



# Geotechnical Engineering Report

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**Lake May Reserve  
Eustis, Lake County, Florida**

September 24, 2019

Terracon Project No. H1195051

**Prepared for:**

CPWG

Oviedo, Florida

**Prepared by:**

Terracon Consultants, Inc.

Winter Park, Florida



September 24, 2019

CPWG  
1221 E. Broadway Street  
Oviedo, Florida 32765



Attn: Mr. Jeff Earhart, P.E. - Principal  
P: (407) 677-1012  
E: jeff.earhart@cpwgeengineering.com

Re: Geotechnical Engineering Report  
Lake May Reserve  
County Road 44A  
Eustis, Lake County, Florida  
Terracon Project No. H1195051

Dear Mr. Earhart:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. PH1195051 dated February 19, 2019. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of small structures, pavement grading and stormwater facilities for the proposed project.

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

Sincerely,

**Terracon Consultants, Inc.**

Certificate of Authorization No. 9330

Shenna McMaster, P.E.  
Senior Geotechnical Engineer  
Florida PE #57537

Jay W. Casper, P.E.  
Principal

This report has been electronically signed and sealed by Shenna McMaster, 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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Environmental



Facilities



Geotechnical



Materials

**REPORT TOPICS**

**REPORT SUMMARY..... I**

**INTRODUCTION..... 1**

**SITE CONDITIONS..... 1**

**PROJECT DESCRIPTION..... 3**

**GEOTECHNICAL CHARACTERIZATION..... 3**

**GEOTECHNICAL OVERVIEW ..... 5**

**EARTHWORK ..... 5**

**SHALLOW FOUNDATIONS..... 8**

**FLOOR SLABS ..... 10**

**CANOE LAUNCH ..... 11**

**PAVEMENT GRADING ..... 12**

**STORMWATER MANAGEMENT ..... 17**

**SEPTIC DRAINFIELD..... 18**

**GENERAL COMMENTS..... 18**

**Note:** This report was originally delivered in a web-based format. For more interactive features, please view your project online at [client.terracon.com](http://client.terracon.com).

**ATTACHMENTS**

- EXPLORATION AND TESTING PROCEDURES**
- SITE LOCATION AND EXPLORATION PLANS**
- EXPLORATION RESULTS**
- SUPPORTING INFORMATION**

**Note:** Refer to each individual Attachment for a listing of contents.

## REPORT SUMMARY

Topic <sup>1</sup>	Overview Statement <sup>2</sup>
<b>Project Description</b>	We understand a few pavilions and restroom building are planned on the eastern portion of the site. A stormwater treatment facility and paved driveway are also planned on the eastern portion of the site. Along the southern edge of Lake May, an overlook platform is planned. A canoe launch is planned along the southeastern shore of Lake May.
<b>Geotechnical Characterization</b>	Mostly sand in the upper 4 to 15 feet underlain by sand with silt and silty sand. Groundwater encountered at depths of 2-1/2 feet or more below existing grade
<b>Earthwork</b>	Normal site preparation is anticipated
<b>Shallow Foundations</b>	Shallow foundations will be sufficient for the restroom and pavilions Allowable bearing pressure = 2,000 psf Expected settlements: < 1-inch total, < 3./4-inch differential Site preparation as noted in <b>Earthwork</b> .
<b>Pavements</b>	With subgrade prepared as noted in <b>Earthwork</b> . <ul style="list-style-type: none"> <li>■ 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.</li> <li>■ Concrete pavements should be supported on a minimum of 18 inches of free draining sand to minimize unstable pumping conditions.</li> </ul>
<b>Stormwater</b>	A dry stormwater pond appears feasible at this site.
<b>General Comments</b>	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.

# Geotechnical Engineering Report

Lake May Reserve

County Road 44A

Eustis, Lake County, Florida

Terracon Project No. H1195051

September 24, 2019

## INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed improvements to the existing park facility located on County Road 44A in Eustis, Lake County, Florida. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Foundation design and construction
- Pavement grading and section design
- Stormwater pond considerations
- Septic drainfield design considerations.

The geotechnical engineering Scope of Services for this project included the advancement of six test borings to depths ranging from 5 to 20 feet below existing site grades. In addition, a limited amount of probing was performed at accessible areas at the canoe launch and overlook locations.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs in the **Exploration Results** section.

## 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.

## Geotechnical Engineering Report

Lake May Reserve ■ Eustis, Lake County, Florida

September 24, 2019 ■ Terracon Project No. H1195051



Item	Description
<b>Parcel Information</b>	The project is located on County Road 44A in Eustis, Lake County, Florida. Approximate 9.5 acres Latitude/Longitude (approximate): 29.165469° N, 81.523974° W (See <a href="#">Site Location</a> )
<b>Current Ground Cover</b>	Heavily wooded
<b>Existing Topography</b> (from USGS Quad)	Ground surface elevations on the main (eastern portion) of the site range from about +130 to +140 feet, generally sloping towards the north. The canoe launch and overlook location have ground surface elevation near +85 feet.
<b>Surface Water</b>	The USGS topographic quadrangle map "Eustis, Florida" depicts Lake May on the west side of the site with a recorded water level near +85 feet and an unnamed water feature to the north of the site with a recorded water level near +75 feet.

## Soil Survey

The Soil Survey of Lake County, Florida as prepared by the United States Department of Agriculture (USDA), Soil Conservation Service (SCS; later renamed the Natural Resource Conservation Service - NRCS, identifies the surficial soil types at the subject site as:

Candler sand, 0 to 5 percent slopes (8) and 5 to 12 percent slopes (9). This soil type is nearly level to gently sloping and excessively drained. It is typically found on rolling uplands of the central ridge. This soil type has a seasonal high water table at a depth of greater than 120 inches (10 feet). This soil type is predominantly sandy to a typical depth of 95 inches (7.9 feet). Thereafter, to the maximum defined depth of 99 inches (8.3 feet), this soil type exists as silty sand (USCS Classification symbol SM).

Typical permeability rates for this soil type are generally between 6 and 20 inches per hour (12 and 40 feet per day) between the surface and a typical depth of 95 inches, and between 2 and 6 inches per hour (4 and 12 feet per day) thereafter to the maximum defined depth of 99 inches.

Tavares sand, 0 to 5 percent slopes (45). This soil type is nearly level to gently sloping and moderately well drained. In its natural state and during years of normal precipitation, this soil type has a seasonal high water table between depths of 40 and 60 inches (3.3 and 5.0 feet) of the surface for 6 months. This soil is predominantly sandy throughout the defined profile of 80 inches (6.7 feet).

Typical permeability rates for this soil type are generally greater than 6 inches per hour (12 feet per day) throughout the defined profile of 80 inches.

A Soils Map is included with this **GeoReport**, depicting the applicable Soil Survey map portion for the subject site.

## PROJECT DESCRIPTION

Our understanding of the project conditions is as follows:

Item	Description
<b>Information Provided</b>	Site plans provided by you.
<b>Project Description</b>	We understand a few pavilions and restroom building are planned on the eastern portion of the site. A stormwater treatment facility and paved driveway are also planned on the eastern portion of the site. Along the southern edge of Lake May, an overlook platform is planned. A canoe launch is planned along the southeastern shore of Lake May.

## GEOTECHNICAL CHARACTERIZATION

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

Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/ Density
4 to 15	Sand (SP)	Very loose to loose
Deepest Boring Termination depth of 20 feet	Sand with silt (SP-SM) and/or silty sand (SM)	Very loose to loose

Conditions encountered at each boring location and results of laboratory testing are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types. The in-situ transition between materials may be gradual. Details for each of the borings can be found on the boring logs in the **Exploration Results** section of this report. Descriptions of our field exploration and laboratory testing procedures are described in the **Exploration and Testing Procedures** section. General notes for SPT borings and more detailed description of the Unified Soil Classification System (USCS) is included in the **Supporting Information** section.

