Geotechnical Engineering Report

Enzian Theater Addition
1300 S. Orlando Avenue
Maitland, Orange County, Florida

Revised January 28, 2014
Terracon Project No. H1135233

Prepared for:
H. J. High Construction Company
Orlando, Florida

Prepared by:
Terracon Consultants, Inc.
Winter Park, Florida

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Geotechnical ■ Environmental ■ Construction Materials ■ Facilities

Revised January 28, 2014

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Attn: Mr. Robert J. High, President
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Re: Geotechnical Engineering Report
Enzian Theater Addition
1300 S. Orlando Avenue
Maitland, Orange County, Florida
Terracon Project Number: H1135233

Dear Mr. High:

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above referenced project. This study was performed in general accordance with our proposal number PH1130918 dated December 13, 2013.

This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork, the design and construction of foundations and pavements, and stormwater management design parameters and lateral earth pressures for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.
Certificate of Authorization Number 8830

Brendan S. O'Brien, P.E.
Senior Geotechnical Engineer
Florida PE #52047

Bruce H. Woloshin, P.E.
Principal

Enclosures

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EXECUTIVE SUMMARY

Geotechnical exploration has been performed for the proposed addition to be constructed to the Enzian Theater, located at the northeast corner of US 17/92 / Orlando Avenue and Magnolia Road in Maitland, Orange County, Florida. Nine (9) borings, designated B-1 through B-9, have been performed to depths of between 6 and 25 feet below the existing ground surface in the proposed building, pavement, and stormwater management areas.

Based on the information obtained from our geotechnical exploration, it appears that the site can be developed for the proposed project. The following geotechnical considerations were identified:

- The site appears to slope to the north. Terracon anticipates up to 9 feet of fill may be necessary. Lateral earth pressures included in this report assume the retained soil placed beneath the proposed addition floor slab meets the material specifications in this report.

- The proposed structure may be supported on shallow foundations bearing on the existing site soil or on newly placed engineered fill.

- Assuming proper site preparation, total and differential settlement should be within the structural engineer's specifications.

- The in-place sands appear suitable for re-use as general engineered fill. In-place silty sands and clayey sands may have limited application for re-use as fill

- Stormwater runoff will be routed to a retention pond at the northeast corner of the site and to an underground exfiltration system beneath the front parking lot.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

GEOTECHNICAL ENGINEERING REPORT
ENZIAN THEATER ADDITION
1300 S. ORLANDO AVENUE
MAITLAND, ORANGE COUNTY, FLORIDA

Terracon Project No. H1135233
Revised January 28, 2014

1.0 INTRODUCTION

This geotechnical engineering report has been prepared for the proposed addition to be constructed to the Enzian Theater, located at the northeast corner of US 17/92 / Orlando Avenue and Magnolia Road in Maitland, Orange County, Florida as shown on the Topographic Vicinity Map included as Exhibit A-1 in Appendix A. Nine (9) soil borings, designated B-1 through B-9 were performed to depths of between 6 and 25 feet below the existing ground surface within the areas of the proposed building, pavement, and stormwater management features. Logs of the borings along with a Boring Location Diagram (Exhibit A-4) are included in Appendix A of this report. Laboratory testing procedures are included in Exhibit B-1 in Appendix B.

The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- soil conditions
- groundwater conditions
- earthwork
- stormwater management design parameters
- foundation design and construction
- pavement design and construction
- floor slab design and construction
- lateral earth pressures

2.0 PROJECT INFORMATION

2.1 Project Description

Item	Description
Site layout	The proposed addition will be along the rear/east and left/north sides of the existing building. An underground exfiltration system will be installed beneath the north portion of the existing parking lot. A retention pond will be reconfigured off the northwest corner of the expanded building. Newly reconfigured pavement will be constructed at the southeast corner of the property, off the southeast corner of the building.

Item	Description
Structure	The project will include a 19,500-square foot, two-story addition to the existing 7,150-square foot building.
Building Construction	Masonry block load-bearing walls or concrete tilt panels with structural steel joists and decking (assumed).
Finished floor elevation	Equivalent to existing building (assumed), about +83.5 feet (per preliminary grading plan [1]).
Maximum loads	Columns: 220 kips (given [1]) Walls: 6 kips per linear foot (given [1]) Slabs: 150 psf (assumed)
Maximum allowable settlement	Columns: 1 inch total (given [1]) Walls: ½ inch (given [1]) over 40 feet
Grading	Fill – estimated at up to 9 feet. Cuts – not anticipated.
Design traffic	Standard duty: 30,000 E_{18}SALs (assumed [2]) Heavy duty: 50,000 E_{18}SALs (assumed [2])
Stormwater Management	Stormwater runoff will be accommodated by an underground exfiltration system beneath the front parking lot and a reconfigured open retention pond off the northeast corner of the expanded building.

1. Per Will Braswell, P.E., of BBM.
2. Pavement design to be based on the indicated total number of 18-kip equivalent single axle load repetitions (E18SALs) over a 20-year design life.

2.2 Site Location and Description

Item	Description
Location	The project is located at the northeast corner of the intersection of Orlando Avenue/US 17/92 and Magnolia Road in Orlando, Orange County, Florida. The site is defined by Parcel ID #36-21-29-0000-00-121 by the Orange County Property Appraiser's web site.
Current ground cover	Existing building, asphalt pavement, grass, and trees.
Existing topography	The site generally slopes to the north, towards the drainageway connecting Park Lake (to the west) to Lake Maitland (to the east), from site grades of about +85 feet to about +75 feet NGVD29 (per USGS topographic quadrangle map "Orlando East, Florida").
Surface Water	The USGS topographic quadrangle map "Orlando East, Florida" depicts a drainageway along the north side of the site, connecting Park Lake (water level of elevation +70 feet) to the west to Lake Maitland (water level of elevation +66 feet) to the east.

3.0 SUBSURFACE CONDITIONS

3.1 Geology

3.1.1 Regional Geology

According to Water Resources of Orange County, Florida, Florida Geologic Survey (FGS) Report of Investigation (RI) 50 (Lichtler, Anderson, and Joyner, 1968), the lithology of the site vicinity generally consists of undifferentiated interbedded sand and clay, underlain by interbedded sand and marl belonging to the Hawthorn Formation (since upgraded to Group status), in turn underlain by the Ocala Group limestone. FGS RI 50 discusses deeper formations; however, the deeper formations are not considered relevant to this study and are not summarized herein. As interpreted from Cross Section A-A' of Figure 6 of RI 50, the undifferentiated sand and clay extend to about 40 feet above mean sea level and the Hawthorn Group extends to about 10 feet below mean sea level.

3.1.2 General Potential For Sinkhole Development

Sinkhole development occurs in Florida and varies geographically from areas with almost no potential or a very low potential to areas with a high potential where sinkholes occur frequently. The subject property is located in Area III, near the border of Area II on the United States Geological Survey map entitled "Sinkhole Type, Development, and Distribution in Florida". The cover (over limestone bedrock) in Area III is between 30 to 200 feet thick and is generally cohesive clayey sediments of low permeability. The cover (over limestone bedrock) in Area II is between 30 to 200 feet thick and is predominantly sandy. Sinkholes are most numerous, of varying size, and develop abruptly in Area III. Sinkholes are few, shallow, and of small diameter and develop gradually in Area II. The risk of sinkhole occurrence at most sites is small even in areas known to have a higher than average risk of sinkhole occurrence.

A review of the Florida Geologic Survey's sinkhole database (updated May 6, 2013) reveals three reported sinkholes within one mile of the subject site. It should be noted that the number of sinkholes is based on information reported to the FGS and does not necessarily reflect the number of sinkholes confirmed by public or private industry.

During our limited evaluation, we did not encounter traditional signs associated with potential sinkhole development including loss of drilling fluids, obvious raveled zones, surface depressions, etc. However, this evaluation was not planned to specifically address sinkhole potential.

If the sinkhole potential of the site is to be evaluated, additional site-specific data must be obtained. This might include using geophysical methods such as Electrical Resistivity tests and additional geotechnical tests such as Cone Penetrometer Test (CPT) soundings, dilatometer

(DMT) soundings, and/or more/deeper Standard Penetration Test borings. Interpretation of the test data should be done by a professional geologist/engineer familiar with the use of these tests under local conditions. However, it should be noted that even if indicators of sinkhole activity are found, it is impossible to predict if, when or precisely where a sinkhole may occur. If requested, Terracon can assist in assessing the sinkhole potential of the location of the proposed construction.

