August 12, 2013

Inwood Consulting Engineers
3000 Dovera Drive, Suite 200
Oviedo, FL 32765

Attn: David S. Dangel, P.E.
Associate Principle

RE: SR 33 PD&E Study
From Old Combee Road to North of Tomkow Road
Polk County, Florida
FPID No. 430185-1-22-01
Tierra Project No. 6511-12-026

Mr. Dangel:

Tierra, Inc. (Tierra) has completed a Geotechnical Memorandum Report to support the PD&E Study for the above referenced project. The results of our review of available existing soils information and our preliminary field exploration program along with preliminary geotechnical recommendations are presented in this report.

Tierra, Inc. appreciates the opportunity to be of service to Inwood Consulting Engineers and the Florida Department of Transportation on this project. If you have any questions or comments regarding this information, please contact our office at (813) 989-1354.

Sincerely,

TIERRA, INC.

Luis (Tony) Almodovar, E.I.
Geotechnical Engineer Intern

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Section 1.0
INTRODUCTION

1.1 PROJECT DECRIPTION

The Florida Department of Transportation, District One, is conducting a Project Development and Environmental (PD&E) Study regarding the proposed widening of State Road (SR) 33 in Polk County. The limits of this project on SR 33 are from Old Combee Road to north of Tomkow Road, which is a distance of approximately 4.3 miles. The location and limits of this study are shown in the project location map as **Figure 1-1** in **Appendix A**.

The recommended action includes capacity improvements consisting of widening SR 33 from a two-lane undivided roadway to a four-lane divided roadway. Reconstruction of the SR 33 interchange with I-4 is also proposed. The interchange improvements will involve replacing the I-4 bridges over SR 33 and reconstructing portions of I-4 approaching the interchange.

1.2 PROJECT PURPOSE AND NEED

SR 33 serves as a primary north-south connection between Lakeland and Interstate 4 (I-4). The project will improve the functional viability of SR 33 as a local regional travel alternative to I-4. SR 33 provides connectivity to University Boulevard which serves the planned Williams DRI, Polk Commerce Center DRI and the future Florida Polytechnic campus. University Boulevard and SR 33 will serve as the most direct link between these new residential and commercial centers and north and central Lakeland. The project provides increased capacity along SR 33 to meet the project future travel demand.

Improvements to the SR 33 interchange with I-4 are also required. Currently, I-4 crosses over SR 33 with two parallel, three lane bridges. There are deficiencies with the existing interchange. First, the existing vertical clearance over SR 33 does not meet the minimum required 16.5 feet of clearance and is as low as 14.9 feet. Maintaining this substandard vertical clearance would require the approval of a design exception which will not be approved by the Federal Highway Administration. Second, the pier footings have less than the minimum required depth of cover of three feet with cover depths as shallow as 1.892 feet. The horizontal clearance between the center pier and the intermediate piers will not accommodate the future four lane roadway. Finally, the existing k-values for the crest and sag vertical curves on I-4 approaching SR 33 are appropriate for 55 miles per hour (mph) and 60 mph design speeds, not for the 70 mph design speed required for the interstate.

1.3 TYPICAL SECTION ALTERNATIVES

The proposed roadway typical section for this project is a suburban typical section that would include two 12-foot travel lanes in each direction separated by a 30-foot median. The proposed improvements also include a four-foot inside paved shoulder and a five-foot outside paved shoulder in each direction. An open drainage system will collect stormwater runoff and convey it to off-site ponds and/or linear ponds. A 10-foot-wide multi-use path is proposed along the south side of the road between SR 659 (Combee Road) and University Boulevard. A five-foot sidewalk is planned along the north side of the road from University Boulevard to north of Tomkow Road. This typical section can be constructed within the existing 200 feet right-of-way. The design speed for this typical section is 55 mph. Two variations of this typical section are being considered. These include full reconstruction of the roadway and a concept to save the existing roadway to serve as half of the future four-lane roadway.

