Geotechnical Technical Memorandum

SR 544 (Lucerne Park Rd) from Ave T NW to SR 17

Polk County, Florida

Financial Project ID: 440273-1-22-01
FAP NO: D119 048 B

Project Development and Environment Study

Florida Department of Transportation
District 1

April 2022

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April 13, 2022

Inwood Consulting Engineers
3000 Dovera Drive, Suite 200
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Attn: Mr. David S. Dangel, P.E.

RE: Geotechnical Technical Memorandum
Project Development and Environment (PD&E) Soil Survey Study
SR 544 (Lucerne Park Rd) from Ave T NW to SR 17
Polk County, Florida
FPID: 440273-1-22-01
Tierra Project No. 6511-19-056

Mr. Dangel:

Tierra, Inc. (Tierra) has completed Geotechnical Engineering Services for the referenced project. The results of the study are enclosed herein.

Tierra appreciates the opportunity to provide our services to Inwood Consulting Engineers (Inwood) and the Florida Department of Transportation (FDOT) on this project. If you have any questions regarding this report, please contact us at (813) 989-1354.

Respectfully Submitted,

TIERRA, INC.

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1.0 PROJECT SUMMARY

1.1 Project Description

This project involves the potential widening of SR 544 (Lucerne Park Road) from two to four lanes from Martin Luther King Boulevard (Avenue T) to SR 17 in Polk County, a length of 7.96 miles. The project location map is provided as **Figure 1-1**. The project corridor traverses three jurisdictions: the City of Winter Haven, Polk County, and Haines City. SR 544 (Lucerne Park Road) plays an important role in the regional network by providing east-west access for a growing area of east-central Polk County. It links two north-south principal arterials of Polk County (US 17 and US 27), US 27 being part of Florida's Strategic Intermodal System (SIS) and connects the cities of Winter Haven and Haines City, the second and third most populated cities within Polk County, respectively.

SR 544 (Lucerne Park Road) is classified as a two-lane urban minor arterial from Martin Luther King Boulevard to US 27 and as an urban collector from US 27 to SR 17. The roadway features two twelve-foot travel lanes with center and right turn lanes dispersed throughout the length of the corridor. The roadway also features an open drainage system, however, curbs and gutters exist from Martin Luther King Boulevard to Avenue Y and from La Vista Drive to SR 17 and in other areas where sidewalks are present.

Paved shoulders are present for the majority of the corridor and marked bicycle lanes exist on both sides of the roadway from 0.10 mile west of Brenton Manor Avenue to 0.2 mile east of US 27. The posted speed limit along the corridor ranges from 35 miles per hour to 55 miles per hour. Citrus Connection Route #60 (Winter Haven Northeast) operates along the eastern portion of the project corridor. Existing right-of-way along SR 544 (Lucerne Park Road) ranges from 50 feet to 85 feet from Martin Luther King Boulevard to Avenue Y, 90 feet to 170 feet from Avenue Y to US 27, and 60 feet to 140 feet from US 27 to SR 17.

The proposed improvements may include paved shoulders/marked bicycle lanes, sidewalks, and/or a shared-use path to provide safe bicycle and pedestrian mobility and meet objectives of the Polk Transportation Planning Organization (TPO) in transforming this corridor into a Complete Street. Additional right-of-way may be required depending on the proposed improvements and specific right-of-way requirements will be determined during this Project Development and Environment (PD&E) Study.

