Report of Geotechnical Exploration

For

Radio Avenue Access Road and Future Expansion

MAE Project No. 0110-0003G
May 1, 2020

Prepared for:

Hazen and Sawyer, PC
6675 Corporate Center Parkway, Suite 330
Jacksonville, Florida 32216

Prepared by:

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May 1, 2020

Hazen and Sawyer, PC
6675 Corporate Center Parkway, Suite 330
Jacksonville, Florida 32216

Attention: Ms. Caitlin Klug, P.E.

Reference: Report of Geotechnical Exploration
Radio Avenue Access Road and Future Expansion
Nassau County, Florida
MAE Project No. 0110-0003G

Dear Ms. Klug:

Meskel & Associates Engineering, PLLC (MAE) has completed a geotechnical exploration for the referenced project. Our work was performed in general accordance with our proposal dated January 27, 2020. The geotechnical exploration was performed to evaluate the general subsurface conditions encountered within the planned Access Roadway swale stormwater management system and the area for a future Wastewater Booster Pump Station as part of the planned future expansion of the Radio Avenue Water Treatment Facility The results of the exploration were used to provide recommendations for construction and site preparation. A summary of our findings and related recommendations is presented below; however, we recommend that you consider this report in its entirety.

As further discussed in this report, the borings typically encountered a topsoil layer up to 6 inches thick, followed by loose to dense fine sands to fine sands with silt (SP, SP-SM, A-3) to the boring termination depths of up to 15 feet below the existing ground surface.

We appreciate this opportunity to be of service as your geotechnical consultant on this phase of the project. If you have any questions, or if we may be of any further service, please contact us.

Sincerely,
MESKEL & ASSOCIATES ENGINEERING, PLLC
MAE FL Certificate of Authorization No. 28142

P. Rodney Mank, State of Florida, Professional Engineer, License No. 41986. This item has been electronically signed and sealed by P. Rodney Mank, P.E. on 05/01/2020 using a Digital Signature. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Philip R Mank Digitally signed by Philip R Mank Date: 2020.05.01 10:06:20 -04'00'

W. Josh Mele, E.I.
Staff Engineer

P. Rodney Mank, P.E.
Principal Engineer
Licensed, Florida No. 41986

Distribution: Ms. Caitlin Klug, P.E. – Hazen and Sawyer, PC 1 pdf

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FIGURES

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1.0 PROJECT INFORMATION

1.1 General

Project information was provided to us by Ms. Caitlin Klug, P.E. – Hazen and Sawyer, PC via several emails and telephone conversations. We were provided with the following project documents for review and reference:

- A *Site and Yard Piping Plan* created by Hazen and Sawyer, PC, dated May 2019.
- Three drawings titled Access Road Existing Conditions I, II, III created by Hazen and Sawyer, PC, dated December 2018.
- Several CADD files denoting the planned construction, created by Hazen and Sawyer, PC.

MAE previously performed a geotechnical exploration for the storage and repump station site, which was reported on April 2, 2019. This report was also referenced for details of the encountered subsurface conditions.

1.2 Project Description

The site for the storage and repump station is an undeveloped 3.5-acre parcel, located east of Art Wilson Lane, west of the planned Nassau Phase 1B WRF, and north of Radio Avenue in Nassau County, Florida. The proposed access road begins off Art Wilson Lane, just north of Radio Avenue, and continues along an existing dirt road to the northeast along the south border of the pump station site. The general site location is shown on Figure 1.

Based on the provided information, we understand the two primary objectives for this geotechnical exploration were to measure the unsaturated vertical infiltration hydraulic conductivity of the near-surface soils at locations along the planned Access Roadway alignment for the design of a proposed swale stormwater management system, and to explore the subsurface conditions within the approximate area of a future Booster Pump Station. We have assumed that the wet well associated with this pump station will bear within the depths of the borings. The swale system will run parallel along the northern side of the planned Access Roadway. The future Booster Pump Station will have a footprint area of approximately 170 feet by 80 feet and is planned to be positioned west of the Phase 1B WRF facility and south of a future stormwater retention pond.

If the project details change from the details described above, then the recommendations in this report may need to be re-evaluated. Any changes in the project design should be provided so that the need for re-evaluation of our recommendations can be assessed prior to final design.

2.0 FIELD EXPLORATION

A field exploration was performed on March 30 and 31, 2020. An aerial obtained from Google Earth, which shows the approximate boring and DRI test locations, is included as the *Boring and DRI Test Location Plan*, Figure 2. GPS coordinates for the boring and Double Ring Infiltrometer Test (DRI) locations were determined by overlaying the provided CADD drawings in Google Earth. Our field personnel then located each boring location using a Garmin GPSMAP 78 hand-held GPS receiver. Prior to starting our field exploration, a utility locate request was submitted to the Sunshine State One-Call Center. Once the site utilities were marked and/or cleared, our field crew mobilized to the site. The boring and DRI locations as shown on Figure 2 should be considered accurate only to the degree implied by the method of layout used. A summary of the field procedures used during our exploration is included in Appendix A.

2.1 SPT and Auger Borings

To explore the subsurface conditions within the area of the future Booster Pump Station, we located and performed two Standard Penetration Test (SPT) borings, each drilled to a depth of approximately 15 feet below the existing ground surface, in general accordance with the methodology outlined in ASTM D 1586. Split-spoon soil samples recovered during performance of the borings were visually described in the field and representative portions of the samples were transported to our laboratory for testing and classification.

To determine the subsurface conditions within the proposed swale stormwater management areas, we located and performed three auger borings, each drilled to a depth of approximately 6 feet below the existing ground surface in general accordance with the methodology outlined in ASTM D 1452. Representative soil samples recovered from the auger borings were returned to our laboratory for further testing and classification.

2.2 Double Ring Infiltrometer Test

Three double ring infiltrometer tests were conducted within the planned stormwater management areas. The test was performed in general accordance with the procedures outlined in the latest revision of ASTMD 3385, "Infiltration Rate of Soils in Field using Double Ring Infiltrometers." The test locations were initially cleared of all surface vegetation and topsoil, excavated to the desired test depths, and then leveled. The outer ring, approximately 24 inches in diameter, was driven to a depth of 6 inches below the test depth. The inner ring, approximately 12 inches in diameter, was centered inside the outer ring and driven to a depth of approximately 2 inches below the test depths. A thin layer of gravel was placed on the exposed soils inside the rings at the test level. The 2 rings were filled simultaneously with 4 inches of water.

The water level was maintained throughout each test period, with the required amount of water added to maintain this level in both rings recorded at time intervals of 10 minutes. After reaching a stabilized inflow volume of water, the tests were continued for approximately 120 minutes.

3.0 LABORATORY TESTING

Representative soil samples obtained during our field exploration of the swale stormwater management areas were classified using the AASHTO Soil Classification System in general accordance with ASTM D 3282. The soil samples obtained from the borings located in the area of the future Booster Pump Station were classified using the Unified Soil Classification System (USCS) in accordance with ASTM D 2488. Both *Keys to the Soil Classification Systems* are included in Appendix A.

Quantitative laboratory testing was performed on selected samples of the soils encountered during the field exploration to better define the composition of the soils encountered and to provide data for correlation to their anticipated strength and compressibility characteristics. The laboratory testing determined the natural moisture content and the percent passing a U.S. No. 200 sieve (percent fines) of the selected soil samples. The results of the laboratory testing are shown in the *Summary of Laboratory Test Results* table included in Appendix B. Also, these results are shown on the *Generalized Soil Profiles* sheets, Figures 3 and 4, and on the Log of Boring records at the respective depths from which the tested samples were recovered. A summary of the laboratory test procedures is included in Appendix B.

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 General Soil Profile

Graphical presentation of the generalized subsurface conditions is presented on the *Generalized Soil Profiles* sheets, Figures 3 and 4. Detailed boring records are included in Appendix A. When reviewing these the soil profiles sheets and boring records, it should be understood that the soil conditions will vary between the boring locations. The following tables summarizes the soil conditions encountered.

