Andreyev Engineering, Inc.

CLERMONT OFFICE
1170 W. Minneola Avenue
Clermont, Florida 34711
352-241-0508

Groundwater ▼ Environmental ▼ Geotechnical ▼ Construction Materials Testing

January 21, 2021
Project No.: CPGT-21-027

To: Mr. Amit Pandey
106 Park Place Boulevard, Suite C
Davenport, Florida 33837

Subject: Preliminary Geotechnical Investigation
Proposed Hooks Street Development
Clermont, Lake County, Florida

Dear Mr. Pandey:

Per your request and authorization, Andreyev Engineering, Inc. (AEI) has completed a preliminary geotechnical investigation for the above referenced project. The purpose of this study was to obtain geotechnical data to assist in the initial design of the proposed development. This report presents the results of our geotechnical investigation along with preliminary evaluation of the soil and groundwater conditions encountered. In addition, it provides geotechnical engineering recommendations for pavement base design and site preparation.

SITE LOCATION AND PROJECT DESCRIPTION

The subject site is located along the southern side of Hooks Street in Clermont, Lake County, Florida Section 29, Township 22 South, Range 26 East. A quadrangle map U.S.G.S. Topographic map is presented on **Figure 1**, a Soil Survey map on **Figure 2,** and a Boring Location Plan is presented on **Figure 3**.

PURPOSE AND SCOPE OF FIELD EXPLORATION

The scope of our field investigation consisted of the following:

- Mobilized crew and drilling equipment to the site.
- Performed eight (8) auger borings to a depth of 10 feet below existing grade in the northern cleared area.
- Performed six (6) auger borings to a depth of 7 feet in the southern wooded area.
- Measured the stabilized groundwater table at each boring location.
- Prepared a geotechnical report including results of the soil investigations, evaluation of encountered conditions, estimation of seasonal high groundwater levels, and geotechnical recommendations for site preparation and pavement section design.

SOIL AND GROUNDWATER CONDITIONS

The approximate locations of the borings are shown on the attached **Figure 3**. Please note that survey control was not provided for our field investigation. Therefore, the locations of the borings indicated on the attached **Figure 3** should be considered approximate.

Representative portions of each soil strata identified in the borings were packaged and sealed for transportation to our laboratory for further examination and visual classification

Soil 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 on **Figure 4** 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 types:

Stratum No.	Soil Description	USCS GROUP
1	Brown to light brown to light orange brown fine sand	(SP)
2	Dark grayish brown slightly silty to silty fine sand	(SP-SM)(SM)
3	Orange brown slightly silty fine sand	(SP-SM)
4	Orange brown to orange clayey fine sand	(SC)

Please refer to the soil profiles on the attached **Figure 4** for specific boring data. The information presented on the soil profiles represent the subsurface conditions encountered at the noted boring locations. Accordingly, the materials between and away from the boring locations may vary from those encountered at the specific boring locations. The strata boundaries presented on the soil profiles have been approximated. The actual boundaries may be gradual or otherwise not clearly defined.

N.R.C.S. Soil Survey

The N.R.C.S. soil survey map of lake County was reviewed for the project site and the following table summarizes the soil types mapped by the NRCS and the approximated high groundwater level associated with these soil types:

Soil Unit #	Name	High Water Table Depth (inches)
8	Candler sand, 0 to 5 percent slopes	>80
9	Candler sand, 5 to 12 percent slopes	>80
10	Candler sand, 12 to 40 percent slopes	>80

The USDA/NRCS soil survey of the project site is provided on the attached **Figure 3**.

Groundwater Table

The subsurface investigation was performed in January 2021. At the time of the soil borings investigation, groundwater table was not encountered to the investigated depth of 7 and 10 feet below ground surface.

Fluctuation of the groundwater table should be anticipated throughout the year due to variations in seasonal rainfall. Based on the time of the year, and the amount of rainfall received to date, we estimate the normal seasonal high groundwater table (apparent condition) to be at more than 10 feet below ground surface.

The clean fine sand soils (Stratum 1) and the slightly silty fine sand soils (Stratum 3) are considered a good source for engineered fill. The Stratum 2 soils can also be used as fill, however, due to their relatively high fines content, they should not be used where good drainage is essential to the project.

EVALUATION AND RECOMMENDATIONS

General

The following conclusions and recommendations are based on the project characteristics previously described, the data obtained from our field exploration and our experience with similar subsurface conditions.

Based on the results of our study, we are of the opinion that the soil and groundwater conditions encountered in the borings are generally suitable for the proposed development. Please refer to the borings location plan on **Figure 3** and the soil profiles on **Figure 4.**

Specific recommendations for site preparation and foundation design are presented below:

General Site Preparation: The initial step in routine site preparation should be the complete removal of the existent topsoil from beneath and a minimum of 5 feet beyond the footprint area.