Probing performed in the proposed canoe launch and overlook areas did not find surficial organic soils. Very loose sand to about 2 feet was found in the canoe launch location and about 1 foot in the overlook area. Due to lack of access for mobilization of our john boat and equipment for probing within Lake May, probing could not be performed in the floating dock area of the canoe

launch site. Standing water to a depth of 1-1/2 feet was found in the area probed in the explored portion of the canoe launch location. Results of the probing can be found in the **Exploration Plan** section of this report.

### **Groundwater Conditions**

The borings were observed during drilling for the presence and level of groundwater. Groundwater was found in Boring B-1, performed near the proposed canoe launch location, at a depth of about 2-1/2 feet below existing grade. The remaining borings did not find groundwater within the explored depths of 10 to 20 feet below existing grade. It should be noted that due to the use of driller's mud to stabilize SPT boreholes, accurate groundwater levels could not be measured below a depth of 10 feet in Borings B-3 and B-4.

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 with rainfall and recharge at a maximum, groundwater levels will be near the levels indicated below. Our estimates of the seasonal groundwater conditions are based on the USDA Soil Survey, provided site specific topographic information, the encountered soil types, antecedent weather conditions, and the interpreted water levels. The water levels observed in the borings can be found on the boring logs in **Exploration Results**, and are summarized below along with the estimated normal seasonal high groundwater table.

<b>Boring Number</b>	<b>Approximate depth to encountered water table (feet)</b>	<b>Approximate depth to estimated normal seasonal high groundwater table (feet)</b>
B-1	2-1/2	1
B-2	>10	5
B-3	>10	>10
B-4	>10	8 (P)
B-5	>20	15 (P)
B-6	>10	6.5 (P)

(P) indicated perched condition following heavy rainfall events.

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.

## **GEOTECHNICAL OVERVIEW**

Borings encountered native sand to sand with silt to silty sand. These materials are generally suitable for construction of the proposed small structures, pavements, and stormwater systems following site preparation according to the recommendations provided in the **Earthwork** section.

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

The **Shallow Foundations** section addresses support of the pavilions and restroom building on in-situ sands or engineered fill.

The **Canoe Launch** section addresses support of the canoe launch on timber piles. It should be noted that due to access restrictions, manual auger borings were performed rather than originally planned deeper borings with a drill rig.

Soil and groundwater parameters for use in stormwater pond design are presented in the **Stormwater Management** section.

Recommendations regarding septic drainfield design are presented in the **Septic Drainfield** section.

The **General Comments** section provides an understanding of the report limitations.

## **EARTHWORK**

Earthwork is anticipated to include clearing and grubbing, excavations, and 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 prepare the site as considered in our geotechnical engineering evaluation for foundations, slabs, and pavements.

### **Site Preparation**

Prior to placing fill, existing vegetation and root mat should be removed. Complete stripping of the topsoil should be performed in the proposed structure and pavement areas.

The subgrade should be proofrolled with an adequately loaded vehicle such as a fully-loaded tandem-axle dump truck or heavy roller. If access restricts use of heavy equipment for proofrolling, hand-guided compactors can be used. The proofrolling should be performed under the direction of the Geotechnical Engineer. 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.

### Fill Material Types

Fill required to achieve design grade should be classified as structural fill and general fill. Structural fill is material used below or within 10 feet of structures, pavements or constructed slopes. General fill is material used to achieve grade outside of these areas. Earthen materials used for structural and general fill should meet the following material property requirements:

Soil Quality <sup>1</sup>	USCS Classification	Acceptable Location for Placement	Maximum Lift Thickness (in.)
Preferred <sup>1</sup>	SP (fines content < 5%)	All locations and elevations	12 <sup>3</sup>
	SP-SM (fines content between 5 and 12%) <sup>2</sup>	All locations and elevations other than beneath concrete pavements or where superior drainage is required. Strict moisture control will be required during placement, particularly during the rainy season.	8 to 12 <sup>3</sup>

1. Controlled, compacted fill should consist of approved materials that are free of organic matter and debris.
2. If fines contents are greater than 12 percent, special design and construction procedures may be 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.

### Fill Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Structural Fill
<b>Minimum Compaction Requirements<sup>1</sup></b>	95 percent of the material's maximum modified Proctor dry density (ASTM D 1557).
<b>Moisture Content<sup>2</sup></b>	Within ±2 percent of optimum moisture content as determined by the Modified Proctor test, at the time of placement and compaction.

Item	Structural Fill
<p><b>Minimum Testing Frequency</b></p>	<ul style="list-style-type: none"> <li>▪ One field density test per 2,500 square feet or fraction thereof per 1-foot lift in structure and pavement areas.</li> <li>▪ One density and water content test should be performed for every 200 linear feet of compacted utility trench backfill.</li> </ul>
<ol style="list-style-type: none"> <li>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.</li> <li>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.</li> </ol>	

### Utility Trench Backfill

All trench excavations should be made with sufficient working space to permit construction including backfill placement and compaction

### Grading and Drainage

All grades should provide effective drainage away from the structures during and after construction. Final surrounding grades should be sloped away from the structures on all sides to prevent ponding of water. 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

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

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

As a minimum, all temporary excavations should be sloped or braced as required by Occupational Health and Safety Administration (OSHA) regulations to provide stability and safe working

## Geotechnical Engineering Report

Lake May Reserve ■ Eustis, Lake County, Florida

September 24, 2019 ■ Terracon Project No. H1195051



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

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 monitored under the direction of the Terracon Geotechnical Engineer. Monitoring should include documentation of adequate removal of vegetation and topsoil, proofrolling, and mitigation of areas delineated by the proofroll to require mitigation.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, until approved by the Terracon 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 and pavement areas. One density and water content test should be performed for every 200 linear feet of compacted utility trench backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Terracon Geotechnical Engineer. If unanticipated conditions are encountered, the Terracon Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Terracon 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

Description	Column Footing	Wall Footing	Monolithic Slab Foundation <sup>4</sup>
<b>Net allowable bearing pressure <sup>1</sup></b>	2,000 psf	2,000 psf	2,000 psf
<b>Minimum width</b>	30 inches	18 inches	12 inches
<b>Minimum embedment below finished grade <sup>2</sup></b>	18 inches	18 inches	12 inches
<b>Compaction requirements</b>	95 percent of the materials maximum Modified Proctor dry density for a depth of 12 inches below footing.		
<b>Minimum Testing Frequency</b>	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.
<b>Approximate total settlement <sup>3</sup></b>	<1 inch	<1 inch	<1 inch
<b>Estimated differential settlement <sup>3</sup></b>	< <sup>3</sup> / <sub>4</sub> inch between columns	< <sup>3</sup> / <sub>4</sub> inch over 40 feet	< <sup>3</sup> / <sub>4</sub> inch over 40 feet

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes any unsuitable fill or soft soils, if encountered, will be undercut and replaced with engineered fill.
2. For erosion protection and to reduce effects of seasonal moisture variations in subgrade soils.
3. The foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations. The above settlement estimates have assumed that the maximum footing width is 5 feet for column footings and 1.5 feet for continuous footings.
4. Turned-down portion of slab. For slab requirements see **Floor Slabs**