GENERAL SOIL PROFILE: BOOSTER PUMP STATION			
TYPICAL DEPTH (FT)		SOIL DESCRIPTION	USCS [1]
FROM	TO		
0.0	0.5	Topsoil	---[2]
0.5	13.5	Fine sands, trace silt, occasional trace root fragments	SP
13.5	15.0	Fine sands with silt	SP-SM

(1) Unified Soil Classification System
(2) Topsoil does not have a corresponding classification

GENERAL SOIL PROFILE: ACCESS ROADWAY SWALE SYSTEM			
TYPICAL DEPTH (FT)		SOIL DESCRIPTION	AASHTO[1]
FROM	TO		
0.0	0.5	Topsoil	---[2]
0.5	6	Fine sands, trace silt, occasional trace root fragments	A-3

(1) American Association of State Highway Transportation Officials
(2) Topsoil does not have a corresponding classification

4.2 Groundwater Level

The groundwater level was encountered at each of the boring locations and recorded at the time of drilling. The measured groundwater level at the proposed Booster Pump Station location was 4 feet 1 inch and 5 feet 8 inches. The measured groundwater levels along the proposed stormwater swale ranged from 4 feet 1 inch to 5 feet 7 inches. However, it should be anticipated that the groundwater levels will fluctuate seasonally and with changes in climate. As such, we recommend that the water table be remeasured prior to construction. Measured groundwater levels are shown the boring profiles and boring logs.

4.3 Review of the USDA Web Soil Survey Map

The results of a review of the USDA Soil Survey Conservation Service (SSCS) Web Soil Survey of Nassau County are shown in the table below. There are two predominant soil map units at the project sight: Hurricane-Pottsburg and Mandarin fine sands. The soil drainage class, hydrological group, and estimated seasonal high groundwater levels reported in the Soil Survey are as follows:

Map Unit Symbol	Map Unit Name	Drainage Class	Hydrologic Group	Depth to the Water Table[1] (inches)
6	Hurricane - Pottsburg fine sands, 0 to 5 percent slopes	Somewhat Poorly Drained	A	24 to 42
10	Mandarin fine sand, 0 to 2 percent slopes	Somewhat Poorly Drained	A	18 to 30

(1) The "Water Table" above refers to a saturated zone in the soil which occurs during specified months, typically the summer wet season. Estimates of the upper limit shown in the Web Soil Survey are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

4.4 Seasonal High Groundwater Level

In estimating seasonal high groundwater level, a number of factors are taken into consideration including antecedent rainfall, soil redoximorphic features (i.e., soil mottling), stratigraphy (including presence of hydraulically restrictive layers), vegetative indicators, effects of development, and relief points such as drainage ditches, low-lying areas, etc.

Based on our interpretation of the current site conditions, including the boring logs and review of published data, and our review of the previous geotechnical exploration of the storage and repump site, we estimate the seasonal high groundwater level at the area of the planned swales and future Booster Pump Station to be approximately 18 inches below existing grade. However, it should be understood that these seasonal high estimates are based on site observations and measurements at the time of our field work and on historical data on the site soil conditions. Changes in onsite stormwater drainage patterns caused by off-site development may cause seasonal highwater levels to be higher or lower than historical patterns. The project drainage engineer should be consulted to evaluate the influence of these changes on groundwater levels at the site. In addition, as we recommended in our previous reports for the storage and repump site, piezometers should be installed across the site and along the access road to measure groundwater fluctuations over time.

It is possible that higher groundwater levels may exceed the estimated seasonal high groundwater level as a result of significant or prolonged rains. Therefore, we recommend that design drawings and specifications account for the possibility of groundwater level variations, and construction planning should be based on the assumption that such variations will occur.

5.0 DESIGN RECOMMENDATIONS

5.1 General

The following evaluation and recommendations are based on the provided project information as presented in this report, the results of the field exploration and laboratory testing performed, and the construction techniques recommended in Section 6.0 below. If the described project details are incorrect or changed after this report, or if subsurface conditions encountered during construction are different from those reported, then MAE should be notified so that these recommendations can be re-evaluated and revised, if necessary. We recommend that MAE review the foundation plans and earthwork specifications to verify that the recommendations in this report have been properly interpreted and implemented.

5.2 Booster Pump Station Foundations Recommendations

Based on the results of our exploration, we consider the subsurface conditions at the site adaptable for support of the proposed pump station equipment on a slab-on-grade foundation. Provided the site preparation and earthwork construction recommendations outlined in Section 6.0 of this report are performed, the following parameters may be used for design of below-grade utilities.

5.2.1 Bearing Pressure

The maximum allowable net soil bearing pressure for use in slab-on-grade design should not exceed 2,000 psf. The maximum allowable net soil bearing pressure for the wet well base slab should not exceed 1,500 psf. Net bearing pressure is defined as the soil bearing pressure at the foundation bearing level in excess of the natural overburden pressure at that level. The slab-on-grade and wet well base slab foundations should be designed based on the maximum load that could be imposed by all loading conditions.

5.2.2 Bearing Depth

The slab-on-grade supporting surface equipment should bear at a depth of at least 12 inches below the exterior final grades. It is recommended that stormwater be diverted away from these slabs to reduce the possibility of erosion beneath the slabs.

5.2.3 Bearing Material

The subgrade soils below the slab-on-grade should consist of suitable on-site or import structural fill soils. The fine sands (SP) and fine sands with silt (SP-SM) as encountered in the borings are considered suitable onsite soils. These soils should be compacted to at least 98 percent of the soil’s modified Proctor maximum dry density (ASTM D-1557) to a depth of at least 2 feet below the slab bearing levels. Control of the soil’s moisture content, particularly for the subgrade soils below the wet well slab, will be necessary to achieve the required level of compaction.

5.3 Below Grade Structures Design Recommendations

Based on the results of the subsurface explorations, laboratory testing, and provided information, as included in this report, we consider the subsurface conditions at the site adaptable for supporting the planned Booster Pump Station wet well structure when constructed upon properly prepared subgrade soils. Provided the site preparation and earthwork construction recommendations outlined in Section 6.0 of this report are performed, the following parameters may be used for design of below-grade utilities.

5.3.1 Lateral Pressure Design Parameters

In general, walls that have adjacent compacted fill will be subjected to lateral earth pressures. Walls that are restrained at the top and bottom will be subjected to at-rest soil pressures, while walls that are not restrained at the top, and where sufficient movement is anticipated, will be subjected to active earth pressures. Surcharge effects for sloped backfill, point or area loads behind the walls, and adequate drainage provisions should be incorporated in the wall design. Passive resistance, resulting from footing embedment at the wall toe, could be neglected for safer design. The following soil parameters can be used for the project where suitable fill soils, as described in Section 6.5, are placed adjacent to the overflow structure:

- Backfill Soil Unit Weight, Saturated (γ_{sat}) = 115 pcf
- Backfill Soil Unit Weight, Moist (γ_m) = 110 pcf
- Backfill Soil Angle of Internal Friction (ϕ) = 30 degrees
- Coefficient of Active Earth Pressure, k_a = 0.33
- Coefficient of At-Rest Earth Pressure, k_o = 0.5
- Coefficient of Passive Earth Pressure, k_p = 3.0
- Foundation Soil Unit Weight, Saturated (γ_{sat}) = 120 pcf
- Foundation Soil Angle of Internal Friction (ϕ) = 30 degrees

The above parameters are based on sand backfill (SP, SP-SM) placed and compacted behind the vault walls as discussed in Section 6.4. A coefficient of friction for poured in-place concrete of 0.45 may be used in the wall design. The wet well structure should be designed to include all temporary construction and permanent traffic and surcharge loads acting on the walls.

