Report
Pavement and Geotechnical Engineering Services
Broken Oak Drive
Wildwood, Sumter County, Florida

Project Number: 07572627
September 8, 2021

Professional Service Industries, Inc.
1748 33rd Street, Orlando, FL 32839
Phone: (407) 304-5560
Fax: (407) 304-5561

Mr. Nicholas J. Mora, P.E.
Kimley-Horn
101 E Silver Springs Boulevard,
Suite 400, Ocala, FL, 34470

RE: Report
Pavement and Geotechnical Engineering Services
Broken Oak Drive
Wildwood, Sumter County, Florida

Dear Mr. Mora:

In general accordance with PSI Proposal No. 0757-326316 dated November 4, 2020 and authorization from Mr. Richard Busche, P.E. of Kimley-Horn, **Professional Service Industries, Inc. (PSI), an Intertek company,** has completed pavement and geotechnical engineering evaluations at the site of the referenced project. The subsurface exploration was conducted to develop design-level geotechnical engineering recommendations for the rehabilitation of the existing roadway.

PROJECT INFORMATION

The project involves the existing flexible pavement of Broken Oak Drive in Wildwood, Sumter County, Florida. More specifically, the project starts from the intersection of North Saint Clair Street with Broken Oak Drive and extends approximately 2,600 lineal feet to the east to the intersection with Powell Road. The referenced roadway is a rural roadway approximately 15 feet wide with no drainage or curb/gutter.

We understand the planned improvements are to rehabilitate the existing distressed roadway pavement and maintain the existing width of the roadway.

PSI was requested to conduct a pavement coring and evaluation program to provide pavement rehabilitation recommendations for the existing pavement.

The noted information/assumptions have been used for the purpose of preparing this report. If any of the stated information/assumptions are incorrect or have been changed, PSI should be notified so appropriate changes to our revised recommendations can be incorporated in this report.

REVIEW OF PUBLISHED DATA

USGS Topographic Map

The topographic survey map published by the USGS entitled "Wildwood, Florida" was reviewed for ground surface features in the vicinity of the proposed development. Based on this review, the natural ground surface elevations at the site are on the order of +60 to +75 feet National Geodetic Vertical Datum (NGVD) of 1929. **Figure 1** of the **Appendix A** contains an excerpt of the USGS topographic map for the site.

At the time of preparing this report, a site-specific topographic survey was not made available for PSI's review.

SCS Soil Survey

The "Soil Survey of Sumter County, Florida," published by the USDA SCS, was reviewed for general near-surface soil information within the general project vicinity. This information indicates that there are three soil groups within the vicinity of the proposed project. The general information provided by the SCS for the mapped soil units is summarized in the following table.

Soil Series	Depth (inches)	Unified Classification	USDA Seasonal High Groundwater Table
			Depth (feet)
4 - Candler fine sand, 0 to 5 percent slopes	0 to 80	A-3, A-2-4	> 6
11- Millhopper sand, 0 to 5 percent slopes	0 to 80	A-3, A-2-4, A-2-6, A-4, A-6	3.5 to 6
33- Sparr fine sand, bouldery subsurface, 0 to 5 percent slopes	0 to 80	A-3, A-2-4, A-2-6, A-4, A-6	1.5 to 3.5

Figure 2 of the **Appendix A** contains an excerpt of the USDA SCS soils map for the site.

FIELD EXPLORATION

General

As requested, PSI executed a program of limited pavement coring and subsurface exploration. PSI cored the existing asphalt pavement at seven (7) locations within the requested areas and measured the asphalt and base thickness and identified the type of the pavement materials. The asphalt pavement and base material were cored with a 6-inch diameter core barrel. The core holes were backfilled with cold patch asphalt prior to leaving the site. PSI also performed shallow manual auger boring through the subgrade in an attempt to measure the existing groundwater level and evaluate the subgrade materials. The approximate core and boring locations are presented on **Sheet 1** in **Appendix A**. The soil types encountered at the specific pavement core locations are presented in the form of soil profiles on **Sheet 2** of **Appendix A.** Included with the boring profiles is a legend describing the encountered soils in AASHTO format and results of PSI's laboratory testing.

Soil Conditions

Based on the pavement borings PSI completed for the project, subsurface conditions are relatively consistent along the limits of the roadway. In general, the upper 4 to 6 feet of the borings revealed a series of fine sands grading relatively clean to slightly silty in composition (i.e. A-3 material). The upper sands were underlain by a series of clayey soils ranging from clayey fine sand to sandy clay (i.e. A-2-6 and A-6 materials).

A detailed description of the individual pavement borings are shown as soil profiles on **Sheet 2** of the **Appendix A**.

The stratification presented is based on visual observation of the recovered soil samples, laboratory testing and interpretation of field logs by a geotechnical engineer. It should be noted that variations in the subsurface conditions are expected and may be encountered between and away from PSI's borings. Also, whereas the individual boring logs indicate distinct strata breaks, the actual transition between the soil layers may be more gradual than shown on the soil profiles.

