April 28, 2023
GPGT-23-033

To: **JTD Land Company, LLC**
210 Hangar Road
Kissimmee, Florida 34741
Attention: Mr. Craig C. Harris

C/O: **HALFF Associates, Inc.**
902 North Sinclair Avenue
Tavares, Florida 32778
Attention: Mr. Scott Harp

Subject: **Geotechnical Investigation, Proposed Site Improvements, Simpson Property, Howey-In-The-Hills, Lake County, Florida**

Dear Mr. Harris:

Andreyev Engineering, Inc. (AEI) has completed a geotechnical investigation for the above referenced project location. We understand that the proposed site improvements will route stormwater into a proposed on-site stormwater retention pond system. The purpose of this geotechnical investigation and evaluation was to assess the shallow soil and groundwater conditions and provide recommendations for pavement section design and assist with stormwater retention system design.

SITE LOCATION AND DESCRIPTION

The subject site is located within Sections 1, 2, and 35, Townships 20 and 21 South, and Range 25 East, in Howey-In-The-Hills, 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 and is presented on the attached **Figure 2**.

PURPOSE AND SCOPE OF SERVICES

The purpose of this geotechnical investigation and evaluation will be to assess the encountered shallow soil and groundwater conditions and provide recommendations for pavement section design and provide stormwater retention system area design parameters. The boring locations and boring designations were selected by representatives of HALFF Associates, Inc. prior to mobilization of drilling personnel and equipment to this project location.

The scope of this investigation included:

- Drilled twenty-two (22) machine auger borings, designated B-1 through B-11, and P-1 through P-11, to a depth of 30 feet below ground surface within the proposed stormwater retention pond areas.

- Collected eleven (11) undisturbed permeability tube samples from proposed stormwater retention area boring locations P-1 through P-11 and conducted laboratory permeability testing on the samples to assess soil hydraulic conductivity.

- Performed four (4) field permeability tests, at proposed stormwater retention area boring locations B-1, B-2, B-3, and B-8, to assess soil hydraulic conductivity between depths of 20 to 30 feet below the existing ground surface.

- Drilled ten (10) machine auger borings, designated R-1 through R-10, to a depth of 20 feet below ground surface within the proposed paved roadways.

- 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**, and results of the machine auger borings, in profile form, are presented on **Figures 4 through 7**. On the soil 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**. Seven soil map units were identified to exist at the subject project location and are depicted as:

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

Brief Description: "This soil is a nearly level to gently sloping, well-drained sandy soil that has a sandy clay loam subsoil at a depth of 55 inches. This soil has the profile described as representative for the series. In a representative profile the surface layer is very dark gray sand about 6 inches thick. The subsurface layers are yellowish-brown and light yellowish-brown sand to a depth of about 55 inches. The subsoil is red sandy clay loam to a depth of about 84 inches. The water table is at a depth of more than 84 inches. The sandy surface and subsurface layers are rapidly permeable and have very low available water capacity. Permeability in the subsoil is moderate or moderately rapid, and available water capacity is medium to high."

Soil Map Unit 6: ***Apopka Sand, 5 to 12 Percent Slopes***

Brief Description: "This is a sloping to strongly sloping, well-drained sandy soil. Unless protected by vegetation, it is readily erodible by wind and water. The water table is at a depth of more than 84 inches. The sandy surface and subsurface layers are rapidly permeable. Available water capacity is very low, and the organic matter content is low. The loamy subsoil is moderately permeable or moderately rapidly permeable and has a medium to high available water capacity. In a representative profile the surface layer is very dark gray sand about 6 inches thick. The subsurface layers are yellowish-brown and light yellowish-brown sand to a depth of about 55 inches. The subsoil is red sandy clay loam to a depth of about 84 inches."

Soil Map Unit 8: **_Candler Sand, 0 to 5 Percent Slopes_**

Brief Description: "This soil is nearly level to gently sloping and is excessively drained. It is on ridges, knolls, and broad uplands. The slopes range from smooth to broken. Typically, the surface layer is dark grayish brown sand about 6 inches thick. The subsurface layer, to a depth of about 63 inches is light yellowish brown and yellowish brown sand. The next layers to a depth of 80 inches or more are yellow sand that has thin strong textural bands. This soil does not have a high water table within 80 inches of the surface. The available water capacity is very low throughout. Permeability is high to very high."

Soil Map Unit 9: **_Candler Sand, 5 to 12 Percent Slopes_**

Brief Description: "This soil is a sloping to strongly sloping, excessively drained soil found on rolling uplands of the central ridge. Typically, the surface layer of this soil type consists of sand about 5 inches thick. The next layer is sand about 62 inches thick followed by a layer of sand about 13 inches thick. The water table for this soil type is at a depth of more than 80 inches. Available water capacity is very low and permeability is considered to be rapid to very rapid throughout the profile of this soil type."

Soil Map Unit 17: **_Arents_**

Brief Description: "This soil consists of material dug up from several areas that have different kinds of soil. This fill material is the result of earthmoving operations. This material is used to fill such areas as sloughs, marshes, shallow depressions, swamps, and other low-lying areas above their natural ground levels, for use in land leveling operations, or as a final cover for sanitary landfills. Fill material used in some areas contain fragments of shells, whole shells, and a few rock fragments. The high water table varies with the amount of fill material and artificial drainage within any mapped area. The Arents soil is used mainly for urban development."

Soil Map Unit 45: **_Tavares Sand, 0 to 5 Percent Slopes_**

Brief Description: "This is a nearly level to gently sloping, moderately well drained soil. It has a very dark grayish-brown sand surface layer about 7 inches thick. Below this is a layer of very pale brown sand that has faint yellowish-brown mottles to a depth of 25 inches. The next layer, to a depth of 34 inches, is a light yellowish-brown sand. Very pale brown sand that has faint yellow mottles is at depth between 34 and 61 inches. Below this is white sand mottled with very pale brown. The water table is at a depth of 40 to 60 inches for more than 6 months of the year. During periods of drought, it is below 60 inches. Tavares sand is very rapidly permeable. Available water capacity and organic matter content are low. This soil has slight limitations for use as foundations for low buildings, roads, airports, and paved parking areas. This soil has slight limitations for use as septic tank filter fields as possible contamination of ground water supplies can occur."

Soil Map Unit 50: **Borrow Pit**

Brief Description: "An area where material has been excavated for use at another location."

* This soil map unit description is not presented in the 1975 NRCS "Soil Survey of Lake County, Florida" publication including revisions made to soil descriptions in 2004. These soil descriptions are interpreted from corresponding soil survey map units published from adjacent or nearby counties.

SOIL AND GROUNDWATER CONDITIONS

The soil types encountered at the boring locations are presented in the form of soil profiles on the attached **Figures 4 through 7**. The stratification presented is based on visual examination of the recovered soil samples and the interpretation of the field logs by a geotechnical engineer.

Soil Conditions

In general, the borings encountered the following soil Strata:

- Gray to Brown to Grayish Brown to Brownish Gray to Yellowish Brown to Reddish Brown Fine Sand (Stratum 1)
- Yellowish Brown to Reddish Brown to Gray to Light Gray to Light Pinkish Gray Slightly Silty to Silty Fine Sand (Stratum 2)
- Yellowish Brown to Reddish Brown to Gray to Grayish Brown Silty to Clayey Fine Sand (Stratum 3)
- Light Brown to Light Yellowish Brown to Light Gray Fine Sand (Stratum 4)
- Dark Gray to Dark Brown to Dark Grayish Brown Fine Sand (Stratum 5)
- Grayish Brown to Reddish Brown to Light Gray Clayey Fine Sand (Stratum 6)

Groundwater Conditions

Groundwater was encountered between depths of 9.0 to 29.0 feet at B-1, B-5, B-6, B-7, B-9, B-11, P-1, P-3, P-8, P-9, and P-10. Groundwater was not encountered between the ground surface and the termination depth of drilling of 30 feet at B-2, B-3, B-4, B-8, B-10, P-2, P-4, P-5, P-6, P-7, and P-11. In addition, groundwater was not encountered between the ground surface and the termination depth of drilling of 20 feet at RB-1 through RB-10. Based on the encountered subsurface conditions, our local experience, review of the NRCS Soil Survey, and antecedent rainfall conditions, the normal seasonal high groundwater level is estimated to exist about 2 to 3 feet above measured levels at B-1, B-5, B-6, B-9, P-3, and P-10. At B-2, B-7, B-8, B-11, P-1, P-2, P-5, P-6, P-7, P-8, P-9, P-10, R-1, R-3, R-5, R-6, R-8, R-9, and R-10, the normal seasonal high groundwater table is estimated to exist in a temporary perched condition, slightly above the poorly permeable Strata 3 and 6 silty to clayey fine sand and clayey fine sand, during periods of heavy or extended rainfall. At B-3, B-4, P-4, P-11, R-2, R-4, and R-7, the normal seasonal high groundwater level is estimated to exist about 3 feet above the respective termination depth of drilling of 20 to 30 feet below existing ground surface.

