GSE Engineering & Consulting, Inc.

SUMMARY REPORT OF A ROADWAY SOIL SURVEY AND PAVEMENT EVALUATION

DEVIL'S MILLHOPPER STATE PRESERVE
ALACHUA COUNTY, FLORIDA

GSE PROJECT No. 15981

Prepared For:

GEORGE F. YOUNG, INC.

MARCH 2023

GSE Engineering & Consulting, Inc.

March 27, 2023

Johnathan Langston, P.E.
George F. Young, Inc.
299 Dr. Martin Luther King, Jr. St. N.
Saint Petersburg, Florida 33701

Subject: Summary Report of a Roadway Soil Survey and Pavement Evaluation
Devil's Millhopper State Preserve
Alachua County, Florida
GSE Project No. 15981

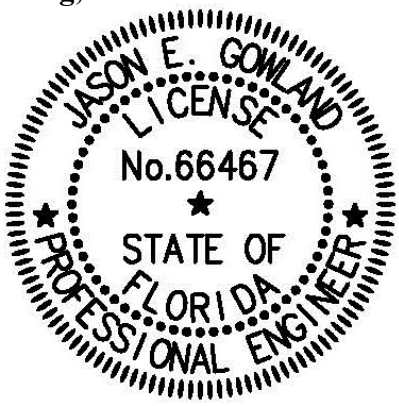
GSE Engineering & Consulting, Inc. (GSE) is pleased to submit this roadway soil survey and pavement evaluation report for the above referenced project.

Presented herein are the findings and conclusions of our exploration, including the evaluation of the existing pavement section at Devil's Millhopper State Preserve in Alachua County, Florida.

We appreciate this opportunity to have assisted you on this project. If you have any questions or comments concerning this report, please contact us.

Sincerely,

GSE Engineering & Consulting, Inc.



This item has been digitally signed and sealed by
Jason E Gowland
Digitally signed by Jason E Gowland
Date: 2023.04.13 08:42:29 -04'00'
on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Kevin P. Fisher, E.I.
Staff Engineer

Jason E. Gowland, P.E.
Principal Engineer
Florida Registration Number 66467

KPF/JEG:hmp
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File (1)

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1.0 INTRODUCTION

1.1 General

GSE Engineering & Consulting, Inc. (GSE) has completed this roadway soil survey and pavement evaluation for Devil's Millhopper State Preserve in Alachua County, Florida. Our exploration was performed in general accordance with GSE Proposal No. 2022-666B dated November 18, 2022. You authorized our services on February 21, 2023, with a Master Subconsultant Agreement.

1.2 Project Description

We understand you wish to determine the thickness of the asphalt wearing surface and limerock base course at two locations along the entrance road and in the parking lot loop of Devil's Millhopper State Preserve.

Mr. Kevin P. Fisher, E.I. with GSE visited the site to observe the roadway conditions and mark the boring locations. The site consists of an entrance road and parking lot loop. The entrance road is in fair condition and the parking lot loop is in poor condition.

GSE performed a roadway soil survey and pavement evaluation to provide information for your design. A recent aerial map was obtained and reviewed. The aerial map was used in this exploration and preparation of this report.

1.3 Purpose

The purpose of this roadway evaluation was to evaluate the condition of the existing roadway and pavement section, and to provide recommendations for milling and re-surfacing.

2.0 FIELD AND LABORATORY TESTS

2.1 General Description

The procedures used for field sampling and testing are in general accordance with industry standards of care and established pavement evaluation practices for this region. This exploration consisted of coring through the asphalt and base course at two (2) locations along the entrance road and in the parking lot loop. Hand auger borings were performed at the pavement core locations to determine the thickness of the limerock base, if encountered. In addition, two (2) hand auger borings were performed to depths of 5 to 6 feet bls in the core locations.

The asphalt cores and hand auger borings were performed and collected at the approximate locations as shown on Figure 2. The asphalt cores and hand auger borings were performed and collected on March 17, 2023.

