot and a maximum column load of 45 kips.

**The recommendations provided herein are based upon the above considerations. If the stated conditions are incorrect or if the project description is revised, please inform UES so that we may review our recommendations with respect to any modifications.**

Two (2) Standard Penetration Test (SPT) borings (B-1 and B-2), advanced to an approximate depth of 40 feet below existing ground surface were performed within the requested boring locations. The locations of the borings are illustrated on the Test Location Plan in Appendix B. The subsurface soil conditions encountered at the boring locations generally consisted of very loose to medium dense fine sand (SP), fine sand with silt (SP-SM), silty fine sand (SM), and clayey fine sand (SC) to termination depths.

Considering the results of our field exploration program, the subsurface soil conditions revealed by the borings are generally favorable for support of the proposed new one-story structure on shallow foundations. A maximum allowable soil bearing pressure of 2,500 psf may be used for foundation design.

The subgrade soils should be improved (densified) with compaction from the stripped grade prior to constructing the building pads. Before placing fill required to achieve final grade, the upper 2 feet of soil below stripped grade should be compacted to a minimum of 95 percent maximum dry density as determined by the modified Proctor test (ASTM D 1557). Fill (including stem wall backfill) should be placed in 12-inch-thick lifts and compacted to achieve a minimum 95 percent modified Proctor maximum dry density. After completing the footing excavations, the bearing subgrade to a depth of 2 feet should be compacted to not less than 95 percent modified Proctor maximum dry density.

We appreciate the opportunity to be of service during this phase of the project and look forward to a continued association. Please do not hesitate to contact us if you have any questions or comments, or if we may further assist you as your plans proceed.

Respectfully Submitted,  
**Universal Engineering Sciences**  
Florida Registry No. 4930

This item has been digitally signed and sealed by Allan G. Abubakar, P.E. on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Allan G. Abubakar, P.E.  
Sr. Project Engineer  
Florida Registration No. 69952

Dhanuhasini Subramaniam, E.I  
Project Engineer

Distribution: Ray Knight – Index Companies

1 pdf

## TABLE OF CONTENTS

1.0 INTRODUCTION.....	4
1.1 Scope of Services .....	4
1.2 Project Description .....	4
2.0 OBSERVATIONS.....	5
2.1 Site Description .....	5
2.2 Field Exploration .....	5
2.3 Laboratory Testing .....	5
2.4 Geomorphic Conditions.....	6
2.5 Hydrogeological Conditions.....	6
3.0 ENGINEERING EVALUATION AND RECOMMENDATIONS.....	7
3.1 General .....	7
3.2 Site Preparation .....	8
3.3 Design of Footings .....	9
3.4 Settlement Estimates .....	9
3.5 Ground Floor Slabs .....	10
4.0 PAVEMENT AREA DESIGN AND CONSTRUCTION CONSIDERATIONS.....	10
4.1 Pavement Design Sections .....	10
4.2 Compacted Subgrade or Embankment Fill .....	11
4.3 Stabilized Subgrade .....	11
4.4 Base Course .....	11
4.5 Flexible (Asphalt) Pavement.....	11
4.6 Rigid (Concrete) Pavement .....	12
4.7 Effects of Water.....	12
4.8 Construction Traffic .....	12
4.9 Pavement Site Preparation.....	12
5.0 REPORT LIMITATIONS.....	13
6.0 BASIS FOR RECOMMENDATIONS .....	14
Appendix A - Vicinity Map	
Appendix B - Test Location Plan	
Appendix C - Notes Related to Borings	
Appendix D - Log of Boring Records	
Appendix E - Discussion of Soil Groups	

## 1.0 INTRODUCTION

### 1.1 Scope of Services

The objective of our geotechnical services was to collect subsurface data for the subject project, summarize the test results, and discuss any apparent site conditions that may have geotechnical significance for the proposed new construction. The following scope of services is provided within this report:

1. Prepare boring logs depicting the subsurface soil conditions encountered during our field exploration.
2. Review the soil samples obtained during our field exploration for classification and additional testing if necessary.
3. Evaluate the existing soil conditions found during our exploration with respect to foundation support for the proposed structure.
4. Provide recommendations with respect to foundation support of the proposed structures, including foundation type, maximum allowable soil bearing capacity, and bearing elevations.
5. Provide recommendations for pavement design and subgrade preparation.
6. Provide site preparation criteria for the proposed construction.

### 1.2 Project Description

Per our recent telephone discussions and email correspondence with you, UES understands that you are considering purchasing the vacant parcel located west of the existing gas station at 4993 US-441 in Okeechobee, Florida. We have been informed that the existing gas station will be demolished and a new one-story building with the associated pavement areas. UES has been provided with an untitled site plan showing the possible layout of the proposed new construction on the property and the location of the requested soil borings.

Additional details and specific structural loads were not provided to UES. For the foundation recommendations presented in this report, we assumed a maximum wall loading of 4 kips per linear foot and a maximum column load of 45 kips.

The recommendations provided herein are based upon the above considerations. If the stated conditions are incorrect or if the project description is revised, please inform UES so that we may review our recommendations with respect to any modifications.