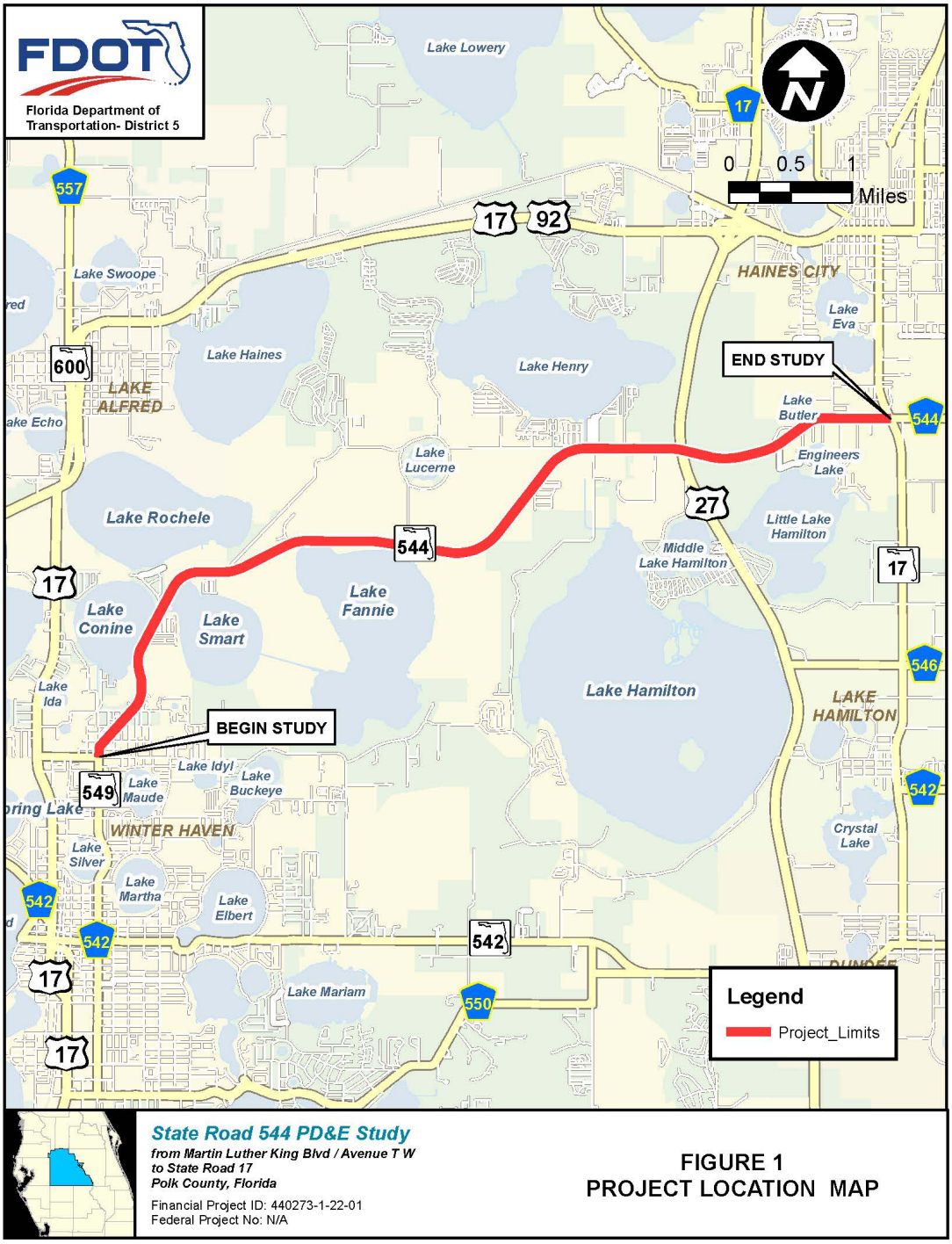


Figure 1-1: Project Location Map

2.0 SCOPE OF SERVICES

The purpose of the geotechnical portion of the PD&E study is to review published information regarding the existing subsurface conditions along the project alignment and within the limits of the pond alternative sites to assist in the preparation of the PD&E Report for the project. The following services were provided to achieve the preceding objective:

1. Reviewed published topographic information. This published information was obtained from the "Winter Haven, Florida" Quadrangle Map published by the USGS.

2. Reviewed published regional geological information. This published information was obtained from the Florida Geological Survey for Polk County.

3. Reviewed published soils information. This published information was obtained from the Web Soil Survey of Polk County, Florida published by the USDA – NRCS.

4. Prepared this Geotechnical Technical Memorandum for the project.

3.0 REVIEW OF USGS QUADRANGLE MAPS

Based on a review of "Winter Haven, Florida" Quadrangle Map, it appears that the project site elevations are on the order of approximately +120 to +215 feet, National Geodetic Vertical Datum of 1929 (NGVD 29). The **USGS Quadrangle Map** of the project area is illustrated in **Appendix A**.

4.0 REVIEW OF REGIONAL GEOLOGY OF POLK COUNY

Polk County Geology was paraphrased from the Florida Geological Survey, Open-File Report 80, 2001 and other geologic references.

The near surface geologic deposits and formations from youngest to oldest in Polk County include: Holocene Sediment (Qh), Undifferentiated sediments (Qu), reworked Cypresshead (TQuc), dunes (TQd), Cypresshead Formation (Tc), the Hawthorn Group Peace River Formation Bone Valley Member (Thpb), the Hawthorn Group Arcadia Formation Tampa Member (That), the Suwannee Limestone (Ts), and Ocala Limestone (To).

The Holocene sediments generally occur within lakes and river flood plains and includes quartz sands, carbonate sand and muds with organics. The Undifferentiated sediments are siliciclastics that are light gray, tan, brown to black, unconsolidated to poorly consolidated, clean to clayey silty, unfossiliferous, variably organic-bearing sands to blue green to olive green, poorly to moderately consolidated, sandy, silty clays. The dune sediments are at elevations greater than 100 feet and are fine to medium quartz sand with varying amounts of organic matter.

The undifferentiated reworked Cypresshead Formation is generally fine to coarse quartz sands with scattered quartz gravel and varying amounts of clay matrix. The Cypresshead Formation occurs above 100 feet msl and consists of reddish brown to reddish orange, unconsolidated to poorly consolidated, fine to very coarse grained, clean to clayey sands.

The Peace River Formation Bone Valley Member occurs in southwest Polk County and is a clastic unit consisting of sand-sized and larger phosphate grains in a matrix of quartz sand, silt and clay. The lithology is highly variable ranging from sandy, silty, phosphatic clays and relatively pure clays to clayey, phosphatic sand to sandy, clayey phosphorites. The Arcadia Formation Tampa member is only found in western Polk County from elevations of 50 to -50 mean sea level (msl) and consist of a white to yellowish gray, fossiliferous and variably sandy and clayey mudstones, wackestone and packstone with minor to no phosphate grains.

The Suwannee Limestone only occurs near the surface in the northwest corner of Polk County and consists of a white to cream, poorly to well indurated, fossiliferous, vuggy to moldic limestone (grainstone and packstone). The dolomitized parts are gray, tan, light brown to moderate brown, moderately to well indurated, finely to coarsely crystalline, dolostone with limited occurrences of fossiliferous beds of mollusks, foraminifers, corals and echinoids.

The Ocala Limestone occurs near the surface in the northwest corner of Polk County and underlies the entire County. The Ocala Limestone is generally a white to poorly to well indurated, poorly sorted, very fossiliferous limestone (grainstone, packstone and wackestone). Chert is common in the upper facies. The permeable and highly transmissive carbonates of the Ocala Limestone form the upper part of the Floridan Aquifer System.

5.0 REVIEW OF USDA-NRCS SOIL SURVEY

5.1 Polk County Soil Survey

Based on a review of the Polk County Soil Survey published by the USDA-NRCS, it appears that there are twenty-four (24) soil-mapping units noted within the project limits. A detailed soil survey map is shown on the **USDA Soil Survey** sheets in **Appendix A**. The general soil descriptions are presented in the sub-sections below, as described in the Web Soil Survey.

5.1.1 Candler Sand (Unit 3)

The Candler 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, knolls 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 (or restricted depth) 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.