Section 2.0
PROJECT PURPOSE AND SCOPE OF SERVICES

The geotechnical PD&E study was performed to obtain information on the existing subsurface conditions along the roadway alignment to assist in the preparation of the PD&E Report for the project. The following services were provided:

- Reviewed published information on topographic, soils and groundwater conditions. Soil, groundwater and regional geology information was obtained from the Web Soil Survey of Polk County, Florida published by the United States Department of Agriculture (USDA) – Natural Resource Conservation Service (NRCS). Topographic information was obtained from "Lakeland, Florida" and "Providence, Florida" Quadrangle maps published by United States Geological Survey (USGS).

- Conducted a visual reconnaissance of the project site, located and coordinated utility clearance.

- The geotechnical services were performed in general accordance with FDOT guidelines and the project scope of services.

- Performed a preliminary geotechnical field study for the proposed roadway consisting of hand auger borings and subsurface sampling. A total of thirteen (13) hand auger borings were performed along the project alignment to depths of approximately 5 to 9.5 feet below the existing ground surface.

- Visually examined the recovered soil samples in the laboratory. Performed laboratory tests on selected representative samples to develop the soil legend for the project using the American Association of State Highway and Transportation Officials (AASHTO) Soil Classification System.

- Prepared this Geotechnical Memorandum Report summarizing the course of study pursued for the PD&E Corridor Study.

3.1 REGIONAL GEOLOGY

The following information is as presented in the Soil Survey of Polk County, Florida published by the USDA/SCS.

The surface and near surface sediments in Polk County consist of quartz sand, clay, phosphorite, limestone and dolomite. These sediments range in age from late Eocene age to Holocene age. The Eocene Series consists of the Oldsmar, Avon Park, and Ocala Group limestones. Essentially all of Polk County is underlain by limestone of the Ocala Group. The Suwannee limestone is throughout the western part of Polk County but does not extend to the northern and eastern parts because of the erosion on the flanks of the Ocala uplift. Above the Suwannee Limestone and the Ocala Group is the Hawthorn Group, which consists of the Arcadia Formation and the Peace River formation. Above the Hawthorn Group are the undifferentiated surficial sand, clayey sand and clay, which blanket essentially all of Polk County.

3.2 USGS TOPOGRAPHIC SURVEY

The USGS topographic survey maps titled “Lakeland, Florida” and “Providence, Florida” were reviewed. The natural ground surface elevations appear to be within a range of about +130 to +150 feet National Geodetic Vertical Datum of 1929 (NGVD29). A reproduction of the USGS maps is presented on **Figure 2** in **Appendix A**.

3.3 USDA SOIL SURVEY

Based on a review of the Soil Survey for Polk County published by the USDA NRCS, it appears that there are seventeen primary (17) soil-mapping units noted along the project corridor. The general soil descriptions as described in the Soil Survey are presented in the table below.

SUMMARY OF USDA SOIL SURVEY
POLK COUNTY, FLORIDA

USDA Map Symbol and Soil Name	Depth (in)	Soil Classification		Permeability (in/hr)	pH	Seasonal High Water Table		Risk of Corrosion	
		USCS	AASHTO			Depth (feet)	Months	Uncoated Steel	Concrete
(3) Candler Sand	0-6	SP, SP-SM	A-3	6.0 - 20.0	4.5-6.0	>6.0	Jan-Dec	Low	High
	6-63	SP, SP-SM	A-3	6.0 - 20.0	4.5-6.0				
	63-80	SP-SM	A-2-4, A-3	6.0 - 20.0	4.5-6.0				
(6) Eaton Mucky Fine Sand, Depressional	0-6	SP-SM	A-2-4, A-3	6.0 - 20.0	4.5-6.0	+2.0-0	June-Feb	High	High
	6-29	SM, SP-SM	A-2-4, A-3	6.0 - 20.0	4.5-6.0				
	29-33	SC	A-4, A-6, A-7	0.06 - 0.2	4.5-6.0				
	33-80	CH, CL, SC	A-7	0.06 - 0.2	4.5-6.0				

