St. Joseph's Carmelite Monastery

Geotechnical Engineering Report

November 6, 2023 | Terracon Project No. H1235290

Prepared for:

Discalced Carmelite Fathers of Florida Inc.
141 Carmelite Drive
Bunnell, Florida 32110

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November 6, 2023

Discalced Carmelite Fathers of Florida Inc.
141 Carmelite Drive
Bunnell, Florida 32110

Attn: Father Krzysztof Jank
P: 386-437-2910
E: bunnellcarmelites@gmail.com

Re: Geotechnical Engineering Report
St. Joseph's Carmelite Monastery
141 Carmelite Drive
Bunnell, Flagler County, Florida
Terracon Project No. H1235290

Dear Fr. Jank:

We have completed the scope of Geotechnical Engineering services for the above referenced project in general accordance with Terracon Proposal No. PH1235290 executed September 27, 2023. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs, pavements, and stormwater management 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

BRENDAN STANLEY O'BRIEN LICENSE No. 52047 STATE OF FLORIDA PROFESSIONAL ENGINEER

11/6/2023

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

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

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Note: This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the Terracon logo will bring you back to this page. For more interactive features, please view your project online at **client.terracon.com**.

Refer to each individual Attachment for a listing of contents.

Report Summary

Topic [1]	Overview Statement [2]
Project Description	Additions to the existing St. Joseph's Carmelite Monastery Estimated maximum loads: columns 100 kips, wall loads: 3 kips/ft, slabs 150 psf As much as 3 to 5 feet of fill to achieve final grade Minor excavation other than foundation construction and utility installation
Geotechnical Characterization	The site soils generally consist of about 2 to 4 feet of sand to sand with silt (GeoModel Layers 1 and 2) over sand with silt to silty sand (GeoModel Layers 2 and 3). Groundwater was observed between depths of about ½ foot and 3½ feet. Seasonal high groundwater estimated at depths of about ½ foot to 1½ feet below the existing grade.
Earthwork	Typical surficial site preparation should be adequate. Temporary construction dewatering will likely be necessary.
Shallow Foundations	Shallow foundations are sufficient for building support Allowable bearing pressure = 3,000 psf Expected settlements: < 1 inch total, < ¾ inch differential
Pavements	With subgrade prepared as noted in **Earthwork**. Pavement grades should be set to provide a minimum separation of 12 inches between the bottom of the base course and the seasonal high groundwater level. Concrete pavements should be supported on a minimum of 18 inches of free draining sand to minimize unstable pumping conditions.
Stormwater Management	Shallow groundwater is a limitation for dry retention. Further discussion is provided in **Stormwater Management**.
General Comments	This section contains important information about the limitations of this geotechnical engineering report.

1. If the reader is reviewing this report as a pdf, the topics above can be used to access the appropriate section of the report by simply clicking on the topic itself.
2. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.

Introduction

This report presents the results of our subsurface exploration and Geotechnical Engineering services performed for the proposed Additions to the existing St. Joseph's Carmelite Monastery located at 141 Carmelite Drive in Bunnell, Flagler County, Florida. The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Dewatering considerations
- Foundation design and construction
- Floor slab design and construction
- Lateral earth pressure
- Pavement design and construction
- Stormwater management

The geotechnical engineering Scope of Services for this project included the advancement of test borings, laboratory testing, engineering analysis, and preparation of this report.

Drawings showing the site and boring locations are shown on the **Site Location** and **Exploration Plan**, respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the boring logs and/or as separate graphs in the **Exploration Results** section.

Project Description

Our final understanding of the project conditions is as follows. Items highlighted are assumed and should be verified by the design team.

Item	Description
Information Provided	Different version of Concept Plan, Sheet EX001, plan only (Alann Engineering Group, Inc., dated August 23, 2023) and superimposed on aerial photography.
Project Description	Additions to the existing St. Joseph's Carmelite Monastery including a proposed meeting hall, paved parking, unpaved parking, and stormwater management.

Item	Description
Proposed Structure	The project includes a one-story meeting hall building with a footprint of 4,176 square feet. The building will be slab-on-grade (non-basement).
Building Construction	Not provided; we anticipate that addition will be constructed using concrete masonry and and/or wood frame, with slab-on-grade construction techniques.
Finished Floor Elevation	Not provided. Based on encountered and estimated seasonal high water levels, finished floor may be more than 2 feet above existing grade as assumed in our proposal.
Maximum Loads	In the absence of information provided by the design team, we will use the following loads in estimating settlement based on our experience with similar projects. ▪ Columns: 100 kips ▪ Walls: 3 kips per linear foot (klf) ▪ Floor slabs: 150 pounds per square foot (psf)
Grading/Slopes	Perhaps as much as 3 to 5 feet of fill may be necessary to adequately raise final grade above estimated seasonal high water levels, excluding remedial grading requirements.
Below-Grade Structures	None anticipated.
Free-Standing Retaining Walls	Retaining walls are not expected to be constructed as part of site development to achieve final grades.
Pavements	The provided plans indicate both asphalt and concrete sections are being considered. The parking area on the west side of Carmelite Drive will be unpaved/grassed.
Stormwater Management	The plan depicts an elongated stormwater management pond along the south side of the proposed building and a square pond on the opposite/west side of Carmelite Drive.
Building Code	Florida Building Code (effective July 2020).

Terracon should be notified if any of the above information is inconsistent with the planned construction, especially our grading assumption, as modifications to our recommendations may be necessary.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located at 141 Carmelite Drive in Bunnell, Flagler County, Florida. The proposed improvements are comprised of two separate areas (opposite sides of Carmelite Drive) totaling about 1.4 acres of land. The approximate center of the site is located latitude 29.406669° N longitude 81.187863° W. See **Site Location**
Existing Improvements	Portion of site cleared and possibly graded, adjacent unpaved road and site development.
Current Ground Cover	Wooded with light undergrowth, some area grassed to bare soil.
Existing Topography	Nearly level, with ground surface around elevation +25 feet referencing the National Geodetic Vertical Datum of 1929 (NGVD29), according to the USGS topographic quadrangle map "Flagler Beach West, Florida".
Surface Water	Aerial photography depict numerous small wet ponds in the site vicinity. The noted quadrangle map depicts areas of swamp in the site vicinity

Regional Geology

According to Geology and Ground-Water Resources of Flagler, Putnam, and St. Johns Counties, Florida, Florida Geologic Survey (FGS) Report of Investigation (RI) 32 (Bermes, Leve, and Tarver, 1963), the lithology of the site vicinity generally consists of Pleistocene and Recent Deposits, over Upper Miocene or Pliocene Deposits, over the Williston Formation, over the Inglis Formation. The Inglis Formation is the basal (lowest) unit of the Ocala Group Limestone, and the Williston Formation is the middle unit the of the Ocala Group Limestone. The Crystal River Formation, the upper unit of the Ocala Group Limestone, is absent in the site vicinity. The Ocala Group Limestone uppermost limestone layer that comprises the Floridan Aquifer. FGS RI 32 discusses deeper formations; however, the deeper formations are not considered relevant to this study and are not summarized herein. As interpreted from Cross Section C-C' of Figure 6 of RI 32, the Pleistocene and Recent Deposits extend to about mean sea level (about 25 feet thick) and the Upper Miocene or Pliocene Deposits extend to about 80 feet below mean sea level (about 80 feet thick). The Williston Formation thins out in the site vicinity, to about 10 feet thick or less. The Inglis Formation extends to about 180 feet below mean sea level (about 90 feet thick).

Soil Survey

The Soil Survey of Flagler County, Florida as prepared by the United States Department of Agriculture (USDA), Natural Resource Conservation Service (NRCS), dated October 1997, identifies the predevelopment soil types at the subject site as Valkaria fine sand, 0 to 2 percent slopes (19). A Soils Map is included with this GeoReport, depicting the applicable Soil Survey map portion for the subject site. A description of the mapped soil type is included in the **Supporting Information** section of this GeoReport.

Geotechnical Characterization

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** and the GeoModel can be found in the **Figures** attachment of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	**Free draining**	Sand (SP); loose to medium dense
2	**Slightly restrictive**	Sand with silt (SP-SM); very loose to medium dense
3	**Hydraulically restrictive**	Silty sand (SM); loose to medium dense

The site soils generally consist of about 2 to 4 feet of sand to sand with silt (GeoModel Layers 1 and 2) over sand with silt to silty sand (GeoModel Layers 2 and 3).

Groundwater Conditions

The borings were observed during drilling for the presence and level of groundwater. Groundwater was encountered in most of the borings, between depths of about ½ foot and 3½ feet below existing grade. Boreholes B-3, B-4, and B-5 collapsed to a depth of 1 foot prior to measuring free groundwater. Based on visual-manual review of the soil samples from these borings, the soils appeared moist at a depth of about 2 feet, possibly indicating the presence of groundwater levels. Longer term monitoring in cased holes or piezometers 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 range from depths of about ½ foot to 1½ feet below the existing grade. Our estimates of the seasonal groundwater conditions are based on the USDA Soil Survey, encountered soil types, antecedent weather conditions, and the measured/estimated water levels. Although the site soils are as Valkaria fine sand, the encountered soils more closely resemble Malabar and Myakka soils, which are associated with Valkaria soils. The water levels observed in the borings can be found on the corresponding logs in **Exploration Results** and in a table in the **Exploration Results** section of this GeoReport. The estimated seasonal high groundwater levels can be found in a table in the **Exploration Results** section of this GeoReport.

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 seasonal high groundwater 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 or around the site following the date of this report.

Geologic Hazards

The risk of sinkhole development is the primary geologic hazard of concern throughout most of Florida

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 as mapped by the Florida Geological Survey (FGS) web site. The cover (over limestone bedrock) in Area III is between 30 to 200 feet thick and is generally cohesive clayey sediments of low permeability. Sinkholes are most numerous, of varying size, and develop abruptly in Area III. 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 Florida Geologic Survey's on-line Subsidence Incident Reports (SIRs) database reveals the closest reported sinkhole is about 5½ miles southeast of the subject site, near Interstate 95 and US 1. 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 such as loss of circulation of drilling fluid, 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 in detail, 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 Penetration Test (CPT) 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.

