Andreyev Engineering, Inc.

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▼ Groundwater ▼ Environmental ▼ Geotechnical ▼ Construction Materials Testing

January 5, 2023
GPGT-22-160

To: **GatorSktch Architects & Planners**
1000 E Highway 50, Suite 201A
Clermont, Florida 34711

Attention: **Mr. Michael Latham, President**
Mrs. Vanassa Brown, Projects Coordinator

Subject: **Geotechnical Investigation, Proposed Building Expansion, New Parking/Drive Areas, and Septic System Evaluation, Helen Lehmann Montverde Library, 17435 5th Street, Montverde, Lake County, Florida 34756**

Dear Mr. Latham & Mrs. Brown:

Andreyev Engineering, Inc. (AEI) has completed a geotechnical investigation for the above referenced project location. We understand the proposed site improvements include plans for expanding the existing library building and addition of paved parking/drive areas. In addition, we have been asked to evaluate the soil and groundwater characteristics in the vicinity of the proposed septic system. AEI has not been made aware of any planned improvements to the existing stormwater system. A boring location plan was provided to us by you. It should be noted that boring TB-1 (**Figure 3**) was offset approximately 10 feet to the south of the initial location due to drill rig access issues.

This report presents the results of our geotechnical investigation along with an evaluation of the soil and groundwater conditions encountered. In addition, it provides geotechnical engineering recommendations for proper site preparation, support of the proposed building expansion, pavement section design, and an evaluation of the proposed septic system.

SITE LOCATION AND DESCRIPTION

The subject site is located in Section 1, Township 22 South, and Range 26 East. More specifically, the site is located at 17435 5th Street, in Montverde, Lake County, Florida. We have included the U.S.G.S. Topographic Map, which depicts the location of the site, on the attached **Figure 1**. In addition, the Natural Resources Conservation Service (NRCS) Soil Map, which depicts the location and general soil types of the subject site, is presented on **Figure 2**.

PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to explore shallow soil and groundwater conditions within the proposed building expansion area, paved parking/drive areas, and septic system area and provide recommendations for proper site preparation, foundation design, pavement section design, and evaluation of the proposed septic system.

The scope of this investigation included:

- Drilled two (2) Standard Penetration Test (SPT) borings, designated as TB-1 and TB-2, to a depth of 25 feet below ground surface, within the proposed building expansion area, for foundation evaluation.

- Drilled four (4) Standard Penetration Test (SPT) borings, designated as RB-1 through RB-4, to a depth of 10 feet below ground surface, within the proposed driveways and parking/drive areas, for pavement section evaluation.

- Drilled one (1) manual auger boring, designated as HA-1, to a depth of 7 feet below ground surface, within the proposed septic system area, for general soil and groundwater evaluation.

- Estimated normal seasonal high groundwater table levels.

Samples were recovered from the borings and returned to AEI's laboratory for visual classification and stratification. Soil strata were classified according to the Unified Soil Classification System (USCS). Approximate boring locations are shown on **Figure 3**. Results of the SPT and manual auger borings, in profile form, are presented on **Figure 4**. On the profiles, horizontal lines designating the interface between differing materials represent approximate boundaries. The actual transition between layers is typically gradual.

NATURAL RESOURCES CONSERVATION SERVICE SOIL SURVEY

The publication titled "Soil Survey of Lake County, Florida" published by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) was reviewed. For your reference, we have included a portion of the NRCS Soil Map which depicts the location of the subject site on the attached **Figure 2**. The one soil map unit identified to exist for the subject site is identified as:

Soil Map Unit 21: ***Lake Sand, 0 to 5 Percent Slopes***

Brief Description: "This soil is a nearly level to gently sloping, well-drained to excessively drained soil. It has the profile described as representative for the series. In a representative profile, the surface layer is dark brown sand about 7 inches thick. It is underlain by a layer of brown loose sand about 11 inches thick. The next layer is strong brown loose sand about 15 inches thick. Below this, and extending to a depth of 98 inches, is yellowish-red loose sand. **The water table is at a depth of more than 120 inches**. Lake sand is very rapidly permeable and has very low available water capacity, low organic matter content, and low natural fertility."

SOIL AND GROUNDWATER CONDITIONS

The soil types encountered at the boring locations are presented in the form of soil profiles on the attached **Figure 4**. The stratification presented is based on visual examination of the recovered soil samples and the interpretation of the field logs by a geotechnical engineer.