SUMMARY OF USDA SOIL SURVEY
POLK COUNTY, FLORIDA

USDA Map Symbol and Soil Name	Depth (in)	Soil Classification		Permeability (in/hr)	pH	Seasonal High Water Table		Risk of Corrosion	
		USCS	AASHTO			Depth (feet)	Months	Uncoated Steel	Concrete
(7) Pomona Fine Sand	0-6	SP, SP-SM	A-2-4, A-3	6.0 - 20.0	3.5-6.0	0.0-1.5	June-Oct	High	High
	6-21	SP, SP-SM	A-2-4, A-3	6.0 - 20.0	3.5-6.0				
	21-26	SM, SP-SM	A-2-4, A-3	0.6 - 6.0	3.5-6.0				
	26-48	SP, SP-SM	A-2-4, A-3	2.0 - 20.0	3.5-6.0				
	48-73	SC, SP-SM, SM	A-2, A-4, A-6	0.2 - 2.0	3.5-6.0				
	73-80	SM, SP-SM	A-2-4, A-3	0.6 - 6.0	3.5-6.0				
(8) Hydraquents, Clayey	0-80	CH	A-7	0.001 - 0.06	7.9-8.4	+2.0-0.0	Jan-Dec	High	Low
(9) Lynne Sand	0-5	SP, SP-SM	A-3	6.0 - 20.0	3.5-6.5	0.0-1.5	June-Oct	High	High
	5-21	SP, SP-SM	A-3	6.0 - 20.0	3.5-6.5				
	21-28	SM, SP-SM	A-2-4, A-3	0.6 - 2.0	3.5-6.5				
	28-33	SP-SM	A-2-4, A-3	6.0 - 20.0	3.5-6.5				
	33-80	CH, CL, SC	A-6, A-7	0.2 - 2.0	3.5-6.5				
(12) Neilhurst Sand	0-3	SP, SP-SM	A-2-4, A-3	20.0 - 50.0	5.1-6.5	>6.0	Jan-Dec	Low	High
	3-80	SP, SP-SM	A-2-4, A-3	20.0 - 50.0	5.1-6.5				
(15) Tavares Fine Sand	0-8	SP, SP-SM	A-3	6.0 - 50.0	3.5-6.0	3.5->6.0	June-Dec	Low	High
	8-80	SP, SP-SM	A-3	6.0 - 50.0	3.5-6.0				
(17) Symrna and Myakka Fine Sands	0-7	SP, SP-SM	A-3	6.0 - 20.0	3.5-6.5	0.5-1.5	June-Oct	High	High
	7-25	SP, SP-SM	A-3	6.0 - 20.0	3.5-6.5				
	25-36	SM, SP-SM	A-2-4, A-3	0.6 - 6.0	3.5-6.5				
	36-80	SP, SP-SM	A-3	6.0 - 20.0	3.5-6.5				
	0-4	SP, SP-SM	A-2-4, A-3	6.0 - 20.0	3.5-7.3	0.0-1.5	June-Dec	High	High
	4-12	SP, SP-SM	A-2-4, A-3	6.0 - 20.0	3.5-7.3				
	12-25	SM, SP-SM	A-2-4, A-3	0.6 - 6.0	3.5-7.3				
	25-42	SP, SP-SM	A-3	6.0 - 20.0	3.5-7.3				
	42-48	SM, SP-SM	A-2-4, A-3	0.6 - 6.0	3.5-7.3				
	48-80	SM, SP-SM	A-2-4, A-3	6.0 - 20.0	3.5-7.3				
(22) Pomello Fine Sand	0-5	SP, SP-SM	A-3	20.0 - 50.0	4.5-6.0	2.0-3.5	July-Nov	Low	High
	5-48	SP, SP-SM	A-3	20.0 - 50.0	4.5-6.0				
	48-63	SM, SP-SM	A-2-4, A-3	2.0 - 6.0	4.5-6.0				
	63-80	SP, SP-SM	A-3	6.0 - 20.0	4.5-6.0				
(25) Placid and Myakka Fine Sands, Depressional	0-18	SM, SP, SP-SM	A-2-4, A-3	6.0 - 20.0	3.5-5.5	+2.0-0.0	Jan-Dec	High	High
	18-80	SM, SP, SP-SM	A-2-4, A-3	6.0 - 20.0	3.5-5.5				
	0-3	SP, SP-SM	A-3	6.0 - 20.0	3.5-6.5				
	3-25	SP, SP-SM	A-3	6.0 - 20.0	3.5-6.5	+2.0-0.0	Jan-Dec	High	High
	25-35	SM, SP-SM	A-2-4, A-3	0.6 - 6.0	3.5-6.5				
	35-80	SP, SP-SM	A-3	6.0 - 20.0	3.5-6.5				