## 2.0 OBSERVATIONS

### 2.1 Site Description

The project site is located at 4993 US-1 in Okeechobee, Florida as illustrated on the Site Vicinity Map in Appendix A. At the time of our field exploration, the property was vacant and undeveloped. The site was bounded by the existing gas station to the east, SW 2<sup>nd</sup> Avenue to the west and commercial buildings to the north and south, respectively.

### 2.2 Field Exploration

Two (2) Standard Penetration Test (SPT) borings (B-1 and B-2), advanced to an approximate depth of 40 feet below existing ground surface were performed within the requested boring locations. The locations of the borings are illustrated on the Test Location Plan in Appendix B.

The Standard Penetration Tests (SPT) were performed in general accordance with ASTM D 1586, "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils." The SPT test procedure consists of driving a 1.4-inch I.D. split-barrel sampler into the soil profile using a 140-pound hammer falling 30 inches. The number of blows per foot, for the second and third 6-inch increment, is referred to as the N-value. The N-value has been empirically correlated with various soil properties and provides an indication of soil strength.

Site specific survey staking of the borings was not provided for our field exploration. The indicated depth and location of each boring were approximated based upon existing grade, the provided Site Plan, and estimated distances and relationships to existing landmarks at the site.

### 2.3 Laboratory Testing

Soil samples recovered from the auger borings were returned to our laboratory where they were visually classified by a geotechnical engineer in general accordance with the Unified Soil Classification System (ASTM D 2488). Selected samples obtained from the borings were tested in the laboratory for moisture content (ASTM D 2216), fines content, or percent dry weight passing the U.S. No. 200 sieve (ASTM D 1140), and organic content (ASTM D 2974). The laboratory test results are summarized in the following table and are also contained on the boring logs.

Table 2.3.1 - Laboratory Test Results					
Boring No.	Sample Depth (feet)	Sample Description	Organic Content (%)	Moisture Content (%)	Fines Content (%)
B-1	2.5 – 4.0	Black fine sand with silt, trace organics (SP-SM)	4.1	25.7	7.2
B-1	8.0 – 10.0	Gray fine sand with silt (SP-SM)	-	23.0	9.8
B-1	28.5 – 30.0	Gray silty fine sand, little shell fragments (SM)	-	29.9	12.3
B-1	38.5 – 40.0	Gray silty fine sand, little shell fragments (SM)	-	29.0	12.1

B-2	4.0 – 6.0	Black fine sand with silty, trace organics (SP-SM)	5.1	39.2	5.7
B-2	38.5 – 40.0	Gray fine sand with silt, little shell fragments (SP-SM)	-	36.0	11.1

The soil samples will be retained in our laboratory for 30 days and then discarded unless we are notified otherwise in writing. The recovered samples were not evaluated, either visually or analytically, for chemical composition or environmental hazards. UES will be pleased to perform these services for an additional fee, if required.

## 2.4 Geomorphic Conditions

The geology of the site as mapped on the USDA Soil Survey website consists of Floridana, Riviera, and Placid soils, depressional (7). **These are sand and loamy sand soils and organic soils are not indicated.** Note that the Soil Survey generally extends to a maximum depth of 80 inches below ground surface and is not indicative of deeper soil conditions.

Boring logs resulting from our field exploration are presented in Appendix D - Log of Boring Records. The logs contain the soil descriptions, the standard penetration test (SPT) N-values logged during the drilling and sampling activities. Note that the soil boring data reflect information from the specific test locations only and the soil conditions may vary between the strata interfaces indicated on the logs. The soil classifications and descriptions shown on the logs are generally based upon visual characterizations of the recovered samples using the Unified Soil Classification System. See Appendix F - Discussion of Soil Groups, for a detailed description of various soil groups.

The subsurface soil conditions encountered at the boring locations generally consisted of very loose to medium dense fine sand (SP), fine sand with silt (SP-SM), silty fine sand (SM) and clayey fine sand (SC) to termination depths.

## 2.5 Hydrogeological Conditions

On the day of our field exploration (September 14, 2022), groundwater was encountered in the SPT borings ranging from depths of 6.0 feet to 7.0 feet below ground surface. The groundwater table typically fluctuates seasonally depending upon local rainfall and other site specific and/or local influences. Brief ponding of stormwater may occur across the site after heavy or extended rainfall events.

## 3.0 ENGINEERING EVALUATION AND RECOMMENDATIONS

### 3.1 General

Our geotechnical engineering evaluation of the site and subsurface conditions at the property, with respect to the planned new construction, and our recommendations for site preparation, foundation support, pavement design, and earthwork construction, are based upon (1) our site observations, (2) the field data obtained, and (3) our understanding of the project information presented in this report. If the stated conditions are incorrect, or if the project description is revised, please inform UES so that we may review our recommendations with respect to any modifications.



We note that the applicability of geotechnical recommendations is very dependent upon project characteristics, specifically (1) improvement locations, (2) grade alterations, (3) and actual applied structural loads. For that reason, UES must be provided with and review the preliminary and final site and grading plans, and structural design loads to validate all recommendations provided in this report. Without performing this review, our recommendations should not be relied upon for final design or construction of any site improvements.