5.3.2 Hydrostatic Uplift Resistance

It is anticipated that the buried structure will exert little or no net downward pressure on the soils, rather, the structure may be subject to hydrostatic uplift pressure when empty. Below grade structures should be designed to resist hydrostatic uplift pressures appropriate for their depth below existing grade and the seasonal high groundwater table. Hydrostatic uplift forces can be resisted in several ways including:

- Addition of dead weight to the structure.
- Mobilizing the dead weight of the soil surrounding the structure through extension of the bottom slab outside the perimeter of the structure.

A moist compacted soil unit weight of 110 lb/ft^3 may be used in designing the wet well structure to resist buoyancy.

5.4 Swale Considerations – Soil Permeability

The DRI tests resulted in the following unsaturated vertical infiltration rates:

Test Location	Vertical Infiltration Rate (inches/hour)
DRI-1	8.3
DRI-2	16.9
DRI-3	10.4

The measured unsaturated vertical infiltration rates should not be construed to represent the actual swale exfiltration rate. For swale design, we recommend a minimum safety factor of 2 be applied to the above infiltration rates provided in the table.

5.5 Borrow Suitability

Based on the boring results and classification of the soil samples, the fine sands and fine sands with silt (SP, SP-SM, A-3) as encountered at the boring locations, are considered suitable for use as fill soil. The soils containing surficial organic material (topsoil) will require removal and are considered unsuitable for use as structural fill. The organic soils could be used in landscape berms.

6.0 SITE PREPERATION AND EARTHWORK RECOMMENDATIONS

Site preparation as outlined in this section should be performed to provide more uniform foundation bearing conditions, to reduce the potential for post-construction settlements of the planned pump station structure.

6.1 Clearing and Stripping

Prior to construction, the location of existing underground utility lines within the construction area should be established. Provisions should then be made to relocate interfering utilities to appropriate locations. It should be noted that, if underground pipes are not properly removed or plugged, they may serve as conduits for subsurface erosion, which may subsequently lead to excessive settlement of overlying structures.

The "footprint" of the proposed Booster Pump Station slab-on-grade plus a minimum additional margin of 5 feet, should be stripped of all surface vegetation, stumps, debris, organic topsoil, or other deleterious materials. During grubbing operations, roots with a diameter greater than 0.5-inch, stumps, or small roots in a concentrated state, should be grubbed and completely removed.

Based on visual inspection, it should be anticipated that up to 6 inches of topsoil and soils containing significant amounts of organic materials may be encountered across the site. The actual depths of unsuitable soils and materials should be determined by MAE using visual observation and judgment during earthwork operations. Any topsoils removed from the construction areas can be stockpiled and used in areas to be grassed.

6.2 Temporary Groundwater Control

Because of the need for densification of the soils within the upper 2 feet below the stripped surface, temporary groundwater control measures may be required if the groundwater level is within 2 feet below the stripped and grubbed surface at the time of construction. In addition, temporary groundwater control will be necessary to maintain a dry excavation for the planned wet well. The dewatering methods should be determined by the contractor. We recommend the groundwater control measures, where necessary, remain in place until compaction of the existing or backfill soils is completed. The dewatering method should be maintained until backfilling around the wet well structure has reached a height of 2 feet above the groundwater level at the time of construction. The site should be graded to direct surface water runoff from the construction area.

Note that discharge of produced groundwater to surface waters of the state from dewatering operations or other site activities is regulated and requires a permit from the State of Florida Department of Environmental Protection (FDEP). This permit is termed a *Generic Permit for the Discharge of Produced Groundwater From Any Non-Contaminated Site Activity*. If discharge of produced groundwater is anticipated, we recommend sampling and testing of the groundwater early in the site design phase to prevent project delays during construction. MAE can provide the sampling, testing, and professional consulting required to evaluate compliance with the regulations.

6.3 Surface Compaction

The exposed surface areas outside of the excavation should be compacted with a vibratory drum roller having a minimum static, at-drum weight, on the order of 3 tons. Typically, the material should exhibit moisture contents within ±2 percent of the modified Proctor optimum moisture content (ASTM D 1557) during the compaction operations. Compaction should continue until densities of at least 98 percent of the modified Proctor maximum dry density (ASTM D 1557) have been achieved within the upper 2 feet of the compacted natural soils at the sites. Prior to compaction, proof-rolling of these areas with a loaded dump truck is recommended to locate any unforeseen soft areas or unsuitable surface or near-surface soils.

Should the surface soils experience pumping and soil strength loss during the compaction operations, compaction work should be immediately terminated. The disturbed soils should be removed and backfilled with dry structural fill soils, which are then compacted, or the excess moisture content within the disturbed soils should be allowed to dissipate before recompacting.

Care should be exercised to avoid damaging any nearby structures while the compaction operation is underway. Prior to commencing compaction, occupants of adjacent structures should be notified, and the existing conditions of the structures should be documented with photographs and survey. Compaction should cease if deemed detrimental to adjacent structures, and MAE should be contacted immediately. It is recommended that the vibratory roller remain a minimum of 50 feet from existing structures. Within this zone, use of a track-mounted bulldozer or a vibratory roller, operating in the static mode, is recommended.

6.4 Compaction of Excavation Bottom and Backfilling

Once the clearing and stripping has been completed, excavation for the wet well may commence. The excavations should extend at least 5 feet in all directions outside the lateral dimensions of the structure. Once the wet well excavation has achieved the target depth, backfill placement can commence. The temporary dewatering method should remain in-place to facilitate compaction of the bottom soils for the wet well, and to facilitate the backfilling operation. The bottom soils for the wet well slab should be compacted to 95 percent of their modified Proctor maximum dry density for a depth of 12 inches below subgrade elevation.

Backfill soil placed against the sides of the wet well walls should consist of sand soils as defined in Section 6.5 below. The backfill should be placed in maximum 6-inch lifts, with each lift compacted with hand-held equipment as defined in Section 6.5. Backfill placed more than 5 feet away from the structure walls may be placed in lifts up to 12 inches in thickness, with each lift compacted with appropriate compaction equipment to achieve the same level of compaction. Dewatering should remain in place until the level of backfill is at least 2 feet above the groundwater table at the time of construction.

6.5 Structural Backfill and Fill Soils

Any structural backfill or fill required for site development should be placed in loose lifts not exceeding 12 inches in thickness and compacted by the use of the above described vibratory drum roller operating in static mode or a track-mounted bulldozer if compaction operations are within 50 feet of a nearby structure. The lift thickness should be reduced to 8 inches if the roller operates in the static mode or if track-mounted compaction equipment is used. If hand-held compaction equipment is used, the lift thickness should be further reduced to 6 inches.

Structural fill is defined as a non-plastic, inorganic, granular soil having less than 10 percent material passing the No. 200 mesh sieve and containing less than 4 percent organic material. The fine sand and fine sand with silt, without roots, as encountered in the borings, are suitable as fill materials and, with proper moisture control, should densify using conventional compaction methods. It should be noted that soils with more than 10 percent passing the No. 200 sieve will be more difficult to compact, due to their nature to retain soil moisture, and may require drying. Typically, the material should exhibit moisture contents within ±2 percent of the modified Proctor optimum moisture content (ASTM D 1557) during the compaction operations. Compaction should continue until densities of at least 95 percent of the modified Proctor maximum dry density (ASTM D 1557) have been achieved within each lift of the compacted structural fill.

We recommend that material excavated from the wet well, which will be reused as backfill, be stockpiled a safe distance from the excavations and in such a manner that promotes runoff away from the open trenches and limits saturation of the materials.

6.6 Foundation Areas

The foundation bearing level soils, after compaction, should exhibit densities equivalent to 98 percent of the modified Proctor maximum dry density (ASTM D 1557), to a depth of 2 feet below the bearing level. For confined areas, such as the footing excavations, any additional compaction operations can probably best be performed by the use of a lightweight vibratory sled or roller having a total weight on the order of 500 to 2000 pounds.

6.7 Excavation Protection

Excavation work for the pump station construction will be required to meet OSHA Excavation Standard Subpart P regulations for Type C Soils. The use of excavation support systems will be necessary where there is not sufficient space to allow the side slopes of the excavation to be laidback to at least 2H:1V (2 horizontal to 1 vertical) to provide a safe and stable working area and to facilitate adequate compaction along the sides of the excavation.

