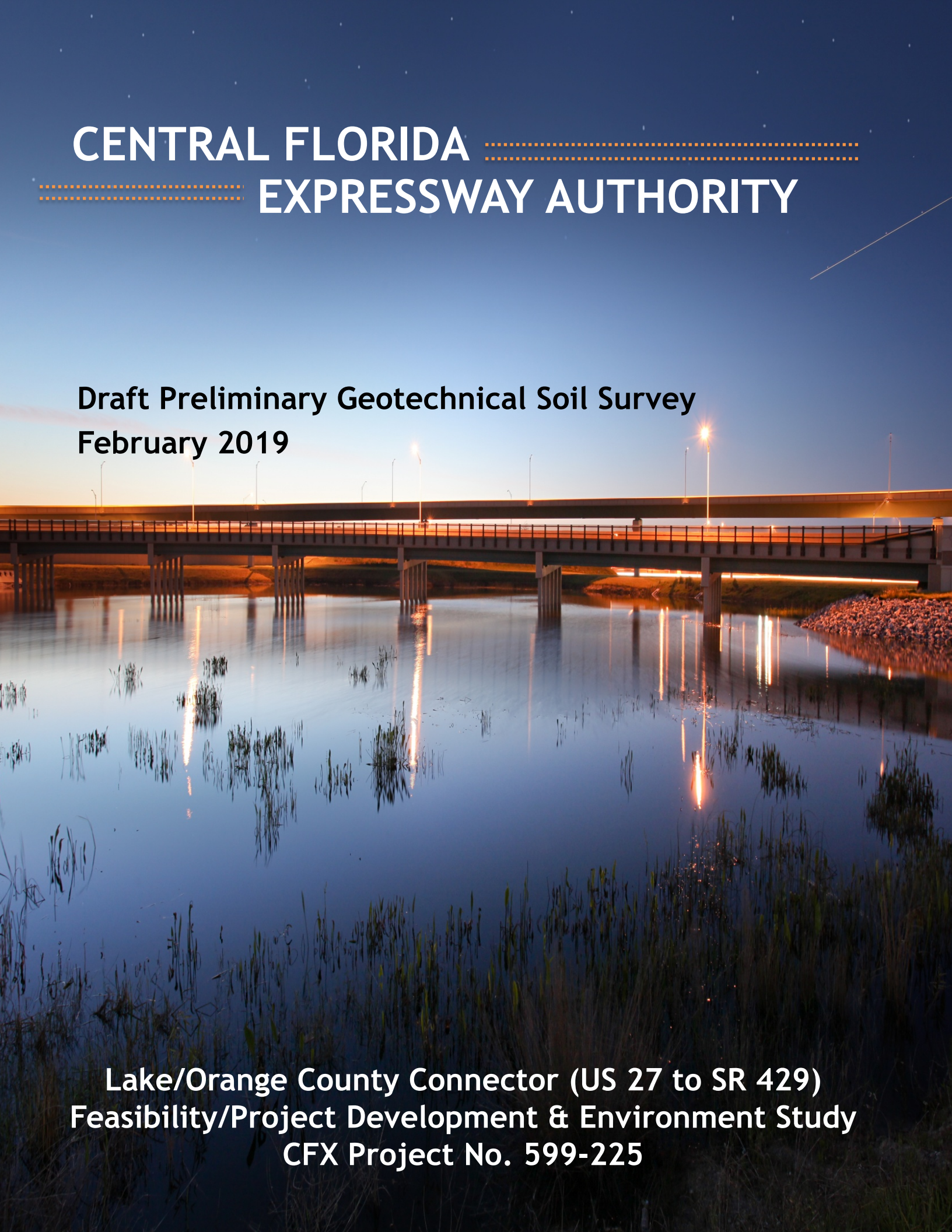
CENTRAL FLORIDA EXPRESSWAY AUTHORITY



Draft Preliminary Geotechnical Soil Survey
February 2019

Lake/Orange County Connector (US 27 to SR 429)
Feasibility/Project Development & Environment Study
CFX Project No. 599-225

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1.0 Introduction

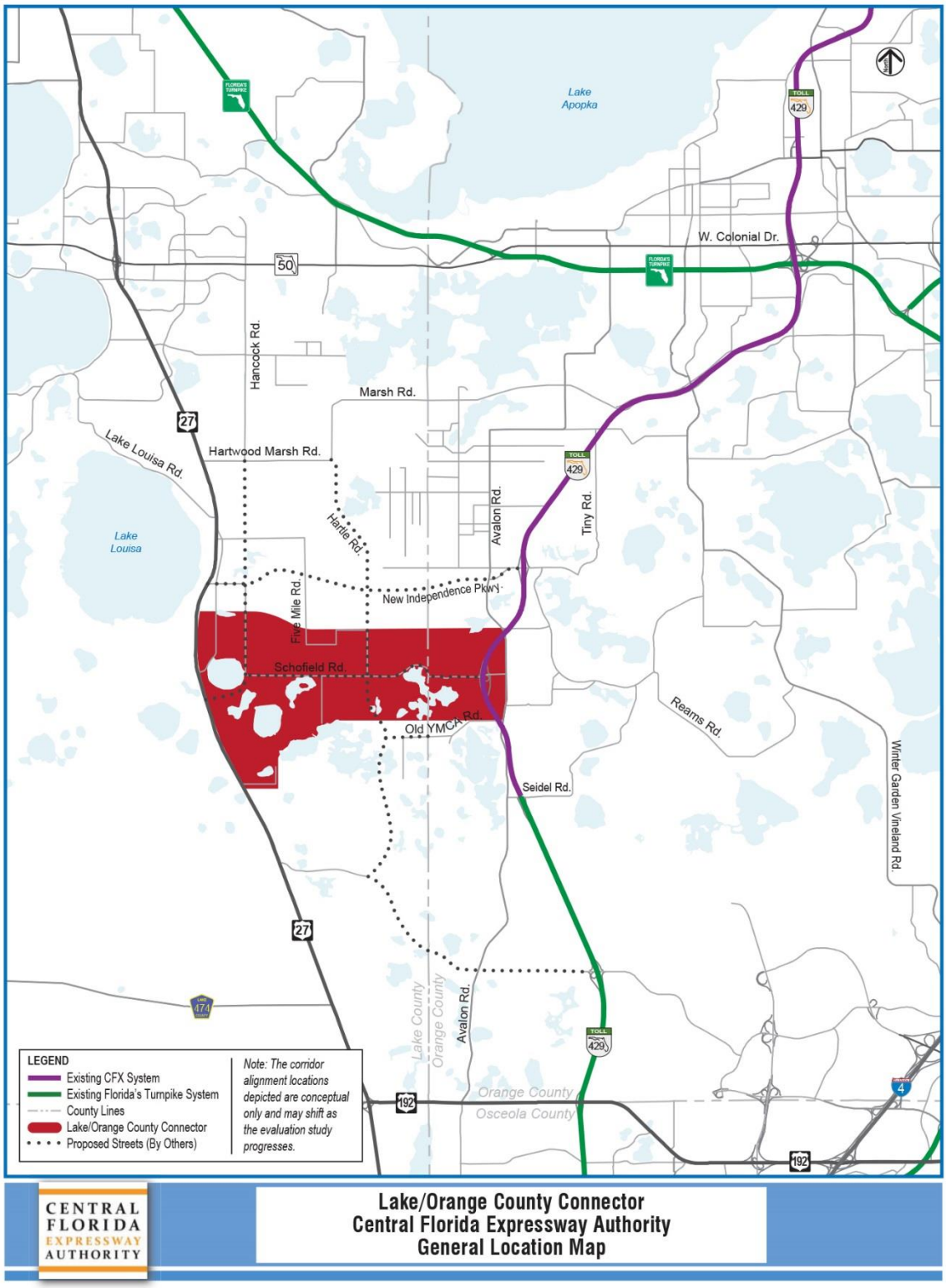
1.1 Project Information

The proposed Lake/Orange County Connector is a strategic transportation investment aimed at supporting existing and future growth in south Lake and west Orange counties. It has been identified as a system expansion project need in the last four consecutive Central Florida Expressway Authority (CFX) master plans, the most current being the 2040 CFX Master Plan. The Orlando-Orange County Expressway Authority (OOCEA), now CFX, completed the 2007 SR 429 to US 27 Connector Concept Development and Evaluation Study which developed various viable corridors/alternatives and identified an unmet need for an east-west connection between US 27 and SR 429. This study will confirm the feasibility of the connector and will conduct a Project Development and Environment (PD&E) Study on defined alignments. **Figure 1-1** illustrates the location of the project.

1.2 Project Description/Background

The purpose of the Lake/Orange County Connector PD&E Study is to develop a proposed improvement strategy that is technically sound, environmentally sensitive and publicly acceptable. As with every PD&E Study, emphasis has been placed on the development, evaluation and documentation of detailed engineering and environmental studies including data collection, conceptual design, environmental analyses, project documentation and the preparation of a Preliminary Engineering Report (PER).

Figure 1-1 | Project Location Map



2.0 Scope of Services

The purpose of the geotechnical portion of the PD&E study is to obtain information on the existing subsurface conditions along the project alignment to assist in the evaluation of project alternatives. The following services were provided to achieve the preceding objective:

- Reviewed published soils information. This published information was obtained from the Soil Survey of Lake and Orange Counties, Florida published by the United States Department of Agriculture (USDA) – Natural Resources Conservation Service (NRCS).
- Conducted a visual reconnaissance of the project site and coordinated utility clearance at the proposed boring locations.
- Performed a geotechnical field study to evaluate the existing subsurface conditions along the roadway alignment consisting of borings, subsurface sampling and field-testing. We performed twenty (20) Standard Penetration Test (SPT) borings to depths of approximately 20 feet below the existing ground surface along the proposed roadway alignment.
- Visually classified and stratified the recovered soil samples in the laboratory. Performed laboratory tests on selected representative samples to develop the soil legend for the project in accordance with the American Association of State Highway and Transportation Officials (AASHTO) Soil Classification System.
- Prepared this Preliminary Soil Survey Study for the project.

3.0 Subsurface Conditions

3.1 Lake County Soil Survey

Based on a review of the Lake County Soil Survey published by USDA NRCS, it appears that there are thirteen (13) soil-mapping units noted within the project limits. The USDA Soil Survey map is shown on **Figure 2** in the **Appendix**. The general soil descriptions are presented in the sub-sections below, as described in the Soil Survey.

3.1.1 Apopka sand, 0 to 5 percent slopes (Unit 5)

The Apopka component makes up 80 percent of the map unit. Slopes are 0 to 5 percent. This component is on ridges on marine terraces on coastal plains. The parent material consists of eolian deposits and/or sandy and loamy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This soil does not meet hydric criteria.

3.1.2 Candler sand, 0 to 5 percent slopes (Unit 8)

The Candler component makes up 75 percent of the map unit. Slopes are 0 to 5 percent. This component is on ridges on marine terraces on coastal plains. The parent material consists of eolian or sandy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This soil does not meet hydric criteria.

3.1.3 Candler sand, 5 to 12 percent slopes (Unit 9)

The Candler component makes up 85 percent of the map unit. Slopes are 5 to 12 percent. This component is on ridges on marine terraces on coastal plains. The parent material consists of eolian or sandy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This soil does not meet hydric criteria.

3.1.4 Candler sand, 12 to 40 percent slopes (Unit 10)

The Candler component makes up 90 percent of the map unit. Slopes are 12 to 40 percent. This component is on ridges on marine terraces on coastal plains. The parent material consists of eolian or sandy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This soil does not meet hydric criteria.

3.1.5 Arents (Unit 17)

The Arents component makes up 100 percent of the map unit. Slopes are 0 to 5 percent. This component is on fills, flats on marine terraces on coastal plains. The parent material consists of altered marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 45 inches during January, February, March, April, May, June, July, August, September, October, November, and December. Organic matter content in the surface horizon is about 0 percent. This soil does not meet hydric criteria.

3.1.6 Immokalee sand (Unit 20)

The Immokalee, non-hydric component makes up 70 percent of the map unit. Slopes are 0 to 2 percent. This component is on flatwoods on marine terraces on coastal plains. The parent material consists of sandy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 12 inches during July, August. Organic matter content in the surface horizon is about 2 percent. This soil does not meet hydric criteria.

The Immokalee, hydric component makes up 20 percent of the map unit. Slopes are 0 to 2 percent. This component is on coastal plains, flats on marine terraces. The parent material consists of sandy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 3 inches during June, July, August, and September. Organic matter content in the surface horizon is about 2 percent. This soil meets hydric criteria.

3.1.7 Myakka sand (Unit 28)

The Myakka, non-hydric component makes up 60 percent of the map unit. Slopes are 0 to 2 percent. This component is on flatwoods on marine terraces on coastal plains. The parent material consists of sandy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 12 inches during June, July, August, and September. Organic matter content in the surface horizon is about 4 percent. This soil does not meet hydric criteria.

The Myakka, hydric component makes up 20 percent of the map unit. Slopes are 0 to 2 percent. This component is on flats on marine terraces on coastal plains. The parent material consists of sandy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 3 inches during June, July, August, and September. Organic matter content in the surface horizon is about 4 percent. This soil meets hydric criteria.

3.1.8 Oklawaha muck (Unit 32)

The Oklawaha, frequently flooded component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. This component is on depressions on marine terraces on coastal plains. The parent material consists of herbaceous organic material over loamy and clayey marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, July, August, September, October, November, and December. Organic matter content in the surface horizon is about 88 percent. This soil meets hydric criteria.