Seismic Considerations

Chapter 1, Part 101.2 of the 2020 Florida Building Code (effective July 2020) states: "Code requirements that address snow loads and earthquake protection are pervasive; they are left in place but shall not be utilized or enforced because Florida has no snow load or earthquake threat.". Therefore, this report does not further address seismic considerations.

Seismic considerations will seldom control the structural design of buildings in Central Florida (as compared to wind loading conditions). If seismic considerations control the structural design, we can provide a proposal to perform additional services to measure shear wave velocity such as MASW (multichannel analysis of surface waves), ReMi testing (refraction microtremor), seismic cone penetrometer (SCPT) testing to see if the site classification improves.

Permeability

Two laboratory permeability tests were conducted, one from both proposed pond areas. Permeability test results are presented in **Exploration and Laboratory Results** and discussed further in **Stormwater Management**.

Septic System

Terracon evaluated the soil texture of the septic system hand auger borings using the United States Department of Agriculture (USDA) soil classification system. Terracon evaluated the soil color using the Munsell Soil Color Charts. Although the site soil is mapped as Valkaria fine sand, the encountered soils more closely resemble associated Malabar and Myakka soils. The seasonal high water levels at the septic borings were estimated at or above the encountered water levels. The soil color and texture portion of the Florida Department of Health (DOH) form DH 4015, page 3, is included in **Exploration and Laboratory Results**. A copy of the USDA soil classification triangle is included in **Supporting Information**. Terracon understand other(s) will complete the remainder of the form DH 4015 and design of the proposed septic system. Shallow groundwater will be a limiting factor in septic design, and may require grading fill and/or the design of a mounded system.

Geotechnical Overview

The borings identified about 2 to 4 feet of sand to sand with silt (GeoModel Layers 1 and 2) over sand with silt to silty sand (GeoModel Layers 2 and 3). The soils are generally loose to medium dense, though at some places the sand with silt is very loose.

The site appears suitable for the proposed construction based upon geotechnical conditions encountered in the test borings, provided that the recommendations provided in this report are implemented in the design and construction phases of this project.

Seasonal high groundwater levels should be considered in the civil engineering design for site grading, utility construction, and pavements. Shallow groundwater is a limitation for dry retention as well as the septic drainfield. The addition grading fill may be necessary in these areas, and perhaps more grading fill for the proposed building pad to maintain proper drainage. Temporary

The **Shallow Foundations** section addresses support of the building bearing on native loose to medium dense soils or engineered fill. The **Floor slabs** section addresses slab-on-grade support of the building.

With subgrade prepared as noted in **Earthwork**, we recommend that pavement grades should be set to provide a minimum separation of 12 inches between the bottom of the base course and the seasonal high groundwater level. If concrete pavements are used, the concrete pavements should be supported on a minimum of 18 inches of free draining sand to minimize unstable pumping conditions.

The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the **Exploration Results**), engineering analyses, and our current understanding of the proposed project. The **General Comments** section provides an understanding of the report limitations.

Earthwork

Earthwork is anticipated to include clearing and grubbing, excavations, and engineered fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Temporary Construction Dewatering

Temporary construction dewatering will likely be necessary. Clearing and mass grading should preferably be conducted during the dry season, though temporary construction dewatering may still be necessary. Temporary construction dewatering should be sufficient to maintain the water level at least 2 feet below all compaction surfaces. Although well points or pumping from ditches may be feasible based on the site soils, the selection and design of a temporary construction dewatering system should be performed by a contractor experienced in construction dewatering. This GeoReport does not include evaluation of potential holding areas for a temporary construction dewatering system.

Site Preparation

Prior to placing fill, existing vegetation, topsoil, and root mats should be removed. Complete stripping of the topsoil should be performed in the proposed building and parking/driveway areas. If temporary construction dewatering is necessary, it is preferable for dewatering to commence prior to stripping surface organics.

The subgrade should be proofrolled with an adequately loaded vehicle such as a fully loaded tandem-axle dump truck or heavy roller. The proofrolling should be performed under the direction of the Geotechnical Engineer. Care should be taken to minimize vibrations near existing structures. Areas excessively deflecting under the proofroll should be delineated and subsequently addressed by the Geotechnical Engineer. Excessively wet or dry material should either be removed, or moisture conditioned and recompacted. In and around dry retention ponds, no more compactive effort should be used than necessary to properly shape the basins; overcompaction will lower the effective permeability of the subgrade soils.

Fill Material Types

Fill required to achieve design grade should meet the following material property requirements.

Soil Quality [1]	USCS Classification	Acceptable Location for Placement	Maximum Lift Thicknes s (inches)
Free draining (corresponds to GeoModel Layer 1)	SP (fines content < 5%)	All locations and elevations except utility cuts into higher fines content soils	12 [3]
Slightly restrictive (corresponds to GeoModel Layer 2)	SP-SM (fines content between 5 and 12 %) [2]	All locations and elevations other than beneath floor slabs, concrete pavements or other areas where superior drainage is required including around dry retention. Should preferably not be used in utility cuts into higher fines content soils. Strict moisture control will be required during placement, particularly during the rainy season.	8 to 12 [3]
Hydraulically restrictive (corresponds to GeoModel Layer 3)	SM (fines content between 12 and 50 %)	Limited to deep utility cuts into similar soil. Should not be placed in upper 2 feet of finished grade. Strict moisture control will be required during placement.	6 to 8 [4]

Soil Quality [1]	USCS Classification	Acceptable Location for Placement	Maximum Lift Thickness (inches)

1. Controlled, compacted fill should consist of approved materials that are non-plastic and free of organic matter (less than 5 percent) and debris. Maximum particle size should be one quarter of the lift thickness, i.e. maximum particle size of 3 inches for a 12-inch lift, 2 inches for an 8-inch lift.
2. If fines contents are greater than 12 percent, special design and construction procedures maybe necessary.
3. 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. Static equipment should be used.

Fill Compaction Requirements

Fill should meet the following compaction requirements.

Item [1]	Requirement
Minimum compaction requirement [1]	95 percent of the material's maximum dry density as determined by the modified Proctor test (ASTM D 1557)
Moisture Content [2]	Within 2 percent of the optimum moisture content as determined by the modified Proctor test at the time of placement
Minimum Testing Frequency	One field density test per 5,000 square feet or fraction thereof per 1-foot lift in pavement areas; per 2,500 square feet in building areas.

Item [1]	Requirement

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.

Utility Trench Backfill

Any soft or unsuitable materials encountered at the bottom of utility trench excavations should be removed and replaced with structural fill or bedding material in accordance with public works specifications for the utility be supported. This recommendation is particularly applicable to utility work requiring grade control and/or in areas where subsequent grade raising could cause settlement in the subgrade supporting the utility. Trench excavation should not be conducted below a downward 1:1 projection from existing foundations without engineering review of shoring requirements and geotechnical observation during construction.

On-site materials are considered suitable for backfill of utility and pipe trenches from 1 foot above the top of the pipe to the final ground surface, provided the material is free of organic matter and deleterious substances.

Trench backfill should be mechanically placed and compacted as discussed earlier in this report. Compaction of initial lifts should be accomplished with hand-operated tampers or other lightweight compactors. Flooding or jetting for placement and compaction of backfill is not recommended.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building. Site grades should be set considering the estimated seasonal high groundwater presented in **Geotechnical Characterization**.

Where paving or flatwork abuts the structure, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

Shallow excavations for the proposed structure are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of grade-supported improvements such as floor slabs and pavements. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

Trees or other vegetation whose root systems have the ability to excessively remove moisture or that may enlarge/grow and displace the foundations or flatwork should not be planted next to the structures (foundations, pavements, sidewalks, etc.).

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

Construction Observation and Testing

The earthwork efforts should be observed by the Geotechnical Engineer (or others under their direction). Observation should include documentation of adequate removal of surficial materials (vegetation, topsoil, and pavements), evaluation and remediation of existing fill materials, as well as proofrolling and mitigation of unsuitable areas delineated by the proofroll.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, as recommended by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. Where not specified by local ordinance, one density and water content test should be performed for every 50 linear feet of compacted utility trench backfill and a minimum of one test performed for every 12 vertical inches of compacted backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated by the Geotechnical Engineer. If unanticipated conditions are observed, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

Shallow Foundations

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

Design Parameters – Compressive Loads

Item	Column Footings	Wall (Continuous) Footings	Monolithic Slab Foundation [1]
Maximum Net Allowable Bearing Pressure [1]	3,000 psf	3,000 psf	3,000 psf
Minimum Width	30 inches	18 inches	12 inches
Minimum Embedment Depth Below Finished Grade [2]	18 inches	18 inches	12 inches
Compaction Requirements	95 percent of the material's maximum dry density (Modified Proctor) for a depth of 12 inches below the bottom of the 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

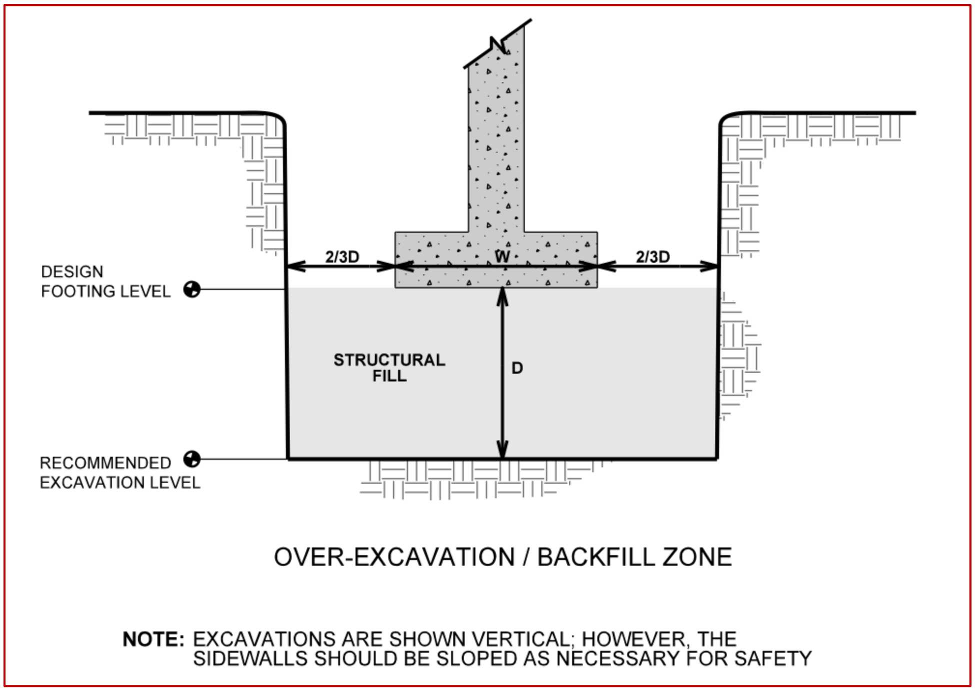
Item	Column Footings	Wall (Continuous) Footings	Monolithic Slab Foundation [1]
Estimated Differential Settlement [3]	< ¾ inch between adjacent columns	< ¾ inch over 40 feet	< ¾ inch over 40 feet

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 countered, 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 6 feet for column footings and 1½ feet for continuous footings (minimum footing width).
4. Turned-down portion of slab. For slab requirements see **Floor Slabs**.

Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the observation of the Geotechnical Engineer. 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. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

If unsuitable bearing soils are observed at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on these soils at the lower level or on compacted backfill placed in the excavations. Overexcavation for structural fill placement below footings should be conducted as shown in the following diagram. The overexcavation should be backfilled up to the footing base elevation, with Free draining or Slightly restrictive soil (GeoModel layers 1 or 2) placed, as recommended in the **Earthwork** section.



Floor Slabs

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure.

Floor Slab Design Parameters

Item	Description
Floor Slab Support	Free draining granular material meeting the Preferred fill specification [1]
Estimated Modulus of Subgrade Reaction	100 pounds per square inch per inch (psi/in) for point loads [2]
Compaction Requirements	95 percent of the material's maximum dry density (Modified proctor)
Minimum Testing Frequency	One field density test per 2,500 square feet or fraction thereof for a depth of 12 inches [3]

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

Item	Description

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. Free draining granular material should have 5 percent or less fines (material passing the #200 sieve). The in-place, predominantly sandy soils appear to meet this requirement.

2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.
3. Density should be rechecked after utility construction.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, when the project includes humidity-controlled areas, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut contraction 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. Joints or cracks should be sealed with a waterproof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Floor Slab Construction Considerations

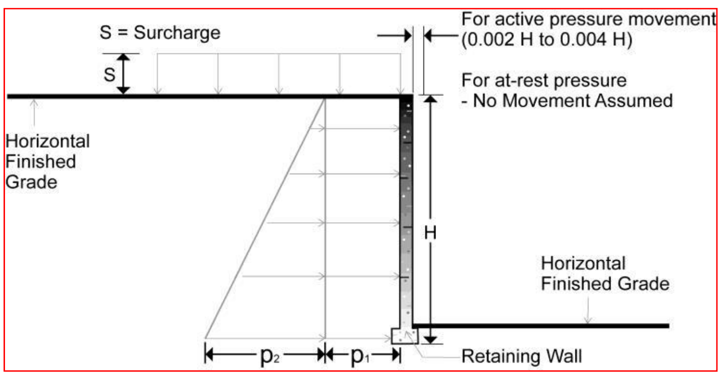
Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

Lateral Earth Pressures

Design Parameters

Structures with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to values 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 in the diagram below. 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 and is commonly used for basement walls, loading dock walls, or other walls restrained at the top. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls (unless stated).



Lateral Earth Pressure Design Parameters

Earth Pressure Condition [1]	Coefficient for Backfill Type [2]	Surcharge Pressure [3,4,5] p_1 (psf)	Equivalent Fluid Pressures (psf) [2,4,5]	
			Unsaturated [6]	Submerged [6]
Active (K_A)	Granular - 0.33	(0.33)S	(37)H	(78)H
At-Rest (K_0)	Granular - 0.50	(0.50)S	(55)H	(86)H
Passive (K_P)	Granular - 3.00	---	(330)H	(205)H

Lateral Earth Pressure Design Parameters

Earth Pressure Condition [1]	Coefficient for Backfill Type [2]	Surcharge Pressure [3,4,5] p_1 (psf)	Equivalent Fluid Pressures (psf) [2,4,5]	
			Unsaturated [6]	Submerged [6]

1. For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height. For passive earth pressure, wall must move horizontally to mobilize resistance.
2. Uniform, horizontal backfill, compacted to at least 95 percent of the ASMT D 698 maximum dry density, rendering a maximum unit weight of 110 pcf.
3. Uniform surcharge, where S is surcharge pressure.
4. Loading from heavy compaction equipment is not included.
5. No safety factor is included in these values.
6. To achieve "Unsaturated" conditions, follow guidelines in **Subsurface Drainage for Below-Grade Walls** as follows. "Submerged" conditions are recommended when drainage behind walls is not incorporated into the design.

Backfill placed against structures should consist of granular soils. For the granular values to be valid, the granular backfill must extend out and up from the base of the wall at an angle of at least 45 degrees from vertical for the active case.

Footings, floor slabs or other loads bearing on backfill behind walls may have a significant influence on the lateral earth pressure. Placing footings within wall backfill and in the zone of active soil influence on the wall should be avoided unless structural analyses indicate the wall can safely withstand the increased pressure.

The lateral earth pressure recommendations given in this section are applicable to the design of rigid retaining walls subject to slight rotation, such as cantilever, or gravity type concrete walls. These recommendations are not applicable to the design of modular block - geogrid reinforced backfill walls (also termed MSE walls). Recommendations covering these types of wall systems are beyond the scope of services for this assignment. However, we would be pleased to develop a proposal for evaluation and design of such wall systems upon request.

Subsurface Drainage for Below-Grade Walls

A perforated rigid plastic drain line installed behind the base of walls and extends below adjacent grade is recommended to prevent hydrostatic loading on the walls. The invert of a drain line around a below-grade building area or exterior retaining wall should be placed near foundation bearing level. The drain line should be sloped to provide positive gravity drainage to daylight or to a sump pit and pump. The drain line should be surrounded by clean, free-draining granular material having less than 5 percent passing the No. 200 sieve, such as Free draining fill classification or No. 57 aggregate. The free-draining aggregate should be encapsulated in a filter fabric.

As an alternative to free-draining granular fill, a prefabricated drainage structure may be used. A prefabricated drainage structure is a plastic drainage core or mesh which is covered with filter fabric to prevent soil intrusion and is fastened to the wall prior to placing backfill.

Pavements

General Pavement Comments

Soil and groundwater conditions appear suitable for conventional pavement sections meeting minimum local requirements. Recommendations for construction of typical pavement section materials are presented below. These pavement construction considerations also assume that the site has been prepared as recommended in the **Earthwork** section.

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 5,000 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 the **Earthwork** section this GeoReport 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.

Design Considerations

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, the following recommendations are based on local municipal standards.

Estimates of Minimum Pavement Section Thicknesses

The following tables provides typical options for AC and PCC Sections. They should be reviewed if specific design traffic parameters become available.

Asphaltic Concrete Design

Layer [6]	Thickness (inches)		
	Surface Course	Base Course [1]	Stabilized Subbase [1, 2, 3, 6]
Light Duty (car parking only) [4]	1¼	6	12
Heavy Duty (trash trucks, driveways) [5]	2	8	12

1. Often referred to as Stabilized Subgrade.
2. 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.
3. Some municipalities do not require stabilized subbase beneath soil cement base.
4. Per Flagler County Public Works Manual, Average Daily Traffic (ADT) of 0 to 1,000 vehicles per day (vpd).
5. Per Flagler County Public Works Manual, ADT of 3,000 to 6,500 vpd.
6. Although the Flagler County Public Works Manual only requires 6 inches of stabilization for ADT of 1,000 or less, based on our experience asphalt pavements should have a minimum of 12 inches of free draining subgrade beneath the sections indicated in this table.

The following table provides our estimated minimum thickness of PCC pavements.

Portland Cement Concrete Design

Layer [1]	Thickness (inches)
Light Duty (car parking only) [1]	5
Heavy Duty (truck parking, driveways) [2]	6

1. Concrete pavements should have a minimum of 12 inches of free draining subgrade beneath the sections indicated in this table.

Asphalt Concrete Design Considerations

The following items are applicable to asphalt concrete pavement sections.

- Terracon recommends a minimum separation of 12 inches between the bottom of the base course and the seasonal high groundwater table. Based on site conditions some grading fill appears necessary to meet this recommendation.
- 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 5 percent or less. The in-place upper soils appear likely to meet this requirement, depending on site grading.
- 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 materials should meet the current FDOT specification 911.
- 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.
- 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.

Portland Cement Concrete Design Considerations

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 Earthwork Section of this report may be considered free-draining for this purpose. Limerock should not be considered free draining for this purpose. The in-place upper soils appear likely to meet this requirement, depending on site grading.
- 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 groundwater table. Terracon recommends that in no case should less than 1 foot of separation be provided. Based on the encountered conditions and anticipated development, some grading fill appears necessary to meet this recommendation.
- Sawcut patterns should generally be square or rectangular but nearly square and extend to a depth equal to a quarter of the slab thickness.

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 of the base layer. 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.

Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic upkeep should be anticipated. 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. Pavement care consists of both localized (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Additional engineering consultation 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.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2 percent.
- Subgrade and pavement surfaces should have a minimum 2 percent slope to promote proper surface drainage.

- Install pavement drainage systems surrounding areas anticipated for frequent wetting.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.

Gravel-Surfaced Drives and Parking

Terracon understands the preference is that some parking areas remain unpaved. If these areas are to remain "as is" (parking on grass) no engineering recommendations are provided by this report.

For parking areas to be unpaved but seeking an engineering recommendation, we recommend cutting existing grade then replacing with stabilized subbase and then aggregate base material. Cut depth should be equivalent to the combined thickness of the stabilized subbase and the aggregate base. Cutting in the gravel-surfaced drive rather than building it up from existing grade will help contain the aggregate base and tend to lessen the need for maintenance. Deleting the stabilized subbase will likely lead to aggregate base pushing into the in-place subgrade soils and need for earlier/more frequent maintenance. Stabilized subbase should be 12 inches thick and prepared as detailed in **Asphalt Concrete Design Considerations**. Aggregate base should be at least 6 inches thick, and should preferably be crushed concrete as opposed to limerock as crushed concrete is less prone to dissolution, particularly when not covered by asphalt surfacing. Aggregate base should be prepared as detailed in **Asphalt Concrete Design Considerations**. There will be a need for an ongoing maintenance program, with greater maintenance frequency than asphalt-paved sections. Ruts or potholes that develop should be filled with additional aggregate base rather than regrading. Also, the unpaved roadway would need to be constructed with adequate drainage to prevent the ponding of water which would contribute to additional ongoing maintenance.

