GEOTECHNICAL INVESTIGATION

Proposed FAMILY DOLLAR STORE
S. Mesa Hills Drive & Cabaret Drive
El Paso, Texas

PROJECT NO. 16-DG8337

Prepared for:

7B DEVELOPMENT
Lubbock, Texas

Prepared by:

GEOSCIENCE
ENGINEERING & TESTING, INC.
Dallas, Texas

October, 2016
Project No. 16-DG8337

October 17, 2016

7B Development
5709 104th Street
Lubbock, Texas 79424

Geotechnical Investigation
Proposed FAMILY DOLLAR STORE
S. Mesa Hills Drive & Cabaret Drive
El Paso, Texas

Geoscience Engineering & Testing, Inc. is pleased to submit this geotechnical investigation for the above referenced project located in El Paso, Texas. This report briefly describes the procedures employed in our subsurface exploration and presents the results of our investigation.

We appreciate the opportunity to be of assistance on this project. Please feel free to contact us if you have any questions or if we can be of further service.

Very Respectfully,

Geoscience Engineering & Testing, Inc.
Firm Reg # F-11285. DBE # IMDB51637Y121 HUB # 113422734310

[Signature]
Shokoofeh Golkhari, MSc, E.I.T.
Project Manager

[Signature]
Syed S. Afzal, P.E.
Vice President

2712 Satsuma Drive, Suite 400 • Dallas, Texas 75229 • 972.488.3500 (P) • e-mail: geti@sbcglobal.net
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GEOSCIENCE, Inc.
INTRODUCTION

Project Description

This report presents the results of the geotechnical investigation performed at the site of the above referenced project located in El Paso, Texas. Based on the project information provided, it is our understanding that construction will consist of an approximately 8,320 square foot Family Dollar Store building and associated paving. Information regarding structural loads was not available at the time of this investigation; however, we anticipate the loads will be light to moderate. It is expected that the finished floor elevations of the proposed structure will be above surrounding ground surface. Grading plans and other information regarding the referenced project were not available at the time of this investigation.

Site Description

The site of the referenced project is located at east side of the S. Mesa Hills Drive and south side of the Cabaret Drive in the City of El Paso, Texas. At the time of this investigation, the site was undeveloped land covered with gravel and rock. The general location and orientation of the site is shown in the Illustrations section of this report.

Purpose and Scope of Work

The principal purposes of this investigation were to:

1). Develop subsurface soil and rock stratigraphy at the boring locations;
2). Evaluate soil swell potential and provide alternatives to reduce soil movement;
3). Provide recommendations for foundation design parameters;
4). Provide site preparation recommendations and
5). Provide paving recommendations.

Report Format

The first sections of this report describe the field and laboratory phases of the study. The remaining sections present our engineering analysis that was used to develop geotechnical parameters for the type of foundation system proposed for this site. Boring logs and laboratory test results are presented in the Illustrations section of this report.
FIELD INVESTIGATION

A total of five (5) test borings were drilled and sampled to explore subsurface conditions at this site. Test borings B-1 to B-4 were drilled to a depth of 15 feet at the location of building pad area and the remaining test boring B-5 was drilled to a depth of 5 feet in the proposed paving area. Test borings were drilled in the area accessible to the drill rig. The approximate locations of the borings are shown on the Location Plan - Plate A. Logs of the borings with descriptions of the soils sampled are presented on Plates 1 and 5. Soil strata boundaries shown on the boring logs are approximate.

The borings were advanced using continuous flight auger techniques. A Standard Penetration sampler was used at selected depths in non-cohesive soils to obtain a standard penetration value (N value). An N-value is defined as the number of blows a 140-pound hammer free falling from 30 inches would require to drive a two-inch O.D. sampler one foot into undisturbed soils below the bottom of the bore hole. The N value is an indication of the relative density of non-cohesive soils. The results of the standard penetration tests, expressed as “blows per foot,” are tabulated at the respective sample depths on the boring logs.

All soil samples were removed from the samplers in the field, visually classified, and placed in appropriate containers to prevent loss of moisture or disturbance during transfer to the laboratory. The borings were advanced using dry auger procedures to observe the water level at the time of the exploration. These water level observations are recorded on the boring logs.