3.2 Soil Survey

The Soil Survey of Orange County, Florida as prepared by the United States Department of Agriculture (USDA), Soil Conservation Service (SCS; later renamed the Natural Resource Conservation Service - NRCS), dated August 1989, identifies the soil type at the subject site as Candler-Urban land complex, 0 to 5 percent slopes. It should be noted that the Soil Survey is not intended as a substitute for site-specific geotechnical exploration; rather it is a useful tool in planning a project scope in that it provides information on soil types likely to be encountered. Boundaries between adjacent soil types on the Soil Survey maps are approximate (included in Appendix as Exhibit A-2). A description of the mapped soil unit is included in Appendix A as Exhibit A-3.

3.3 Typical Profile

Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/ Density
Surface Course [1]	1 inch to 2 inches thick	Asphalt	N/A
Base Course [1]	3½ inches to 4 inches thick	Limerock	N/A
1	6	Fine sand with silt, trace of limerock fragments (FILL [2])	Loose to medium dense
2	2 to 5½	Fine sand with silt	Very loose to medium dense
3	8 to at least 15	Fine sand	Loose to medium dense
4	18½	Clayey sand to fine sand with clay	Loose to medium dense
5	At least 25 feet	Fine sand	Medium dense

1. Borings B-5, B-6, B-8 and B-9 were located in existing pavement.
2. Fill was only specifically delineated in Boring B-1.

Minor variations were noted among individual borings from the preceding generalized profile such as Stratum 3 was absent from Borings B-8 and B-9, Stratum 4 was not encountered in every boring extending to that depth range. Conditions encountered at each boring location and results of laboratory testing are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Details for each of the borings can be found on the boring logs in Appendix A of this report. Descriptions of our field exploration are included as Exhibit A-5 in Appendix A. Descriptions of our laboratory testing procedures are included as Exhibit B-1 in Appendix B. General notes for SPT borings can be found in Exhibit C-1. A more detailed description of the Unified Soil Classification System (USCS) is included as Exhibit C-2 in Appendix C.

3.4 Groundwater

The boreholes were observed during drilling for the presence and level of groundwater. Groundwater was observed in all of the borings except B-4, B-8, and B-9, between depths of 6½ and 9½ feet below existing grade. Borings B-8 and B-9 only extended to a depth of 6 feet. Groundwater was not encountered within a depth of 10 feet in Boring B-4, at which point bentonite slurry ("drillers' mud") was added to stabilize the hole, obscuring further groundwater readings. Longer term monitoring in cased holes or piezometers, possibly installed to greater depths than explored under this project scope, would be required to better define groundwater conditions at the site.

It should be recognized that fluctuations of the groundwater table will occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the boring was performed. In addition, perched water can develop within higher permeability soils overlying less permeable soils. Therefore, groundwater levels during construction or at other times in the future may be higher or lower than the levels indicated on the boring logs.

We estimate that during the normal wet season (typically June through October) with rainfall and recharge at a maximum, groundwater levels will be about 5 to 9 feet below the existing grade, excluding Borings B-8 and B-9. Our estimates of the seasonal groundwater conditions are based on the USDA Soil Survey, the encountered soil types, and the encountered water levels. The estimated normal seasonal high groundwater tables are included in the following table:

Boring No.	Approximate depth to encountered water table (feet)	Approximate depth to estimated normal seasonal high groundwater table (feet)
B-1	6½	5
B-2	8	7
B-3	9½	8
B-4	NE @ 10	9
B-5	6½	5
B-6	6	5
B-7	8	7
B-8	NE	NA
B-9	NE	NA

These seasonal water table estimates do not represent the temporary rise in water table that occurs immediately following a storm event, including adjacent to other stormwater management facilities. This is different from static groundwater levels in wet ponds and/or drainage canals which can affect the design water levels of new, nearby ponds. The actual water table may vary from normal when affected by extreme weather changes, localized or regional flooding, karst activity, future grading, drainage improvements, or other construction that may occur on our around the site following the date of this report.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

Borings encountered native sand with some mid-depth clayey sand. These materials are generally suitable for construction of the proposed foundations, floor slabs, pavements, and stormwater management systems following the recommended Earthwork portions of this report.

Seasonal high groundwater levels should be considered in the civil engineering design for site grading, utility construction, and pavements.

Shallow foundations bearing on natural sands or engineered fill are recommended for support of the proposed building. The engineered fill should be placed as outlined in Section 4.2, **Earthwork,** of this report.

We recommend that the exposed subgrade be thoroughly evaluated after stripping of any topsoil and creation of all cut areas, but prior to the start of structural fill operations (if any). We

recommend that Terracon be retained to evaluate the satisfactory preparation of the bearing material for the pavements, foundations, and floor slab subgrade soils. Subsurface conditions, as identified by the field and laboratory testing programs, have been reviewed and evaluated with respect to the proposed building plans known to us at this time.

Design and construction recommendations for foundation systems and other earth connected phases of the project are outlined below.

4.2 Earthwork

4.2.1 Site Preparation

Prior to placing any fill, all vegetation, topsoil, existing pavement that will not be replaced (including that over the proposed exfiltration system) and any otherwise unsuitable material should be removed from the construction areas. Wet or dry material should either be removed or moisture conditioned and re-compacted. After stripping and grubbing and achieving cut grades, the exposed surface should be compacted as recommended in the following sections. Because the proposed addition abuts the existing building, compaction should be performed with static equipment or hand-operated vibratory equipment (not vibratory roller). Unstable soil (pumping) should be removed or moisture conditioned and compacted in place prior to placing fill.

Where fill is placed on existing slopes, we recommend that fill slopes be over filled and then cut back to develop an adequately compacted slope face. Slopes should be provided with appropriate erosion protection.

4.2.2 Material Requirements

Compacted structural fill should meet the following material property requirements:

Fill Type [1]	USCS Classification	Acceptable Location for Placement	Maximum Lift Thickness (in.)
General [1]	SP (fines content < 5%)	All locations and elevations	12[2]
	SP-SM (fines content between 5 and 12%)	All locations and elevations away from stormwater management features, except strict moisture control will be required during placement, particularly during the rainy season.	8 to 12[2]

1. Controlled, compacted fill should consist of approved materials that are free of organic matter and debris.
2. Loose thickness when heavy compaction equipment is used in vibratory mode. Lift thickness should be decreased if static compaction is being used, typically to no more than 8 inches, and the required compaction must still be achieved. Use 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is required.

4.2.3 Compaction Requirements

Item	Description
Minimum Compaction Requirements [1]	95 percent of the material's maximum modified Proctor dry density (ASTM D 1557).
Moisture Content[2]	Within ±2 percent of optimum moisture content as determined by the Modified Proctor test, at the time of placement and compaction.
Minimum Testing Frequency	One field density test per 20,000 square feet or fraction thereof per 1-foot lift.

1. We recommend that engineered fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled.

4.2.4 Utility Trench Backfill

All trench excavations should be made with sufficient working space to permit construction including backfill placement and compaction. Utility trenches are a common source of water infiltration and migration. All utility trenches that penetrate beneath the building should be backfilled with native soils to avoid creating a preferred flow path through the trenches.

4.2.5 Grading and Drainage

Final surrounding grades should be sloped away from the structure on all sides to prevent ponding of water. Gutters, downspouts, or other appropriate methods that direct water a minimum of 10 feet beyond the footprint of the proposed structures are recommended. Site grades should be set considering the estimated seasonal high groundwater presented in Section 3.4.

4.2.6 Earthwork Construction Considerations

After initial proofrolling and compaction, unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of floor slabs and pavements. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and re-compacted prior to floor slab and pavement construction.

Trees or other vegetation whose root systems have the ability to remove excessive moisture from the subgrade and foundation soils should not be planted next to the structure. Trees and shrubbery should be kept away from the exterior edges of the foundation element a distance at least equal to 1.5 times their expected mature height.