2.2 Asphalt Cores

Two (2) asphalt cores were performed to determine the asphalt and limerock base course thicknesses. The asphalt cores were performed with a coring machine. The cores were approximately 4-inches in diameter and were patched with cold-weather asphalt upon completion. These patches should be considered temporary. Results of the asphalt cores are included in Section 5.1.

2.3 Hand Auger Borings

Two (2) hand auger borings were performed to depths of 5 to 6 feet below land surface (bls) in the coring locations. The auger borings were performed in accordance with ASTM D-1452. The borings were performed with hand auger equipment that was rotated into the ground in a manner that reduces soil disturbance. After penetrating to the required depth, the auger was retracted and the soils collected were field classified and placed in sealed containers. Representative samples of each stratum were retained from the auger boring. Results from the asphalt cores and auger borings are included in Section 5.1.

2.4 Soil Laboratory Tests

The soil samples recovered from the soil borings were returned to our laboratory and examined to confirm the field descriptions. Representative samples were then selected for laboratory testing.

The laboratory tests consisted of three (3) natural moisture content determinations, three (3) percent passing the No. 200 sieve tests, and one (1) Atterberg Limits test.

These tests were performed in order to aid in classifying the soils and to further evaluate their engineering properties. The laboratory tests are provided in Section 5.2.

3.0 FINDINGS

3.1 Surface Conditions

Mr. Kevin P. Fisher, E.I. with GSE visited the site on March 2, 2023 to observe site conditions and mark the boring locations. The site is an existing entrance road and parking lot loop in the Devil's Millhopper State Preserve in Alachua County, Florida. The area surrounding the roadway consists of grass, trees, and underbrush on either side of the roadway.

The topography across the site is relatively flat. Regional topography within the vicinity of the site is gently sloping. The Alachua County Growth Management website indicates the elevation across the site is approximately 178 feet[1].

3.2 Subsurface Conditions

The locations of the asphalt cores and hand auger borings are provided on Figure 2. Complete logs for the borings are provided in Section 5.1. Descriptions for the soils encountered are accompanied by the American Association of State Highway and Transportation Officials (AASHTO) Soil Classification System (A-3, A-2-4, A-2-6, etc.) and are based on visual examination of the recovered soil samples and the laboratory tests performed. Stratification boundaries between the soil types should be considered approximate, as the actual transition between soil types may be gradual.

The auger borings performed in the coring locations indicate the soils across these areas are relatively consistent. The auger borings initially penetrated 3.5 to 4 feet of a near-surface sandy stratum consisting of sand with silt and sand with silt and roots (A-3). This was underlain by silty sand and silty sand with roots (A-2-4) to the explored depths of 5 to 6 feet bls. Auger boring C-2 encountered the roots from 2.5 to 5.5 feet bls.

A total of two soil stratum layers were encountered in the auger borings. The following descriptions of the stratums were defined from the auger boring logs:

- Stratum 1 consists of sand with silt and sand with silt and roots (A-3).
- Stratum 2 consists of silty sand and silty sand with roots (A-2-4).

Roots were encountered at auger boring C-2 at depths of approximately 2.5 to 5.5 feet bls. The roots were abundant in the samples obtained from the augers and could be contributing to the pavement performance at this boring location. GSE did not evaluate the lateral extent of the roots.

The groundwater table was not encountered in the auger borings at the time of our investigation.

3.3 Asphalt Cores

The locations of the asphalt cores and hand auger borings are illustrated on Figure 2. The asphalt cores performed indicate approximately 1 to 1.25 inches of asphalt overlies approximately 7 to 7.5 inches of limerock base course at the time and location of our exploration. The results of the asphalt cores are included in the Table below.