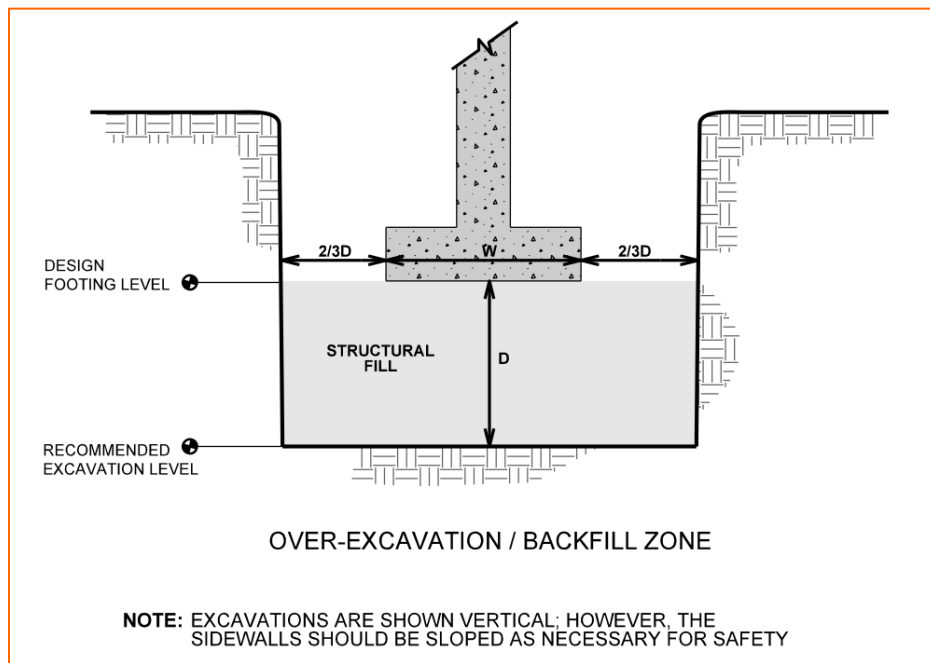
The soil above the footings and the weight of the concrete within the footings should be considered for uplift resistance. A unit weight of 105 pounds per cubic foot is recommended for compacted structural fill above the footings. A buoyant unit weight of 50 pounds per cubic foot may be used for soil below the seasonal high groundwater table.

## Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the direction 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 and subgrade compaction 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 encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on compacted structural backfill up to the footing elevation, 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 and positive drainage of the aggregate base beneath the floor slab.

### Floor Slab Design Parameters

Item	Description
<b>Floor Slab Support <sup>1</sup></b>	Minimum 6 inches of free-draining (less than 6% passing the U.S. No. 200 sieve) crushed aggregate compacted to at least 95% of ASTM D 1557 <sup>2, 3</sup>
<b>Estimated Modulus of Subgrade Reaction <sup>2</sup></b>	100 pounds per square inch per inch (psi/in) for point loads

Item	Description
1.	Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2.	Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in <b>Earthwork</b> , 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.	Free-draining granular material should have less than 5% fines (material passing the No. 200 sieve). Other design considerations such as cold temperatures and condensation development could warrant more extensive design provisions.

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, 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 control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or cracks should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

The Structural Engineer should account for potential differential movement 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 approve 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.

## **CANOE LAUNCH**

We anticipate the canoe launch will be supported on timber piles or other pile system. At this time, specific plans and loading information are not available. Based on the results of our limited exploration, we recommend that the piles be driven, jetted, or placed in augered holes at least 10

feet below the bottom of the soft or very loose surficial sediments (organic muck/peat or very loose sands) in the lake. It should be noted that probing performed for this exploration was limited due to access restrictions of a john boat to probe within the lake and boring depths were limited due to restrictions to the drill rig. Probing is recommended prior to installation of the canoe launch foundation system to better evaluate anticipated pile lengths.

It is recommended that augered or jetted holes be backfilled with sand or gravel. The annuli may also be filled with concrete. For design of the piles, the following capacities are recommended:

- For compressive loads, an allowable skin friction of 250 psf is recommended for the timber piles. This is a conservative estimate considering that boring depths were limited due to drill rig restrictions at the site. Skin friction within surficial soft sediments (such as organic muck) should not be considered. If the piles are encased in concrete, the perimeter of the concrete encasement can be used in calculating the skin friction achieved. If the augered or jetted holes are backfilled with sand or gravel, the perimeter of the piles should be used in estimating the allowable skin friction.
- For calculation of uplift resistance, 2/3 of the allowable skin friction for compression is recommended.
- For lateral capacity, an ultimate lateral passive soil pressure of 150 psf per foot of embedment below soft surficial sediments is recommended. Lateral passive resistance for the length of pile above and within the soft or loose surficial sediments should not be considered.

## **PAVEMENT GRADING**

### **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 2,500 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 in 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 Thickness

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

Typical Pavement Section (inches)						
Traffic Area	Alternative	Asphalt Concrete Surface Course	Limerock, Soil-Cement or Crushed Concrete Base Course	Stabilized Subbase Course <sup>2,3,4</sup>	Portland Cement Concrete	Free Draining Subgrade
Car Parking	PCC	--	--		5.0	18.0
	AC	1.5	6.0	12.0	--	--
	PCC	--	--		6.0	18.0

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

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

## 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.
- 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.
- Stabilized subgrade soils (also identified as stabilized subbase) should be stabilized to a minimum Limerock Bearing Ratio (LBR; Florida Method of Test Designation FM 5-515) value of 40 if they do not already meet this criterion or modified/replaced with new compacted fill that meets the minimum LBR value. Although LBR testing has not been performed, our experience with similar soils indicates that the near surficial sands encountered in the soil borings are unlikely to meet this requirement.
- The stabilized subgrade course should be compacted to at least 98 percent of the Modified Proctor maximum dry density (AASHTO T-180 or ASTM D-1557). Any underlying, newly-placed subgrade fill need only be compacted to a minimum of 95 percent of the Modified Proctor maximum dry density. Compaction tests should be performed at a frequency of 1 test per 10,000 square feet or fraction thereof.
- Limerock base courses from an approved FDOT source should have a minimum LBR value of 100 and be compacted to a minimum of 98 percent of the maximum dry density as determined by the Modified Proctor test. Limerock should be placed in uniform lifts not

to exceed 6 inches loose thickness. Recycled limerock is not a suitable substitute for virgin limerock for base courses but may be used as a granular stabilizing admixture.

- Soil cement base courses typically experience shrinkage cracking due to hydration curing of the cement. This shrinkage cracking typically propagates through the overlying asphalt course and reflects in the pavement surface. This reflective cracking is not necessarily indicative of a pavement structural failure, though it is sometimes considered to be aesthetically undesirable.
- Soil cement bases should have 7-day design strength of 300 psi. Soil cement base should be compacted to a minimum of 98 percent of the material's maximum dry density as determined by the Standard Proctor Test for Soil Cement (AASHTO T-134). Higher design strengths may result in increased cracking.
- Crushed (recycled) concrete base should meet the current FDOT specification 911 for recycled materials.
- Asphalt should be compacted to a minimum of 95 percent of the design mix density. Asphalt surface courses should be Type SP, Type S, or other suitable mix design according to FDOT and local requirements.
- To verify thicknesses, after placement and compaction of the pavement courses, core the wearing surface to evaluate material thickness and composition at a minimum frequency of 5,000 square feet or two locations per day's production.
- Underdrains or strip drains should be considered along all landscaped areas in, or adjacent to pavements to reduce moisture migration to subgrade soils. Underdrains will also be required below pavement if the separation between the bottom of the base course and the seasonal high groundwater table is less than 1 foot.
- 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 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, we anticipate this requirement can be readily met.
- Sawcut patterns should generally be square or rectangular but nearly square and extend to a depth equal to a quarter of the slab thickness. If the bottom of the concrete pavement is separated from the seasonal high groundwater table by at least 1 foot, filter fabric will not be necessary beneath the expansion joints.

## **Pavement Drainage**

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. The subgrade and the pavement surface should have a minimum  $\frac{1}{4}$  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 maintenance should be anticipated. Therefore, preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance (e.g. surface sealing). Preventive maintenance is usually the priority when implementing a pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur, and repairs may be required.

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:

- Install below 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.

## STORMWATER MANAGEMENT

Design of the stormwater management system has not been completed yet, though we understand a dry retention system is planned in the interior of the parking area. Dry retention ponds generally need to be at least 1 foot and sometimes as much as 3 feet (or more for large ponds) above the seasonal high groundwater table to recover within the time required.