### 3.2 Site Preparation

UES recommends the following compaction requirements for this project:

- Proof Roll ..... 95 percent of modified Proctor
- Building Pad Fill ..... 95 percent of modified Proctor
- Footings ..... 95 percent of modified Proctor

The above compaction percentages are based upon the maximum dry density as determined by the modified Proctor test (ASTM D 1557). **All density tests should be performed to a depth of 2 feet below stripped surface and bottom of footings.** Density testing should be performed using either the nuclear method (ASTM D 6938) or the sand cone method (ASTM D 1556). Hand Cone Penetrometer (HCP) tests can also be performed to evaluate compaction.

Our recommendations for preparation of the site for use of shallow foundation systems and on-grade slabs are presented below. This approach to improving and maintaining site soils has been found to be successful on projects having similar soil conditions.

1. Initial site preparation should consist of removing surface vegetation, topsoil, near surface roots, and other miscellaneous debris within and to 5 feet beyond the planned construction limits. Foundations and the below grade remain of former structures within the footprint of the new construction should also be removed. Similarly, irrigation and utility lines within the limits of the proposed construction should be removed or properly abandoned so that they will not adversely impact overlying structures.
2. Following site stripping and prior to placing fill, areas of surficial sand should be compacted (proof rolled) and tested. We recommend using a steel drum vibratory roller having sufficient static weight and vibratory impact energy to achieve the required compaction. Density tests should be performed on the proof rolled surface at a frequency of not less than one test per 2,500 square feet, or a minimum of three (3) tests, whichever is greater.
3. Fill material may then be placed for the building pads and general site grading, as required. The fill should be inorganic (i.e., contain less than 5 percent by weight organic material) and classified as SP, SW, GP, GW, SP-SM, SW-SM, GW-GP, or GP-GM. **UES does not recommend using fill material having soil fines contents exceeding 12 percent.** Fill should be placed in lifts having a maximum thickness of 12-inches. Each lift should be compacted and tested prior to placement of the next lift. Density tests should be performed within the fill at a frequency of not less than one test per 2,500 square feet per lift in building areas, or a minimum of three (3) tests per lift, whichever is greater.



4. For foundations placed on structural fill or compacted native granular soils, the bearing subgrade should be tested for compaction and observed by an engineer or geologist or his/her representative to determine if the soil is free of organic and/or deleterious material. Density tests should be performed at a frequency of not less than one (1) density test per each column footing and one (1) test per each seventy-five (75) lineal feet of wall footing.
5. The contractor should consider the final grading contours contained on the project plans when executing backfilling and compaction operations.

### **3.3 Design of Footings**

A foundation system for any structure must be designed to resist bearing capacity failures, have settlements that are tolerable, and resist the environmental forces that the foundation may be subjected to over the life of the structure. The soil bearing capacity is the soil's ability to support loads without plunging into the soil profile. Bearing capacity failures are analogous to shear failures in structural design and are usually sudden and catastrophic.

Based on the results of the soil borings performed at the site, UES recommends the structure foundations be designed using a maximum allowable soil bearing pressure of 2,500 psf. Conventional shallow foundations and thickened-edge slab foundation systems should be embedded at least 12 inches below lowest adjacent grade. Furthermore, maintain minimum foundation widths of 20 and 48 inches for isolated strip and square footings, respectively, even if the maximum allowable soil bearing pressure is not developed in all cases.

Once site preparation has been performed in accordance with the recommendations presented in this report, the soils should readily support the proposed structures bearing upon properly designed and constructed shallow foundation systems. Footings and columns should be structurally separated from the ground floor slabs, as they will be loaded differently and at different times, unless monolithic slab foundations are designed.

### **3.4 Settlement Estimates**

Post construction settlements of the structures will be influenced by several interrelated factors, including (1) subsurface soil stratification and the strength/compressibility characteristics, (2) footing size, bearing level, applied loads, and resulting bearing pressure beneath the footings, and (3) the site preparation and earthwork construction techniques used by the contractor. Our settlement estimates for the proposed construction are based on the use of the site preparation and earthwork construction methods recommended in this report. Any deviation from these recommendations could result in an increase in the estimated post-construction settlements of the proposed construction.

We expect most of the settlement to occur in an elastic manner and rapidly during construction. Using the recommended maximum bearing pressure, the assumed maximum structural loads, and the field test data that we have correlated geotechnical strength and compressibility characteristics of the subsurface soils, we estimate that total settlements of the structures could be on the order of one (1) inch or less.

Differential settlements result from differences in applied bearing pressures and variations in the compressibility characteristics of the subsurface soils. Because of the general uniformity of the subsurface conditions and the recommended site preparation and earthwork construction methods presented in this report, we anticipate that differential settlements of the structures should be within tolerable magnitudes (0.5 inch or less).

### 3.5 Ground Floor Slabs

Ground floor slabs may be constructed upon either existing grade or fill following completion of the site preparation and fill placement procedures outlined in this report. We recommend that a modulus of subgrade reaction (k) of 150 pounds per cubic inch (pci) be considered during design. The floor slabs should be structurally separated from walls and columns to allow for differential vertical movement unless monolithic slab foundations are designed.