As a minimum, all temporary excavations should be sloped or braced as required by Occupational Health and Safety Administration (OSHA) regulations to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The grading contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proof-rolling; placement and compaction of controlled compacted fills; backfilling of excavations into the completed subgrade, and just prior to construction of building floor slabs.

4.3 Foundations

In our opinion, the proposed building addition can be supported by a shallow foundation system bearing on native soil or newly placed fill extending to native soil. Design recommendations for shallow foundations for the proposed structure are presented in the following sections.

4.3.1 Foundation Design Recommendations

Description	Column Footing	Wall Footing	Monolithic Slab Foundation [4]
Net allowable bearing pressure [1]	2,000 psf	2,000 psf	2,000 psf
Minimum width	30 inches	18 inches	12 inches
Minimum embedment below finished grade [2]	18 inches	18 inches	12 inches
Compaction requirements	95 percent of the materials maximum Modified Proctor dry density for a depth of 12 inches below footing.		
Minimum Testing Frequency	One field density test per footing for a minimum depth of 1 foot below the footing subgrade.	One field density test per 50 linear feet for a minimum depth of 1 foot below the footing subgrade.	One field density test per 50 linear feet for a minimum depth of 1 foot below the footing subgrade.
Approximate total settlement [3]	≤1 inch	≤1 inch	≤1 inch

Description	Column Footing	Wall Footing	Monolithic Slab Foundation [4]
Estimated differential settlement [3]	≤½ inch between columns	≤½ inch over 40 feet	≤½ inch over 40 feet

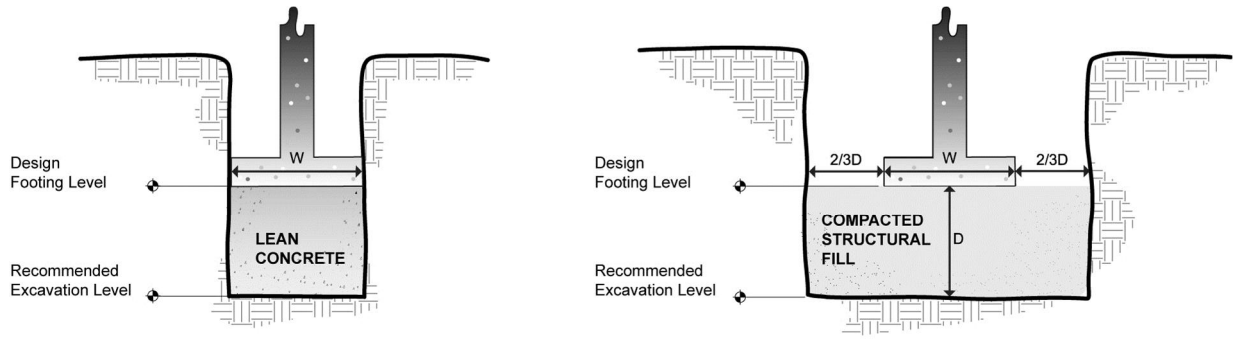
1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes any unsuitable fill or soft soils, if encountered, will be undercut and replaced with engineered fill.
2. For erosion protection and to reduce effects of seasonal moisture variations in subgrade soils.
3. The foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations. The above settlement estimates have assumed that the maximum footing width is 10.5 feet for column footings and 3 feet for continuous footings.
4. Turned-down portion of slab. For slab requirements see Section 4.5.1.

4.3.2 Foundation Construction Considerations

The base of all foundation excavations should be free of water and loose soil and debris prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Should the soils at bearing level become excessively dry, disturbed or saturated, the affected soil should be removed or moisture conditioned and re-compacted prior to placing concrete. Place a lean concrete mud-mat over the bearing soils if the excavations must remain open over night or for an extended period of time. It is recommended that the geotechnical engineer be retained to observe and test the soil foundation bearing materials.

If unsuitable bearing soils are encountered in footing excavations, the excavations should be extended deeper to suitable soils and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. The footings could also bear on properly compacted backfill extending down to the suitable soils. Overexcavation for compacted backfill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of overexcavation depth below footing base elevation. The overexcavation should then be backfilled up to the footing base elevation with granular material placed in lifts of 6 inches or less in loose thickness and compacted to at least 95 percent of the material's modified effort maximum dry density (ASTM D-1557). The overexcavation and backfill procedures are described in the figures below. Compaction tests should be performed at a frequency of 1 test per footing per 1-foot lift for square footings, and 1 test per 50 linear feet per 1-foot lift for wall or continuous footings.

The base of all foundation excavations should be free of water and loose soil prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Should the soils at bearing level become excessively dry, disturbed or saturated, the affected soil should be removed prior to placing concrete. It is recommended that Terracon be retained to observe and test the soil foundation bearing materials.



NOTE: Excavations in sketches shown vertical for convenience. Excavations should be sloped as necessary for safety.

4.4 Floor Slabs

4.4.1 Floor Slab Design Recommendations

Item	Description
Floor slab support	Free draining granular material meeting the general fill specification [1]
Modulus of subgrade reaction	100 pounds per square inch per inch (psi/in) for point loading conditions
Compaction requirements	95 percent of the materials maximum Modified Proctor dry density
Minimum Testing Frequency	One field density test per 2,500 square feet or fraction thereof for a depth of 12 inches. [2]

1. We recommend subgrades be maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become desiccated prior to construction of floor slabs, the affected material should be removed or the materials scarified, moistened, and recompacted. Upon completion of grading operations in the building areas, care should be taken to maintain the recommended subgrade moisture content and density prior to construction of the building floor slabs.
2. Density should be re-checked after utility construction.

Where appropriate, saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual.

The use of a vapor retarder should be considered beneath concrete slabs-on-grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer and slab contractor should refer to ACI and Florida Building Code (FBC) regarding moisture for procedures and cautions regarding the use and placement of a vapor retarder. We note that FBC requires a minimum of 6-mil polyethylene, which is typically

used in Florida. However, local requirements that might affect what moisture barrier may use should also be consulted.

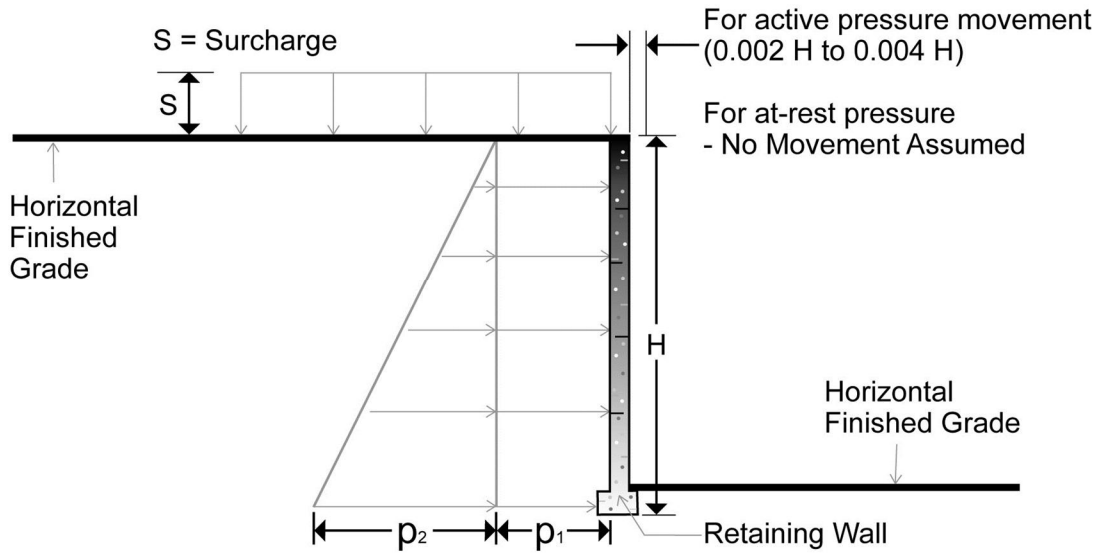
4.4.2 Floor Slab Construction Considerations

On most project sites, the site grading is generally accomplished early in the construction phase. We recommend the area underlying the floor slab be rough graded and then thoroughly proofrolled prior to final grading. However as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, the floor slab subgrade may not be suitable for placement of concrete and corrective action will be required.

Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the affected material with properly compacted fill. All floor slab subgrade areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to placement of concrete.

4.5 Lateral Earth Pressures

Reinforced concrete walls with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to those indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement, such as a basement wall that is structurally confined at both the top and bottom of the wall. Terracon anticipates much of the addition exterior, particularly along the north wall, will be supported by a stem wall, with existing grade backfilled up to interior floor slab level. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls.



Earth Pressure Coefficients

Earth Pressure Conditions	Coefficient for Backfill Type	Equivalent Fluid Density (pcf)	Surcharge Pressure, p_1 (psf)	Earth Pressure, p_2 (psf)
Active (Ka)	Granular - 0.33	40	(0.33)S	(40)H
At-Rest (Ko)	Granular - 0.46	55	(0.46)S	(55)H
Passive (Kp)	Granular - 3.0	360	---	---

Applicable conditions to the above include:

- Uniform surcharge, where S is surcharge pressure
- In-situ soil backfill weight a maximum of 120 pcf
- Horizontal backfill, compacted between 95 and 98 percent of modified Proctor maximum dry density
- Loading from heavy compaction equipment not included
- No hydrostatic pressures acting on wall
- No dynamic loading
- No safety factor included in soil parameters

Backfill placed against structures should consist of granular soils. For the granular values to be valid, the granular backfill must extend out from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively. To calculate the resistance to sliding, a value of 0.35 should be used as the ultimate coefficient of friction between the footing and the underlying soil.

To control hydrostatic pressure behind the wall we recommend that a drain be installed at the foundation wall with a collection pipe leading to a reliable discharge. If this is not possible, then

combined hydrostatic and lateral earth pressures should be calculated for lean clay backfill using an equivalent fluid weighing 90 and 100 pcf for active and at-rest conditions, respectively. For granular backfill, an equivalent fluid weighing 85 and 90 pcf should be used for active and at-rest, respectively. These pressures do not include the influence of surcharge, equipment or floor loading, which should be added. Heavy equipment should not operate within a distance closer than the exposed height of retaining walls to prevent lateral pressures more than those provided.

4.6 Pavements

4.6.1 Subgrade Preparation

Site grading is typically accomplished relatively early in the construction phase. Fills are placed and compacted in a uniform manner. However, as construction proceeds, excavations are made into these areas, rainfall and surface water saturates some areas, heavy traffic from concrete trucks and other delivery vehicles disturbs the subgrade and many surface irregularities are filled in with loose soils to temporarily improve ride comfort. As a result, the pavement subgrades, initially prepared early in the project, should be carefully evaluated as the time for pavement construction approaches.

We recommend the moisture content and density of the top 12 inches of the subgrade be evaluated and the pavement subgrades be proofrolled and tested within two days prior to commencement of actual paving operations. Compaction tests should be performed at a frequency of 1 test per 10,000 square feet or fraction thereof. Areas not in compliance with the required ranges of moisture or density should be moisture conditioned and recompacted. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are found should be repaired by removing and replacing the materials with properly compacted fills.

After proofrolling and repairing deep subgrade deficiencies, the entire subgrade should be scarified and prepared as recommended in Section 4.2, **Earthwork**, of this report to provide a uniform subgrade for pavement construction. Areas that appear severely desiccated following site stripping may require further undercutting and moisture conditioning. If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

4.6.2 Design Considerations

Traffic patterns and anticipated loading conditions were not available at the time that this report was prepared. However, we anticipate that traffic loads will be produced primarily by automobile traffic and occasional delivery and trash removal trucks. The thickness of pavements subjected to heavy truck traffic should be determined using expected traffic volumes, vehicle types, and vehicle loads and should be in accordance with local, city or county ordinances.

Pavement thickness can be determined using AASHTO, Asphalt Institute, PCA, and/or other methods if specific wheel loads, axle configurations, frequencies, and desired pavement life are provided. Terracon can provide thickness recommendations for pavements subjected to loads other than personal vehicle and occasional delivery and trash removal truck traffic if this information is provided. However, absent that data, we recommend the following minimum typical sections.

4.6.3 Estimates of Minimum Pavement Thickness

Typical Pavement Section (inches)						
Traffic Area	**Alternative**	**Asphalt Concrete Surface Course**	**Limerock, Soil-Cement or Crushed Concrete Base Course**	**Stabilized Subbase Course[2,3,4]**	**Portland Cement Concrete**	**Free Draining Subgrade**
Car Parking	PCC	--	--		5.0	18.0
	AC	1.5	6.0	12.0	--	--
Truck and Drive Areas	PCC	--	--		6.0	18.0
	AC	2.5	8.0	12.0	--	--
Trash Container Pad [1]	PCC	--	--		6.0	18.0

1. The trash container pad should be large enough to support the container and the tipping axle of the collection truck.
2. Often referred to as Stabilized Subgrade.
3. Use coarse granular materials such as recycled crushed concrete, shell, or gravel when seasonal high groundwater is within 4 feet of the profile grade. Clay stabilization is acceptable with deeper seasonal high groundwater.
4. Some municipalities do not require stabilized subbase beneath soil-cement base.

4.6.4 Asphalt Concrete Design Recommendations

The following items are applicable to asphalt concrete pavement sections.

- Terracon recommends a minimum separation of 12 inches for this purpose between the bottom of the base course and the seasonal high water table.
- Natural or fill subgrade soils to a depth of 18 inches below the base should be clean, free draining sands with a fines content passing a No. 200 sieve of 7 percent or less.
- Stabilized subgrade soils (also identified as stabilized subbase) should be stabilized to a minimum Limerock Bearing Ratio (LBR; Florida Method of Test Designation FM 5-515) value of 40 if they do not already meet this criterion, or modified/replaced with new compacted fill that meets the minimum LBR value. Although LBR testing has not been

performed, our experience with similar soils indicates that the near surficial sands encountered in the soil borings are unlikely to meet this requirement.

- The stabilized subgrade course should be compacted to at least 98 percent of the Modified Proctor maximum dry density (AASHTO T-180 or ASTM D-1557). Any underlying, newly-placed subgrade fill need only be compacted to a minimum of 95 percent of the Modified Proctor maximum dry density. Compaction tests should be performed at a frequency of 1 test per 10,000 square feet or fraction thereof.
- Limerock base courses from an approved FDOT source should have a minimum LBR value of 100, and be compacted to a minimum of 98 percent of the maximum dry density as determined by the Modified Proctor test. Limerock should be placed in uniform lifts not to exceed 6 inches loose thickness. Recycled limerock is not a suitable substitute for virgin limerock for base courses but may be used as a granular stabilizing admixture.
- Soil cement base courses typically experience shrinkage cracking due to hydration curing of the cement. This shrinkage cracking typically propagates through the overlying asphalt course and reflects in the pavement surface. This reflective cracking is not necessarily indicative of a pavement structural failure, though it is sometimes considered to be aesthetically undesirable.
- Soil cement bases should have 7-day design strength of 300 psi. Soil cement base should be compacted to a minimum of 98 percent of the material's maximum dry density as determined by the Standard Proctor Test for Soil Cement (AASHTO T-134). Higher design strengths may result in increased cracking.
- Crushed (recycled) concrete base should meet the current FDOT specification 204 modified for recycled materials (found at ftp://ftp.dot.state.fl.us/LTS/CO/Specifications/WorkBook/Jul2009/SP2040000.pdf)
- Asphalt should be compacted to a minimum of 95 percent of the design mix density. Asphalt surface courses should be Type SP, Type S, or other suitable mix design according to FDOT and local requirements.
- To verify thicknesses, after placement and compaction of the pavement courses, core the wearing surface to evaluate material thickness and composition at a minimum frequency of 5,000 square feet or two locations per day's production.
- Underdrains or strip drains should be considered along all landscaped areas in, or adjacent to pavements to reduce moisture migration to subgrade soils. Underdrains will also be required below pavement if the separation between the bottom of the base course and the seasonal high groundwater table is less than 1 foot. Orange County will require soil cement on all of the project roads if underdrains are required for high groundwater conditions.
- All curbing should be full depth. Use of extruded curb sections which lie on top of asphalt surface courses can allow migration of water between the surface and base courses, leading to rippling and pavement deterioration.