SUMMARY OF USDA SOIL SURVEY
POLK COUNTY, FLORIDA

USDA Map Symbol and Soil Name	Depth (in)	Soil Classification		Permeability (in/hr)	pH	Seasonal High Water Table		Risk of Corrosion	
		USCS	AASHTO			Depth (feet)	Months	Uncoated Steel	Concrete
(29) St. Lucie Fine Sand	0-3	SP	A-3	20.0 - 50.0	3.5-7.3	>6.0	Jan-Dec	Low	Moderate
	3-80	SP	A-3	20.0 - 50.0	3.5-7.3				
(35) Hontoon Muck	0-75	PT	A-8	6.0 - 20.0	2.0-4.4	+2.0-0.0	Jan-Dec	High	High
	75-80	SM, SP, SP-SM	A-2-4, A-3	6.0 - 20.0	3.3-5.5				
(36) Basinger Mucky Fine Sand, Depressional	0-7	SP, SP-SM	A-2-4, A-3	6.0 - 20.0	3.5-7.6	+2.0-0.0	June-Feb	High	Moderate
	7-35	SP, SP-SM	A-2-4, A-3	6.0 - 20.0	3.5-7.6				
	35-45	SP, SP-SM	A-2-4, A-3	6.0 - 20.0	3.5-7.6				
	45-80	SP, SP-SM	A-2-4, A-3	6.0 - 20.0	3.5-7.6				
(51) Pomona Urban land complex	0-6	SP, SP-SM	A-2-4, A-3	6.0 - 20.0	3.5-5.5	0.0 - 1.5	June-Oct	High	High
	6-21	SP, SP-SM	A-2-4, A-3	6.0 - 20.0	3.5-5.5				
	21-26	SM, SP-SM	A-2-4, A-3	0.6 - 6.0	3.5-5.5				
	26-48	SP, SP-SM	A-2-4, A-3	2.0 - 20.0	3.5-6.0				
	48-73	SC, SC-SM, SM	A-2, A-4, A-6	0.2 - 2.0	3.5-5.5				
	73-80	SM, SP-SM	A-2-4, A-3	0.6 - 6.0	3.5-5.5				
(54) Pomello Urban land complex	0-5	SP, SP-SM	A-3	20.0 - 50.0	4.5-6.0	2.0 - 3.5	July-Nov	Low	High
	5-48	SP, SP-SM	A-3	20.0 - 50.0	4.5-6.0				
	48-63	SM, SP-SM	A-2-4, A-3	2.0 - 6.0	4.5-6.0				
	63-80	SP, SP-SM	A-3	6.0 - 20.0	4.5-6.0				
(68) Arents	-	-	-	-	-	-	-	-	-
(99) Water	-	-	-	-	-	-	-	-	-

Section 4.0
SUBSURFACE EXPLORATION

4.1 BORING LOCATION PLAN, UTILITY CLEARANCE AND TRAFFIC CONTROL

The boring location plan was generated based on our engineering judgment and discussions with project personnel. Generally, the borings were located in the field using hand-held Global Positioning System (GPS) equipment at the time of the field activities and the location of each boring was staked. Generally, the borings were performed at the proposed boring locations. When not possible, due to access or utility constraints, the boring locations were altered and the relocated GPS coordinates were recorded on the field boring logs.