Excessive moisture vapor transmission through foundation slabs can result in damage to floor coverings as well as cause other deleterious affects. An appropriate moisture vapor barrier should be placed beneath the slabs to reduce moisture vapor from entering the structures through the slabs. The barriers should be installed in general accordance with applicable ASTM procedures including sealing around pipe penetrations and at the foundation edges.

## 4.0 PAVEMENT AREA DESIGN AND CONSTRUCTION CONSIDERATIONS

### 4.1 Pavement Design Sections

The pavement sections were designed considering assumed traffic loading and previous experience with similar projects. Flexible pavement sections in the geographic area typically consist of an asphaltic wearing course, a base course, and a stabilized subgrade layer. Rigid pavements are constructed either directly upon prepared soil subgrades or upon a base course and stabilized subgrade for heavier loads.

Based on our prior experience and the assumed traffic loading criteria, recommended pavement section thicknesses are provided in Table 4.1.1 below.

<b>Table 4.1.1 - Design Pavement Sections</b>				
Pavement Type	Layer	Material Description	Layer Thickness	
			Light Duty	Heavy Duty
<b>Flexible</b>	(A)	Asphalt Wearing Surface FDOT SP-9.5 or SP-12.5	1.5	2.5
	(B)	Base rock (minimum LBR of 100), compacted to 98 percent of modified Proctor maximum dry density	6	8
	(SSG)	Stabilized subgrade (minimum LBR of 40), compacted to 98 percent of modified Proctor maximum dry density	12	12
	<b>STRUCTURAL NUMBER (SN)</b>		<b>2.7</b>	<b>3.5</b>
<b>Rigid</b>	(C)	FDOT Portland Cement Concrete	NA	8
	(B)	Base rock (minimum LBR of 100), compacted to 98 percent of modified Proctor maximum dry density	NA	-

---

	(CSG)	Soil subgrade compacted to 98 percent of modified Proctor maximum dry density	NA	12
--	-------	---	----	----

#### 4.2 Compacted Subgrade or Embankment Fill

The subgrade or embankment fill is the layer that supports the structural pavement section. Subgrade and embankment fill should be constructed following the criteria and procedures presented in Section 4.9 of this report.

#### 4.3 Stabilized Subgrade

The stabilized subgrade is the portion of the pavement section between the compacted subgrade or embankment fill and the base course. We recommend that subgrade material be compacted to at least 98 percent of modified Proctor maximum dry density (AASHTO T-180). The stabilized subgrade material should have a minimum Limerock Bearing Ratio (LBR) value of 40. Compliance tests should be performed upon the stabilized subgrade for full depth at a frequency of one test per 5,000 square feet, or at a minimum of two test locations, whichever is greater.

#### 4.4 Base Course

The base course is the portion of the pavement section between the surface course and stabilized subgrade. In areas where separation of at least 1.5 feet between the estimated wet seasonal high groundwater table and the bottom of the base material occurs, we recommend the base course be limerock or cemented coquina having a minimum Limerock Bearing Ratio (LBR) value of 100. The base material should be obtained from an approved source. The base material should be placed in maximum 6-inch-thick lifts and compacted to at least 98 percent of modified Proctor maximum dry density (AASHTO T-180).

If the separation between the estimated wet seasonal high groundwater table and the bottom of the base material is less than 1.5 feet, we recommend that asphaltic concrete base (FDOT SP-12.5) be used in lieu of limerock or cemented coquina. The subgrade should be mechanically stabilized (compacted) to a minimum of 98 percent of modified Proctor maximum dry density (AASHTO T-180). Compliance tests should be performed on the base course at a frequency of one test per 5,000 square feet, or a minimum of two test locations, whichever is greater.

#### 4.5 Flexible (Asphalt) Pavement

Asphalt pavement should consist of either FDOT SP-9.5 or SP-12.5 asphaltic concrete. The mixes should be a current FDOT approved design for the materials used for the project. Samples of the materials delivered to the project should be tested to verify that the aggregate gradation and asphalt content satisfies the mix design specifications.

The asphalt should be compacted to meet the requirements of the latest edition of the FDOT *Standard Specifications for Road and Bridge Construction*. Compliance tests should be performed by obtaining cores to evaluate material thickness and density at a frequency of one test per 10,000 square feet, or a minimum of two test locations, whichever is greater.

---

#### 4.6 Rigid (Concrete) Pavement

Rigid pavements should be constructed using concrete having a minimum 28-day compressive strength of 4,000 psi. Fill required to raise grades in pavement areas should be compacted to at least 98 percent of modified Proctor maximum dry density (AASHTO T-180).

The pavement slabs should be reinforced to make them as rigid as practical. Proper joints should be provided at the junctions of slabs so that a small amount of independent movement can occur without causing structural damage. Construction and control joints should be in accordance with current American Concrete Institute (ACI) and industry practices.

The pavement sections presented in this report are minimum pavement section thicknesses typically used for similar type projects. The pavement materials and construction procedures should conform to FDOT, ACI, or appropriate city/county requirements.

