Report of Geotechnical Exploration
For

JEA Nocatee Substation

MAE Project No. 0020-0025
July 25, 2024

Prepared for:

cma
chen moore and associates

501 Riverside Avenue, Suite 501
Jacksonville, Florida 32202

Prepared by:

MAE
Meskel & Associates Engineering
Geotechnical Engineering ▾ Materials Testing ▾ CEI Services
Environmental Consulting ▾ Private Provider Services

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Geotechnical Engineering • Materials Testing • CEI Services
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July 25, 2024

Chen Moore & Associates
501 Riverside Avenue, Suite 501
Jacksonville, Florida 32202

Attention: Mr. Thomas Gardner, P.E.

Reference: Report of Geotechnical Exploration
JEA Nocatee Substation
Jacksonville, Florida
MAE Project No. 0020-0025

Dear Mr. Gardner:

Meskel & Associates Engineering, PLLC (MAE) has completed a geotechnical exploration for the subject project. Our work was performed in general accordance with our proposal dated December 4, 2023. The geotechnical exploration was performed to evaluate the general subsurface conditions within the proposed structures, provide recommendations for foundation support and design, and site preparation.

As further discussed in this report, borings encountered surficial layer of topsoil to a depth of about 5 to 8 inches below ground surface, underlain by medium dense to dense fine sand (SP) and fine sand with silt (SP-SM), with few samples containing varying amount of organic material to the boring termination depth of 25 feet below the existing grade. The groundwater level was encountered at each of the boring locations and recorded at the time of drilling at depths varying from 9 feet 4 inches to 10 feet below the existing ground surface.

Based on our field exploration and laboratory testing, it is our opinion that the soil conditions at the site are adaptable for support of the planned substations on a conventional shallow or drilled shaft foundation system, provided the recommendations in this report are followed.

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 Registry No. 28142

Brett H. Harbison, State of Florida, Professional Engineer, License No. 74679. This item has been electronically signed and sealed by Brett H. Harbison, P.E. on 07/25/2024 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.

Digitally signed by Brett Harbison
Date: 2024.07.25 16:11:41 -04'00'

Marlon C. Verceles, E.I.
Staff Engineer

Brett H. Harbison, P.E.
Director, Geotechnical Services
Licensed, Florida No. 74679

Distribution: Thomas Gardner, P.E. – Chen Moore & Associates 1 pdf

TABLE OF CONTENTS

Subject **Page No.**

FIGURES

APPENDICES

1.0 PROJECT INFORMATION

1.1 General

Project information was provided to us by Mr. Thomas Gardner, P.E., with Chen Moore & Associates. We were provided with an aerial showing the layout of the proposed construction. We were also provided with the following project documents for review and reference:

- Design CADD files titled Nocatee 230kV/260kV Substation T2 Electrical Plan and Online Diagram dated February 27, 2024.

1.2 Project Description

The site for the subject project is located at 14981 Philips Highway approximately 700 feet northwest of Nocatee Parkway in Jacksonville, Florida. The general site location is shown on Figure 1.

Based on the provided information and our discussions with Mr. Gardner, it is our understanding that the project includes the construction of transformer flat slabs and shallow low voltage supports. We understand the structures may be constructed on conventional shallow foundations or drilled shaft foundations.

If actual project information varies from these conditions, then the recommendations in this report may need to be re-evaluated. Any changes in these conditions should be provided so 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 May 18, 2024. Boring locations were provided by Chen Moore & Associates, Inc. Prior to starting our field exploration, a utility locate request was submitted to the Sunshine 811 Call Center. A private utility locator was contracted to locate any utilities not identified through Sunshine 811. Once the site utilities were marked and cleared, our field crew mobilized to the site. GPS coordinates for the final boring locations were obtained in the field at the time of drilling using a Garmin GPSMAP78 hand-held receiver. The boring locations as shown on the *Boring Location Plan* sheet, Figure 2, should be considered approximate based on the method of layout and the equipment used.

2.1 SPT Borings

To explore the subsurface conditions within the area of the proposed structures, we located and performed three Standard Penetration Test (SPT) borings, drilled to depths of approximately 25 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 further testing and classification. A summary of the field procedures is included in Appendix A.

3.0 LABORATORY TESTING

3.1 Soil Classification

Representative soil samples obtained during our field exploration were visually classified by a geotechnical engineer using the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488. A key to the soil classification system is included in Appendix A.

