

# UNIVERSAL ENGINEERING SCIENCES

## REPORT OF A GEOTECHNICAL EXPLORATION

Walgreens  
Normandy Boulevard and Fouraker Road  
Jacksonville, Florida

April 29, 2008

PROJECT NO. 0930.0800069.0000  
REPORT NO. 674909

### Prepared For:

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April 29, 2008

Rock Ventures, LLC  
111 East Fairbanks Avenue – First Floor  
Winter Park, Florida 32789

Attention: Mr. Gregg Zuckerman

Reference: **REPORT OF A GEOTECHNICAL EXPLORATION**  
Walgreens – Normandy Boulevard and Fouraker Road  
Jacksonville, Florida  
UES Project No. 0930.0800069.0000 and Report No. 674909

Dear Mr. Ferber:

Universal Engineering Sciences, Inc. has completed a subsurface exploration at the site of the proposed Walgreens located in the southwestern quadrant of the intersection of Normandy Boulevard and Fouraker Road in Jacksonville, Duval County, Florida. These services were provided in general accordance with our Proposal No. 668348 dated April 1, 2008. Authorization for our services was provided by Mr. Gregg Zuckerman dated April 2, 2008. This report contains the results of our exploration, an engineering evaluation with respect to the project characteristics described to us, and recommendations for groundwater control, foundation design, pavement design and site preparation. A summary of our findings is as follows:

- The borings generally found very loose to medium dense sand with silt (SP-SM) to a depth of 7.5 to 12.5 feet below existing grade, underlain with dense to very dense sand with silt (SP-SM) to the maximum boring termination depth of 15 feet. As exceptions, boring B-6 encountered a loose organic silt (ML) layer from a depth of 3 to 4 feet, and a layer of very loose sand with silt (SP-SM) from 7 to 9.5 feet.
- We measured the stabilized groundwater level at a depth of 5.8 to 8.4 feet below the existing grade. We estimate the normal seasonal high groundwater level will occur at a depth of 1 to 1.5 feet below the existing ground surface during the wet season.
- Results from the falling-head permeability testing provided permeability values ranging from less than 0.01 feet per day to 15.5 feet per day.
- Assuming the building and pavement areas will be constructed in accordance with our Site Preparation Recommendations, we have recommended the proposed structures be

supported on conventional, shallow spread foundations with an allowable soil bearing pressure of 2,500 pounds per square foot.

- Pavements should be designed as a function of the anticipated traffic loadings. Either flexible or rigid pavement systems may be used at this site.
- We recommend only normal, good practice site preparation techniques to prepare the existing subgrade to support the proposed structure and pavement areas. These techniques include stripping the construction areas of topsoils and vegetation, compacting the subgrade and placing engineered fill to the desired grades.

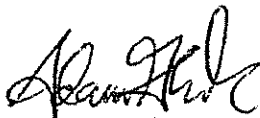
*We note that since the applicability of geotechnical recommendations is very dependent upon project characteristics, most specifically: improvement locations, grade alterations, and actual structural loads applied, UES must review the preliminary and final site and grading plans, and structural design loads to validate all recommendations rendered herein. Without such review our recommendations should not be relied upon for final design or construction of any site improvements.*

We trust this report meets your needs and addresses the geotechnical issues associated with the proposed construction. We appreciate the opportunity to have worked with you on this project and look forward to a continued association. If you have any questions, or when preliminary or final project design plans are available for our recommended review, please contact the undersigned.

Respectfully submitted,

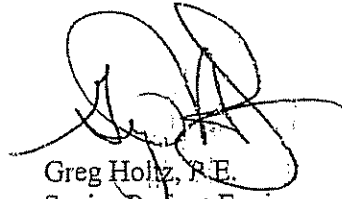
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Certificate of Authenticity No 549



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Date: 4/29/08



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CONSTRAINTS AND RESTRICTIONS



## 1.0 INTRODUCTION

### 1.1 GENERAL

In this report, we present the results of the subsurface exploration of the site for the proposed Walgreens located in the southwestern quadrant of the intersection of Normandy Boulevard and Fouraker Road in Jacksonville, Duval County, Florida. We have divided this report into the following sections:

- SCOPE OF SERVICES - Defines what we did
- FINDINGS - Describes what we encountered
- RECOMMENDATIONS - Describes what we encourage you to do
- LIMITATIONS - Describes the restrictions inherent in this report
- APPENDICES - Presents support materials referenced in this report

## 2.0 SCOPE OF SERVICES

### 2.1 PROJECT DESCRIPTION

We understand that this project will consist of developing the referenced site for a typical Walgreen's Store. We have been provided with a preliminary site plan which indicates the property boundaries, the adjacent roadways, and the proposed layout of the building, parking, and retention areas. We have not been provided with any loading conditions, however, based on our experience with similar projects in the area, we assume that maximum column and load bearing wall loads will not exceed 45 kips and 4 klf, respectively. It is also understood that fill heights will not exceed 2 feet to reach final site grades.

*We note that since the applicability of geotechnical recommendations is very dependent upon project characteristics, most specifically: improvement locations, grade alterations, and actual structural loads applied, UES must review the preliminary and final site and grading plans, and structural design loads to validate all recommendations rendered herein. Without such review our recommendations should not be relied upon for final design or construction of any site improvements.*

### 2.2 PURPOSE

The purposes of this exploration were:

- to explore the general subsurface conditions at the site;
- to interpret and evaluate the subsurface conditions with respect to the proposed construction; and



- to provide geotechnical engineering recommendations for groundwater considerations, foundation design, pavement design, and site preparation.

This report presents an evaluation of site conditions on the basis of traditional geotechnical procedures for site characterization. The recovered samples were not examined, either visually or analytically, for chemical composition or environmental hazards. Universal Engineering Sciences would be pleased to perform these services, if you desire.

Our exploration was confined to the zone of soil likely to be stressed by the proposed construction. Our work did not address the potential for surface expression of deep geological conditions. This evaluation requires a more extensive range of field services than performed in this study. We will be pleased to conduct an investigation to evaluate the probable effect of the regional geology upon the proposed construction, if you desire.