3.1.9 Ona fine sand (Unit 33)

The Ona, non-hydric component makes up 70 percent of the map unit. Slopes are 0 to 2 percent. This component is on flatwoods on marine terraces on coastal plains. The parent material consists of sandy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 12 inches during March, April, May, June, July, August, September, and October. Organic matter content in the surface horizon is about 3 percent. This soil does not meet hydric criteria.

The Ona, hydric component makes up 20 percent of the map unit. Slopes are 0 to 2 percent. This component is on flats on marine terraces on coastal plains. The parent material consists of sandy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 3 inches during June, July, August, and September. Organic matter content in the surface horizon is about 3 percent. This soil meets hydric criteria.

3.1.10 Placid and Myakka sands, depressional (Unit 40)

The Placid component makes up 55 percent of the map unit. Slopes are 0 to 2 percent. This component is on depressions on marine terraces on coastal plains. The parent material consists of sandy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, July, August, September, October, November, and December. Organic matter content in the surface horizon is about 6 percent. This soil meets hydric criteria.

The Myakka component makes up 35 percent of the map unit. Slopes are 0 to 2 percent. This component is on depressions on marine terraces on coastal plains. The parent material consists of sandy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at 0

inches during January, February, March, April, May, June, July, August, September, October, November, and December. Organic matter content in the surface horizon is about 4 percent. This soil meets hydric criteria.

3.1.11 Pomello sand, 0 to 5 percent slopes (Unit 41)

The Pomello component makes up 85 percent of the map unit. Slopes are 0 to 5 percent. This component is on ridges on marine terraces on coastal plains. The parent material consists of sandy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 33 inches during June, July, August, and September. Organic matter content in the surface horizon is about 1 percent. This soil does not meet hydric criteria.

3.1.12 Swamp (Unit 44)

Generated brief soil descriptions are created for major soil components. The Swamp is a miscellaneous area.

3.1.13 Tavares sand, 0 to 5 percent slopes (Unit 45)

The Tavares component makes up 90 percent of the map unit. Slopes are 0 to 5 percent. This component is on ridges on marine terraces on coastal plains. The parent material consists of eolian or sandy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is very high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 51 inches during April, May, June, July, August, September, and October. Organic matter content in the surface horizon is about 1 percent. This soil does not meet hydric criteria.

3.2 Orange County Soil Survey

Based on a review of the Orange County Soil Survey published by USDA NRCS, it appears that there are four (4) soil-mapping units noted within the project limits. The USDA Soil Survey map is shown on **Figure 2** in the **Appendix**. The general soil descriptions are presented in the sub-sections below, as described in the Soil Survey.

3.2.1 Basinger fine sand, depressional (Unit 3)

The Basinger component makes up 89 percent of the map unit. Slopes are 0 to 2 percent. This component is on depressions on marine terraces on coastal plains. The parent material consists of sandy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, July, August, September, October, November, and December. Organic matter content in the surface horizon is about 4 percent. This soil meets hydric criteria.

3.2.2 Candler fine sand, 0 to 5 percent slopes (Unit 4)

The Candler component makes up 93 percent of the map unit. Slopes are 0 to 5 percent. This component is on ridges on marine terraces on coastal plains. The parent material consists of eolian deposits and/or sandy and loamy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This soil does not meet hydric criteria.

3.2.3 Candler fine sand, 5 to 12 percent slopes (Unit 5)

The Candler component makes up 94 percent of the map unit. Slopes are 5 to 12 percent. This component is on ridges on marine terraces on coastal plains. The parent material consists of eolian deposits and/or sandy and loamy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This soil does not meet hydric criteria.

3.2.4 Tavares fine sand, 0 to 5 percent slopes (Unit 46)

The Tavares component makes up 86 percent of the map unit. Slopes are 0 to 5 percent. This component is on ridges on marine terraces on coastal plains. The parent material consists of eolian or sandy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 57 inches during June, July, August, September, October, November, and December. Organic matter content in the surface horizon is about 1 percent. This soil does not meet hydric criteria.

3.3 General Soil Properties

Additional information regarding the soils and groundwater conditions for the above soil mapping units were obtained from the Lake and Orange County Soil Surveys published by the USDA NRCS and are presented in **Tables 3-1** through **3-4** as follows:

Table 3-1 | Lake County USDA NRCS Soil Survey Hydrologic Information

Map No.	Soil Name	Hydrologic Soil Group	Depth to High Water Table (ft)	Typical Soil Types (Profile from Ground Surface to depth of approximately 80 inches)
5	Apopka sand, 0 to 5 percent slopes	A	> 6.0	Sand to Sandy Clay Loam
8	Candler sand, 0 to 5 percent slopes	A	> 6.0	Sand
9	Candler sand, 5 to 12 percent slopes	A	> 6.0	Sand
10	Candler sand, 12 to 40 percent slopes	A	> 6.0	Sand
17	Arents	B	2.5 – 5.0	Sandy Clay Loam
20	Immokalee sand	B/D	0.0 – 1.5	Sand
28	Myakka sand	A/D	0.0 – 1.5	Sand
32	Oklawaha muck	D	0.0	Muck to Mucky Peat to Sandy Loam to Sandy Clay
33	Ona fine sand	B/D	0.0 – 1.5	Sand
40	Placid and Myakka sands, depressional	A/D	0.0	Sand
41	Pomello sand, 0 to 5 percent slopes	A	2.0 – 3.5	Sand
44	Swamp	--	0.0	Sand to Muck to Mucky Peat
45	Tavares sand, 0 to 5 percent slopes	A	3.5 – 5.0	Sand

Table 3-2 | Orange County USDA NRCS Soil Survey Hydrologic Information

Map No.	Soil Name	Hydrologic Soil Group	Depth to High Water Table (ft)	Typical Soil Types (Profile from Ground Surface to depth of approximately 80 inches)
3	Basinger fine sand, depressional	D	+2.0 – 1.0	Fine Sand
4	Candler fine sand, 0 to 5 percent slopes	A	> 6.0	Fine Sand
5	Candler fine sand, 5 to 12 percent slopes	A	> 6.0	Fine Sand
46	Tavares fine sand, 0 to 5 percent slopes	A	3.5 – 6.0	Fine Sand

Table 3-3 | Lake County USDA NRCS Soil Survey Information

Map No.	Soil Name	Soil Classification			Permeability (in/hr)
		Depth (in)	USCS	AASHTO	
5	Apopka sand, 0 to 5 percent slopes	0-6	SP, SP-SM	A-3, A-2-4	6.0-20.0
		6-55	SP, SP-SM	A-3, A-2-4	6.0-20.0
		55-80	SM-SC, SC	A-2-4, A-2-6, A-4	0.6-2.0
8	Candler sand, 0 to 5 percent slopes	0-7	SP, SP-SM	A-3	20.0-50.0
		7-67	SP, SP-SM	A-3	20.0-50.0
		67-80	SP-SM	A-3, A-2-4	6.0-20.0
9	Candler sand, 5 to 12 percent slopes	0-6	SP, SP-SM	A-3	20.0-50.0
		6-67	SP, SP-SM	A-3	20.0-50.0
		67-80	SP-SM	A-3, A-2-4	6.0-20.0
10	Candler sand, 12 to 40 percent slopes	0-3	SP, SP-SM	A-3	20.0-50.0
		3-67	SP, SP-SM	A-3	20.0-50.0
		67-80	SP-SM	A-3, A-2-4	6.0-20.0
17	Arents	0-80	SM, SM-SC, SC	A-2-4, A-2-6, A-4, A-6	0.6-2.0
20	Immokalee sand	0-4	SP, SP-SM	A-3	6.0-20.0
		4-38	SP, SP-SM	A-3	6.0-20.0
		38-56	SP-SM, SM	A-3, A-2-4	0.6-2.0
		56-68	SP, SP-SM	A-3	6.0-20.0
28	Myakka sand	0-6	SP, SP-SM	A-3	6.0-20.0
		6-20	SP, SP-SM	A-3	6.0-20.0
		20-36	SP-SM, SM	A-3, A-2-4	0.6-6.0
		36-80	SP, SP-SM	A-3	6.0-20.0

Map No.	Soil Name	Soil Classification			Permeability (in/hr)
		Depth (in)	USCS	AASHTO	
32	Oklawaha muck	0-9	PT	A-8	2.0-6.0
		9-25	PT	A-8	6.0-20.0
		25-31	SM-SC	A-2-4, A-4	0.6-6.0
		31-54	CH	A-7	0.0-0.1
33	Ona fine sand	0-6	SP, SP-SM	A-3, A-2-4	6.0-20.0
		6-20	SP-SM	A-3, A-2-4	2.0-6.0
		20-80	SP-SM	A-3	6.0-20.0
40	Placid and Myakka sands, depressional	0-18	SP, SP-SM	A-3, A-2-4	6.0-20.0
		18-80	SP, SP-SM	A-3, A-2-4	6.0-20.0
		0-6	SP, SP-SM	A-3	6.0-20.0
		6-20	SP, SP-SM	A-3	6.0-20.0
		20-36	SP-SM, SM	A-3, A-2-4	0.6-6.0
		36-80	SP, SP-SM	A-3	6.0-20.0
41	Pomello sand, 0 to 5 percent slopes	0-3	SP, SP-SM	A-3	20.0-50.0
		3-39	SP, SP-SM	A-3	20.0-50.0
		39-57	SP-SM, SM	A-3, A-2-4	2.0-6.0
		57-80	SP, SP-SM	A-3	6.0-20.0
44	Swamp	0-18	SP, SP-SM	A-3, A-2-4	6.0-20.0
		18-80	SP, SP-SM	A-3, A-2-4	6.0-20.0
		0-80	PT	A-8	2.0-6.0
45	Tavares sand, 0 to 5 percent slopes	0-7	SP, SP-SM	A-3	20.0-50.0
		7-80	SP, SP-SM	A-3	20.0-50.0

Table 3-4 | Orange County USDA NRCS Soil Survey Information

Map No.	Soil Name	Soil Classification			Permeability (in/hr)
		Depth (in)	USCS	AASHTO	
3	Basinger fine sand, depressional	0-7	SP	A-3	6.0-20.0
		7-32	SP, SP-SM	A-3, A-2-4	6.0-20.0
		32-47	SP, SP-SM	A-3, A-2-4	6.0-20.0
		47-80	SP, SP-SM	A-3, A-2-4	6.0-20.0
4	Candler fine sand, 0 to 5 percent slopes	0-5	SP, SP-SM	A-3	6.0-20.0
		5-74	SP, SP-SM	A-3	6.0-20.0
		74-80	SP-SM	A-3, A-2-4	6.0-20.0
5	Candler fine sand, 5 to 12 percent slopes	0-4	SP, SP-SM	A-3, A-2-4	6.0-20.0
		4-61	SP, SP-SM	A-3, A-2-4	6.0-20.0
		61-80	SP-SM	A-3, A-2-4	6.0-20.0
46	Tavares fine sand, 0 to 5 percent slopes	0-6	SP, SP-SM	A-3	6.0-20.0
		6-80	SP, SP-SM	A-3	6.0-20.0

3.4 Groundwater Conditions

According to the USDA NRCS Soil Survey, the project corridor consists of poorly to excessively drained soils. The seasonal high groundwater table along the project corridor varies from at or near the ground surface to depths greater than 6 feet.

4.0 Preliminary Subsurface Exploration

4.1 Roadway Borings

To evaluate the subsurface conditions and groundwater table levels along the proposed project limits Standard Penetration Test (SPT) borings were advanced to depths of approximately 20 feet below the existing ground surface along the project corridor. The borings were located in areas along the various corridor alternatives in an attempt to encounter problematic soil conditions.

The borings were performed using a drill rig with bentonite mud drilling procedures. The soil sampling for the borings were performed in general accordance with the American Society for Testing and Materials (ASTM) test designation D-1586. SPT resistance N-values were generally taken continuously to a depth of 10 feet and on intervals of 5 feet thereafter. As each soil type was revealed, representative samples were placed in air-tight containers and returned to our office for confirmation of the field classification by a geotechnical engineer.

The location of the borings performed were determined using the recorded GPS coordinates obtained by Tierra in conjunction with the design files provided by Metric. The locations of these borings should be considered approximate. The soil profile of each boring performed is shown on the **Roadway Soil Profiles** sheet in the **Appendix**.

5.0 Laboratory Testing

5.1 General

Representative soil samples collected from the borings performed along the project corridor were classified and stratified in general accordance with the American Association of State Highway and Transportation Officials (AASHTO) Soil Classification System. Our classification was based on visual observations, using the results from the laboratory testing as confirmation. These tests included grain-size analyses, Atterberg Limits and natural moisture content determination.

5.2 Test Designation

The following list summarizes the laboratory tests performed by Tierra and the respective test methods utilized.

- Grain-Size Analyses - The grain-size analyses were conducted in general accordance with the AASHTO test designation T-088 (ASTM test designation D-422).
- Atterberg Limits - The liquid limit and the plastic limit tests ("Atterberg Limits") were conducted in general accordance with the AASHTO test designations T-089 and T-090, respectively (ASTM test designation D-4318).
- Natural Moisture Content - The moisture content tests were conducted in general accordance with the AASHTO test designation T-265 (ASTM test designation D-2216).

A detailed summary of the laboratory test results performed for this report is presented in **Table 1** of the **Appendix**.

6.0 Results of Subsurface Exploration

6.1 General Soil Conditions

Specific information of each boring performed is provided on the **Roadway Soil Profiles** sheet in the **Appendix**.

The soil types encountered during this exploration have been assigned a stratum number. The stratum number and soil types associated with this project to date are provided below.