PSI conducted two (2) Limerock Bearing Ratio (LBR) tests from subgrade soils at the location of cores BO-1 and BO-5. The samples comprised gray fine sand and revealed LBR values of 41 and 61, respectively. The LBR test results are also included in the **Appendix A**.

Groundwater Conditions

At the time of our fieldwork (May 26, 2021), groundwater was not encountered in PSI's borings.

The estimated normal seasonal high groundwater levels presented herein are based on the observed soil stratigraphy, conditions observed in the borings, USDA Soil Survey information, and our past experience in the project vicinity. In this regard, we estimate the normal seasonal high groundwater table will occur in the form of perched groundwater above the shallow confining layer soils at approximate elevations of 4 to 5 feet below the existing grades at the eastern side of the alignment (between approximately 300 feet east of North Saint Clair Street to Woodlane Avenue). The normal seasonal high groundwater table is estimated deeper than 6 feet close to the east end of the alignment. The western 200 to 300 feet of the alignment is anticipated to have a normal seasonal high groundwater table in the range 2 to 3 feet below existing grade.

In general, the estimated normal seasonal high groundwater level is not intended to define a limit or ensure that future seasonal fluctuations in groundwater levels will not exceed the estimated levels. Groundwater conditions will vary with environmental changes and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences, such as swales, ponds, drainage systems, underdrains and areas of covered soil (buildings, paved parking lots, sidewalks, etc.).

Pavement Cores

A list of asphalt and base thicknesses encountered in PSI's pavement cores/borings, are summarized as below:

Table 1: Pavement Core Data

Core No.	Core Name	Asphalt Thickness (inch)	Base Thickness (inch)	Type of Base Material
1	BO-1	2	7	Soil Cement
2	BO -2	1.5	6.5	Soil Cement
3	BO -3	1.5	4.5	Limerock
4	BO -4	2.25	6.5	Limerock
5	BO -5	2.25	13.5	Limerock
6	BO -6	1.75	14	Limerock
7	BO -6	3	17	Limerock

Photographs of the pavement cores, as well as photographs of the core locations, are included in **Appendix B**.

PAVEMENT EVALUATIONS

Based on the PSI's site visit on 5/25/2021, severe pavement distresses were observed along the roadway alignment, mainly between North Saint Clair Street and Wildwood Avenue. The distresses include reflective cracks (approximate location of cores BO-1 and BO-2) as well as longitudinal and transverse cracking, block cracking and alligator cracking. In several areas, trees roots were observed below the asphalt pavement (see **Photo 1**). The base material at the locations of BO-1 and BO-2 was composed of soil-cement while the rest of the pavement cores revealed limerock base material.

Based on our limited field exploration and the data collected during our pavement coring program, inadequate asphalt and base thickness, top-down cracking as well as application of soil-cement base (where present) have caused the observed pavement distresses along most of the alignment.

Photo 1: Tree roots under the asphalt pavement

DESIGN RECOMMENDATIONS

Pavement Support

We were not provided with any traffic information for the referenced roadway alignment; however, based on our past experience with similar projects, data obtained during this study, our pavement survey, and provided positive drainage outside of the pavement areas is provided, the following geotechnical engineering recommendations are provided for reconstruction/rehabilitation of the noted roadway.

The following rehabilitation/reconstruction options are based on the order of cost-performance:

Option 1- Total Reconstruction:

Remove full depth of the existing pavement section. Any unsuitable materials (i.e. peat/organic soils/clayey soils) below the exposed excavated grade shall be removed to their full depth and hauled off the site. Clayey soils (A-2-6 and A-6 materials) and tree roots, where encountered, should be removed within 2 feet of the bottom of the new pavement base and backfilled with materials consistent with Strata 1 (AASHTO A-3 sands) or engineered fill. Compact the exposed subgrade soils to at least 98 percent of the material's modified Proctor (ASTM D-1557) maximum dry density. Construct the new flexible pavement following the below recommendations:

- 2.5 inches Type SP Asphaltic Concrete (1.5-inch lift of SP-12.5 followed by 1.0-inch lift of SP-9.5 on top, with minimum PG 67-22 or higher).
- 8.0 inches limerock (LBR=100) or crushed concrete (LBR = 150) base course, compacted to at least 98 percent of the material's modified Proctor (ASTM D-1557) maximum dry density.
- 12.0 inches stabilized subgrade, Type B Stabilization (LBR = 40), compacted to at least 98 percent of the material's modified Proctor (ASTM D-1557) maximum dry density.

Option 2- Full Depth Reclamation (FDR)

Construct a minimum 8.0 inches reclaimed base materials by pulverizing, mixing and reusing the existing asphalt, base and subgrade materials and adding additives (Portland cement and emulsion asphalt) at the designed ratios and placing/compacting the reclaimed materials. This process will provide an improved pavement base layer for support of the new surface asphaltic concrete.