5.1.2 Pomona Fine Sand (Unit 7)

The Pomona, 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 and loamy 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 (or restricted depth) 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, September, and October. Organic matter content in the surface horizon is about 3 percent.

The Pomona, 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 and loamy 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 (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during June, July, August, September, and October. Organic matter content in the surface horizon is about 3 percent.

5.1.3 Samsula Muck (Unit 13)

The Samsula component makes up 85 percent of the map unit. Slopes are 0 to 1 percent. This component is on depressions on marine terraces on coastal plains. The parent material consists of herbaceous organic material over 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 (or restricted depth) is very high. Shrink-swell potential is low. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at or above the natural ground surface during January, June, July, August, September, October, November, and December. Organic matter content in the surface horizon is about 75 percent.

5.1.4 Sparr Sand (Unit 14)

The Sparr component makes up 85 percent of the map unit. Slopes are 0 to 5 percent. This component is on rises on marine terraces on coastal plains. The parent material consists of sandy marine deposits and/or loamy 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 (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 23 inches during July, August, September, and October. Organic matter content in the surface horizon is about 2 percent.

5.1.5 Tavares Fine Sand (Unit 15)

The Winder component makes up 85 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 and loamy 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 low. Available water to a depth of 60 inches (or restrictive depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during July, August, September, and October. Organic matter content in the surface horizon is about 2 percent.

5.1.6 Urban Land (Unit 16)

The Urban land component consists of areas where most of the surface is covered with impervious materials, such as buildings and paved areas. This land type consists of areas where the original soil has been modified through cutting, grading, filling and shaping or has been generally altered for urban development.

5.1.7 Smyrna and Myakka Fine Sands (Unit 17)

The Smyrna, non-hydric component makes up 41 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 (or restricted depth) 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, September, and October. Organic matter content in the surface horizon is about 3 percent.

The Myakka component makes up 39 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 (or restricted depth) 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, September, and October. Organic matter content in the surface horizon is about 4 percent.

The Smyrna, hydric component makes up 15 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 (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during June, July, August, September, and October. Organic matter content in the surface horizon is about 3 percent.

5.1.8 Immokalee Sand (Unit 21)

The Immokalee, non-hydric component makes up 75 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 (or restricted depth) 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, September, and October. Organic matter content in the surface horizon is about 2 percent.

The Immokalee, hydric component makes up 10 percent of the map unit. Slopes are 0 to 2 percent. This component is on flats on marine terraces, 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 (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during June, July, August, September, and October. Organic matter content in the surface horizon is about 2 percent.

5.1.9 Ona-Ona, wet, Fine Sand (Unit 23)

The Ona component makes up 75 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 (or restricted depth) 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 January, February, March, April, May, June, July, August, September, October, November, and December. Organic matter content in the surface horizon is about 3 percent.

The Ona, wet component makes up 12 percent of the map unit. Slopes are 0 to 2 percent. This component is on sloughs 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 (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 8 inches during July, August, and September. Organic matter content in the surface horizon is about 3 percent.

5.1.10 Placid and Myakka Fine Sands (Unit 25)

The Placid, depressional component makes up 60 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 (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at or above the natural ground surface during January, February, March, June, July, August, September, October, November, and December. Organic matter content in the surface horizon is about 6 percent.

The Myakka, depressional component makes up 30 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 moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at or above the natural ground surface during January, February, June, July, August, September, October, November, and December. Organic matter content in the surface horizon is about 5 percent.

5.1.11 Lochloosa Fine Sand (Unit 26)

The Lochloosa component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. This component is on flats on marine terraces on coastal plains, rises on marine terraces on coastal plains. The parent material consists of sandy and loamy 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 low. Available water to a depth of 60 inches (or restricted depth) 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 July, August, September, and October. Organic matter content in the surface horizon is about 3 percent.

5.1.12 Pompano Fine Sand (Unit 30)

The Pompano component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on drainageways on marine terraces on coastal plains, 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 (or restricted depth) 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 3 inches during June, July, August, September, October, and November. Organic matter content in the surface horizon is about 3 percent.

5.1.13 Adamsville Fine Sand (Unit 31)

The Adamsville component makes up 95 percent of the map unit. Slopes are 0 to 2 percent. This component is on rises, 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 somewhat poorly drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) 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 20 inches during June, July, August, September, October, and November. Organic matter content in the surface horizon is about 1 percent.

5.1.14 Kaliga Muck (Unit 32)

The Kaliga component makes up 80 percent of the map unit. Slopes are 0 to 1 percent. This component is on depressions, marine terraces on coastal plains. The parent material consists of herbaceous organic material over loamy 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 moderately low. Available water to a depth of 60 inches (or restricted depth) is very high. Shrink-swell potential is low. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at or above the natural ground surface during January, June, July, August, September, October, November, and December. Organic matter content in the surface horizon is about 75 percent.

5.1.15 Hontoon Muck (Unit 35)

The Hontoon component makes up 85 percent of the map unit. Slopes are 0 to 1 percent. This component is on depressions on marine terraces on coastal plains. The parent material consists of herbaceous organic material. 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 (or restricted depth) is very high. Shrink-swell potential is low. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at or above the natural ground surface during January, June, July, August, September, October, November, and December. Organic matter content in the surface horizon is about 75 percent.

5.1.16 Basinger mucky Fine Sand (Unit 36)

The Basinger component makes up 85 percent of the map unit. Slopes are 0 to 1 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 (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at or above the natural ground

surface during July, August, September, and October. Organic matter content in the surface horizon is about 12 percent.

5.1.17 Wauchula Fine Sand (Unit 40)

The Wauchula, non-hydric component makes up 65 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 and loamy 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 low. Available water to a depth of 60 inches (or restricted depth) is moderate. 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, September, and October. Organic matter content in the surface horizon is about 2 percent.