4.6.5 Portland Cement Concrete Design Recommendations

The following items are applicable to rigid concrete pavement sections.

- At least 18 inches of free-draining material should be included directly beneath rigid concrete pavement. Fill meeting the requirements presented in Section 4.2 (Earthwork) of this report may be considered free-draining for this purpose. Limerock should not be considered free draining for this purpose.
- The PCC should be a minimum of 4,000 psi at 28 days. PCC pavements are recommended for trash container pads and in any other areas subjected to heavy wheel loads and/or turning traffic.
- The upper 1 foot of rigid pavement subgrade soils should be compacted to at least 98 percent of the Modified Proctor maximum dry density (AASHTO T-180 or ASTM D-1557). Compaction tests should be performed at a frequency of 1 test per 10,000 square feet or fraction thereof.
- Rigid PCC pavements will perform better than ACC in areas where short-radii turning and braking are expected (i.e. entrance/exit aprons) due to better resistance to rutting and shoving. In addition, PCC pavement will perform better in areas subject to large or sustained loads. An adequate number of longitudinal and transverse control joints should be placed in the rigid pavement in accordance with ACI and/or AASHTO requirements. Expansion (isolation) joints must be full depth and should only be used to isolate fixed objects abutting or within the paved area.
- Adequate separation should be provided between the bottom of the concrete and the seasonal high water table. Terracon recommends that in no case should less than 1 foot of separation be provided. Based on the encountered conditions and anticipated development, we anticipate this requirement can be readily met.
- Sawcut patterns should generally be square or rectangular but nearly square, and extend to a depth equal to a quarter of the slab thickness.

4.6.6 Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. The subgrade and the pavement surface should have a minimum ¼ inch per foot slope to promote drainage. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the base layer.

4.6.7 Pavement Maintenance

The pavement sections provided in this report represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration, and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Preventive maintenance is usually the first priority when implementing a pavement maintenance program.

Additional engineering observation is recommended to determine the type and extent of a cost effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

4.7 Stormwater Management

Design of the stormwater management system has not been completed yet, though we understand a dry retention pond is planned off the northeast corner of the proposed building expansion and an underground exfiltration system is planned beneath the front parking lot. Dry retention ponds and underground exfiltration systems generally need to be at least 1 foot and sometimes as much as 3 feet (or more for large ponds) above the seasonal high water table to recover within the time required by the St. Johns River Water Management District (SJRWMD). Wide exfiltration bed systems typically require greater separation than narrow lines of exfiltration trenches.

The tested samples of anticipated underground exfiltration system subgrade soil and dry retention pond subgrade soil (from Borings B-6 and B-7, from between 4 and 6 feet below existing grade) had measured permeability rates of 34 feet/day and 38 feet/day, respectively. We consider these permeability rates to be indicative of a saturated horizontal permeability. Past experience and published references have indicated that unsaturated vertical permeability as used in some locally available groundwater models is typically two thirds of the saturated value. Also, it has been our experience that SJRWMD requires use of an appropriate factor of safety, generally reducing measured permeability rates or recovery time by a factor of safety of 2 for design of artificial recovery systems such and exfiltration trenches or underdrains, although this does not presently apply to ponds recovering by infiltration. Therefore, we recommend using an unsaturated vertical infiltration rate, k_V, of 11 feet/day for the purpose of designing the proposed underground exfiltration system and a k_V of 25 feet/day for the purpose of designing the proposed dry retention pond.

No confining layer was encountered by the stormwater management feature borings, within the explored depths. Therefore we conservatively recommend that you consider the maximum boring depth of 15 feet as the confining layer for the purpose stormwater system design. Based upon our visual review of the sands, and our local project experience, we recommend that you consider the surficial aquifer (the site sands) to have a fillable porosity (η) of 30 percent. The table below summarizes our recommended stormwater management system design parameters. A factor of safety of 2.0 is applied to the permeability rates for exfiltration in the following table while no factor of safety is applied for dry retention.

Parameter	Exfiltration	Dry Retention
Estimated Confining Layer Depth, B	15 feet	15 feet
Estimated Seasonal High Water Table Depth, WT	5 feet	7 feet
Unsaturated Vertical Infiltration Rate, k_V	11 feet/day	25 feet/day
Horizontal Saturated Hydraulic Conductivity, k_H	17 feet/day	38 feet/day
Fillable Porosity, η	30 percent	30 percent

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

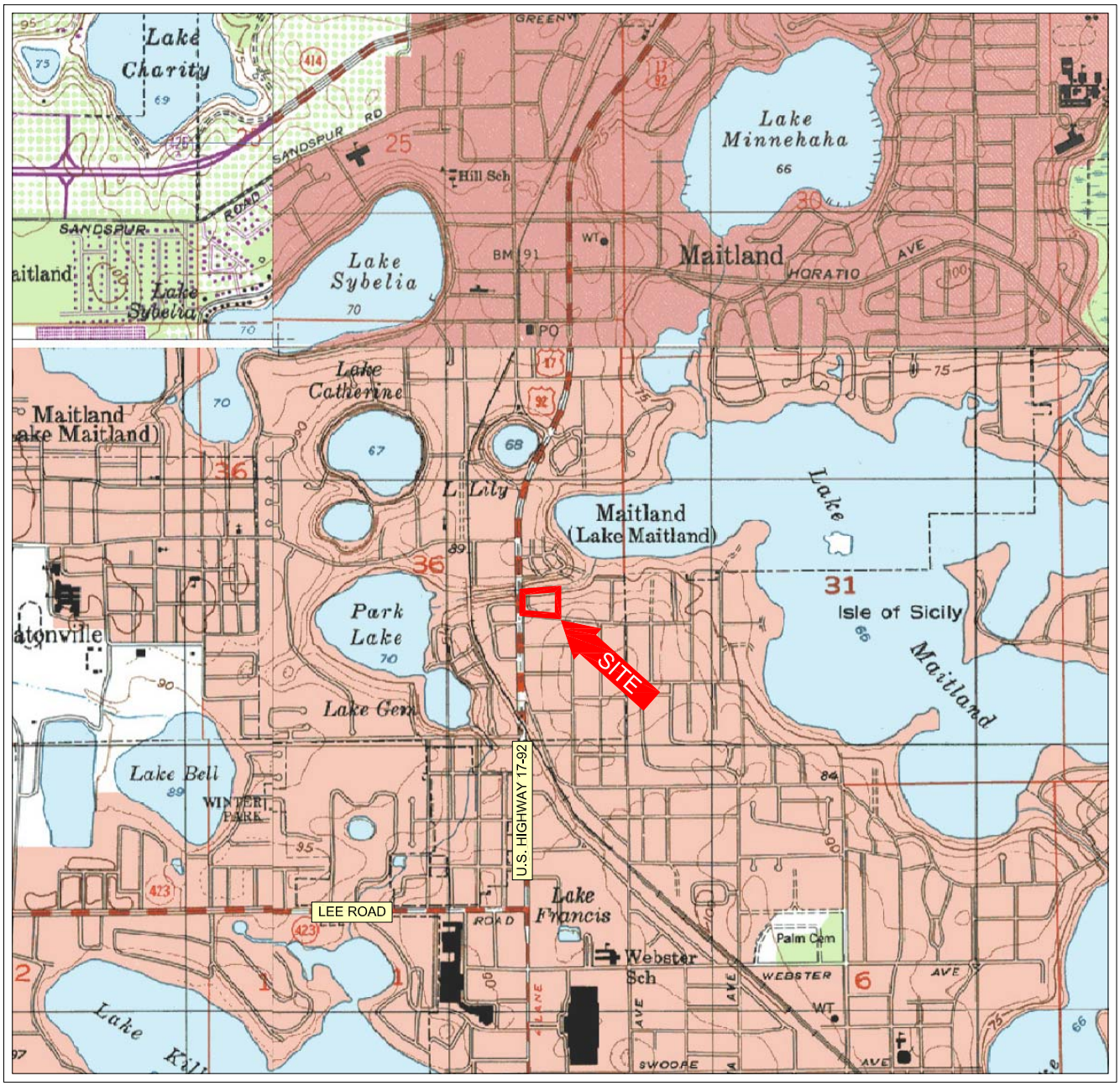
The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A
FIELD EXPLORATION