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 the underground utilities during the boring process. Subsurface explorations were performed in general compliance with the applicable FDOT Roadway and Traffic Design Standard Indices.

4.2 ROADWAY BORINGS

To evaluate the subsurface conditions along the proposed project alignment, a total of thirteen (13) hand auger borings were performed to depths of approximately 5 to 9.5 feet below the existing ground surface. The hand auger borings were performed by manually twisting and advancing a bucket auger into the ground, typically in 4 to 6 inch increments. As each soil type was revealed, representative soil samples were placed in air-tight containers and returned to our office for confirmation of the field classification by a geotechnical engineer.

The GPS coordinates recorded in the field at the time of drilling along with the soil profile of each boring performed are shown on the **Roadway Soil Profiles Sheets** in **Appendix A**.

5.1 GENERAL

Representative soil samples collected from the borings were classified and stratified in general accordance with the 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, organic content, Atterberg Limits and natural moisture content determination.

5.2 TEST DESIGNATION

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

- 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).

- 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).

- Natural Moisture Content - The laboratory moisture content test consists of determining the percentage of moisture in selected samples in general accordance with the AASHTO test designation T-265 (ASTM test designation D-2216).

A summary of the laboratory test results for each soil stratum is presented on the **Roadway Soils Survey Sheet** in **Appendix A**. This sheet includes ranges of laboratory test results for different stratum soil samples collected from borings included in this report. A detailed summary of the laboratory tests with the corresponding results is also presented in **Appendix B**.

Section 6.0
RESULTS OF SUBSURFACE EXPLORATION

6.1 GENERAL SOIL CONDITION

The soil types encountered during exploration have been assigned a stratum number. The stratum numbers and soil types associated with this project are listed in the following table.

Stratum Number	Typical Soil Description	AASHTO Classification
1	Pale Brown to Gray SAND to SAND with SILT	A-3
2	Gray to Brown Silty to Clayey SAND	A-2-4/A-2-6
3	Dark Brown Slightly Organic Silty SAND	A-2-4/A-8
4	Brown to Gray Brown Clayey SAND to Sandy CLAY	A-2-6/A-6
5	Light Gray to Dark Brown Fine SAND with SILT to Silty SAND with CLAY Nodules, Cemented SAND, Limerock Fragments and Rocks, (FILL)	A-3/A-2-4

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 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.

The results of the borings performed for this project along with the boring location plans are presented on the **Roadway Soil Profiles Sheet** in **Appendix A** of this report.

6.2 GROUNDWATER

The groundwater table, when encountered, was measured at the boring locations during our field exploration. The depths to the encountered groundwater table at the roadway boring locations along the project alignment were found to range from 2.5 to 6 feet below the existing ground surface. As an exception, groundwater was not encountered at Borings SH-1 and AB-3 within the boring termination depths. The groundwater table measured at each of the boring locations is presented on the **Roadway Soil Profiles Sheet** in **Appendix A**.

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).

Section 7.0
PRELIMINARY ENGINEERING EVALUATIONS AND RECOMMENDATIONS

7.1 GENERAL

In general, the existing shallow subsurface soils encountered in the borings performed are suitable for supporting the proposed roadway construction after proper subgrade preparation. If buried organic soils, debris or unsuitable fills are encountered during construction, they should be removed and replaced with clean, compacted, sandy (SELECT) soils in accordance with the FDOT Standard Indices 500 and 505.

Similarly, plastic soils encountered within the embankment section should be removed and placed in areas not affecting pavement performance. The removal of top-soils and other surficial organic soils should be accomplished in accordance with the FDOT Standard Indices 500 and 505. Site preparation should consist of normal clearing and grubbing followed by compaction of subgrade soils. Backfill should consist of materials conforming to FDOT Standard Index 505 and compacted in accordance with Section 120-9 of the FDOT Standard Specifications for Road and Bridge Construction (SSRBC), latest edition.