Following the construction of the reclaimed base layer, a minimum of 2.5 inches of asphalt concrete (1.5-inch lift of SP-12.5 followed by 1.0-inch lift of SP-9.5 on top, with minimum PG 67-22 or higher) should be placed as surface cover.

All pavement materials and construction procedures should be in accordance with the Florida Department of Transportation (FDOT) standards and meet Sumter County standards.

SITE PREPARATION CONSIDERATIONS

Fill Placement and Subgrade Preparation

The subgrade within the roadway limits should be densified by heavy proof rolling. Proof rolling operations should be carried out from the stripped/cleared surface with a self-propelled vibratory roller. Where site grading requires cuts to achieve proposed grades, proof rolling should follow excavation activities. The roller should have a drum weight of at least 10 tons.

Densification of the subsoils should be accomplished by making repeated overlapping coverages of the roller as it operates at its full vibrational frequency and at a travel speed of not more than two feet per second. Within 75 feet of existing buildings/structures, the roller should be operated in the static mode to reduce vibrations that could disturb building occupants or cause structural distress, or vibration monitoring should be performed to assess vibration levels. Proof rolling operations should be carried out under the surveillance of PSI's Geotechnical Engineer or his representative so that observations of the subgrade can be made and in place density tests can be taken to evaluate if compaction is being achieved. The upper 12 inches of the subgrade should be compacted to at least 98 percent of the soil's ASTM D-1557 maximum dry density.

If unstable/yielding soils are encountered by the roller, then such materials should be locally removed and replaced with clean, dry granular soil (Engineered Fill) that is thoroughly and uniformly compacted.

Engineered Fill

Any fill for the project should consist of clean fine sand with less than 10 percent by dry weight passing the U.S. Standard No. 200 sieve and be free of rubble, organics, clay, debris and other deleterious material. Fill should be tested and approved prior to import and placement. Each lift should have a loose thickness not exceeding 12 inches. Density tests should be performed to confirm the required compaction is being achieved before placing the next lift.

Before beginning compaction, soil moisture conditioning may be required. Soil moisture contents should be controlled to facilitate proper compaction. A moisture content within two percentage points of the material's optimum indicated by the modified Proctor test (ASTM D-1557) is recommended prior to compaction of the natural ground and fill. All engineered fill should be compacted to at least 98 percent of the material's modified Proctor (ASTM D-1557) maximum dry density.

LIMITATIONS

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This company is not responsible for the conclusions, opinions or recommendations made by others based on these data.

The scope of our exploration was intended to evaluate soil conditions within the influence of the noted roadway and does not include an evaluation of potential deep soil problems such as sinkholes. The analysis and recommendations submitted in this report are based on the data obtained from the soil borings and pavement cores performed at the locations indicated. If any subsoil variations become evident during the course of this project, a re-evaluation of the recommendations contained in this report will be necessary after we have had an opportunity to observe the characteristics of the conditions encountered.

The scope of our geotechnical services presented herein 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 our client.

CLOSURE

PSI appreciates the opportunity to provide our services to you on this project. If you have any questions regarding the information provided in this report, or if we may be of further service, please contact the undersigned.

Respectfully submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.
Certificate of Authorization No. 3684

Behnam Golestani, Ph.D., P.E.
Principal Consultant/Senior Geotechnical Engineer
FL License No. 84787

Robert A. Trompke, P.E.
Florida Geotechnical Practice Leader
FL License No. 55456

07572627 (Broken Oak Drive)