UNITED STATES – DEPARTMENT OF THE INTERIOR – GEOLOGICAL SURVEY



SCALE 1:24 000

KILOMETERS 1 .5 0 1 2

MILES 1000 0 1000 2000

FEET 1 .5 0 1

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

CONTOUR INTERVAL 5 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

N

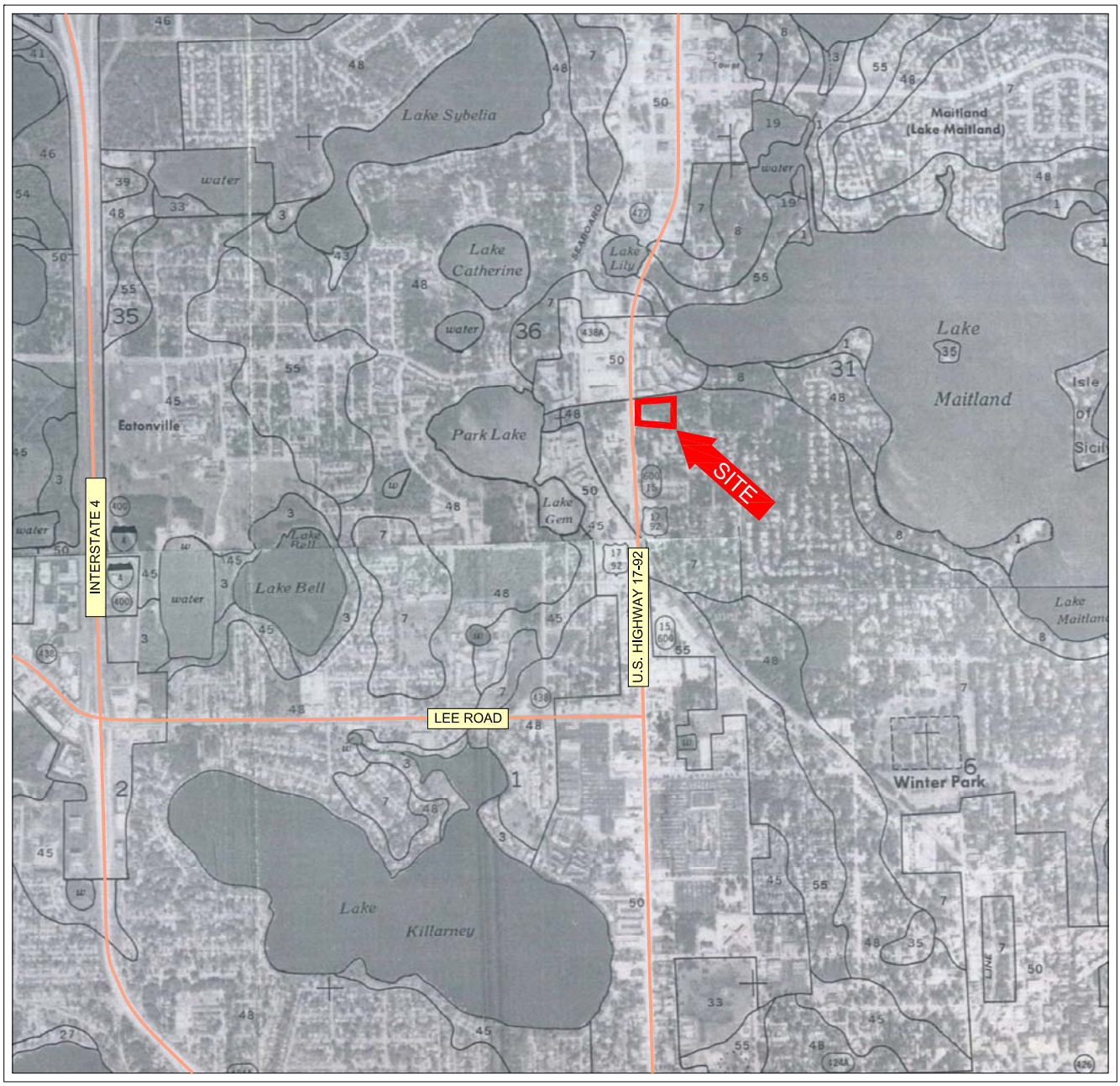
SECTION: 36
TOWNSHIP: 21 SOUTH
RANGE: 29 EAST

ORLANDO EAST, FLORIDA
1994
7.5 MINUTE SERIES (QUADRANGLE)

Project Mngr: BSO	Project No. H1135233	Terracon Consulting Engineers and Scientists	TOPOGRAPHIC VICINITY MAP
Drawn By: MG	Scale: AS SHOWN	1675 LEE ROAD WINTER PARK, FLORIDA 32789	GEOTECHNICAL ENGINEERING REPORT
Checked By: BSO	File No. H1135233	PH. (407) 740-6110 FAX. (407) 740-6112	ENZIAN THEATER ADDITION
Approved By: BHW	Date: 1-20-14		1300 S. ORLANDO AVENUE
			MAITLAND, ORANGE COUNTY, FLORIDA

EXHIBIT A-1

N:\Projects\2013\H1135233\PROJECT DOCUMENTS (Reports-Letters-Drafts to Clients)\Cad\H1135233-Exhibit-A-1.dwg



SCALE 1" = 2000'

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

U.S.D.A. SOIL SURVEY FOR ORANGE COUNTY, FLORIDA
ISSUED: AUGUST 1989

N

SECTION: 36
TOWNSHIP: 21 SOUTH
RANGE: 29 EAST

SOIL LEGEND

7	CANDLER-URBAN LAND COMPLEX, 0 TO 5 PERCENT SLOPES

Project Mngr:	BSO
Drawn By:	MG
Checked By:	BSO
Approved By:	BHW
Project No.	H1135233
Scale:	AS SHOWN
File No.	H1135233
Date:	1-20-14

Terracon
Consulting Engineers and Scientists
1675 LEE ROAD WINTER PARK, FLORIDA 32789
PH. (407) 740-6110 FAX. (407) 740-6112

SOILS MAP
GEOTECHNICAL ENGINEERING REPORT
ENZIAN THEATER ADDITION
1300 S. ORLANDO AVENUE
MAITLAND, ORANGE COUNTY, FLORIDA

EXHIBIT
A-2

N:\Projects\2013\H1135233\PROJECT DOCUMENTS (Reports-Letters-Drafts to Clients)\Cad\H1135233-Exhibit-A-2.dwg

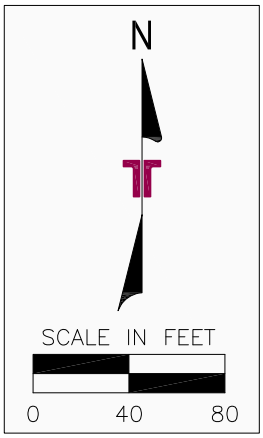
Soil Survey Description

7 – Candler-Urban land complex, 0 to 5 percent slopes. This soil type consists of areas of Candler soil that is nearly level to gently sloping and excessively drained and areas of Urban land. This complex is typically found in the uplands. This complex has a seasonal high water table at a depth of greater than 80 inches (6.7 feet) of the surface, for more 1 to 4 months during most years. Candler soil is predominantly sandy throughout the defined profile of 80 inches (6.7 feet). The areas of Urban land have been covered or altered such that the natural soil profile is no longer observable.

Typical permeability rates for the Candler portion of this soil type generally range from 6 to 20 inches per hour (12 to 40 feet per day) throughout the defined profile of 80 inches (6.7 feet).