The method of excavation support should be determined by the contractor but can consist of a trench box, drilled-in soldier piles with lagging, interlocking steel sheeting or other methods. The support structure should be designed according to OSHA sheeting and bracing requirements by a Florida registered Professional Engineer.

7.0 QUALITY CONTROL TESTING

A representative number of field in-place density tests should be made in the upper 2 feet of compacted natural soils, in each lift of compacted backfill and fill, and in the upper 12 inches below the bearing levels in the footing excavations. The density tests are considered necessary to verify that satisfactory compaction operations have been performed. We recommend density testing be performed as listed below:

- One location for every 5,000 square feet of slab foundation area, minimum of 2 locations.
- One test per lift of backfill placed against the wet well walls, alternating sides around the wet well.

8.0 REPORT LIMITATIONS

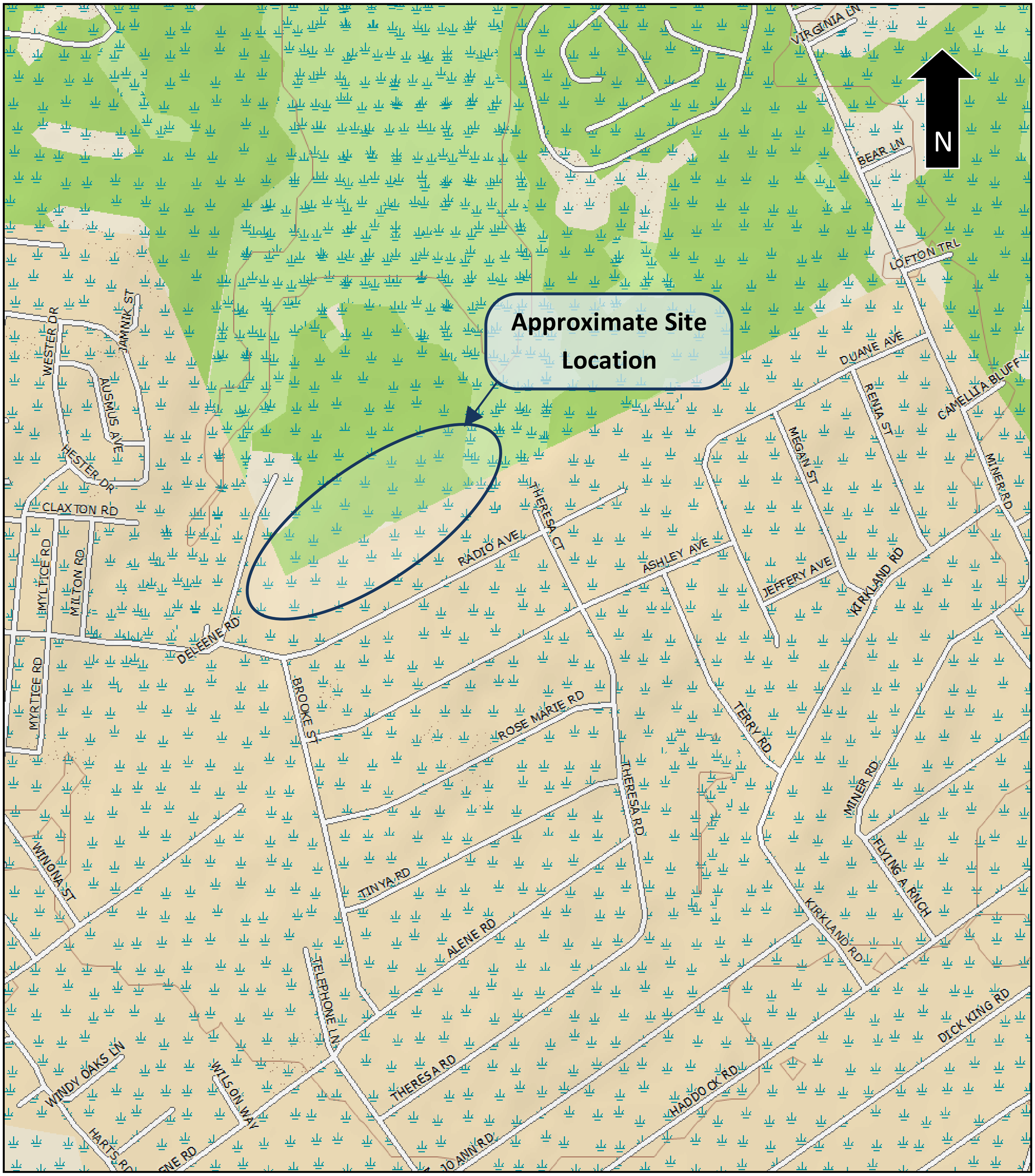
This report has been prepared for the exclusive use of Hazen and Sawyer, PC and JEA for specific application to the design and construction of the *JEA Radio Avenue Access Road and Future Expansion* projec*t*. An electronically signed and sealed version, and a version of our report that is signed and sealed in blue ink, may be considered an original of the report. Copies of an original should not be relied on unless specifically allowed by MAE in writing. Our work for this project was performed in accordance with generally accepted geotechnical engineering practice. No warranty, express or implied, is made.

The analyses and recommendations contained in this report are based on the data obtained from this project. This testing indicates subsurface conditions only at the specific locations and times, and only to the depths explored. These results do not reflect subsurface variations that may exist away from the boring locations and/or at depths below the boring termination depths. Subsurface conditions and water levels at other locations may differ from conditions occurring at the tested locations. In addition, it should be understood that the passage of time may result in a change in the conditions at the tested locations. If variations in subsurface conditions from those described in this report are observed during construction, the recommendations in this report must be re-evaluated.

The scope of our services did not include any environmental assessment or testing for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the subject site. Any statements made in this report, and/or notations made on the generalized soil profiles or boring logs, regarding odors or other potential environmental concerns are based on observations made during execution of our scope of services and as such are strictly for the information of our client. No opinion of any environmental concern of such observations is made or implied. Unless complete environmental information regarding the site is already available, an environmental assessment is recommended.

If changes in the design or location of the planned access road stormwater maintenance swales and/or future expansion occur, the conclusions and recommendations contained in this report may need to be modified. We recommend that these changes be provided to us for our consideration. MAE is not responsible for conclusions, interpretations, opinions or recommendations made by others based on the data contained in this report.

Figures



Site Location Map

PREPARED BY	PROJECT NAME	
Meskel & Associates Engineering	**JEA Phase 1B Radio Avenue: Access Road & Future Expansion Yulee, Nassau County, Florida**	
	REFERENCE	SCALE
	Delorme XMap 7.0	NTS
PREPARED FOR	MAE PROJECT NO.	**FIGURE NO.**
Hazen & Sawyer	0110-0003G	1

Project Manager:	PRM	Project No.	0110-0003G
Drawn by:	MCV	Scale:	AS SHOWN
Checked by:	MCV	File Name:	0110-0003G.BLP
Approved by:	WJM	Date:	4/7/2020