Percent of Fines Passing a U.S # 200 Sieve Test Results

The results of the laboratory classification tests selected for moisture content and percent of fines passing a U.S. #200 Sieve are shown adjacent to the corresponding soil profile and depth on **Figure 6** are also presented as follows:

B-4
Sample Depth: 22.5 feet
Classification: S.S. to S.F.S.*
Moisture Content: 8.3%
Percent of Fines: 20.1%

B-4
Sample Depth: 28.5 feet
Classification: F.S. to S.S.F.S.**
Moisture Content: 3.7%
Percent of Fines: 5.8%

B-6
Sample Depth: 10.5 feet
Classification: F.S. to S.S.F.S.**
Moisture Content: 2.3%
Percent of Fines: 1.9%

B-7
Sample Depth: 11.0 feet
Classification: Clayey Fine Sand
Moisture Content: 8.8%
Percent of Fines: 18.5%

B-9
Sample Depth: 17.5 feet
Classification: F.S. to S.S.F.S.**
Moisture Content: 7.3%
Percent of Fines: 2.1%

P-1
Sample Depth: 10.0 Feet
Classification: Clayey Fine Sand
Moisture Content: 15.3%
Percent of Fines: 26.8%

P-8
Sample Depth: 17.5 feet
Classification: F.S. to S.S.F.S.**
Moisture Content: 3.2%
Percent of Fines: 5.9%

P-8
Sample Depth: 22.5 Feet
Classification: Silty to Clayey Fine Sand
Moisture Content: 14.7%
Percent of Fines: 21.3%

* Slightly Silty to Silty Fine Sand
** Fine Sand to Slightly Silty Fine Sand

EVALUATIONS AND RECOMMENDATIONS

Based on the results of this investigation and dependent on planned site grades, conventional pavement section design and construction using flexible or semi flexible pavement sections will be possible at this site, provided that a two-foot separation is maintained between the bottom of the pavement base course and the estimated normal seasonal high groundwater table levels. In addition, a two-foot separation should also be maintained between the bottom of the pavement base course and the top of any encountered poorly permeable Strata 3 and 6 silty to clayey fine sand and clayey fine sand to prevent perched groundwater from adversely affecting the pavement section. Depending on final site grades, roadway underdrains may be necessary to control possible perched groundwater conditions, from affecting the long-term performance of the proposed paved roadways.

Dependent on planned site grades, the proposed stormwater retention pond areas appear suitable for dry stormwater retention design. On-site Strata 1, 4, and 5 sandy soils, excavated from the proposed stormwater retention pond areas, should be suitable for general fill purposes.

Paved Roadways

In general, conventional pavement section design and construction using flexible or semi flexible pavement sections will be possible at this site, provided that a two-foot separation is maintained between the pavement base course and the top of any encountered poorly permeable Strata 3 and 6 silty to clayey fine sand and clayey fine sand to prevent perched groundwater from adversely affecting the pavement base. Dependent on final site grades, pavement section underdrains may be necessary to control perched groundwater conditions, from affecting the long-term performance of the proposed paved roadways.

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 percent of the modified Proctor maximum density (AASHTO T-180).

12” stabilized subbase with minimum Limerock Bearing Ratio (LBR) of 40 percent. The subbase should be compacted to a minimum density equivalent to 98 percent of the modified Proctor maximum density (AASHTO T-180). The subgrade material, below the subbase, shall be compacted to 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 percent passing a U.S. #200 sieve. The subgrade should be compacted to a minimum density of 98 percent 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 percent of the Modified proctor maximum dry density per ASTM D-1557.

12” stabilized subbase with minimum Limerock Bearing Ratio (LBR) of 40 percent. The subbase should be compacted to a minimum density equivalent to 98 percent of the modified Proctor maximum density per ASTM D-1557. The subgrade material, below the subbase, shall be compacted to 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
Residential Subdivision	< 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 percent of the modified Proctor maximum density (AASHTO T-180).

Stormwater Retention Pond Areas

Based on the results of the borings and permeability tests and dependent on planned site grades, the proposed stormwater retention pond areas located in the vicinities of B-1 through B-11 and P-1 through P-11, appear suitable for dry stormwater retention pond design.

Strata 1, 4, and 5 fine sand and fine sand to slightly silty fine sand, excavated from the stormwater retention pond areas during construction, are considered suitable for use as general fill with minimal soil preparation efforts provided that the soil's moisture content is maintained near optimum prior to fill placement and compaction. For more detailed recommendations for soils excavated from the stormwater retention pond area, please reference the fill suitability section presented in the following section of this geotechnical report.

For analysis and design purposes the following aquifer characteristics should be used. Dependent on the final planned stormwater retention system configuration for this project, the flowing aquifer design parameters may be averaged, for each individual stormwater retention area location, where two or more auger borings were performed within, to assist with performing stormwater recovery analysis calculations. These aquifer characteristics were determined from the results of the field and laboratory investigations, adjusting for depth and soil variability:

Boring Location	Bottom of Aquifer *	Avg. Unsat. Vertical Hydraulic Conductivity (ft/day)	Avg. Horizontal Hydraulic Conductivity (ft/day)	Depth to Seasonal High Groundwater Level *	Soil Storage Coefficient
B-1	21.0	12.1	24.8	6.1 (apparent)	0.25
B-2	7.0	16.0	36.0	6.5 (perched)	0.25
B-2**	30.0	10.9	17.9	27.0 (estimated)	0.25
B-3	30.0	7.1	17.5	27.0 (estimated)	0.25
B-4	30.0	8.1	21.4	27.0 (estimated)	0.25
B-5	30.0	15.4	26.2	12.0 (apparent)	0.25
B-6	30.0	15.9	27.6	11.0 (apparent)	0.25
B-7	9.0	15.4	34.8	8.5 (perched)	0.25
B-8	17.0	8.4	22.3	16.5 (perched)	0.25
B-9	30.0	16.1	36.9	17.0 (apparent)	0.25
B-10	30.0	12.2	31.9	27.0 (estimated)	0.25
B-11	15.0	15.0	33.7	14.5 (perched)	0.25
P-1	9.0	12.2	28.4	8.5 (perched)	0.25
P-1**	30.0	11.9	24.3	11.5 (apparent)	0.25
P-2	6.0	12.3	28.4	5.5 (perched)	0.25
P-3	30.0	13.3	30.0	9.0 (apparent)	0.25
P-4	30.0	8.1	22.9	27.0 (estimated)	0.25
P-5	20.0	11.2	28.0	19.5 (perched)	0.25
P-5**	30.0	10.4	21.2	27.0 (estimated)	0.25
P-6	4.5	13.2	29.7	4.0 (perched)	0.25
P-6**	25.0	9.0	19.6	24.5 (perched)	0.25
P-7	20.0	12.2	32.2	19.5 (perched)	0.25
P-8	20.0	8.3	21.1	19.5 (perched)	0.25
P-9	15.0	10.3	22.6	14.5 (perched)	0.25
P-10	30.0	14.6	28.9	11.0 (apparent)	0.25
P-11	30.0	12.0	26.7	27.0 (estimated)	0.25

* Feet below existing land surface
** With over-excavation and replacement of poorly permeable Strata 3 and 6 silty to clayey fine sand and clayey fine sand soils to connect the pond bottom to a deeper, more permeable aquifer base. In this

scenario, the replacement fine sand soils should have an in-place vertical permeability of 15 feet per day or greater.

Factors of safety have not been applied to the above weighted average permeability values. For the purpose of recovery analysis in accordance with water management district rules, a factor of safety of 2 should be applied to the unsaturated vertical permeability to account for long-term performance and siltation of the pond bottom.