Stratum Number	Typical Soil Description	AASHTO Classification
1	Gray to Light Gray, Brown to Light Brown SAND to SAND with Silt	A-3
2	Gray to Gray-Brown Silty SAND	A-2-4
3	Gray Clayey SAND	A-2-6

A geotechnical engineer bases soil stratification on a visual review of the recovered samples, laboratory testing and interpretation of the field boring logs. The boring stratification lines represent the approximate boundaries between soil types of significantly different engineering properties; however, the actual transition may be gradual. In some cases, small variations in properties within the same boring not considered pertinent to our engineering evaluation may have been abbreviated or omitted for clarity. The boring profiles represent the conditions at the particular boring location and variations do occur among the borings.

6.2 Groundwater

The groundwater table was recorded, if encountered, at each of the boring locations during our field exploration. The groundwater table, when apparent, at the boring locations along the project corridor was found to range from depths of approximately 6 inches to 10 feet below the existing ground surface. The groundwater table measured at each of the boring locations is presented on the **Roadway Soil Profiles** sheet in the **Appendix**.

If the groundwater table was not apparent within the borings prior to the commencement of mud-rotary drilling, Groundwater Not Apparent (GNA) is indicated on the soil profiles on the **Roadway Soil Profiles** sheet in the **Appendix**. The introduction of drilling mud prevents an accurate measurement of the groundwater table.

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences (i.e., existing water management canals, swales, drainage ponds, underdrains, and areas of covered soils, such as paved parking lots and sidewalks).

6.3 Seasonal High Groundwater Estimates

The seasonal high groundwater table (SHGWT) levels at the boring locations along the project corridor are estimated to range from at or above the existing ground surface to depths greater than 6 feet below existing grades.

In general, the seasonal high groundwater table levels estimated along the project alignments were based on soil stratigraphy, measured groundwater levels from the borings, the USDA NRCS Soil Survey information for Lake and Orange Counties, Florida, and surrounding topography. In areas where subsurface soil conditions were disturbed, normal indications such as “stain lines” were not evident.

7.0 Preliminary Engineering Evaluations

7.1 General

Based upon the USDA-NRCS Soil Survey for Lake and Orange Counties, sandy soils to depths of 80 inches below the natural ground surface are reported along the majority of the project corridor with intermittent areas of plastic soils. In general, these soils are suitable for supporting proposed roadway embankments after proper subgrade preparation and removal of unsuitable materials. It should be noted that although soil conditions considered detrimental to the proposed roadway alignment were not encountered, further explorations will be required during design. The proposed alignments do traverse wetland areas and, although not encountered during this exploration, deeper organic soil may be encountered.

Areas along the project corridor where clay, organics and/or groundwater conditions may impact the project are detailed below.

7.1.1 Shallow Groundwater

The SHGWT for the soil units is reported to range from at or above the natural grade to depths greater than 6 feet below the within the project limits. The estimated SHGWT at the boring locations ranges from the existing ground surface to depths greater than 6 feet below natural grades.

Roadway base to groundwater clearance will need to be evaluated to ensure minimum separation between the base and the SHGWT is maintained or to determine if additional measures are required (ie, blackbase, underdrains, etc.). In areas where the existing SHGWT is above grade, the SHWGT will have to be established by the project biologist utilizing biological indicators.

7.1.2 Plastic/Clayey Soils

The following soil mapping units noted plastic/clayey soils (A-2-6, A-4, A-6 and A-7) from the natural ground surface to a depth of 80 inches below/from natural grades along intermittent areas of the project limits:

- Apopka Sand, 0 to 5 Percent Slopes (Unit 5) – Lake County
- Arents (Unit 17) – Lake County
- Oklawaha Muck (Unit 32) – Lake County

Plastic soils have limitations related to base clearance and are also poorly drained. Separation between plastic soils and the roadway pavement sections should be in accordance with FDOT Standard Plans requirements. As the project progresses beyond the PD&E stage, additional geotechnical services should be performed to determine the impact these materials will have to the proposed design.

7.1.3 Organic Soils

The following soil mapping units noted organic/muck soils (A-8) from the natural ground surface to depths within 25 to 80 inches of natural grades along intermittent areas of the project limits:

- Oklawaha Muck (Unit 32) – Lake County
- Swamp (Unit 44) – Lake County

Organic/muck (A-8) soil, if encountered during construction, should be removed in accordance with FDOT Standard Plans Index 120-002 and replaced with backfill in accordance with Index 120-001. It should be noted that organic soils were not encountered during our field exploration program within the boring depths of 20 feet. As the project progresses beyond the PD&E phase, deeper borings should be performed to delineate the areas with reported organic soils in order to determine the impact of the organic soils (if encountered) on the proposed design. Additional geotechnical services should be performed during design to identify the vertical and horizontal limits of the encountered organic soils within the project limits.

7.2 Roadway Construction

Site preparation should consist of normal clearing and grubbing followed by compaction of subgrade soils. Subgrade preparation should include the removal of plastic soils, top-soils and organic soils in accordance with FDOT Standard Plans. Backfill embankment materials should consist of materials conforming to FDOT Standard Plans. Clearing and grubbing and compaction should be accomplished in accordance with the latest FDOT Specifications.

The overall site preparation and mechanical densification work for the construction of the proposed new roadway should be in accordance with the FDOT Standard Specifications and Standard Plans requirements. In general, the existing subsurface soils appear capable of supporting the construction of the proposed new roadway subject to the above geotechnical considerations and after proper subgrade preparation.

8.0 Limitations

Our professional services have been performed, our findings obtained and our preliminary evaluations prepared in accordance with generally accepted geotechnical engineering principles and practices at the time of this report. Tierra is not responsible for the conclusions, opinions or recommendations made by others based on this data.

The scope of the geotechnical portion of the PD&E study is to provide information on the existing subsurface conditions along the project alignment based on a review of the Lake and Orange County Soil Surveys published by the USDA-NRCS and limited subsurface exploration to assist in the preparation of the PD&E Report for the project. The preliminary evaluations submitted in this report are based upon the data obtained from the published information and the limited subsurface exploration. Should subsoil variations become evident during the course of this project, a re-evaluation will be necessary after we have had an opportunity to observe the characteristics of the condition encountered. The applicability of the report should also be reviewed in the event significant changes occur in the design, nature or location of the proposed roadway construction.

The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of Metric Engineering, Inc. and the Central Florida Expressway Authority (CFX).

Tierra appreciates the opportunity to be of service to Metric Engineering, Inc. and CFX on this project. If you have any questions or comments regarding this report, please contact our office at your earliest convenience.

Respectfully Submitted,

TIERRA, INC.

Luis A. Almodovar, E.I.
Geotechnical Engineer Intern

Jeremy A. Sewell, P.E.
Senior Geotechnical Engineer
Florida License No. 62951

Appendix

Tables

Table 1 | Summary of Laboratory Test Results for Soil Classification

Figures

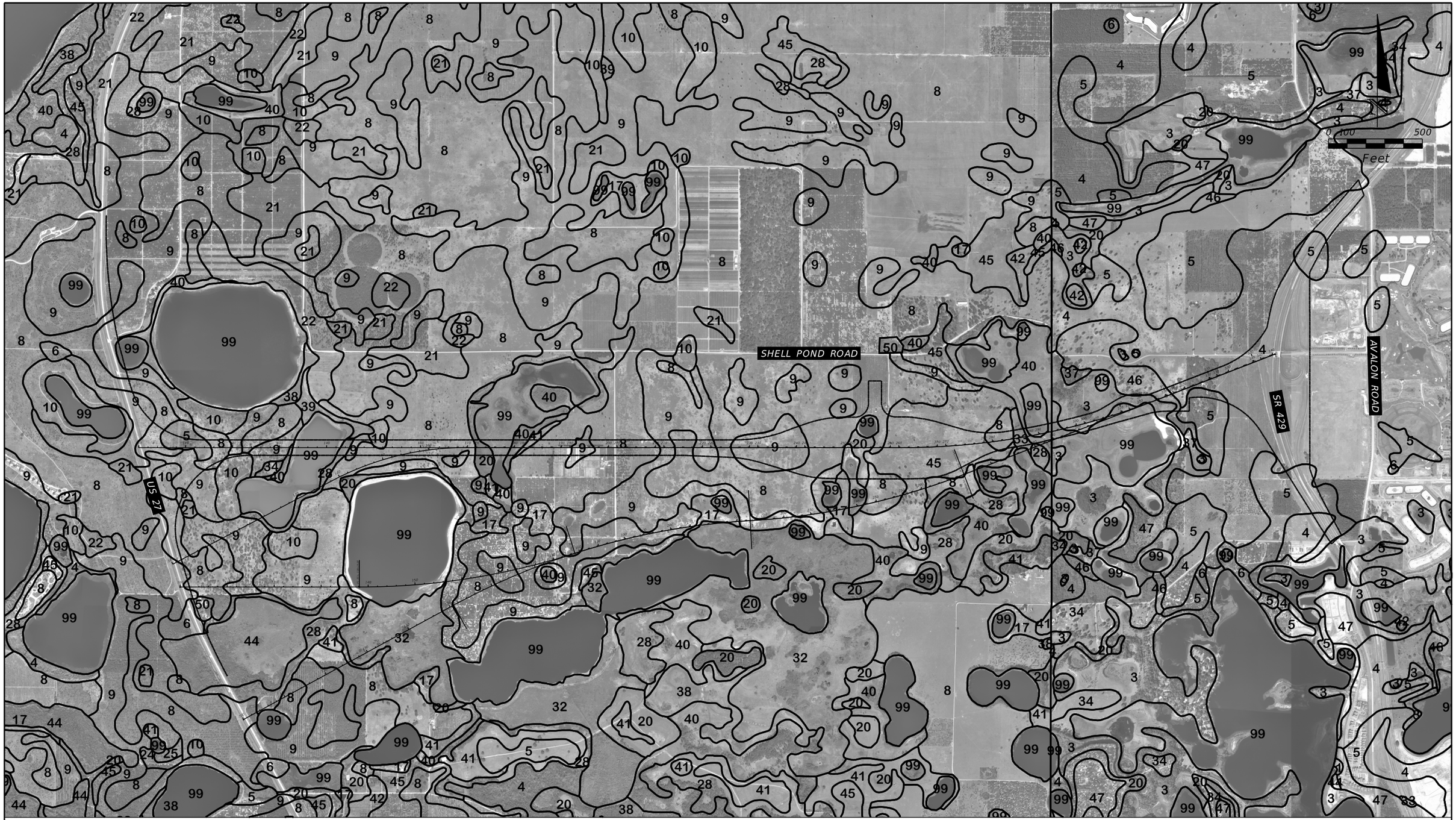
FIGURE 2 - 3 | USDA Soil Survey & USGS Quadrangle Maps

FIGURES 4 - 8 | Roadway Boring Location Plan Sheets

FIGURE 9 | Roadway Soil Profiles Sheet

Table 1
Summary of Laboratory Test Results for Soil Classification
Lake/Orange County Connector Feasibility/PD&E Study
Lake & Orange Counties, Florida
CFX Project No. 599-225
Tierra Project No: 5511-17-043

Boring Number	Sample Depth (ft)	Stratum Number	AASHTO Symbol	Sieve Analysis					Atterberg Limits			Organic Content (%)	Natural Moisture Content (%)
				#10	#40	#60	#100	#200	Liquid Limit	Plastic Limit	Plasticity Index		
B-1	6.0 - 8.0	1	A-3	-	-	-	-	5	-	-	-	-	-
B-3	6.0 - 8.0	1	A-3	100	66	29	4	2	-	-	-	-	-
B-4	2.0 - 4.0	1	A-3	-	-	-	-	1	-	-	-	-	-
B-8	0.0 - 2.0	1	A-3	-	-	-	-	1	-	-	-	-	-
B-10	4.0 - 6.0	1	A-3	-	-	-	-	1	-	-	-	-	-
B-16	13.5 - 15.0	1	A-3	100	84	41	6	1	-	-	-	-	-
B-17	2.0 - 4.0	1	A-3	-	-	-	-	3	-	-	-	-	-
B-18	2.0 - 4.0	1	A-3	-	-	-	-	4	-	-	-	-	-
B-11	13.5 - 15.0	2	A-2-4	100	96	81	36	24	NP	NP	NP	-	22
B-12	13.5 - 15	2	A-2-4	-	-	-	-	19	NP	NP	NP	-	24
B-13	13.5 - 15.0	2	A-2-4	-	-	-	-	17	-	-	-	-	-
B-14	18.5 - 20.0	2	A-2-4	-	-	-	-	21	-	-	-	-	-
B-15	8.0 - 10.0	2	A-2-4	100	99	95	62	26	NP	NP	NP	-	19
B-13	8.0 - 10.0	3	A-2-6	100	89	74	45	32	32	19	13	-	17
B-19	13.5 - 15.0	3	A-2-6	100	84	52	32	30	38	18	20	-	19