The Wauchula, hydric component makes up 15 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 and loamy 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 low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during June, July, August, September, and October. Organic matter content in the surface horizon is about 2 percent.

5.1.18 Felda Fine Sand (Unit 42)

The Felda component makes up 80 percent of the map unit. Slopes are 0 to 2 percent. This component is on drainageways on marine terraces on coastal plains. The parent material consists of sandy and loamy 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 (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during January, February, March, July, August, September, October, November, and December. Organic matter content in the surface horizon is about 3 percent.

5.1.19 Zolfo Fine Sand (Unit 47)

The Zolfo component makes up 85 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 somewhat poorly drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 30 inches during June, July, August,

September, October, and November. Organic matter content in the surface horizon is about 1 percent.

5.1.20 Adamsville-Urban Land Complex (Unit 49)

The Adamsville component makes up 60 percent of the map unit. Slopes are 0 to 2 percent. This component is on rises 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 somewhat poorly drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) 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, September, October, and November. Organic matter content in the surface horizon is about 1 percent.

The Urban land component consists of areas where most of the surface is covered with impervious materials, such as buildings and paved areas. This land type consists of areas where the original soil has been modified through cutting, grading, filling and shaping or has been generally altered for urban development.

5.1.21 Candler-Urban Land Complex (Unit 50)

The Candler component makes up 55 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 (or restricted depth) 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.

The Urban land component consists of areas where most of the surface is covered with impervious materials, such as buildings and paved areas. This land type consists of areas where the original soil has been modified through cutting, grading, filling and shaping or has been generally altered for urban development.

5.1.22 Arents-Urban Land Complex (Unit 59)

The Arents component makes up 55 percent of the map unit. Slopes are 0 to 5 percent. This component is on fills, rises 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 high. Available water to a depth of 60 inches (or restricted depth) 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 27 inches during June, July, August, September, October, and November.

The Urban land component consists of areas where most of the surface is covered with impervious materials, such as buildings and paved areas. This land type consists of areas where the original soil has been modified through cutting, grading, filling and shaping or has been generally altered for urban development.

5.1.23 Tavares-Urban Land Complex (Unit 63)

The Tavares component makes up 75 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 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 (or restricted depth) 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.

The Urban land component consists of areas where most of the surface is covered with impervious materials, such as buildings and paved areas. This land type consists of areas where the original soil has been modified through cutting, grading, filling and shaping or has been generally altered for urban development.

5.1.24 Millhopper Fine Sand (Unit 76)

The Millhopper 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 and loamy 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 (or restricted depth) is 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 January, February, July, August, September, October, November, and December. Organic matter content in the surface horizon is about 1 percent.

5.2 General Soil Properties Presented in USDA Soil Survey

Additional information regarding the soils and groundwater conditions for the above soil mapping units was obtained from the Polk County Soil Surveys published by USDA-NRCS and the Web Soil Survey and is presented in **Tables 5-1** and **5-2** as follows:

Table 5-1
Polk County USDA NRCS Soil Survey 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	Candler Sand	A	> 6.0	Sand
7	Pomona Fine Sand	A/D	0.5-1.5, 0.0-1.0	Fine Sand to Sand to Fine Sand to Fine Sandy Loam to Loamy Sand
13	Samsula Muck	A/D	+2.0-0.0	Muck to Sand
14	Sparr Sand	A/D	1.5-3.5	Sand to Sandy Clay Loam
15	Tavares Fine Sand	A	3.5-6.0	Fine Sand
16	Urban Land	Data not provided for Urban Land		
17	Smyrna and Myakka Fine Sands	A/D	0.5-1.5, 0.0-1.0	Fine Sand
21	Immokalee Sand	B/D	0.5-1.5, 0.0-1.0	Sand
23	Ona-Ona, wet, Fine Sand	B/D	0.5-1.5,0.0-1.5	Fine Sand
25	Placid and Myakka Fine Sands	A/D	+2.0-0.0	Fine Sand
26	Lochloosa Fine Sand	C	2.5-5.0	Fine Sand to Sandy Clay Loam
30	Pompano Fine Sand	A/D	0.0-0.5	Fine sand
31	Adamsville Fine Sand	A/D	1.5-3.5	Fine Sand
32	Kaliga Muck	C/D	+2.0-0.0	Muck to Fine Sandy Loam to Sandy Clay Loam
35	Hontoon Muck	A/D	+2.0-0.0	Muck to Sandy Loam
36	Basinger mucky Fine Sand	A/D	+2.0-0.0	Mucky Fine Sand to Fine Sand
40	Wauchula Fine Sand	C/D	0.5-1.5, 0.0-1.0	Fine Sand to Sandy Clay Loam to Fine Sandy Loam
42	Felda Fine Sand	A/D	0.0-1.0	Fine Sand to Sandy Clay Loam to Sandy Loam
47	Zolfo Fine Sand	A	1.5-3.5	Fine Sand
49	Adamsville-Urban Land Complex	A	2.0-3.5	Fine Sand

*Depth to High Water Table is also commonly known as the depth to the Seasonal High Groundwater Table.

Table 5-1 (Cont.)
Polk County USDA NRCS Soil Survey 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)
50	Candler-Urban Land Complex	A	>6.0	Sand
59	Arents-Urban Land Complex	A	1.5-3.0	Sand
63	Tavares-Urban Land Complex	A	3.5-6.0	Fine Sand
76	Millhopper Fine Sand	A	3.5-6.5	Fine Sand to Sandy Clay Loam

*Depth to High Water Table is also commonly known as the depth to the Seasonal High Groundwater Table.