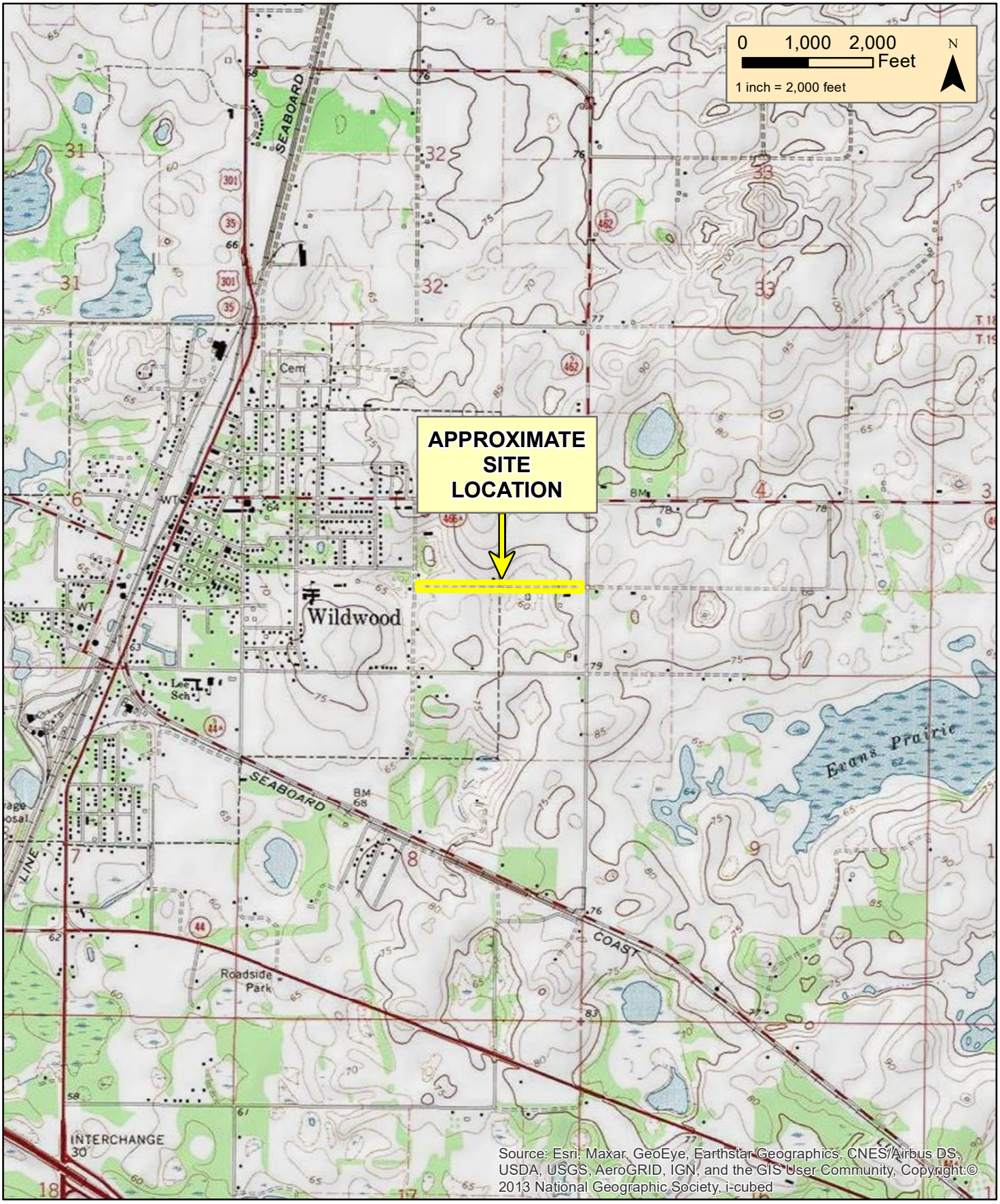
Appendix A

- Figure 1 – USGS Topographic Map
- Figure 2 – USDA Soils Map
- Sheet 1 – Boring Location Plan
- Sheets 2 Boring Profiles
- LBR Test Results