Stormwater Management

Design of the stormwater management system has not been completed yet, though we understand dry retention is preferred. Based on site conditions (shallow groundwater), we are also providing recommendations for wet detention. Based on the provided Concept Plan, Terracon understands dry retention will be provided by an elongated northern pond south of the new building and a square pond at south end of the proposed improvements.

Dry retention basins generally need to be at least 1 foot and sometimes as much as 3 feet (or more for large/nearly square ponds) above the seasonal high groundwater table to recover within the time required by the St. Johns River Water Management District (SJRWMD) or be provided with underdrains for recovery.

Soil samples of anticipated dry retention pond subgrade soils had measured permeability rates of 11 feet/day and 23 feet/day. We consider these permeability rates to be indicative of a saturated horizontal permeability. 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 as exfiltration trenches or underdrains, although this does not presently apply to ponds recovering by infiltration.

The hydraulically restrictive soil (GeoModel Layer 3) identified in Boring B-6 should be considered the confining layer. We recommend considering the slightly restrictive soil (GeoModel Layer 2) to be the confining layer in Boring B-7. Depending on site grading, pond bottom underdrains may be considered for dry retention. 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 28 percent. The table below summarizes our recommended dry retention system design parameters.

Parameter [1]	North Pond	South Pond
Boring	B-6	B-7
Estimated Confining Layer Depth, B	4½ feet	9½ feet
Estimated Seasonal High Groundwater Table Depth, WT	1½ feet	1 foot
Unsaturated Vertical Infiltration Rate, K_V	7 feet/day	15 feet/day
Horizontal Saturated Hydraulic Conductivity, K_H	11 feet/day	23 feet/day
Fillable Porosity, η	28 percent	28 percent

1. No factors of safety have been added to these parameters.

Wet detention ponds generally need to have at least 6 feet of permanent pool volume to prevent growth of water tolerant plant species. Therefore, wet detention ponds are generally excavated at least 6 feet below the seasonal low water level, though they are sometimes excavated deeper to obtain soils to be reused as fill elsewhere on site.

Terracon understands normal water levels in wet detention ponds are established as equivalent to the annual average groundwater table, unless they are artificially controlled at a lower level (if allowed by SJRWMD and local regulators). The annual average groundwater level is understood to be the average of the average wet season groundwater table and the seasonal lower groundwater table. The average wet season groundwater table is understood to be the average groundwater table over the course of the entire wet season and is understood to be less than the seasonal high groundwater table which occurs at the peak of the wet season.

If the water level in the wet detention pond is to be artificially controlled below natural level Terracon recommends considering the considering the permeability rates from the dry retention basins. The following table summarizes our recommended wet detention pond design parameters.

Parameter [1]	North Pond	South Pond
Boring	B-6	B-7
Estimated Confining Layer Depth, B	4½ feet	9½ feet
Estimated Seasonal High Groundwater Table Depth, WT	1½ feet	1 foot
Estimated Average Wet Season Groundwater Table Depth, WSWT	1½ feet	1 foot
Estimated Seasonal Low Groundwater Table Depth, SLWT	3½ feet	3½ feet
Estimated Annual Average Groundwater Table Depth, AAWT	2½ feet	2¼ feet
Horizontal Saturated Hydraulic Conductivity, K_H	11 feet/day	23 feet/day
Fillable Porosity, η	28 percent	28 percent

General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations 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. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services 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.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly effect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

Figures

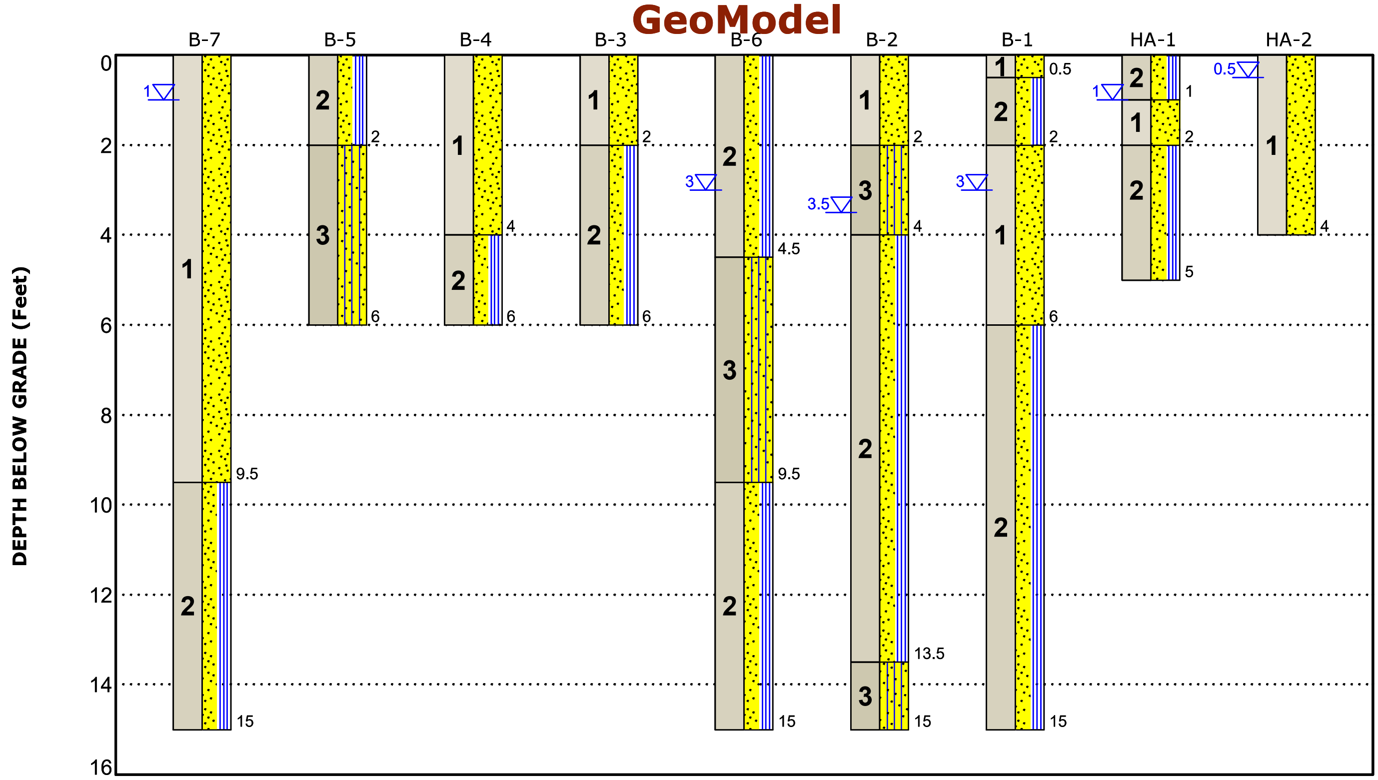
Contents:

GeoModel

St. Joseph's Carmelite Monastery
141 Carmelite Drive | Bunnell, Flagler County, Florida
Terracon Project No. H1235290

1675 Lee Rd
Winter Park, FL

GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	**Free draining**	Sand (SP); loose to medium dense
2	**Slightly restrictive**	Sand with silt (SP); very loose to medium dense
3	**Hydraulically restrictive**	Silty sand (SM); loose to medium dense

Legend

Poorly-graded Sand
Poorly-graded Sand with Silt
Silty Sand

First Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

Attachments

Exploration and Testing Procedures

Field Exploration

Number of Borings	Approximate Boring Depth (feet)	Location
2 SPT	15	Building area
3 SPT	6	Parking/driveway area
2 auger	15	Stormwater management
2 hand auger	7	Septic drainfield

Boring Layout and Elevations: Terracon personnel provided the boring layout using handheld GPS equipment (estimated horizontal accuracy of about ±20 feet) and referencing existing site features.

Subsurface Exploration Procedures: We advanced the borings with a mini rubber track-mounted rotary drill rig using rotary wash methodology. Five samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the middle 12 inches of a 24-inch penetration of the last 12 inches of an 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with auger cuttings/bentonite chips after their completion.

The auger borings were conducted by rotating solid stem auger flights into the ground to the planned depth using the drill rig. The auger flights were then withdrawn and soil samples were collected from the auger flights.

The hand auger borings were conducted by manually twisting a bucket style auger into the ground, then withdrawing the auger and collecting the sample. This process was repeated until the planned boring depth was reached.

The samples were placed in appropriate containers, taken to our soil laboratory for testing, and classified by a Geotechnical Engineer. In addition, we observed and record groundwater levels during drilling and sampling.