## **2.3 FIELD EXPLORATION**

A field exploration was performed on April 16, 2008. The approximate boring locations are shown on the attached Field Exploration Plan in Appendix A. The approximate boring locations were determined in the field by our personnel using taped measurements from existing features at the site, and should be considered accurate only to the degree implied by the method of measurement used. Samples of the soils encountered will be held in our laboratory for your inspection for 60 days unless we are notified otherwise.

### **2.3.1 SPT Borings**

To explore the subsurface conditions within the area of the proposed structure, we located and drilled six (6) Standard Penetration Test (SPT) borings to a depth of approximately 15 feet below the existing ground surface in general accordance with the methodology outlined in ASTM D 1586. A summary of this field procedure is included in Appendix A. Split-spoon soil samples recovered during performance of the borings were visually classified in the field and representative portions of the samples were transported to our laboratory for further evaluation.

### **2.3.2 Undisturbed Tube Samples**

Four (4) relatively undisturbed soil samples were obtained in the stormwater retention and pavement areas using the Shelby Tube method. This method is described in the Field Exploration Procedures in Appendix A. These samples were returned to our laboratory for examination and subsequent testing.



## 2.4 LABORATORY TESTING

Representative soil samples obtained during our field exploration were returned to our office and classified by a geotechnical engineer. The samples were visually classified in general accordance with ASTM D 2488 (Unified Soil Classification System).

Seven (7) fines content tests and seven (7) moisture content tests were conducted in the laboratory on representative soil samples obtained from the borings. These tests were performed to aid in classifying the soils and to help quantify and correlate engineering properties. Four (4) falling head permeability tests were also conducted in the laboratory on relatively undisturbed soil samples obtained from the proposed retention and pavement areas. These tests were performed to help establish soil permeability values and drainage characteristics. The results of these tests are presented on the Boring Logs in Appendix A. A brief description of the laboratory procedures used is also provided in Appendix A.

## 3.0 FINDINGS

### 3.1 SOIL SURVEY

Based on the 1998 Soil Survey for Duval County, Florida, as prepared by the US Department of Agriculture Soil Conservation Service, the predominant predevelopment soil type at the site is identified as Boulogne fine sand.

A summary of characteristics of this soil series was obtained from the Soil Survey and is included in Table 1.

Soil Type	Constituents	Hydrologic Group	Natural Drainage	Soil Permeability (Inches/Hr)	Seasonal High Water Table
Boulogne (14)	0-6" Fine sand	B/D	Poorly Drained	0-6" 6.0 - 2.0	0.5 - 1.5
	6-16" Fine sand			6-16" 2.0 - 6.0	
	16-31" Fine sand			16-31" 6.0 - 2.0	
	31-39" Fine sand, loamy fine sand			31-39" 0.2 - 2.0	
	39-80" Fine sand			39-80" 0.06 - 0.2	

### 3.2 SURFACE CONDITIONS

The site of the proposed Walgreens located in the southwestern quadrant of the intersection of Normandy Boulevard and Fouraker Road in Jacksonville, Duval County, Florida. At the time of our visit, the site was paved with concrete and asphalt pavement at the northern end of the property, and heavily wooded with oak trees to the south. The topography was relatively level



except for the south side of the site where a minor topographic high area approximately 2 to 3 feet higher than the northern area of the site. Surface water was not observed on site at the time of our visit.

### 3.3 SUBSURFACE CONDITIONS

The boring locations and detailed subsurface conditions are illustrated in Appendix A: Boring Location Plan and Boring Logs. The classifications and descriptions shown on the logs are generally based upon visual characterizations of the recovered soil samples and a limited number of laboratory tests. It should be noted that soil conditions will vary away from and between the boring locations. Also, see Appendix A: Key to Boring Logs, for further explanation of the symbols and placement of data on the Boring Logs. Table 2: General Soil Profile, summarizes the soil conditions encountered.

TABLE 2 General Soil Profile		
Typical depth (ft)		Soil Descriptions
From	To	
0	0.5	Asphalt and Limerock
0.5	7.5 to 12.5	Very loose to medium sand with silt (SP-SM)**
7.5 to 12.5	15*	Dense to very dense sand with silt (SP-SM) (Hardpan)**
* Termination Depth of Deepest Boring		
** See Exceptions Noted Below		
( ) Indicates Unified Soil Classification		

As exceptions, boring B-6 encountered a loose organic silt (ML) layer from a depth of 3 to 4 feet, and a layer of very loose sand with silt (SP-SM) from 7 to 9.5 feet

The stabilized groundwater level was recorded at a depth of 5.8 to 8.4 feet below the existing ground surface.

Our field exploration found evidence of shallow or buried organics in boring B-6 at a depth of 3 to 4 feet. These materials are not suitable for support of foundations and other site improvements. It is not uncommon for natural and/or man-made deposits of organic materials to lie randomly in lateral extent and thickness. Our borings are about 2 inches in diameter and explore only a very limited spatial area. For example, a 50 foot grid of borings over a one acre site only exposes about one square foot of the 43000 square feet of ground surface (0.002%). For perspective, this is roughly comparable to the ratio of the size of this dot ■ to the entire sheet of paper. It should be obvious that the exploration already performed is inadequate to estimate the extent of organic materials across the site. **Therefore, if you wish to estimate the quantity of unsuitable organic materials on this site, additional exploration must be performed.** UES



would be pleased to develop a scope of exploration to assist you and we envision a combination of mechanical or hand borings, probes and test pits for this purpose.

## 4.0 RECOMMENDATIONS

### 4.1 GENERAL

In this section of the report, we present our detailed recommendations for groundwater control, building foundation, pavement design, site preparation, and construction related services. 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. We recommend that we be provided the opportunity to review the project plans and specifications to confirm that our recommendations have been properly interpreted and implemented. If the structural loadings or the building locations change significantly from those discussed previously, we request the opportunity to review and possibly amend our recommendations with respect to those changes. The discovery of any subsurface conditions during construction which deviate from those encountered in the borings should be reported to us immediately for observation, evaluation and recommendations.

