AREHNA | Engineering, Inc.

REPORT OF GEOTECHNICAL EXPLORATION

WEST MARJORY AVENUE
TAMPA, FLORIDA

AREHNA PROJECT NO. B-15-008

March 11, 2015

Prepared For:
City of Tampa – Stormwater Division
306 W. Jackson Street, 6N
Tampa, Florida 33602

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March 11, 2015

Ms. Barbara Graves
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Subject: **Report of Geotechnical Exploration**
W. Marjory Avenue, S. Howard Avenue to S. Albany Avenue
Tampa, Florida
AREHNA Project B-15-008

Dear Ms. Graves,

AREHNA Engineering, Inc. (AREHNA) is pleased to submit this report of our geotechnical exploration for the proposed project. Services were conducted in general accordance with AREHNA Proposal B.Prop-15-019 dated February 11, 2015. The purpose of our geotechnical study was to obtain information on the general subsurface conditions for the proposed re-grading of W. Marjory Avenue from S. Howard Avenue to S. Albany Avenue and S. Albany Avenue from the alley north of W. Marjory Avenue to W. Dekle Avenue.

This report presents our understanding of the project, outlines our exploratory procedures, documents the field data obtained and includes our recommendations for site preparation and pavement design.

AREHNA appreciates the opportunity to have assisted the City of Tampa on this project. Should you have any questions with regards to this report, or if we can be of any further assistance, please contact this office.

Best Regards,

AREHNA ENGINEERING, INC.
FLORIDA BOARD OF PROFESSIONAL ENGINEERS CERTIFICATE OF AUTHORIZATION NO. 28410

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1.0 EXECUTIVE SUMMARY

The purpose of this geotechnical exploration was to obtain information concerning the site and subsurface conditions within the existing roadway of W. Marjory Avenue between S. Howard Avenue and S. Albany Avenue in Tampa, Florida and within the existing roadway of S. Albany Avenue from the alley north of W. Marjory Avenue to W. Dekle Avenue. W. Marjory Avenue and S. Albany Avenue are two-lane, two-way residential roadways containing patches of varying age and size and other distress. It is our understanding that the City of Tampa plans to re-grade W. Marjory Avenue so that it slopes away from S. Howard Avenue towards S. Albany Avenue and to re-grade S. Albany Avenue so that it slopes away from the alley north of W. Marjory Avenue towards W. Dekle Avenue.

The SPT borings performed at this site generally encountered a 2¾ inch pressed asphalt paver section along W. Marjory Avenue with asphalt patch in some areas and a pavement section consisting of 1 to 1.5 inches of asphalt along S. Albany Avenue. Limerock base was encountered beneath the asphalt sections along S. Albany Avenue. The limerock base ranged in thickness from 7 to 8.5 inches. The pavement section was underlain by sandy soils to the termination depth of the borings at 10 feet. Boring B-2 encountered a clayey sand layer from 8 to 10 feet. The groundwater level was encountered at depths of 1 to 2 feet.

General recommendations for site preparation and pavement design are presented in this report.

2.0 PROJECT INFORMATION AND SCOPE OF WORK

2.1 Site Description and Project Characteristics

The project consists of re-grading W. Marjory Avenue between S. Howard Avenue and S. Albany Avenue in Tampa, Florida. The existing two-lane, two-way residential roadways contain patches of varying age and size and other distress. W. Marjory Avenue currently consists of pressed asphalt pavers, and S. Albany Avenue consists of asphalt pavement. It is our understanding that the city would like to keep the pressed asphalt pavers on W. Marjory Avenue.

2.2 Scope of Work

The purpose of our geotechnical study was to obtain information on the general subsurface conditions within the project limits of the existing roadways. We also identified existing groundwater levels and estimated seasonal high groundwater levels. We evaluated the subsurface soils encountered in the borings with respect to the available project characteristics and provided recommendations for use in the design of the re-grading of the existing roadway.

The following services were performed to achieve the above-outlined objectives:

- Coordinated utility location services with the City of Tampa and Sunshine State One-Call.
- Obtained City of Tampa Right of Way (ROW) permit to perform the requested services within the existing roadways.
- Performed a total of seven Standard Penetration Test (SPT) borings to a depth of 10 feet at previously identified locations within the existing roadways.
- Measured the thickness of the pavement sections. Determined whether base material is present and measured the thickness of the base if present.
- Visually classified the soil samples in the laboratory using the AASHTO Classification System and conducted a laboratory testing program to evaluate soil properties.
- Reported the results of the field exploration, lab testing, and engineering analysis. The results of the subsurface exploration are presented in this report, signed and sealed by professional engineers specializing in geotechnical engineering.