7.2 ORGANIC SOILS

Muck (A-8)/Organic soils should be expected to occur on both sides of the alignment to the north side of the SR 33 and I-4 interchange. Based on the Polk County soil survey, muck depths could be expected to be approximately 75 inches below the natural ground surface at the following Soil Unit.

- Hontoon Muck (Unit 35)

Construction of the roadway within areas of muck will require removal of the muck in accordance with FDOT Index 500. During the project design, detailed design level muck delineation will be required as part of the design-level geotechnical services.

7.3 NEAR SURFACE CLAYEY SOILS

Near-surface, plastic/clayey soils (A-2-6, A-6 and A-7) were noted within 36 inches of the natural ground surface in several areas along the project. The following soil mapping units noted plastic/clayey soils within 36 inches:

- Eaton Mucky Fine Sand, Depressional (Unit 6)
- Hydraquents, Clayey (Unit 8)
- Lynne Sand (Unit 9)

Construction of the roadway within areas of clayey soils will require removal and embankment utilization in accordance with FDOT Index 500 and 505.

7.4 MINE SPOILS

The USDA Soil Survey identified four soil mapping units along the project corridor which are indicative of mine spoil soils resulting from past phosphate mining operations. The following soil mapping unit is associated with mine spoil waste consisting of phosphatic clay:

- Hydraquents, Clayey (Unit 8)

The following soil mapping units are typically associated with mine spoils consisting of sandy mine spoil and unidentified mine spoil:

- Neilhurst Sand, 1 to 5 Percent Slopes (Unit 12)
- Arents, 0 to 5 Percent Slopes (Unit 68)

The landform numbered 99 includes areas with water at the ground surface. Many of the water features in the project area are past mine cuts associated with phosphate mining that occurred in the project area.

The mine spoils are identified for a portion of the alignment extending from the south side of the SR 33/I-4 interchange heading south for approximately 2.2 miles on both sides of the alignment. Mine spoil soils with waste phosphatic clay can be very soft, weak and compressible. These soils can also be expected to have potential for instability and high potential for excessive settlement both total and differential without soil improvement measures such as surcharging or soil strengthening by means of ground improvements. During the project design, detailed design level delineation will be required as part of the design-level geotechnical services for the areas of the project that will encroach upon the mined land.

7.5 ESTIMATED SEASONAL HIGH GROUNDWATER

Seasonal high groundwater table levels were estimated at the boring locations along the roadway alignment. The estimated seasonal high groundwater table (SHGWT) levels ranged from above the ground surface to greater than 6 feet below the existing ground surface. Estimated Seasonal High Groundwater (SHGWT) levels along the proposed roadway alignment are summarized in **Appendix B.**

Roadway base to groundwater clearance will need to be evaluated. In several areas of the project alignment the existing SHGWT is above grade in natural areas. The SHWGT at these locations will have to be established by the project biologist utilizing biological indicators.

The SHGWT level was estimated based on a review of the soil samples, measured groundwater levels in the borings, the Polk County, Florida USDA Soil Survey information and the surrounding topography.

7.6 EMBANKMENT SETTLEMENT

As the project progresses to the design phase, and cross-sections are established, settlement analyses should be performed, if necessary, for representative critical embankment heights.

7.7 SLOPE STABILITY

As the project progresses to the design phase, and cross-sections are established, slope stability analyses should be performed for representative critical slopes.

7.8 CUT AND FILL SLOPES

It is anticipated that fills will be required for the proposed roadway construction. Fills heights are not known at this time. Once this information becomes available, slope stability construction recommendations should be completed during the project design.

7.9 TEMPORARY SIDE SLOPES

Side slopes for temporary excavations above the water table may stand near 1H:1.5V for short dry periods of time; however, it is recommended that temporary excavations below a 4-foot depth be cut on slopes of 2H:1V or flatter. Where restrictions will not permit slopes to be laid back as recommended above, the excavation should be shored in accordance with OSHA requirements. Furthermore, open-cut excavations exceeding 10 feet in depth should be properly dewatered and sloped 2H:1V or flatter or be benched using a bracing plan approved by a professional engineer licensed in the State of Florida. Excavated materials should not be stockpiled at the top of the slope within a horizontal distance equal to the excavation depth.