After the initial stripping process, the exposed grade soils should be proofrolled. Non-vibratory equipment should be used within 75 feet of any existing structure and 2 feet of the groundwater table. Proofrolling of the structure areas should consist of at least ten (10) overlapping passes in each of two perpendicular directions and should be observed by a geotechnical engineer. The purposes of the proofrolling will be to detect any areas where unsuitable soils are present as well as to densify the exposed subgrade soils. Materials which yield excessively during the proofrolling should be undercut and replaced with well-compacted structural fill. The geotechnical engineer, based on observations at the site, can recommend the nature and extent of any remedial work. Proofrolling should continue until the soil is compacted to a minimum of 95 percent (%) of the soil's modified Proctor maximum dry density as determined by ASTM Specification D-1557 to a minimum depth of 1 foot below exposed grade.

Fill Placement

After the site has been proofrolled, any fill required to bring the site to final grade may be placed and properly compacted. All fill should be inorganic, non-plastic, granular soil with less than 10% passing the number 200 sieve. The fill should be placed in level lifts not to exceed 12 inches loose and should be compacted to a minimum of 95 percent (%) 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. The 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). For fill placed in restricted working areas, compaction should be accomplished with lightweight, hand-guided compaction equipment and lift thicknesses should be limited to a maximum of 4 inches loose thickness.

Excavations

All excavations should be constructed in accordance with applicable local, state and federal regulations including those outlined by the Occupational Safety and Health Administration (OSHA). It is the contractor’s responsibility for designing and constructing safe and stable excavations. Excavation 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 stockpile 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.

Pavement Areas

The pavement areas subgrade preparation should follow the general recommendations presented in the “Site Preparation” and “Fill Placement” sections of this report.

Proofrolling of the subgrade soils in the pavement areas should continue for the required number of passes and until the soil at a depth of 12 inches below the compaction surface has attained a minimum of 95% of the soil's modified Proctor maximum dry density as determined by ASTM Standard D-1557. In-place density tests should be performed by an experienced geotechnical engineering technician working under the direction of a geotechnical engineer to verify the required degree of compaction. We suggest a minimum testing frequency of one (1) test for every 5,000 square feet of proposed pavement areas.

Pavement/Base Recommendations: The shallow surface soils are considered acceptable for construction and support of flexible (limerock) or semi-flexible (soil-cement) base. If a minimum separation of 24 inches between the bottom of the base and the seasonal high groundwater table is maintained, then either soil-cement or limerock can be used. Where the separation will be consistently less than 24 inches, soil-cement should be used and pavement underdrains may be necessary. In no case should the separation be less than 12 inches.

Although a comprehensive pavement design is not within the scope of this study, below are recommendations on the use of pavement base for the proposed roadway/drive areas.

A limerock base should have a minimum thickness of 6 inches for light duty pavement and 8 inches for heavy duty pavement and should meet Florida Department of Transportation (FDOT) standards, including a minimum Limerock Bearing Ratio (LBR) of 100. A stabilized sub-base with a minimum Limerock Bearing Ratio (LBR) of 40 and a thickness of 12 inches would be required. Both base and sub-base should be compacted to at least 98% of the AASHTO T-180 Maximum Density.

In lieu of using a limerock base material for flexible pavement structure, consideration can be given to using a crushed concrete base material. The crushed concrete base material should have a minimum Limerock Bearing Ratio (LBR) of 120 and be compacted to at least 98 percent of the Modified proctor maximum dry density per ASTM D-1557. The crushed concrete material should meet FDOT specifications. The base course should be underlain by at least 12 inches of stabilized sub-base for both light and heavy duty pavement sections having an LBR of at least 40 and compacted to a minimum of 98 percent of the Modified proctor. The thickness for light and heavy duty areas shall be the same as the limerock base thicknesses provided above.

If a soil-cement base is used, the base thickness should be a minimum of 6 inches for light duty pavement and 8 inches for heavy duty pavement. A stabilized sub-base would not be required. However, the subgrade soils to a depth of 12 inches should be compacted to a minimum density of 98% of AASHTO T-180. The soil-cement base should be compacted to at least 95% of AASHTO T-134 and should have a minimum 7-day compressive strength of 300 psi. Please note that reflective cracking tends to be more common in pavement constructed with a soil soil-cement base. Therefore, it is also recommended that the pavement surface be seal coated within 1 year after construction and receive regular inspections and maintenance for long term performance.