In general, the borings encountered the following soil Strata:

- Orange to Orange Brown to Brown Fine Sand (Stratum 1)
- Orange Clayey Fine Sand (Stratum 2)
- Dark Brown to Brown Slightly Silty Fine Sand (Stratum 3)

Please refer to **Figures 3** and **4** for boring locations, ground surface elevations, strata depths, and encountered soil conditions. The stratification lines represent the approximate boundaries between soil types, the actual transition may be gradual. Minor variations not considered important to our engineering evaluations may have been abbreviated or omitted for clarity.

Groundwater Conditions

Groundwater was not encountered at the time of drilling at any of the boring locations. When performing SPT drilling, groundwater is not measured beyond a certain depth due to the introduction of a slurry mixture which interrupts the in-situ soil moisture conditions. This mixture was introduced at a depth of 10 feet below ground surface at each of the six SPT boring locations. Groundwater was also not encountered within the 7-foot termination depth of HA-1.

Based on the encountered subsurface conditions, our local experience, antecedent rainfall conditions, and review of the NRCS Soil Survey, the normal seasonal high groundwater levels at the boring locations are estimated to exist at a depth of about 10 feet or deeper. Due to this estimate, groundwater is not expected to provide any limitations to the design and construction of the proposed building foundations, paved areas, or the septic system.

EVALUATION AND RECOMMENDATIONS

General

Based on the results of this investigation and our evaluation of the encountered subsurface conditions, it is our opinion that the soils encountered throughout the site are generally suitable to support conventionally designed structures, provided that proper site soil preparation and soil densification are carried out. It is critical that site preparation and soil densification procedures are thorough to ensure consistent and uniform support conditions for the proposed site improvements. Stratum 1 fine sands, excavated from the site during construction, are considered suitable for use as general fill with minimal soil preparation efforts, provided minimal root content and that the soil's moisture content is maintained near optimum prior to placement and compaction.

Boring TB-1 was relocated approximately 10 feet south of its originally planned location due to the original location being inaccessible for the SPT drill rig. This was as close as the drillers could get without damaging the nearby sidewalk and wooden deck, while also stabilizing the rig. The results from this boring show very similar conditions to TB-2, and it is our opinion that similar conditions would be found at the original location of TB-1. The results from TB-1 and TB-2 do not present any limitations to the design and construction of the building expansion, provided proper site preparation takes place.

The soil and groundwater conditions encountered at RB-1 through RB-4 appear suitable for construction of paved parking/drive areas. If the proposed parking/drive areas are to be constructed with brick, the brick manufacturer should be consulted to provide recommendations for proper pavement section design. AEI provides our general pavement section recommendations in the 'Paved Areas' section below.

The soil and groundwater conditions encountered at HA-1 appear suitable for construction of a conventional septic system without the need for mounding. An evaluation of the proposed septic system area along with a chart to assist with permitting can be found in the 'Septic System Evaluation' section below.

More specific recommendations for the proposed site improvements are provided below.

Site Preparation

The building expansion and paved parking/drive areas, plus a minimum margin of 5 feet beyond their outer lines, should be cleared and stripped to remove all surface vegetation, roots, topsoil, organic debris, or any other encountered deleterious materials. Any encountered type(s) of debris will need to be properly removed from beneath all building expansion and paved areas, plus a five-foot perimeter. Additionally, a minimum two-foot separation should be maintained between the bottom of building slabs, bottom of footings, bottom of pavement base course and the top of any Strata 2 clayey soils. Adequate separation should also be maintained between the bottom of building slabs, bottom of footings, bottom of pavement base course and the estimated normal seasonal high groundwater table.

After clearing, grubbing, and any necessary additional site preparation efforts, the exposed soils for the building expansion and pavement areas, plus a minimum margin of 5 feet beyond building lines, should be proof rolled and compacted to a minimum of 95% of the soil's modified Proctor maximum dry density as determined by ASTM Specification D-1557 to a depth of 2 feet before any fill material is placed. All fill required to bring the site to final grade should be inorganic, non-plastic, granular soil (clean sands) with less that 10% passing a U.S. #200 sieve.