3.2 Index Testing

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, percent passing the US No. 200 Sieve (percent fines), and organic contents of selected soil samples. The results of the laboratory testing are shown in the *Summary of Laboratory Index Test Results* included in Appendix B. Also, these results are shown on the *Generalized Soil Profiles* on Figure 3 and on the *Boring Logs* records at the respective depths from which the tested samples were recovered. A summary of the laboratory test procedures is also 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*, Figure 3. Detailed soil boring logs are included in Appendix A. When reviewing the soil profiles and boring logs, it should be understood that the soil conditions will vary between the boring locations.

In general, borings encountered surficial layer of topsoil to a depth of about 5 to 8 inches below ground surface, underlain by medium dense to dense fine sand (SP) and fine sand with silt (SP-SM), with few samples containing varying amount of organic material to the boring termination depth of 25 feet below the existing grade.

4.2 Groundwater Level

The groundwater level was encountered at each of the boring locations and recorded at the time of drilling at depths varying from 9 feet 4 inches to 10 feet below the existing ground surface. 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 on the *Generalized Soil Profiles* sheet, Figure 3, and on the soil boring logs.

4.3 Review of the USDA Web Soil Survey Map

A review of the USDA Soil Survey Conservation Service (SSCS) Web Soil Survey of Duval County shows that there is 1 predominant soil map unit at the project site as tabulated below. 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)
32	Leon fine sand, 0 to 2 percent slopes	Poorly Graded	A/D	6 to 18

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 factor s 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, we estimate the seasonal high groundwater levels at the site to be as shown on the *Generalized Soil Profiles* sheet, Figures 3.

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 conditions 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 be allowed to review the foundation plans and earthwork specifications to verify that the recommendations in this report have been properly interpreted and implemented.

5.2 Foundation Design Recommendations

Based on the results of our exploration, we consider the subsurface conditions at the site adaptable for support of the proposed substation structures when constructed on a properly designed shallow foundation system. 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 foundation design.

5.2.1 Bearing Pressure

The maximum allowable net soil bearing pressure for use in shallow foundation design should not exceed 2,500 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 foundations should be designed based on the maximum load that could be imposed by all loading conditions.

5.2.2 Foundation Size

We understand that large power transformers and high voltage breaker structures will be supported on either a slab or “mat” shallow foundation, or a grade-supported slab with thickened edges. If monolithically placed thickened edges are used, we recommend a minimum width of 12 inches. Even though the maximum allowable soil bearing pressure may not be achieved, these width recommendations should control the size of the foundations.

5.2.3 Bearing Depth

Monolithically placed thickened edges should bear at a depth of at least 18 inches below the exterior final grades. If a slab or mat foundation is used, then it should bear at a depth of at least 12 inches below exterior final grades to provide confinement to the bearing level soils. It is recommended that stormwater be diverted away from the structures to reduce the potential of erosion of bearing level soils.

5.2.4 Bearing Material

The foundations may bear in either the compacted suitable natural soils or compacted structural fill. The 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 at least one foot below the foundation bearing levels.

5.2.5 Settlement Estimates

Post-construction settlements of the structure will be influenced by several interrelated factors, such as (1) subsurface stratification and strength/compressibility characteristics; (2) footing size, bearing level, applied loads, and resulting bearing pressures beneath the foundations; and (3) site preparation and earthwork construction techniques used by the contractor. Our settlement estimates for the structure are based on the use of site preparation/earthwork construction techniques as recommended in Section 6.0 of this report. Any deviation from these recommendations could result in an increase in the estimated post-construction settlements of the structure.

Due to the sandy nature of the near-surface soils, we expect the majority of settlement to occur in an elastic manner and fairly rapidly during construction. Using the recommended maximum bearing pressure, the supplied/assumed maximum structural loads, and the field and laboratory test data that we have correlated to geotechnical strength and compressibility characteristics of the subsurface soils, we estimate that total settlements of the structure could be on the order of one inch or less.

Differential settlements result from differences in applied bearing pressures and variations in the compressibility characteristics of the subsurface soils. Because of the general uniformity of the subsurface conditions and the recommended site preparation and earthwork construction techniques outlined in Section 6.0, we anticipate that differential settlements of the structure could be on the order of 0.5 inches or less.