Table 1. Core Results			
Core Identification	Asphalt Thickness (in)	Limerock Base Thickness (in)	Stabilized Subgrade Thickness (in)
C-1	1.25	7.5	NE
C-2	1	7	NE

NE = Not Encountered

3.4 Review of Published Data

The site is mapped as one soil series by the Soil Conservation Service (SCS) Soil Survey for Alachua County[2] (Figure 1). The following soil description is from the Soil Survey.

Millhopper sand, 0 to 5 percent slopes - This nearly level to gently sloping, moderately well drained soil is in small and large irregularly shaped areas on uplands and on slightly rolling knolls in the broad flatwoods. Slopes are mostly nearly smooth or convex. The areas are variable in size. They range from about 10 to 250 acres.

Typically, the surface layer is dark grayish brown sand about 9 inches thick. The subsurface layer is sand or fine sand about 49 inches thick. The upper 17 inches is yellowish brown, the next 22 inches is light yellowish brown, and the lower 10 inches is very pale brown. The subsoil extends to a depth of 89 inches. The upper 6 inches is yellowish brown loamy sand that has grayish and brownish mottles; the next 22 inches is light gray, mottled sandy clay loam; and the lower 3 inches is light gray, mottled sandy loam.

Included with this soil in mapping are small areas of Arredondo, Bonneau, Fort Meade, Gainesville, Kanapaha, Lochloosa, and Sparr soils. Siliceous limestone boulders and small sinks are within some delineations. Small areas of Millhopper soils that have 5 to 8 percent slopes are also included. About 25 acres mapped as this Millhopper soil along the Santa Fe River is occasionally flooded. Total included areas are about 20 percent or less.

This Millhopper soil has a water table that is at a depth of 40 to 60 inches for 1 to 4 months and at a depth of 60 to 72 inches for 2 to 4 months during most years. The available water capacity is low in the surface and subsurface layers and is low to medium in the subsoil. Permeability is rapid in the surface and subsurface layers, moderately rapid in the upper 6 inches of the subsoil, and slow to moderately slow below this depth. Natural fertility is low. Organic matter content is low to moderately low.

3.5 Laboratory Soil Analysis

Selected soil samples recovered from the soil borings were analyzed for natural moisture content, percent fines passing the No. 200 sieve, and Atterberg Limits. Selected soil samples were collected from depths ranging from 1 to 4.5 feet bls. These tests were performed to confirm visual soil classifications and evaluate their engineering properties. The complete laboratory report is provided in Section 5.2.

[1] Alachua County Growth Management website, http://mapgenius.alachuacounty.us/.

[2] Soil Survey of Alachua County, Florida. Soil Conservation Service, U.S. Department of Agriculture.

Laboratory tests were conducted on soil samples consisting of sand with silt (A-3) and silty sand (A-2-4).

The tested sand with silt (A-3) contains approximately 9.3 percent soil fines passing the No. 200 sieve with a natural moisture content of about 6.1 percent.

The tested silty sand (A-2-4) contained approximately 18 to 23 percent soil fines passing the No. 200 sieve with natural moisture contents of about 11 percent. Atterberg Limits tests indicate the tested silty sand (A-2-4) is a non-plastic "NP" material[1].

[1] FDOT Index 120-001.

4.0 EVALUATION AND PRELIMINARY RECOMMENDATIONS

4.1 General

The following evaluation and preliminary recommendations are made based upon our understanding of the project, a review of published information, the field test results, the attached soil borings, laboratory test data, and experience with similar projects and subsurface conditions.

In this section of the report, we present our evaluation of the existing pavement section and our preliminary recommendations for pavement milling and resurfacing.

4.2 Groundwater

The groundwater table was not encountered at the boring locations at the time of our exploration. The anticipated seasonal high groundwater is indicated on the logs.