**Furthermore, dense to very dense soils were encountered in the borings at depths from approximately 7.5 to 12.5 feet to the maximum boring termination depths of 15 feet below existing site grades.** These soils could be difficult to excavate when performing deeper underground utility construction. These soils contain some weakly to moderately cemented zones (locally termed "hardpan"), which may be difficult to excavate with conventional rubber tire backhoe equipment or smaller rubber tracked excavators. We recommend that this information be made available in all bid/subcontract documents so that appropriate considerations can be made for excavating within this soil zone.

As previously mentioned, loose organic silt (OL) was encountered at boring location B-6 at depths of 3 to 4 feet below the existing ground surface. Although this material appears to be isolated to the vicinity of boring B-6, we recommend that a series of mechanically excavated test pits be performed to determine the horizontal extent of these deposits. These materials appear to be unsuitable to remain in place beneath the adjacent pavement areas. If left in place beneath the planned pavement areas, adverse performance of the pavement support is anticipated. Test pits would aid in determination of both the exact nature and horizontal and vertical extent.

### 4.2 GROUNDWATER CONSIDERATIONS

The groundwater table will fluctuate seasonally depending upon local rainfall. The rainy season in Northeast Florida is normally between June and September. Based upon our review of U.S.G.S data, Duval County Soils Survey, and regional hydrogeology, it is our opinion the seasonal high water level will occur at a depth of 1 to 1.5 feet below the existing ground surface.



Note, it is possible the estimated seasonal high groundwater levels will temporarily exceed these estimated levels during any given year in the future. Should impediments to surface water drainage exist on the site, or should rainfall intensity and duration, or total rainfall quantities exceed the normally anticipated rainfall quantities, groundwater levels may exceed our seasonal high estimates. We recommend positive drainage be established and maintained on the site during construction. We further recommend permanent measures be constructed to maintain positive drainage from the site throughout the life of the project.

We recommend all foundation and pavement grade designs be based on the seasonal high groundwater conditions.

### **4.3 BUILDING FOUNDATIONS**

Based on the results of our exploration, we consider the subsurface conditions at the site adaptable for support of the proposed structure when constructed on a properly designed conventional shallow foundation system. Provided the site preparation and earthwork construction recommendations outlined in Section 4.5 of this report are performed, the following parameters may be used for foundation design.

#### **4.3.1 Bearing Pressure**

The maximum allowable net soil bearing pressure for use in shallow foundation design should not exceed 2,500 psf. Net bearing pressure is defined as the soil bearing pressure at the foundation bearing level in excess of the natural overburden pressure at that level. The foundations should be designed based on the maximum load which could be imposed by all loading conditions.

In designing foundations for canopies, special consideration must be given to the effect of wind loads on the foundations. The footings should be designed to provide adequate uplift resistance and stability against overturning. Should temporary wind loading conditions cause footing edge pressures to exceed 3300 psf or if any portions of the footings are in tension, additional evaluation will be required.

#### **4.3.2 Foundation Size**

The minimum widths recommended for any isolated column footings and continuous wall footings are 24 inches and 18 inches, respectively. Even though the maximum allowable soil bearing pressure may not be achieved, these width recommendations should control the minimum size of the foundations.



#### 4.3.3 Bearing Depth

The exterior foundations should bear at a depth of at least 18 inches below the finished exterior grades and the interior foundations should bear at a depth of at least 12 inches below the finish floor elevation to provide confinement to the bearing level soils. It is recommended that stormwater be diverted away from the building exteriors to reduce the possibility of erosion beneath the exterior footings.

#### 4.3.4 Bearing Material

The foundations may bear in either the compacted suitable natural soils or compacted structural fill. The bearing level soils, after compaction, should exhibit densities equivalent to at least 95 percent of the Modified Proctor maximum dry density (ASTM D 1557) to a depth of at least two foot below the foundation bearing level.

#### 4.3.5 Settlement Estimates

Post-construction settlements of the structures will be influenced by several interrelated factors, such as (1) subsurface stratification and strength/compressibility characteristics; (2) footing size, bearing level, applied loads, and resulting bearing pressures beneath the foundations; and (3) site preparation and earthwork construction techniques used by the contractor. Our settlement estimates for the structures are based on the use of site preparation/earthwork construction techniques as recommended in Section 4.5 of this report. Any deviation from these recommendations could result in an increase in the estimated post-construction settlements of the structures.

Due to the sandy nature of the near-surface soils, we expect the majority of settlement to occur in an elastic manner and fairly rapidly during construction. Using the recommended maximum bearing pressure, the assumed maximum structural loads and the field data which we have correlated to geotechnical strength and compressibility characteristics of the subsurface soils, we estimate that total settlements of the structures could be on the order of one 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 techniques outlined in Section 4.5, we anticipate that differential settlements of the structures should be within tolerable magnitudes ( $\frac{1}{2}$  inch or less).

#### 4.3.6 Floor Slabs

The floor slab can be constructed as a slab-on-grade member using a modulus of subgrade reaction (K) of 100 pci provided the subgrade materials are compacted as outlined in Section 4.6. It is recommended the floor slab bearing soils be covered with an impervious membrane to



reduce moisture entry and floor dampness in accordance with applicable Florida Building Code Standards. A 10-mil thick plastic membrane is commonly used for this purpose. Care should be exercised not to tear the membrane during placement of reinforcing steel and concrete.

#### 4.4 PAVEMENTS

##### 4.4.1 General

A rigid or flexible pavement section could be used on this project. Flexible pavement combines the strength and durability of several layer components to produce an appropriate and cost-effective combination of available construction materials. Concrete pavement has the advantage of the ability to "bridge" over isolated soft areas, it requires less security lighting, and it typically has a longer service life than asphalt pavement. Disadvantages of rigid pavement include an initial higher cost and more difficult patching of distressed areas than occurs with flexible pavement.

##### 4.4.2 Asphalt (Flexible) Pavements

We have recommended a flexible pavement section with a 20-year design life for use on this project. Because traffic loadings are commonly unavailable, we have generalized our pavement design into two groups. The group descriptions and the recommended component thicknesses are presented in Table 3: Pavement Component Recommendations. The structural numbers in Table 3 are based on a structural number analysis with the stated estimated daily traffic volume for a 20-year replacement design life.