LABORATORY TESTING

Engineering properties of the foundation soils were evaluated in the laboratory by tests performed on representative soil samples. A series of moisture contents were performed to develop soil moisture profiles at the boring locations and to aid in evaluating the uniformity of soil conditions. Plastic and liquid limit (Atterberg limits); and percentage passing number 200 sieve tests were performed on selected samples from the borings to confirm visual classification and to evaluate soil volume change potentials. The results of these tests are presented on the boring logs. As mentioned earlier that the relative densities of the soils were determined in the field by standard penetration.
**Review**

Descriptions of subsurface materials obtained in the field at the time the borings were drilled were modified in accordance with results of laboratory tests and visual examination in the laboratory. All recovered soil samples were examined and classified in accordance with ASTM D 2487, and described as recommended in ASTM D 2488 and the Unified Soil Classification procedures. Classification of the soils and finalized material descriptions are shown on the boring logs.

**GENERAL SUBSURFACE CONDITIONS**

**Stratigraphy**

The subsurface stratigraphy encountered within the depths of the test borings drilled for this study consisted of:

Tan/tan and brown CLAYEY SAND (SC) with gravel and hard rock fragments from existing ground surface elevation to the completion depths of test borings drilled.

It should be noted that increase in gravel and rock fragments were noted below 8 feet in test boring B-3 and remained in evidence to a depth of 10 feet.

Detailed descriptions of the subsurface stratigraphy encountered at the locations of the test borings drilled for this study are included on Plates 1 to 5 in the Illustrations section of this report.

**Subsurface Water Conditions**

All the borings were advanced using dry auger drilling procedures in order to observe any groundwater seepage levels. At the time of this investigation, NO subsurface groundwater seepage was encountered at any of the test borings drilled at the time of this study. It should be noted that future construction activities may alter the surface and subsurface drainage characteristics of the site. If there is a noticeable variation in the conditions reported herein, this office should be notified immediately so that a thorough review of the current design recommendations can be made. Based upon short-term observations, it is not possible to accurately predict the magnitude of subsurface water fluctuations that might occur. In addition, it is not uncommon to detect water seepage occurring in soils within the fractures, particularly after periods of heavy rainfall.
ANALYSIS AND RECOMMENDATIONS

Construction Consultation and Monitoring

We recommend that GETI be given an opportunity to review the final design drawings and specifications to ensure that the recommendations provided in this report have been properly interpreted. Wide variations in soil conditions are known to exist between the boring locations. Furthermore, unanticipated variations in subsurface conditions may become evident during construction. During the excavation and foundation phases of the project, we recommend that a reputable Geotechnical Engineering firm be retained to provide construction surveillance services in order to 1) observe compliance with the geotechnical design concepts, specifications and recommendations, and 2) observe subsurface conditions during construction to verify that the subsurface conditions are as anticipated, based on the borings drilled for this investigation.

Soil Movement

The soils encountered at this site exhibited Plasticity Indices of 9 and 15. These type soils are considered as non to low expansive in nature. The magnitude of the moisture induced vertical movement was calculated using the Texas Department of Transportation method in conjunction with current moisture profile. Based on the aforementioned method, the potential vertical rise (PVR) at the locations of the test borings drilled is estimated to be less than one inch.

FOUNDATION RECOMMENDATIONS

Shallow Foundation

Based on the subsurface stratigraphy encountered at this site the structural load of the proposed “Family Dollar” can be supported by shallow foundation/spread footing.

The spread footings should be placed at a minimum depth of 3 feet from finished ground surface elevation. The bearing capacity of 4,000 psf can be used for the natural soils at 3 feet depth.

We recommend that each foundation excavation should be evaluated by a geotechnical engineer to ensure that the foundation bears within hard stratum and is free of any loose materials.
Grade Beams and Floor Slab - In conjunction with shallow foundation system, ground supported grade beam and floor slab can be used at this site. Provided:

- All the loose soils should be removed until hard stratum is encountered. The exposed surface should be compacted to 95 and 100 percent of the maximum dry density as per ASTM D 698 with the moisture content between optimum and three points above optimum.
- The foundation is designed to resist the anticipated vertical movement.
- Additional fill soil if is required should consist of soils with plasticity index between 4 and 15 or flex base (TxDOT 247) should be used. On site soils can also be used provided no rock larger than 4 inches are present within the fill soils.