Table 5-2
Polk County USDA NRCS Soil Survey Information

USDA Map Symbol and Soil Name	Soil Classification			
	Depth (in)	USCS	AASHTO	Permeability (in/hr)
(3) Candler	0-6	SP-SM, SP	A-3	6.0-50.0
	6-63	SP-SM, SP	A-2-4, A-3	6.0-50.0
	63-80	SP-SM	A-2-4, A-3	6.0-20.0
(7) Pomona, non-hydric - Pomona, hydric	0-6	SP-SM, SP	A-2-4, A-3	6.0-20.0
	6-21	SP-SM, SP	A-2-4, A-3	6.0-20.0
	21-26	SP-SM, SM	A-2-4, A-3	0.6-6.0
	26-48	SP-SM, SP	A-2-4, A-3	2.0-20.0
	48-73	SC-SM, SC, SM	A-2, A-4, A-6	0.2-2.0
	73-80	SP-SM, SM	A-2-4, A-3	0.6-6.0
	0-6	SP-SM, SP	A-2-4, A-3	6.0-20.0
	6-21	SP-SM, SP	A-2-4, A-3	6.0-20.0
	21-26	SP-SM, SM	A-2-4, A-3	0.6-6.0
	26-48	SP-SM, SP	A-2-4, A-3	2.0-20.0
	48-73	SC-SM, SC, SM	A-2, A-4, A-6	0.2-2.0
	73-80	SP-SM, SM	A-2-4, A-3	0.6-6.0

Table 5-2 (Cont.)
Polk County USDA NRCS Soil Survey Information

USDA Map Symbol and Soil Name	Soil Classification			
	Depth (in)	USCS	AASHTO	Permeability (in/hr)
(13) Samsula	0-24	PT	A-8	6.0-20.0
	24-32	PT	A-8	6.0-20.0
	32-35	SP-SM, SM	A-2-4, A-3	6.0-20.0
	35-44	SP-SM, SM	A-2-4, A-3	6.0-20.0
	44-80	SP-SM, SM	A-2-4, A-3	6.0-20.0
(14) Sparr	0-8	SP-SM, SM	A-2-4, A-3	6.0-20.0
	8-57	SP-SM, SM	A-2-4, A-3	6.0-20.0
	57-80	SC-SM, SC	A-2-4, A-2-6, A-7-6	0.6-2.0
(15) Tavares	0-5	SP-SM, SP	A-2-4, A-3	6.0-20.0
	5-80	SP-SM, SP, SM	A-2-4, A-3	6.0-20.0
(16) Urban Land	Data not provided for Urban Land			
(17) Myakka – Smyrna, non-hydric – Smyrna, hydric	0-7	SP-SM, SP	A-3	6.0-20.0
	7-25	SP-SM, SP	A-3	6.0-20.0
	25-36	SP-SM, SM	A-2-4, A-3	0.6-6.0
	36-80	SP-SM, SP	A-3	6.0-20.0
	0-4	SP-SM, SP	A-2-4, A-3	6.0-20.0
	4-12	SP-SM, SP	A-2-4, A-3	6.0-20.0
	12-25	SP-SM, SM	A-2-4, A-3	0.6-6.0
	25-42	SP-SM, SP	A-3	6.0-20.0
	42-48	SP-SM, SM	A-2-4, A-3	0.6-6.0
	48-80	SP-SM, SM	A-2-4, A-3	6.0-20.0
	0-4	SP-SM, SP	A-2-4, A-3	6.0-20.0
	4-12	SP-SM, SP	A-2-4, A-3	6.0-20.0
	12-25	SP-SM, SM	A-2-4, A-3	0.6-6.0
	25-42	SP-SM, SP	A-3	6.0-20.0
	42-48	SP-SM, SM	A-2-4, A-3	0.6-6.0
	48-80	SP-SM, SM	A-2-4, A-3	6.0-20.0

Table 5-2 (Cont.)
Polk County USDA NRCS Soil Survey Information

USDA Map Symbol and Soil Name	Soil Classification			
	Depth (in)	USCS	AASHTO	Permeability (in/hr)
(21) Immokalee, non-hydric - Immokalee, hydric	0-7	SP-SM, SP	A-3	6.0-20.0
	7-39	SP-SM, SP	A-3	6.0-20.0
	39-58	SP-SM, SM	A-2-4, A-3	0.6-2.0
	58-66	SP-SM, SP	A-3	6.0-20.0
	66-80	SP-SM, SM	A-2-4, A-3	0.6-2.0
	0-7	SP-SM, SP	A-3	6.0-20.0
	7-39	SP-SM, SP	A-3	6.0-20.0
	39-58	SP-SM, SM	A-2-4, A-3	0.6-2.0
	58-66	SP-SM, SP	A-3	6.0-20.0
	66-80	SP-SM, SM	A-2-4, A-3	0.6-2.0
(23) Ona, - Ona, wet	0-9	SP-SM, SM	A-2-4	6.0-20.0
	9-16	SP-SM, SM	A-2-4	0.6-2.0
	16-80	SP-SM, SM	A-2-4, A-3	6.0-20.0
	0-9	SP-SM, SM	A-2-4	6.0-20.0
	9-16	SP-SM, SM	A-2-4	0.6-2.0
	16-80	SP-SM, SM	A-2-4, A-3	6.0-20.0
(25) Placid, depressional - Myakka, depressional	0-18	SP-SM, SM, SP	A-2-4, A-3	6.0-20.0
	18-80	SP-SM, SM, SP	A-2-4, A-3	6.0-20.0
	0-3	SP-SM, SP	A-3	6.0-20.0
	3-25	SP-SM, SP	A-3	6.0-20.0
	25-35	SP-SM, SM	A-2-4, A-3	0.6-6.0
	35-80	SP-SM, SP	A-3	6.0-20.0
(26) Lochloosa	0-6	SP-SM, SM	A-2-4, A-3	2.0-20.0
	6-36	SP-SM, SM	A-2-4, A-3	2.0-20.0
	36-65	SC-SM, SC	A-2-6, A-4, A-6	0.1-0.2
	65-80	SC-SM, SC	A-2-6, A-4, A-6	0.1-0.2
(30) Pompano	0-15	SP-SM, SP	A-3	6.0-20.0
	15-80	SP-SM, SP	A-3	6.0-20.0
(31) Adamsville	0-7	SP-SM, SM, SP	A-2-4, A-3	6.0-20.0
	7-20	SP-SM, SM, SP	A-2-4, A-3	6.0-20.0
	20-80	SP-SM, SM, SP	A-2-4, A-3	6.0-20.0
(32) Kaliga	0-25	PT	A-8	6.0-20.0
	25-35	SC, SM	A-2-4, A-4, A-7-6	0.6-6.0
	35-60	CL, SC-SM	A-4, A-6	0.1-0.2
	60-80	CL, SC, SM	A-4, A-6	2.0-20.0