4.3 Evaluation of Existing Road

It is GSE's opinion that the asphalt pavement section is generally in a fair condition at the entrance road and a poor condition in the parking lot loop. The entrance road asphalt pavement section would have a reduced structural coefficient of 0.25 and the parking lot loop would have a reduced structural coefficient of 0.15 from Table 7.1 Reduced Structural Coefficient of Asphalt Materials Per Inch in the FDOT Flexible Pavement Design Manual. The limerock base course is assumed to have an LBR of greater than 100 with a structural coefficient of 0.18.

Considering the findings of the field tests and reduced structural coefficients of the existing asphalt material, the existing roadway likely has a Structural Number (SN) on the order of 1.41 to 1.66. Our existing SN considers the pavement to be in a poor to fair condition and 7- to 7.5-inches of limerock base course.

Table 2. Existing Structural Numbers	
C-1	1.66
C-2	1.41

Our existing SN considers the pavement to be in a poor to fair condition. The average SN is 1.54.

4.4 Suitability of In-Situ Soils

Stratum 1 - This stratum consists of sand with silt and sand with silt and roots (A-3). This material is non plastic and contains no to trace amounts of organic matter. This material is suitable for re-use as stabilized subgrade when utilized in accordance with FDOT Index 120-001. It cannot be used as base material.

Stratum 2 - This stratum consists of silty sand and silty sand with roots (A-2-4). This material is non plastic and contains no organic matter. This material is suitable for use in the embankment when utilized in accordance with FDOT Index 120-001. It may be suitable as stabilized subgrade. This material is likely to retain excess moisture and may be difficult to dry and compact. It cannot be used as base material.

4.5 Pavement Resurfacing Preliminary Recommendations

It appears that a majority of the pavement section consists of a thin asphalt wearing surface and limerock base course over native or improved subgrade soils. It is our opinion the pavement is in poor to fair condition.

Based upon our observations of the existing pavement and our experience with similar projects, GSE recommends typical milling and re-surfacing of the existing asphalt wearing surface. It is likely milling will result in exposing the existing limerock base. If milling and exposing the limerock base are performed, GSE recommends protecting and re-working the limerock base in accordance with FDOT Section 210 Reworking Limerock Base.

The asphalt-wearing surface should consist of an FDOT Type SP Hot Mix Asphalt mixture. For automobile parking areas, the thickness should be a minimum of 1.5 inches. For driveway areas, the thickness should be a minimum of 2 inches. The asphalt-wearing surface should consist of an SP-12.5 mix. The asphalt should be compacted to at least 95 percent of the mix design density.

The thickness of asphalt and the thickness of the re-worked limerock base should meet the required design structural number.

5.0 FIELD DATA

5.1 Roadway Soil Survey, Asphalt Core Results, and Auger Boring Logs

THE ABOVE NAMED REGISTERED PROFESSIONAL ENGINEER SHALL BE RESPONSIBLE FOR THE FOLLOWING SHEETS IN ACCORDANCE WITH RULE 61G15-23.004 F.A.C.

SHEET NO.	SHEET DESCRIPTION
1	SIGNATURE SHEET
2	ROADWAY SOIL SURVEY
3	AUGER BORING PROFILES

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

JASON E. GOWLAND P.E. 66467
GSE ENGINEERING & CONSULTING, INC.
5590 SW 64TH STREET, SUITE B
GAINESVILLE, FLORIDA 32608

GEORGE F. YOUNG, INC.

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
N/A	ALACHUA	N/A

SIGNATURE SHEET

SHEET NO. 1

GEORGE F. YOUNG, INC.

DATE OF SURVEY : 03/17/2023
SURVEY MADE BY : GSE ENGINEERING & CONSULTING, INC.
SUBMITTED BY : JASON E. GOWLAND, P.E.