Grade beams should be structurally connected into spread footing. The grade beam and slab should be designed to provide sufficient rigidity to the foundation system. The beam should be minimum of 12 inches wide and 24 inches deep. A net allowable soil bearing pressure of 2,000 psf for compacted and tested natural soils. A moisture barrier of polyethylene sheeting or similar material should be placed between the slab and the subgrade soils to retard moisture migration through the slab. Proper drainage away from the building pad is of the utmost importance.

Building Pad Preparation

Prior to the placement of any fill material, all existing vegetation (if any) and loose soils should be removed until hard stratum is encountered. The exposed surface should then be scarified to a minimum depth of 6 inches, watered as required and compacted to 95 to 100 percent of the maximum dry density, moisture contents should be between -1 to +3 percentage points above optimum.

Subsurface soils can create pumping action if the in-situ moisture content increase above 4 points above optimum, due to such nature of the soils present at this site, cement stabilization may be required in the event the soils become too wet (in order for proper workability) or too dry or to increase the bearing capacity of the soils.

Additional fill soil if is required then off-site select fill soils or on-site soils with the PI between 4 and 15 (provided no rock larger than 4 inches are present) should be used -or- flex base (TxDOT 247) material can also be used as fill. The off-site select fill should be placed in 6 to 8 inches loose lifts.
and compacted between 95 to 100 percent with moisture content between optimum and 3 percentage points above optimum. The flex base material should be compacted to a minimum of 98 percent of the maximum dry density with the moisture content between -2 to +3 of optimum moisture as per ASTM D 698. Each lift should be compacted between 95 and 100 percent of the maximum dry density as defined in ASTM D 698. Field density tests should be taken at a rate of one test at every 2,500 square feet, per lift, a minimum of 3 tests per lift in the area of all compacted fill. For areas where hand tamping is required, the testing frequency should be increased to approximately one test per lift, per 100 linear feet of area.

Select Fill

"Select fill," as referred to in this report, should consist of clayey sands free of organic materials and have a Plasticity Index between 6 and 18, a Liquid Limit of 35 or less, and between 25 and 45 percent passing a No. 200 sieve. Placement and compaction of the select fill should be performed in accordance with the "Building Pad Preparation" section of this report. The provision of the subsurface drainage system will be required in areas where the select fill is placed below the surrounding ground surface.

Flex Base

TXDOT 247

PAVING RECOMMENDATIONS

General

Specific wheel loading and traffic volume characteristics were not available at the time of this investigation. However, based on assumed loading conditions, we have developed the following Portland Cement Concrete Pavement design sections for use at this site:

<table>
<thead>
<tr>
<th></th>
<th>Thickness (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Traffic</td>
<td></td>
</tr>
<tr>
<td>Portland Cement Concrete</td>
<td>5</td>
</tr>
<tr>
<td>Compacted Subgrade</td>
<td>6</td>
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<tr>
<td>Heavy Traffic</td>
<td></td>
</tr>
<tr>
<td>Portland Cement Concrete</td>
<td>6</td>
</tr>
<tr>
<td>Compacted Subgrade</td>
<td>6</td>
</tr>
</tbody>
</table>
Prior to the placement of any fill material, all existing vegetation (if any) and loose soils should be removed until hard stratum is encountered. The exposed surface should then be scarified to 6 inches, watered as required and compacted to 95 to 100 percent of the maximum dry density. Moisture contents should be between -1 to +3 percentage points above optimum.

On-site soils can be used if additional fill is required. However, as mentioned earlier that rock size should not be greater than 4 inches in diameter. The fill soils should be placed and compacted as per the procedure outlined in the Building Pad Preparation Section of this report.