TABLE 3 Summary of Pavement Component Recommendations				
Traffic Group	Structural Number	Component Thickness (inches)		
		Stabilized Subgrade	Base Course	Surface Course
Automobile parking lots and driveways - standard duty	2.7	12	6	1.5
Truck parking lots and driveways - heavy duty	3.3	12	8	2.0



The Design Traffic Groups are defined below:

**Automobile Parking lots and driveways- standard duty:**

1,000 cars and light panel and pickup trucks per day, (average gross weight of 4,000 pounds), two tractor-trailer trucks per week (H-20 loading), and two trash trucks per week (46,000 pound gross weight)

**Truck Parking and driveways - heavy duty:**

Standard duty loading plus; twenty 18-wheel tractor-trailer trucks per day (H-20 loading)

**4.4.2.1 Stabilized Subgrade**

We recommend that subgrade materials be compacted in place according to the requirements in the "Site Preparation" section of this report. Further, beneath the base course, stabilize the subgrade materials to a minimum Limerock Bearing Ratio (LBR) of 40, as specified by Florida Department of Transportation (FDOT) requirements for Type B Stabilized Subgrade. The subgrade material should be compacted to at least 98 percent of the Modified Proctor maximum dry density (ASTM D 1557, AASHTO T-180) value.

The stabilized subgrade can be a blend of existing soil and imported material such as limerock. If a blend is proposed, we recommend that the contractor perform a mix design to find the optimum mix proportions.

The primary function of stabilized subgrade beneath the base course is to provide a stable and firm subgrade so that the limerock can be properly and uniformly placed and compacted. Depending upon the soil type, the subgrade material may have sufficient stability to provide the needed support without additional stabilizing material. Generally, sands with silt or clay should have sufficient stability and may not require additional stabilizing material. Conversely, relatively "clean" sand will not provide sufficient stability to adequately construct the limerock base course. Universal Engineering Sciences should observe the soils exposed on the finish grades to evaluate whether or not additional stabilization will be required beneath the base course.

**4.4.2.2 Base Course**

We recommend the base course consist of either limerock or crushed concrete. If limerock base course is utilized, it should have a minimum Limerock Bearing Ratio (LBR) of 100 and should be compacted to 98 percent of the Modified Proctor maximum dry density (ASTM D 1557, AASHTO T-180) value.



As an alternative to limerock base course, crushed concrete could be used. An advantage to using crushed concrete is a lower sensitivity to water than what occurs with limerock. The main disadvantage is that crushed concrete may not be available at the time of construction.

Crushed concrete should be supplied by an FDOT approved plant with quality control procedures. The crushed concrete stockpile should be free of sandy pockets, foreign materials, or uncrushed particles. We recommend that the crushed concrete meet applicable FDOT Standards.

#### 4.4.2.3 Wearing Surface

The wearing surface should consist of Florida Department of Transportation (FDOT) Type S asphaltic concrete having a minimum Marshall Stability of 1,500 lbs and a flow range of 0.07 to 0.12 inches. Specific requirements for Type S asphaltic concrete wearing surface are outlined in the Florida Department of Transportation, Standard Specifications for Road and Bridge Construction, 2000 Edition.

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

#### 4.4.3 Concrete (Rigid) Pavements

Concrete pavement is a rigid pavement that transfers much lighter wheel loads to the subgrade soils than a flexible asphalt pavement. For a concrete pavement subgrade, we recommend using the existing surficial sands or recommend clean fine sand fill (SP), densified to at least 98 percent of Modified Proctor test maximum dry density (ASTM D 1557) without additional stabilization, with the following stipulations:

1. Subgrade soils must be densified to at least 98 percent of Modified Proctor test maximum dry density (ASTM D 1557) to a depth of at least 2 feet prior to placement of concrete.
2. The surface of the subgrade soils must be smooth, and any disturbances or wheel rutting corrected prior to placement of concrete.
3. The subgrade soils must be moistened prior to placement of concrete.
4. Concrete pavement thickness should be uniform throughout, with exception to thickened edges (curb or footing).
5. The bottom of the pavement should be separated from the estimated typical wet season groundwater level by at least 18 inches.



Our recommendations for slab thickness for standard duty and heavy duty concrete pavements are based on a) subgrade soils densified to 98 percent of the Modified Proctor maximum dry density (ASTM D 1557) b) modulus of subgrade reaction (k) equal to 200 pounds per cubic inch, c) a 20 year design life, and 3) previously stated traffic conditions in Section 4.4.2, we recommend using the design shown in Table 4 for standard duty concrete pavements.

TABLE 4 STANDARD DUTY (UNREINFORCED) CONCRETE PAVEMENT		
Minimum Pavement Thickness	Maximum Control Joint Spacing	Recommended Sawcut Depth
5 Inches	10 Feet x 10 Feet	1¼ Inches

Our recommended design for heavy duty concrete pavement is shown in Table 5 below.

TABLE 5 HEAVY DUTY (UNREINFORCED) CONCRETE PAVEMENT		
Minimum Pavement Thickness	Maximum Control Joint Spacing	Recommended Sawcut Depth
6 Inches	12 Feet x 12 Feet	1½ Inches

We recommend using concrete with minimum 28-day compressive strength of 4,000 psi and a minimum 28-day flexural strength (modulus of rupture) of at least 600 pounds per square inch, based on 3<sup>rd</sup> point loading of concrete beam test samples. Layout of the sawcut control joints should form square panels, and the depth of sawcut joint should be at least ¼ of the concrete slab thickness. The joints should be sawed within six hours of concrete placement or as soon as the concrete has developed sufficient strength to support workers and equipment. We recommend allowing Universal to review and comment on the final concrete pavement design, including section and joint details (type of joints, joint spacing, etc.), prior to the start of construction.

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

#### 4.4.4 Effects of Groundwater

One of the most critical factors influencing pavement performance in Northeast Florida is the relationship between the pavement subgrade and the seasonal high groundwater level. Many roadways and parking areas have been damaged as a result of deterioration of the base conditions and/or the base/surface course bond. We recommend that the seasonal high groundwater and the bottom of the flexible pavement limerock base course be separated by at least 24 inches. We



recommend a separation of at least 18 inches below the bottom of a rigid concrete pavement or below a flexible pavement with a crushed concrete base. If this separation cannot be established and maintained by grading and surface drainage improvements, permanent groundwater control measures (underdrains) will be required.