REFERENCE: USDA SOIL SURVEY OF LAKE COUNTY, FLORIDA &
USDA SOIL SURVEY OF ORANGE COUNTY, FLORIDA

TOWNSHIP:	23S	23S	24S
RANGE:	26E	27E	26E
SECTION:	33, 34, 35, 36	7	3, 4

FIGURE 2

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

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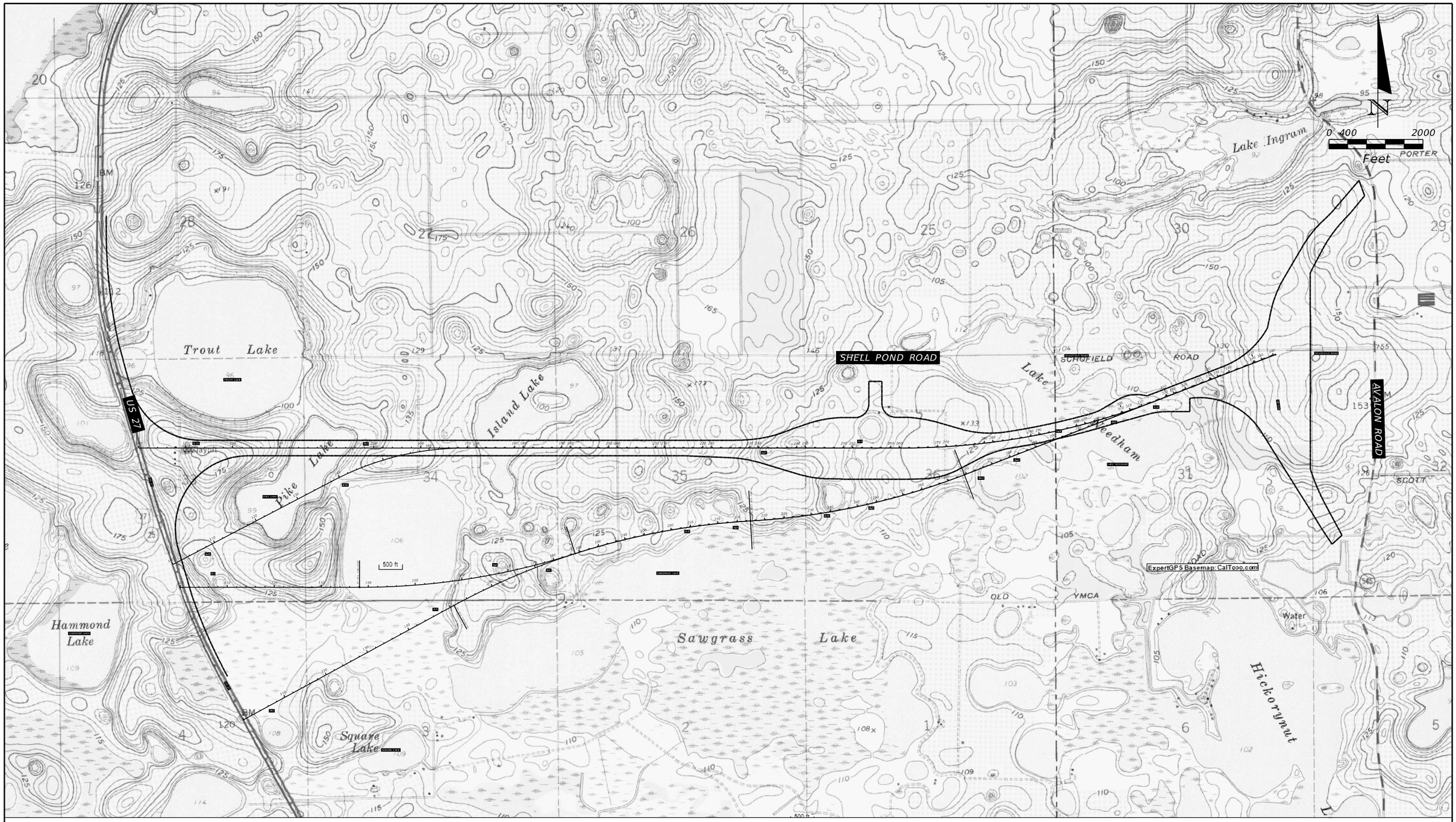
WINTER GARDEN, FLORIDA 34787
CERTIFICATE OF AUTHORIZATION NO. 6486

CENTRAL FLORIDA EXPRESSWAY AUTHORITY

ROAD NO.	COUNTY	CFX PROJECT NO.
	LAKE ORANGE	599-225

USDA SOIL SURVEY

SHEET NO.



REFERENCE: USGS QUADRANGLE MAP OF "LAKE LOUISA, FLORIDA"

TOWNSHIP:	23S	23S	24S
RANGE:	26E	27E	26E
SECTION:	33, 34, 35, 36	7	3, 4

FIGURE 3

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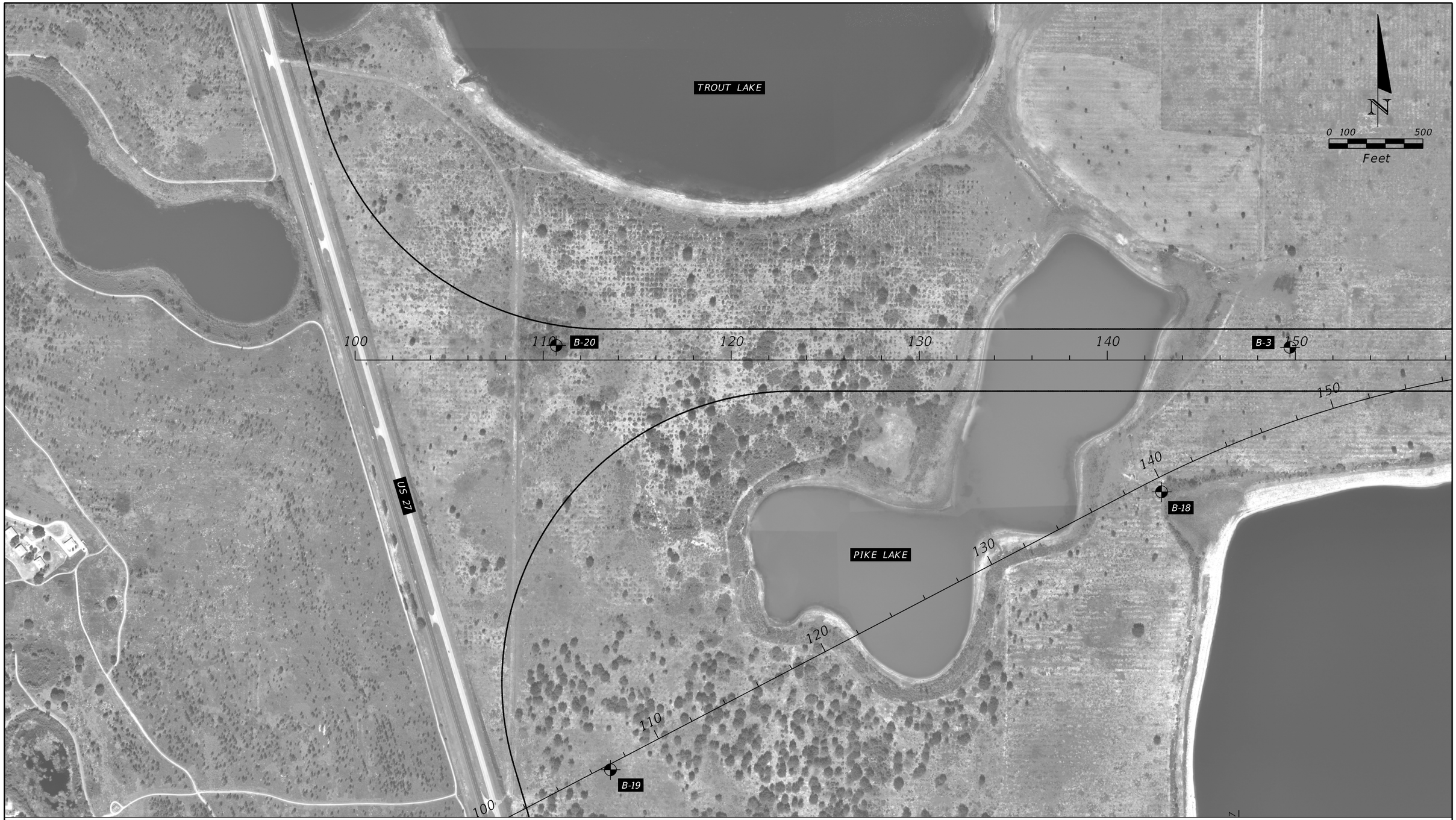
CENTRAL FLORIDA EXPRESSWAY AUTHORITY

ROAD NO.	COUNTY	CFX PROJECT NO.
	LAKE ORANGE	599-225

USGS QUADRANGLE MAP

SHEET NO.



LEGEND

APPROXIMATE SPT BORING LOCATION

FIGURE 4

REVISIONS			
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ROAD NO.	COUNTY	CFX PROJECT NO.
	LAKE ORANGE	599-225

BORING LOCATION PLAN (1)

SHEET NO.

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LEGEND

APPROXIMATE SPT BORING LOCATION

FIGURE 5

REVISIONS			
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CENTRAL FLORIDA EXPRESSWAY AUTHORITY

ROAD NO.	COUNTY	CFX PROJECT NO.
	LAKE ORANGE	599-225

BORING LOCATION PLAN (2)

SHEET NO.

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LEGEND

APPROXIMATE SPT BORING LOCATION

FIGURE 6

REVISIONS			
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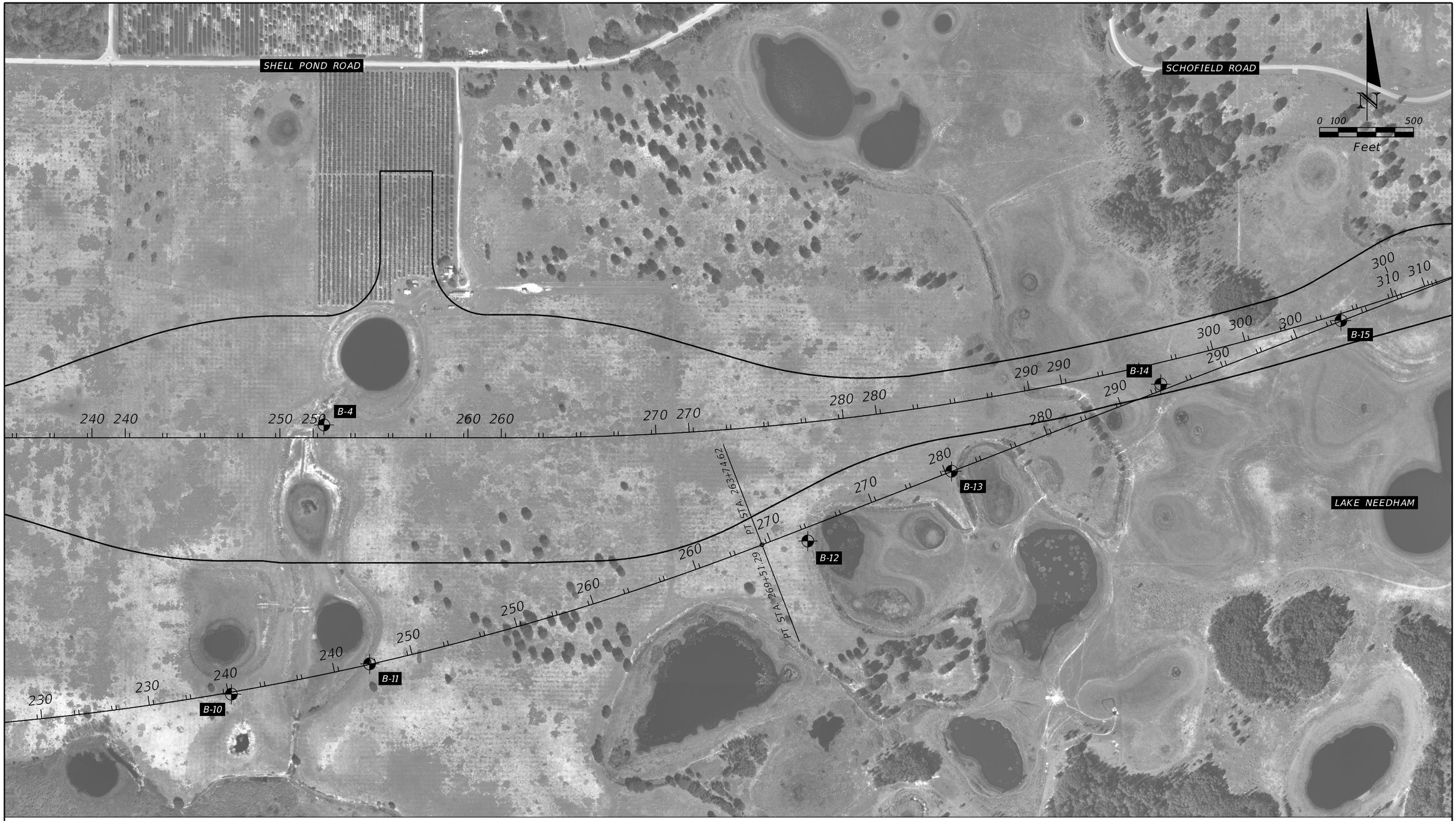
CENTRAL FLORIDA EXPRESSWAY AUTHORITY

ROAD NO.	COUNTY	CFX PROJECT NO.
	LAKE ORANGE	599-225

BORING LOCATION PLAN (3)

SHEET NO.



LEGEND

APPROXIMATE SPT BORING LOCATION

FIGURE 7

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

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CERTIFICATE OF AUTHORIZATION NO. 6486

CENTRAL FLORIDA EXPRESSWAY AUTHORITY

ROAD NO.	COUNTY	CFX PROJECT NO.
	LAKE ORANGE	599-225

BORING LOCATION PLAN (4)

SHEET NO.