Boring B-5 was performed in the approximate center of the proposed stormwater pond area. Soil conditions observed consisted of sand (SP) to a depth of 15 feet underlain by sand with silt (SP-SM) to the boring termination depth of 20 feet below existing grade. Groundwater was not observed within the explored depth of 20 feet. A perched groundwater level above the sand with silt (SP-SM) layer should be considered in stormwater pond design. A bulk soil sample of anticipated stormwater pond subgrade soils (clean sand) had a measured permeability rate of 7 feet/day. We consider this permeability rate to be indicative of a mean permeability rate. Experience and published references have indicated that vertical permeability as used in some locally available groundwater models is typically ½ the horizontal value.

Therefore, we recommend using an unsaturated vertical infiltration rate,  $k_v$ , of 5 feet/day and a horizontal saturated hydraulic conductivity rate,  $k_H$ , of 10 feet/day for the purpose of designing the proposed stormwater pond.

The top of sand with silt (SP-SM) observed at a depth of 15 feet below existing grade should be considered as the confining layer for the purpose stormwater system design. Based upon our visual review of the sands, and our local project experience, we recommend that you consider the surficial aquifer (the site sands) to have a fillable porosity ( $\eta$ ) of 25 percent. The table below summarizes our recommended stormwater management system design parameters.

Parameter	Boring Location B-5
Estimated Confining Layer Depth (ft) <sup>1</sup>	15
Estimated Seasonal High Groundwater Table Depth (ft) <sup>1</sup>	15
Unsaturated Vertical Infiltration Rate, $k_v$	5 feet/day
Horizontal Saturated Hydraulic Conductivity, $k_H$	10 feet/day
Fillable Porosity, $\eta$	25 percent

Parameter	Boring Location B-5
1. Below existing grade.	

## SEPTIC DRAINFIELD

Boring B-6 was performed in the approximate septic drainfield location. Generally, soil conditions observed at this location consisted of sand (SP) to a depth of about 6.5 feet below existing grade underlain by sand with silt (SP-SM) to the boring termination depth of 10 feet. These soils are generally favorable for construction of a septic drainfield as part of an on-site sewage treatment system.

Groundwater was not observed within the explored depth of 10 feet. A perched groundwater table above the lower permeable sand with silt (SP-SM) may be observed following heavy rainfall events. Due to the depth of the groundwater table, a mounded drainfield is not anticipated. Typically, the building pad would be elevated about 2 feet above the drainfield for proper drainage.

Based on the subsurface conditions observed, for a trench drainfield configuration, a loading rate of 0.8 gallons per square foot per day is recommended. For a bed drainfield configuration, a loading rate of 0.6 gallons per square foot per day is recommended. Unobstructed area requirements and setbacks in accordance with Chapter 64E-6 of the Florida Administrative Code and/or Orange County Ordinances will be applicable. Future exploration for permitting of the drainfield will be required to confirm the loading rate for drainfield design and if unsuitable soils would be to be removed and replaced below the absorption area.

## 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. Natural 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

## Geotechnical Engineering Report

Lake May Reserve ■ Eustis, Lake County, Florida

September 24, 2019 ■ Terracon Project No. H1195051



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 or collaboration through this system 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 impact 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. 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.

## ATTACHMENTS

## EXPLORATION AND TESTING PROCEDURES

### Field Exploration

Number of Borings	Boring Depth (feet) <sup>1</sup> and type	Location
1 (B-1) <sup>2</sup>	5 Auger	Canoe Launch
1 (B-2) <sup>2</sup>	10 Auger	Overlook
2 (B-3, B-4)	15 SPT	Pavilion Areas
1 (B-5)	20 Auger	Stormwater Pond Area
1 (B-6)	10 Auger	Septic Drainfield Area

1. Below ground surface.
2. Manual auger borings were performed due to access restrictions to a drill rig. Borings were not extended as deep as originally planned. A limited amount of probing was also performed at the canoe launch and overlook locations. Access to a john boat was not available to perform a more thorough exploration in the canoe launch area.

**Boring Layout:** We used handheld GPS equipment to locate borings with an estimated horizontal accuracy of +/-20 feet. Field measurements from existing site features were used.

**Subsurface Exploration Procedures:** We advanced the SPT borings with an ATV-mounted drill rig using rotary wash techniques as necessary depending on soil conditions. Five samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. We obtained representative samples primarily by the split-barrel sampling procedure. In the split-barrel sampling procedure, a standard, 2-inch O.D., split-barrel sampling spoon is driven into the boring with a 140-pound automatic SPT (Standard Penetration Test) hammer falling 30 inches. We recorded the number of blows required to advance the sampling spoon the last 12 inches of an 18-inch sampling interval as the standard penetration resistance value, N.

The machine auger borings were performed by hydraulically turning a 4 inch diameter continuous flight auger into the ground in 5 foot increments. Additional flights are added until the desired termination depth was achieved. The auger is then extracted without further rotation and representative soil samples are retrieved from the auger.

The hand auger boring procedure consisted of manually turning a 3 inch diameter, 6 inch long sampler into the soil until it is full. The sampler was then retrieved and the soils in the sampler were visually examined and classified. The procedure was repeated until the desired termination depth was achieved or shallow groundwater levels cause collapse of the borehole.

## Geotechnical Engineering Report

Lake May Reserve ■ Eustis, Lake County, Florida

September 24, 2019 ■ Terracon Project No. H1195051



The sampling depths, penetration distances, 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 encountered 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 to understand the engineering properties of the various soil strata, as necessary, for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods were applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil by Mass
- ASTM D1140 Standard Test Method for Amount of Material in Soils Finer than No. 200 (75- $\mu$ m) Sieve
- ASTM D2434 Standard Test Method for Permeability of Granular Soils (Constant Head)

The laboratory testing program often included examination of soil samples by an engineer. Based on the material's texture and plasticity, we described and classified the soil samples in accordance with the Unified Soil Classification System.

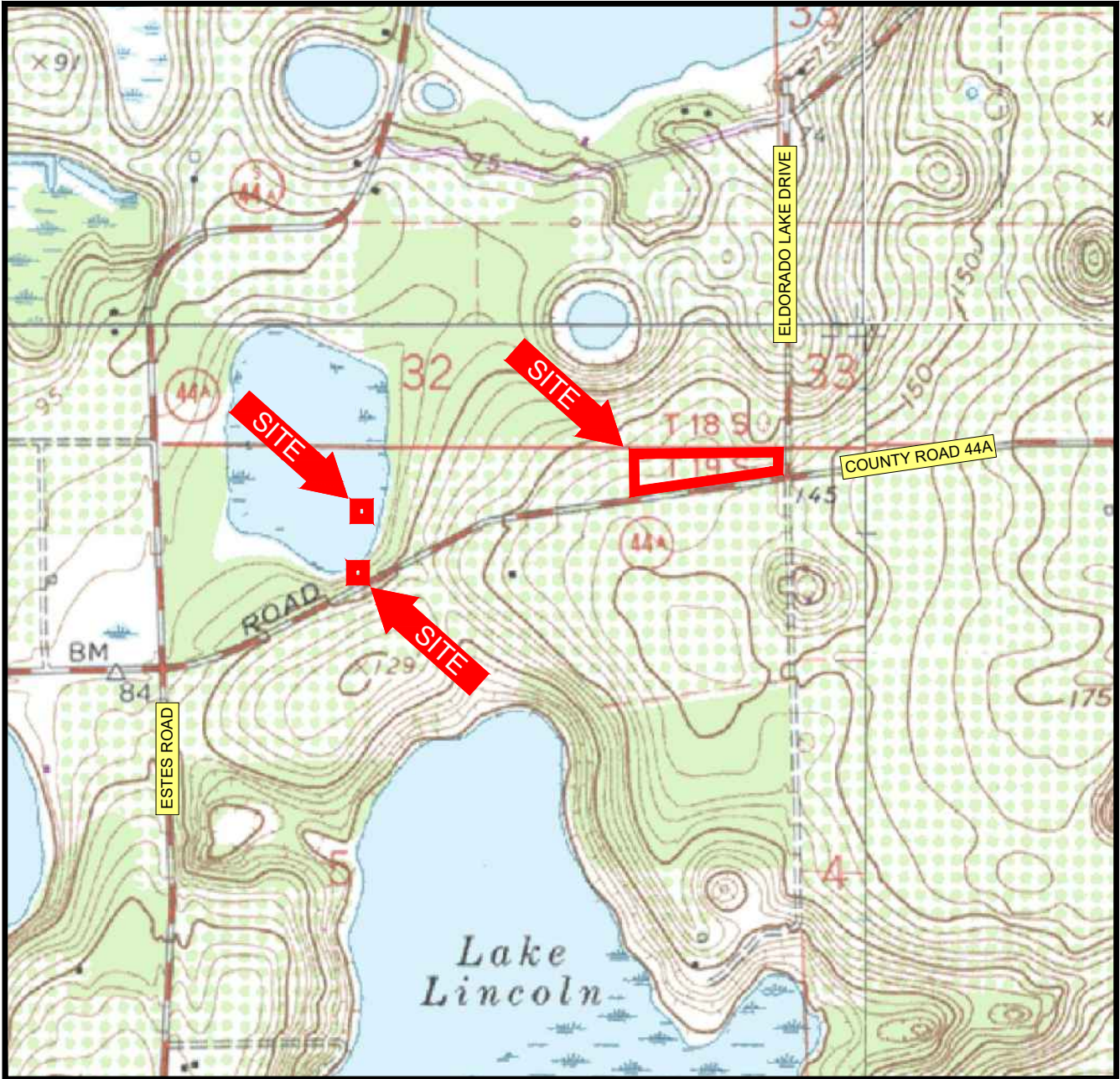
## **SITE LOCATION AND EXPLORATION PLANS**