Design of the concrete pavement should specify a minimum 28-day concrete compressive strength of 3,000 psi with 4 to 6 percent entrained air. The concrete should be placed within one and one half hours of batching. During hot weather, concrete placement should follow ACI 311 Hot Weather concreting. In no case should concrete temperatures exceed 95°F. Consideration should be given to limiting concrete placement to that time of day, which will minimize large differences in the ambient and concrete temperature. Use of superplasticizer should be considered to improve the concrete workability without increasing water cement ratio.

Pavements with sealed joints on 15 to 20-foot spacings cut to a depth of at least one-quarter of the pavement thickness, generally exhibit less uncontrolled post-construction cracking than pavements with wider spacings. Expansion joints should be used wherever the pavement is going to abut some type of structural fixture that was designed to undergo a different level of movement than the pavement (e.g. light poles, retaining walls, existing pavement, stairways, entryway piers, building walls, or manholes). The construction and expansion joints should be inspected periodically and resealed, if necessary. The loading dock and heavy traffic drive way should be reinforced using at least No. 3 bars, 24 inches on center.

Site Grading and Drainage

All grading should provide positive drainage away from the proposed structures, and should prevent water from collecting or discharging near the foundations. Water must not be permitted to pond adjacent to the structures during or after construction.

Surface drainage gradients should be designed to divert surface water away from the buildings and edges of pavements and towards suitable collection and discharge facilities. Unpaved areas and permeable surfaces should be provided with steeper gradients than paved areas. Pavement drainage gradients within 5 feet of buildings should be constructed with a minimum
slope of one inch per foot to prevent negative drainage gradients (ponding water conditions) from developing due to differential upward pavement movements. Sidewalk drainage gradients should be along maximum slopes allowed by local codes.

Roofs should be provided with gutters and downspouts to prevent the discharge of rainwater directly onto the ground adjacent to the building foundations. Downspouts should not discharge into any landscaped bed near the foundations. Downspouts should discharge directly into storm drains or drainage swales, if possible. Roof downspouts and surface drain outlets should discharge into erosion-resistant areas, such as paving or rock riprap. Recessed landscaped areas filled with pervious sandy loam or organic soil should not be used near the foundation. Landscaped beds should be elevated above a compacted and well-graded clay surface. Sealed planters are preferred. All trees should be a minimum of one-half their mature height away from the building or pavement edges to reduce potential moisture losses. Water permitted to pond in planters, open areas, or areas with unsealed joints next to structures can result in on-grade slab or pavement movements, which exceed those indicated in this report.

Exterior sidewalks and pavements will be subject to some post-construction movement as indicated in this report. These potential movements should be considered during preparation of the grading plan. Flat grades should be avoided. Where concrete pavement is used, joints should be sealed to prevent the infiltration of water. Some post-construction movement of pavement and flatwork may occur. Particular attention should be given to joints around the building. These joints should be periodically inspected and resealed where necessary.

CLOSURE

Subsurface conditions were obtained only from the boring locations noted. It should be understood that variations in the subsurface conditions were encountered at the boring locations, and as such, further variations may exist between the boring locations. Subsurface conditions varying from those found at the boring locations may be present because of, among other factors, soil moisture variations, fill placement and naturally occurring variations in soil properties.

The soil stratigraphy described herein and on the boring logs is based on visual observations and interpretations during sampling and classification of the soil samples. Boring and laboratory data
presented was developed solely for the preparation of this report. We are not responsible for interpretation or use of this data for purposes beyond the stated scope of this report.
ILLUSTRATIONS
Proposed FAMILY DOLLAR STORE
S. Mesa Hills Drive & Cabaret Drive
El Paso, Texas

GEOSCIENCE, Inc.
# LOG OF BORING NO. B-1

**Proposed "Family Dollar Store"**  
S. Mesa Hills Drive & Cabaret Drive  
El Paso, Texas  

**Project No. 16-DG8337**

## Field Data

<table>
<thead>
<tr>
<th>Depth (ft.)</th>
<th>Soil &amp; Rock</th>
<th>Sample Type</th>
<th>Sample Symbol</th>
<th>Stratum Depth</th>
<th>Remarks</th>
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<tr>
<td>0</td>
<td>N50</td>
<td>TUBESAMPLE</td>
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<td></td>
<td>Tan CLAYEY SAND (SC) with gravel &amp; rock fragments</td>
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<tr>
<td>5</td>
<td>N70</td>
<td>AUGER</td>
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<td>N62</td>
<td>AUGER</td>
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**Location:** See Location Plan  
**Drilling Method:** CFA  
**Date Boring Drilled:** 10/03/2016  
**Completion Depth:** 15  
**Groundwater Information:**  
Seepage Encountered During Drilling: None  
Upon Completion: Dry