The following formulas were used in the calculation of both the weighted average horizontal and weighted average vertical permeabilities:

$$\text{Weighted Average Vertical Permeability} = \frac{\sum L}{\frac{L_1}{Kv_1} + \frac{L_2}{Kv_2} + \frac{L_3}{Kv_3} + \ldots\ldots\ldots \frac{L_n}{Kv_n}}$$

$$\text{Weighted Average Horizontal Permeability} = \frac{Kh_1.L_1 + Kh_2.L_2 + Kh_3.L_3 + \ldots.Kh_n.L_n}{\sum L}$$

B-1:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 6.1 ft / (5.0 ft/17.5 ft/day + 1.1 ft/22.5 ft/day) X 2/3 = 12.1 ft/day

Horizontal Hydraulic Conductivity
Kh = (5.0 ft. x 17.5 ft/day + 8.0 ft. x 22.5 ft/day + 8.0 ft. x 9.9 ft/day) / 21.0 ft) X 1.5 = 24.8 ft/day

B-2:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 6.5 ft / (6.5 ft/24.0 ft/day) X 2/3 = 16.0 ft/day

Horizontal Hydraulic Conductivity
Kh = (7.0 ft. x 24.0 ft/day) / 7.0 ft) X 1.5 = 36.0 ft/day

B-2 (With Over-Excavation and Replacement of Stratum 3 silty to clayey soils. Replacement fine sand soils should have an in-place vertical permeability of 15 feet per day or greater.):

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 27.0 ft / (7.0 ft/24.0 ft/day + 5.0 ft/15.0 ft/day + 8.0 ft/12.5 ft/day + 3.5 ft/9.0 ft/day) X 2/3 = 10.9 ft/day

Horizontal Hydraulic Conductivity
Kh = (7.0 ft. x 24.0 ft/day + 5.0 ft. x 0.01 ft/day + 8.0 ft. x 12.5 ft/day + 10.0 ft. x 9.0 ft/day) / 30.0 ft) X 1.5 = 17.9 ft/day

B-3:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 27.0 ft / (5.0 ft/22.5 ft/day + 22.0 ft/9.5 ft/day) X 2/3 = 7.1 ft/day

Horizontal Hydraulic Conductivity
Kh = (5.0 ft. x 22.5 ft/day + 25.0 ft. x 9.5 ft/day) / 30.0 ft) X 1.5 = 17.5 ft/day

B-4:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 27.0 ft / (5.0 ft/22.5 ft/day + 5.0 ft/25.0 ft/day + 17.0 ft/9.5 ft/day) X 2/3 = 8.1 ft/day

Horizontal Hydraulic Conductivity
Kh = (5.0 ft. x 22.5 ft/day + 5.0 ft. x 25.0 ft/day + 17.0 ft. x 9.5 ft/day 3.0 ft. x 10.0 ft/day) / 30.0 ft) X 1.5 = 21.4 ft/day

B-5:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 12.0 ft / (9.0 ft/22.5 ft/day + 3.0 ft/25.0 ft/day) X 2/3 = 15.4 ft/day

Horizontal Hydraulic Conductivity
Kh = (9.0 ft. x 22.5 ft/day + 7.5 ft. x 25.0 ft/day + 13.5 ft. x 9.9 ft/day) / 30.0 ft) X 1.5 = 26.2 ft/day

B-6:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 11.0 ft / (5.0 ft/22.5 ft/day + 6.0 ft/25.0 ft/day) X 2/3 = 15.9 ft/day

Horizontal Hydraulic Conductivity
Kh = (5.0 ft. x 22.5 ft/day + 11.0 ft. x 25.0 ft/day + 4.0 ft. x 17.5 ft/day + 10.0 ft. x 9.5 ft/day) / 30.0 ft) X 1.5 = 27.6 ft/day

B-7:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 8.5 ft / (6.5 ft/22.5 ft/day + 2.0 ft/25.0 ft/day) X 2/3 = 15.4 ft/day

Horizontal Hydraulic Conductivity
Kh = (6.5 ft. x 22.5 ft/day + 2.5 ft. x 25.0 ft/day) / 9.0 ft) X 1.5 = 34.8 ft/day

B-8:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 16.5 ft / (7.0 ft/22.5 ft/day + 9.5 ft/9.5 ft/day) X 2/3 = 8.4 ft/day

Horizontal Hydraulic Conductivity
Kh = (7.0 ft. x 22.5 ft/day + 10.0 ft. x 9.5 ft/day) / 17.0 ft) X 1.5 = 22.3 ft/day

B-9:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 17.0 ft / (5.0 ft/22.5 ft/day + 12.0 ft/25.0 ft/day) X 2/3 = 16.1 ft/day

Horizontal Hydraulic Conductivity
Kh = (5.0 ft. x 22.5 ft/day + 25.0 ft. x 25.0 ft/day) / 30.0 ft) X 1.5 = 36.9 ft/day

B-10:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 27.0 ft / (15.0 ft/22.5 ft/day + 12.0 ft/25.0 ft/day) X 2/3 = 12.2 ft/day

Horizontal Hydraulic Conductivity
Kh = (15.0 ft. x 22.5 ft/day + 15.0 ft. x 25.0 ft/day) / 30.0 ft) X 1.5 = 31.9 ft/day

B-11:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 14.5 ft / (14.5 ft/22.5 ft/day) X 2/3 = 15.0 ft/day

Horizontal Hydraulic Conductivity
Kh = (15.0 ft. x 22.5 ft/day) / 15.0 ft) X 1.5 = 33.7 ft/day

P-1:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 8.5 ft / (5.0 ft/16.1 ft/day + 3.5 ft/22.5 ft/day) X 2/3 = 12.2 ft/day

Horizontal Hydraulic Conductivity
Kh = (5.0 ft. x 16.1 ft/day + 4.0 ft. x 22.5 ft/day) / 9.0 ft) X 1.5 = 28.4 ft/day

P-1 (With Over-Excavation and Replacement of Stratum 6 clayey soils. Replacement fine sand soils should have an in-place vertical permeability of 15 feet per day or greater.):

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 11.5 ft / (5.0 ft/16.1 ft/day + 4.0 ft/22.5 ft/day + 2.0 ft/15.0 ft/day + 0.5 ft/22.5 ft/day) X 2/3 = 11.9 ft/day

Horizontal Hydraulic Conductivity
Kh = (5.0 ft. x 16.1 ft/day + 4.0 ft. x 22.5 ft/day + 2.0 ft. x 0.01 ft/day + 10.0 ft. x 22.5 ft/day + 9.0 ft. x 10.0 ft/day) / 30.0 ft) X 1.5 = 24.3 ft/day

P-2:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 5.5 ft / (4.0 ft/17.2 ft/day + 1.5 ft/22.5 ft/day) X 2/3 = 12.3 ft/day

Horizontal Hydraulic Conductivity
Kh = (4.0 ft. x 17.2 ft/day + 2.0 ft. x 22.5 ft/day) / 6.0 ft) X 1.5 = 28.4 ft/day

P-3

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 9.0 ft / (5.0 ft/18.4 ft/day + 4.0 ft/22.5 ft/day) X 2/3 = 13.3 ft/day

Horizontal Hydraulic Conductivity
Kh = (5.0 ft. x 18.4 ft/day + 5.0 ft. x 22.5 ft/day + 10.0 ft. x 20.0 ft/day + 10.0 ft. x 17.5 ft/day) / 30.0 ft) X 1.5 = 30.0 ft/day

P-4

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 27.0 ft / (10.0 ft/23.3 ft/day + 10.0 ft/12.5 ft/day + 10.0 ft/10.0 ft/day) X 2/3 = 8.1 ft/day

Horizontal Hydraulic Conductivity
Kh = (10.0 ft. x 23.3 ft/day + 10.0 ft. x 12.5 ft/day + 10.0 ft. x 10.0 ft/day) / 30.0 ft) X 1.5 = 22.9 ft/day

P-5:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 19.5 ft / (5.0 ft/24.7 ft/day + 5.0 ft/25.0 ft/day + 9.5 ft/12.5 ft/day) X 2/3 = 11.2 ft/day

Horizontal Hydraulic Conductivity
Kh = (5.0 ft. x 24.7 ft/day + 5.0 ft. x 25.0 ft/day + 10.0 ft/12.5 ft/day) / 20.0 ft) X 1.5 = 28.0 ft/day

P-5 (With Over-Excavation and Replacement of Stratum 3 silty to clayey fine sand soils. Replacement fine sand soils should have an in-place vertical permeability of 15 feet per day or greater.):