### **Contents:**

Topographic Vicinity Map

Soils Map

Location Plans



SCALE 1"=1000'



EUSTIS, FLORIDA  
 ISSUED: 1980  
 7.5 MINUTE SERIES (QUADRANGLE)



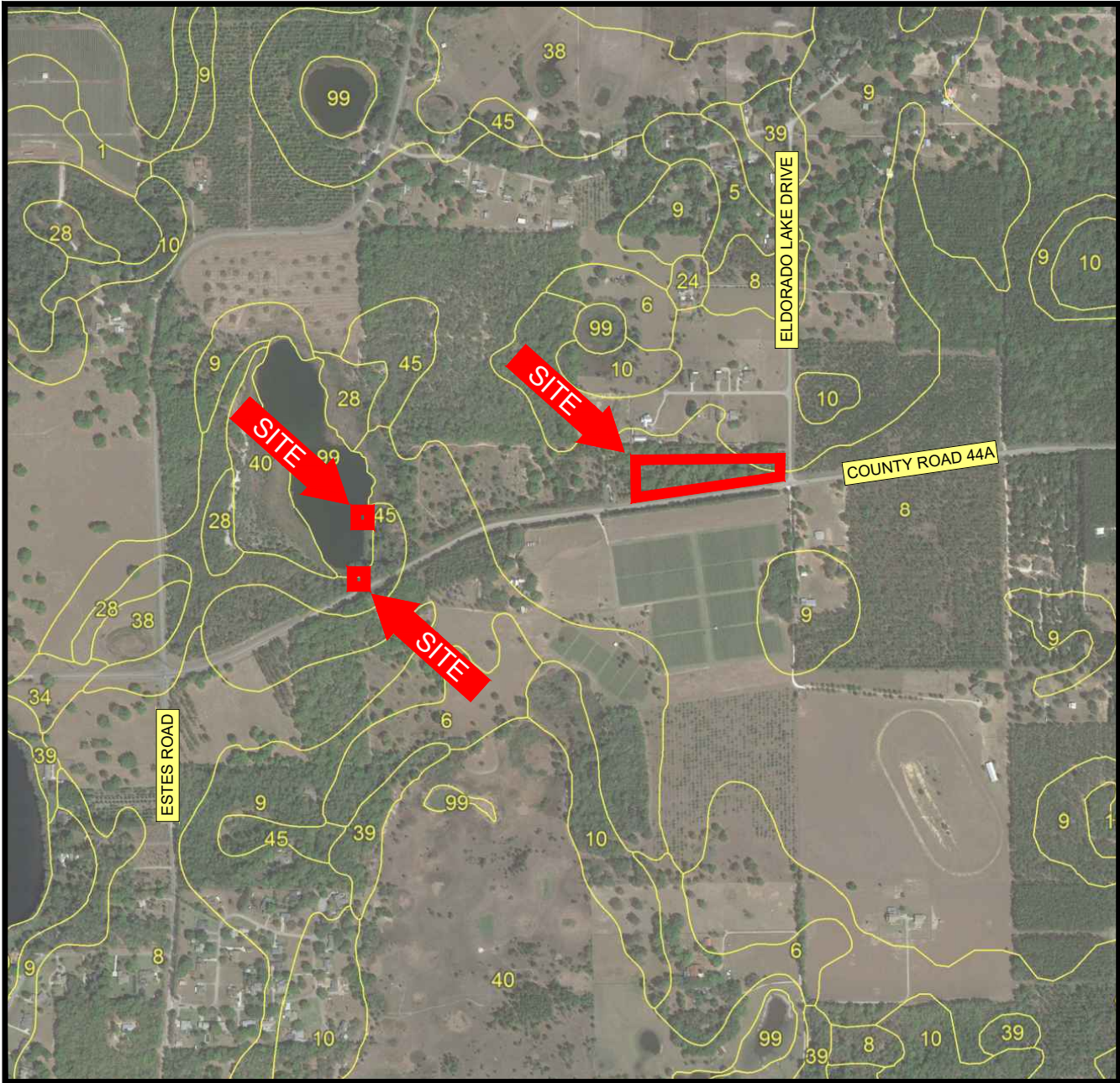
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Project Mngr:	SM	Project No.	H1195051
Drawn By:	AS	Scale:	AS SHOWN
Checked By:	SM	File No.	H1195051
Approved By:	JWC	Date:	8-13-19

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

TOPOGRAPHIC VICINITY MAP  
 GEOTECHNICAL ENGINEERING REPORT  
 LAKE MAY RESERVE  
 COUNTY ROAD 44A  
 EUSTIS, LAKE COUNTY, FLORIDA

EXHIBIT



SCALE 1"=1000'



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

**SOIL LEGEND**

- 8 CANDLER SAND, 0 TO 5 PERCENT SLOPES
- 9 CANDLER SAND, 5 TO 12 PERCENT SLOPES
- 45 TAVARES SAND, 0 TO 5 PERCENT SLOPES