3.0 FIELD EXPLORATION

3.1 Field Exploration

Our scope included performing seven Standard Penetration Test (SPT) borings within the existing roadways. After coring through the pavement section along S. Albany Avenue and removing the pressed asphalt pavers along W. Marjory Avenue, the borings were advanced by hand augering to a depth of 4 feet to avoid unmarked utilities. The hand auger method consisted of manually advancing a 3-inch diameter, 6-inch long sampler into the soil until the sampler was full. The sampler was then retrieved and the soils in the sampler were removed and visually classified. The soil sampling was performed in general accordance with ASTM Test Designation D-1452, entitled "Soil Investigation and Sampling by Auger Borings." Between 4 feet and the termination depth of 10 feet, the borings were advanced with a Power Drill Rig using Bentonite "Mud" drilling procedures. Samples were collected and Standard Penetration Test resistances were measured at approximate intervals of two feet. The soil sampling was performed in general accordance with ASTM Test Designation D-1586, entitled "Penetration Test and Split-Barrel Sampling of Soils."

Representative portions of these soil samples were sealed in glass jars, labeled and transferred for appropriate classification and laboratory testing.

In **Appendix A**, this report provides a boring location site plan showing the relationship of the proposed roadway to the exploration borings. The borings were located in the field by measuring from existing features.

4.0 LABORATORY TESTING

Laboratory tests were performed on representative soil samples in order to classify the soil and to evaluate its engineering properties. Laboratory testing was performed in general accordance with ASTM Standards and included moisture content and single sieve (#200) grain size. Laboratory test results are presented below and are also included as **Table 1** in **Appendix B**.

Boring No.	Sample Depth (feet)	Percent Moisture Content	Percent Finer (-200 sieve)
B-1	0.0 – 2.0	26.7	4.8
B-1	8.0 – 10.0	17.7	9.5
B-2	8.0 – 10.0	17.4	14.1

Our Laboratory Procedures are presented in **Appendix B**.

5.0 SUBSURFACE CONDITIONS

5.1 USDA Natural Resources Conservation Service Data

The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) survey for Hillsborough County indicates that the soils at the project site consist of the following soil unit:

Soil Unit Number	Soil Name	Seasonal High Water Table (depth relative to natural grade)
55	Tavares-Urban land complex, 0 to 5 percent slopes	42 to 72 inches

The soil survey also indicates that the average annual precipitation is 48 to 56 inches. The seasonal distribution of rainfall is generally uniform, with greater than two inches of rain every month and in excess of 6 inches of rain in June, July, August and September. The seasonal high water table depths shown occur in naturally drained areas. However, urban areas including the project site are artificially drained by storm sewers, gutters, and surface ditches.

The upper soils encountered below the pavement section in our borings are consistent with the soil types referenced in the USDA mapping of the site. The USDA Soil Survey map for the project site is attached as **Figure 4**.

5.2 USGS Topographic Data

The topographic survey map published by the United States Geological Survey was reviewed for ground surface features at the proposed project location (**Figure 3**, **Appendix A**). Based on this review, ground surface elevations are approximately +20 feet National Geodetic Vertical Datum of 1929 (NGVD).

5.3 Subsurface Conditions

A pictorial representation of the subsurface conditions encountered by the borings is shown in the Report of Core Borings, in **Appendix B**. These profiles and the following soil conditions highlight the general subsurface stratification. When reviewing the subsurface profiles, it should be understood that soil conditions may vary between and away from boring locations.

The SPT borings generally encountered a 2¾ inch pressed asphalt pavers and/or a pavement section consisting of 1 to 1.5 inches of asphalt. A limerock base was encountered in B-5, B-6, and B-7. The following table presents the pavement types and corresponding thicknesses encountered in the borings:

SPT Boring	Pavement Type	Pavement Thickness (inches)
B-1	Pressed Asphalt Paver	2.75
B-2	Asphalt Patch	5
B-3	Pressed Asphalt Paver	2.75
B-4	Asphalt Patch	4
B-5	Asphalt	1
	Limerock Base	7
B-6	Asphalt	1.25
	Limerock Base	8
B-7	Asphalt	1.5
	Limerock Base	8

Below the pavement section the borings encountered sand of various fines content (A-3 and A-2-7) to the termination depth of 10 feet. The relative density was very loose to medium dense with standard penetration test resistances (N-values) ranging from 3 to 19 blows per foot.