The sampling depths, penetration distances, groundwater levels, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials observed during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests. The laboratory testing program included the following types of tests:

- Moisture Content
- Particle Size Analysis (Sieve)
- Permeability

The laboratory testing program often included examination of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

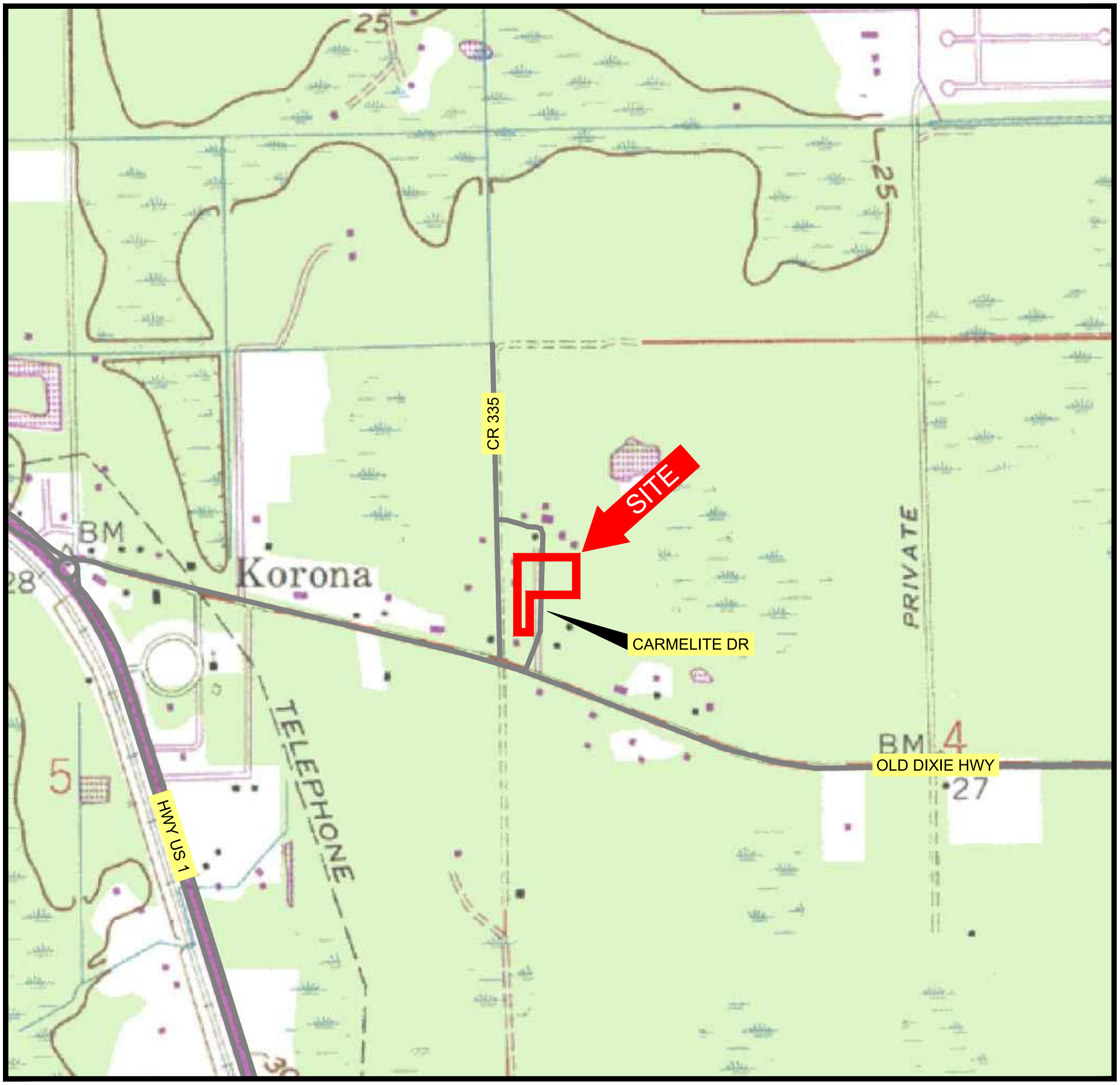
Site Location and Exploration Plans

Contents:

Topographic Vicinity Map
Soils Map
Location Plan

Note: All attachments are one page unless noted above.

UNITED STATES — DEPARTMENT OF THE INTERIOR — GEOLOGICAL SURVEY



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FLAGLER BEACH WEST, FLORIDA
ISSUED: 1993
7.5 MINUTE SERIES (QUADRANGLE)

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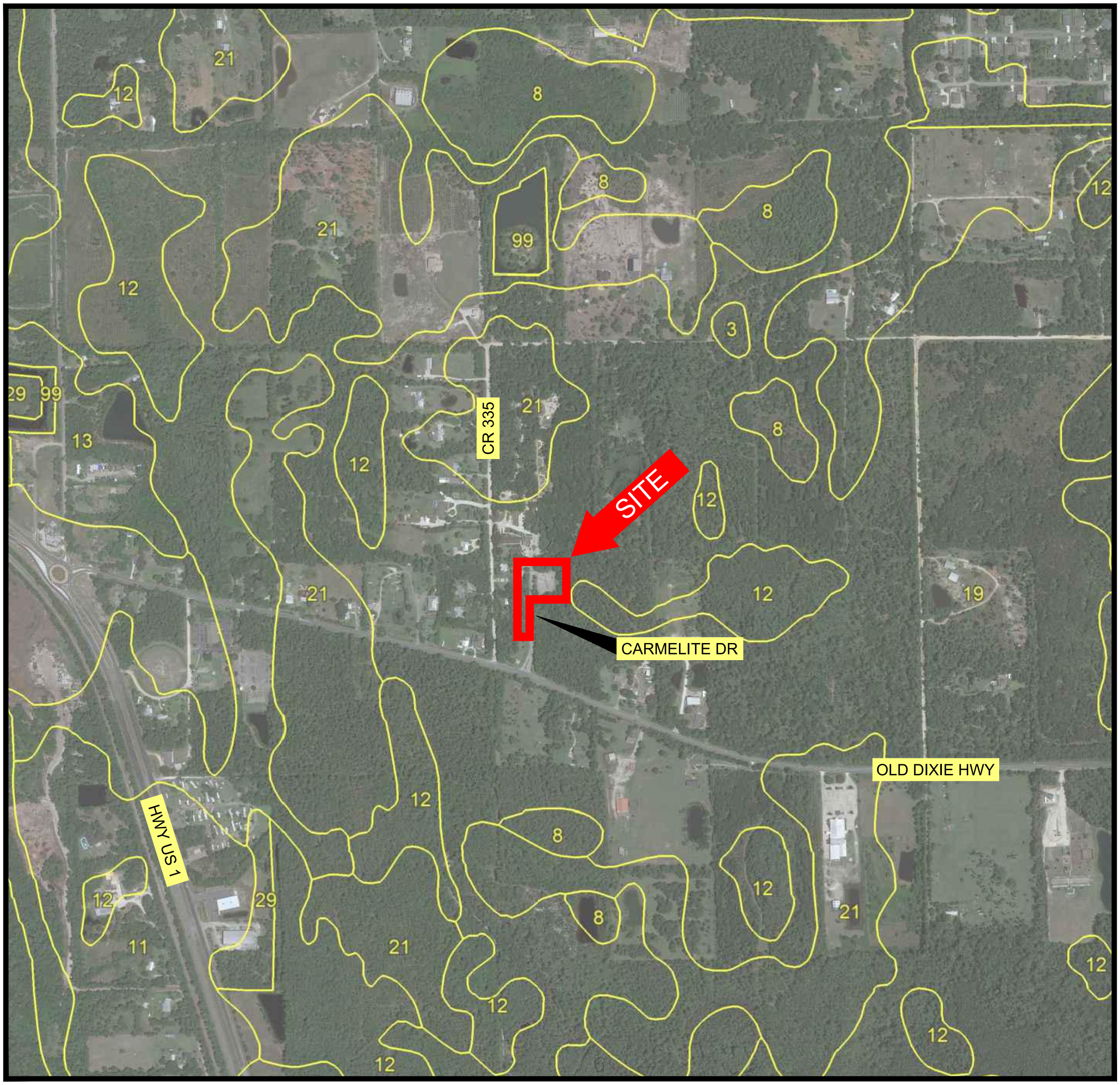
Project Mngr: BSO	Project No. H1235290	Terracon Explore with us	TOPOGRAPHIC VICINITY MAP
Drawn By: AS	Scale: AS SHOWN		GEOTECHNICAL ENGINEERING REPORT ST JOSEPH'S CARMELITE MONASTERY
Checked By: BSO	File No. H1235290	1675 LEE ROAD WINTER PARK, FLORIDA 32789	141 CARMELITE DRIVE
Approved By: BHW	Date: 10-5-23	PH. (407) 740-6110 FAX. (407) 740-6112	BUNNELL, FLAGLER COUNTY, FLORIDA

EXHIBIT



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U.S.D.A. SOIL SURVEY FOR FLAGLER COUNTY, FLORIDA

N

SOIL LEGEND

19 VALKARIA FINE SAND, 0 TO 2 PERCENT SLOPES

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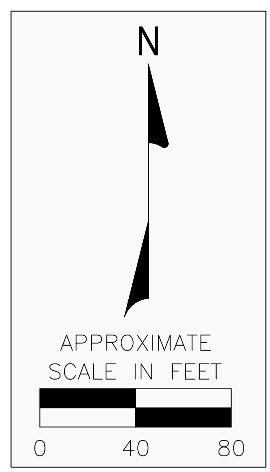
Project Mngr: BSO	Project No. H1235290	Terracon Explore with us	SOILS MAP
Drawn By: AS	Scale: AS SHOWN	1675 LEE ROAD WINTER PARK, FLORIDA 32789	GEOTECHNICAL ENGINEERING REPORT ST JOSEPH'S CARMELITE MONASTERY
Checked By: BSO	File No. H1235290	PH. (407) 740-6110 FAX. (407) 740-6112	141 CARMELITE DRIVE BUNNELL, FLAGLER COUNTY, FLORIDA
Approved By: BHW	Date: 10-5-23		EXHIBIT

LEGEND

APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

APPROXIMATE LOCATION OF HAND AUGER

APPROXIMATE LOCATION OF AUGER BORING



Project Mngr: BSO	Project No. H1235290		BORING LOCATION PLAN
Drawn By: AS	Scale: AS SHOWN	Terracon Explore with us	GEOTECHNICAL ENGINEERING REPORT ST JOSEPH'S CARMELITE MONASTERY
Checked By: BSO	File No. H1235290	1675 LEE ROAD WINTER PARK, FLORIDA 32789	141 CARMELITE DRIVE
Approved By: BHW	Date: 10-5-23	PH. (407) 740-6110 FAX. (407) 740-6112	BUNNELL, FLAGLER COUNTY, FLORIDA

EXHIBIT

N:\Projects\2023\H1235290\PROJECT DOCUMENTS (Reports-Letters-Drafts to Clients)\Cad\H1235290 Loc Plan.dwg

Exploration and Laboratory Results

Contents:

Boring Logs (B-1 through B-7, HA-1 and HA-2)
Groundwater Levels
Permeability Test Results
Grain Size Distribution (2 pages)
Florida DOH Form DH 4015 (evaluated for soil color/texture and groundwater only)

Note: All attachments are one page unless noted above.