All fill should be placed in level lifts not to exceed 12 inches loose and should be compacted to a minimum of 95% of the soil's modified Proctor maximum dry density as determined by ASTM Specification D-1557. In-place density tests should be performed on each lift by an experienced engineering technician working under the direction of a registered geotechnical engineer to verify that the recommended degree of compaction has been achieved. We suggest a minimum testing frequency of one (1) test per lift per 2,500 square feet of area within structural limits and one (1) test per lift per 10,000 square feet in pavement areas. This fill should extend a minimum of 5 feet beyond building lines to prevent possible erosion or undermining of footing bearing soils. Further, fill slopes should not exceed 2 horizontal to 1 vertical (2H:1V).

All fill placed in utility line trenches and adjacent to footings beneath slabs on grade should also be properly placed and compacted to the specifications stated above. However, in these restricted working areas, compaction should be accomplished with lightweight, hand-guided compaction equipment and lift thickness should be limited to a maximum of 4 inches loose thickness. This will need to be exercised for the building expansion area as to not disturb the existing structure.

Foundation Design

Once the existing subgrade and new fill soils in the proposed structural support areas have been prepared in accordance with the preceding recommendations, the proposed buildings can be constructed on a system of conventional shallow spread or strip footings bearing at minimum depths below the finished floor elevations. The bottom of footings and slabs should maintain a 2-foot separation from the estimated seasonal high groundwater levels. Footings, which bear in densified existing soils or in new structural fill, may be designed based on a maximum allowable bearing pressure of 2,500 pounds per square foot. Minimum footing dimensions of 18 inches for strip footings and 24 inches for column footings should be used even though the maximum allowable bearing pressures may not be fully developed in all cases. Footings should bear at least 18 inches below finished exterior grades. For monolithic slab or post tension slab construction, footings should bear at least 12 inches below finished exterior grades. Footing subgrade soils should be approved by the geotechnical engineer prior to placement of concrete and steel. As a minimum acceptance criterion, the footing subgrade soils should be compacted to a minimum density of 95% of the soil's modified Proctor maximum dry density for a depth of 24 inches.

Paved Areas

In general, the compacted subsurface soils will be suitable for support of a flexible (limerock) or semi-flexible (crushed concrete or soil cement) type pavement base after subgrade preparation. The use of one system over another is normally governed by the depth to the encountered and/or seasonal high groundwater table. Soil cement is typically used in areas where the wet season groundwater table levels are within 12 inches of the proposed bottom of the pavement subbase. For limerock a two-foot separation should be maintained between the bottom of the pavement base course and the estimated seasonal high groundwater levels. As a possible pavement design alternative, AEI also presents recommendations for a rigid pavement section.

Typical flexible and semi-flexible pavement sections are as follows:

Limerock Base

1-1/2" to 2-1/2" asphaltic concrete wearing surface

6" to 8" limerock base course, quality of limerock to be in accordance with current Florida Department of Transportation specifications and compacted to a minimum density equivalent to 98% of the modified Proctor maximum density (AASHTO T-180).

12" stabilized subbase with minimum Limerock Bearing Ratio (LBR) of 40%. The subbase should be compacted to a minimum density equivalent to 98% of the modified Proctor maximum density (AASHTO T-180). The subgrade material, below the subbase, shall be compacted to a minimum density of 98% of the modified Proctor maximum density of the soil.

Soil-Cement Base

1-1/2" to 2-1/2" asphaltic concrete wearing surface

6" to 8" soil-cement base designed and constructed in accordance with current Portland Cement Association recommended methods.

12" subgrade consisting of free draining natural fine sand or fine sand fill with less than 7% passing a U.S. #200 sieve. Subgrade to be compacted to a minimum density of 98% of the modified Proctor maximum density (AASHTO T-180).

Crushed Concrete Base

1-1/2" to 2-1/2" asphaltic concrete wearing surface

6" to 8" crushed concrete base with the quality of crushed concrete to be in accordance with current Florida Department of Transportation specifications and should have a minimum Limerock Bearing Ratio (LBR) of 150% and be compacted to at least 98% of the modified Proctor maximum dry density per ASTM D-1557.

12" stabilized subbase with minimum Limerock Bearing Ratio (LBR) of 40%. The subbase should be compacted to a minimum density equivalent to 98% of the modified Proctor maximum density per ASTM D-1557. The subgrade material, below the subbase, shall be compacted to a minimum density of 98% of the modified Proctor maximum density of the soil per ASTM D-1557.