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 27.0 ft / (5.0 ft/24.7 ft/day + 5.0 ft/25.0 ft/day + 10.0 ft/12.5 ft/day + 5.0 ft/15.0 ft/day + 2.0 ft/10.0 ft/day) X 2/3 = 10.4 ft/day

Horizontal Hydraulic Conductivity
Kh = (5.0 ft. x 24.7 ft/day + 5.0 ft. x 25.0 ft/day + 10.0 ft. x 12.5 ft/day + 5.0 ft. x 0.01 ft/day + 5.0 ft. x 10.0 ft/day) / 30.0 ft) X 1.5 = 21.2 ft/day

P-6:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 4.0 ft / (4.0 ft/19.8 ft/day) X 2/3 = 13.2 ft/day

Horizontal Hydraulic Conductivity
Kh = (4.5 ft. x 19.8 ft/day) / 4.5 ft) X 1.5 = 29.7 ft/day

P-6 (With Over-Excavation and Replacement of shallow Stratum 3 silty to clayey soils. Replacement fine sand soils should have an in-place vertical permeability of 15 feet per day or greater.):

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 24.5 ft / (4.5 ft/19.8 ft/day + 1.5 ft/15.0 ft/day + 18.5 ft/12.5 ft/day) X 2/3 = 9.0 ft/day

Horizontal Hydraulic Conductivity
Kh = (4.5 ft. x 19.8 ft/day + 1.5 ft. x 0.01 ft/day + 19.0 ft. x 12.5 ft/day) / 25.0 ft) X 1.5 = 19.6 ft/day

P-7:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 19.5 ft / (11.0 ft/25.6 ft/day + 4.0 ft/25.0 ft/day + 4.5 ft/9.5 ft/day) X 2/3 = 12.2 ft/day

Horizontal Hydraulic Conductivity
Kh = (11.0 ft. x 25.6 ft/day + 4.0 ft. x 25.0 ft/day + 5.0 ft. x 9.5 ft/day) / 20.0 ft) X 1.5 = 32.2 ft/day

P-8:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 19.5 ft / (5.0 ft/19.7 ft/day + 10.0 ft/9.5 ft/day + 4.5 ft/17.5 ft/day) X 2/3 = 8.3 ft/day

Horizontal Hydraulic Conductivity
Kh = (5.0 ft. x 19.7 ft/day + 10.0 ft. x 9.5 ft/day + 5.0 ft. x 17.5 ft/day) / 20.0 ft) X 1.5 = 21.1 ft/day

P-9:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 14.5 ft / (10.0 ft/21.5 ft/day + 4.5 ft/9.5 ft/day) X 2/3 = 10.3 ft/day

Horizontal Hydraulic Conductivity
Kh = (10.0 ft. x 21.5 ft/day + 5.0 ft. x 9.5 ft/day) / 15.0 ft) X 1.5 = 26.2 ft/day

P-10:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 11.0 ft / (10.0 ft/22.9 ft/day + 1.0 ft/17.5 ft/day) X 2/3 = 14.6 ft/day

Horizontal Hydraulic Conductivity
Kh = (10.0 ft. x 22.9 ft/day + 20.0 ft. x 17.5 ft/day) / 30.0 ft) X 1.5 = 28.9 ft/day

P-11:

Unsaturated Vertical Hydraulic Conductivity
Kv unsat = 27.0 ft / (15.0 ft/20.8 ft/day + 10.0 ft/17.5 ft/day + 2.0 ft/9.5 ft/day) X 2/3 = 12.0 ft/day

Horizontal Hydraulic Conductivity
Kh = (15.0 ft. x 20.8 ft/day + 10.0 ft. x 17.5 ft/day + 5.0 ft. x 9.5 ft/day) / 30.0 ft) X 1.5 = 26.7 ft/day

Fill Suitability

Based on the results of this geotechnical investigation and to evaluate soils planned to be excavated from the stormwater retention pond areas during construction, AEI presents the following evaluations and recommendations for fill material preparation and fill placement.

Strata 1, 4, and 5 fine sand and fine sand to slightly silty fine sand will be suitable for use as general fill with minimal soil preparation efforts, provided root content is minimal, and provided the soil's moisture content is maintained near the laboratory modified Proctor test result for optimum moisture content, prior to fill placement and compaction.

Excavated Stratum 2 slightly silty to silty fine sand may also be used as general fill material, however; additional soil preparation efforts should be anticipated. Due to the higher percent of fines content of this soil, this soil type will exhibit a high level of moisture retention characteristics. Additional soil preparation efforts, in order to maintain the moisture content near optimum, will be needed prior to fill placement and compaction.

The excavated soil type classifications with limitations for use as general fill, includes the encountered Strata 3 and 6 silty to clayey fine sand and clayey fine sand. The Strata 3 and 6 silty to clayey fine sand and clayey fine sand should not be used for direct foundation support or placed in near-surface areas, due to their moisture retention properties, difficulties with compaction, and drainage issues associated with higher surface runoff volumes, from these poorly permeable soils, when compacted. The Strata 3 and 6 silty to clayey fine sand and clayey fine sand soils can also expose overlying supported structures to increased levels of differential settlement, so their use should also be minimized in settlement sensitive project areas.

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 need 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 JTD Land Company, LLC, HALFF Associates, Inc., 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 **Figures 4 through 7**. 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 stormwater retention areas and paved roadways to the drilled depths of 20 to 30 feet 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.

This item has been digitally signed and sealed by Ray Jones, P.E. on 4/28/23.

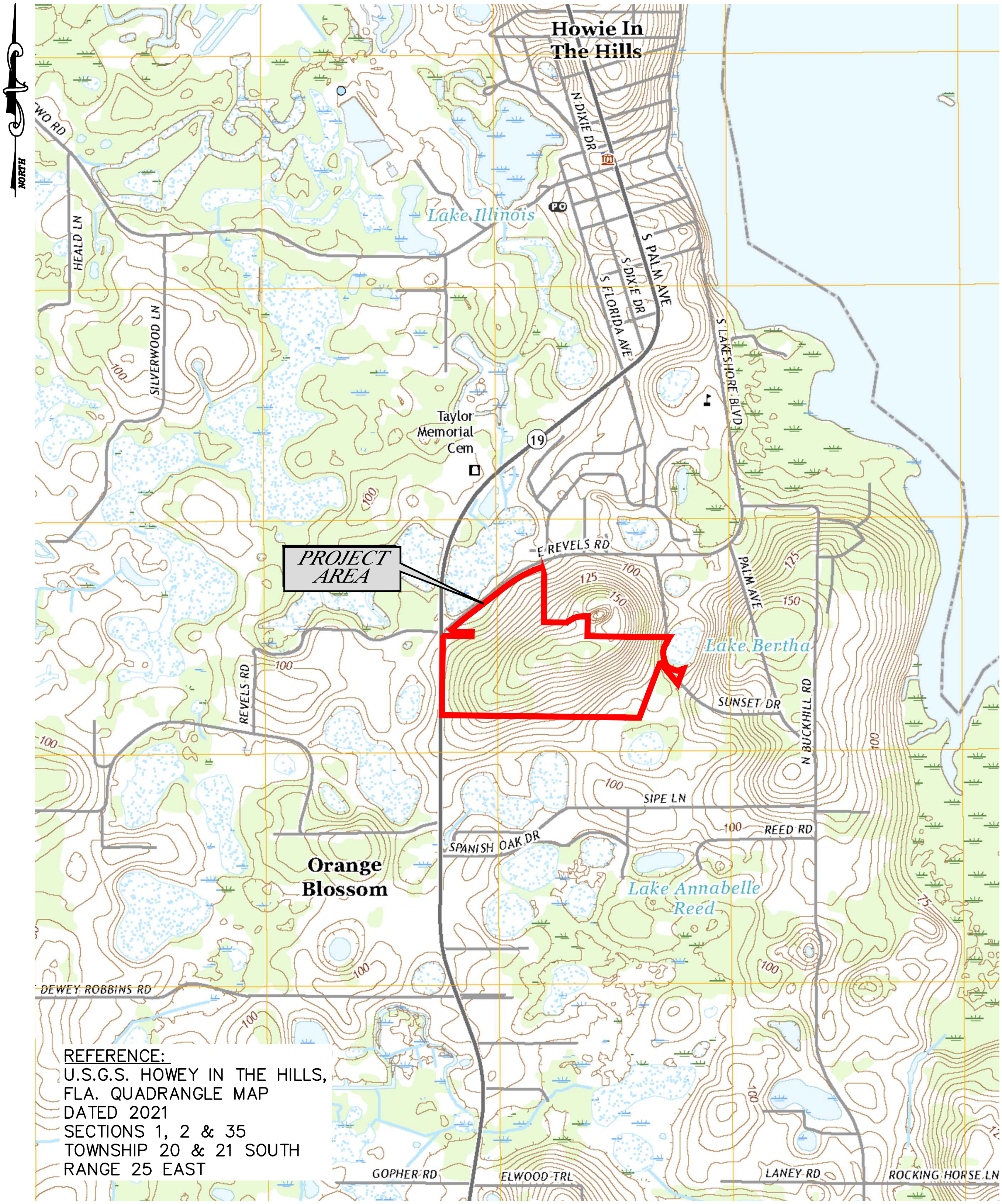
Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