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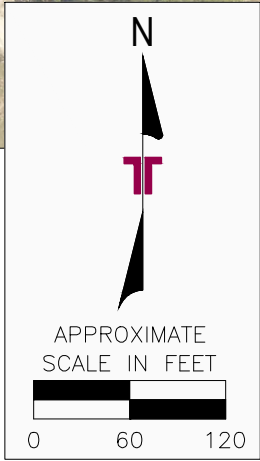
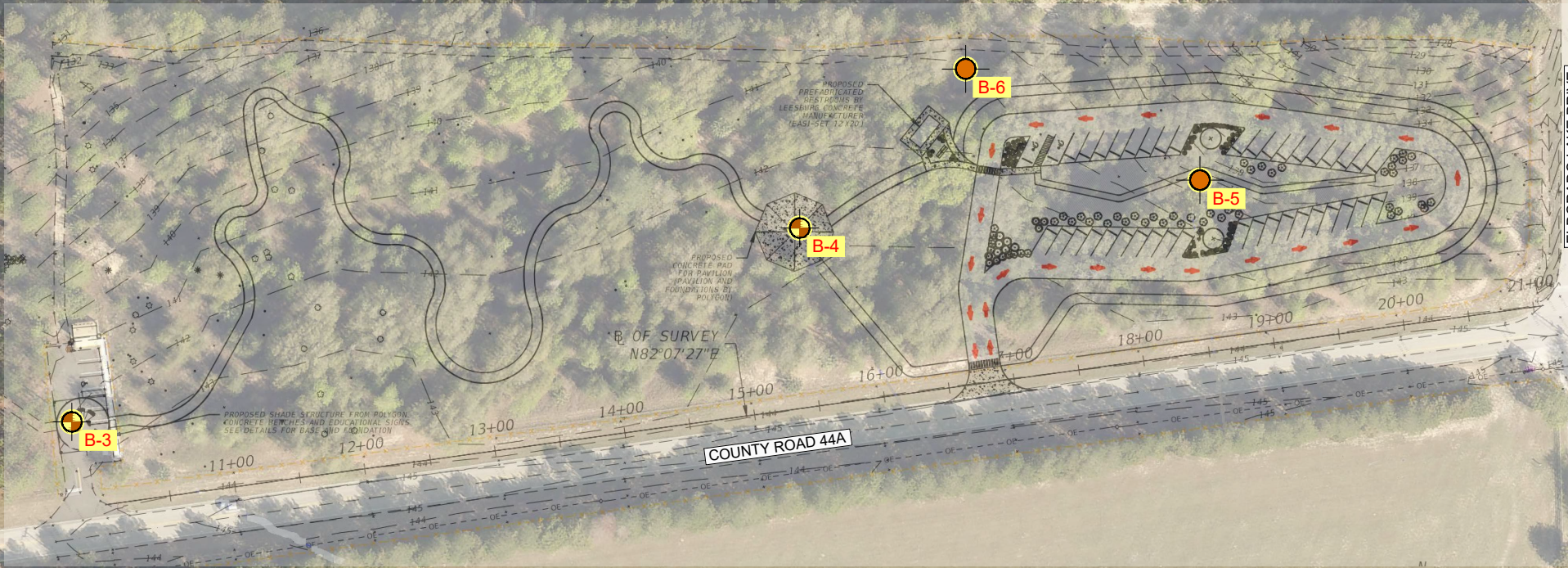
Project Mngr:	SM	Project No.	H1195051
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**SOILS MAP**  
**GEOTECHNICAL ENGINEERING REPORT**  
**LAKE MAY RESERVE**  
 COUNTY ROAD 44A  
 EUSTIS, LAKE COUNTY, FLORIDA

**EXHIBIT**

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**LEGEND**



APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING



APPROXIMATE LOCATION OF AUGER BORING WITH PERMEABILITY SAMPLE

Project Mngr:	SM	Project No.	H1195051
Drawn By:	AS	Scale:	AS SHOWN
Checked By:	SM	File No.	H1195051
Approved By:	JWC	Date:	8-15-19

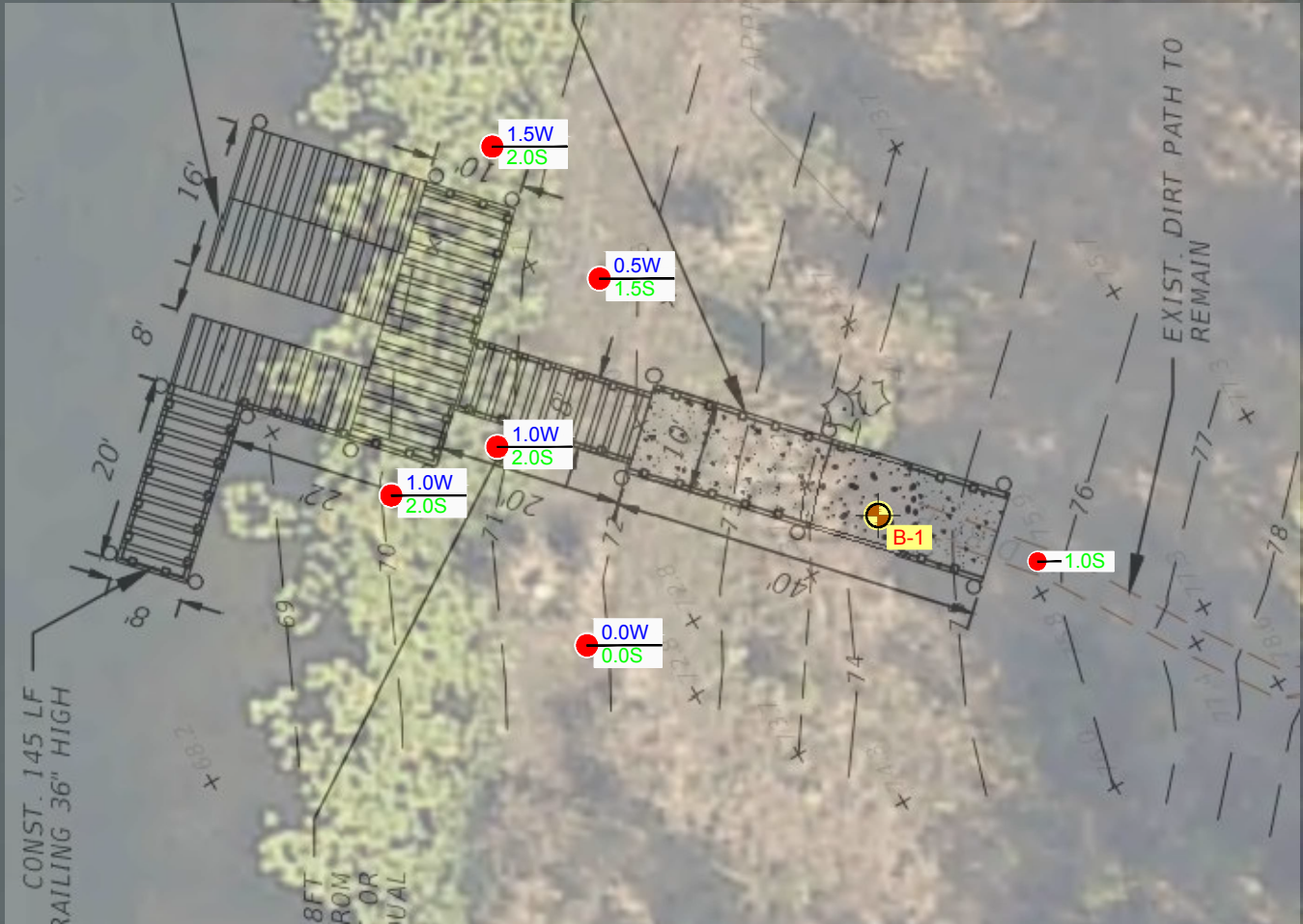
**Terracon**  
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LOCATION PLAN - MAIN  
GEOTECHNICAL ENGINEERING REPORT  
LAKE MAY RESERVE  
COUNTY ROAD 44A  
EUSTIS, LAKE COUNTY, FLORIDA

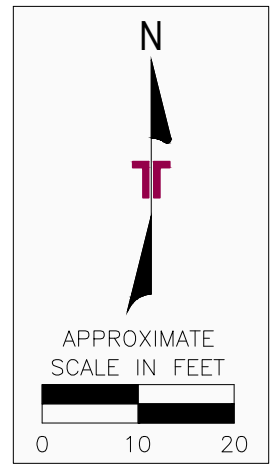
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**LEGEND**

- 0.0W MEASURED DEPTH OF STANDING WATER IN FEET
- 0.0S MEASURED THICKNESS OF LOOSE SAND IN FEET
- APPROXIMATE LOCATION OF HAND AUGER BORING



Project Mngr:	SM	Project No.	H1195051
Drawn By:	AS	Scale:	AS SHOWN
Checked By:	SM	File No.	H1195051
Approved By:	JWC	Date:	9-24-19

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**PROBES-1**  
**GEOTECHNICAL ENGINEERING REPORT**  
**LAKE MAY RESERVE**  
COUNTY ROAD 44A  
EUSTIS, LAKE COUNTY, FLORIDA

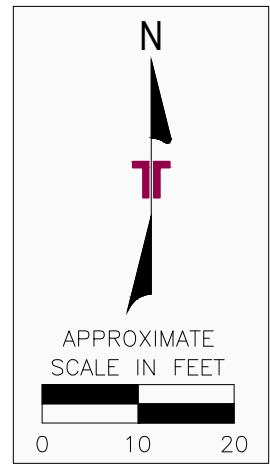
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**LEGEND**