## Laboratory Data

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<tr>
<th>Water Content, %</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plasticity Index</th>
<th>Unit Dry Weight (PCF)</th>
<th>Unconfined Strength</th>
<th>% Passing No. 200</th>
<th>Soil Suction Test (Total cm. of Water)</th>
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</table>

## Remarks

- Tube Sample  
- Auger Sample  
- Split-Spoon  
- Rock Core  
- THD Cone Pen.  
- No Recovery
Location: See Location Plan

Surface Elevation: Unknown

Drilling Method: CFA

Date Boring Drilled: 10/03/2016

Completion Depth: 15

Groundwater Information:
Seepage Encountered During Drilling: None
Upon Completion: Dry

Tan and brown CLAYEY SAND (SC) with gravel & rock fragments

Recommendation: Proceed with caution due to the presence of gravel and rock fragments.
### LOG OF BORING NO. B-3

#### Proposed "Family Dollar Store"
S. Mesa Hills Drive & Cabaret Drive
El Paso, Texas
Project No. 16-DG8337

<table>
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<th>FIELD DATA</th>
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<td>Drilling Method:</td>
<td>CFA</td>
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<td>Date Boring Drilled:</td>
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<td>Completion Depth:</td>
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<td>Seepage Encountered During Drilling:</td>
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<tr>
<td>Upon Completion:</td>
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#### DESCRIPTION OF STRATUM

- **Depth**: 0 ft.
- **Soil & Rock Symbol**: N78
- **Sample Type**: Hand Pen.
- **Soil & Rock**: Tan CLAYEY SAND (SC) with gravel & rock fragments

- **Depth**: 5 ft.
- **Soil & Rock Symbol**: N66
- **Sample Type**: Hand Pen.

- **Depth**: 10 ft.
- **Soil & Rock Symbol**: N33
- **Sample Type**: Hand Pen.

- **Depth**: 15 ft.
- **Soil & Rock Symbol**: N36
- **Sample Type**: Hand Pen.

- **Depth**: 15 ft.
- **Soil & Rock Symbol**: N28
- **Sample Type**: Hand Pen.

- **Depth**: 0 to 15 ft.
- **Remarks**: Increase in gravel & rock fragments to 10'

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<thead>
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<tr>
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<th>UNIT DRY WEIGHT (PCF)</th>
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<table>
<thead>
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<th>% PASSING NO. 200 SIEVE</th>
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<table>
<thead>
<tr>
<th>SOIL SUCTION TEST (TOTAL CM. OF WATER)</th>
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<tr>
<td>26</td>
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Geoscience Engineering & Testing

Plate 3
# LOG OF BORING NO. B-4

**Proposed "Family Dollar Store"**  
S. Mesa Hills Drive & Cabaret Drive  
El Paso, Texas  

**Project No. 16-DG8337**

<table>
<thead>
<tr>
<th>FIELD DATA</th>
<th>LABORATORY DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location:</strong> See Location Plan</td>
<td><strong>Location:</strong> See Location Plan</td>
</tr>
<tr>
<td><strong>Drilling Method:</strong> CFA</td>
<td><strong>Drilling Method:</strong> CFA</td>
</tr>
<tr>
<td><strong>Date Boring Drilled:</strong> 10/03/2016</td>
<td><strong>Date Boring Drilled:</strong> 10/03/2016</td>
</tr>
<tr>
<td><strong>Completion Depth:</strong> 15</td>
<td><strong>Completion Depth:</strong> 15</td>
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<tr>
<td><strong>Groundwater Information:</strong> None</td>
<td><strong>Groundwater Information:</strong> None</td>
</tr>
<tr>
<td><strong>Upon Completion:</strong> Dry</td>
<td><strong>Upon Completion:</strong> Dry</td>
</tr>
</tbody>
</table>