RAYMOND W. JONES LICENSE NO. 58079 STATE OF FLORIDA PROFESSIONAL ENGINEER

Mark L. Jung
Senior Project Manager

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

FIGURES



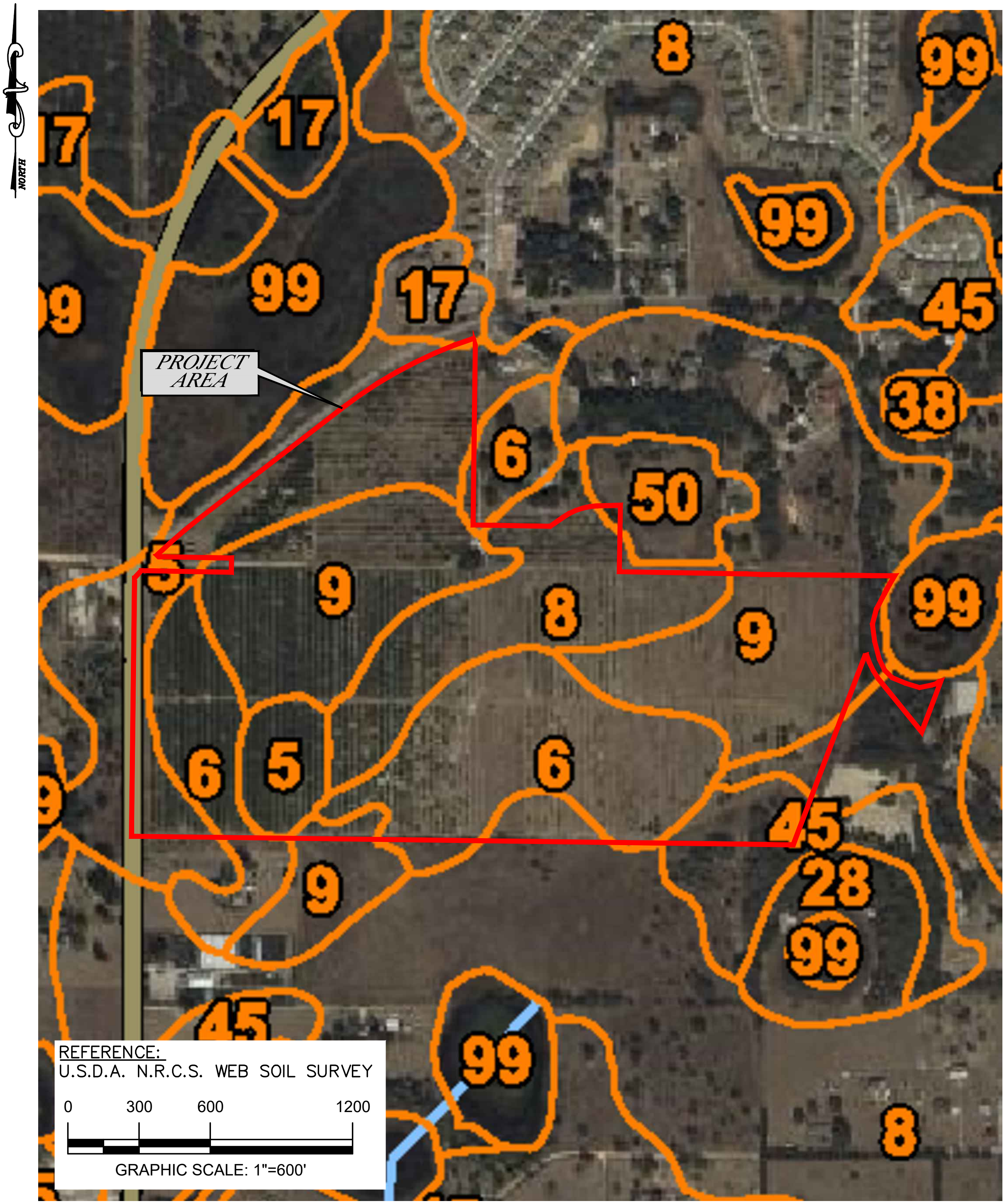
Andreyev Engineering, Inc.

GEOTECHNICAL INVESTIGATION
PROPOSED SITE IMPROVEMENTS

SIMPSON PROPERTY

HOWEY IN THE HILLS, LAKE COUNTY, FL

APPROXIMATE SCALE:	DATE: 04/03/23	ENGINEER: RJ	U.S.G.S. TOPOGRAPHIC MAP
1"=2000'	PN: GPGT-23-033	DRAWN BY: DLS	FIGURE 1



LEGEND:

5	APOPKA SAND, 0 TO 5% SLOPES
6	APOPKA SAND, 5 TO 12% SLOPES
8	CANDLER SAND, 0 TO 5% SLOPES
9	CANDLER SAND, 5 TO 12% SLOPES
17	ARENTS
45	TAVARES SAND, 0 TO 5% SLOPES
50	BORROW PITS

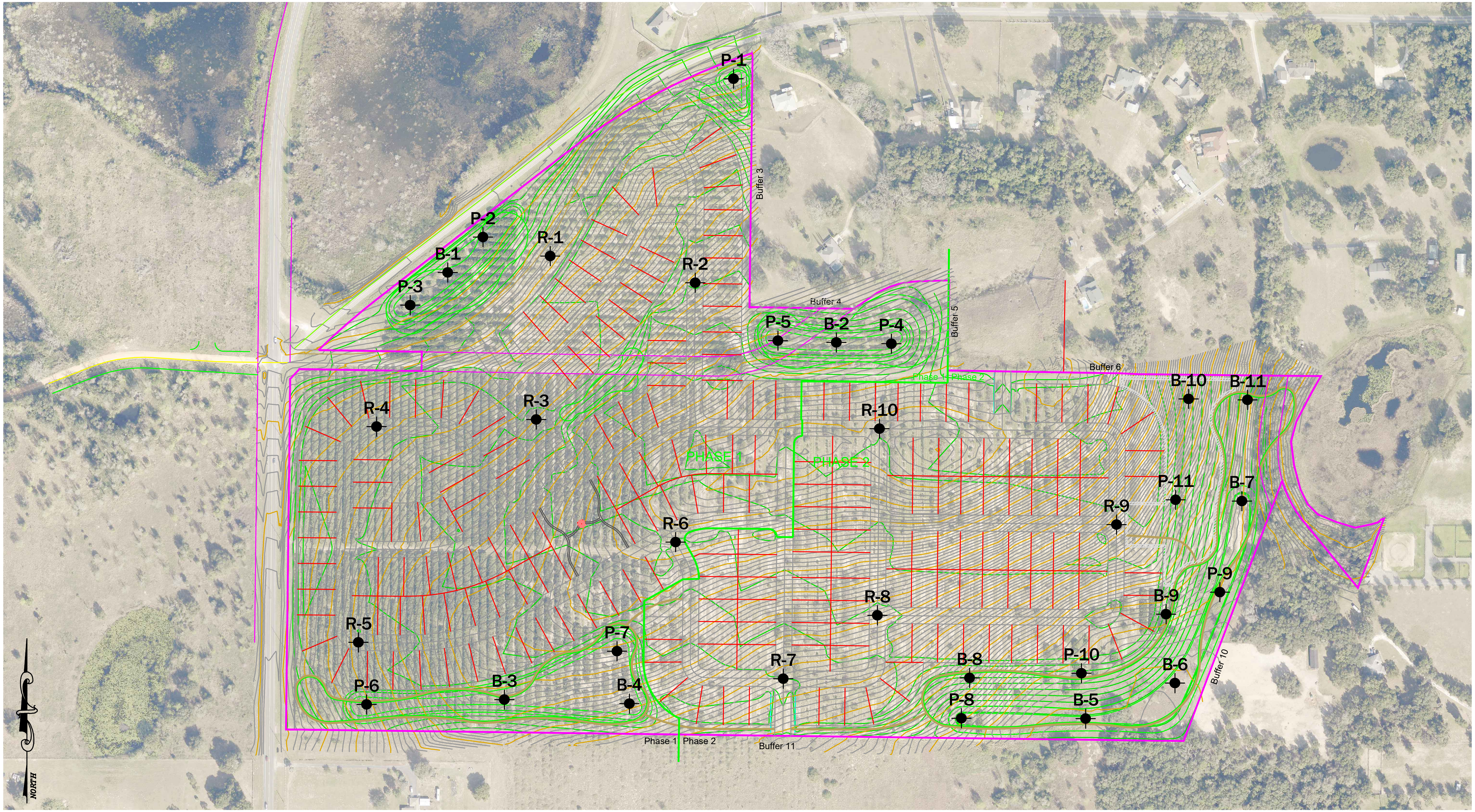
Andreyev Engineering, Inc.