PROJECT NAME : DEVIL'S MILLHOPPER STATE PRESERVE
GSE PROJECT NUMBER : 15981
FINANCIAL PROJECT ID : N/A

DISTRICT : N/A
ROAD NO : N/A
COUNTY : ALACHUA

CROSS SECTION SOIL SURVEY FOR ROADWAY

SURVEY BEGINS STA. : N/A SURVEY ENDS STA.: N/A
REFERENCE : BASELINE SURVEY

	MOISTURE CONTENT		SIEVE ANALYSIS RESULTS % PASS					ATTERBERG LIMITS (%)					
STRATUM NO.	NO. OF TESTS	MOISTURE CONTENT	NO. OF TESTS	No. 4 SIEVE	No. 10 SIEVE	No. 40 SIEVE	200 MESH	NO. OF TESTS	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	AASHTO GROUP	DESCRIPTION
1	1	6.1	1	–	–	–	9.3	–	–	–	–	A–3	BROWN SAND WITH SILT AND SAND WITH SILT AND ROOTS
2	2	11	2	–	–	–	18–23	1	NP	NP	NP	A–2–4	BROWN SILTY SAND AND SILTY SAND WITH ROOTS

SUBGRADE MATERIAL AND EXCAVATION FOR ROADWAYS

STRATA BOUNDARIES ARE APPROXIMATE MAKE FINAL CHECK AFTER GRADING

NOTES

1. STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL STRATA AT EACH BORING LOCATION ONLY. ANY SUBSOIL CONNECTING LINES SHOWN ARE FOR ESTIMATING EARTHWORK ONLY AND DO NOT INDICATE ACTUAL STRATUM LIMITS. SUBSURFACE VARIATIONS BETWEEN BORINGS SHOULD BE ANTICIPATED.
2. GROUNDWATER LEVEL SHOWN AS ▼ WHERE ENCOUNTERED. GROUNDWATER NOT ENCOUNTERED AS "GNE".
3. THE MATERIAL FROM STRATUM NUMBER 1 APPEARS SATISFACTORY FOR USE IN THE ROADWAY WHEN UTILIZED IN ACCORDANCE WITH INDEX 120–001.
4. THE MATERIAL FROM STRATUM NUMBER 2 APPEARS SATISFACTORY FOR USE IN THE ROADWAY WHEN UTILIZED IN ACCORDANCE WITH INDEX 120–001. HOWEVER, THIS MATERIAL IS LIKELY TO RETAIN EXCESS MOISTURE AND MAY BE DIFFICULT TO DRY AND COMPACT. IT SHOULD BE USED IN THE ROADWAY ABOVE THE WATER LEVEL EXISTING AT THE TIME OF CONSTRUCTION.
5. THE ROOTS AND ORGANIC MATTER ENCOUNTERED SHALL BE REMOVED IN ACCORDANCE WITH INDEX 120–001.

LEGEND

A–3	AASHTO GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW
A–2–4	AASHTO GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW
▼	GROUNDWATER TABLE
GNE	GROUNDWATER NOT ENCOUNTERED
B.T.	BORING TERMINATED
NP	NOT PLASTIC