5.2.6 Floor Slab

The floor slab can be constructed as a slab-on-ground, provided unsuitable material is removed and replaced with compacted structural fill as outlined in Section 6.0. It is recommended that the floor slab bearing soils be covered with an impervious membrane to reduce moisture entry and floor dampness. A 6-mil thick plastic membrane is commonly used for this purpose. Care should be exercised not to tear large sections of the membrane during placement of reinforcing steel and concrete. In addition, we recommend that a minimum separation of 2 feet be maintained between the finished floor levels and the estimated normal seasonal high groundwater level.

5.3 Soil Parameters

Based on the results of the borings, we consider the subsurface conditions to be favorable for support of the shallow low-voltage bus supports on drilled shaft or augered pier foundations. Soil parameters, which can be used in design of the drilled shaft foundations, were estimated based on the encountered subsurface conditions, and are presented in Appendix C. These parameters are based on empirical correlations between average SPT N-values and various soil properties, and our experience with similar conditions. We assumed that groundwater is at the existing ground surface when developing these parameters. Finally, we recommend that the friction coefficient between the soils encountered in the borings and concrete structures be 0.4.

6.0 SITE PREPARATION 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 structures.

6.1 Removal of Existing Pavement

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 the overlying pavement structure.

The existing pavement within the construction area should be completely removed to the existing subgrade soils. All pavement materials (asphalt and base) should be removed and disposed of off-site.

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. Should groundwater control measures become necessary, dewatering methods should be determined by the contractor. We recommend the groundwater control measures, if necessary, remain in place until compaction of the existing soils is completed. The dewatering method should be maintained until backfilling 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 Compaction

After completing the removal of pavement materials and installing the temporary groundwater control measures (if required), the exposed surface area should be compacted with a vibratory drum roller having a minimum static, at-drum weight, on the order of 5 to 10 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 95 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 site.

Should the bearing level 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, if deemed necessary. Compaction should cease if deemed detrimental to adjacent structures, and MAE should be contacted immediately. It is recommended that the vibratory roller operate in the static mode within a distance of 50 feet from existing structures. Alternatively, a track-mounted bulldozer may also be used.

6.4 Structural Backfill and Fill Soils

Any structural backfill or fill required for site development should be placed in loose lifts not exceeding 8 inches in thickness and compacted by the use of the above-described vibratory drum roller operating 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.

Import structural fill should consist of non-plastic, inorganic, granular soil having less than 12 percent material passing the No. 200 mesh sieve and containing less than 4 percent organic material. The fine sand and slightly silty fine sand, without roots, 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 12 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 soil should exhibit moisture contents within ±2 percent of the modified Proctor optimum moisture content (ASTM D 1557) during compaction. 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 fill soil.

6.5 Foundation Areas

After satisfactory placement and compaction of the required structural fill, the foundation areas may be excavated to the planned bearing levels. The foundation bearing level soils, after compaction, should exhibit densities equivalent to 95 percent of the modified Proctor maximum dry density (ASTM D 1557), to a depth of one foot 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.

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. 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 foundation/pad area or a minimum of two locations within the pad area