GEOTECHNICAL INVESTIGATION
PROPOSED SITE IMPROVEMENTS

SIMPSON PROPERTY

HOWEY IN THE HILLS, LAKE COUNTY, FL

APPROXIMATE SCALE: 1"=600'	DATE: 04/03/23	ENGINEER: RJ	N.R.C.S. SOIL SURVEY MAP
	PN: GPGT-23-033	DRAWN BY: DLS	FIGURE 2



0 150 300 600

GRAPHIC SCALE: 1"=300'

LEGEND:

APPROXIMATE LOCATION OF MACHINE AUGER BORING

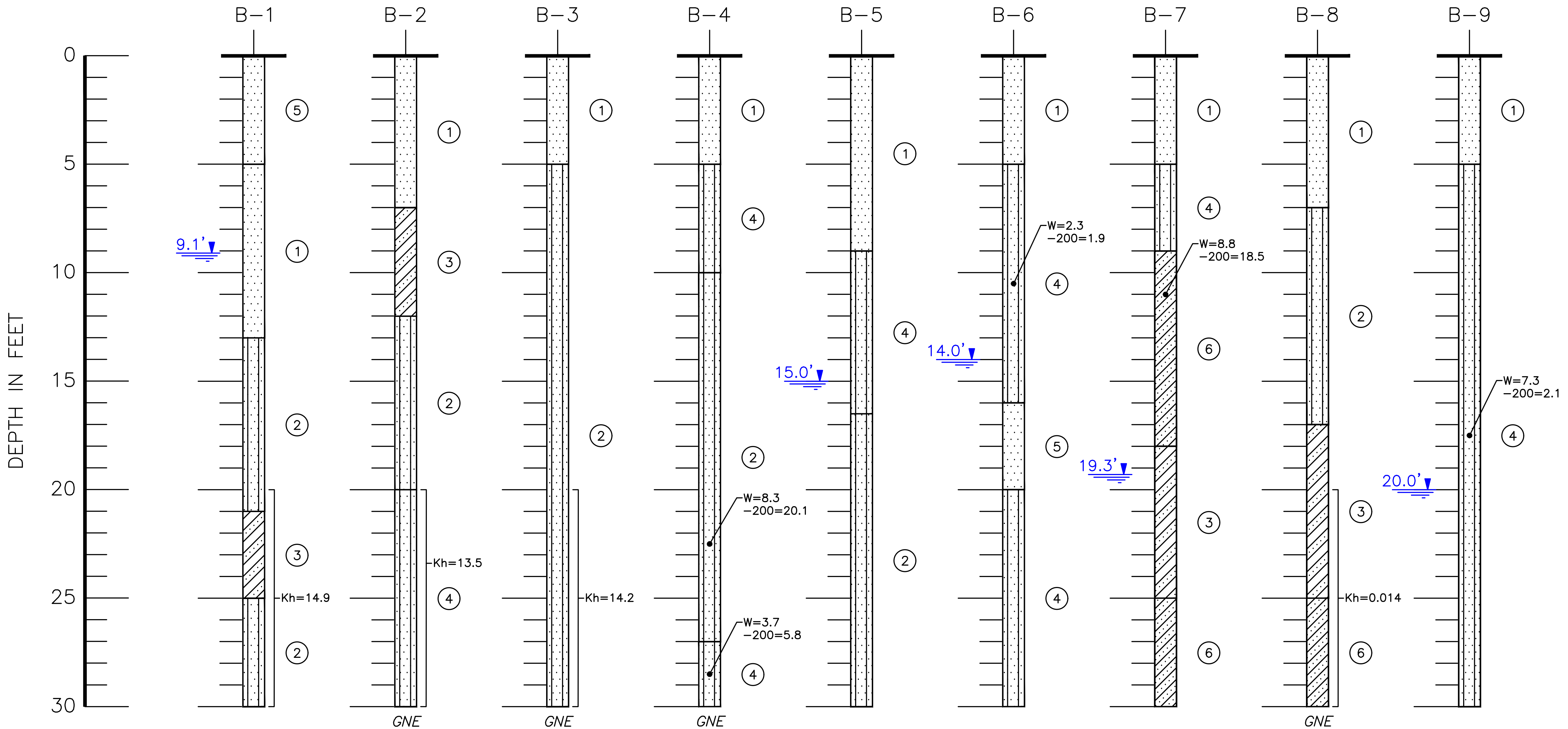
Andreyev Engineering, Inc.

GEOTECHNICAL INVESTIGATION
PROPOSED SITE IMPROVEMENTS

SIMPSON PROPERTY

HOWEY IN THE HILLS, LAKE COUNTY, FL

APPROXIMATE SCALE:	DATE: 04/03/23	ENGINEER: RJ	BORING LOCATION PLAN
1"=300'	PN: GPGT-23-033	DRAWN BY: DLS	FIGURE 3



LEGEND:

1. GRAY TO BROWN TO GRAYISH BROWN TO BROWNISH GRAY TO YELLOWISH BROWN TO REDDISH BROWN FINE SAND (SP)
2. YELLOWISH BROWN TO REDDISH BROWN TO GRAY TO LIGHT GRAY TO LIGHT PINKISH GRAY SLIGHTLY SILTY TO SILTY FINE SAND (SP-SM)(SM)
3. YELLOWISH BROWN TO REDDISH BROWN TO GRAY TO GRAYISH BROWN SILTY TO CLAYEY FINE SAND (SM)(SC)
4. LIGHT BROWN TO LIGHT YELLOWISH BROWN TO LIGHT GRAY FINE SAND TO SLIGHTLY SILTY FINE SAND (SP)(SP-SM)
5. DARK GRAY TO DARK BROWN TO DARK GRAYISH BROWN FINE SAND (SP)
6. GRAYISH BROWN TO REDDISH BROWN TO LIGHT GRAY CLAYEY FINE SAND (SC)