St. Joseph's Carmelite Monastery
141 Carmelite Drive | Bunnell, Flagler County, Florida
Terracon Project No. H1235290

Terracon
1675 Lee Rd
Winter Park, FL

Boring Log No. B-1

Location: See Exploration Plan

Latitude: 29.4068° Longitude: -81.1872°

Model Layer	Graphic Log	Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Percent Fines
1		0.5	**SAND (SP)**, fine grained, light brown						
2		2.0	**SAND WITH SILT (SP-SM)**, fine grained, dark grayish brown, medium dense, few cemented nodules				11-9-7-6 N=16		
1		6.0	**SAND (SP)**, fine grained, light brown, medium dense		▽		6-5-5-7 N=10		
				5			4-5-5-8 N=10		
2		15.0	**SAND WITH SILT (SP-SM)**, fine grained, grayish brown, very loose to medium dense				4-6-8-10 N=14		
							6-5-9-8 N=14		
				10					
			gray				1-1-1 N=2		
				15					
			Boring Terminated at 15 Feet						

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
▽ Groundwater encountered at a depth of 3 feet

Drill Rig
BR2500

Hammer Type
Automatic

Driller
Jose

Logged by

Boring Started
10-18-2023

Boring Completed
10-18-2023

Notes

Advancement Method
mud rotary

Abandonment Method

Terracon
1675 Lee Rd
Winter Park, FL

Boring Log No. B-2

Location: See Exploration Plan

Latitude: 29.4066° Longitude: -81.1871°

Model Layer	Graphic Log	Depth (Ft.) / Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Percent Fines
1		**SAND (SP)**, fine grained, orangish brown, medium dense				6-5-5-5 N=10		
		2.0						
3		**SILTY SAND (SM)**, dark brown, loose		▽		4-3-3-4 N=6		
		4.0						
2		**SAND WITH SILT (SP-SM)**, fine grained, brown, medium dense, few cemented nodules	5			5-7-9-10 N=16		
		no nodules				5-6-6-6 N=12		
						6-8-7-8 N=15		
			10					
		13.5						
3		**SILTY SAND (SM)**, gray, loose				1-2-2 N=4		
		15.0	15					
		Boring Terminated at 15 Feet						

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
▽ Groundwater encountered at a depth of 3.5 feet

Drill Rig
BR2500

Hammer Type
Automatic

Driller
Jose

Logged by

Boring Started
10-18-2023

Boring Completed
10-18-2023

Notes

Advancement Method
mud rotary

Abandonment Method

Boring Log No. B-3

Location: See Exploration Plan

Latitude: 29.4067° Longitude: -81.1874°

Model Layer	Graphic Log	Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Percent Fines
1		2.0	**SAND (SP)**, fine grained, grayish brown, loose		Cave-in		10-2-3-4 N=5		
2			**SAND WITH SILT (SP-SM)**, fine grained, brown, moist, medium dense				10-10-7-9 N=17		
		6.0	light grayish brown	5			7-9-10-10 N=19		

Boring Terminated at 6 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations

Cave-in at depth of 1 foot

Advancement Method

Abandonment Method

Drill Rig
BR2500

Hammer Type
Automatic

Driller
Jose

Logged by

Boring Started
10-18-2023

Boring Completed
10-18-2023

St. Joseph's Carmelite Monastery
141 Carmelite Drive | Bunnell, Flagler County, Florida
Terracon Project No. H1235290

1675 Lee Rd
Winter Park, FL

Boring Log No. B-4

Location: See Exploration Plan

Latitude: 29.4069° Longitude: -81.1878°

Model Layer	Graphic Log	Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Percent Fines
1		**SAND (SP)**, fine grained, light brown, loose to medium dense		Cave-in		4-3-4-5 N=7		
						2-3-6-7 N=9		
2		4.0 **SAND WITH SILT (SP-SM)**, fine grained, grayish brown, moist, medium dense	5			6-5-7-9 N=12		
		6.0 ***Boring Terminated at 6 Feet***						

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations

Cave-in at depth of 1 foot

Notes

Advancement Method

Abandonment Method

Drill Rig
BR2500

Hammer Type
Automatic

Driller
Jose

Logged by

Boring Started
10-18-2023

Boring Completed
10-18-2023

St. Joseph's Carmelite Monastery
141 Carmelite Drive | Bunnell, Flagler County, Florida
Terracon Project No. H1235290

Terracon
1675 Lee Rd
Winter Park, FL

Boring Log No. B-5

Location: See Exploration Plan

Latitude: 29.4064° Longitude: -81.1878°

Model Layer	Graphic Log	Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Percent Fines
2		**SAND WITH SILT (SP-SM)**, fine grained, dark brown, loose		Cave-in		2-2-4-5 N=6		
		2.0						
3		**SILTY SAND (SM)**, brown, moist, medium dense				4-5-7-9 N=12		
		light grayish brown	5			4-9-8-9 N=17		
		6.0						
		Boring Terminated at 6 Feet						

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations

Cave-in at depth of 1 foot

Advancement Method

Abandonment Method

Drill Rig
BR2500

Hammer Type
Automatic

Driller
Jose

Logged by

Boring Started
10-18-2023

Boring Completed
10-18-2023

Terracon
1675 Lee Rd
Winter Park, FL

Boring Log No. B-6

Location: See Exploration Plan

Latitude: 29.4065° Longitude: -81.1872°

Model Layer	Graphic Log	Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Percent Fines
2			**SAND WITH SILT (SP-SM)**, fine grained, light brown						
			dark gray					23.8	6
					▽ (3 ft)				
		4.5							
3			**SILTY SAND (SM)**, grayish brown	5				25.3	12
		9.5							
2			**SAND WITH SILT (SP-SM)**, fine grained, gray	10					
		15.0		15					
			Boring Terminated at 15 Feet						

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
▽ Groundwater encountered at a depth of 3 feet

Drill Rig
BR2500

Driller
Jose

Logged by

Boring Started
10-18-2023

Boring Completed
10-18-2023

Notes

Advancement Method

Abandonment Method

St. Joseph's Carmelite Monastery
141 Carmelite Drive | Bunnell, Flagler County, Florida
Terracon Project No. H1235290

1675 Lee Rd
Winter Park, FL

Boring Log No. B-7

Location: See Exploration Plan

Latitude: 29.4060° Longitude: -81.1878°

Model Layer	Graphic Log	Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Percent Fines
1		**SAND (SP)**, fine grained, light brown		▽				
		gray	5				27.0	4
		9.5						
2		**SAND WITH SILT (SP-SM)**, fine grained, gray, trace of shell fragments	10					
		15.0	15					
		Boring Terminated at 15 Feet						

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations

▽ Groundwater encountered at a depth of 1 foot

Advancement Method

Abandonment Method

Drill Rig
BR2500

Driller
Jose

Logged by

Boring Started
10-18-2023

Boring Completed
10-18-2023

Terracon
1675 Lee Rd
Winter Park, FL

Boring Log No. HA-1

Location: See Exploration Plan

Latitude: 29.4068° Longitude: -81.1870°

Model Layer	Graphic Log	Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Percent Fines
2		**SAND WITH SILT (SP-SM)**, fine grained, black 1.0		▽			26.3	6
1		**SAND (SP)**, fine grained, dark gray 2.0						
2		**SAND WITH SILT (SP-SM)**, fine grained, very dark gray **SAND WITH SILT (SP-SM)**, fine grained, very dark gray **SAND WITH SILT (SP-SM)**, fine grained, dark grayish brown 5.0	5					
		Boring Terminated at 5 Feet						

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations

▽ Groundwater encountered at a depth of 1 foot

Drill Rig
Hand Auger

Driller
Jose

Logged by

Notes

Advancement Method

Abandonment Method

Boring Started
10-18-2023

Boring Completed
10-18-2023

Terracon
1675 Lee Rd
Winter Park, FL

Boring Log No. HA-2

Location: See Exploration Plan

Latitude: 29.4070° Longitude: -81.1870°

Model Layer	Graphic Log	Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Percent Fines
1		**SAND (SP)**, fine grained, grayish brown brown grayish brown 4.0		▽				
		Boring Terminated at 4 Feet						

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations
▽ Groundwater encountered at a depth of 0.5 foot

Advancement Method

Abandonment Method

Drill Rig
Hand Auger

Driller
Jose

Logged by

Boring Started
10-18-2023

Boring Completed
10-18-2023

Groundwater Levels

Boring number	Approximate depth to encountered water table (feet)	Approximate depth to estimated seasonal high water table (feet)
B-1	3	1
B-2	3½	1½
B-3	2 [1]	1
B-4	2 [1]	1
B-5	2 [1]	1
B-6	3	1½
B-7	1	1
HA-1	1	½
HA-2	½	½

1. Estimated, based on visual-manual review of soil samples.
2. Seasonal high water level anticipated to be at or above existing ground surface.