The wearing surface may consist of Superpave asphalt concrete meeting current FDOT specifications. A minimum of 1.5 inches of asphalt for light duty pavement and 2.0 inches of asphalt for heavy duty pavement are recommended. The mixture should be compacted in-place to achieve a density equivalent of at least 95% of the laboratory density for the approved mix as determined by the Marshall Stability Test method (AASHTO T-245).

As an alternative to the asphalt pavement, a concrete section could be used. For a rigid concrete pavement section, we recommend a minimum thickness of 6 inches within light duty areas and 8 inches within heavy duty areas. The concrete should be reinforced sufficiently 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. The sub-grade soils underlying the concrete pavement should consist of well-draining fine sand with less than 7 percent passing the No. 200 sieve and should be compacted to at least 98 percent of the Modified proctor maximum dry density to a depth of at least 12 inches. We would be pleased to review the final pavement design for consistency with our recommendations.

For limerock/crushed concrete pavement sections, the bottom of the base course should be set at least 2 feet above the normal wet season high groundwater table. A minimum separation of 1 foot is recommended between the bottom of a soil-cement base/concrete pavement and the normal wet season high groundwater table. If these minimum separations cannot be achieved, then an underdrain system can be used to artificially lower groundwater levels. Any underdrain system will require a positive outfall.

The recommended pavement thicknesses presented herein are minimum thicknesses typical of local construction practices. Actual pavement section thicknesses should be designed by the project civil engineer based on traffic loads, volumes and the selected design life. All pavement materials should conform to the requirements of FDOT, American Concrete Institute (ACI) and city/county requirements.

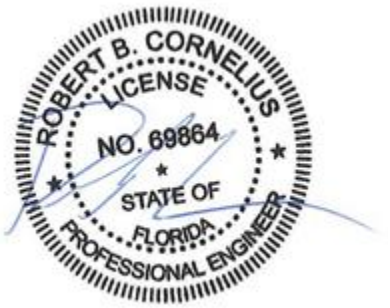
LIMITATIONS OF REPORT

The analyses and recommendations submitted in this report are based on the anticipated location and type of construction discussed herein and the data obtained from the soil borings performed at the locations indicated and does not reflect any variations which may occur beyond these borings.

CLOSURE

AEI appreciates the opportunity to participate in this project and we trust that the information provided 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.



Robert B. Cornelius, P.E.
Vice President
Florida Registration No. 69864

REFERENCE:
U.S.G.S. CLERMONT EAST, FLA.
QUADRANGLE MAP
DATED 2018
SECTION 29
TOWNSHIP 22 SOUTH
RANGE 26 EAST

Andreyev Engineering, Inc.

GEOTECHNICAL INVESTIGATION

PROPOSED HOOKS STREET PARCEL DEVELOPMENT

CLERMONT, LAKE COUNTY, FL

U.S.G.S. TOPOGRAPHIC MAP

FIGURE 1

APPROXIMATE SCALE:	DATE: 01/18/21	ENGINEER: RC
1"=2000'	PN: CPGT-21-027	DRAWN BY: DLS

LEGEND:

8	CANDLER SAND 0 TO 5% SLOPES
9	CANDLER SAND 5 TO 12% SLOPES
10	CANDLER SAND 12 TO 40% SLOPES

Andreyev Engineering, Inc.

APPROXIMATE SCALE: 1"=300'	DATE: 01/18/21	ENGINEER: RC
	PN: CPGT-21-027	DRAWN BY: DLS

GEOTECHNICAL INVESTIGATION

PROPOSED HOOKS STREET PARCEL DEVELOPMENT

CLERMONT, LAKE COUNTY, FL

N.R.C.S. SOIL SURVEY MAP

FIGURE 2

LEGEND:

APPROXIMATE LOCATION OF MACHINE AUGER BORING

0 75 150 300

GRAPHIC SCALE: 1"=150'

Andreyev Engineering, Inc.