(SP) UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL

1.0' DEPTH TO GROUNDWATER, MARCH 2023

GNE GROUNDWATER NOT ENCOUNTERED

W MOISTURE CONTENT, IN PERCENT

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

Kv VERTICAL COEFFICIENT OF PERMEABILITY, IN FEET PER DAY

Kh HORIZONTAL COEFFICIENT OF PERMEABILITY, IN FEET PER DAY

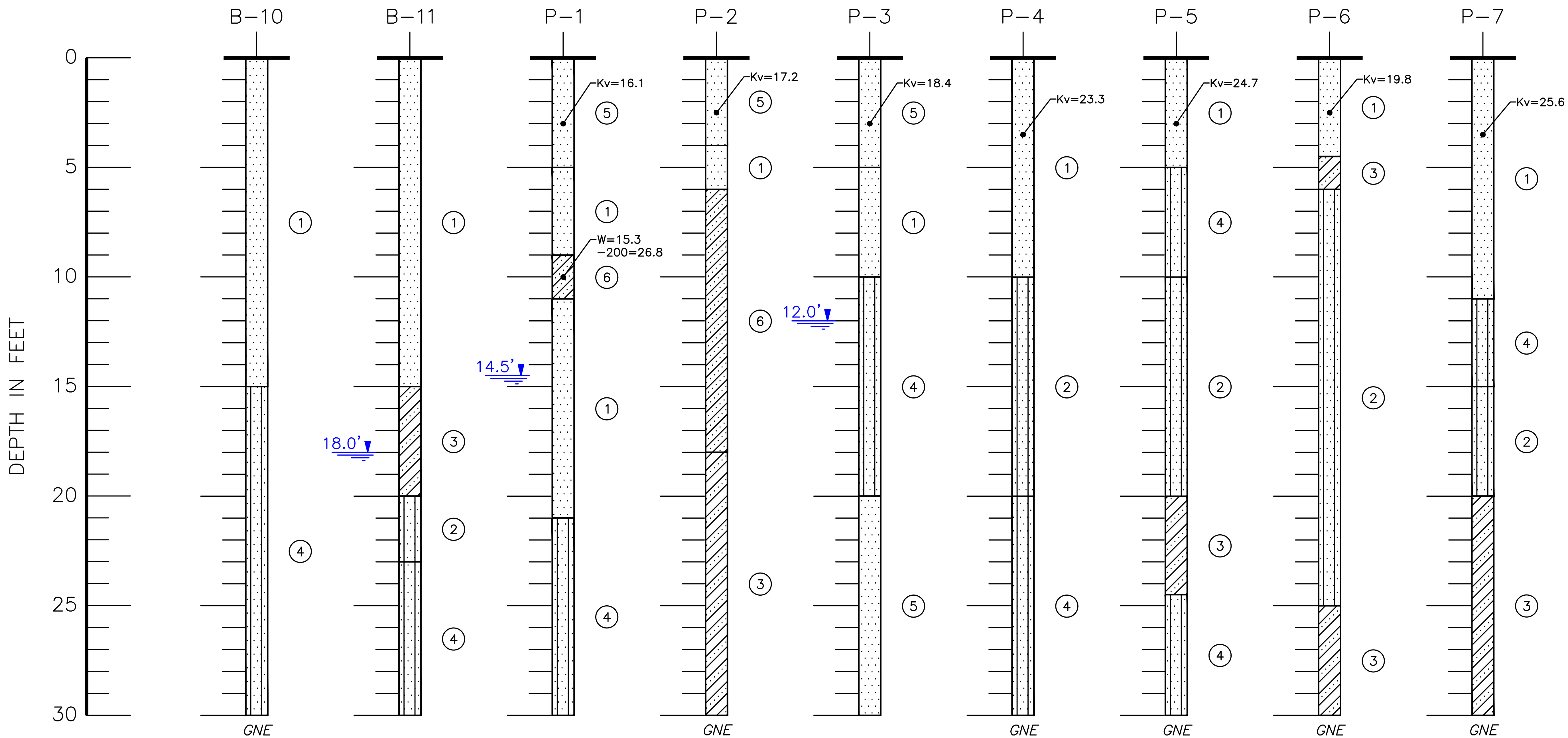
Andreyev Engineering, Inc.

GEOTECHNICAL INVESTIGATION
PROPOSED SITE IMPROVEMENTS

SIMPSON PROPERTY

HOWEY IN THE HILLS, LAKE COUNTY, FL

APPROXIMATE SCALE: 1"=5'	DATE: 04/18/23	ENGINEER: RJ	SOIL PROFILES
	PN: GPGT-23-033	DRAWN BY: DLS	FIGURE 4



LEGEND:

- ① GRAY TO BROWN TO GRAYISH BROWN TO BROWNISH GRAY TO YELLOWISH BROWN TO REDDISH BROWN FINE SAND (SP)
- ② YELLOWISH BROWN TO REDDISH BROWN TO GRAY TO LIGHT GRAY TO LIGHT PINKISH GRAY SLIGHTLY SILTY TO SILTY FINE SAND (SP–SM)(SM)
- ③ YELLOWISH BROWN TO REDDISH BROWN TO GRAY TO GRAYISH BROWN SILTY TO CLAYEY FINE SAND (SM)(SC)
- ④ LIGHT BROWN TO LIGHT YELLOWISH BROWN TO LIGHT GRAY FINE SAND TO SLIGHTLY SILTY FINE SAND (SP)(SP–SM)
- ⑤ DARK GRAY TO DARK BROWN TO DARK GRAYISH BROWN FINE SAND (SP)
- ⑥ GRAYISH BROWN TO REDDISH BROWN TO LIGHT GRAY CLAYEY FINE SAND (SC)

(SP) UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL

1.0' DEPTH TO GROUNDWATER, MARCH 2023

GNE GROUNDWATER NOT ENCOUNTERED

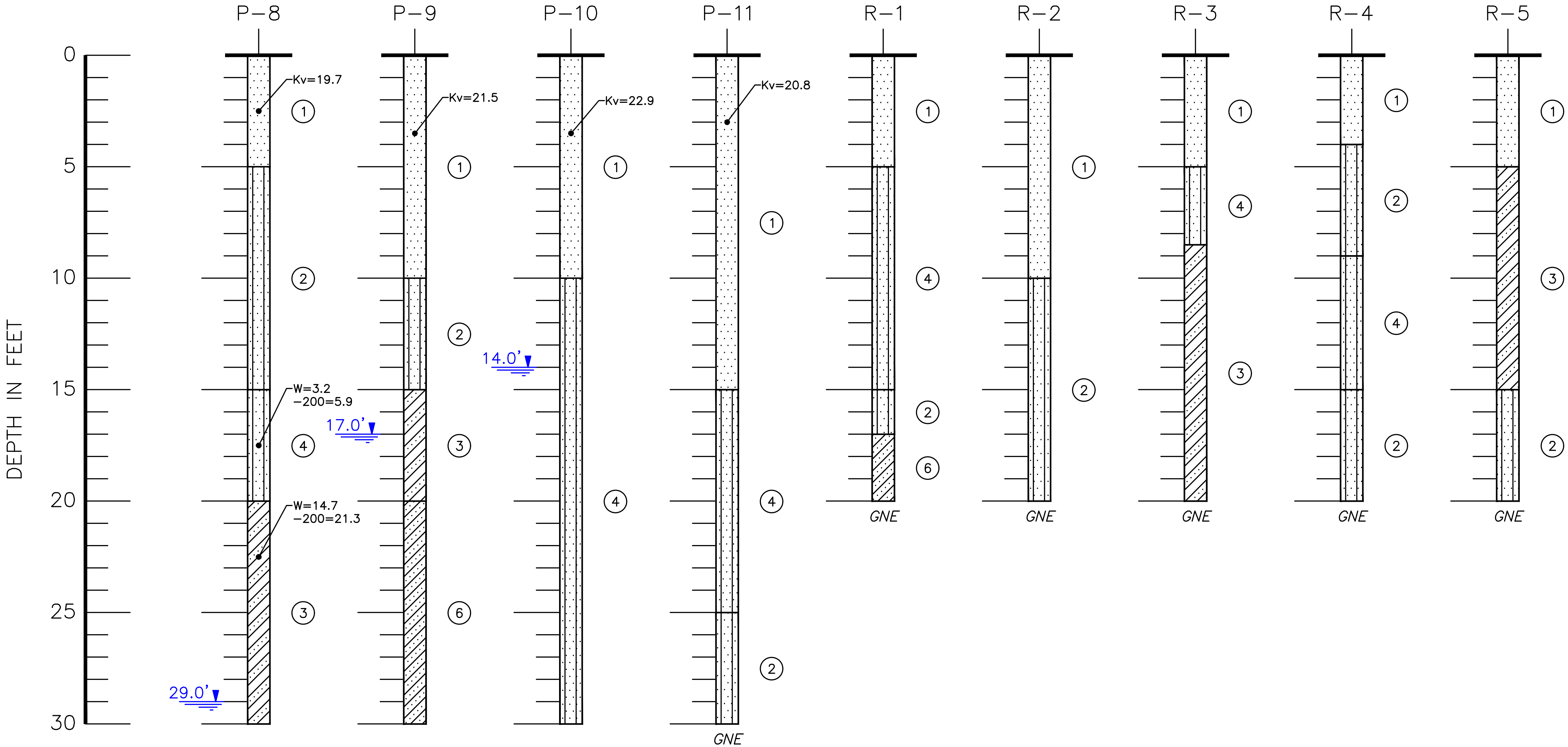
W MOISTURE CONTENT, IN PERCENT

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

Kv VERTICAL COEFFICIENT OF PERMEABILITY, IN FEET PER DAY

Kh HORIZONTAL COEFFICIENT OF PERMEABILITY, IN FEET PER DAY

Andreyev Engineering, Inc.			GEOTECHNICAL INVESTIGATION PROPOSED SITE IMPROVEMENTS **SIMPSON PROPERTY** HOWEY IN THE HILLS, LAKE COUNTY, FL
APPROXIMATE SCALE:	DATE: 04/18/23	ENGINEER: RJ	SOIL PROFILES
1"=5'	PN: GPGT-23-033	DRAWN BY: DLS	FIGURE 5