MAE Meskel & Associates Engineering

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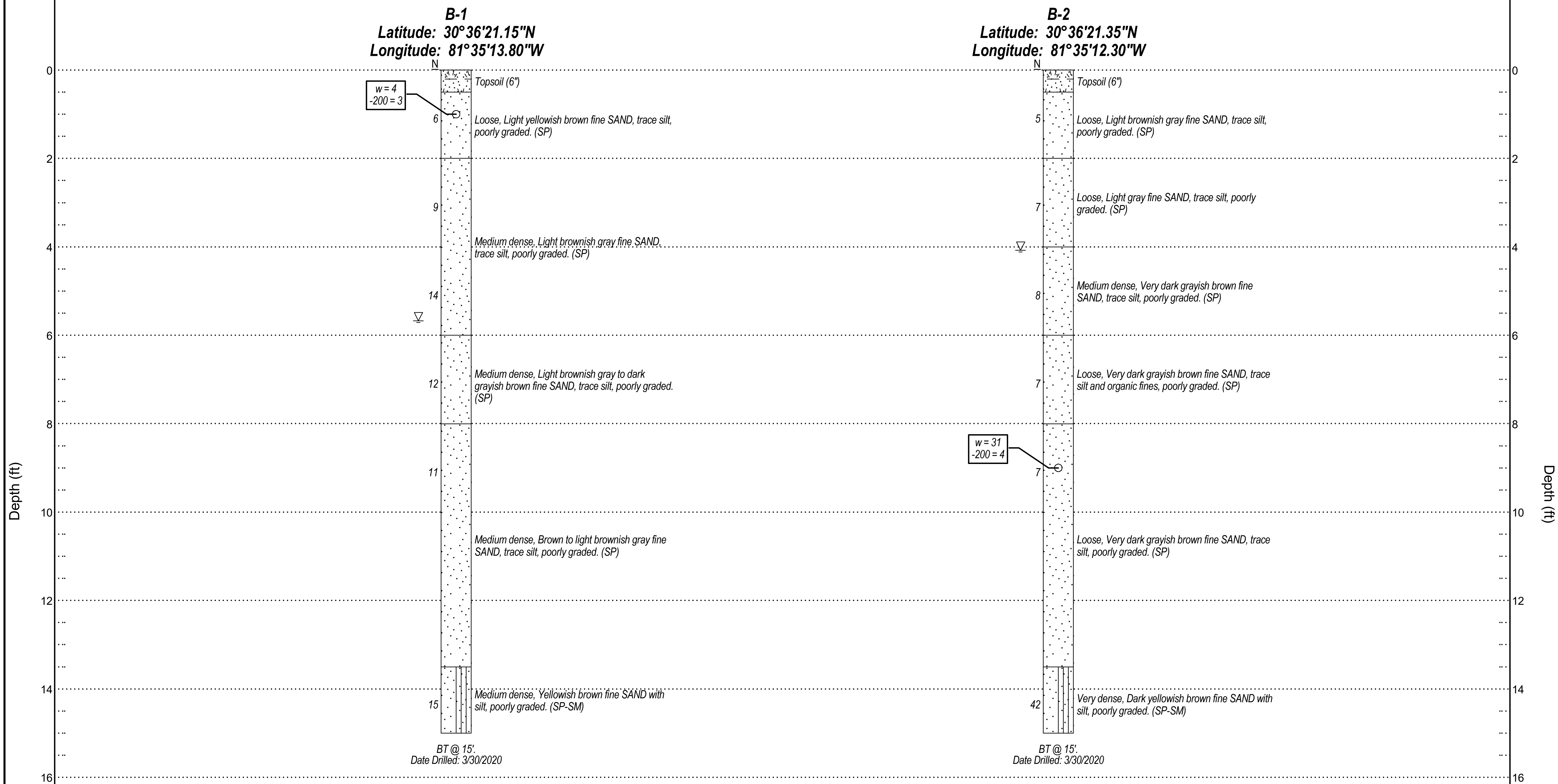
BORING AND DRI TEST LOCATION PLAN

JEA PHASE 1B RADIO AVENUE: ACCESS ROAD & FUTURE EXPANSION
YULEE, NASSAU COUNTY, FLORIDA

FIG NO.

2



Legend

Topsoil

Fine Sand

Fine Sand with Silt

- N — Standard Penetration Resistance, Blows/Foot
- BT — Boring Terminated at Depth Below Existing Grade
- (SP) — Unified Soil Classification System (USCS)
- ∇ — Depth to Groundwater at Time of Drilling
- w — Natural Moisture Content (%)
- -200 — % Passing No. 200 U.S. Standard Sieve

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

P. RODNEY MANK, P.E. P.E. NO.: 41986

MAE
Meskel & Associates Engineering
FL. Registry No. 28142
3728 Philips Highway, Suite 208, Jacksonville, FL 32207

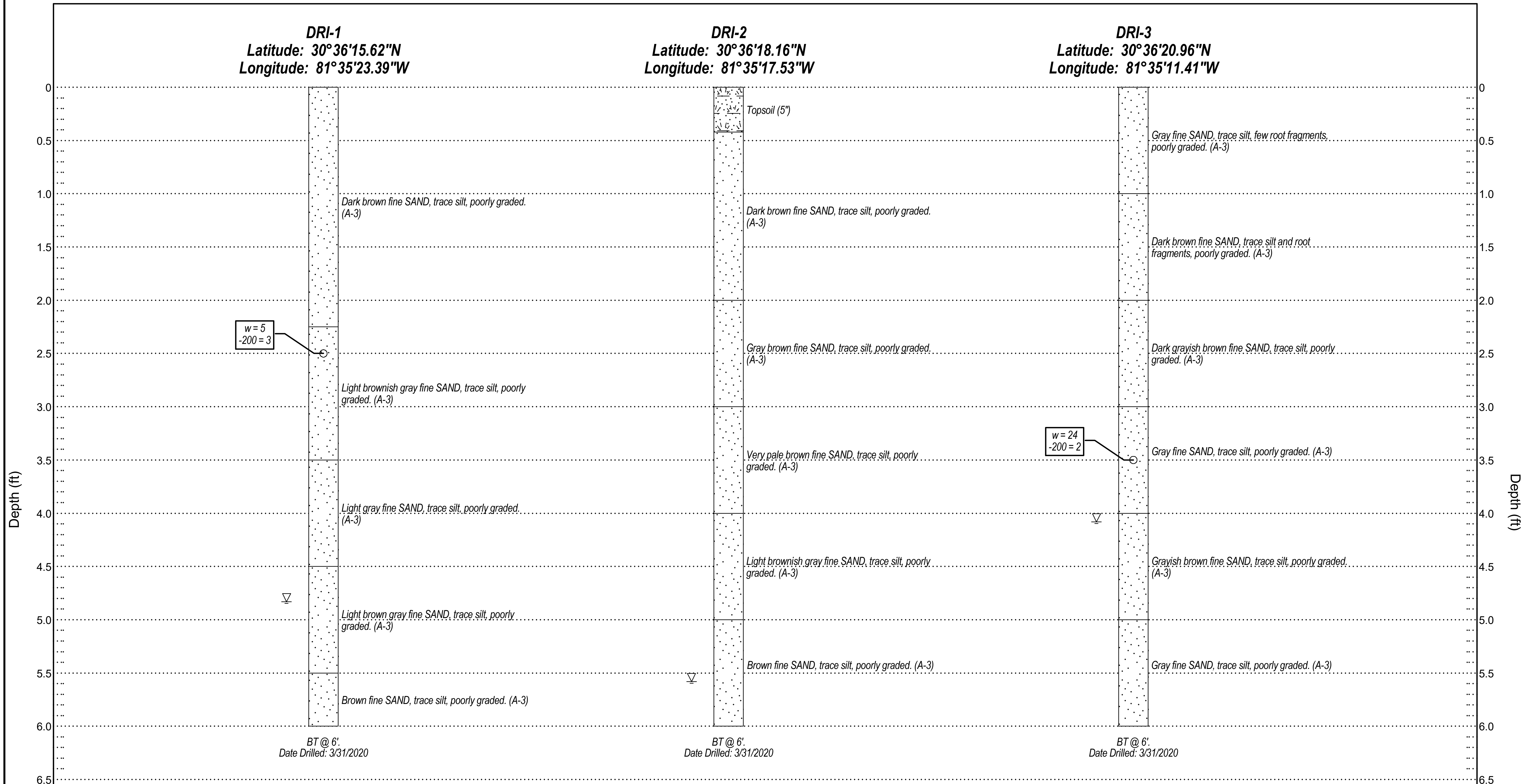
Hazen & Sawyer

DATE:	MAE PROJECT NO.
4/27/2020	0110-0003G

SHEET TITLE: Generalized Soil Profiles

PROJECT NAME: JEA Phase 1B Radio Avenue: Access Road & Future Expansion
Yulee, Nassau County, Florida