Table 5-2 (Cont.)
Polk County USDA NRCS Soil Survey Information

USDA Map Symbol and Soil Name	Soil Classification			
	Depth (in)	USCS	AASHTO	Permeability (in/hr)
(35) Hontoon	0-75	PT	A-8	6.0-20.0
	75-80	SC-SM, SC, SM	A-2-4, A-6	6.0-20.0
(36) Basinger	0-7	SP-SM, SM	A-2-4, A-3	6.0-20.0
	7-19	SP-SM, SM	A-2-4, A-3	6.0-20.0
	19-39	SP-SM, SM	A-2-4, A-3	6.0-20.0
	39-80	SP-SM, SM	A-2-4, A-3	6.0-20.0
(40) Wauchula, non-hydric - Wauchula, hydric	0-7	SP-SM	A-2-4, A-3	6.0-20.0
	7-18	SP-SM	A-3, A-2-4	6.0-20.0
	18-26	SP-SM, SM	A-2-4, A-3	0.2-6.0
	26-33	SP-SM, SM	A-2-4, A-3	2.0-6.0
	33-70	SC-SM, SC, SM	A-2-4, A-2-6, A-4, A-6	0.1-0.2
	70-80	SC-SM, SC	A-2-4, A-2-6	0.6-6.0
	0-7	SP-SM	A-2-4, A-3	6.0-20.0
	7-18	SP-SM	A-3, A-2-4	6.0-20.0
	18-26	SP-SM, SM	A-2-4, A-3	0.2-6.0
	26-33	SP-SM, SM	A-2-4, A-3	2.0-6.0
	33-70	SC-SM, SC, SM	A-2-4, A-2-6, A-4, A-6	0.1-0.2
	70-80	SC-SM, SC	A-2-4, A-2-6	0.6-6.0
(42) Felda	0-5	SP-SM, SP	A-3	6.0-20.0
	5-22	SP-SM, SP	A-3	6.0-20.0
	22-50	SC-SM, SC, SM	A-2-4, A-2-6	0.6-6.0
	50-80	SP-SM, SP	A-2-4, A-3	6.0-20.0
(47) Zolfo	0-5	SP-SM, SM	A-2-4, A-3	6.0-20.0
	5-59	SP-SM, SM	A-2-4, A-3	6.0-20.0
	59-80	SP-SM, SM	A-2-4, A-3	0.6-2.0
(49) Adamsville – Urban Land	0-6	SP-SM	A-2-4, A-3	6.0-20.0
	6-80	SP-SM, SP	A-2-4, A-3	6.0-20.0
	Data not provided for Urban Land			
(50) Candler - Urban Land	0-6	SP-SM, SP	A-3	6.0-20.0
	6-63	SP-SM, SP	A-3	6.0-20.0
	63-80	SP-SM	A-2-4, A-3	6.0-20.0
	Data not provided for Urban Land			
(59) Arents - Urban Land	0-80	SP-SM, SP	A-2-4, A-3	6.0-20.0
	Data not provided for Urban Land			

Table 5-2 (Cont.)
Polk County USDA NRCS Soil Survey Information

USDA Map Symbol and Soil Name	Soil Classification			
	Depth (in)	USCS	AASHTO	Permeability (in/hr)
(63) Tavares - Urban land	0-8	SP-SM, SP	A-3	6.0-50.0
	8-80	SP-SM, SP	A-3	6.0-50.0
	Data not provided for Urban Land			
(76) Millhopper	0-7	SP-SM, SM	A-2-4	6.0-20.0
	7-59	SC-SM, SP-SM, SM	A-2-4	6.0-20.0
	59-64	CL, SC	A-2-4, A-6	2.0-6.0
	64-80	CL, SC	A-7-6, A-6	0.6-2.0

6.0 PRELIMINARY ENGINEERING EVALUATIONS

6.1 General Based on USDA Soil Survey

Based upon the USDA-NRCS Soil Surveys for Polk County, sandy soils occasionally underlain by silty to clayey (loam) soils are reported along the majority of the project corridor to depths of 80 inches below the natural ground surface. Some areas along the project corridor are expected to contain organic material/muck.

In general, the sandy soils are suitable for supporting proposed roadway embankments after proper subgrade preparation including removal and replacement of unsuitable materials. Areas along the project corridor where shallow groundwater conditions, clay soils, and muck may impact the project are detailed below.

6.1.1 Shallow Groundwater

The Seasonal High Groundwater Table (SHGWT) for the soil units presented above is reported to range from at or above the predevelopment natural grade to a depth of 6 feet or greater below the predevelopment natural grade within the project limits. According to the USDA-NRSC Soil Survey, the project corridor includes both excessively drained soils with a deep water table to very poorly drained soils with shallow water table levels. One of the **USDA Soil Survey** maps provided with this report is shaded blue for the soil types reported with a Seasonal High Groundwater Table within 1.5 feet of 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 need to be established by the project biologist utilizing biological indicators. Additionally, drainage design will need to consider the impact of shallow groundwater levels on stormwater management facilities.