8.0 REPORT LIMITATIONS

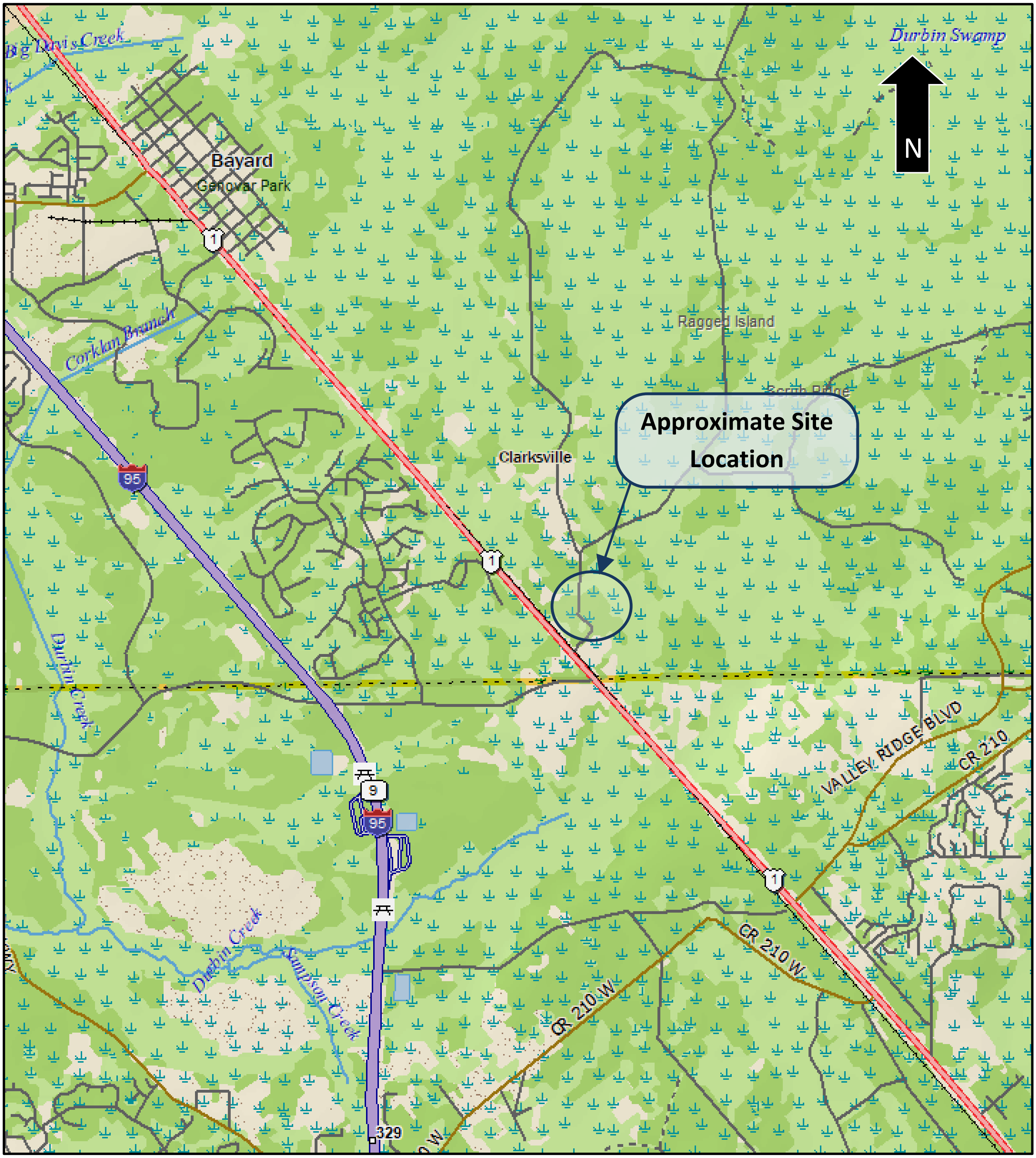
This report has been prepared for the exclusive use of Chen Moore & Associates and their clients for specific application to the design and construction of the *JEA Nocatee Substa*tion project. An electronically signed and sealed version, and a version of our report that is signed and sealed in blue 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, then 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.

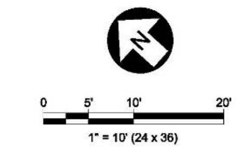
If changes in the design or location of the structures occur, then the conclusions and recommendations contained in this report may need to be modified. We recommend that these changes be provided to us for our consideration. MAE is not responsible for conclusions, interpretations, opinions, or recommendations made by others based on the data contained in this report.