Type of Development	ADT (average daily traffic)	Base Thickness	Wearing Surface Thickness
Commercial	< 1,500	6"	1 ½"
	> 1,500	8"	2 ½"

The pavement section should be designed based on expected traffic including truck loads. Traffic should not be allowed on the subgrade prior to placement of the base to avoid rutting. The final pavement thickness design should be checked by the project civil engineer using data contained in this report and anticipated traffic conditions.

As a possible pavement section design alternative, AEI presents recommendations for a rigid pavement section as follows:

Rigid Pavement

6" reinforced concrete wearing surface: Designed to withstand the design traffic loads and jointed to reduce the chances for crack development. The concrete should have a minimum unconfined compressive strength of 3,000 psi.

12" subgrade: consisting of free draining natural fine sand or fine sand fill. Subgrade to be compacted to a minimum density equivalent to 98% of the modified Proctor maximum density (AASHTO T-180).

Septic System Evaluation & Recommendations

According to the current State of Florida, Department of Health, Chapter 64E-6 Florida Administrative Code, for "Standards For Onsite Sewage Treatment and Disposal Systems" effective July 31, 2018, the maximum sewage loading rate for fine sand, in gallons per day (gpd) per square foot, is: 0.60 gpd for absorption bed and 0.80 gpd for absorption trench system design.

The encountered soils generally consist of fine sands down to a relative elevation of approximately 108.1 feet NAVD88, which is where boring HA-1 was terminated. A high precision GPS was used to record the ground surface elevation of approximately 115.1 feet at the boring location. A 42-inch separation from any unsuitable (clayey, silty or organic) soil is required and a 24-inch separation from the estimated normal seasonal high groundwater level is required. The normal seasonal high groundwater level is estimated to exist at approximately 3 feet below the termination depth of 7 feet, at a relative elevation of approximately 105.1 feet. A standard absorption bed or absorption trench system is expected to meet the separation criteria.

Based on the results of our investigation, we conclude that the proposed location is suitable for installation of a conventional septic system without mounding. Groundwater and unsuitable soil materials were not encountered at boring HA-1 and should not provide limitations to design and construction.

For installation at this site, the bottom of the drainfield should be no deeper than an average relative elevation of 107.1 feet (24 inches above the estimated NSHGWT). Normal drainfield construction consists of a 12-inch deep drainfield bed or trench and 6 inches of soil cover, such that the ground surface is 18 inches above the bottom of the bed or trench. Based on the GPS elevation measurement and the depth to groundwater and unsuitable soils, the resulting ground surface over the drainfield area will not be mounded.

The existing soil types, to a relative elevation of 108.1 feet, are fine sand as defined in 64E-6 F.A.C., carrying a maximum sewage loading rate of 0.60 gpd per square foot for a standard absorption bed and 0.80 gpd per square foot for a standard absorption trench. The minimum total unobstructed area required is at least 1.5 times as large as the drainfield absorption area, as specified in 64E-6. Location and layout of the drainfield boundaries are subject to regulatory setbacks (property boundaries, buildings, wells, etc.).

For septic tank permitting purposes, the soil is classified according to the USCS Soil Classification System and the Munsell Color Charts as presented in the following table. Soil classifications are as follows:

Septic System Boring HA-1		
Depth (feet)	Texture (USCS Classification)	Color (Munsell color/number)
0 – 1.0	slightly silty fine sand (SP-SM)	dark yellowish brown (10YR 4/4)
1.0 – 2.0	fine sand (SP)	dark yellowish brown (10YR 4/4)
2.0 – 3.0	fine sand (SP)	dark yellowish brown (10YR 4/4)
3.0 – 4.0	fine sand (SP)	dark yellowish brown (10YR 4/4)
4.0 – 5.0	fine sand (SP)	dark yellowish brown (10YR 4/4)
5.0 – 6.0	fine sand (SP)	dark yellowish brown (10YR 4/4)
6.0 – 7.0	fine sand (SP)	dark yellowish brown (10YR 4/4)
Ground surface elevation (GPS)		115.10 feet
Measured groundwater elevation (Groundwater not encountered)		Groundwater not encountered to a relative elevation of 108.1 feet
Estimated NSHGWT		105.1 feet

Excavations

Any and all excavations should be constructed in accordance with applicable local, state and federal regulation including those outlined by the Occupational Safety and Health Administration (OSHA). It is the contractor's sole responsibility for designing and constructing safe and stable excavations. Excavations should be sloped, benched or braced as required to maintain stability of the excavation sides and bottoms. Excavations should take into account loads resulting from equipment, fill stockpiles and existing construction. Any shoring needed to maintain a safe excavation should be designed by a professional engineer registered in the State of Florida in accordance with local, state and federal guidelines.