DATE	DESCRIPTION	DATE	DESCRIPTION

JASON E. GOWLAND P.E. 66467
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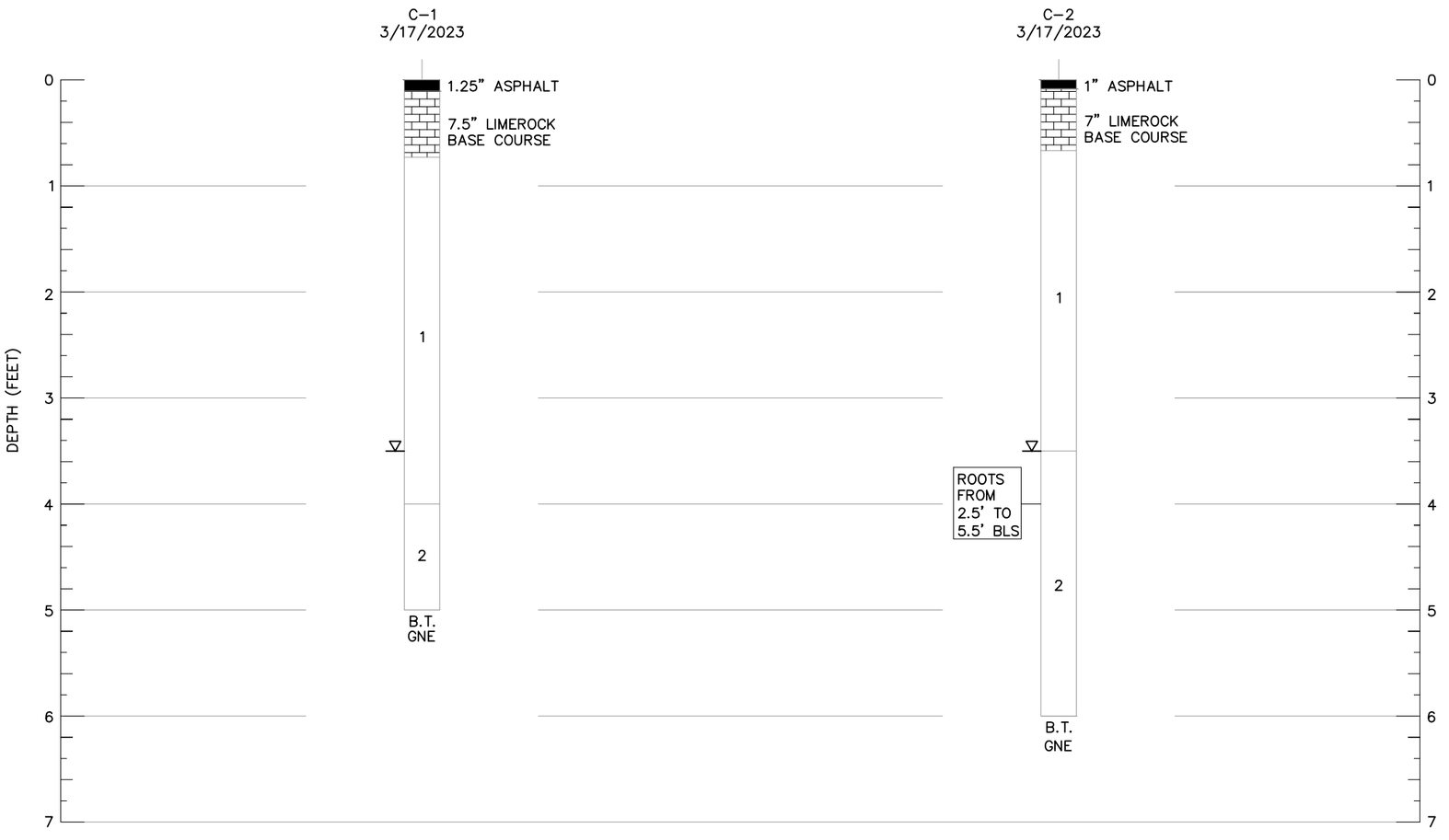
GEORGE F. YOUNG, INC.

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
N/A	ALACHUA	N/A

ROADWAY SOIL SURVEY

SHEET NO. 2



LEGEND

1. (A–3) BROWN SAND WITH SILT AND SAND WITH SILT AND ROOTS
2. (A–2–4) BROWN SILTY SAND AND SILTY SAND WITH ROOTS

A–3 AASHTO GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW

▼ GROUNDWATER TABLE

▽ ESTIMATED PERCHED SEASONAL HIGH GROUNDWATER TABLE

* ESTIMATED SEASONAL HIGH GROUNDWATER IS DEEPER THAN BORING DEPTH IF NOT SHOWN.

GNE GROUNDWATER NOT ENCOUNTERED

B.T. BORING TERMINATED

SOIL PROFILES

0 — 2'

VERTICAL SCALE
1" = 2' APPROX.