A page defining the terms and classification symbols used in the boring profiles is included in **Appendix B** of this report.

5.4 Groundwater Conditions

The ground water level was encountered in the SPT borings at depths between 1 and 2 feet below land surface. Fluctuation in ground water levels should be expected due to seasonal climatic changes, construction activity, rainfall variations, surface water runoff, and other site-specific factors.

Since ground water level variations are anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based on the assumption that variations will occur.

5.5 Estimated Seasonal High Ground Water Level

Based on the results of the SPT borings, soils information obtained from the USDA Soil Survey, and our experience in the area, we estimate that the seasonal high ground water level will be encountered at a depth of approximately 1/2 foot below pavement surface.

6.0 DESIGN RECOMMENDATIONS

6.1 General

Our geotechnical evaluation is based upon the previously presented project information as well as the field data obtained during this geotechnical exploration. If the final project scope and plans are significantly different from those described, or if the subsurface conditions during construction are different from those revealed by our borings, we should be notified immediately so that we might review our recommendations presented in this report.

Our recommended site preparation is presented in Section 7.0, General Site Preparation.

6.2 Pavement Design

The results of the SPT borings indicate that the sandy subgrade soils encountered beneath the existing pavement section are suitable for support of a flexible pavement section. The pavement surface should be crowned to facilitate surface water runoff to the stormwater system.

Subgrade: The results of the SPT borings indicate that the sandy subgrade soils encountered beneath the existing pavement section are suitable for support of a flexible pavement section. An LBR of no more than 20 should be assumed for the unstabilized subgrade soils. After removal of the existing pavement section, the subgrade soils should be proofrolled in accordance with the recommendations contained in the General Site Preparation section of this report.

Base: Based on the soil and groundwater conditions encountered in the borings, a crushed concrete base should be suitable at this site. At least a foot of clearance between the bottom of the base and the wet season ground water level should be maintained. The base should have an LBR value of 100 and be graded in accordance with Florida Department of Transportation (FDOT) Standard Specification Section 230.

Asphaltic Concrete: The asphaltic concrete structural course should consist of Type SP-9.5 or Type SP-12.5 asphaltic concrete material. The asphaltic concrete should meet standard FDOT material requirements and placement procedures as outlined in the 2010 Edition of the FDOT Standard Specifications for Road and Bridge Construction.

If an alternate pavement section is desired, the geotechnical engineer should be consulted.

7.0 GENERAL SITE PREPARATION

The initial step in site preparation should be the complete removal of the existing pavement section generally consisting of pressed asphalt bricks as well as any other deleterious materials such as roots or debris from beneath the project area. Prior to construction, the location of any existing underground structures such as culverts and storm sewers within the construction area should be established. Any abandoned structures should be removed and any damaged structures should be repaired. Any underground pipes or structures that are not properly removed or repaired may serve as conduits for subsurface erosion which may result in subsequent excessive settlements.

Our recommendations listed in this section should be used as a guideline for the project general specifications:

- The roadway area should be proofrolled with a vibratory roller with a 5 foot diameter drum and a static weight of at least 10 tons. At least 8 complete overlapping coverages should be performed over the entire subgrade area prior to placement of any fill. Careful observations should be made during proofrolling to help identify any areas of soft-yielding soils that may require over excavation and replacement. The subgrade should be compacted to a minimum depth of 12 inches to at least 95 percent of the Modified Proctor maximum dry density (AASHTO T-180). Subgrade soils within 12 inches of the bottom of the pavement base course should be compacted to at least 98 percent of the Modified Proctor maximum dry density (AASHTO T-180).

- Following satisfactory completion proofrolling, additional fill should be placed and compacted as needed to achieve the desired grades. At least a foot of clearance between the bottom of the base and the wet season ground water level should be maintained. Fill should generally consist of dry fine sand with less than 12 percent passing the No. 200 sieve and be free of rubble, organics, clay, debris and other unsuitable material. Fill should be tested and approved prior to acquisition.

- Approved sand fill should be placed in loose lifts not exceeding 12 inches in thickness and should be compacted to a minimum of 95 percent of the Modified Proctor maximum dry density (AASHTO T-180). The upper foot of pavement subgrade should be compacted to at least 98 percent of Modified Proctor. Density tests to confirm compaction should be performed in each fill lift before the next lift is placed.