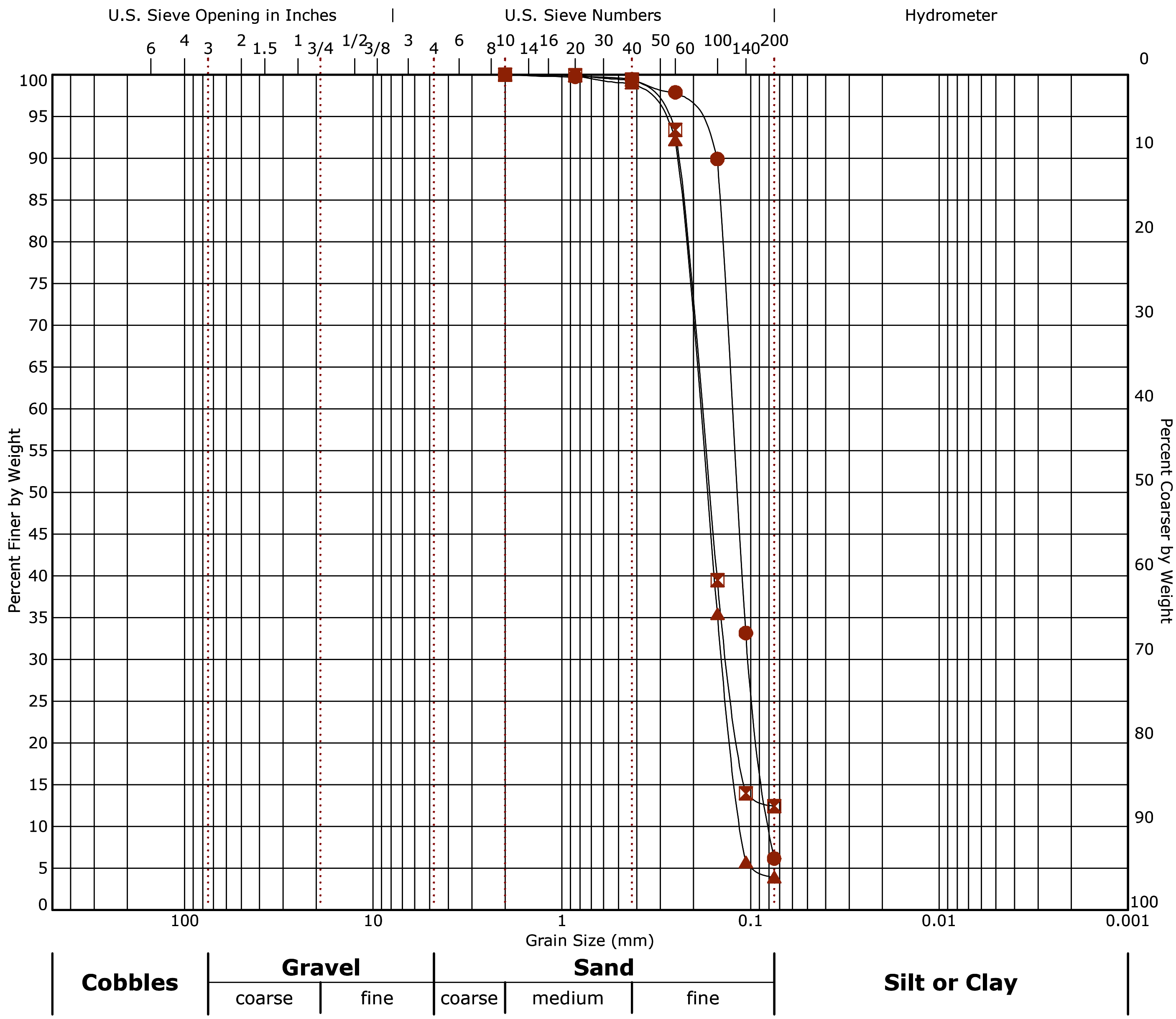
Permeability Test Results

Boring number	Sample number	Sample depth (feet)	Fines content (percent)	Moisture content (percent)	Measured permeability (feet per day)
B-6	2	½ to 1	6	23.8	11
B-7	2	4½ to 5	4	27.0	23

Terracon
1675 Lee Rd
Winter Park, FL

Grain Size Distribution

ASTM D422 / ASTM C136



	Boring ID	Depth	% Cobbles	% Gravel	% Sand	% Fines	% Silt	% Clay	USCS
●	B-6	0.5 - 1	0.0	0.0	93.8	6.2			
⊠	B-6	4.5 - 5	0.0	0.0	87.6	12.4			
▲	B-7	4.5 - 5	0.0	0.0	96.1	3.9			SP

	Description
●	
⊠	
▲	POORLY GRADED SAND

	Remarks
●	
⊠	
▲	

● Sieve	● % Finer	⊠ Sieve	⊠ % Finer	▲ Sieve	▲ % Finer
#10	100.0	#10	100.0	#10	100.0
#20	99.76	#20	99.93	#20	99.86
#40	99.46	#40	99.42	#40	98.99
#60	97.9	#60	93.4	#60	92.18
#100	89.91	#100	39.5	#100	35.45
#140	33.16	#140	13.98	#140	5.74
#200	6.17	#200	12.43	#200	3.93

Grain Size

	●	⊠	▲
D_{60}	0.125	0.182	0.187
D_{30}	0.102	0.132	0.141
D_{10}	0.079		0.111

Coefficients

	●	⊠	▲
C_c	1.05	2.19	0.95
C_u	1.59	4.18	1.68

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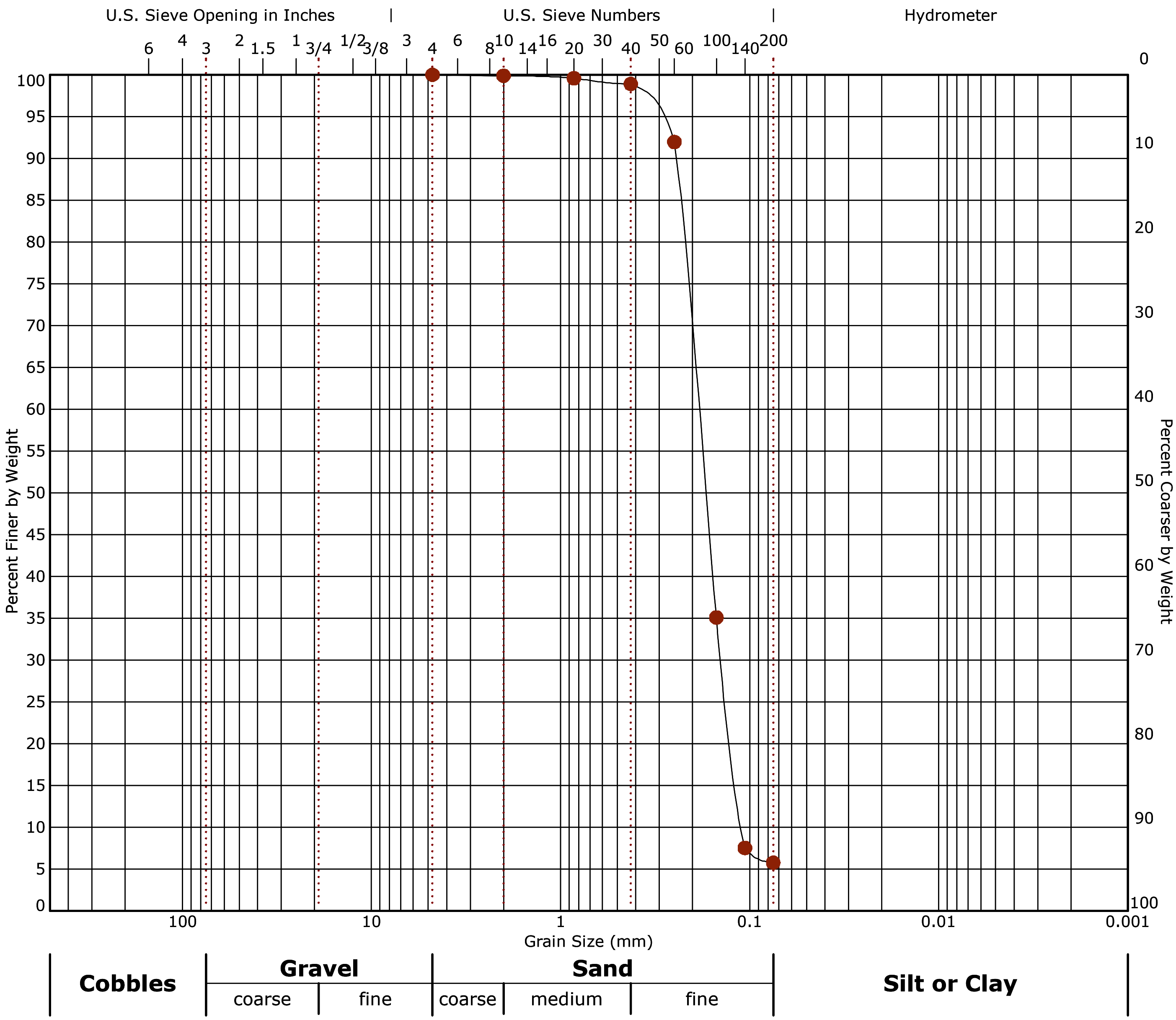
Terracon Project No. H1235290

1675 Lee Rd
Winter Park, FL

Grain Size Distribution

ASTM D422 / ASTM C136



	Boring ID	Depth	% Cobbles	% Gravel	% Sand	% Fines	% Silt	% Clay	USCS
●	HA-1	0 - 1	0.0	0.0	94.2	5.8			

	Description
●	

	Remarks
●	

Sieve (●)	% Finer (●)	Sieve	% Finer	Sieve	% Finer
#4	100.0				
#10	99.89				
#20	99.59				
#40	98.9				
#60	91.97				
#100	35.09				
#140	7.53				
#200	5.76				

Grain Size

	●		
D_{60}	0.188		
D_{30}	0.141		
D_{10}	0.109		

Coefficients

	●		
C_C	0.96		
C_U	1.72		

STATE OF FLORIDA
DEPARTMENT OF HEALTH
ONSITE SEWAGE TREATMENT AND DISPOSAL SYSTEM
SITE EVALUATION AND SYSTEM SPECIFICATIONS

PERMIT #. ______________

APPLICANT: ______________ AGENT: ______________

LOT: ______ BLOCK: ______ SUBDIVISION: ______________

PROPERTY ID #: 04-13-31-0650-000B0-0050 [Section/Township/Parcel No. or Tax ID Number]

TO BE COMPLETED BY ENGINEER, HEALTH DEPARTMENT EMPLOYEE,OR OTHER QUALIFIED PERSON. ENGINEERS MUST PROVIDE REGISTRATION NUMBER AND SIGN AND SEAL EACH PAGE OF SUBMITTAL. COMPLETE ALL ITEMS.