6.1.2 Near Surface Clayey Soils

Shallow plastic soils are reported at an isolated area along the project alignment near Vista Del Lago Drive. The following soil mapping unit noted plastic/clayey soils (A-2-4, A-2-6) at depths within 24 inches of natural grades:

- Felda Fine Sand (Unit 42)

Plastic soils have limitations related to base clearance and are also poorly drained. Separation between plastic clayey soils and the roadway pavement sections should be in accordance with FDOT Standard Plans, Indices 120-001 and 120-002.

One of the **USDA Soil Survey** maps provided with this report is shaded orange for the soil type reported with plastic/clayey soils (A-2-4, A-2-6) at depths within 24 inches of natural grades.

6.1.3 Organic Soils

According to the USDA, organic soil mapping units are reported along the proposed roadway alignment and within select pond alternatives. The following soil mapping units noted organic/muck (A-8) soils from the predevelopment natural ground surface to up to 75 inches below the ground surface within the project limits:

- Samsula Muck (Unit 13)
- Kaliga Muck (Unit 32)
- Hontoon Muck (Unit 35)

Organic/muck (A-8) soil should be removed in accordance with FDOT Standard Plans, Index 120-002 and replaced with backfill in accordance with Index 120-001.

One of the **USDA Soil Survey** maps provided with this report is shaded red for the soil types reported to contain organic/muck soils.

6.2 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, organic soils, and unsuitable materials in accordance with FDOT Standard Plans, Index 120-002. Backfill embankment materials should consist of materials conforming to the FDOT Standard Plans, Index 120-001. Clearing and grubbing and compaction should be accomplished in accordance with the FDOT Standard Specifications.

The overall site preparation and mechanical densification work for the construction of the proposed roadway improvements should be in accordance with FDOT Standard Specifications and Standard Plans Index requirements. In general, the existing subsurface soils appear

capable of supporting the construction of the proposed roadway improvements subject to the above geotechnical considerations and after proper subgrade preparation.

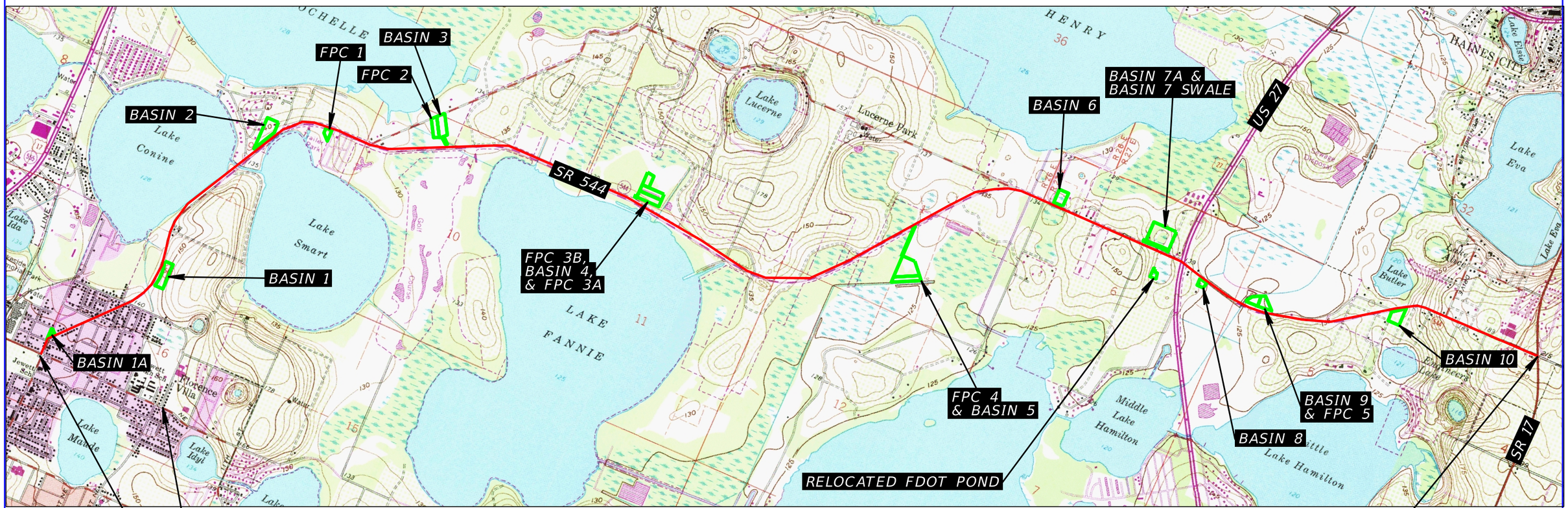
7.0 LIMITATIONS

Our 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 preliminary information on the existing subsurface conditions along the project alignment based on a review of the Polk County Soil Survey published by the USDA-NRCS 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. 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 conditions 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 and stormwater management areas.

Our 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.

Appendix A



REFERENCE: USGS QUADRANGLE MAP OF "WINTER HAVEN, FLORIDA"