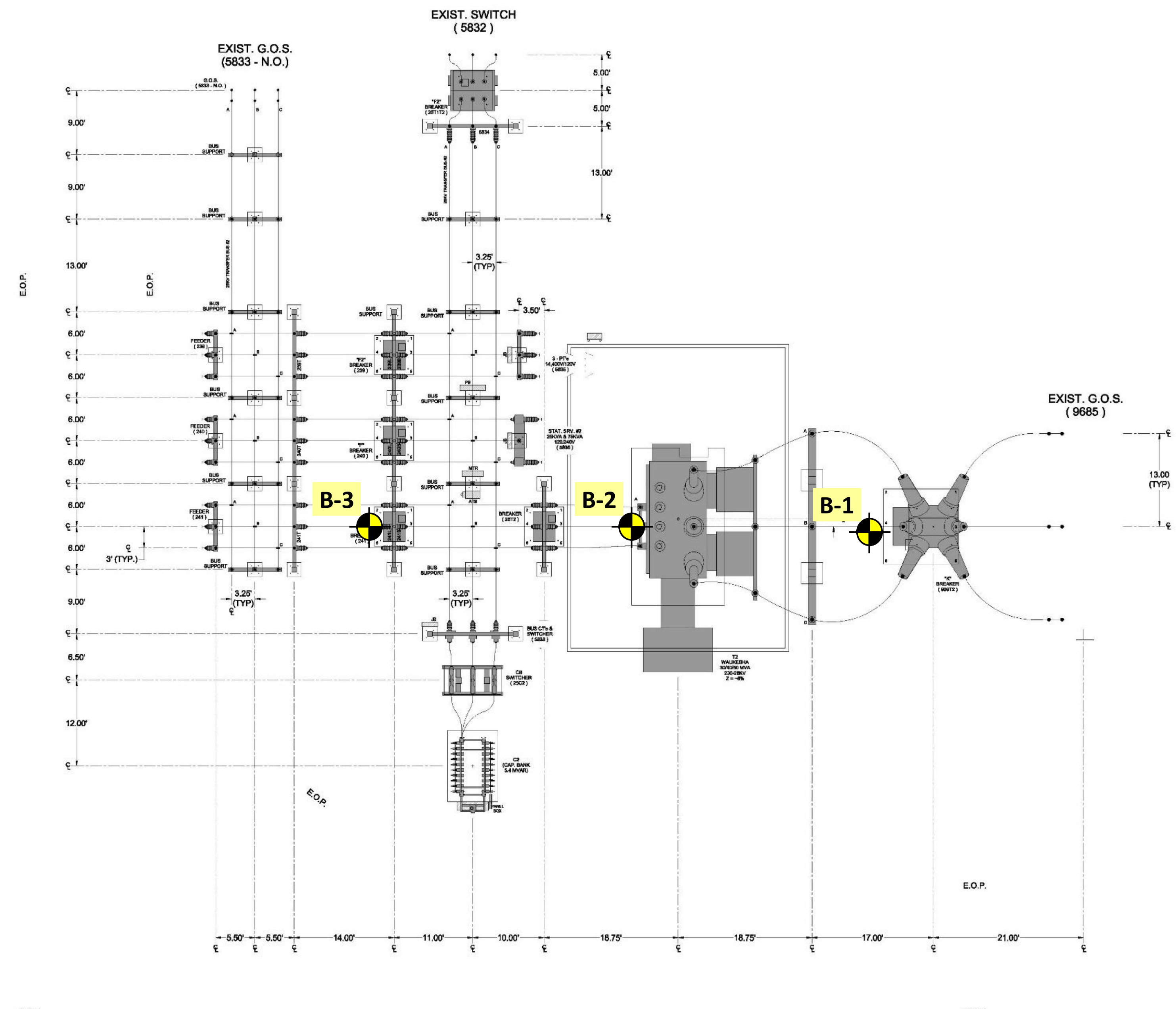
Figures



Site Location Map

PREPARED BY	PROJECT NAME	
Meskel & Associates Engineering	JEA Nocatee Substation Jacksonville, Florida	
	REFERERENCE	SCALE
	Delorme XMap 7.0	NTS
PREPARED FOR	MAE PROJECT NO.	FIGURE NO.
Chen Moore & Associates	0020-0025	1





LEGEND

SPT BORING

NOTES: Grading and Drainage Plan dated 02/27/2024 as provided by Chen Moore & Associates.

Project Manager:	MCV	Project No.	0020-0025
Drawn by:	BC	Scale:	AS SHOWN
Checked by:	MCV	File Name:	0020-0025.BLP
Approved by:	MCV	Date:	7/19/2024