FIGURE NO. 3



Legend

Fine Sand

Topsoil

(A-3) AASHTO Soil Classification System

∇ Depth to Groundwater at Time of Drilling

w Natural Moisture Content (%)

BT Boring Terminated at Depth Below Existing Grade

-200 % Passing No. 200 U.S. Standard Sieve

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

P. RODNEY MANK, P.E. P.E. NO.: 41986
MAE
Meskel & Associates Engineering
FL Registry No. 28142
3728 Philips Highway, Suite 208, Jacksonville, FL 32207

Hazen & Sawyer

DATE:	MAE PROJECT NO.
4/27/2020	0110-0003G

SHEET TITLE: Generalized Soil Profiles

PROJECT NAME: JEA Phase 1B Radio Avenue: Access Road & Future Expansion
Yulee, Nassau County, Florida

FIGURE NO. 4

Appendix A

Meskel & Associates Engineering, PLLC
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Meskel & Associates Engineering

BORING B-1

PROJECT NO. 0110-0003G

PROJECT NAME JEA Phase 1B Radio Avenue: Access Road & Future Expansion
PROJECT LOCATION Yulee, Nassau County, Florida **CLIENT** Hazen & Sawyer
DATE STARTED 3/30/20 **COMPLETED** 3/30/20 **LATITUDE** 30°36'21.15"N **LONGITUDE** 81°35'13.80"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY T.Biscardi **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (6")												
	1	Loose, Light yellowish brown fine SAND, trace silt, poorly graded.	SP		2 3 3 3	6	4	3						
	2	Medium dense, Light brownish gray fine SAND, trace silt, poorly graded.	SP		2 4 5 8	9								
5	3	▽			3 8 6 9	14								
	4	Medium dense, Light brownish gray to dark grayish brown fine SAND, trace silt, poorly graded.	SP		5 5 7 7	12								
10	5	Medium dense, Brown to light brownish gray fine SAND, trace silt, poorly graded.	SP		4 5 6 5	11								
15	6	Medium dense, Yellowish brown fine SAND with silt, poorly graded.	SP-SM		8 7 8	15								
		Bottom of borehole at 15 feet.												

NOTES Boring backfilled with soil cuttings.

GROUND WATER LEVELS
▽ **AT TIME OF DRILLING** 5 ft 8 in
*▽ **AFTER DRILLING** ---

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BORING B-2

PROJECT NO. 0110-0003G

PROJECT NAME JEA Phase 1B Radio Avenue: Access Road & Future Expansion
PROJECT LOCATION Yulee, Nassau County, Florida **CLIENT** Hazen & Sawyer
DATE STARTED 3/30/20 **COMPLETED** 3/30/20 **LATITUDE** 30°36'21.35"N **LONGITUDE** 81°35'12.30"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY T.Biscardi **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (6")												
	1	Loose, Light brownish gray fine SAND, trace silt, poorly graded.	SP		2 2 3 2	5								
	2	Loose, Light gray fine SAND, trace silt, poorly graded.	SP		3 3 4 6	7								
5	3	▽ Medium dense, Very dark grayish brown fine SAND, trace silt, poorly graded.	SP		3 4 4 2	8								
	4	Loose, Very dark grayish brown fine SAND, trace silt and organic fines, poorly graded.	SP		1 2 5 6	7								
10	5	Loose, Very dark grayish brown fine SAND, trace silt, poorly graded.	SP		3 3 4 5	7	31	4						
15	6	Very dense, Dark yellowish brown fine SAND with silt, poorly graded.	SP-SM		13 22 20	42								
		Bottom of borehole at 15 feet.												

NOTES Boring backfilled with soil cuttings.

GROUND WATER LEVELS
▽ **AT TIME OF DRILLING** 4 ft 1 in
*▽ **AFTER DRILLING** ---

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Meskel & Associates Engineering

BORING DRI-1

PROJECT NO. 0110-0003G

PROJECT NAME JEA Phase 1B Radio Avenue: Access Road & Future Expansion
PROJECT LOCATION Yulee, Nassau County, Florida **CLIENT** Hazen & Sawyer
DATE STARTED 3/31/20 **COMPLETED** 3/31/20 **LATITUDE** 30°36'15.62"N **LONGITUDE** 81°35'23.39"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Hand Auger
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0.0	1, 2	Dark brown fine SAND, trace silt, poorly graded.	A-3											
2.5	3	Light brownish gray fine SAND, trace silt, poorly graded.	A-3				5	3						
	4	Light gray fine SAND, trace silt, poorly graded.	A-3											
5.0	5	▽ Light brown gray fine SAND, trace silt, poorly graded.	A-3											
	6	Brown fine SAND, trace silt, poorly graded.	A-3											

Bottom of borehole at 6 feet.

NOTES Boring backfilled with soil cuttings.

GROUND WATER LEVELS
▽ **AT TIME OF DRILLING** 4 ft 10 in *▽ **END OF DAY** ---

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BORING DRI-2

PROJECT NO. 0110-0003G

PROJECT NAME JEA Phase 1B Radio Avenue: Access Road & Future Expansion

PROJECT LOCATION Yulee, Nassau County, Florida **CLIENT** Hazen & Sawyer

DATE STARTED 3/31/20 **COMPLETED** 3/31/20 **LATITUDE** 30°36'18.16"N **LONGITUDE** 81°35'17.53"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Hand Auger

LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0.0	1	Topsoil (5")												
	2	Dark brown fine SAND, trace silt, poorly graded.	A-3											
2.5	3	Gray brown fine SAND, trace silt, poorly graded.	A-3											
	4	Very pale brown fine SAND, trace silt, poorly graded.	A-3											
5.0	5	Light brownish gray fine SAND, trace silt, poorly graded.	A-3											
	6	▽ Brown fine SAND, trace silt, poorly graded.	A-3											
		Bottom of borehole at 6 feet.												

NOTES Boring backfilled with soil cuttings.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 5 ft 7 in *▽ **END OF DAY** ---

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Meskel & Associates Engineering

BORING DRI-3

PROJECT NO. 0110-0003G

PROJECT NAME JEA Phase 1B Radio Avenue: Access Road & Future Expansion
PROJECT LOCATION Yulee, Nassau County, Florida **CLIENT** Hazen & Sawyer
DATE STARTED 3/31/20 **COMPLETED** 3/31/20 **LATITUDE** 30°36'20.96"N **LONGITUDE** 81°35'11.41"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Hand Auger
LOGGED BY T.Biscardi **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0.0	1	Gray fine SAND, trace silt, few root fragments, poorly graded.	A-3											
	2	Dark brown fine SAND, trace silt and root fragments, poorly graded.	A-3											
2.5	3	Dark grayish brown fine SAND, trace silt, poorly graded.	A-3											
	4	Gray fine SAND, trace silt, poorly graded.	A-3				24	2						
	5	▽ Grayish brown fine SAND, trace silt, poorly graded.	A-3											
5.0	6	Gray fine SAND, trace silt, poorly graded.	A-3											
		Bottom of borehole at 6 feet.												

NOTES Boring backfilled with soil cuttings.

GROUND WATER LEVELS
▽ **AT TIME OF DRILLING** 4 ft 1 in *▽ **END OF DAY** ---

FIELD EXPLORATION PROCEDURES

Standard Penetration Test (SPT) Borings

The Standard Penetration Test (SPT) boring(s) were performed in general accordance with the latest revision of ASTM D 1586, "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils." The borings were advanced by rotary drilling techniques. A split-barrel sampler was inserted to the borehole bottom and driven 18 to 24 inches into the soil using a 140-pound hammer falling an average of 30 inches per hammer blow. The number of hammer blows for the final 12 inches of penetration (18" sample) or for the sum of the middle 12 inches of penetration (24" sample) is termed the "penetration resistance, blow count, or N-value." This value is an index to several in-situ geotechnical properties of the material tested, such as relative density and Young's Modulus.