Appendix B

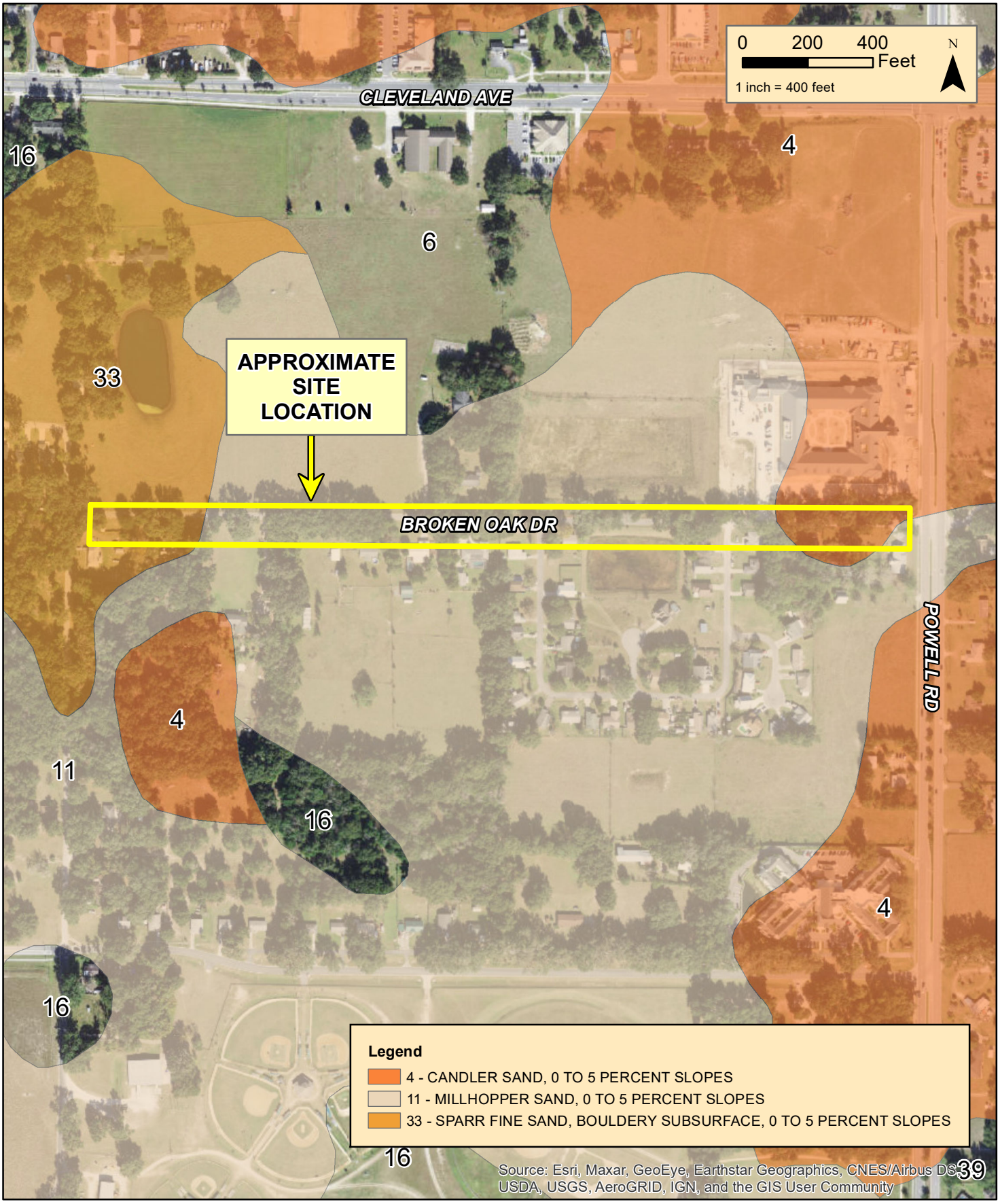
- Pavement Core Photos

APPENDIX A



REFERENCE: THE 2017 AERIAL PHOTOGRAPH WAS OBTAINED FROM ESRI. THE PRESENTED DATA IS FOR INFORMATIONAL PURPOSES ONLY. IT IS NOT MEANT FOR DESIGN, LEGAL, OR ANY OTHER USES. INTERTEK-PSI ASSUMES NO RESPONSIBILITY FOR ANY DECISIONS MADE OR ANY ACTIONS TAKEN BY THE USER BASED UPON INFORMATION OBTAINED FROM THE ABOVE DATA.

PROJECT NO. 07572627	intertek psi 1748 33rd Street Orlando, FL 32839 (407)304-5560 (407)304-5561 fax	TOPOGRAPHIC MAP **BROKEN OAK DRIVE** WILDWOOD, SUMTER COUNTY, FLORIDA	FIGURE: 1
TWN/RNG/SEC -			DRAWN: DJW
DATE CREATED 8-27-21			CHECKED: MM