MAE Meskel & Associates Engineering

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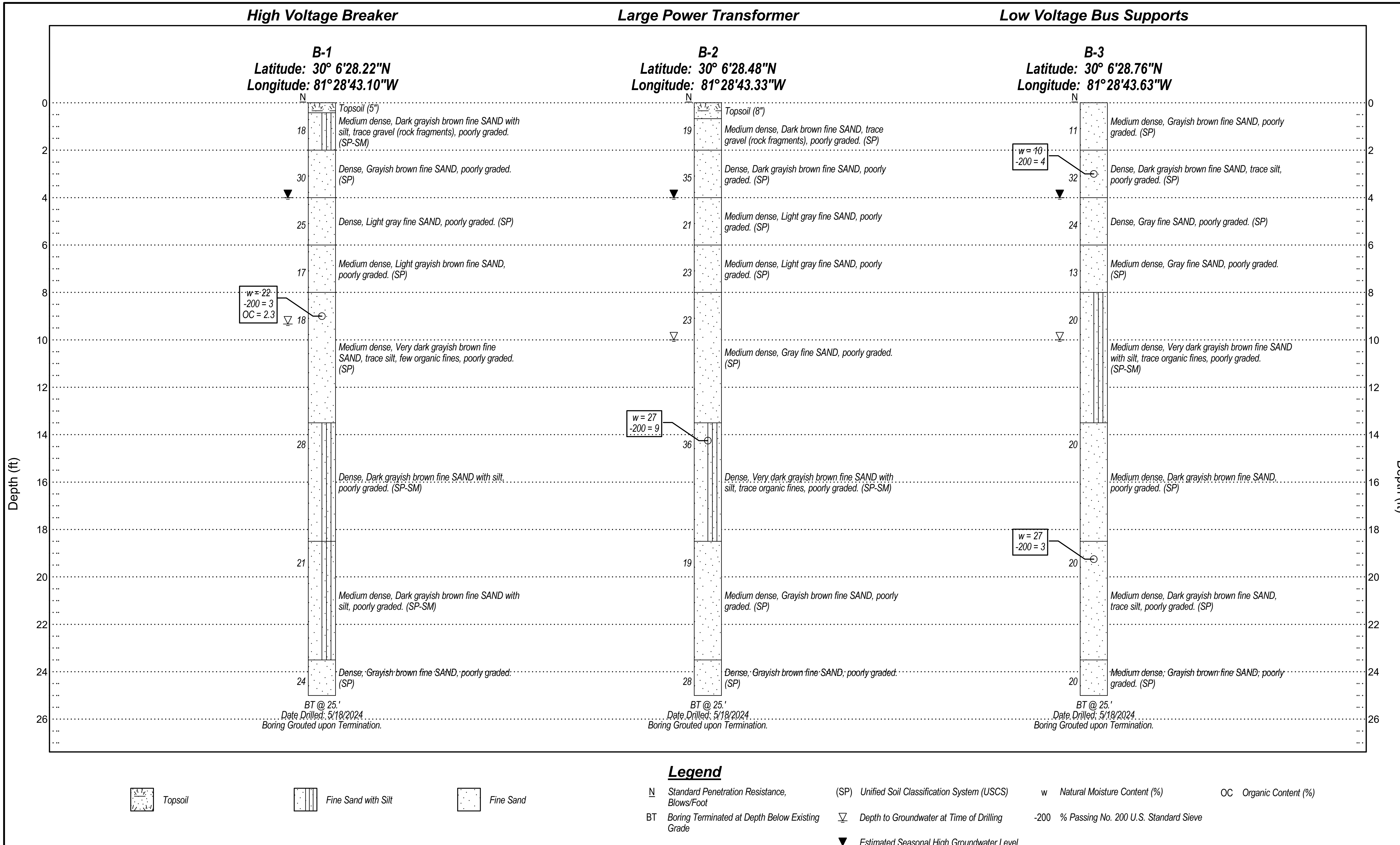
BORING LOCATION PLAN

JEA NOCATEE SUBSTATION
JACKSONVILLE, FLORIDA

FIG NO.

2



REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

BRETT H. HARBISON, P.E. P.E. NO.: 74679

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

Chen Moore & Associates

DATE:	MAE PROJECT NO.
7/19/2024	0020-0025

SHEET TITLE: Generalized Soil Profiles

PROJECT NAME: JEA Nocatee Substation
Jacksonville, Florida

FIGURE NO. 3

Appendix A

Meskel & Associates Engineering, PLLC
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BORING B-1

PROJECT NO. 0020-0025

PROJECT NAME JEA Nocatee Substation

PROJECT LOCATION Jacksonville, Florida **CLIENT** Chen Moore & Associates

DATE STARTED 5/18/2024 **COMPLETED** 5/18/2024 **LATITUDE** 30° 6'28.22"N **LONGITUDE** 81°28'43.10"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Open Hole Bentonite Fluid Rotary Drilling

LOGGED BY D.Hayward **CHECKED BY** M.Verceles **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 (5")												
	1	Medium dense, Dark grayish brown fine SAND with silt, trace gravel (rock fragments), poorly graded.	SP-SM		6 8 10 14	18								
	2	Dense, Grayish brown fine SAND, poorly graded.	SP		12 12 18 26	30								
5	3	Dense, Light gray fine SAND, poorly graded.	SP		15 13 12 13	25								
	4	Medium dense, Light grayish brown fine SAND, poorly graded.	SP		11 8 9 10	17								
10	5	Medium dense, Very dark grayish brown fine SAND, trace silt, few organic fines, poorly graded.	SP		10 9 9 7	18	22	3	2.3					
15	6	Dense, Dark grayish brown fine SAND with silt, poorly graded.	SP-SM		13 12 16	28								
20	7	Medium dense, Dark grayish brown fine SAND with silt, poorly graded.	SP-SM		6 8 13	21								
25	8	Dense, Grayish brown fine SAND, poorly graded.	SP		8 10 14	24								

Bottom of borehole at 25 feet.