#### 4.7 Effects of Water

Premature pavement section deterioration can occur due to intrusion of the wet season high groundwater table and/or improper surface water runoff management. We recommend the pavement areas be constructed to have a minimum separation of 1.5 feet between the wet season high groundwater table and the bottom of base course, regardless of the type of base material. In addition, we recommend that full-depth curb sections be designed and constructed. Using either extruded curb sections, which lie directly on top of the final surface course, or eliminating the curbing entirely, may allow runoff and/or irrigation water to migrate between the base and surface course. This condition can result in the separation of the surface course from the base course, causing a rippling effect, which results in premature deterioration of the pavement.

#### 4.8 Construction Traffic

**Incomplete pavement sections or pavement areas designed for light duty traffic will not perform satisfactorily under typical construction traffic loading.** We recommend that all construction traffic (i.e., construction equipment, vehicles, etc.) either be re-routed away from these areas or the pavement sections be designed to support construction phase loading conditions.

#### 4.9 Pavement Site Preparation

Our recommendations for preparation of the site for pavement construction are noted below. This approach to improving and maintaining site soils has been found to be successful with similar soil conditions.

1. The proposed construction limits should be cleared, stripped, and grubbed of all surface vegetation, topsoil, and associated root systems to depths of their vertical reaches. This should be performed within and to 5 feet beyond the limits of the pavement areas.
2. Prior to initiating fill operations, the existing ground surface should be compacted (proof rolled) using a steel drum vibratory roller having sufficient static weight and vibratory impact

energy to achieve the required compaction. After completing the proof rolling, density tests should be performed at a frequency of one test per 5,000 square feet, or at a minimum of two test locations, whichever is greater, to confirm a minimum compaction compliance of 98 percent of modified Proctor maximum dry density (AASHTO T-180).

3. Fill material should be inorganic (classified as SP/GW) containing not more than 5 percent (by weight) fibrous organic materials. **Fill material having silt/clay-size fines contents greater than 5 percent should not be used, including cyclone sand material.** The fill should be placed in maximum 12-inch-thick lifts. Each lift should be compacted to a minimum density of 98 percent of modified Proctor maximum dry density (AASHTO T-180).
4. Compliance density tests should be performed within the fill at a frequency of not less than one test per 5,000 square feet per lift, or at a minimum of two test locations, whichever is greater.
5. Representative samples of both on-site and import materials proposed for use as fill should be obtained and tested to determine compliance with the project specifications. The testing should include moisture-density relations (AASHTO T-180) and particle size analysis.
6. The contractor should consider the contours contained on the final grading, paving, and drainage plans when executing backfilling and compaction operations.

## 5.0 REPORT LIMITATIONS

This consulting report has been prepared for the exclusive use of Index Companies and other members of the design team for the proposed new construction located at 4993 US-441 in Okeechobee, Florida. This report has been prepared in accordance with generally accepted local geotechnical engineering practices; no other warranty, either express or implied, is made.

The evaluation submitted in this report is based in part upon the data collected during a field exploration. However, the nature and extent of variations throughout the subsurface profile may not become evident until construction. If variations then appear evident, it may be necessary to reevaluate information and professional opinions provided in this report. In the event changes are made in the nature, design, or location of the proposed structures or pavement areas, the evaluation and opinions contained in this report should not be considered valid unless the changes are reviewed, and our conclusions modified or verified in writing by UES.

UES should be provided the opportunity to review the final civil plans, structural plans, and project specifications to determine if UES's recommendations have been properly interpreted, communicated, and implemented. If UES is not afforded the opportunity to participate in construction related aspects of foundation installation and pavement construction as recommended in this report or any report addendum, UES cannot accept responsibility for the interpretation of our recommendations made in this report or in a report addendum for foundation or pavement performance.

## 6.0 BASIS FOR RECOMMENDATIONS

The recommendations presented in this report are based on the data obtained from the borings performed at the locations indicated on the Test Location Plan in Appendix B. This report does not reflect variations which may occur between borings. While the borings are representative of the subsurface conditions at their respective locations and for their vertical reaches, local variations characteristic of the subsurface soils of the region are anticipated and may be encountered. The delineation between soil types shown on the boring logs is approximate and the descriptions represent our interpretation of the subsurface conditions at the designated boring locations on the specific dates drilled.

Any third-party reliance of our geotechnical report or parts thereof is strictly prohibited without the express written consent of Universal Engineering Sciences. The applicable SPT methodology (ASTM D 1586) used in performing our borings, and for determining penetration resistance and soil relative density, is specific to the sampling tools utilized and does not reflect the ease or difficulty to advance other tools or materials.