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LEGEND

APPROXIMATE SPT BORING LOCATION

FIGURE 8

REVISIONS			
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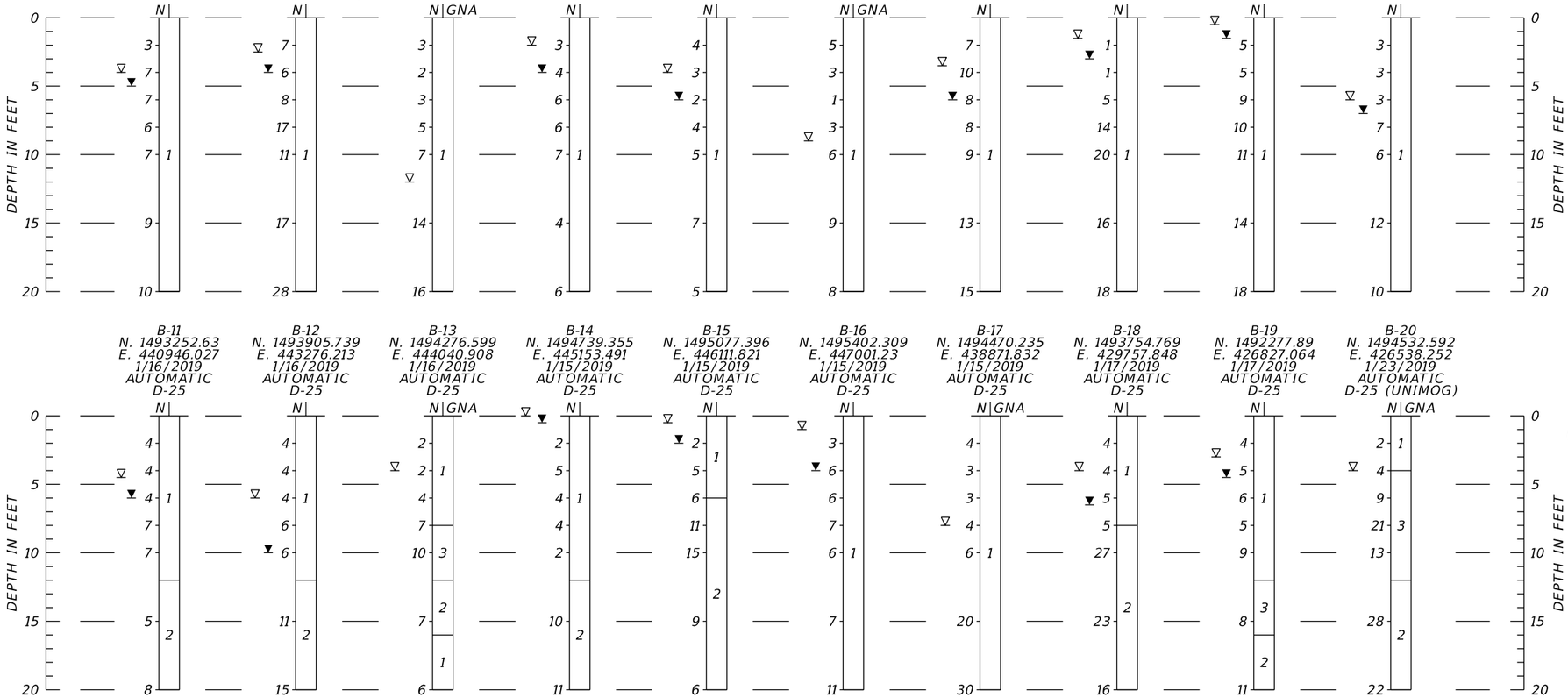
CERTIFICATE OF AUTHORIZATION NO. 6486

CENTRAL FLORIDA EXPRESSWAY AUTHORITY

ROAD NO.	COUNTY	CFX PROJECT NO.
	LAKE ORANGE	599-225

BORING LOCATION PLAN (5)

SHEET NO.



LEGEND

1.	GRAY TO LIGHT GRAY, BROWN TO LIGHT BROWN SAND TO SAND WITH SILT (A-3)
2.	GRAY TO GRAY-BROWN SILTY SAND (A-2-4)
3.	GRAY CLAYEY SAND (A-2-6)
A-3	AASHTO GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND LABORATORY TESTING ON SELECTED SAMPLES FOR CONFIRMATION OF VISUAL REVIEW.
N	NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED).
▼	GROUNDWATER LEVEL ENCOUNTERED DURING FIELD EXPLORATIONS
▽	ESTIMATED SEASONAL HIGH GROUNDWATER TABLE
GNA	GROUNDWATER NOT APPARENT DUE TO THE INTRODUCTION OF DRILLING FLUID.
EASTING	EASTING COORDINATE REFERENCED TO THE FLORIDA STATE PLANE COORDINATE SYSTEM, FLORIDA EAST ZONE, N.A.D. 83.
NORTHING	NORTHING COORDINATE REFERENCED TO THE FLORIDA STATE PLANE COORDINATE SYSTEM, FLORIDA EAST ZONE, N.A.D. 83.

	SAFETY HAMMER	AUTOMATIC HAMMER
GRANULAR MATERIALS-RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE	LESS THAN 4	LESS THAN 3
LOOSE	4 to 10	3 to 8
MEDIUM DENSE	10 to 30	8 to 24
DENSE	30 to 50	24 to 40
VERY DENSE	GREATER THAN 50	GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY SOFT	LESS THAN 2	LESS THAN 1
SOFT	2 to 4	1 to 3
FIRM	4 to 8	3 to 6
STIFF	8 to 15	6 to 12
VERY STIFF	15 to 30	12 to 24
HARD	GREATER THAN 30	GREATER THAN 24

FIGURE 9

REVISIONS			
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CENTRAL FLORIDA EXPRESSWAY AUTHORITY

ROAD NO.	COUNTY	CFX PROJECT NO.
	LAKE ORANGE	599-225

ROADWAY SOIL PROFILES

SHEET NO.

Lake/Orange County Connector Feasibility/PD&E Study

Preliminary Geotechnical Soil Survey - Addendum

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Date of Publication
July 11, 2019

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1.0 Introduction

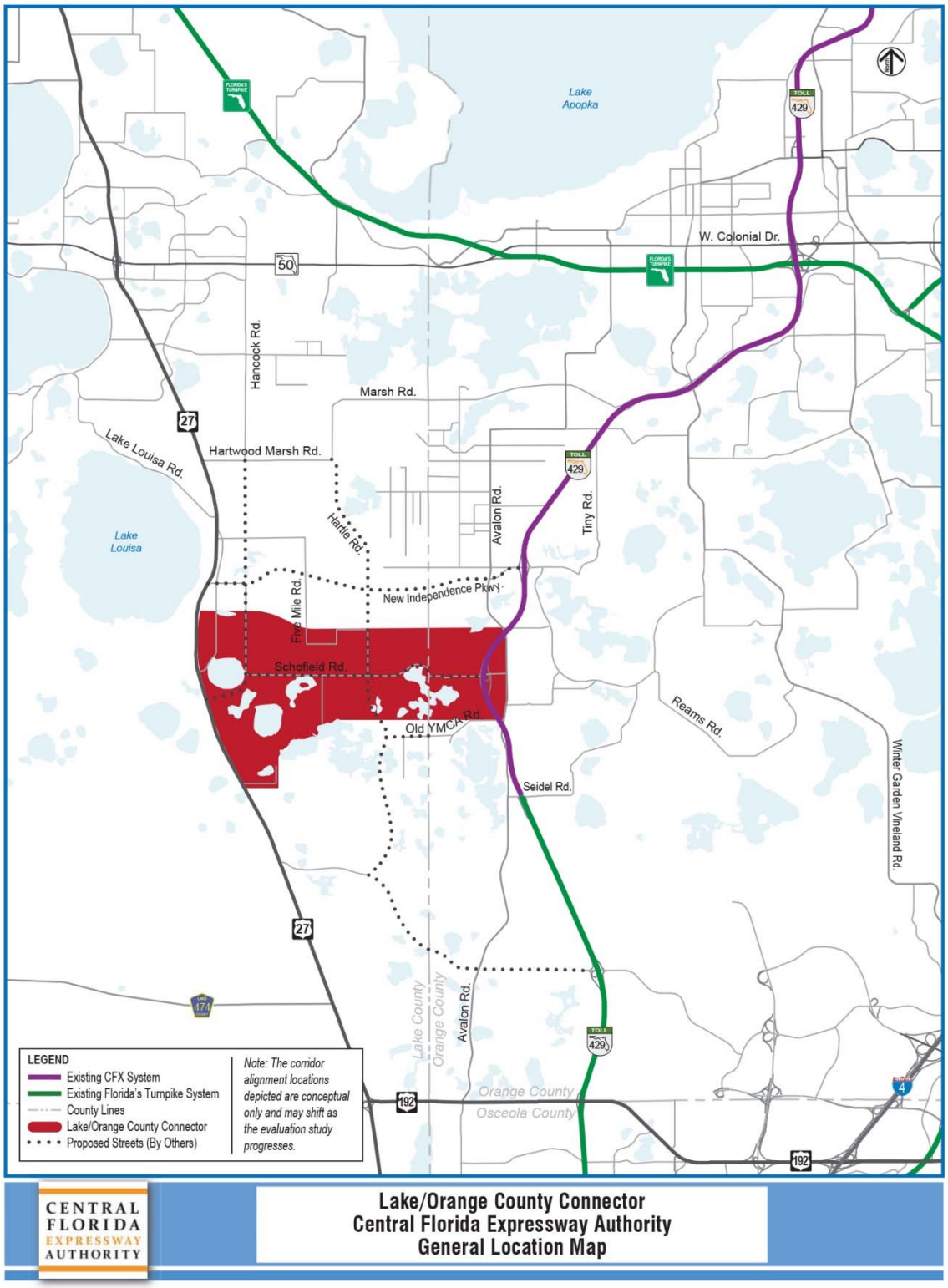
1.1 Project Information

The proposed Lake/Orange County Connector is a strategic transportation investment aimed at supporting existing and future growth in south Lake and west Orange counties. It has been identified as a system expansion project need in the last four consecutive Central Florida Expressway Authority (CFX) master plans, the most current being the 2040 CFX Master Plan. The Orlando-Orange County Expressway Authority (OOCEA), now CFX, completed the 2007 SR 429 to US 27 Connector Concept Development and Evaluation Study which developed various viable corridors/alternatives and identified an unmet need for an east-west connection between US 27 and SR 429. This study will confirm the feasibility of the connector and will conduct a Project Development and Environment (PD&E) Study on defined alignments. **Figure 1-1** illustrates the location of the project.

1.2 Project Description/Background

The purpose of the Lake/Orange County Connector PD&E Study is to develop a proposed improvement strategy that is technically sound, environmentally sensitive and publicly acceptable. As with every PD&E Study, emphasis has been placed on the development, evaluation and documentation of detailed engineering and environmental studies including data collection, conceptual design, environmental analyses, project documentation and the preparation of a Preliminary Engineering Report (PER).

Figure 1-1 | Project Location Map



2.0 Scope of Services

The purpose of this study is to provide geotechnical data (i.e. subsurface soil conditions and related engineering properties) to aid in determining constructability of the preferred alignment alternative (Alternative 3) over the wetlands which separate Lake Adain and Sawgrass Lake within the southwest portion of the proposed alignment. The general purpose of the study was to attempt to determine problematic soil conditions (i.e. deep organic soils) within the study area. The following services were provided in order to achieve the preceding objective:

- Reviewed published soil information from the "Soil Survey of Lake County, Florida" published by the United States Department of Agriculture (USDA) and Natural Resources Conservation Service (NRCS). Reviewed topographic and potentiometric information obtained from "Lake Louisa, Florida" USGS Quadrangle map and the "Potentiometric Surface of the Upper Floridan Aquifer in the St. Johns River Water Management District and Vicinity, Florida" maps published by the United States Geological Survey (USGS).

- Executed a program of subsurface exploration consisting of five (5) test borings and subsurface sampling. Tierra has performed five (5) Standard Penetration Test (SPT) borings advanced to a depth of approximately 100 feet below the existing mudline/grade.

- Visually classified and stratified the samples in the laboratory using the Unified Soil Classification System (USCS) in general accordance with the American Society of Testing and Materials (ASTM) test designation D-2487 and D-2488. Conducted laboratory testing on selected soil samples to confirm the visual classification.

- Conducted environmental corrosion tests on recovered soil samples obtained from the borings to provide a basis for environmental classification.

- Prepared this geotechnical data report, which summarizes the course of study pursued, the field and laboratory data generated, and the subsurface conditions encountered within the area of the proposed alignment through the wetlands area.

3.0 Review of Published Data

3.1 USDA Soil Survey

Based on review of the published information, it appears that there are four (4) primary soil-mapping unit noted within the vicinity of the study area. A reproduction of the **USDA Vicinity Map** is included in the **Appendix** and the soil mapping units are summarized in the summary table below.