LEGEND

APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING



Project Mngr: BSO	Project No. H1135233	Terracon Consulting Engineers and Scientists	BORING LOCATION PLAN
Drawn By: MG	Scale: AS SHOWN	1675 LEE ROAD WINTER PARK, FLORIDA 32789	GEOTECHNICAL ENGINEERING REPORT
Checked By: BSO	File No. H1135233	PH. (407) 740-6110 FAX. (407) 740-6112	ENZIAN THEATER ADDITION
Approved By: BHW	Date: 1-20-14		1300 S. ORLANDO AVENUE
			MAITLAND, ORANGE COUNTY, FLORIDA

EXHIBIT

A-4

N:\Projects\2013\H1135233\PROJECT DOCUMENTS (Reports-Letters-Drafts to Clients)\Cad\H1135233-Exhibit-A-4.dwg

Field Exploration Description

The boring locations were laid out at the project site by Terracon personnel. The locations indicated on the attached diagram are approximate and were measured by pacing distances and estimating right angles, across vegetated/wooded terrain. The locations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The SPT soil borings were drilled with a mini rubber track-mounted, rotary drilling rig equipped with a rope and cathead-operated safety hammer. The boreholes were advanced with a cutting head and stabilized with the use of bentonite (drillers' mud). Soil samples were obtained by the split spoon sampling procedure in general accordance with the Standard Penetration Test (SPT) procedure. In the split spoon sampling procedure, the number of blows required to advance the sampling spoon the last 12 inches of an 18-inch penetration or the middle 12 inches of a 24-inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance value (N). This value is used to estimate the in-situ relative density of cohesionless soils and the consistency of cohesive soils. The sampling depths and penetration distance, plus the standard penetration resistance values, are shown on the boring logs.

Portions of the samples from the borings were sealed in glass jars to reduce moisture loss, and then the jars were taken to our laboratory for further observation and classification. Upon completion, the boreholes were backfilled with the site soil.

Field logs of each boring were prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. The boring logs included with this report represent an interpretation of the field logs and include modifications based on laboratory observation of the samples.

BORING LOG NO. B-1

PROJECT: Enzian Theater Addition

CLIENT: H.J. High Construction Company

SITE: 1300 S. Orlando Avenue
Maitland, Florida

LOCATION See Exhibit A-4

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
	FILL - SAND WITH SILT (SP-SM), trace of limerock fragments (fill), gray-brown, loose to medium dense, fine-grained				9-8-7-6 N=15		
					4-4-3-3 N=7		
		5			4-5-5-3 N=10		
6.0	**SAND (SP)**, gray, loose to medium dense, fine-grained		▽		3-3-6-6 N=9		
					4-3-4-6 N=7		
		10					
	light gray				6-5-7 N=12		
		15					
					8-8-10 N=18		
		20					
	gray-brown				8-8-11 N=19		
25.0	***Boring Terminated at 25 Feet***	25					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water Initially Observed at 6.5'*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 1/7/2014 | Boring Completed: 1/7/2014
Drill Rig: BR-2500 | Driller: Melvin
Project No.: H1135233 | Exhibit: A-6

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO LOG-DEPTH TO BOTTOM OF PAGE H1135233-BORING LOGS.GPJ TERRACON_STD_TEMPLATE.GDT 1/21/14

BORING LOG NO. B-2

PROJECT: Enzian Theater Addition

CLIENT: H.J. High Construction Company

SITE: 1300 S. Orlando Avenue
Maitland, Florida

LOCATION See Exhibit A-4

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
	SAND WITH SILT (SP-SM), dark gray, very loose, fine-grained			X	1-1-1-1 N=2		
	mixed light gray and dark brown			X	2-1-2-4 N=3		
4.0	**SAND (SP)**, light brown, loose to medium dense, fine-grained	5		X	4-4-4-5 N=8		
	light gray		▽	X	6-8-10-10 N=18		
		10		X	7-9-9-9 N=18		
		15		X	8-8-14 N=22		
		20		X	8-11-13 N=24		
23.5	**SAND WITH SILT (SP-SM)**, gray-brown, medium dense, fine-grained			X	5-7-10 N=17		
25.0	***Boring Terminated at 25 Feet***	25					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water Initially Observed at 8.0'*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 1/7/2014 | Boring Completed: 1/7/2014
Drill Rig: BR-2500 | Driller: Melvin
Project No.: H1135233 | Exhibit: A-7

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO LOG-DEPTH TO BOTTOM OF PAGE H1135233-BORING LOGS.GPJ TERRACON_STD_TEMPLATE.GDT 1/21/14

BORING LOG NO. B-3

PROJECT: Enzian Theater Addition

CLIENT: H.J. High Construction Company

SITE: 1300 S. Orlando Avenue
Maitland, Florida

LOCATION See Exhibit A-4

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
	SILTY SAND (SM), with limerock, dark brown, medium dense				7-5-5-5 N=10		
2.0	**SAND (SP)**, brown, loose, fine-grained				4-2-2-2 N=4		
	light brown	5			3-2-2-2 N=4		
	light gray-brown				4-3-4-4 N=7		
8.0	**CLAYEY SAND (SC)**, orange-brown, loose		▽		4-4-4-4 N=8		
		10					
13.5	**SAND WITH CLAY (SP-SC)**, brown, medium dense, fine-grained				4-6-4 N=10		
		15					
18.5	**SAND (SP)**, light gray-brown, medium dense, fine-grained				6-7-9 N=16		
		20					
25.0					7-7-7 N=14		
	Boring Terminated at 25 Feet	25					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water Initially Observed at 9.5'*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 1/7/2014 | Boring Completed: 1/7/2014
Drill Rig: BR-2500 | Driller: Melvin
Project No.: H1135233 | Exhibit: A-8

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO LOG-DEPTH TO BOTTOM OF PAGE H1135233-BORING LOGS.GPJ TERRACON_STD_TEMPLATE.GDT 1/21/14

BORING LOG NO. B-4

PROJECT: Enzian Theater Addition

CLIENT: H.J. High Construction Company

SITE: 1300 S. Orlando Avenue Maitland, Florida

LOCATION See Exhibit A-4

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
	SAND WITH SILT (SP-SM), dark reddish-brown, fine-grained						
	2.0 **SAND (SP)**, brown, loose, fine-grained						
	brown-gray	5			5-4-4-5 N=8		
	6.0 **SAND WITH CLAY (SP-SC)**, light brown, medium dense, fine-grained				6-6-7-7 N=13	9	11
					6-8-9-9 N=17		
		10					
	13.5 **SAND (SP)**, light gray-brown, medium dense, fine-grained				7-9-13 N=22		
		15					
					7-8-8 N=16		
		20					
	light gray				11-11-11 N=22		
	25.0 ***Boring Terminated at 25 Feet***	25					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Water Not Initially Observed To The Depth of 10'

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 1/7/2014	Boring Completed: 1/7/2014
Drill Rig: BR-2500	Driller: Melvin
Project No.: H1135233	Exhibit: A-9

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO LOG-DEPTH TO BOTTOM OF PAGE H1135233-BORING LOGS.GPJ TERRACON_STD_TEMPLATE.GDT 1/21/14

BORING LOG NO. B-5

PROJECT: Enzian Theater Addition

CLIENT: H.J. High Construction Company

SITE: 1300 S. Orlando Avenue
Maitland, Florida

LOCATION See Exhibit A-4

DEPTH	Description	FIELD TEST RESULTS
0.1	**ASPHALT**	
0.5	**LIMEROCK BASE**	
	SAND WITH SILT (SP-SM), dark gray-brown, fine-grained	
4.0	**SAND (SP)**, brown, loose to medium dense, fine-grained	3-3-5-5 N=8
	light gray	4-5-5-6 N=10
		5-6-5-5 N=11
15.0		3-3-5 N=8
	Boring Terminated at 15 Feet	

DEPTH (Ft.): 5, 10, 15, 20, 25

WATER LEVEL OBSERVATIONS: Water Initially Observed at 6.5'

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Water Initially Observed at 6.5'

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 1/7/2014 | Boring Completed: 1/7/2014
Drill Rig: BR-2500 | Driller: Melvin
Project No.: H1135233 | Exhibit: A-10

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO LOG-DEPTH TO BOTTOM OF PAGE H1135233-BORING LOGS.GPJ TERRACON_STD_TEMPLATE.GDT 1/21/14

BORING LOG NO. B-6

PROJECT: Enzian Theater Addition

CLIENT: H.J. High Construction Company

SITE: 1300 S. Orlando Avenue
Maitland, Florida

LOCATION See Exhibit A-4

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
0.2	**ASPHALT**						
0.6	**LIMEROCK BASE**						
2.0	**SAND WITH SILT (SP-SM)**, dark gray-brown, fine-grained						
	SAND (SP), brown, loose to medium dense, fine-grained						
	light brown	5	▽		5-4-6-6 N=10	4	3
	light gray				6-4-4-6 N=8		
					5-7-7-9 N=14		
		10					
15.0					4-4-6 N=10		
	Boring Terminated at 15 Feet	15					
		20					
		25					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water Initially Observed at 6.0'*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 1/7/2014 | Boring Completed: 1/7/2014
Drill Rig: BR-2500 | Driller: Melvin
Project No.: H1135233 | Exhibit: A-11