LIMITATIONS

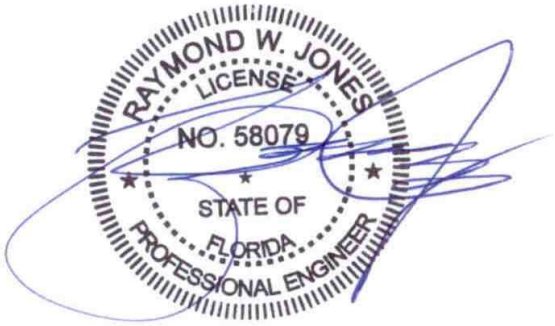
This report has been prepared for the exclusive use of GatorSktch Architects & Planners, and their designers, based on our understanding of the project as stated in this report. Any modifications in design concepts from the description stated in this report should be made known to AEI for possible modification of recommendations presented in this report. This exploration was performed in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made as to the professional advice presented herein. Statements regarding all geotechnical recommendations are for use by the designers and are not intended for use by potential contractors. The geotechnical exploration and recommendations submitted herein are based on the data obtained from the soil borings presented on **Figure 4**. The report does not reflect any variations which may occur adjacent to, between, or away from the borings. The nature and extent of the variations between the borings may not become evident until during construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations presented in this report. An on-site visit may be required by a geotechnical engineer to note the characteristics of the variations during the construction period. This geotechnical study investigated the soil conditions within the proposed building expansion, septic system, and pavement areas to drilled depths of 7 to 25 feet below ground surface and was not intended to investigate deeper soil conditions with regard to the presence or absence of Karst activity.

CLOSURE

AEI appreciates the opportunity to participate in this project, and we trust that the information herein is sufficient for your immediate needs. If you have any questions or comments concerning the contents of this report, please do not hesitate to contact the undersigned.

Sincerely,

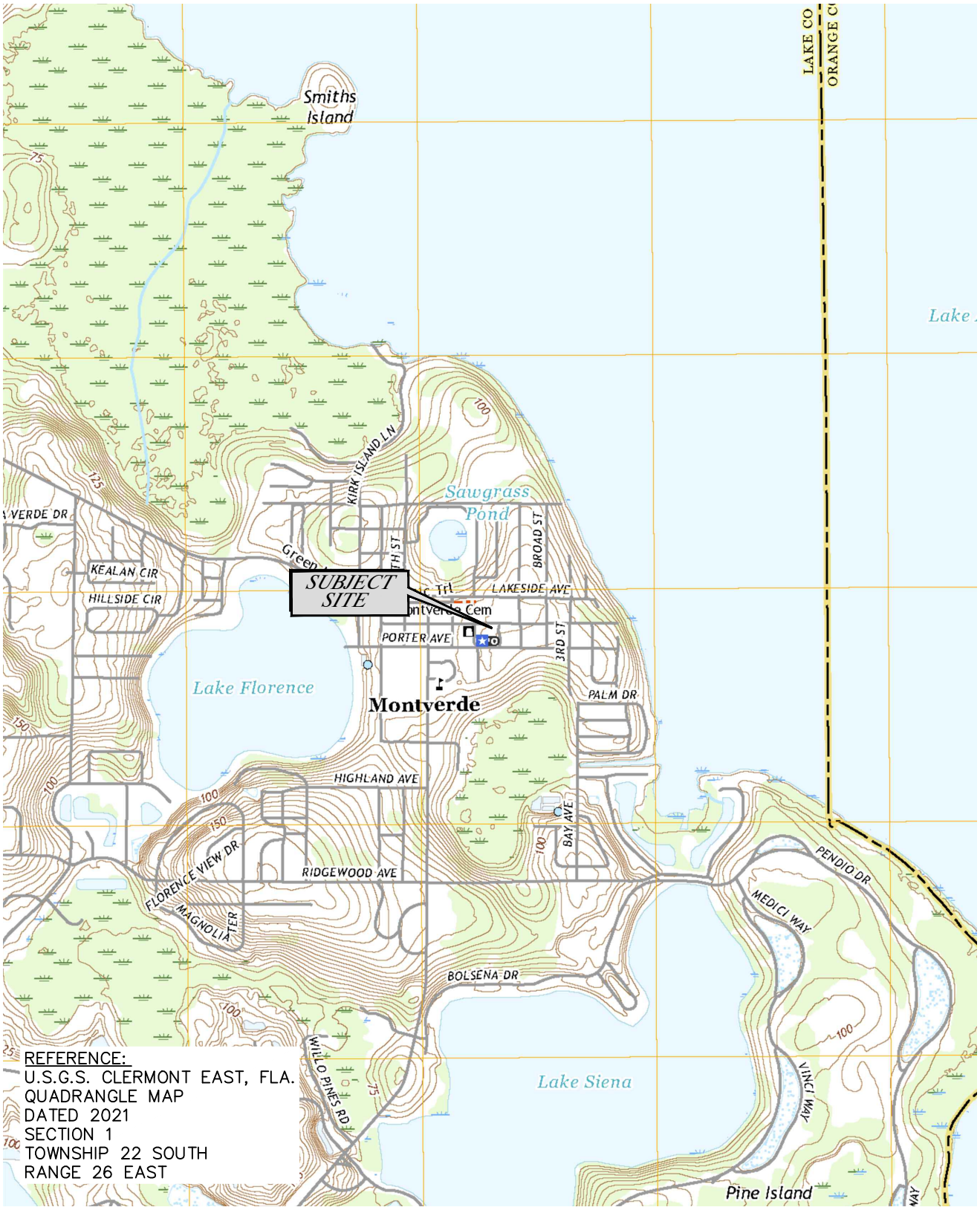
ANDREYEV ENGINEERING, INC.