Table 3-1 | Lake County USDA NRCS Soil Survey Information

SUMMARY OF USDA SOIL SURVEY LAKE COUNTY, FLORIDA							
USDA Map Unit and Soil Name	**Depth (in)**	**Soil Classification**		**Permeability (in/hr)**	**pH**	**Seasonal High Water Table**	
		USCS	**AASHTO**			**Depth (feet)**	**Months**
(8) Candler sand, 0 to 5 percent slopes	0-7	SP, SP-SM	A-3	20.0 – 50.0	4.5-6.0	> 6.0	Jan-Dec
	7-67	SP, SP-SM	A-3	20.0 – 50.0	4.5-6.0		
	67-80	SP-SM	A-3, A-2-4	6.0 – 20.0	4.5-6.0		
(9) Candler sand, 5 to 12 percent slopes	0-6	SP, SP-SM	A-3	20.0 – 50.0	4.5-6.0	> 6.0	Jan-Dec
	6-67	SP, SP-SM	A-3	20.0 – 50.0	4.5-6.0		
	67-80	SP-SM	A-3, A-2-4	6.0 – 20.0	4.5-6.0		
(28) Myakka sand	0-6	SP, SP-SM	A-3	6.0-20.0	3.5-6.5	0.0-1.5	Jun-Sept
	6-20	SP, SP-SM	A-3	6.0-20.0	3.5-6.5		
	20-36	SP-SM, SM	A-3, A-2-4	0.6-6.0	3.5-6.5		
	36-80	SP, SP-SM	A-3	6.0-20.0	3.5-6.5		
(32) Oklawaha muck	0-9	PT	A-8	2.0-6.0	4.5-6.0	0.0	Jan-Dec
	9-25	PT	A-8	6.0-20.0	4.5-6.0		
	25-31	SM-SC	A-2-4, A-4	0.6-6.0	6.1-8.4		
	31-54	CH	A-7	0.0-0.1	6.1-8.4		

3.2 USGS Quadrangle Map

A review of the "Lake Louisa, Florida" Quadrangle Map indicates that the natural ground surface elevations within the vicinity of the study area ranges from +110 to +115 feet National Geodetic Vertical Datum of 1929 (NGVD). A reproduction of the **USGS Vicinity Map** is illustrated in the **Appendix**.

3.3 Review of Potentiometric Surface Information

Based on a review of the "Potentiometric Surface of the Upper Floridan Aquifer in the St. Johns River Management District and Vicinity, Florida" maps published by the USGS, the potentiometric surface elevation of the Upper Floridan Aquifer at the bridge location appears to range from approximately elevation +90 to +100 feet, NGVD29. Artesian flow conditions were not encountered during the field exploration.

4.0 Subsurface Exploration

4.1 Boring Location Plan and Utility Clearance

Prior to commencing our subsurface explorations, a boring location plan was produced. This boring location plan was generated based on a review of the design information supplied by Metric Engineering, Inc. and general guidance provided in the FDOT "Soils and Foundations Handbook" along with our engineering judgment.

Utility clearances were coordinated by Tierra and updated as required prior to performing the soil borings in order to reduce the potential for damage to any underground utilities during the drilling process.

4.2 Soil Borings

Subsurface conditions were explored within the study area with five (5) SPT borings to a depth of approximately 100 feet below the existing mudline/grade. The results and location of the SPT borings are presented on the **Report of Core Borings** sheets in the **Appendix**.

The SPT borings were performed with the use of an amphibious drill rig using Bentonite Mud drilling procedures. The soil sampling was performed in general accordance with the ASTM test designation D-1586. SPT resistance N-values were taken on intervals of 2 feet thereafter to a depth of 10 feet. Then, SPT resistance N-values were taken on intervals of 5 feet thereafter to the boring termination depth. Representative portions of these soil samples were sealed in glass jars, labeled and transferred to our Winter Garden laboratory for classification and analyses.

Soil stratification was determined based on a review of recovered samples, laboratory test results, and interpretation of field boring logs. Stratification lines represent approximate boundaries between soil layers of different engineering properties; however actual transitions between layers may be gradual. In some cases, small variations in properties that were not considered pertinent to our engineering evaluation may have been abbreviated or omitted for clarity. The soil profile represents the conditions at the particular boring location. Specific details about subsurface conditions and materials encountered at the test location can be obtained from the soil profile presented on the **Report of Core Borings** sheets in the **Appendix** of this report.

5.0 Laboratory Testing

5.1 General

Representative soil samples collected from the SPT borings were classified and stratified in general accordance with the USCS. Our classification was based on visual observations, using the results from the laboratory testing as confirmation. Laboratory testing consisting of fines content (percentage passing the No. 200 sieve), Atterberg limits, organic content, and natural moisture content determination were performed on representative materials encountered. In addition, Environmental Corrosion tests were performed to evaluate the corrosive nature of the soil encountered. The results of the laboratory tests are presented on the **Report of Core Borings** sheets in the **Appendix**.

5.2 Test Designation

The following list summarizes the laboratory tests performed by Tierra and the respective test methods utilized.

- Grain-Size Analyses - The grain-size analyses were conducted in general accordance with the AASHTO test designation T-088 (ASTM test designation D-422).
- Atterberg Limits - The liquid limit and the plastic limit tests ("Atterberg Limits") were conducted in general accordance with the AASHTO test designations T-089 and T-090, respectively (ASTM test designation D-4318).
- Natural Moisture Content - The moisture content tests were conducted in general accordance with the AASHTO test designation T-265 (ASTM test designation D-2216).
- Organic Content – The organic content test consists of determining the percentage of organics in selected samples in general accordance with the AASHTO test designation T-267 (ASTM test designation D-2974).
- Environmental Corrosion – The Environmental corrosion tests were conducted in general accordance with the FDOT test designations FM 5-550, FM 5-551, FM 5-552, and FM 5-553.

6.0 Results of Subsurface Exploration

6.1 General Soil Conditions

The subsurface conditions encountered are shown on the **Report of Core Borings** sheets in **Appendix A**.

The soil types encountered during this exploration are listed below.

Typical Soil Description	USCS Classification
Gray to Light Gray, and Brown to Gray-Brown SAND to SAND with Silt	SP/SP-SM
Dark Gray to Dark Brown SAND with Silt	SP-SM
Brown to Gray-Brown, and Gray to Green-Gray Silty SAND	SM
Gray to Green-Gray Clayey SAND with Limestone Fragments	SC
Dark Gray Organic Silt	OH
Dark Gray Peat	PT

A geotechnical engineer bases soil stratification on a visual review of the recovered samples, laboratory testing and interpretation of the field boring logs. The boring stratification lines represent the approximate boundaries between soil types of significantly different engineering properties; however, the actual transition may be gradual. In some cases, small variations in properties within the same boring not considered pertinent to our engineering evaluation may have been abbreviated or omitted for clarity. The boring profiles represent the conditions at the particular boring location and variations do occur among the borings.

6.2 Groundwater

The groundwater table was recorded at each of the boring locations during our field exploration. The groundwater table at the boring locations was found to range from approximately 3 inches to 7 feet above the existing mudline/grade. The groundwater levels measured at each of the boring locations is presented on the **Report of Core Borings** sheets in the **Appendix**.

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences (i.e., existing water management canals, swales, drainage ponds, underdrains, and areas of covered soils, such as paved parking lots and sidewalks).

7.0 Preliminary Engineering Evaluations

7.1 General

Based on the preliminary borings performed for the study, it appears the soils are capable of supporting standard roadway embankment construction following proper subgrade preparation. However, highly organic (organic content > 20%) soils were encountered during our field exploration program within the upper 2 to 8 feet along the portion of the alignment that traverses the swamp area. Standard removal and replacement of organic soils with "select" backfill may be difficult due to the depths of organic soils (up to 8 feet) and water levels in the swamp area (up to 7 feet deep). Subgrade preparation will likely consist of a combination of removal and replacement of organic soils where feasible based on water levels with possible surcharge embankments or other ground remediation techniques. Further laboratory testing including consolidation testing may also be required on the deeper deposits of organic silt encountered within boring BB-144 to evaluate the potential for long term settlement based on final embankment heights and roadway design.

Based on the subsurface soil conditions encountered at the boring locations, competent bearing layers of dense to very dense sands with variable silts content (SP/SP-SM/SM) were encountered at depths of approximately 40 to 75 feet below the existing mudline within the swamp area. Driven concrete and steel piles are widely used and proven foundation system in these subsurface soil conditions. However, due to the corrosive nature of the soils encountered at the boring locations, steel piles may be an undesirable foundation alternative and sacrificial steel would be required.

The data presented in this report is for informational purposes only. Once the design has been established, additional borings, project-specific geotechnical evaluations and design analyses should be completed to support the design. It should be noted that the design team will be responsible for the final design and their own interpretation of the data presented in this report along with further geotechnical explorations performed.

8.0 Limitations

Our professional services have been performed, our findings obtained and our preliminary evaluations prepared in accordance with generally accepted geotechnical engineering principles and practices at the time of this report. Tierra is not responsible for the conclusions, opinions or recommendations made by others based on this data.

The scope of the geotechnical portion of the PD&E study is to provide information on the existing subsurface conditions along the project alignment based on a review of the Lake County Soil Surveys published by the USDA-NRCS and limited subsurface exploration to assist in the preparation of the PD&E Report for the project. The preliminary evaluations submitted in this report are based upon the data obtained from the published information and the limited subsurface exploration. Should subsoil variations become evident during the course of this project, a re-evaluation will be necessary after we have had an opportunity to observe the characteristics of the condition encountered. The applicability of the report should also be reviewed in the event significant changes occur in the design, nature or location of the proposed roadway construction.

The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of Metric Engineering, Inc. and the Central Florida Expressway Authority (CFX).

Tierra appreciates the opportunity to be of service to Metric Engineering, Inc. and CFX on this project. If you have any questions or comments regarding this report, please contact our office at your earliest convenience.

Respectfully Submitted,

TIERRA, INC.

Luis A. Almodovar, E.I.
Geotechnical Engineer Intern

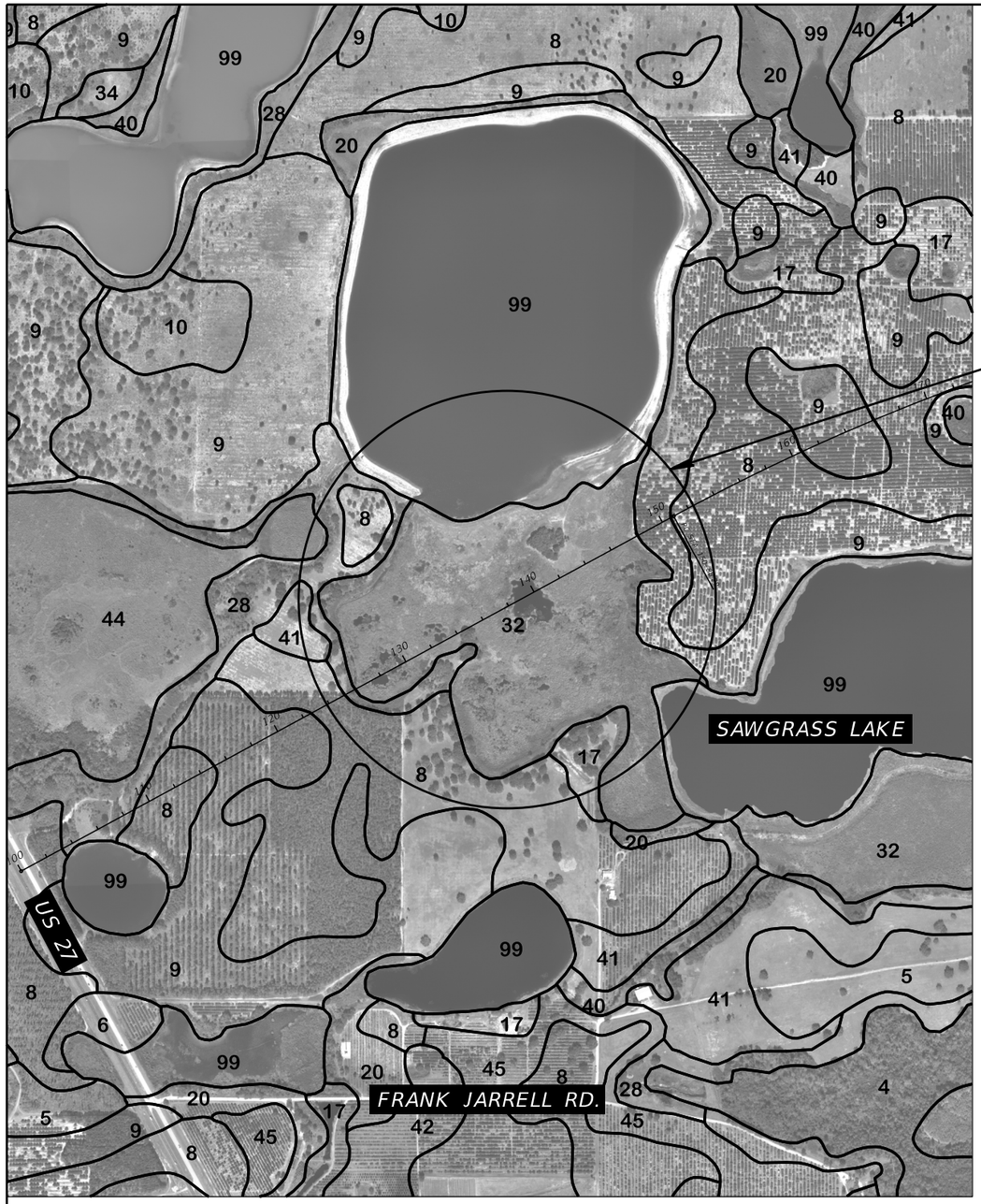
Jeremy A. Sewell, P.E.
Senior Geotechnical Engineer
Florida License No. 62951