DATE	DESCRIPTION	DATE	DESCRIPTION

JASON E. GOWLAND P.E. 66467
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5590 SW 64TH STREET, SUITE B
GAINESVILLE, FLORIDA 32608

GEORGE F. YOUNG, INC.

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
N/A	ALACHUA	N/A

AUGER BORING PROFILES

SHEET NO. 3

5.2 Laboratory Test Results

GSE Engineering & Consulting, Inc.

SUMMARY REPORT OF LABORATORY TEST RESULTS

Project Number: 15981

Project Name: Devil's Millhopper State Preserve

Boring Number	Depth (ft)	Soil Description	Natural Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Percent Passing No. 200 Sieve	Organic Content (%)	Hydraulic Conductivity (ft/day)	AASHTO Soil Classification
C-1	1-1.5	Brown SAND with silt	6.1				9.3			A-3
C-1	4-4.5	Brown silty SAND	11				18			A-2-4
C-2	4-4.5	Brown silty SAND and roots	11	NP	NP	NP	23			A-2-4

6.0 LIMITATIONS

6.1 Warranty

This report has been prepared for our client for his exclusive use, in accordance with generally accepted soil and foundation engineering practices, and makes no other warranty either expressed or implied as to the professional advice provided in the report.

6.2 Auger Borings

The determination of soil type and conditions was performed from the ground surface to the maximum depth of the borings, only. Any changes in subsurface conditions that occur between or below the borings would not have been detected or reflected in this report.

Soil classifications that were made in the field are based upon identifiable textural changes, color changes, changes in composition or changes in resistance to penetration in the intervals from which the samples were collected. Abrupt changes in soil type, as reflected in boring logs and/or cross sections may not actually occur, but instead, be transitional.

Depth to the water table is based upon observations made during the performance of the auger borings. This depth is an estimate and does not reflect the annual variations that would be expected in this area due to fluctuations in rainfall and rates of evapotranspiration.

6.3 Site Figures

The measurements used for the preparation of the figures in this report were made with a fiberglass tape and by estimating distances from existing structures and site features. Figures in this report were not prepared by a licensed land surveyor and should not be interpreted as such.