Frank Moschette, E.I.
Project Engineer

Raymond W. Jones, P.E.
Vice President
Florida Registration No.58079

FIGURES



Andreyev Engineering, Inc.

GEOTECHNICAL INVESTIGATION
PROPOSED BUILDING EXPANSION, PAVED AREAS & SEPTIC SYSTEM EVALUATION

HELEN LEHMANN MONTVERDE LIBRARY

17435 5th ST., MONTVERDE, LAKE COUNTY, FL

U.S.G.S. TOPOGRAPHIC MAP

APPROXIMATE SCALE:	DATE: 12/27/22	ENGINEER: RJ
1"=2000'	PN: GPGT-22-160	DRAWN BY: DLS

FIGURE 1

LEGEND:

21 LAKE SAND, 0 TO 5% SLOPES

0 150 300 600

GRAPHIC SCALE: 1"=300'

Andreyev Engineering, Inc.

APPROXIMATE SCALE:	DATE: 12/27/22	ENGINEER: RJ
1"=300'	PN: GPGT-22-160	DRAWN BY: DLS

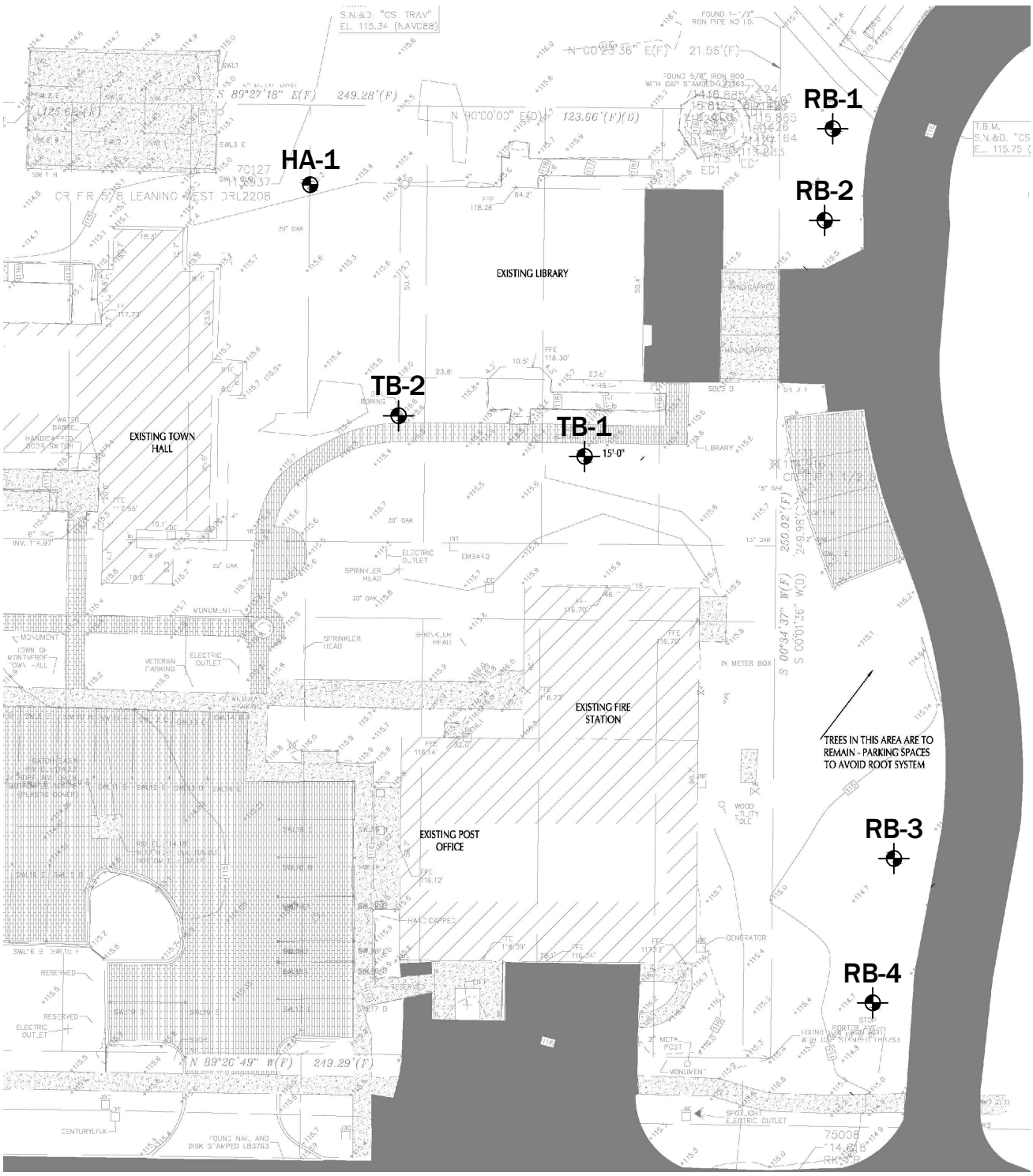
GEOTECHNICAL INVESTIGATION
PROPOSED BUILDING EXPANSION, PAVED AREAS & SEPTIC SYSTEM EVALUATION

HELEN LEHMANN MONTVERDE LIBRARY

17435 5th ST., MONTVERDE, LAKE COUNTY, FL

N.R.C.S. SOIL SURVEY MAP

FIGURE 2



LEGEND:

APPROXIMATE LOCATION OF SPT BORING

APPROXIMATE LOCATION OF HAND AUGER BORING

0 20 40 80

GRAPHIC SCALE: 1"=40'

Andreyev Engineering, Inc.