Appendix

Figures

FIGURE 2 | USDA Soil Survey & USGS Quadrangle Maps

FIGURES 3 - 5 | Report of Core Borings Sheets

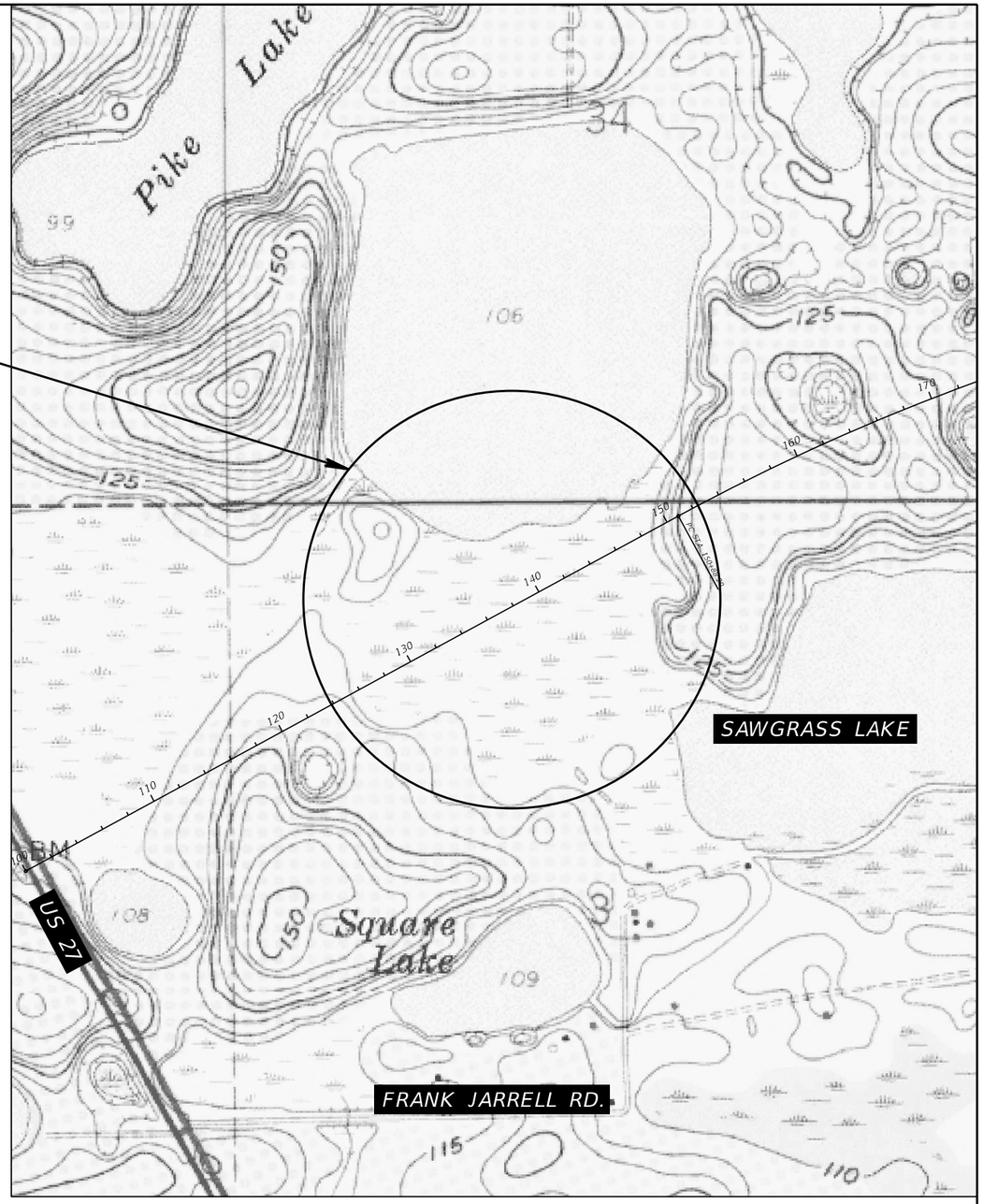


N

0 200 1000

Feet

APPROXIMATE SITE LOCATION



REFERENCE: USDA SOIL SURVEY OF LAKE COUNTY, FLORIDA

REFERENCE: USGS QUADRANGLE MAP OF "LAKE LOUISA, FLORIDA"

TOWNSHIP: 24S
RANGE: 26E
SECTION: 3

FIGURE 2

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

JEREMY A. SEWELL, P.E.
P.E. LICENSE NUMBER 62951
TIERRA, INC.
591 SUSAN B. BRITT COURT
WINTER GARDEN, FLORIDA 34787
CERTIFICATE OF AUTHORIZATION NO. 6486

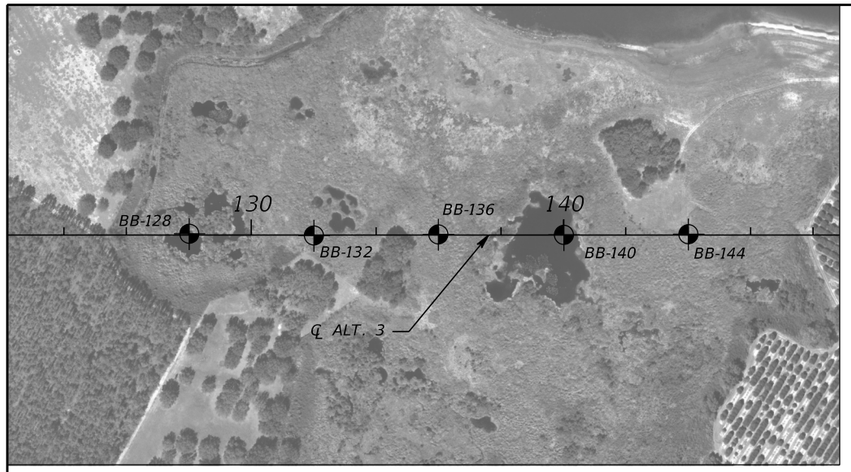
CENTRAL FLORIDA EXPRESSWAY AUTHORITY

ROAD NO.	COUNTY	CFX PROJECT NO.
	LAKE ORANGE	599-225

USDA SOIL SURVEY

SHEET NO.

bsawaska 7/10/2019 2:15:53 PM L:\5511\2017\2017 Projects\5511-17-043 Lake-Orange Connector\Microstation\USDA_USGS



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Feet

TOWNSHIP: 24S
RANGE: 26E
SECTION: 3

ENVIRONMENTAL CLASSIFICATION:

SUBSTRUCTURE	CONCRETE: MODERATELY AGGRESSIVE (pH = 5.3)
SUBSTRUCTURE	STEEL: EXTREMELY AGGRESSIVE (pH = 5.3)
SUPERSTRUCTURE	SLIGHTLY AGGRESSIVE

SOIL TEST RESULTS:

RESISTIVITY	4,100 TO 7,900 OHM-CM
CHLORIDES	<5 TO 15 PPM
SULFATES	<5 TO 21 PPM
pH	5.3 TO 6.6

LEGEND

- SAND
- PEAT
- SILTY SAND
- ORGANIC SANDY SILT
- CLAYEY SAND
- SP — UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND LABORATORY TESTING ON SELECTED SAMPLES FOR CONFIRMATION OF VISUAL REVIEW.
- N — NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED).
- 50/4 — NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION
- WH — SPLIT-SPOON SAMPLER ADVANCED UNDER WEIGHT OF ROD AND HAMMER
- -200 — PERCENT PASSING #200 SIEVE
- NMC — NATURAL MOISTURE CONTENT (%)
- LL — LIQUID LIMIT
- PI — PLASTICITY INDEX
- OC — ORGANIC CONTENT (%)
- R — RESISTIVITY
- C — CHLORIDES
- S — SULPHATES
- APPROXIMATE SPT BORING LOCATION
- CASING
- ℄ ALT. 3 — CENTERLINE ALIGNMENT ALTERNATIVE 3

BORING LOCATION PLAN

BOR # BB-128
STA. 128+02
REF. ℄ ALT. 3
OFF. 4 LT
DATE 6/4/2019
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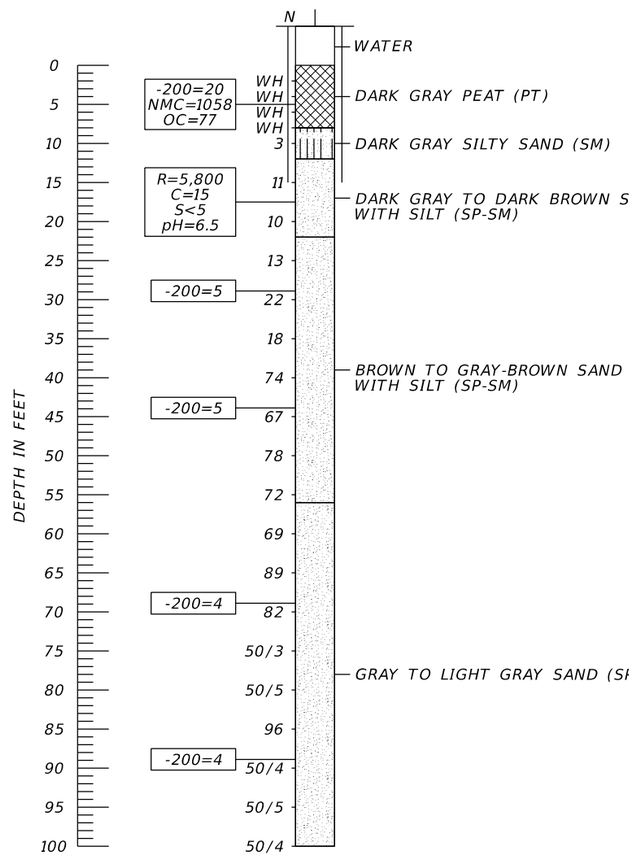
RIG D-25 (AMPHIBIOUS)



BOR # BB-132
STA. 132+01
REF. ℄ ALT. 3
OFF. 2 RT
DATE 6/3/2019
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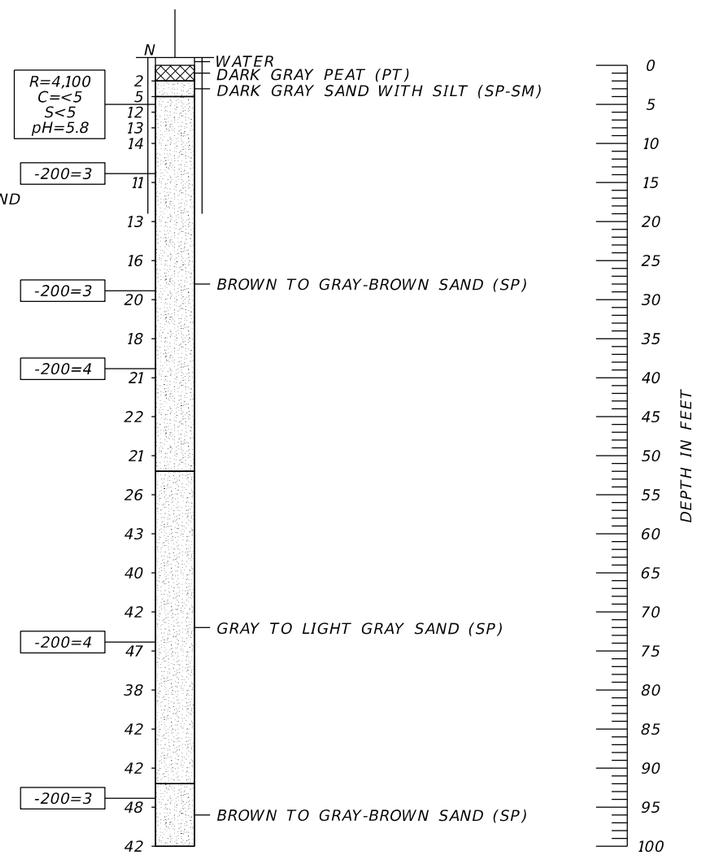
RIG D-25 (AMPHIBIOUS)



	SAFETY HAMMER	AUTOMATIC HAMMER
GRANULAR MATERIALS- RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE	LESS THAN 4	LESS THAN 3
LOOSE	4 to 10	3 to 8
MEDIUM DENSE	10 to 30	8 to 24
DENSE	30 to 50	24 to 40
VERY DENSE	GREATER THAN 50	GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY SOFT	LESS THAN 2	LESS THAN 1
SOFT	2 to 4	1 to 3
FIRM	4 to 8	3 to 6
STIFF	8 to 15	6 to 12
VERY STIFF	15 to 30	12 to 24
HARD	GREATER THAN 30	GREATER THAN 24

FIGURE 3

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

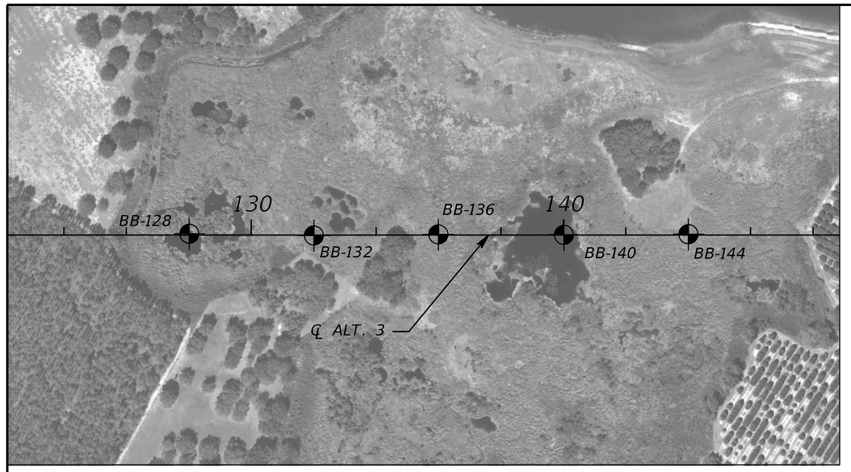
JEREMY A. SEWELL, P.E.
P.E. LICENSE NUMBER 62951
TIERRA, INC.
591 SUSAN B. BRITT COURT
WINTER GARDEN, FLORIDA 34787
CERTIFICATE OF AUTHORIZATION NO. 6486

CENTRAL FLORIDA EXPRESSWAY AUTHORITY

ROAD NO.	COUNTY	CFX PROJECT NO.
	LAKE ORANGE	599-225

REPORT OF CORE BORINGS (1)

SHEET NO.