After driving the sampler, it was retrieved from the borehole and representative samples of the material within the split-barrel were containerized and sealed. After completing the drilling operations, the samples for each boring were transported to the laboratory where they were examined by a geotechnical engineer to verify the field descriptions and classify the soil, and to select samples for laboratory testing.

Hand Auger Boring

The auger boring(s) were performed manually by the use of a hand-held bucket auger in general accordance with the latest revision of ASTM D 1452, "Standard Practice for Soil Exploration and Sampling by Auger Borings." Representative samples of the soils brought to the ground surface by the auger were placed in sealed containers and transported to our laboratory where they were examined by a geotechnical engineer to verify the field descriptions and classify the soil, and to select samples for laboratory testing.

DRI TEST PROCEDURES

The Double-Ring Infiltrometer test was performed in the field in general accordance with the procedures outlined in the latest revision of ASTM D 3385, “Infiltration Rate of Soils in Field using Double-Ring Infiltrometers.” The test location was initially cleared of all surface vegetation and topsoil, excavated to the desired test depth and then leveled. The outer ring, approximately 24 inches in diameter, was driven to a depth of 6 inches below the test depth. The inner ring, approximately 12 inches in diameter, was inserted inside the outer ring, centered, and driven to a depth of approximately 2 inches below the test depth. A thin layer of gravel was placed on the exposed soils inside the rings at the test level. The two rings were filled simultaneously with 4 inches of water.

This water level maintained throughout the test period, with the required amount of water added to maintain this level in both rings recorded at time intervals of five minutes. After reaching a stabilized inflow volume of water, the test was continued for approximately 120 minutes. To determine the infiltration rate, the volume of water used during the stabilized flow period for the inner ring, the annular space and both rings combined is converted to the depth of water per unit of time (e.g., in inches per hour).

KEY TO BORING LOGS – USCS/AASHTO

Soil Classification

Soil classification of samples obtained at the boring locations is based on the Unified Soil Classification System (USCS) or the American Association of State Highway and Transportation Officials (AASHTO) classification system. Coarse grained soils have more than 50% of their dry weight retained on a #200 sieve. Their principal descriptors are: sand, cobbles and boulders. 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 to 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.

BORING LOG LEGEND

Symbol	Description
N	Standard Penetration Resistance, the number of blows required to advance a standard spoon sampler 12" when driven by a 140-lb hammer dropping 30".
WOR	Split Spoon sampler advanced under the weight of the drill rods
WOH	Split Spoon sampler advanced under the weight of the SPT hammer
50/2”	Indicates 50 hammer blows drove the split spoon 2 inches; 50 Hammer blows for less than 6-inches of split spoon driving is considered “Refusal”.
(SP)	Unified Soil Classification System
-200	Fines content, % Passing No. 200 U.S. Standard Sieve
w	Natural Moisture Content (%)
OC	Organic Content (%)
LL	Liquid Limit
PI	Plasticity Index
NP	Non-Plastic
PP	Pocket Penetrometer in tons per square foot (tsf)

MODIFIERS

SECONDARY CONSTITUENTS (Sand, Silt or Clay)	
Trace	Less than 5%
With	5% to 12%
Sandy, Silty or Clayey	12% to 35%
Very Sandy, Very Silty or Very Clayey	35% to 50%

ORGANIC CONTENT	
Trace	Less than 5%
Organic Soils	5% to 20%
Highly Organic Soils (Muck)	20% to 75%
PEAT	Greater than 75%

MINOR COMPONENTS (Shell, Rock, Debris, Roots, etc.)	
Trace	Less than 5%
Few	5% to 10%
Little	15% to 25%
Some	30% to 45%

RELATIVE DENSITY (Coarse-Grained Soils)

Relative Density	N-Value *
Very Loose	Less than 3
Loose	3 to 8
Medium Dense	8 to 24
Dense	24 to 40
Very Dense	Greater than 40

CONSISTENCY (Fine-Grained Soils)

Consistency	N-Value *
Very Soft	Less than 1
Soft	1 to 3
Firm	3 to 6
Stiff	6 to 12
Very Stiff	12 to 24
Hard	Greater than 24

RELATIVE HARDNESS (Limestone)

Relative Hardness	N-Value *
Soft	Less than 50
Hard	Greater than 50

* Using Automatic Hammer

AASHTO Soil Classification System
(from AASHTO M 145 or ASTM D 3282)

General Classification	***Granular Materials*** *(35% or less passing the 0.075 mm sieve)*							***Silt-Clay Materials*** *(>35% passing the 0.075 mm sieve)*			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5* A-7-6*
Sieve Analysis, % passing:											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40):											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General ***local**** rating as a subgrade	excellent to good			fair to poor							

* Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

** *Northeast Florida*

Unified Soil Classification System (USCS)
(from ASTM D 2487)

Major Divisions			***Group Symbol***	***Typical Names***
Coarse-Grained Soils More than 50% retained on the 0.075 mm (No. 200) sieve	**Gravels** 50% or more of coarse fraction retained on the 4.75 mm (No. 4) sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands 50% or more of coarse fraction passes the 4.75 (No. 4) sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils More than 50% passes the 0.075 mm (No. 200) sieve	**Silts and Clays** Liquid Limit 50% or less		ML	Inorganic silts, very fine sands, rock four, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly/sandy/silty/lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid Limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays or high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils

Prefix: G = Gravel, S = Sand, M = Silt, C = Clay, O = Organic
Suffix: W = Well Graded, P = Poorly Graded, M = Silty, L = Clay, LL < 50%, H = Clay, LL > 50%

Appendix B

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SUMMARY OF LABORATORY TEST RESULTS

PROJECT NO. 0110-0003G

PROJECT NAME JEA Phase 1B Radio Avenue: Access Road & Future Expansion

DATE. 4/9/2020

PROJECT LOCATION Yulee, Nassau County, Florida

CLIENT Hazen & Sawyer

Borehole	Sample No.	Approx. Depth (ft)	%<#200 Sieve	Water Content (%)	Organic Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	USCS/ AASHTO Classification	Comments
B-1	1	1	3	4	---	---	---	---	SP	
B-2	5	9	4	31	---	---	---	---	SP	
DRI-1	3	2.5	3	5	---	---	---	---	A-3	
DRI-3	4	3.5	2	24	---	---	---	---	A-3	

Note: "---" Untested Parameter

LABORATORY TEST PROCEDURES

Percent Fines Content

The percent fines or material passing the No. 200 mesh sieve of the sample tested was determined in general accordance with the latest revision of ASTM D 1140. The percent fines are the soil particles in the silt and clay size range.

Natural Moisture Content

The water content of the tested sample was determined in general accordance with the latest revision of ASTM D 2216. The water content is defined as the ratio of “pore” or “free” water in a given mass of material to the mass of solid material particles.