7.10 GROUNDWATER CONTROL

As the project progresses to the design phase, profile and grade lines should be established to meet the base to seasonal high groundwater clearance requirements as presented in the current FDOT Plans Preparation Manual (PPM).

7.11 PAVEMENT DESIGN CONSIDERATIONS

It is recommended that the subgrade soils be stabilized in accordance with the FDOT Design and Construction Specifications. It is likely that the amount of stabilizing material required will vary depending on the embankment fill borrow sources.

In accordance with FDOT guidelines, grades for this type of roadway should be set to provide a minimum separation per FDOT, PPM between the bottom of the base and the estimated seasonal high groundwater levels. Correspondingly, the base should remain equally above sustained water treatment levels in roadside ditches, making positive drainage of the ditches important. The choice of base material would depend upon the relationship of final roadway improvement grades and the bottom of the base to the estimated seasonal high groundwater table levels.

7.12 GENERAL ROADWAY CONSTRUCTION

The overall site preparation and mechanical densification work for the construction of the proposed roadway should be in accordance with the FDOT SSRBC and Standard Index requirements.

Section 8.0
REPORT LIMITATIONS

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices at the time of this report. Our geotechnical engineering evaluation of the site and subsurface conditions with respect to the planned roadway improvements, and our recommendations for site preparation and foundation construction are based upon the following: (1) site observations, (2) the field exploratory test data obtained during the geotechnical study, and (3) our understanding of the project information and anticipated grades as presented in this report. This company is not responsible for the conclusions, opinions or recommendations made by others based on these data.

The scope of the exploration was intended to allow a preliminary evaluation of the soil conditions within the influence of the proposed roadway alignment. The analyses and recommendations submitted in this report are based upon the anticipated location and type of construction and data obtained from the soil borings performed at the locations indicated and does not reflect any variations which may occur among these borings. Because the scope of the field exploration was very limited and preliminary in nature, design-level geotechnical explorations are necessary to be completed during project design.

The scope of services, included herein, did not include any environmental assessment for the presence or absence of hazardous or toxic materials in the soil, surface water, groundwater, air, on the site, below and around the site. Any statements in this report or on the boring logs regarding odors, colors, unusual or suspicious items and conditions are strictly for the information of Inwood Consulting Engineers and the FDOT.

APPENDIX A

- Project Location Map (**Figure 1-1**)
- NRCS Soil Survey Maps (**Figure 1**)
- USGS Vicinity Map (**Figure 2**)
- Roadway Soil Survey Sheet (**1 Sheet**)
- Boring Location Plan Sheets (**6 Sheets**)
- Roadway Soil Profiles Sheet (**1 Sheet**)

APPENDIX B

- Summary of Seasonal High Groundwater Table Estimates for Roadway
- Summary of Laboratory Classification Test Results

SUMMARY OF SEASONAL HIGH GROUNDWATER TABLE ESTIMATES FOR ROADWAY
SR 33 FROM OLD COMBEE ROAD TO NORTH OF TOMKOW ROAD
POLK COUNTY, FLORIDA
FPN: 430185-1-22-01
TIERRA PROJECT NO: 6511-12-026