## **Appendix A - Vicinity Map**



# Site Vicinity Map

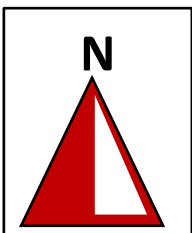
US-441 S New Construction  
4993 US-441, Okeechobee, Florida

Project No. 3330.2200178.0000

Drafted by: JR

Reviewed By: AA

Date: 9/15/2022



## **Appendix B - Test Location Plan**



# Test Location Plan

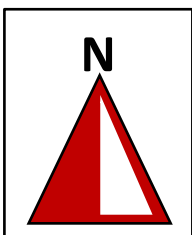
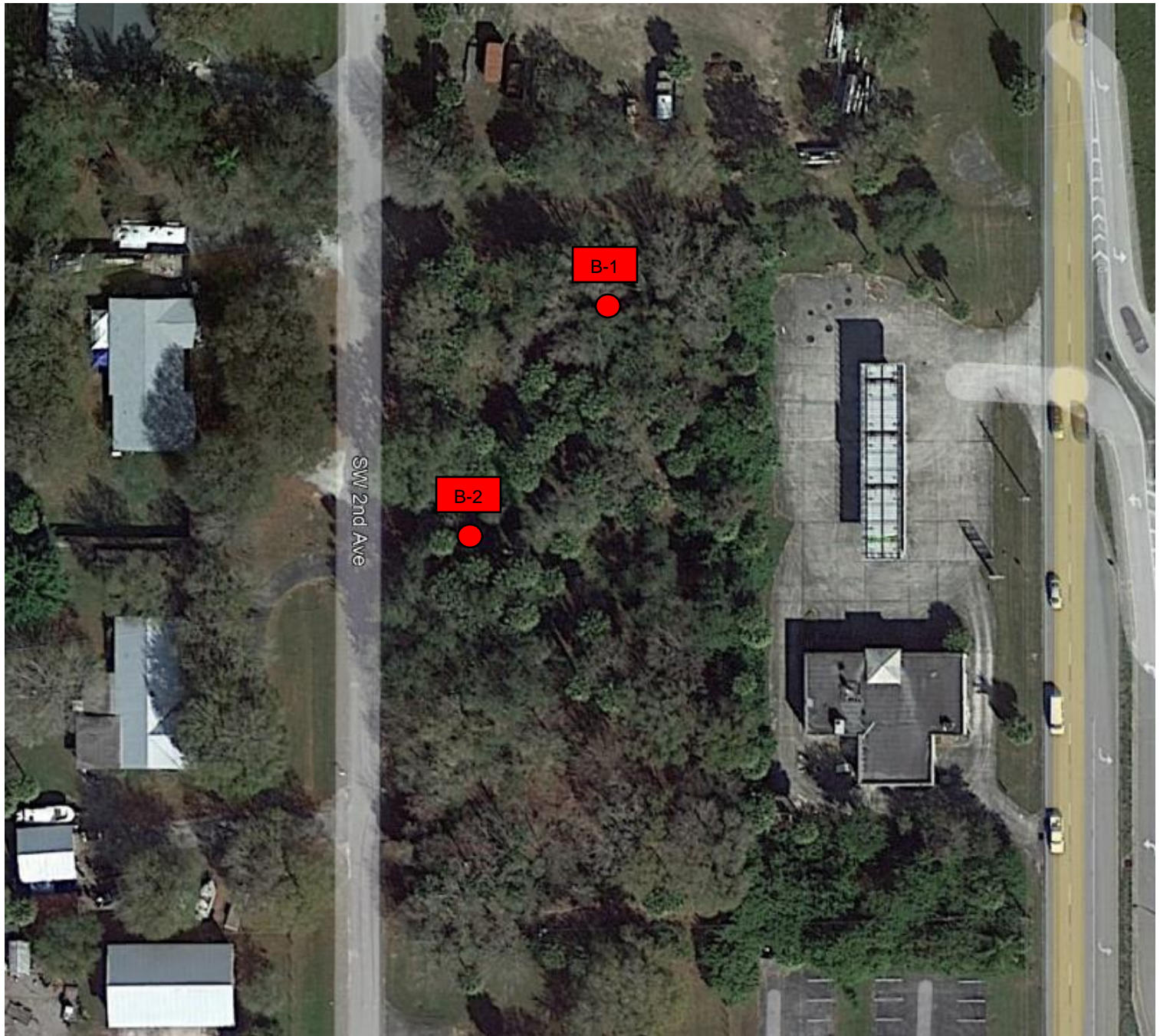
US-441 S New Construction  
4993 US-441, Okeechobee

Project No. 3330.2200178.0000

Drafted by: JR

Reviewed By: AA

Date: 9/15/2022



## Legend

- Approximate 40' Standard Penetration Test Boring Locations

## **Appendix C - Notes Related to Borings**

## NOTES RELATED TO BORING RECORDS AND GENERALIZED SUBSURFACE PROFILES

1. Groundwater levels (if encountered) were recorded either during or following the boring completion on the date indicated. Fluctuations in groundwater levels are common - see the report text for a discussion.
2. The boring locations were identified in the field by estimated distances and offsets from existing reference marks and/or other site landmarks.
3. The completed boreholes were backfilled to adjacent site grade using drilling spoils and patched with asphalt cold mix in pavement areas.
4. The Log of Boring records represent our interpretation of soil conditions based on visual classification of the soil samples recovered from the borings.
5. The Log of Boring records are subject to the limitations, conclusions, and recommendations presented in the report text.
6. The Standard Penetration Test (SPT) N-values contained on the Log of Boring records refer to the total blow counts of a 140-pound drop hammer falling 30 inches required to drive a split-barrel sampler a total distance of 12 inches into soil strata at specific depth intervals.
7. The Hand Cone Penetrometer (HCP) values contained on Log of Boring records and the Cone Penetration Test (CPT) values contained on the Cone Penetration Sounding logs refer to the cone tip resistance recorded when pushing the cone tip into the soil strata at specific depth intervals.
8. The soil and/or rock strata interfaces shown on the Log of Boring records are approximate and may vary from those shown on the logs. The soil and/or rock descriptions shown on the Log of Boring records refer to conditions at the specific location tested. Soil/rock conditions may vary between test locations.
9. Relative density for coarse-grained soils (sands/gravels) and consistency for fine-grained soils (silts/clays) are described as follows:

Coarse Grained Soils (Sands and Gravels)				Fine Grained Soils (Silts and Clays)			
SPT N-Value	HCP Value (kg/cm <sup>2</sup> )	CPT Value (tsf)	Relative Density	SPT N-Value	HCP Value (kg/cm <sup>2</sup> )	CPT Value (tsf)	Consistency
0-4	0-16	0-20	Very Loose	0-2	0-20	0-3	Very Soft
5-10	17-36	21-40	Loose	3-4	21-35	4-6	Soft
11-30	37-116	41-120	Med. Dense	5-8	>35	7-12	Firm
31-50	117-196	121-200	Dense	9-15		13-25	Stiff
>50	> 196	>200	Very Dense	16-30		26-50	Very Stiff
				>30		>50	Hard

10. Grain size descriptions are as follows:

Description	Particle Size Limits
Boulder	Greater than 12 inches
Cobble	3 to 12 inches
Coarse Gravel	<sup>3</sup> / <sub>4</sub> to 3 inches
Fine Gravel	No. 4 sieve to <sup>3</sup> / <sub>4</sub> inch
Coarse Sand	No. 10 to No. 4 sieve
Medium Sand	No. 40 to No. 10 sieve
Fine Sand	No. 200 to No. 40 sieve
Fines (Silt/Clay)	Smaller than No. 200 sieve

11. Definitions for modifiers used in soil/rock descriptions:

Proportion	Modifier	Approximate Root Diameter	Modifier
<5%	Trace	Less than <sup>1</sup> / <sub>32</sub> "	Fine roots
5% to 12%	Little	<sup>1</sup> / <sub>32</sub> " to <sup>1</sup> / <sub>4</sub> "	Small roots
12% to 30%	Some	<sup>1</sup> / <sub>4</sub> " to 1"	Medium roots
30% to 50%	And	Greater than 1"	Large roots
Organic Soils: Soils containing vegetative tissue in various stages of decomposition having a fibrous to amorphous texture. Usually having a dark brown to black color and an organic odor.			
Organic Content Modifiers: <25%: Slightly to Highly Organic; 25% to 75%: Muck; >75%: Peat			

## **Appendix D - Log of Boring Records**

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/20/22 16:46 - V:\PROJECTS\UES PROJECT SETUP\2022 UES PROJECTS\3330.2200178.0000 - HWY 441 S NEW CONSTRUCTION - GEO\GEOAPPENDICES NORMALS

Universal Engineering Sciences  
607 NW Commodity Cove  
Port St. Lucie, Florida 34986  
(772) 924-3575

LOG OF BORING B-1

CLIENT 2605 HWY 441 S Holdings, LLC

PROJECT NAME US-441 S New Building

PROJECT NUMBER 3330.2200178.0000

PROJECT LOCATION 4993 US-441, Okeechobee, Florida

DRILLING CONTRACTOR Universal Engineering Sciences

HOLE DEPTH 40 ft

HOLE DIAMETER 3 in

DRILLER SC/CS

DATE STARTED 9/14/22

COMPLETED 9/14/22

DRILL RIG CME-45

GROUND WATER LEVEL: ▽ AT TIME OF DRILLING 6.00 ft

METHOD SPT

LATITUDE

LONGITUDE

NOTE:

HAMMER TYPE

DEPTH (ft)	SAMPLE	SAMPLE NUMBER	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	X	1	0 2 2 4	4		Brown fine sand, trace roots (SP) 2.5	25.7	7.2	4.1
	X	2	4 4 4 3	8		Black fine sand with silt, trace organics (SP-SM) 4.0			
5	X	3	6 6 6 5	12		Light brown fine sand (SP) 6.0 ▽			
	X	4	3 3 3 4	6		Gray fine sand with silt (SP-SM)			
10		5	2 4 3 2	7			23.0	9.8	
15	X	6	4 2 2	4			29.9	12.3	
20	X	7	2 3 2	5		Gray fine sand, trace shell (SP) 18.5	29.0	12.1	
25	X	8	3 3 3	6		Gray fine sand, little shell fragments (SP) 23.5	29.0	12.1	
30	X	9	4 2 2	4		Gray silty fine sand, little shell fragments (SM) 28.5	29.0	12.1	
35	X	10	2 2 2	4			29.0	12.1	
40	X	11	2 2 2	4		40.0	29.0	12.1	

Bottom of borehole at 40.0 feet.