- 0.0S MEASURED THICKNESS OF LOOSE SAND IN FEET
- APPROXIMATE LOCATION OF HAND AUGER BORING



Project Mngr:	SM	Project No.	H1195051
Drawn By:	AS	Scale:	AS SHOWN
Checked By:	SM	File No.	H1195051
Approved By:	JWC	Date:	9-24-19

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**PROBOS-2**  
**GEOTECHNICAL ENGINEERING REPORT**  
**LAKE MAY RESERVE**  
COUNTY ROAD 44A  
EUSTIS, LAKE COUNTY, FLORIDA

**EXHIBIT**

## **EXPLORATION RESULTS**

### **Contents:**

Boring Logs (B-1 through B-6)

# BORING LOG NO. B-1

**PROJECT:** Lake May Reserve

**CLIENT:** CPWG  
Oviedo, FL

**SITE:** County Road 44A  
Eustis, FL

GRAPHIC LOG	LOCATION See <a href="#">Exploration Plan</a> Latitude: 28.872° Longitude: -81.6343°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERM (ft/day)	WATER CONTENT (%)	PERCENT FINES
DEPTH								
5.0	<b>SAND (SP)</b> , gray to light gray	5	▽		P=18 P=22 P=26 P=25 P=21		17	3
	<b>Boring Terminated at 5 Feet</b>							

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

Advancement Method:	See <a href="#">Exploration and Testing Procedures</a> for a description of field and laboratory procedures used and additional data (If any).	Notes:	
Abandonment Method:	See <a href="#">Supporting Information</a> for explanation of symbols and abbreviations.		
<b>WATER LEVEL OBSERVATIONS</b>		Boring Started: 09-10-2019	Boring Completed: 09-10-2019
▽ Water observed at 2.5 ft. during drilling		Drill Rig:	Driller: T. Evans
		Project No.: H1195051	



THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL. H1195051 LAKE MAY GPJ TERRACON\_DATATEMPLATE.GDT 9/23/19

# BORING LOG NO. B-2

**PROJECT:** Lake May Reserve

**CLIENT:** CPWG  
Oviedo, FL

**SITE:** County Road 44A  
Eustis, FL

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL. H1195051 LAKE MAY GPJ TERRACON.DATATEMPLATE.GDT 9/23/19

GRAPHIC LOG	LOCATION See <a href="#">Exploration Plan</a> Latitude: 28.8711° Longitude: -81.6346°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERM (ft/day)	WATER CONTENT (%)	PERCENT FINES
DEPTH								
4.5	<b>SAND (SP)</b> , gray to gray-brown to light brown				P=16			
					P=25			
					P=23			
					P=14			
6.0	<b>SILTY SAND (SM)</b> , light gray	5			P=20			
					P=26			
7.0	<b>SILTY SAND (SM)</b> , trace clay, light gray and orange-brown mottled				P=29		14	24
					P=30			
					P=26			
					P=30			
10.0	<b>Boring Terminated at 10 Feet</b>	10			P=25			

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

<p>Advancement Method:</p> <p>Abandonment Method:</p>	<p>See <a href="#">Exploration and Testing Procedures</a> for a description of field and laboratory procedures used and additional data (If any).</p> <p>See <a href="#">Supporting Information</a> for explanation of symbols and abbreviations.</p>	<p>Notes:</p>						
<p><b>WATER LEVEL OBSERVATIONS</b></p> <p><i>Water not observed within 10 ft.</i></p>	<p>1675 Lee Rd Winter Park, FL</p>	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Boring Started: 09-10-2019</td> <td style="width: 50%;">Boring Completed: 09-10-2019</td> </tr> <tr> <td>Drill Rig:</td> <td>Driller: T. Evans</td> </tr> <tr> <td>Project No.: H1195051</td> <td></td> </tr> </table>	Boring Started: 09-10-2019	Boring Completed: 09-10-2019	Drill Rig:	Driller: T. Evans	Project No.: H1195051	
Boring Started: 09-10-2019	Boring Completed: 09-10-2019							
Drill Rig:	Driller: T. Evans							
Project No.: H1195051								

# BORING LOG NO. B-3

**PROJECT:** Lake May Reserve

**CLIENT:** CPWG  
Oviedo, FL

**SITE:** County Road 44A  
Eustis, FL

GRAPHIC LOG	LOCATION See <a href="#">Exploration Plan</a> Latitude: 28.8724° Longitude: -81.6299°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERM (ft/day)	WATER CONTENT (%)	PERCENT FINES
DEPTH								
15.0	<b>SAND (SP)</b> , brown to light orange-brown	5		X	1-2-2-2 N=4			
				X	2-2-2-2 N=4			
				X	1-2-1-2 N=3			
				X	2-2-2-2 N=4			
				X	2-2-2-2 N=4			
				X	4-4-5 N=9			
	<b>Boring Terminated at 15 Feet</b>	15						

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

Hammer Type: Automatic

Advancement Method:

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

Notes:

Abandonment Method:

See [Supporting Information](#) for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*Water not observed within 10 ft.*



Boring Started: 09-10-2019

Boring Completed: 09-10-2019

Drill Rig: DR-898

Driller: T. Evans

Project No.: H1195051

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL - H1195051 LAKE MAY GPJ TERRACON\_DATATEMPLATE.GDT 9/23/19

# BORING LOG NO. B-4

**PROJECT:** Lake May Reserve

**CLIENT:** CPWG  
Oviedo, FL

**SITE:** County Road 44A  
Eustis, FL

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL - H1195051 LAKE MAY GPJ TERRACON DATATEMPLATE.GDT 9/23/19

GRAPHIC LOG	LOCATION See <a href="#">Exploration Plan</a> Latitude: 28.8729° Longitude: -81.6282°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERM (ft/day)	WATER CONTENT (%)	PERCENT FINES
DEPTH								
8.0	<b>SAND (SP)</b> , brown to light orange-brown	5		X	1-1-1-1 N=2			
8.0				X	1-1-1-1 N=2			
8.0				X	1-2-2-2 N=4			
8.0				X	2-2-2-2 N=4			
13.5	<b>SILTY SAND (SM)</b> , orange-brown	10		X	2-1-1-3 N=2			
13.5				X				
15.0	<b>SAND (SP)</b> , light orange-brown	15		X	5-5-6 N=11			
15.0	<b>Boring Terminated at 15 Feet</b>							

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

Hammer Type: Automatic

Advancement Method:	See <a href="#">Exploration and Testing Procedures</a> for a description of field and laboratory procedures used and additional data (If any).	Notes:	
Abandonment Method:	See <a href="#">Supporting Information</a> for explanation of symbols and abbreviations.		
<b>WATER LEVEL OBSERVATIONS</b>	 1675 Lee Rd Winter Park, FL	Boring Started: 09-10-2019	Boring Completed: 09-10-2019
<i>Water not observed within 10 ft.</i>		Drill Rig: DR-898	Driller: T. Evans
		Project No.: H1195051	

# BORING LOG NO. B-5

**PROJECT:** Lake May Reserve

**CLIENT:** CPWG  
Oviedo, FL

**SITE:** County Road 44A  
Eustis, FL

GRAPHIC LOG	LOCATION See <a href="#">Exploration Plan</a> Latitude: 28.873° Longitude: -81.6272°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERM (ft/day)	WATER CONTENT (%)	PERCENT FINES
DEPTH								
SAND (SP), gray-brown to light brown		5		I				
		10		I		7	4	2
SAND WITH SILT (SP-SM), orange-brown		15		I				
		20		I			6	5
<b>Boring Terminated at 20 Feet</b>		20						

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

Advancement Method:

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

Notes:

Abandonment Method:

See [Supporting Information](#) for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

Water not observed within 20 ft.