LEGEND:

1 GRAY TO BROWN TO GRAYISH BROWN TO BROWNISH GRAY TO YELLOWISH BROWN TO REDDISH BROWN FINE SAND (SP)

2 YELLOWISH BROWN TO REDDISH BROWN TO GRAY TO LIGHT GRAY TO LIGHT PINKISH GRAY SLIGHTLY SILTY TO SILTY FINE SAND (SP-SM)(SM)

3 YELLOWISH BROWN TO REDDISH BROWN TO GRAY TO GRAYISH BROWN SILTY TO CLAYEY FINE SAND (SM)(SC)

4 LIGHT BROWN TO LIGHT YELLOWISH BROWN TO LIGHT GRAY FINE SAND TO SLIGHTLY SILTY FINE SAND (SP)(SP-SM)

5 DARK GRAY TO DARK BROWN TO DARK GRAYISH BROWN FINE SAND (SP)

6 GRAYISH BROWN TO REDDISH BROWN TO LIGHT GRAY CLAYEY FINE SAND (SC)

(SP) UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL

1.0' DEPTH TO GROUNDWATER, MARCH 2023

GNE GROUNDWATER NOT ENCOUNTERED

W MOISTURE CONTENT, IN PERCENT

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

Kv VERTICAL COEFFICIENT OF PERMEABILITY, IN FEET PER DAY

Kh HORIZONTAL COEFFICIENT OF PERMEABILITY, IN FEET PER DAY

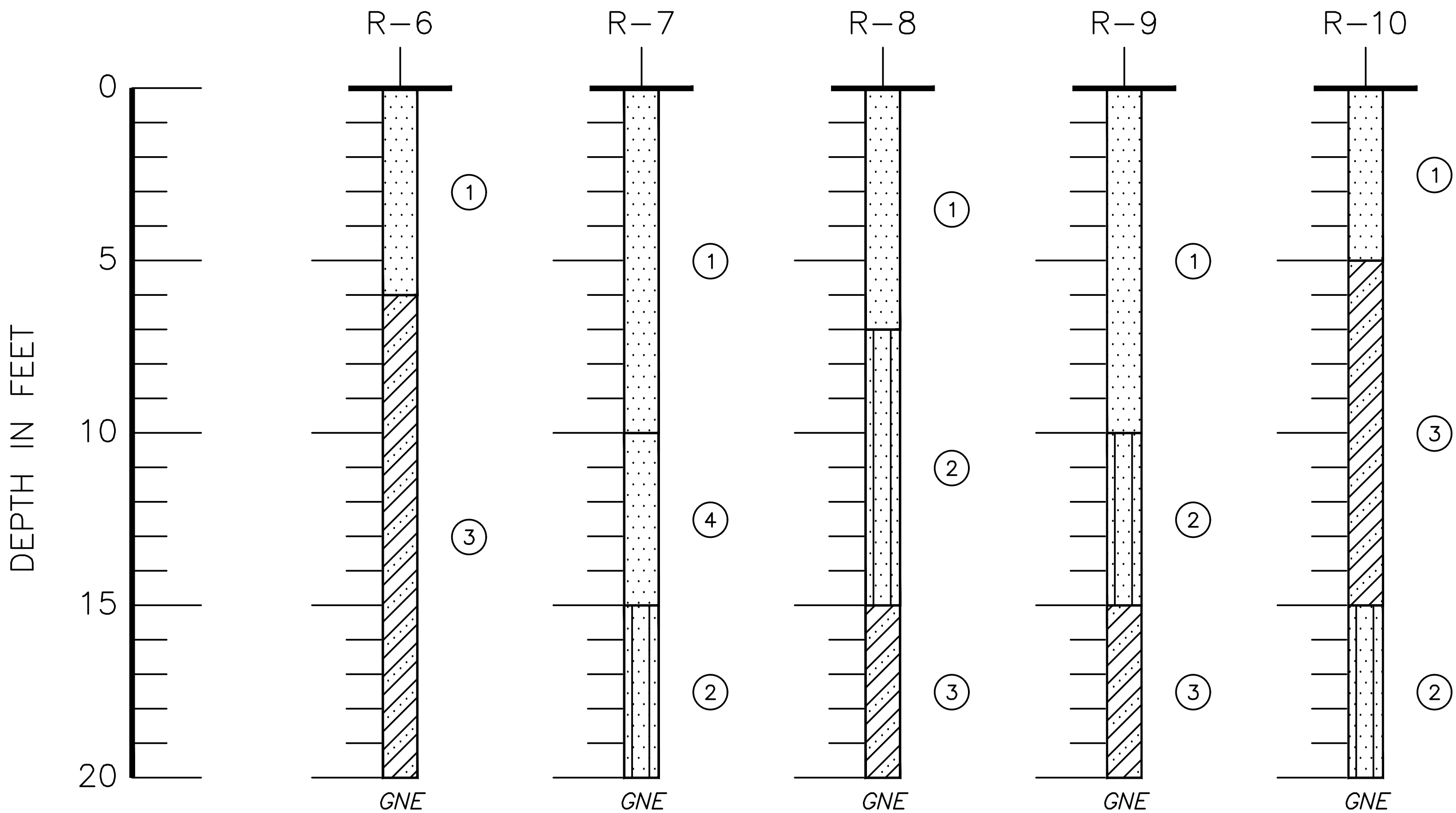
Andreyev Engineering, Inc.

GEOTECHNICAL INVESTIGATION
PROPOSED SITE IMPROVEMENTS

SIMPSON PROPERTY

HOWEY IN THE HILLS, LAKE COUNTY, FL

APPROXIMATE SCALE: 1"=5'	DATE: 04/17/23	ENGINEER: RJ	SOIL PROFILES
	PN: GPGT-23-033	DRAWN BY: DLS	FIGURE 6



LEGEND:

① GRAY TO BROWN TO GRAYISH BROWN TO BROWNISH GRAY TO YELLOWISH BROWN TO REDDISH BROWN FINE SAND (SP)

② YELLOWISH BROWN TO REDDISH BROWN TO GRAY TO LIGHT GRAY TO LIGHT PINKISH GRAY SLIGHTLY SILTY TO SILTY FINE SAND (SP-SM)(SM)

③ YELLOWISH BROWN TO REDDISH BROWN TO GRAY TO GRAYISH BROWN SILTY TO CLAYEY FINE SAND (SM)(SC)

④ LIGHT BROWN TO LIGHT YELLOWISH BROWN TO LIGHT GRAY FINE SAND TO SLIGHTLY SILTY FINE SAND (SP)(SP-SM)

⑤ DARK GRAY TO DARK BROWN TO DARK GRAYISH BROWN FINE SAND (SP)

⑥ GRAYISH BROWN TO REDDISH BROWN TO LIGHT GRAY CLAYEY FINE SAND (SC)

(SP) UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL

1.0' DEPTH TO GROUNDWATER, MARCH 2023

GNE GROUNDWATER NOT ENCOUNTERED

W MOISTURE CONTENT, IN PERCENT

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

Kv VERTICAL COEFFICIENT OF PERMEABILITY, IN FEET PER DAY

Kh HORIZONTAL COEFFICIENT OF PERMEABILITY, IN FEET PER DAY

Andreyev Engineering, Inc.

GEOTECHNICAL INVESTIGATION
PROPOSED SITE IMPROVEMENTS

SIMPSON PROPERTY

HOWEY IN THE HILLS, LAKE COUNTY, FL

APPROXIMATE SCALE:	DATE: 04/18/23	ENGINEER: RJ	SOIL PROFILES
1"=5'	PN: GPGT-23-033	DRAWN BY: DLS	FIGURE 7