#### **4.4.5 Curbing**

We recommend that curbing around the landscaped sections adjacent to the parking areas and driveways be constructed with full-depth curb sections. Using extruded curb sections which lie directly on top of the final asphalt level, or eliminating the curbing entirely, can allow migration of irrigation water from the landscape areas to the interface between the asphalt and the base. This migration often causes separation of the wearing surface from the base and subsequent rippling and pavement deterioration. Topsoil placed behind curbing in landscaped areas should be limited to 6 inches vertical thickness within five feet of flexible pavement.

#### **4.4.6 Construction Traffic**

Light duty roadways and incomplete pavement sections will not perform satisfactorily under construction traffic loadings. We recommend that construction traffic (construction equipment, concrete trucks, sod trucks, garbage trucks, dump trucks, etc.) be re-routed away from these roadways or that the pavement section be designed for these loadings.

### **4.5 SITE PREPARATION**

We recommend normal, good practice site preparation procedures. These procedures include: stripping the site of existing vegetation and topsoil, compacting the subgrade and placing necessary fill or backfill to grade with engineered fill. A more detailed synopsis of this work is as follows:

1. Prior to construction, the location of any existing underground utility lines within the construction area should be established. Provisions should then be made to relocate interfering utilities to appropriate locations. It should be noted that if underground pipes are not properly removed or plugged, they may serve as conduits for subsurface erosion which may subsequently lead to excessive settlement of overlying structure(s).
2. Strip the proposed construction limits of all grass, roots, topsoil, existing pavement, structures and foundations, and other deleterious materials within and 5 feet beyond the perimeter of the proposed structure footprint and within and 3 feet beyond the perimeter of the proposed paved areas. Expect typical stripping at this site to depths of about 6 to 12 inches. Some isolated areas may require more than a foot of stripping or undercutting to remove larger root systems.



3. The groundwater level was encountered at depths of 5.8 to 8.4 feet below the existing ground surface at the time of our exploration. The seasonal high groundwater level is estimated to occur at depths of 1 to 1.5 feet below the existing ground surface at the time of our exploration. If required, temporary groundwater control can probably be achieved by pumping from sumps located in perimeter ditches. Each sump should be located outside the bearing area to avoid loosening of the fine sandy bearing soils.
4. Compact the subgrade from the surface with tracked dozer equipment or a medium weight vibratory roller (a 2- to 3-ton roller, minimum static weight and 2- to 3-foot minimum drum diameter) until you obtain a minimum density of at least 95 percent of the Modified Proctor maximum dry density (ASTM D-1557), to a depth of 1 foot below the compacted surface. Typically the soils should exhibit a moisture content within  $\pm 2$  percent of the Modified Proctor optimum moisture content (ASTM D-1577) during the compaction procedures. A minimum of eight (8) complete coverages (in perpendicular directions) should be made in the construction area with the roller to improve the uniformity and increase the density of the underlying sandy soils.

Should the bearing level soils experience pumping and soil strength loss during the compaction operations, compaction work should be immediately terminated and (1) the disturbed soils removed and backfilled with dry structural fill soils which are then compacted, or (2) the excess pore pressures within the disturbed soils allowed to dissipate before recompacting.

Care should be exercised to avoid damaging any nearby structures while the compaction operation is underway. Prior to commencing compaction, occupants of adjacent structures should be notified and the existing conditions of the structures be documented with photographs and survey (if deemed necessary). Compaction should cease if deemed detrimental to adjacent structures. Universal Engineering Sciences can provide vibration monitoring services to help document and evaluate the effects of the surface compaction operation on existing structures. In the absence of vibration monitoring it is recommended the vibratory roller remain a minimum of 50 feet from existing structures. Within this zone, use of a bulldozer or a vibratory roller operating in the static mode is recommended.

5. Test the subgrade for compaction at a frequency of not less than one test per 2,500 square feet in the building area, or a minimum of two test locations per building, whichever is greater and every 10,000 square feet in pavement areas, or a minimum of two test locations, whichever is greater.
6. Place fill material, as required. The fill should consist of "clean," fine sand with less than 5 percent soil fines. You may use fill materials with soil fines between 5 and 10 percent, but strict moisture control may be required. Place fill in uniform 10- to 12-inch loose lifts and compact each lift to a minimum density of 95 percent of the Modified Proctor



maximum dry density. Typically the soils should exhibit a moisture content within  $\pm 2$  percent of the Modified Proctor optimum moisture content (ASTM D-1577) during the compaction procedures.

The top 12 inches of fill beneath flexible pavement areas and the top 24 inches of fill beneath rigid pavements should be compacted to 98 percent of the Modified Proctor maximum dry density. For flexible pavements, stabilize this zone with clay or limerock as necessary as recommended in Section 4.3.2, to obtain a minimum LBR of 40.

7. Perform compliance tests within the fill/backfill at a frequency of not less than one test per 2,500 square feet per lift in the building areas, or at a minimum of two tests per building area, whichever is greater. In paved areas, perform compliance tests at a frequency of not less than one test per 10,000 square feet per lift, or at a minimum of two test locations, whichever is greater.
8. Test all footing cuts for compaction to a depth of 1 foot. We recommend you conduct density testing in every column footing, and every 100 linear feet in wall footings. Recompaction of the foundation excavation bearing level soils, if loosened by the excavation process, can probably be achieved by making several coverages with a light weight walk-behind vibratory sled or roller.

#### 4.6 RETENTION POND CONSIDERATION

##### 4.6.1 Borrow Suitability

The pond boring was planned, in part, to provide an indication of the suitability of excavated soils from the proposed retention pond area for use as structural fill. Based on the boring results and classification of the soil samples, the soils below the concrete and asphalt pavement described as sand with silt (SP-SM) encountered to a depth of 3 feet and below a depth of 4 feet are generally suitable for use as structural fill. The organic silt (OL) layer from a depth of 3 to 4 feet is not considered suitable as structural fill due to excessive fines content and moisture sensitivity. It should be understood that soils excavated from below the water table may be excessively wet and may require stockpiling or spreading to dry prior to placement and compaction.