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO LOG-DEPTH TO BOTTOM OF PAGE H1135233-BORING LOGS.GPJ TERRACON_STD_TEMPLATE.GDT 1/21/14

BORING LOG NO. B-7

PROJECT: Enzian Theater Addition

CLIENT: H.J. High Construction Company

SITE: 1300 S. Orlando Avenue
Maitland, Florida

LOCATION See Exhibit A-4

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
	SAND WITH SILT (SP-SM), dark brown, fine-grained						
	2.0						
	SAND (SP), light brown, loose to medium dense, fine-grained						
		5			2-2-2-4 N=4	3	3
	light brown-gray				4-4-6-6 N=10		
			▽		5-4-5-7 N=9		
		10					
	15.0				6-6-4 N=10		
	Boring Terminated at 15 Feet	15					
		20					
		25					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water Initially Observed at 8.0'*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 1/7/2014	Boring Completed: 1/7/2014
Drill Rig: BR-2500	Driller: Melvin
Project No.: H1135233	Exhibit: A-12

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO LOG-DEPTH TO BOTTOM OF PAGE H1135233-BORING LOGS.GPJ TERRACON_STD_TEMPLATE.GDT 1/21/14

BORING LOG NO. B-8

PROJECT: Enzian Theater Addition

CLIENT: H.J. High Construction Company

SITE: 1300 S. Orlando Avenue
Maitland, Florida

LOCATION See Exhibit A-4

GRAPHIC LOG	DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
	0.2	**ASPHALT**						
	0.5	**LIMEROCK BASE**						
		FILL - SAND WITH SILT (SP-SM), (fill), mixed brown and gray, medium dense, fine-grained				13-10-11-12 N=21		
						7-9-9-9 N=18		
			5			8-7-7-8 N=14		
	5.5							
	6.0	**CLAYEY SAND (SC)**, orange-brown, medium dense						
		Boring Terminated at 6 Feet						
			10					
			15					
			20					
			25					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Water Not Initially Observed To The Depth of Boring

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 1/7/2014	Boring Completed: 1/7/2014
Drill Rig: BR-2500	Driller: Melvin
Project No.: H1135233	Exhibit: A-13

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO LOG-DEPTH TO BOTTOM OF PAGE H1135233-BORING LOGS.GPJ TERRACON_STD_TEMPLATE.GDT 1/21/14

BORING LOG NO. B-9

PROJECT: Enzian Theater Addition

CLIENT: H.J. High Construction Company

SITE: 1300 S. Orlando Avenue
Maitland, Florida

LOCATION See Exhibit A-4

DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
0.2	**ASPHALT**						
0.5	**LIMEROCK BASE**						
	FILL - SAND WITH SILT (SP-SM), (fill), mixed dark gray and dark brown, medium dense, fine-grained				24-6-10-11 N=16		
					12-4-9-9 N=13		
5.5		5			7-9-7-7 N=16		
6.0	**CLAYEY SAND (SC)**, orange-brown, medium dense						
	Boring Terminated at 6 Feet						
		10					
		15					
		20					
		25					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Water Not Initially Observed To The Depth of Boring

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 1/7/2014	Boring Completed: 1/7/2014
Drill Rig: BR-2500	Driller: Melvin
Project No.: H1135233	Exhibit: A-14

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO LOG-DEPTH TO BOTTOM OF PAGE H1135233-BORING LOGS.GPJ TERRACON_STD_TEMPLATE.GDT 1/21/14

APPENDIX B – LABORATORY TESTING

Laboratory Testing

During the field exploration, a portion of each recovered sample was sealed in a glass jar and transported to our laboratory for further visual observation and laboratory testing. Selected samples retrieved from the borings were tested for moisture (water) content, fines content (soil passing a US standard #200 sieve), and laboratory permeability. Those results are included in this report and on the respective boring logs, except for permeability. The visual-manual classifications were modified as appropriate based upon the laboratory testing results.

The soil samples were classified in general accordance with the appended General Notes and the Unified Soil Classification System based on the material's texture and plasticity. The estimated group symbol for the Unified Soil Classification System is shown on the boring logs and a brief description of the Unified Soil Classification System is included in Appendix B. The results of our laboratory testing are presented in the Laboratory Test Results section of this report and on the corresponding borings logs.

Permeability testing was performed on selected soil samples obtained from SPT borings. The soil samples were remolded in a permeameter to subjectively approximate in-place relative density of the sampled soils. Water was allowed to flow into the soil samples until the samples were apparently saturated. Once saturated, a constant-head source of water was allowed to flow through the samples. Measured quantities of water were collected over timed intervals.

APPENDIX C
SUPPORTING DOCUMENTS

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1-$^{3}/_{8}$" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube – 2" O.D., 3" O.D., unless otherwise noted	PA:	Power Auger (Solid Stem)
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB	Wash Boring or Mud Rotary

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	N/E:	Not Encountered
WCI:	Wet Cave in	WD:	While Drilling	ESH:	Estimated Seasonal High Groundwater
DCI:	Dry Cave in	BCR:	Before Casing Removal	ESL:	Estimated Seasonal Low Groundwater
AB:	After Boring	ACR:	After Casing Removal		

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	0 – 1	Very Soft
500 – 1,000	2 – 3	Soft
1,000 – 2,000	4 – 6	Medium Stiff
2,000 – 4,000	7 – 12	Stiff
4,000 – 8,000	13 – 26	Very Stiff
8,000+	> 26	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 50	Dense
> 50	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	≥ 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75 to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 – 10
Medium	11 – 30
High	> 30

Rev. 4/10

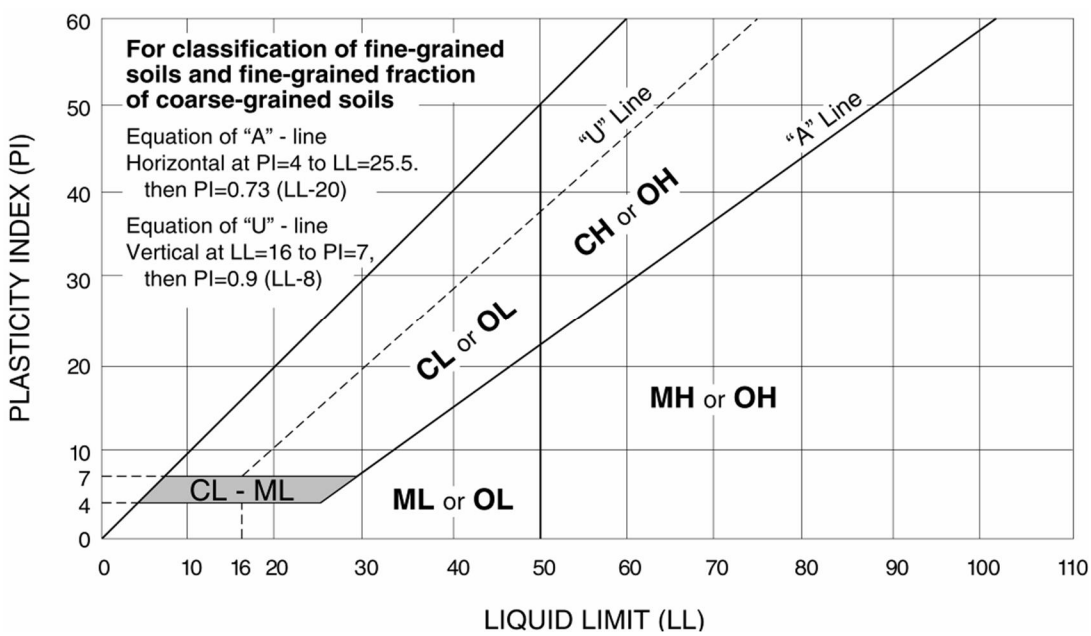
UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OL	Organic clay [K,L,M,N]
						Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OH	Organic clay [K,L,M,P]
						Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.



Terracon