6.4 Unanticipated Soil Conditions

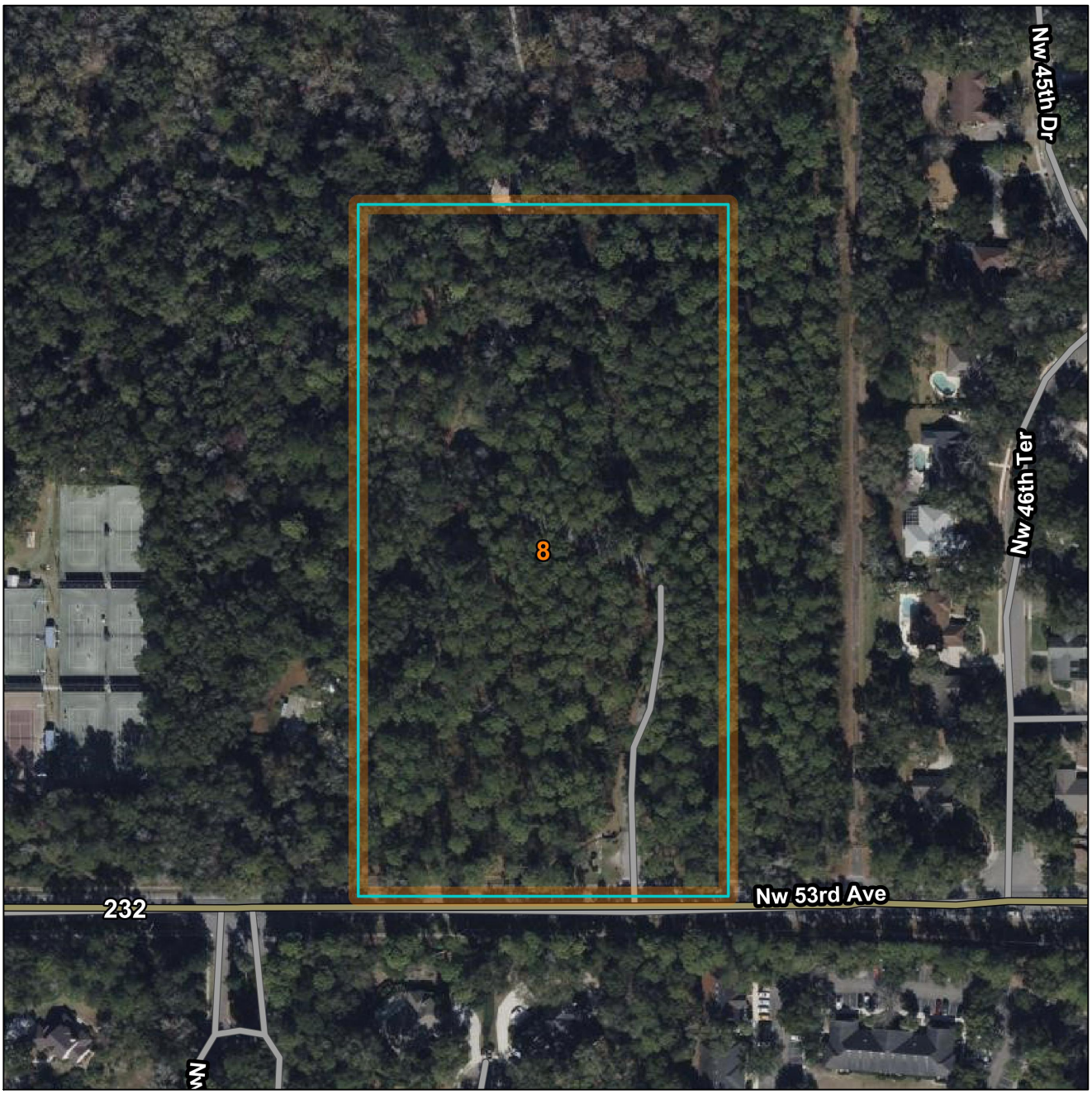
The analysis and recommendations submitted in this report are based upon the data obtained from soil borings performed at the locations indicated on Figure 2. This report does not reflect any variations that may occur between these borings.

The nature and extent of variations between borings may not become known until excavation begins. If variations appear, we may have to re-evaluate our recommendations after performing on-site observations and noting the characteristics of any variations.

6.5 Misinterpretation of Soil Engineering Report

GSE Engineering & Consulting, Inc. is responsible for the conclusions and opinions contained within this report based upon the data relating only to the specific project and location discussed herein. If others make the conclusions or recommendations based upon the data presented, those conclusions or recommendations are not the responsibility of GSE.

FIGURES



LEGEND:

8 MILLHOPPER SAND, 0 TO 5 PERCENT SLOPES

NORTH

0 200'

SCALE: 1" = 200' APPROX.

DEVIL'S MILLHOPPER STATE PRESERVE GAINESVILLE, ALACHUA COUNTY, FLORIDA GSE PROJECT NO. 15981	U.S.D.A SITE SOIL VICINITY MAP		
	DESIGNED BY: KPF CHECKED BY : KLH DRAWN BY : EEW	GSE Engineering & Consulting, Inc.	FIGURE 1

NORTH

0 150'

SCALE: 1" = 150' APPROX.

LEGEND:

AUGER BORING

DEVIL'S MILLHOPPER STATE PRESERVE
GAINESVILLE, ALACHUA COUNTY, FLORIDA
GSE PROJECT NO. 15981

AERIAL PHOTOGRAPH SHOWING APPROXIMATE LOCATIONS OF FIELD TESTS

DESIGNED BY: KPF
CHECKED BY : KLH
DRAWN BY : JNM

GSE Engineering & Consulting, Inc.

FIGURE 2