PROPERTY SIZE CONFORMS TO SITE PLAN: [ ] YES [ ] NO NET USABLE AREA AVAILABLE: ______ ACRES
TOTAL ESTIMATED SEWAGE FLOW: ______ GALLONS PER DAY [RESIDENCES-TABLE 1/OTHER-TABLE 2]
AUTHORIZED SEWAGE FLOW: ______ GALLONS PER DAY [1500 GPD/ACRE OR 2500 GPD/ACRE]
UNOBSTRUCTED AREA AVAILABLE: ______ SQFT UNOBSTRUCTED AREA REQUIRED: ______ SQFT

BENCHMARK/REFERENCE POINT LOCATION: ______________
ELEVATION OF PROPOSED SYSTEM SITE IS ______ [INCHES / FT] [ABOVE / BELOW] BENCHMARK/REFERENCE POINT

THE MINIMUM SETBACK WHICH CAN BE MAINTAINED FROM THE PROPOSED SYSTEM TO THE FOLLOWING FEATURES
SURFACE WATER: ______ FT DITCHES/SWALES: ______ FT NORMALLY WET? [ ] YES [ ] NO
WELLS: PUBLIC: ______ FT LIMITED USE: ______ FT PRIVATE: ______ FT NON-POTABLE: ______ FT
BUILDING FOUNDATIONS: ______ FT PROPERTY LINES: ______ FT POTABLE WATER LINES: ______ FT

SITE SUBJECT TO FREQUENT FLOODING: [ ] YES [ ] NO 10 YEAR FLOODING? [ ] YES [ ] NO
10 YEAR FLOOD ELEVATION FOR SITE: ______ FT MSL/NGVD SITE ELEVATION: ______ FT MSL/NGVD

SOIL PROFILE INFORMATION SITE 1

MUNSELL #/COLOR	TEXTURE	DEPTH
10YR/2/1	sand	0 TO 12
black		TO
10YR/4/1	sand	12 TO 24
dark gray		TO
10YR/3/2	sand	24 TO 48
v dk grayish brown		TO
10YR/4/2	sand	48 TO 60
dark grayish brown		TO
		TO

USDA SOIL SERIES: Malabar

SOIL PROFILE INFORMATION SITE 2

MUNSELL #/COLOR	TEXTURE	DEPTH
10YR/5/2	sand	0 TO 12
grayish brown		TO
10YR/5/3	sand	12 TO 24
brown		TO
10YR/5/2	sand	24 TO 48
grayish brown		TO
	sand	TO
		TO
		TO

USDA SOIL SERIES: Malabar

OBSERVED WATER TABLE: 12 and 6 INCHES [BELOW] EXISTING GRADE. TYPE: [APPARENT]
ESTIMATED WET SEASON WATER TABLE ELEVATION: 6 INCHES [BELOW] EXISTING GRADE
HIGH WATER TABLE VEGETATION: [ ] YES [✔] NO MOTTLING: [ ] YES [✔] NO DEPTH: ______ INCHES

SOIL TEXTURE/LOADING RATE FOR SYSTEM SIZING: ______ DEPTH OF EXCAVATION: ______ INCHES
DRAINFIELD CONFIGURATION: [ ] TRENCH [ ] BED [ ] OTHER (SPECIFY) ______
REMARKS/ADDITIONAL CRITERIA: Observed water table at Site 1 at 12 inches below grade, and at Site 2 at 6 inches below grade.

SITE EVALUATED BY: ______________ DATE: ______

Supporting Information

Contents:

Soil Survey Description
General Notes
Unified Soil Classification System
USDA Soil Classification Triangle

Note: All attachments are one page unless noted above.

Soil Survey Description

19 – Valkaria fine sand, 0 to 2 percent slopes. This soil map unit is nearly level and poorly drained. It is typically found on low broad flats and in sloughs connecting depressions. In its natural state and during years of normal rainfall, this soil type has an apparent seasonal high water table within 6 inches (0.5 feet) of the surface for 2 to 6 months and recedes to depths of between 10 and 40 inches (0.8 and 3.3 feet) during dry periods. Water is at the surface for a few days to several weeks. This soil map unit is predominantly sandy throughout the defined profile of 80 inches (6.7 feet).

Typical permeability rates for 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.

Terracon
1675 Lee Rd
Winter Park, FL

General Notes

Sampling	Water Level		Field Tests	
	▽	Water Initially Encountered	N	Standard Penetration Test Resistance (Blows/Ft.)
	▽	Water Level After a Specified Period of Time	(HP)	Hand Penetrometer
	▼	Water Level After a Specified Period of Time	(T)	Torvane
		Cave In Encountered	(DCP)	Dynamic Cone Penetrometer
			UC	Unconfined Compressive Strength
			(PID)	Photo-Ionization Detector
			(OVA)	Organic Vapor Analyzer

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		Consistency of Fine-Grained Soils (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Relative Density	**Standard Penetration or N-Value (Blows/Ft.)**	**Consistency**	**Unconfined Compressive Strength Qu (tsf)**	**Standard Penetration or N-Value (Blows/Ft.)**
Very Loose	< 3	Very Soft	less than 0.25	< 1
Loose	3 - 8	Soft	0.25 to 0.50	1 - 3
Medium Dense	8 - 24	Medium Stiff	0.50 to 1.00	3 - 6
Dense	24 - 40	Stiff	1.00 to 2.00	6 - 12
Very Dense	> 40	Very Stiff	2.00 to 4.00	12 - 24
		Hard	> 4.00	> 24

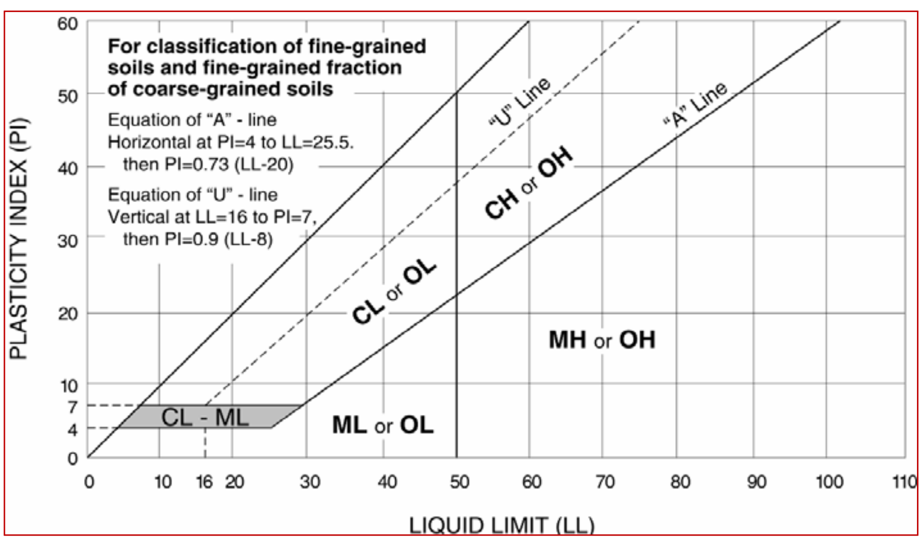
Relevance of Exploration and Laboratory Test Results

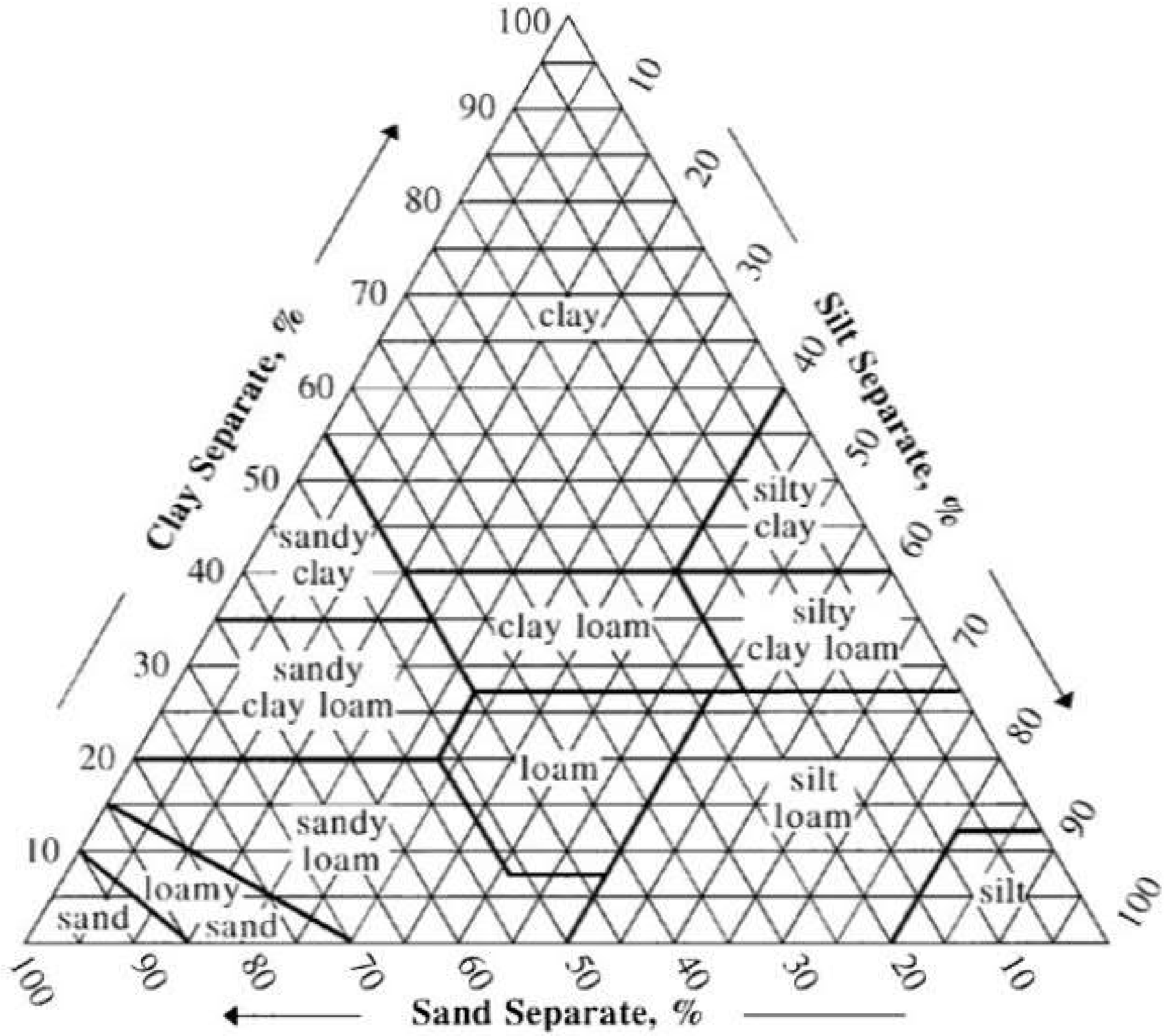
Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

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≥4 and 1≤Cc≤3 [E]	GW	Well-graded gravel [F]
			Cu<4 and/or [Cc<1 or Cc>3.0] [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≥6 and 1≤Cc≤3 [E]	SW	Well-graded sand [I]
			Cu<6 and/or [Cc<1 or Cc>3.0] [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 above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	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:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	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] $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[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.




Clay Separate, %
Silt Separate, %
Sand Separate, %
clay
silty clay
sandy clay
clay loam
silty clay loam
sandy clay loam
loam
silt loam
sandy loam
silt
loamy sand
sand
100
90
80
70
60
50
40
30
20
10