NOTES Boring Grouted upon Termination.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 9 ft 4 in

▼ **ESHGWT** 4.00 ft

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Meskel & Associates Engineering

BORING B-2

PROJECT NO. 0020-0025

PROJECT NAME JEA Nocatee Substation
PROJECT LOCATION Jacksonville, Florida **CLIENT** Chen Moore & Associates
DATE STARTED 5/18/2024 **COMPLETED** 5/18/2024 **LATITUDE** 30° 6'28.48"N **LONGITUDE** 81°28'43.33"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Open Hole Bentonite Fluid Rotary Drilling
LOGGED BY D.Hayward **CHECKED BY** M.Verceles **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	1	Topsoil (8")			4 7 12 16	19								
		Medium dense, Dark brown fine SAND, trace gravel (rock fragments), poorly graded.	SP											
	2	Dense, Dark grayish brown fine SAND, poorly graded.	SP		9 13 22 16	35								
5	3	Medium dense, Light gray fine SAND, poorly graded.	SP		16 11 10 12	21								
	4	Medium dense, Light gray fine SAND, poorly graded.	SP		10 12 11 11	23								
10	5	Medium dense, Gray fine SAND, poorly graded.	SP		15 10 13 17	23								
15	6	Dense, Very dark grayish brown fine SAND with silt, trace organic fines, poorly graded.	SP-SM		18 22 14	36	27	9						
20	7	Medium dense, Grayish brown fine SAND, poorly graded.	SP		6 10 9	19								
25	8	Dense, Grayish brown fine SAND, poorly graded.	SP		7 12 16	28								

Bottom of borehole at 25 feet.

NOTES Boring Grouted upon Termination.

GROUND WATER LEVELS
∇ **AT TIME OF DRILLING** 10 ft 0 in
▼ **ESHGWT** 4.00 ft

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Meskel & Associates Engineering

BORING B-3

PROJECT NO. 0020-0025

PROJECT NAME JEA Nocatee Substation

PROJECT LOCATION Jacksonville, Florida **CLIENT** Chen Moore & Associates

DATE STARTED 5/18/2024 **COMPLETED** 5/18/2024 **LATITUDE** 30° 6'28.76"N **LONGITUDE** 81°28'43.63"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Open Hole Bentonite Fluid Rotary Drilling

LOGGED BY D.Hayward **CHECKED BY** M.Verceles **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	1	Medium dense, Grayish brown fine SAND, poorly graded.	SP		4 5 6 8	11								
	2	Dense, Dark grayish brown fine SAND, trace silt, poorly graded.	SP		14 13 19 22	32	10	4						
5	3	Dense, Gray fine SAND, poorly graded.	SP		13 11 13 12	24								
	4	Medium dense, Gray fine SAND, poorly graded.	SP		6 6 7 7	13								
10	5	Medium dense, Very dark grayish brown fine SAND with silt, trace organic fines, poorly graded.	SP-SM		6 10 10 13	20								
15	6	Medium dense, Dark grayish brown fine SAND, poorly graded.	SP		7 10 10	20								
20	7	Medium dense, Dark grayish brown fine SAND, trace silt, poorly graded.	SP		6 9 11	20	27	3						
25	8	Medium dense, Grayish brown fine SAND, poorly graded.	SP		10 8 12	20								

Bottom of borehole at 25 feet.

NOTES Boring Grouted upon Termination.

GROUND WATER LEVELS

∇ **AT TIME OF DRILLING** 10 ft 0 in

▼ **ESHGWT** 4.00 ft

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." The relative density descriptions have been modified from ASTM D-1586 due to recommendations from FDOT Based on an auto hammer efficiency study. Values have been adjusted by a factor of 1.24. 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.