TOWNSHIP:	28S	28S
RANGE:	26E	27E
SECTION:	1, 2, 3, 9, 10, 11, 16, 17	5, 6

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

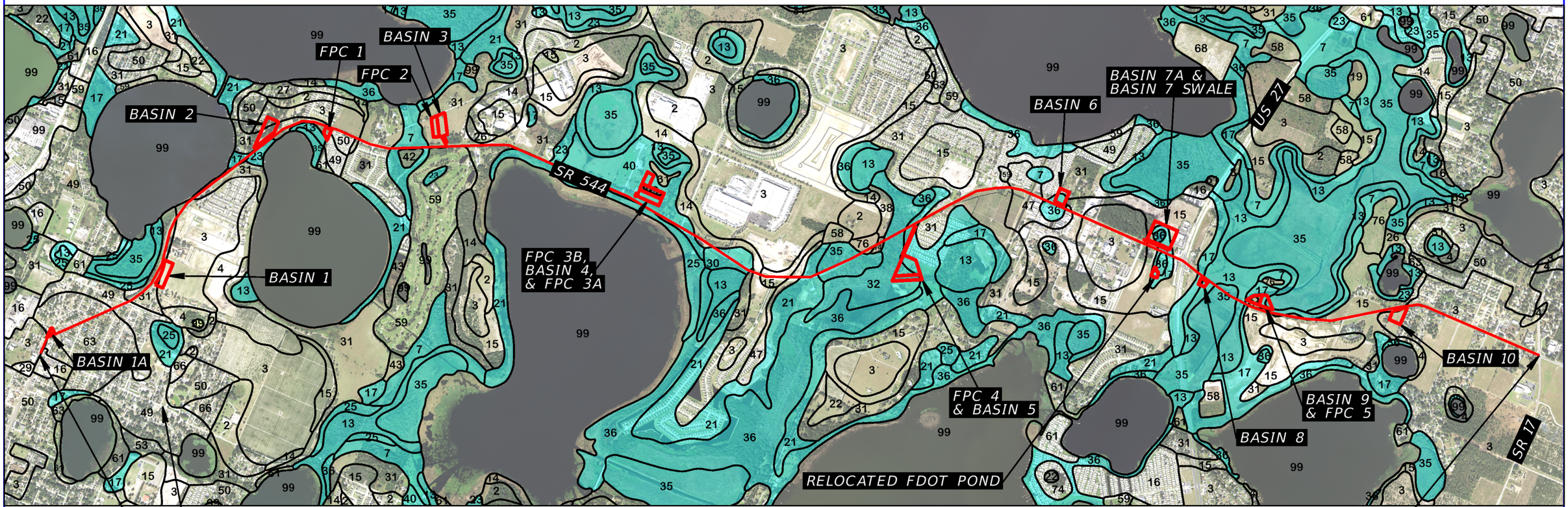
TIERRA, INC.
7351 TEMPLE TERRACE HIGHWAY
TAMPA, FLORIDA 33637

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 544	POLK	440273-1-22-01

USGS QUADRANGLE MAP

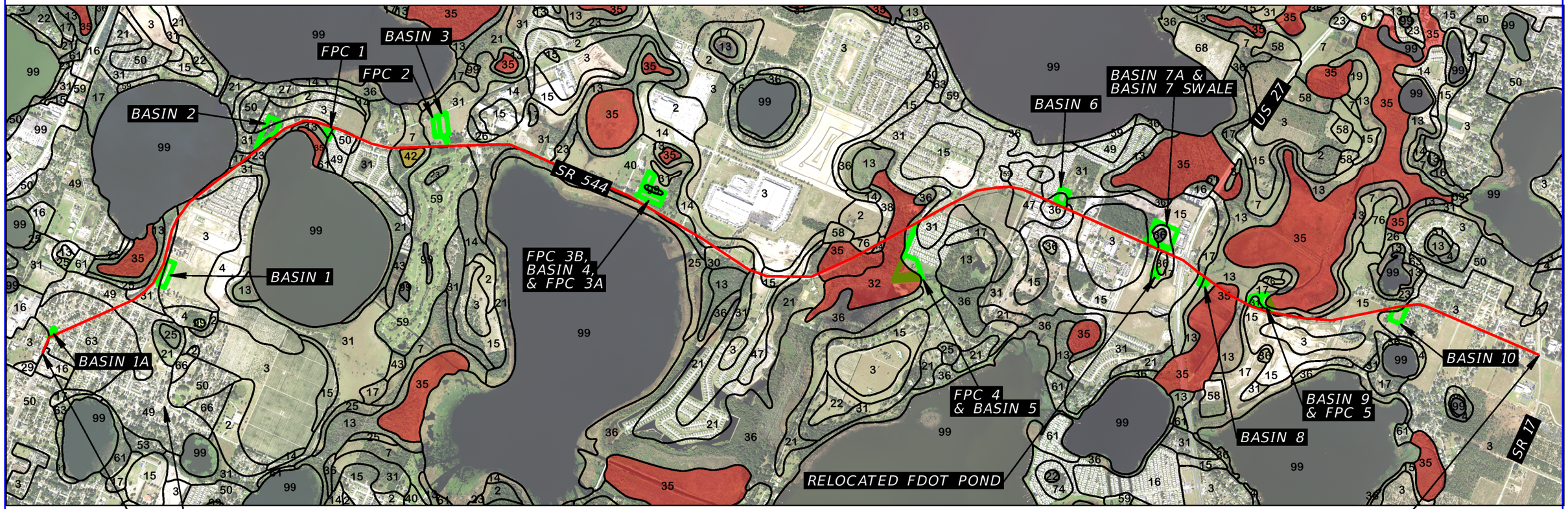
SHEET NO.



REFERENCE: USDA SOIL SURVEY OF POLK COUNTY, FLORIDA

SEASONAL HIGH GROUNDWATER ABOVE NATURAL GRADES TO WITHIN 1.5 FEET OF NATURAL GRADES

REVISIONS				TIERRA, INC. 7351 TEMPLE TERRACE HIGHWAY TAMPA, FLORIDA 33637	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			USDA SOIL SURVEY	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
					SR 544	POLK	440273-1-22-01		



REFERENCE: USDA SOIL SURVEY OF POLK COUNTY, FLORIDA

ORGANIC SOILS (A-8) AT THE NATURAL GROUND SURFACE TO GREATER THAN 6 FEET BELOW NATURAL GRADES

CLAYEY SOILS WITHIN 2 FEET OF NATURAL GRADES

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

TIERRA, INC.
7351 TEMPLE TERRACE HIGHWAY
TAMPA, FLORIDA 33637

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 544	POLK	440273-1-22-01

USDA SOIL SURVEY

SHEET NO.