## DESCRIPTION OF STRATUM

<table>
<thead>
<tr>
<th>STRATUM DEPTH (FT.)</th>
<th>DESCRIPTION OF STRATUM</th>
<th>WATER CONTENT, %</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>UNIT DRY WEIGHT (PCF)</th>
<th>UNCONFINED STRENGTH (TSF)</th>
<th>% PASSING NO. 200 SIEVE</th>
<th>SOIL SUCTION TEST (TOTAL CM. OF WATER)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Tan and brown CLAYEY SAND (SC) with gravel &amp; rock fragments</td>
<td>6</td>
<td>30</td>
<td>25</td>
<td>10</td>
<td>38</td>
<td></td>
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<tr>
<td>5</td>
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<td>15</td>
<td>10</td>
<td>38</td>
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<td></td>
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## REMARKS:

<table>
<thead>
<tr>
<th>TUBE SAMPLE</th>
<th>AUGER SAMPLE</th>
<th>SPLIT-SPOON</th>
<th>ROCK CORE</th>
<th>THD CONE PEN.</th>
<th>NO RECOVERY</th>
</tr>
</thead>
</table>

Geoscience Engineering & Testing
# LOG OF BORING NO. B-5

## Proposed "Family Dollar Store"
S. Mesa Hills Drive & Cabaret Drive
El Paso, Texas

**Project No. 16-DG8337**

<table>
<thead>
<tr>
<th>FIELD DATA</th>
<th>LABORATORY DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location:</td>
<td>See Location Plan</td>
</tr>
<tr>
<td>Drilling Method:</td>
<td>CFA</td>
</tr>
<tr>
<td>Date Boring Drilled:</td>
<td>10/03/2016</td>
</tr>
<tr>
<td>Completion Depth:</td>
<td>5</td>
</tr>
<tr>
<td>Groundwater Information:</td>
<td>Seepage Encountered During Drilling: None</td>
</tr>
<tr>
<td>Upon Completion:</td>
<td>Dry</td>
</tr>
</tbody>
</table>

### DESCRIPTION OF STRATUM

<table>
<thead>
<tr>
<th>DEPTH (FT.)</th>
<th>SOIL &amp; ROCK SYMBOL</th>
<th>SAMPLE TYPE</th>
<th>SAMPLE NO.</th>
<th>TUBESAMPLE</th>
<th>AUGER SAMPLE</th>
<th>AVERAGE TUBES</th>
<th>AVERAGE AUGER</th>
<th>THD CONE PEN.</th>
<th>REMARKS</th>
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</thead>
<tbody>
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</tbody>
</table>

### FIELD DATA

- **Depth (ft.):** 0, 5, 10, 15, 20, 25, 30
- **Soil & Rock Symbol:** N80, N78
- **Sample Type:** TUBESAMPLE, AUGER SAMPLE
- **Remarks:**
  - TUBE SAMPLE
  - AUGER SAMPLE
  - SPLIT-SPOON
  - ROCK CORE
  - THD CONE PEN.
  - NO RECOVERY

### LABORATORY DATA

- **Water Content (%):** 4
- **Liquid Limit:** 26
- **Plastic Limit:** 16
- **Plasticity Index:** 10
- **Unit Dry Weight (PCF):** 45
- **Unconfined Strength (TSF):** 3

**Location:** See Location Plan

**Surface Elevation:** Unknown

**Drilling Method:** CFA

**Date Boring Drilled:** 10/03/2016

**Completion Depth:** 5

**Groundwater Information:**
- Seepage Encountered During Drilling: None
- Upon Completion: Dry

**Soil SUCTION Test (Total CM. of Water):**

- **WATER CONTENT, %:** 4
- **LIQUID LIMIT:** 26
- **PLASTIC LIMIT:** 16
- **PLASTICITY INDEX:** 10
- **UNIT DRY WEIGHT (PCF):** 45
- **UNCONFINED STRENGTH (TSF):** 3
- **% PASSING NO. 200 SIEVE:**
- **SOIL SUCTION TEST (TOTAL CM. OF WATER):**

**Geoscience Engineering & Testing**

Plate 5