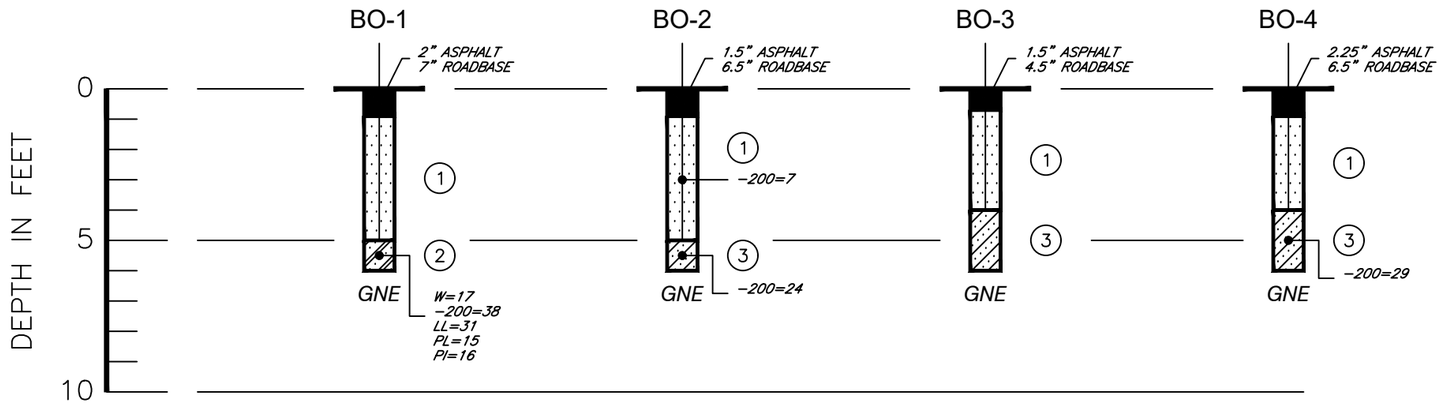


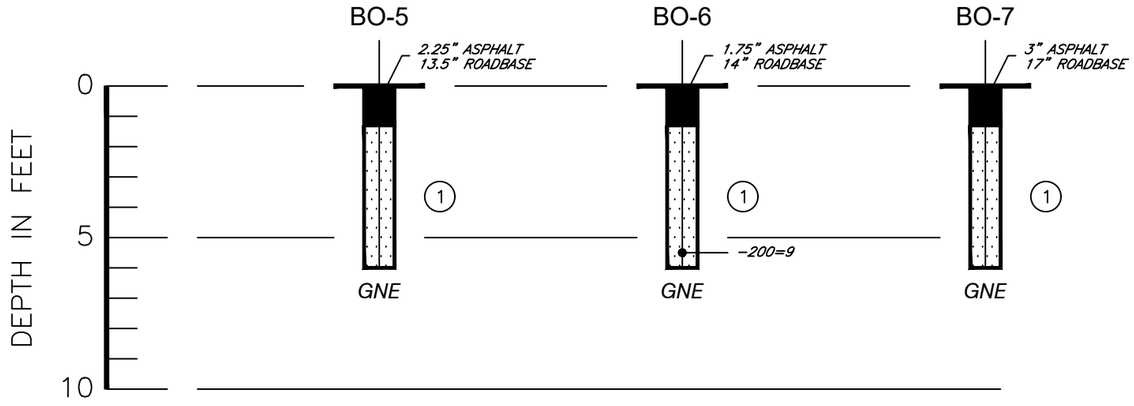
REFERENCE: THE 2017 AERIAL PHOTOGRAPH WAS OBTAINED FROM ESRI. THE PRESENTED DATA IS FOR INFORMATIONAL PURPOSES ONLY. IT IS NOT MEANT FOR DESIGN, LEGAL, OR ANY OTHER USES. INTERTEK-PSI ASSUMES NO RESPONSIBILITY FOR ANY DECISIONS MADE OR ANY ACTIONS TAKEN BY THE USER BASED UPON INFORMATION OBTAINED FROM THE ABOVE DATA.

PROJECT NO. 07572627 TWN/RNG/SEC - DATE CREATED 8-27-21	intertek psi 1748 33rd Street Orlando, FL 32839 (407)304-5560 (407)304-5561 fax	SOILS MAP **BROKEN OAK DRIVE** WILDWOOD, SUMTER COUNTY, FLORIDA	FIGURE: 2 DRAWN: DJW CHECKED: MM

REFERENCE: THE 2017 AERIAL PHOTOGRAPH WAS OBTAINED FROM ESRI. THE PRESENTED DATA IS FOR INFORMATIONAL PURPOSES ONLY. IT IS NOT MEANT FOR DESIGN, LEGAL, OR ANY OTHER USES. INTERTEK-PSI ASSUMES NO RESPONSIBILITY FOR ANY DECISIONS MADE OR ANY ACTIONS TAKEN BY THE USER BASED UPON INFORMATION OBTAINED FROM THE ABOVE DATA.

PROJECT NO. **07572627** SCALE: **NOTED** DATE CREATED **6-8-21**	intertek psi 1748 33rd Street Orlando, FL 32839 (407)304-5560 (407)304-5561 fax	GEOTECHNICAL ENGINEERING SERVICES **BROKEN OAK DRIVE** WILDWOOD, SUMTER COUNTY, FLORIDA	SHEET: **1** DRAWN: **DJW** CHECKED: **BG**	0 100 200 Feet 1 inch = 200 feet N





SOIL PROFILES

SCALE: 1"=5'

LEGEND

1	*LIGHT BROWN TO GRAY-BROWN FINE SAND, OCCASIONALLY WITH TRACE CLAYEY NODULES, (A-3)*
2	*GRAY-BROWN SANDY CLAY, (A-6)*
3	*BROWN CLAYEY FINE SAND, (A-2-6)*
(SP)	*UNIFIED SOIL CLASSIFICATION GROUP SYMBOL*
GNE	*GROUNDWATER LEVEL NOT EVIDENT IN UPPER 6 FEET OF BORING*
W	*NATURAL MOISTURE CONTENT IN PERCENT*
-200	*FINES PASSING #200 SIEVE IN PERCENT*
LL	*LIQUID LIMIT IN PERCENT*
PL	*PLASTIC LIMIT IN PERCENT*
PI	*PLASTICITY INDEX*

PROJECT NO. 07572627
SCALE: NOTED
DATE CREATED: 6-8-21

intertek psi
1748 33rd Street
Orlando, FL 32839
(407)304-5560
(407)304-5561 fax

GEOTECHNICAL ENGINEERING SERVICES

BROKEN OAK DRIVE

WILDWOOD, SUMTER COUNTY, FLORIDA

SHEET: 2
DRAWN: DJW
CHECKED: BG

Professional Service Industries, Inc.
1748 33rd Street
Orlando, FL 32839
Eng Certificate Of Authorization 3684
Phone: (407) 304-5560
Fax: (407) 304-5561