Boring Started: 09-10-2019

Boring Completed: 09-10-2019

Drill Rig: DR-898

Driller: T. Evans

Project No.: H1195051

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL - H1195051 LAKE MAY GPJ TERRACON\_DATATEMPLATE.GDT 9/23/19

# BORING LOG NO. B-6

**PROJECT:** Lake May Reserve

**CLIENT:** CPWG  
Oviedo, FL

**SITE:** County Road 44A  
Eustis, FL

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL. H1195051 LAKE MAY GPJ TERRACON\_DATATEMPLATE.GDT 9/23/19

GRAPHIC LOG	LOCATION See <a href="#">Exploration Plan</a> Latitude: 28.8732° Longitude: -81.6278°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERM (ft/day)	WATER CONTENT (%)	PERCENT FINES
DEPTH								
6.5	<b>SAND (SP)</b> , brown to light orange-brown	5		I		44	3	2
10.0	<b>SAND WITH SILT (SP-SM)</b> , orange-brown	10		I			6	6
	<b>Boring Terminated at 10 Feet</b>							

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

<p>Advancement Method:</p> <p>Abandonment Method:</p>	<p>See <a href="#">Exploration and Testing Procedures</a> for a description of field and laboratory procedures used and additional data (If any).</p> <p>See <a href="#">Supporting Information</a> for explanation of symbols and abbreviations.</p>	<p>Notes:</p>						
<p><b>WATER LEVEL OBSERVATIONS</b></p> <p><i>Water not observed within 10 ft.</i></p>	<p>1675 Lee Rd Winter Park, FL</p>	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Boring Started: 09-10-2019</td> <td style="width: 50%;">Boring Completed: 09-10-2019</td> </tr> <tr> <td>Drill Rig: DR-898</td> <td>Driller: T. Evans</td> </tr> <tr> <td>Project No.: H1195051</td> <td></td> </tr> </table>	Boring Started: 09-10-2019	Boring Completed: 09-10-2019	Drill Rig: DR-898	Driller: T. Evans	Project No.: H1195051	
Boring Started: 09-10-2019	Boring Completed: 09-10-2019							
Drill Rig: DR-898	Driller: T. Evans							
Project No.: H1195051								

## **SUPPORTING INFORMATION**










### **Contents:**

General Notes

Unified Soil Classification System

# GENERAL NOTES

## DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

<b>SAMPLING</b>	 Auger Cuttings  Grab Sample  Shelby Tube	 Rock Core  No Recovery  Standard Penetration Test	<b>WATER LEVEL</b>	 Water Initially Encountered  Water Level After a Specified Period of Time  Water Level After a Specified Period of Time  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.	<b>FIELD TESTS</b>	(HP) Hand Penetrometer  (T) Torvane  (DCP) Dynamic Cone Penetrometer  (PID) Photo-Ionization Detector  (OVA) Organic Vapor Analyzer
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## DESCRIPTIVE SOIL CLASSIFICATION

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

## LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. 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.

<b>STRENGTH TERMS</b>	RELATIVE DENSITY OF COARSE-GRAINED SOILS <small>(More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance</small>		CONSISTENCY OF FINE-GRAINED SOILS <small>(50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance</small>		
	Descriptive Term (Density)	Automatic Hammer SPT N-Value (Blows/Ft.)	Descriptive Term (Consistency)	Unconfined Compressive Strength Qu, (psf)	Automatic Hammer SPT N-Value (Blows/Ft.)
	Very Loose	< 3	Very Soft	less than 500	< 1
	Loose	3 - 8	Soft	500 to 1,000	1 - 3
	Medium Dense	8 - 24	Medium Stiff	1,000 to 2,000	3 - 6
	Dense	24 - 40	Stiff	2,000 to 4,000	6 - 12
	Very Dense	> 40	Very Stiff	4,000 to 8,000	12 - 24
			Hard	> 8,000	> 24

## RELATIVE PROPORTIONS OF SAND AND GRAVEL

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

## GRAIN SIZE TERMINOLOGY

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

## RELATIVE PROPORTIONS OF FINES

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

## PLASTICITY DESCRIPTION

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

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests <sup>A</sup>				Soil Classification		
				Group Symbol	Group Name <sup>B</sup>	
<b>Coarse-Grained Soils:</b> More than 50% retained on No. 200 sieve	<b>Gravels:</b> More than 50% of coarse fraction retained on No. 4 sieve	<b>Clean Gravels:</b> Less than 5% fines <sup>C</sup>	$Cu \geq 4$ and $1 \leq Cc \leq 3$ <sup>E</sup>	GW	Well-graded gravel <sup>F</sup>	
			$Cu < 4$ and/or $[Cc < 1$ or $Cc > 3.0]$ <sup>E</sup>	GP	Poorly graded gravel <sup>F</sup>	
		<b>Gravels with Fines:</b> More than 12% fines <sup>C</sup>	Fines classify as ML or MH	GM	Silty gravel <sup>F, G, H</sup>	
			Fines classify as CL or CH	GC	Clayey gravel <sup>F, G, H</sup>	
	<b>Sands:</b> 50% or more of coarse fraction passes No. 4 sieve	<b>Clean Sands:</b> Less than 5% fines <sup>D</sup>	$Cu \geq 6$ and $1 \leq Cc \leq 3$ <sup>E</sup>	SW	Well-graded sand <sup>I</sup>	
			$Cu < 6$ and/or $[Cc < 1$ or $Cc > 3.0]$ <sup>E</sup>	SP	Poorly graded sand <sup>I</sup>	
		<b>Sands with Fines:</b> More than 12% fines <sup>D</sup>	Fines classify as ML or MH	SM	Silty sand <sup>G, H, I</sup>	
			Fines classify as CL or CH	SC	Clayey sand <sup>G, H, I</sup>	
<b>Fine-Grained Soils:</b> 50% or more passes the No. 200 sieve	<b>Silts and Clays:</b> Liquid limit less than 50	<b>Inorganic:</b>	$PI > 7$ and plots on or above "A"	CL	Lean clay <sup>K, L, M</sup>	
			$PI < 4$ or plots below "A" line <sup>J</sup>	ML	Silt <sup>K, L, M</sup>	
		<b>Organic:</b>	Liquid limit - oven dried	< 0.75	OL	Organic clay <sup>K, L, M, N</sup>
			Liquid limit - not dried			Organic silt <sup>K, L, M, O</sup>
	<b>Silts and Clays:</b> Liquid limit 50 or more	<b>Inorganic:</b>	$PI$ plots on or above "A" line	CH	Fat clay <sup>K, L, M</sup>	
			$PI$ plots below "A" line	MH	Elastic Silt <sup>K, L, M</sup>	
		<b>Organic:</b>	Liquid limit - oven dried	< 0.75	OH	Organic clay <sup>K, L, M, P</sup>
			Liquid limit - not dried			Organic silt <sup>K, L, M, Q</sup>
	<b>Highly organic soils:</b>	Primarily organic matter, dark in color, and organic odor			PT	Peat

<sup>A</sup> Based on the material passing the 3-inch (75-mm) sieve.

<sup>B</sup> If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

<sup>C</sup> 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.

<sup>D</sup> 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.

<sup>E</sup>  $Cu = D_{60}/D_{10}$      $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

<sup>F</sup> If soil contains  $\geq 15\%$  sand, add "with sand" to group name.

<sup>G</sup> If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

<sup>H</sup> If fines are organic, add "with organic fines" to group name.

<sup>I</sup> If soil contains  $\geq 15\%$  gravel, add "with gravel" to group name.

<sup>J</sup> If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

<sup>K</sup> If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

<sup>L</sup> If soil contains  $\geq 30\%$  plus No. 200 predominantly sand, add "sandy" to group name.

<sup>M</sup> If soil contains  $\geq 30\%$  plus No. 200, predominantly gravel, add "gravelly" to group name.

<sup>N</sup>  $PI \geq 4$  and plots on or above "A" line.

<sup>O</sup>  $PI < 4$  or plots below "A" line.

<sup>P</sup>  $PI$  plots on or above "A" line.

<sup>Q</sup>  $PI$  plots below "A" line.