Boring Number	Boring Location[1]		Boring Depth[2] (feet)	Date Boring Performed/ Groundwater Table Recorded	Groundwater Table Depth Below Ground Surface (feet)	Estimated Seasonal High Groundwater Table Depth Below Ground Surface (feet)[4]	USDA Soil Survey		Ground Surface Depth Below Edge of Pavement (feet)	Groundwater Table Depth Below Edge of Pavement (feet)	Estimated Seasonal High Groundwater Table Depth Depth Below Edge of Pavement (feet)
	Station	Offset					Soil Map Unit	Seasonal High Groundwater Table Depth Depth[3] (feet)			
SH-1	1272+80	80 LT	9.5	11/19/2012	GNE[5]	>6.0	3	>6.0	4.3[7]	>10[7]	>10[7]
SH-2	1337+10	7 RT	6	11/19/2012	3.6	2.0	68	2.0-4.0	3.2[7]	6.8[7]	5.2[7]
SH-3	1401+08	107 LT	7	11/19/2012	4.2	2.0	68	2.0-4.0	3.2[7]	7.4[7]	5.2[7]
AB-1	1441+05	245 RT	5	1/3/2012	4.5	1.5	7	3.5-6.0	3.8[7]	8.3[7]	5.3[7]
AB-2	1442+90	150 LT	5	1/3/2012	4.0	2.0	7	3.5-6.0	5.3[8]	9.3[8]	7.3[8]
AB-3	1445+50	430 RT	5	1/3/2012	GNE[5]	1.5	7	3.5-6.0	4.2[8]	>9.2[8]	5.7[8]
SH-4	1446+78	32 RT	5	11/19/2012	3.4	2.0	7	3.5-6.0	2.0[7]	5.4[7]	4.0[7]
AB-4	1450+18	32 LT	7	1/3/2012	6.0	2.0	7	3.5-6.0	0.8[7]	6.8[7]	2.8[7]
SH-5	1451+42	25 RT	7	11/19/2012	4.4	2.0	7	3.5-6.0	1.4[7]	5.8[7]	3.4[7]
AB-5	1454+20	120 RT	5	1/3/2012	2.5	ABG[6]	35	+2.0-0	3.6[8]	6.1[8]	<3.6[8]
AB-6	1453+70	115 LT	5	1/3/2012	4.0	0.5	35	+2.0-0	4.4[8]	8.4[8]	4.9[8]
SH-6	1457+60	70 LT	7	11/19/2012	4.2	0.5	35	+2.0-0	3.5[7]	7.7[7]	4.0[7]
SH-7	1472+30	70 LT	7	11/19/2012	4.2	1.0	6	+2.0-0	3.3[7]	7.5[7]	4.3[7]

[1] Station and Offset of the borings were estimated from the S.R. 33 survey baseline provided by Inwood Consulting Engineers.

[2] Depth below existing grades at time of field services.

[3] Seasonal high groundwater table depth as reported in the Soil Survey of Polk County, Florida published by the USDA NRCS.

[4] Seasonal high groundwater table depth estimated based on soil stratigraphy, measured groundwater levels from the borings, and the Polk County, Florida USDA NRCS Soil Survey information.

[5] GNE indicates groundwater table not encountered within depth of boring performed.

[6] ABG: At or above existing ground surface (SHGWT should be determined by the project biologist utilizing biological indicators).

[7] Referenced from SR 33 EOP.

[8] Referenced from adjacent ramp EOP.

Summary of Laboratory Test Results for Soil Classification
SR 33 PD&E Study from Old Combee Road to north of Tomkow Road PD&E
Polk County, Florida
FPID: 430185-1-22-01
Tierra Project No. 6511-12-026

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		
SH-1	1.0 - 2.0	1	A-3	100	96	84	62	9	-	-	-	-	-
SH-2	5.0 - 6.0	2	A-2-4	-	-	-	-	26	NP	NP	NP	-	16
SH-3	5.0 - 7.0	2	A-2-4	100	96	77	51	22	NP	NP	NP	-	18
SH-7	4.0 - 5.0	2	A-2-4	100	97	81	61	35	24	14	10	-	17
SH-6	3.0 - 3.5	3	A-2-4	-	-	-	-	20	-	-	-	4	20
SH-6	5.5 - 6.0	3	A-2-4	-	-	-	-	19	-	-	-	4	39
SH-7	0.0 - 0.5	3	A-2-4/A-8	-	-	-	-	17	-	-	-	5	20
SH-5	4.5 - 5.0	4	A-6	100	97	84	63	39	24	13	11	-	18