Once the boring is complete and the groundwater level is measured, the borehole is backfilled with soil, or it is backfilled from bottom to top with a lean cementitious grout.

KEY TO BORING LOGS – USCS

Soil Classification

Soil classification of samples obtained at the boring locations is based on the Unified Soil Classification System (USCS). 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	2% or less
Few	3% to 5%
Little	5% to 10%
With	Greater than 10%

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

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

Summary of Laboratory Index Test Results
JEA Nocatee Substation
Jacksonville, Florida
MAE Project No.:0020-0025

Boring No.	Sample No.	Approximate Depth (ft) [1]	Moisture Content (%)	Percent Passing #200 (%)	Liquid Limit	Plasticity Index	Organic Content (%)	USCS [2] Classification
B-1	5	8 to 10	22	3	---	---	2.3	SP
B-2	6	13.5 to 15	27	9	---	---	---	SP-SM
B-3	2	2 To 4	10	4	---	---	---	SP
B-3	8	18.5 to 20	27	3	---	---	---	SP

(1) Feet below existing ground surface.

(2) Unified Soil Classification System.

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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.

Organic Loss on Ignition (Percent Organics)

The organic loss on ignition or percent organic material in the sample tested was determined in general accordance with ASTM D 2974. The percent organics is the material, expressed as a percentage, which is burned off in a muffle furnace at 455±10 degrees Celsius.

Appendix C

Soil Design Parameters
JEA Nocatee Substation
Jacksonville, Florida
MAE Project No.: 0020-0025

Boring: B-1

Soil Type	Approximate Depth (ft)		Average N-Value	Effective Unit Weight, γ (pcf) [2]	Friction Angle, ϕ (Degrees)	Cohesion, c (psf)	Modulus of Lateral Subgrade Reaction, K (pci)	Recommended Earth Pressure Coefficients		
	From	To						At Rest (K_o) [3]	Active (K_a) [4]	Passive (K_p) [5]
SP-SM	0	2	18	63	33	0	67	0.46	0.30	3.32
SP	2	6	28	63	35	0	107	0.43	0.27	3.69
SP	6	13.5	18	63	33	0	67	0.46	0.30	3.32
SP	13.5	18.5	28	63	35	0	107	0.43	0.27	3.69
SP, SP-SM	18.5	25	23	63	34	0	86	0.44	0.29	3.51

Boring: B-2

Soil Type	Approximate Depth (ft)		Average N-Value	Effective Unit Weight, γ (pcf) [2]	Friction Angle, ϕ (Degrees)	Cohesion, c (psf)	Modulus of Lateral Subgrade Reaction, K (pci)	Recommended Earth Pressure Coefficients		
	From	To						At Rest (K_o) [3]	Active (K_a) [4]	Passive (K_p) [5]
SP	0	2	19	63	33	0	71	0.46	0.30	3.36
SP	2	4	35	63	37	0	137	0.40	0.25	3.99
SP	4	13.5	22	63	34	0	82	0.45	0.29	3.46
SP-SM	13.5	18.5	36	63	37	0	141	0.40	0.25	4.02
SP	18.5	23.5	19	63	33	0	71	0.46	0.30	3.36
SP	23.5	25	28	63	35	0	107	0.43	0.27	3.69

Soil Design Parameters
JEA Nocatee Substation
Jacksonville, Florida
MAE Project No.: 0020-0025

Boring: B-3										
Soil Type	Approximate Depth (ft)		Average N-Value	Effective Unit Weight, γ (pcf) [2]	Friction Angle, ϕ (Degrees)	Cohesion, c (psf)	Modulus of Lateral Subgrade Reaction, K (pci)	Recommended Earth Pressure Coefficients		
	From	To						At Rest (K_o) [3]	Active (K_a) [4]	Passive (K_p) [5]
SP	0	2	11	55	31	0	41	0.49	0.32	3.10
SP	2	4	32	63	36	0	124	0.41	0.26	3.85
SP	4	8	18	63	33	0	67	0.46	0.30	3.32
SP, SP-SM	8	25	20	63	33	0	74	0.46	0.29	3.39

Notes:

1. Elevations approximated from Google Earth.
2. In accordance with the FDOT *Soils and Foundation Handbook* , the groundwater level was assumed at the ground surface for design purposes.
3. $K_o = 1 - \sin(\phi)$
4. $K_a = \tan^2 (45 - \phi / 2)$
5. $K_p = \tan^2 (45 + \phi / 2)$