We further recommend a series of mechanically excavated test pits be performed at the pavement edge in the vicinity of boring B-6. The organic silt (OL) does not appear to be suitable to remain in place beneath the proposed pavements. The test pits will determine the horizontal extent and exact nature of the organic material. If left in place, adverse performance of the pavement support is anticipated.



#### 4.6.1 Hydraulic Conductivity

Hydraulic conductivity testing for relatively undisturbed samples from indicated permeability values from less than 0.01 feet per day to 15.5 feet per day, in the proposed retention pond and pavement areas. As previously noted, the USDA Soil Survey indicates hydraulic conductivity values of approximately 0.06 to 20 inches per hour (approximately 0.12 to 40 feet per day) for the upper sandy soils.

The coefficients of permeability from the laboratory tests and Soil Survey are intended to provide an indication of the soils drainage characteristics. The actual exfiltration rates may be different due to pond geometry, soil stratification, retention volume and groundwater mounding effects. The table below summarizes the results from the falling-head permeability testing on the relatively undisturbed soil samples. The locations of the undisturbed samples can be found on the Boring Location Plan in Appendix A.

TABLE 6 SUMMARY OF FALLING-HEAD PERMEABILITY TEST RESULTS				
Location	Depth (ft)	Permeability Value (ft/day)	Fines Content (%)	Moisture Content (%)
P-1	2 to 2.5	15.5	7.1	7.8
P-2	3 to 3.5	< 0.01	93.9	75.3
P-3	1 to 1.5	7.9	7.1	6.8
P-4	1 to 1.5	6.6	7.9	6.0

#### 4.7 TEST PITS

Boring B-6 encountered loose organic silt (OL) at depths of 4 to 4 feet below the existing ground surface. These soils do not appear to be suitable to remain in place beneath the proposed pavement areas. We recommend backhoe-excavated test pits be performed to better evaluate the need for over-excavation of these soils, and to delineate the vertical and horizontal extent, if warranted.

#### 4.8 CONSTRUCTION RELATED SERVICES

We recommend the owner retain Universal Engineering Sciences to perform construction materials tests and observations on this project. Field tests and observations include verification of foundation and pavement subgrades by performing quality assurance tests on the placement of compacted structural fill and pavement courses. We can also provide concrete testing, pavement section testing, structural steel testing, and general construction observation services.



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 problems that might arise during construction in a timely and cost-effective manner.

## 5.0 LIMITATIONS

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. An Association of Engineering Firms Practicing in the Geosciences (ASFE) publication, "Important Information About Your Geotechnical Engineering Report" appears in Appendix B, and will help explain the nature of geotechnical issues.

*We note that since the applicability of geotechnical recommendations is very dependent upon project characteristics, most specifically: improvement locations, grade alterations, and actual structural loads applied, UES must review the preliminary and final site and grading plans, and structural design loads to validate all recommendations rendered herein. Without such review our recommendations should not be relied upon for final design or construction of any site improvements.*

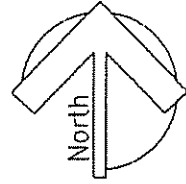
Our field exploration found evidence of shallow or buried organics in boring B-6. These materials are not suitable for support of foundations and other site improvements. It is not uncommon for natural and/or man-made deposits of organic materials to lie randomly in lateral extent and thickness. Our borings are about 2 inches in diameter and explore only a very limited spatial area. For example, a 50 foot grid of borings over a one acre site only exposes about one square foot of the 43000 square feet of ground surface (0.002%). For perspective, this is roughly comparable to the ratio of the size of this dot ■ to the entire sheet of paper. It should be obvious that the exploration already performed is inadequate to estimate the extent of organic materials across the site. **Therefore, if you wish to estimate the quantity of unsuitable organic materials on this site, additional exploration must be performed.** UES would be pleased to develop a scope of exploration to assist you and we envision a combination of mechanical or hand borings, probes and test pits for this purpose.