APPROXIMATE SCALE:	DATE: 01/18/21	ENGINEER: RC
1"=150'	PN: CPGT-21-027	DRAWN BY: DLS

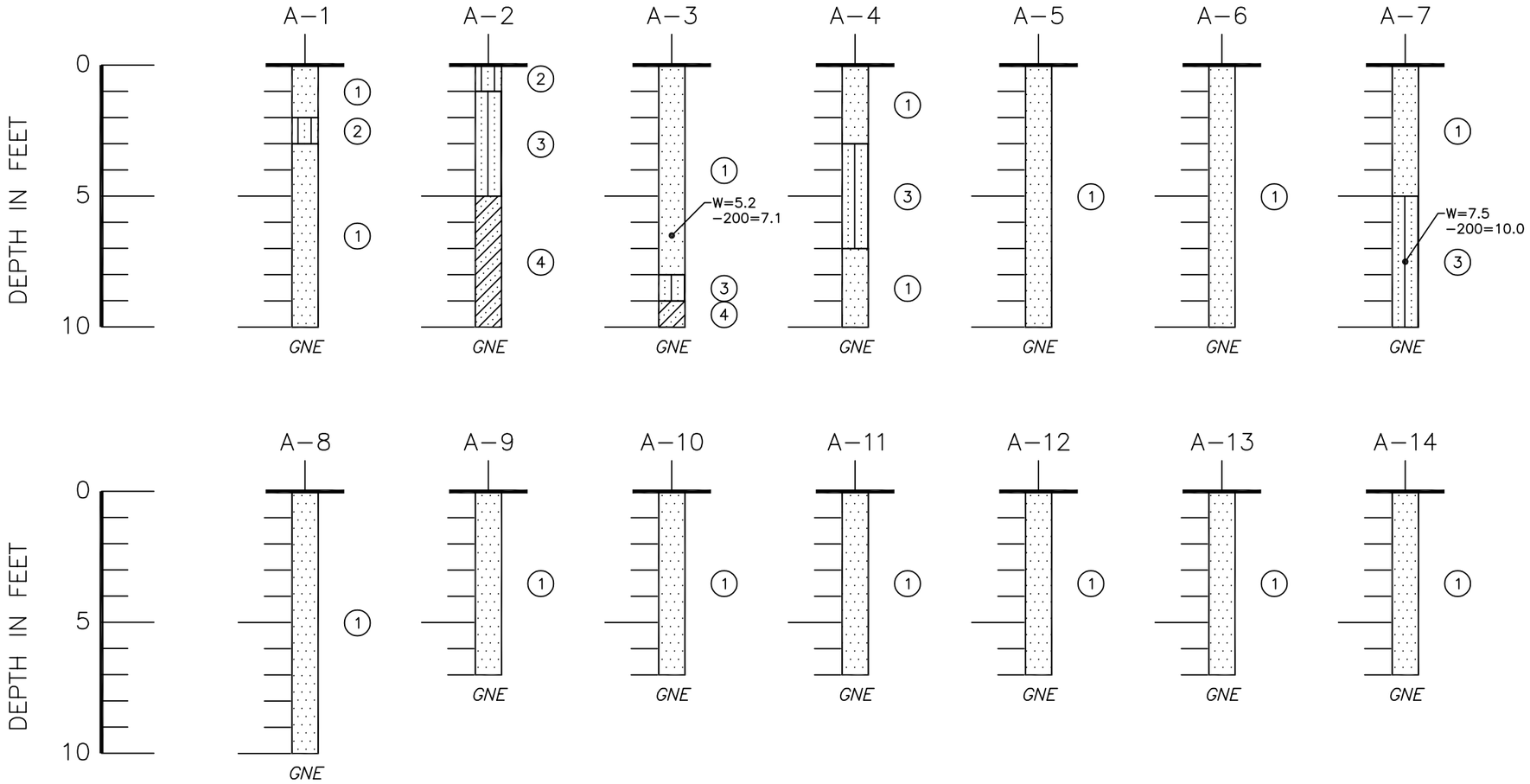
GEOTECHNICAL INVESTIGATION

PROPOSED HOOKS STREET PARCEL DEVELOPMENT

CLERMONT, LAKE COUNTY, FL

BORING LOCATION PLAN

FIGURE 3



LEGEND:

1 BROWN TO LIGHT BROWN TO LIGHT ORANGE BROWN FINE SAND (SP)

2 DARK GRAYISH BROWN SLIGHTLY SILTY TO SILTY FINE SAND (SP–SM)(SM)

3 ORANGE BROWN SLIGHTLY SILTY FINE SAND (SP–SM)

4 ORANGE BROWN TO ORANGE CLAYEY FINE SAND (SC)

(SP) UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL

GNE GROUNDWATER NOT ENCOUNTERED

W MOISTURE CONTENT, IN PERCENT

–200 PERCENT OF FINES PASSING THE U.S. No. 200 SIEVE

Andreyev Engineering, Inc.

GEOTECHNICAL INVESTIGATION

PROPOSED HOOKS STREET PARCEL DEVELOPMENT

CLERMONT, LAKE COUNTY, FL

SOIL PROFILES

APPROXIMATE SCALE:	DATE: 01/18/21	ENGINEER: RC
1"=5'	PN: CPGT–21–027	DRAWN BY: DLS

FIGURE 4