SPT LOGS - GFA DATA TEMPLATE.GDT - 9/20/22 16:46 - V:\PROJECTS\UES PROJECT SETUP\2022 UES PROJECTS\3330.2200178.0000 - HWY 441 S NEW CONSTRUCTION - GEO\GEOAPPENDICES NORMALS

Universal Engineering Sciences  
607 NW Commodity Cove  
Port St. Lucie, Florida 34986  
(772) 924-3575

# LOG OF BORING B-2

PAGE 1 OF 1

CLIENT	2605 HWY 441 S Holdings, LLC	PROJECT NAME	US-441 S New Building		
PROJECT NUMBER	3330.2200178.0000	PROJECT LOCATION	4993 US-441, Okeechobee, Florida		
DRILLING CONTRACTOR	Universal Engineering Sciences	HOLE DEPTH	40 ft	HOLE DIAMETER	3 in
DRILLER	SC/CS	DATE STARTED	9/14/22	COMPLETED	9/14/22
DRILL RIG	CME-45	GROUND WATER LEVEL: $\nabla$ AT TIME OF DRILLING	7.00 ft		
METHOD	SPT	LATITUDE		LONGITUDE	
NOTE:	HAMMER TYPE				

DEPTH (ft)	SAMPLE	SAMPLE NUMBER	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	X	1	2 2 4 6	6		Brown fine sand (SP) 2.0	39.2	5.7	5.1
	X	2	7 6 3 3	9		Brown fine sand, trace shell fragments (SP) 4.0			
5	X	3	2 2 2 2	4		Black fine sand with silt, trace organics (SP-SM) 6.0			
	X	4	3 3 4 4	7		$\nabla$ Brown clayey fine sand, little roots (SC) 8.0			
10	X	5	0 1 2 2	3		Light brown silty fine sand (SM) 13.5			
15	X	6	2 2 2	4		Gray fine sand, trace shell fragments (SP) 18.5	36.0	11.1	
20	X	7	3 3 4	7		Gray fine sand, little shell fragments (SP)			
25	X	8	4 3 4	7					
30	X	9	1 2 2	4					
35	X	10	2 1 2	3		Gray fine sand with silt, little shell fragments (SP-SM) 33.5			
40	X	11	2 3 2	5		40.0			

Bottom of borehole at 40.0 feet.

## **Appendix E - Discussion of Soil Groups**

## **DISCUSSION OF SOIL GROUPS**

### **COARSE GRAINED SOILS**

**General.** A soil is classified as coarse-grained if more than 50 percent of a representative sample of the material is retained on the No. 200 sieve.

**GW and SW Groups.** These groups comprise well-graded gravelly and sandy soils containing little or no plastic fines (less than 5 percent passing the No. 200 sieve). The low fines content does not noticeably change the shear strength characteristics of these soils and does not interfere with their free-draining characteristics.

**GP and SP Groups.** Poorly graded gravels and sands containing little or no plastic fines (less than 5 percent passing the No. 200 sieve) are in the GP and SP groups. The materials can be called uniform gravels, uniform sands, or non-uniform mixtures of very coarse materials and very fine sand, with intermediate sizes lacking (sometimes called skip-graded, gap-graded, or step-graded). This last group often results from borrow pit excavation in which gravel and sand layers are mixed.

**GM and SM Groups.** In general, the GM and SM groups comprise gravels or sands with fines (more than 12 percent passing the No. 200 sieve) having little or no plasticity. The plasticity index and liquid limit of soils in these groups plot below the “A” line on the plasticity chart. The gradation of the material is not considered significant and both well and poorly graded materials are included.

**GC and SC Groups.** In general, the GC and SC groups comprise gravelly or sandy soils containing fines (more than 12 percent passing the No. 200 sieve) having plasticity characteristics. The plasticity index and liquid limit of soils in these groups plot above the “A” line on the plasticity chart.

### **FINE GRAINED SOILS**

**General.** A soil is classified as fine-grained if more than 50 percent of a representative sample of the material passes the No. 200 sieve.

**ML and MH Groups.** These groups comprise inorganic silts (ML) and elastic silts (MH) having either low (L) or high (H) liquid limits, respectively. ML soils have a liquid limit of less than 50 while MH soils have a liquid limit of 50 and greater. Silts and elastic silts can also contain varying amounts of sand and gravel. Also included in this group are loess sediments and rock flours.

**CL and CH Groups.** These groups comprise low plasticity (lean) clays (CL) and medium to high plasticity (fat) clays (CH) having either low (L) or high (H) liquid limits, respectively. CL soils have a liquid limit of less than 50 while CH soils have a liquid limit of 50 and greater. The low plasticity clays can also be sandy clays or silty clays. The moderate to high plasticity clays can also be sandy clays and include some volcanic clays.

**OL and OH Groups.** These groups comprise organic silts and clays. The soils are characterized by the presence of organic odor and/or dark color. The OL and OH soils are differentiated by determining and comparing their liquid limit values before and after oven drying representative soil samples.

### **HIGHLY ORGANIC SOILS**

The highly organic soils are usually very soft and compressible and have undesirable construction characteristics. Particles of leaves, grasses, branches, or other fibrous vegetative matter are common components of these soils. They are not subdivided and are classified into one group with the symbol PT. Peat humus and swamp soils with a highly organic texture are typical soils of the group.