Report No: LBR:07613559-17-S15

Limerock Bearing Ratio Test

Client: MISCELLANEOUS
1748 33RD STREET
ORLANDO, FL 32839

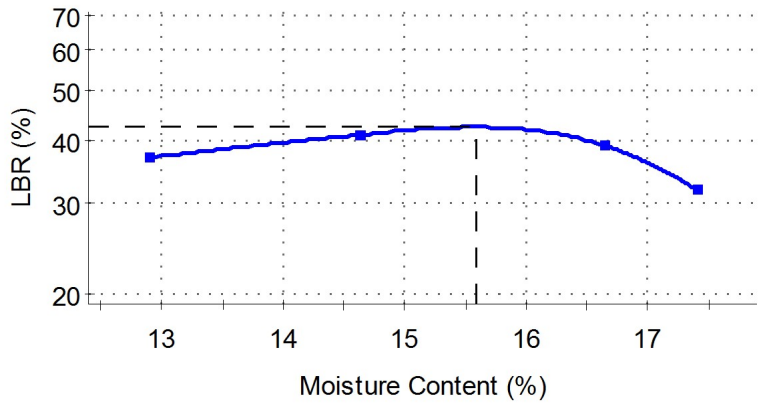
CC:

Project: ORLANDO LAB TESTING

Sample Details

Sample ID:	07613559-17-S15	**Date Sampled:**	6/2/2021
Client Sample ID:		**Sampling Method:**	
Source:		**Material:**	BROWN FINE SAND
Specification:	AGSO Sec. 160 - Stabilizing Subgrade	**Location:**	B0-1
Tested By:	Kenneth Thompson	**Date Tested:**	6/3/2021

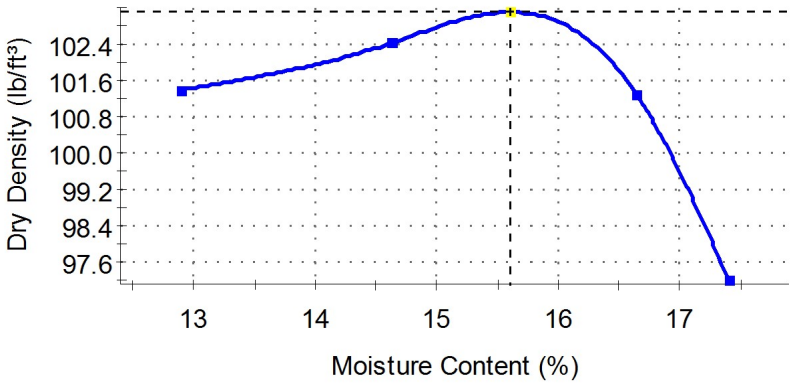
Moisture vs LBR



Test Results

	FM 5-515
Required LBR (%):	40
Percent Retained (2 Inch):	
Maximum LBR (%):	42
MDD (lb/ft³):	103.1
OMC (%):	15.6

Moisture vs Dry Density



Comments

Professional Service Industries, Inc.
1748 33rd Street
Orlando, FL 32839
Eng Certificate Of Authorization 3684
Phone: (407) 304-5560
Fax: (407) 304-5561

Report No: LBR:07613559-17-S16

Limerock Bearing Ratio Test

Client: MISCELLANEOUS
1748 33RD STREET
ORLANDO, FL 32839

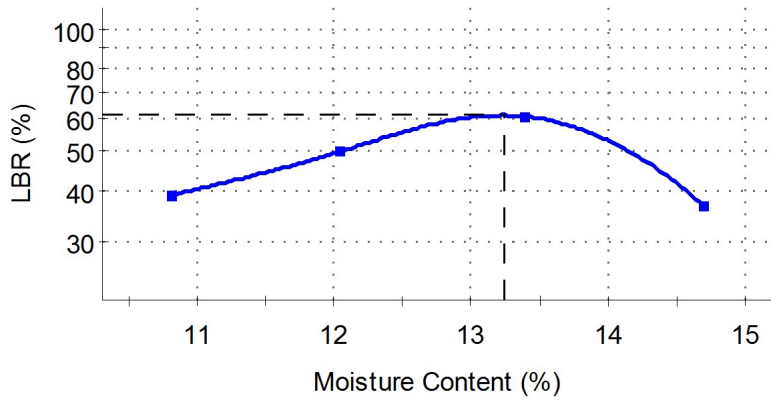
CC:

Project: ORLANDO LAB TESTING

Sample Details

Sample ID:	07613559-17-S16	**Date Sampled:**	6/2/2021
Client Sample ID:		**Sampling Method:**	
Source:		**Material:**	GREY FINE SAND WITH TRACE OF ROOTS
Specification:		**Location:**	BO-5
Tested By:	Sheila Daniels	**Date Tested:**	6/3/2021

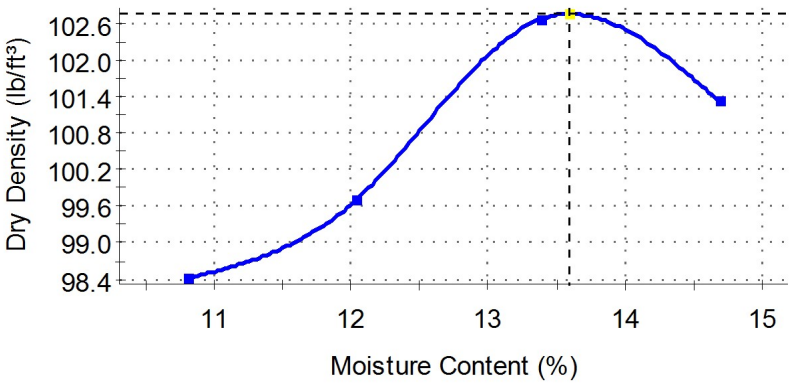
Moisture vs LBR



Test Results

	FM 5-515
Required LBR (%):	40
Percent Retained (2 Inch):	
Maximum LBR (%):	61
MDD (lb/ft³):	102.7
OMC (%):	13.6

Moisture vs Dry Density



Comments

APPENDIX B

PAVEMENT CORE PHOTOGRAPHS

- **Asphalt:** 2 inches
- **Pavement Base:** 7 inches soil cement

SHEET NO.:	
DRAWN BY:	B.G.
CHECKED BY:	B.G.

PAVEMENT ENGINEERING SERVICES
BROKEN OAK DRIVE– PROPOSED PAVEMENT EVALUATION
PSI PROJECT NO.: 07572627
DATE: 9/3/2021

intertek psi

PAVEMENT CORE PHOTOGRAPHS

- **Asphalt:** 1.5 inch
- **Pavement Base:** 6.5 inches soil cement

SHEET NO.:	
DRAWN BY:	B.G.
CHECKED BY:	B.G.

PAVEMENT ENGINEERING SERVICES
BROKEN OAK DRIVE– PROPOSED PAVEMENT EVALUATION
PSI PROJECT NO.: 07572627
DATE: 9/3/2021

intertek psi

PAVEMENT CORE PHOTOGRAPHS

- **Asphalt:** 1.5 inches
- **Pavement Base:** 4.5 inches of limerock

SHEET NO.:	
DRAWN BY:	B.G.
CHECKED BY:	B.G.

PAVEMENT ENGINEERING SERVICES
BROKEN OAK DRIVE– PROPOSED PAVEMENT EVALUATION
PSI PROJECT NO.: 07572627
DATE: 9/3/2021

intertek psi

PAVEMENT CORE PHOTOGRAPHS

- **Asphalt:** 2.25 inches
- **Pavement Base:** 6.5 inches of limerock

SHEET NO.:	
DRAWN BY:	B.G.
CHECKED BY:	B.G.

PAVEMENT ENGINEERING SERVICES
BROKEN OAK DRIVE– PROPOSED PAVEMENT EVALUATION
PSI PROJECT NO.: 07572627
DATE: 9/3/2021

intertek psi

PAVEMENT CORE PHOTOGRAPHS

- **Asphalt:** 2.25 inches
- **Pavement Base:** 13.5 inches of limerock

SHEET NO.:	
DRAWN BY:	B.G.
CHECKED BY:	B.G.

PAVEMENT ENGINEERING SERVICES
BROKEN OAK DRIVE– PROPOSED PAVEMENT EVALUATION
PSI PROJECT NO.: 07572627
DATE: 9/3/2021

intertek psi

PAVEMENT CORE PHOTOGRAPHS

- **Asphalt:** 1.75 inches
- **Pavement Base:** 14 inches of limerock

SHEET NO.:	
DRAWN BY:	B.G.
CHECKED BY:	B.G.

PAVEMENT ENGINEERING SERVICES
BROKEN OAK DRIVE– PROPOSED PAVEMENT EVALUATION
PSI PROJECT NO.: 07572627
DATE: 9/3/2021

intertek psi

PAVEMENT CORE PHOTOGRAPHS

- **Asphalt:** 3 inches
- **Pavement Base:** 17 inches of limerock

SHEET NO.:	
DRAWN BY:	B.G.
CHECKED BY:	B.G.

PAVEMENT ENGINEERING SERVICES
BROKEN OAK DRIVE– PROPOSED PAVEMENT EVALUATION
PSI PROJECT NO.: 07572627
DATE: 9/3/2021

intertek psi