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

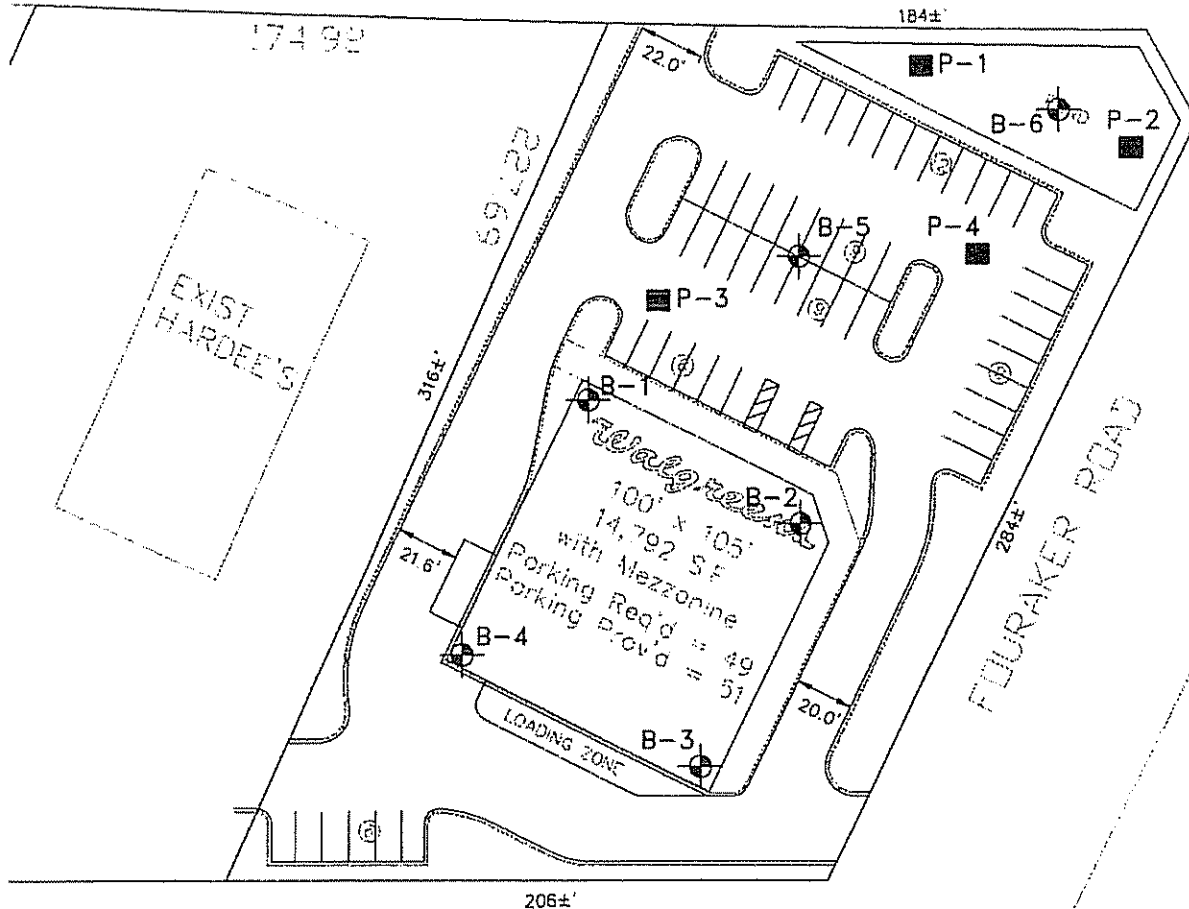


**APPENDIX A**

**BORING LOCATION PLAN  
BORING LOGS  
KEY TO BORING LOGS  
FIELD EXPLORATION PROCEDURES  
LABORATORY TESTING PROCEDURES**



NORMANDY BOULEVARD



LEGEND



- PERMEABILITY TEST LOCATIONS
- ⊕ SPT BORING LOCATIONS



UNIVERSAL  
ENGINEERING SCIENCES

GEOTECHNICAL EXPLORATION  
WALGREENS-NORMANDY BOULEVARD & FOURAKER ROAD  
JACKSONVILLE, FLORIDA

BORING LOCATION PLAN

REVISED BY: TW	DATE: 4/22/08	CHECKED BY: AK	DATE: 4/22/08
SCALE: 1"=60'	PROJECT NO: 0930.080006.0000	REPORT NO: 674909	PAGE NO: A-1









# UNIVERSAL ENGINEERING SCIENCES BORING LOG

PROJECT NO :	0930 080069 0000
REPORT NO.:	674909
PAGE:	A-5

PROJECT: GEOTECHNICAL EXPLORATION  
WALGREENS - NORMANDY BLVD & FOURAKER RD  
JACKSONVILLE FL

BORING DESIGNATION: **B-4** SHEET: **1 of 1**  
SECTION: TOWNSHIP: RANGE:

CLIENT: ROCK VENTURES LLC  
LOCATION: SEE BORING LOCATION PLAN  
REMARKS:

G S ELEVATION (ft): DATE STARTED: 4/16/08  
WATER TABLE (ft): 5.8 DATE FINISHED: 4/16/08  
DATE OF READING: 4/16/08 DRILLED BY: TH/FC  
EST W S W T. (ft): TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT)	S A M P L E	BLOWS PER 6" INCREMENT	N (BLOWS/ FT)	W T	S Y M B O L	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS		K (FT./ DAY)	ORG. CONT. (%)
									LL	PI		
0						Very loose to loose dark gray to grayish brown SAND with Silt (SP-SM)						
		1-1-1	2									
		2-2-2	4									
		3-3-2	5									
5						Loose to medium dense dark grayish brown SAND with Silt (SP-SM)						
		2-3-4	7	▼								
		3-6-8	14			Very dense dark grayish brown to dark brown SAND with Silt (SP-SM) (hardpan)						
		12-23-33	56									
10		22-39-50/5"	100+									
15		23-36-50/4"	100+									

BORING LOG 0930.080069.0000 WALGREENS - NDRMANDY BLVD & FOURAKER RD.GPJ UNIENGSC.GDT 4/24/08



# UNIVERSAL ENGINEERING SCIENCES BORING LOG

PROJECT NO :	093D 0800059.0000
REPORT NO :	674509
PAGE:	A-6

PROJECT: GEOTECHNICAL EXPLORATION  
WALGREENS - NORMANDY BLVD & FOURAKER RD  
JACKSONVILLE, FL

BORING DESIGNATION: **B-5**  
SECTION TOWNSHIP:

SHEET: **1 of 1**  
RANGE:

CLIENT: ROCK VENTURES, LLC  
LOCATION: SEE BORING LOCATION PLAN  
REMARKS:

G S ELEVATION (ft):  
WATER TABLE (ft): 8.4  
DATE OF READING: 4/15/08  
EST W S W T (ft):

DATE STARTED: 4/15/08  
DATE FINISHED: 4/15/08  
DRILLED BY: TH/FC  
TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT)	S A M P L E	BLOWS PER 6" INCREMENT	N (BLOWS/ FT)	W T	S Y M B O L	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS		K (FT / DAY)	ORG. CONT (%)
									LL	PI		
0						1" Asphalt 8" Limerock						
4-3"-8		12				Medium dense dark grayish brown SAND with Silt (SP-SM)						
7-17-9		26				Medium dense to loose light brown SAND with Silt (SP-SM)						
2-2-3		5				Loose to medium dense dark grayish brown SAND with Silt (SP-SM)						
3-3-3		6										
3-4-6		10										
6-10-12		22		▼								
12-18-27		45				Dense to very dense dark grayish brown SAND with Silt (SP-SM) (hardpan)						
21-33-39		72										

BORING LOG 093D 0800059.0000 WALGREENS - NORMANDY BLVD & FOURAKER RD.GPJ UNIEINGSC GDT 4/24/08



# UNIVERSAL ENGINEERING SCIENCES BORING LOG

PROJECT NO.	0930 0800069 0000
REPORT NO :	674909
PAGE:	A-7

PROJECT: GEOTECHNICAL EXPLORATION  
WALGREENS - NORMANDY BLVD & FOURAKER RD  
JACKSONVILLE FL

BORING DESIGNATION: **B-6** SHEET: **1 of 1**  
SECTION: TOWNSHIP: RANGE:

CLIENT: ROCK VENTURES LLC  
LOCATION: SEE BORING LOCATION PLAN  
REMARKS:

G S. ELEVATION (ft): DATE STARTED: 4/15/08  
WATER TABLE (ft): 6.6 DATE FINISHED: 4/15/08  
DATE OF READING: 4/15/08 DRILLED BY: TH/FC  
EST W S W T. (ft): TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT)	SAMPLING	BLOWS PER 6" INCREMENT	N (BLOWS/FT)	W T	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS		K (FT./DAY)	ORG. CONT (%)
									LL	PI		
0						1" Asphalt						
						5" Limerock						
		4-8	12			Medium dense brown to dark brown SAND with Silt with limerock and concrete fragments (SP-SM)						
		7-7-5	12			Loose dark grayish brown Organic SILT (OL)	97	93				
		1-3-4	7			Loose to very loose dark grayish brown SAND with Silt (SP-SM)	57.2	50.9				
5		2-2-2	4									
		1-1-1	2									
		1-1-1	2				72	27.9				
10		1-8-14	22			Medium dense dark grayish brown SAND with Silt (SP-SM)						
						Very dense dark brown SAND with Silt (SP-SM) (hardpan)						
15		17-33-40	73									

BORING LOG 0930 0800069 0000 WALGREENS - NORMANDY BLVD & FOURAKER RD.GPJ UNIENGS.C.GDT 4/24/08



**SYMBOLS AND ABBREVIATIONS**

SYMBOL	DESCRIPTION
N-Value	No. of Blows of a 140-lb Weight Falling 30 Inches Required to Drive Standard Spoon 1Foot
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)
% REC	Percent Core Recovery from Rock Core Drilling
RQD	Rock Quality Designation
	Stabilized Groundwater Level
	Seasonal High Groundwater Level
NE	Not Encountered
BT	Boring Terminated
-200	Fines Content or % Passing No. 200 Sieve
MC	Moisture Content
LL	Liquid Limit
PI	Plasticity Index
K	Coefficient of Permeability
Org Cont.	Organic Content

**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 SOILS 50% or more passed 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 soil with more than 5% but less than 12% passing the No. 200 sieve

**RELATIVE DENSITY**  
(Sands and Gravels)

Very Loose - Less than 4 Blows / 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**  
(Sils 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"  
Hard - 100 Blows for less than 2"

**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%

## FIELD EXPLORATION PROCEDURES

### Standard Penetration Test Boring

The penetration boring was made in general accordance with the latest revision of ASTM D 1586, "Penetration Test and Split-Barrel Sampling of Soils". The boring was advanced by rotary drilling techniques using a circulating bentonite fluid for borehole flushing and stability. At 2 ½ to 5 foot intervals, the drilling tools were removed from the borehole and a split-barrel sampler inserted to the borehole bottom and driven 18 inches into the soil using a 140 pound hammer falling on the average 30 inches per hammer blow. The number of blows for the final 12 inches of penetration is termed the "penetration resistance, blow count, or N-value". This value is an index to several in-place geotechnical properties of the material tested, such as relative density and Young's Modulus.

After driving the sampler 18 inches (or less if in hard rock-like material), the sampler was retrieved from the borehole and representative samples of the material within the split-barrel were placed in glass jars and sealed. After completing the drilling operations, the samples for each boring were transported to our laboratory where they were examined by our engineer in order to verify the driller's field classification.

### Tube Sample (Shelby tube)

Relatively undisturbed samples were obtained by forcing a section of 3 inch O.D., 16 gauge, steel tubing (Shelby tube) into the soil at the desired sampling level. The sampling procedure is described by ASTM Specification D-1587. The tube, together with the encased soil, was carefully removed from the ground, made air-tight, and transported to our laboratory.

## **LABORATORY TESTING PROCEDURES**

### **Natural Moisture Content**

The water content of the sample tested was determined in general accordance with the latest revision of ASTM D 2216. The water content is defined as the ratio of "pore" or "free" water in a given mass of material to the mass of solid material particles.

### **Percent Fines Content**

The percent fines or material passing the No. 200 mesh sieve of the sample tested was determined in general accordance with the latest revision of ASTM D 1140. The percent fines are the soil particles in the silt and clay size range.

### **Falling Head Permeability**

An undisturbed Shelby tube sample of the soil encountered in the area of the propose retention pond was collected for permeability testing. The Shelby tube and sample were sealed in a permeameter and saturated. The sample diameter was about 2.8 inches with a height of approximately 5 inches. The hydraulic head ranged from 33 to 13 inches during testing. Several tests were performed to verify the initial results. The testing procedures used were in substantial accordance with methodology for laboratory permeability testing described in ASTM D-2434.

**APPENDIX B**

**IMPORTANT INFORMATION ABOUT YOUR  
GEOTECHNICAL ENGINEERING REPORT**

**CONSTRAINTS AND RESTRICTIONS**

# Important Information About Your Geotechnical Engineering Report

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

*The following information is provided to help you manage your risks.*

## **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 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 your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one—not even you—*should apply the 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

## **A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors**

Geotechnical engineers consider a number of 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,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- 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 study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the 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 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 construction recommendations included in your report. *Those 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 recommendations if that engineer does not perform construction observation.*

### **A Geotechnical Engineering Report Is Subject To Misinterpretation**

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower 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. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing 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 Contractors a Complete Report and Guidance**

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors 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 contractors have sufficient time to perform additional study.* Only then might you be in a position to give contractors 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 contractors do not 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 such risks, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations", many of the provisions indicate where geotechnical engineers responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

### **Geoenvironmental Concerns Are Not Covered**

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental 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 geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

### **Rely on Your Geotechnical Engineer for Additional Assistance**

Membership in ASFE exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.



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## CONSTRAINTS AND RESTRICTIONS

### **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 express 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 investigation. 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.