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Feet

TOWNSHIP: 24S
RANGE: 26E
SECTION: 3

ENVIRONMENTAL CLASSIFICATION:

SUBSTRUCTURE	CONCRETE: MODERATELY AGGRESSIVE (pH = 5.3)
SUBSTRUCTURE	STEEL: EXTREMELY AGGRESSIVE (pH = 5.3)
SUPERSTRUCTURE	SLIGHTLY AGGRESSIVE

SOIL TEST RESULTS:

RESISTIVITY	4,100 TO 7,900 OHM-CM
CHLORIDES	<5 TO 15 PPM
SULFATES	<5 TO 21 PPM
pH	5.3 TO 6.6

LEGEND

- SAND
- PEAT
- SILTY SAND
- ORGANIC SANDY SILT
- CLAYEY SAND

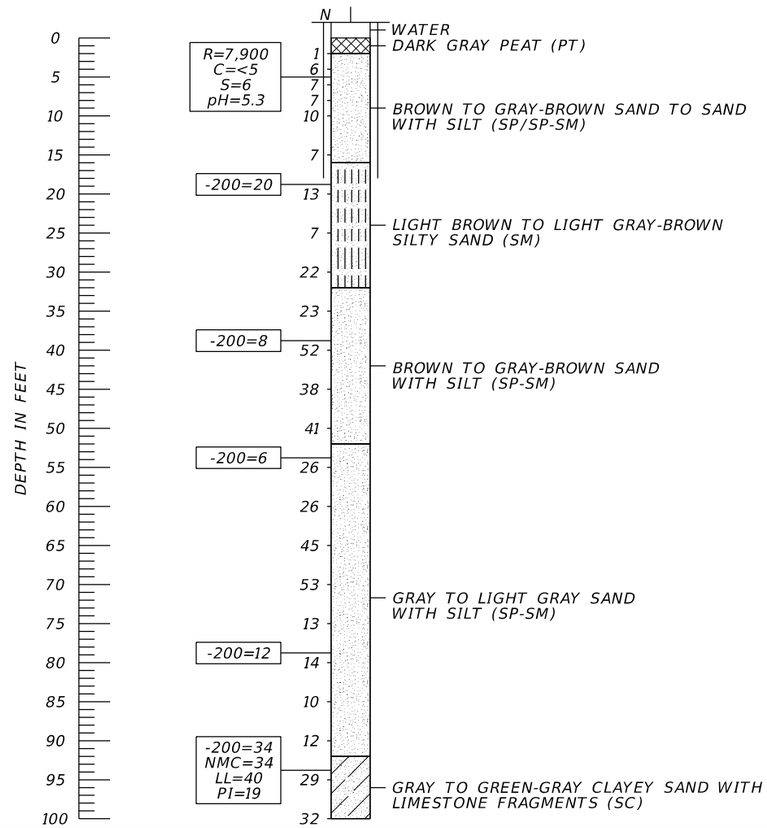
SP	UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND LABORATORY TESTING ON SELECTED SAMPLES FOR CONFIRMATION OF VISUAL REVIEW.
N	NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED).
50/4	NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION
WH	SPLIT-SPOON SAMPLER ADVANCED UNDER WEIGHT OF ROD AND HAMMER
-200	PERCENT PASSING #200 SIEVE
NMC	NATURAL MOISTURE CONTENT (%)
LL	LIQUID LIMIT
PI	PLASTICITY INDEX
OC	ORGANIC CONTENT (%)
R	RESISTIVITY
C	CHLORIDES
S	SULPHATES

- APPROXIMATE SPT BORING LOCATION
- CASING

℄ ALT. 3 CENTERLINE ALIGNMENT ALTERNATIVE 3

BORING LOCATION PLAN

BOR # BB-136
STA. 135+99
REF. ℄ ALT. 3
OFF. 2 LT
DATE 6/3/2019
HAMMER AUTOMATIC
RIG D-25 (AMPHIBIOUS)



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STA. 140+02
REF. ℄ ALT. 3
OFF. C.L.
DATE 5/30/2019
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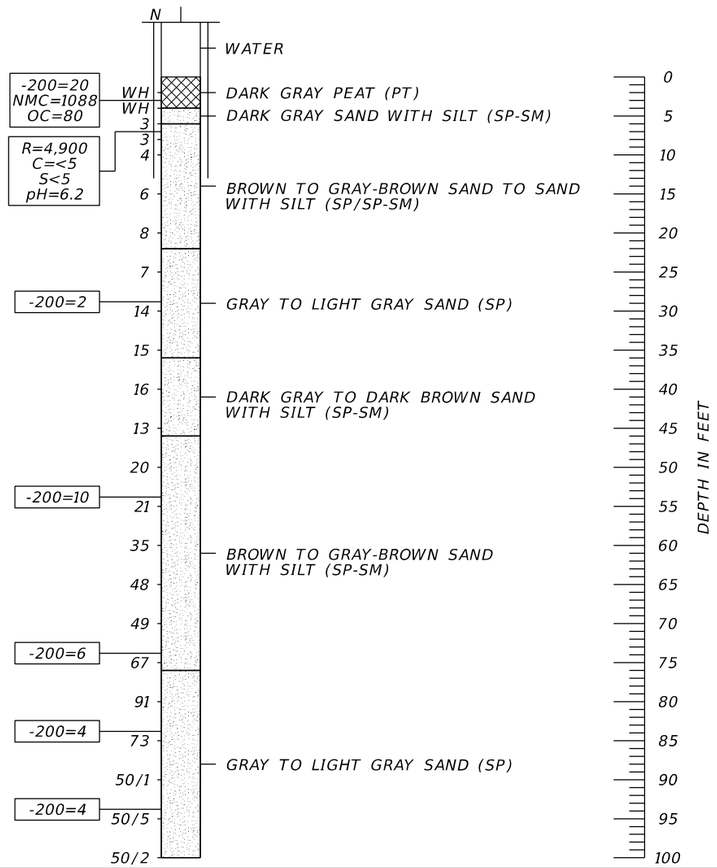
RIG D-25 (AMPHIBIOUS)



	SAFETY HAMMER	AUTOMATIC HAMMER
GRANULAR MATERIALS- RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE	LESS THAN 4	LESS THAN 3
LOOSE	4 to 10	3 to 8
MEDIUM DENSE	10 to 30	8 to 24
DENSE	30 to 50	24 to 40
VERY DENSE	GREATER THAN 50	GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY SOFT	LESS THAN 2	LESS THAN 1
SOFT	2 to 4	1 to 3
FIRM	4 to 8	3 to 6
STIFF	8 to 15	6 to 12
VERY STIFF	15 to 30	12 to 24
HARD	GREATER THAN 30	GREATER THAN 24

FIGURE 4

REVISIONS

DATE	DESCRIPTION	DATE	DESCRIPTION

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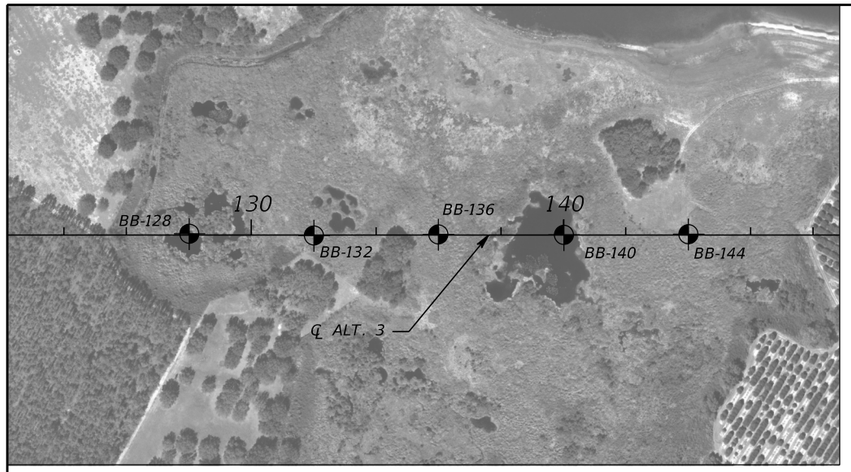
591 SUSAN B. BRITT COURT
WINTER GARDEN, FLORIDA 34787
CERTIFICATE OF AUTHORIZATION NO. 6486

CENTRAL FLORIDA EXPRESSWAY AUTHORITY

ROAD NO.	COUNTY	CFX PROJECT NO.
	LAKE ORANGE	599-225

REPORT OF CORE BORINGS (2)

SHEET NO.



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Feet

TOWNSHIP: 24S
RANGE: 26E
SECTION: 3

ENVIRONMENTAL CLASSIFICATION:

SUBSTRUCTURE	CONCRETE: MODERATELY AGGRESSIVE (pH = 5.3)
SUBSTRUCTURE	STEEL: EXTREMELY AGGRESSIVE (pH = 5.3)
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SULFATES	<5 TO 21 PPM
pH	5.3 TO 6.6

LEGEND

SAND
PEAT
SILTY SAND
ORGANIC SANDY SILT
CLAYEY SAND

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50/4 — NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION

WH — SPLIT-SPOON SAMPLER ADVANCED UNDER WEIGHT OF ROD AND HAMMER

-200 — PERCENT PASSING #200 SIEVE
NMC — NATURAL MOISTURE CONTENT (%)
LL — LIQUID LIMIT
PI — PLASTICITY INDEX
OC — ORGANIC CONTENT (%)
R — RESISTIVITY
C — CHLORIDES
S — SULPHATES

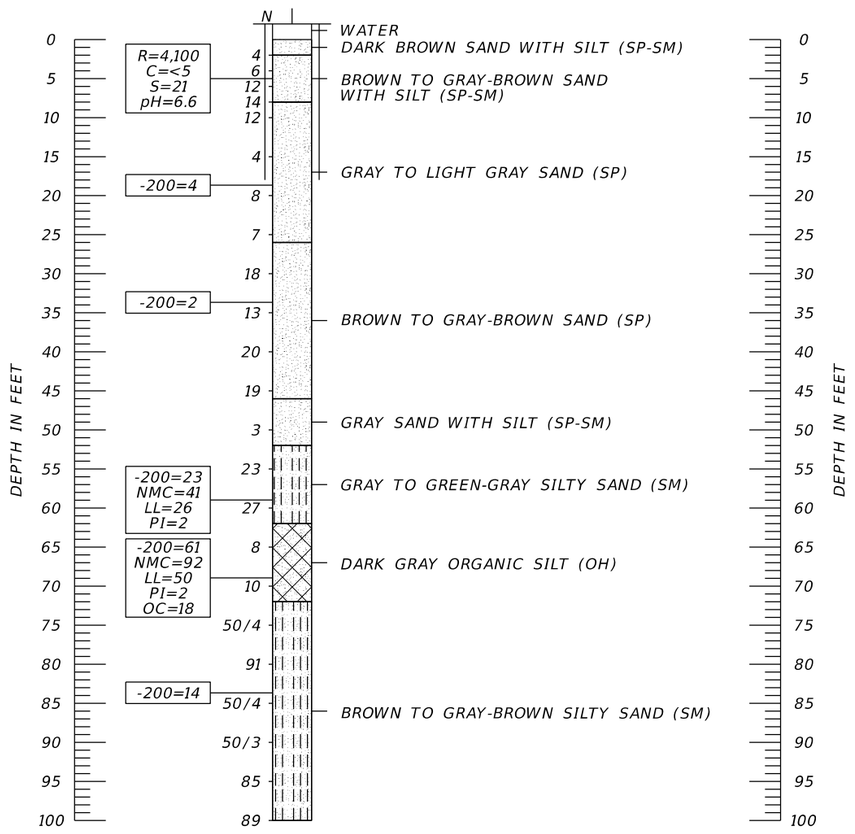
APPROXIMATE SPT BORING LOCATION

CASING

℄ ALT. 3 — CENTERLINE ALIGNMENT ALTERNATIVE 3

BORING LOCATION PLAN

BOR # BB-144
STA. 144+01
REF. ℄ ALT. 3
OFF. 2 LT
DATE 5/28/2019
HAMMER AUTOMATIC
RIG D-25 (AMPHIBIOUS)



	SAFETY HAMMER	AUTOMATIC HAMMER
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SOFT	2 to 4	1 to 3
FIRM	4 to 8	3 to 6
STIFF	8 to 15	6 to 12
VERY STIFF	15 to 30	12 to 24
HARD	GREATER THAN 30	GREATER THAN 24

FIGURE 5

REVISIONS

DATE	DESCRIPTION	DATE	DESCRIPTION

JEREMY A. SEWELL, P.E.
P.E. LICENSE NUMBER 62951
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591 SUSAN B. BRITT COURT
WINTER GARDEN, FLORIDA 34787
CERTIFICATE OF AUTHORIZATION NO. 6486

CENTRAL FLORIDA EXPRESSWAY AUTHORITY

ROAD NO.	COUNTY	CFX PROJECT NO.
	LAKE ORANGE	599-225

REPORT OF CORE BORINGS (3)

SHEET NO.