GEOTECHNICAL INVESTIGATION
PROPOSED BUILDING EXPANSION, PAVED AREAS & SEPTIC SYSTEM EVALUATION

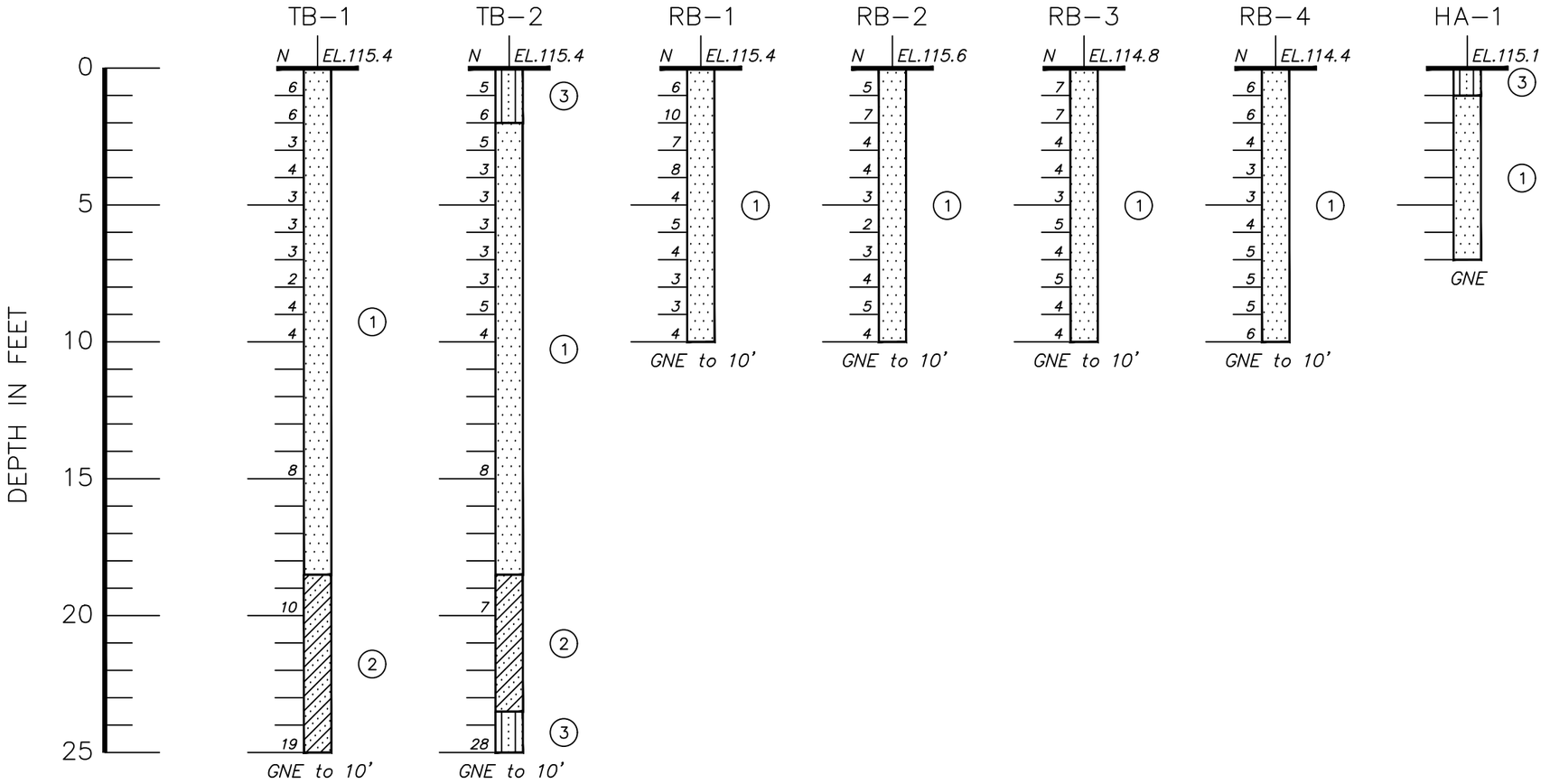
HELEN LEHMANN MONTVERDE LIBRARY

17435 5th ST., MONTVERDE, LAKE COUNTY, FL

BORING LOCATION PLAN

APPROXIMATE SCALE:	DATE: 12/27/22	ENGINEER: RJ
1"=40'	PN: GPGT-22-160	DRAWN BY: DLS

FIGURE 3



LEGEND:

- (1) ORANGE TO ORANGE BROWN TO BROWN FINE SAND (SP)
- (2) ORANGE CLAYEY FINE SAND (SC)
- (3) DARK BROWN TO BROWN SLIGHTLY SILTY FINE SAND (SP–SM)

(SP) UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL

GNE GROUNDWATER NOT ENCOUNTERED

N STANDARD PENETRATION RESISTANCE, IN BLOWS PER FOOT

EL. GROUND SURFACE ELEVATION AT BORING LOCATION (FT–NAVD88)

Andreyev Engineering, Inc.

GEOTECHNICAL INVESTIGATION
PROPOSED BUILDING EXPANSION, PAVED AREAS & SEPTIC SYSTEM EVALUATION

HELEN LEHMANN MONTVERDE LIBRARY

17435 5th ST., MONTVERDE, LAKE COUNTY, FL

SOIL PROFILES

APPROXIMATE SCALE:	DATE: 01/03/23	ENGINEER: RJ
1"=5'	PN: GPGT–22–160	DRAWN BY: DLS

FIGURE 4