Appendix C

Double Ring Infiltrometer Test Summary Sheet

ASTM D3385

Project Name: **Radio Ave Access Rd & Future Expansion**

Test Location: **DRI-1**

Test No.: DRI-1

Groundwater Depth: 4 feet 10 inches

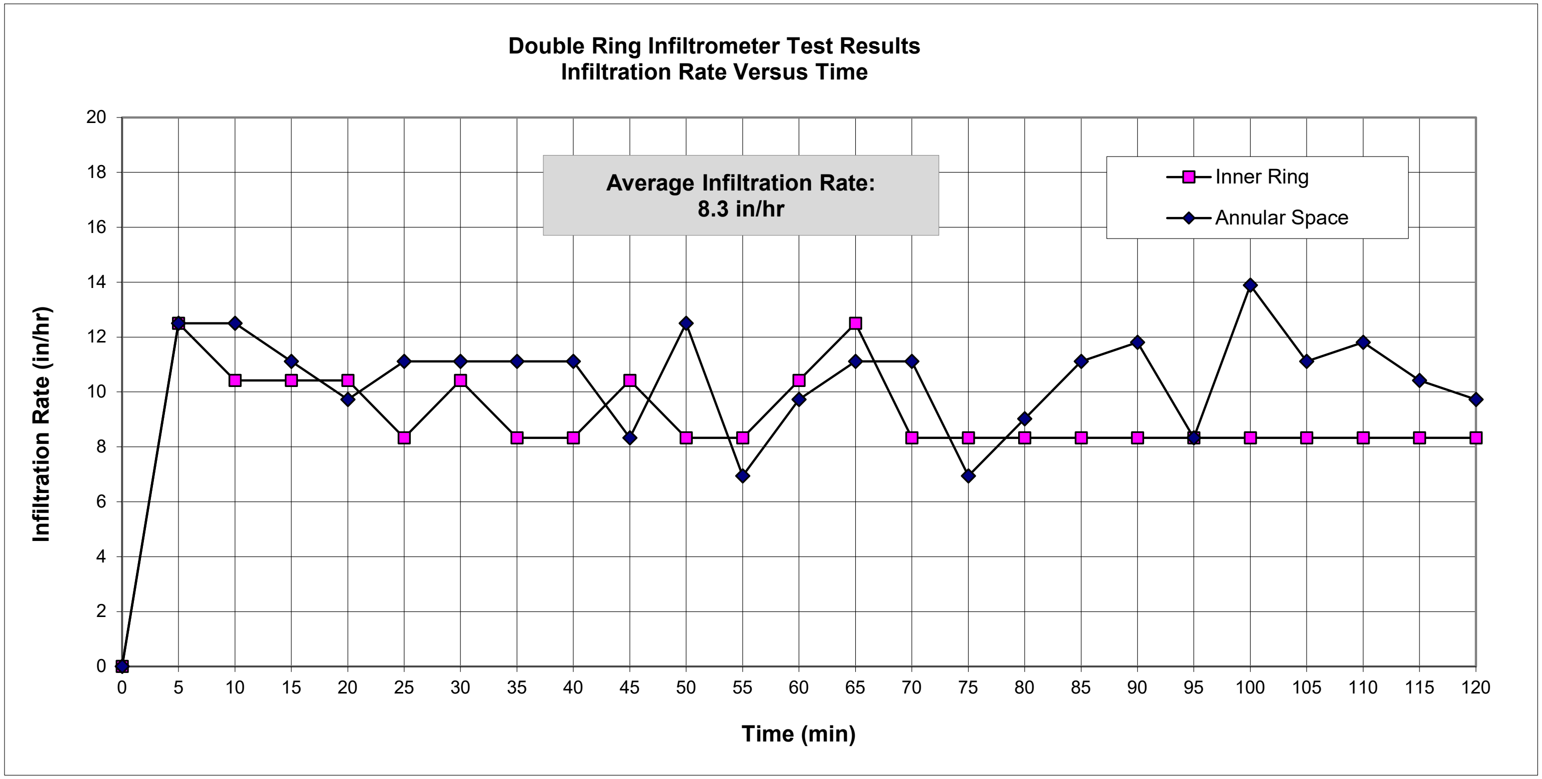
Date Performed: 3/31/2020

Test Depth: 2.0 feet

Performed by: Paul Young

Soil Description: See Boring Logs DRI-1

MAE Project No.: 0110-0003G



Double Ring Infiltrometer Test Summary Sheet

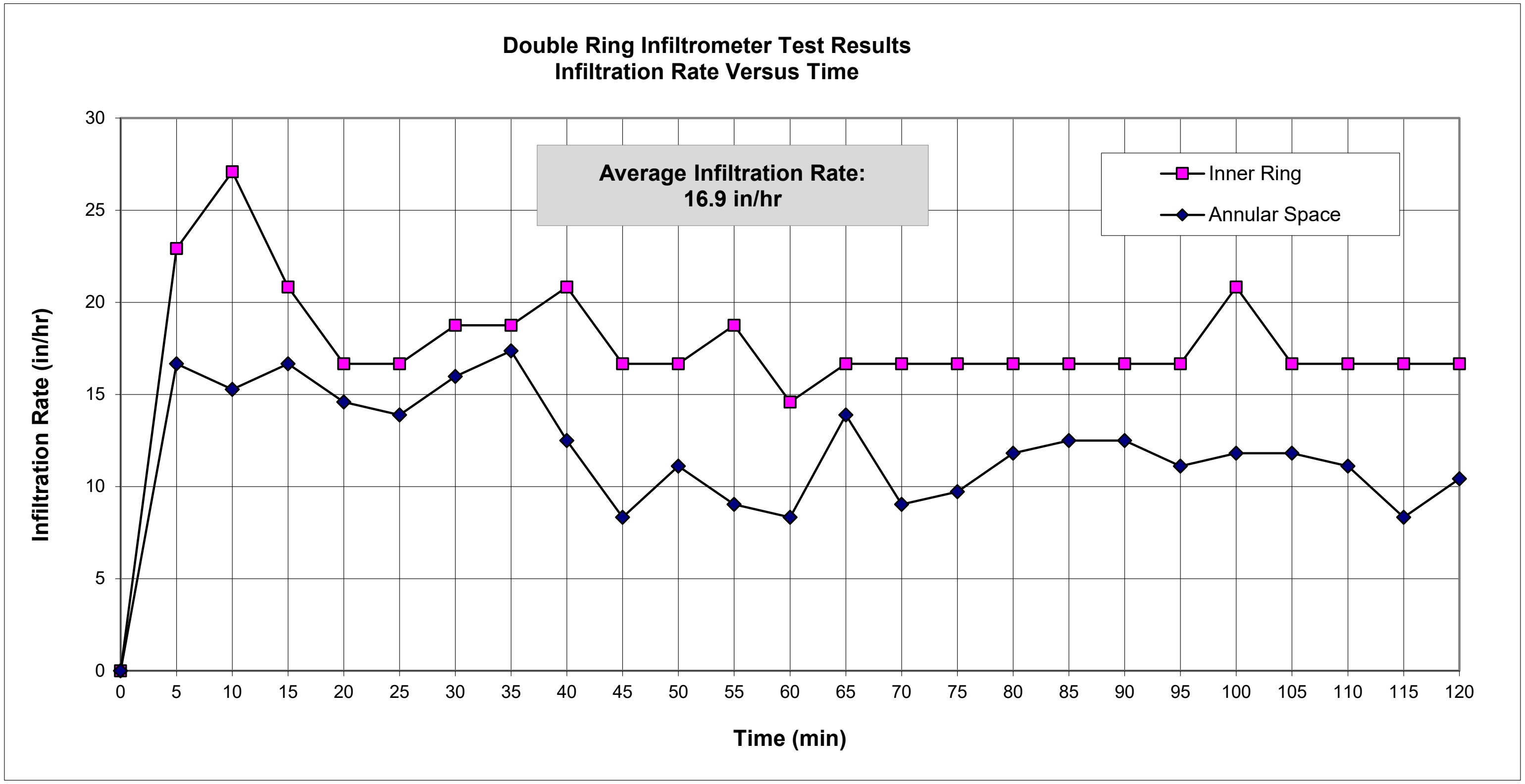
ASTM D3385

Project Name: **Radio Ave Access Rd & Future Expansion**

Test Location: **DRI-2**

Test No.: DRI-2
Date Performed: 3/31/2020
Performed by: Paul Young
MAE Project No.: 0110-0003G

Groundwater Depth: 5 feet 7 inches
Test Depth: 2.0 feet
Soil Description: See Boring Logs DRI-2



Project Name: Radio Ave Access Rd & Future Expansion

Test Location: DRI-3

Test No.: DRI-3
Groundwater Depth: 4 feet 1-inch
Date Performed: 3/30/2020
Test Depth: 2.0 feet
Performed by: Tyler Biscardi and David Hayward
Soil Description: See Boring Logs DRI-3
MAE Project No.: 0110-0003G