- Prior to beginning compaction, soil moisture contents should be adjusted in order to facilitate proper compaction. A moisture content within 2 percentage points of the optimum indicated by the Modified Proctor Test (AASHTO T-180) is recommended prior to compaction of the natural ground and fill.

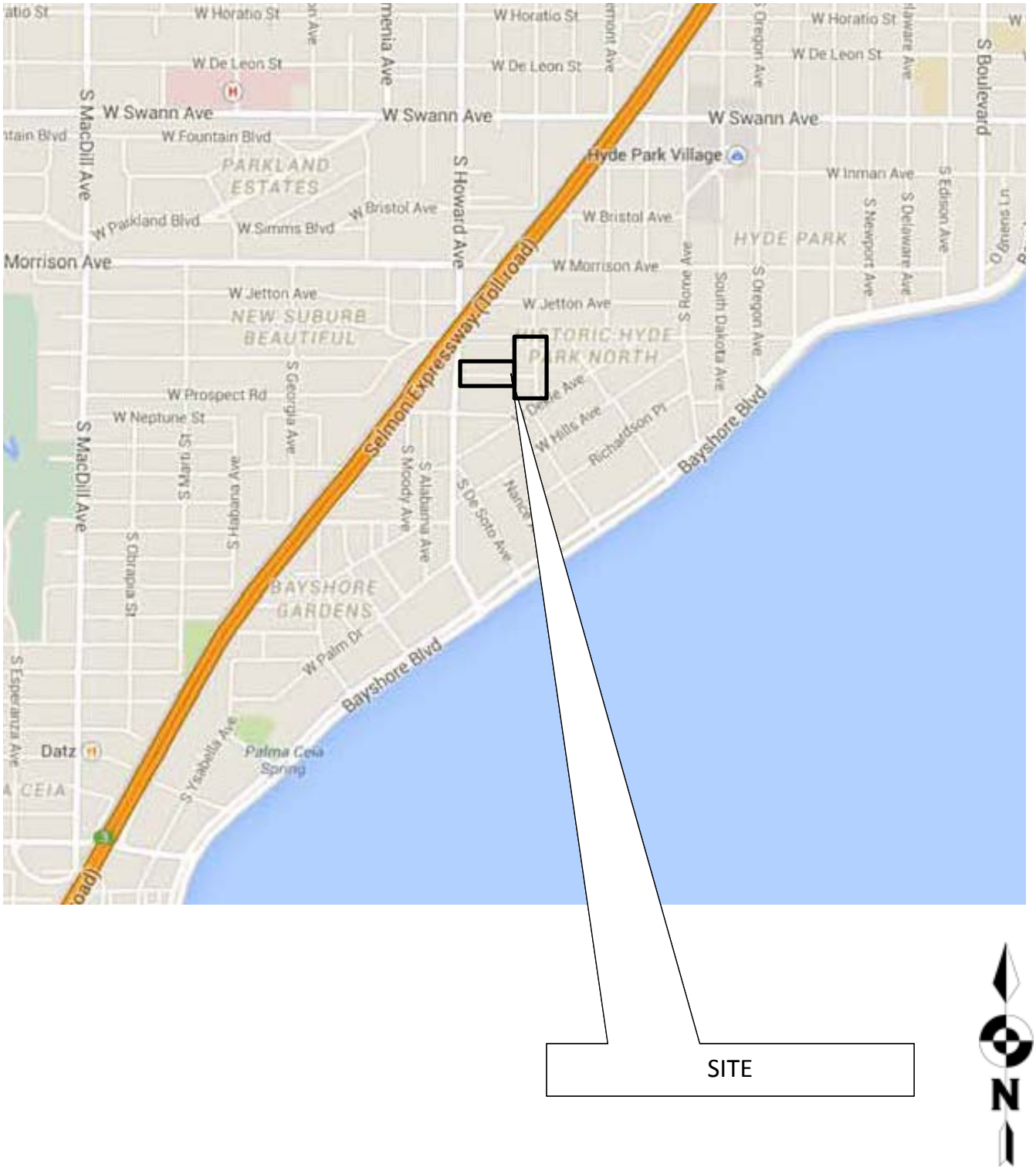
- A materials testing laboratory should be retained to provide on-site observation of earthwork and ground modification activities. Density tests should be performed in the top one foot of compacted existing ground, in each fill lift, and at the bottom of foundation excavations.

8.0 BASIS FOR RECOMMENDATIONS

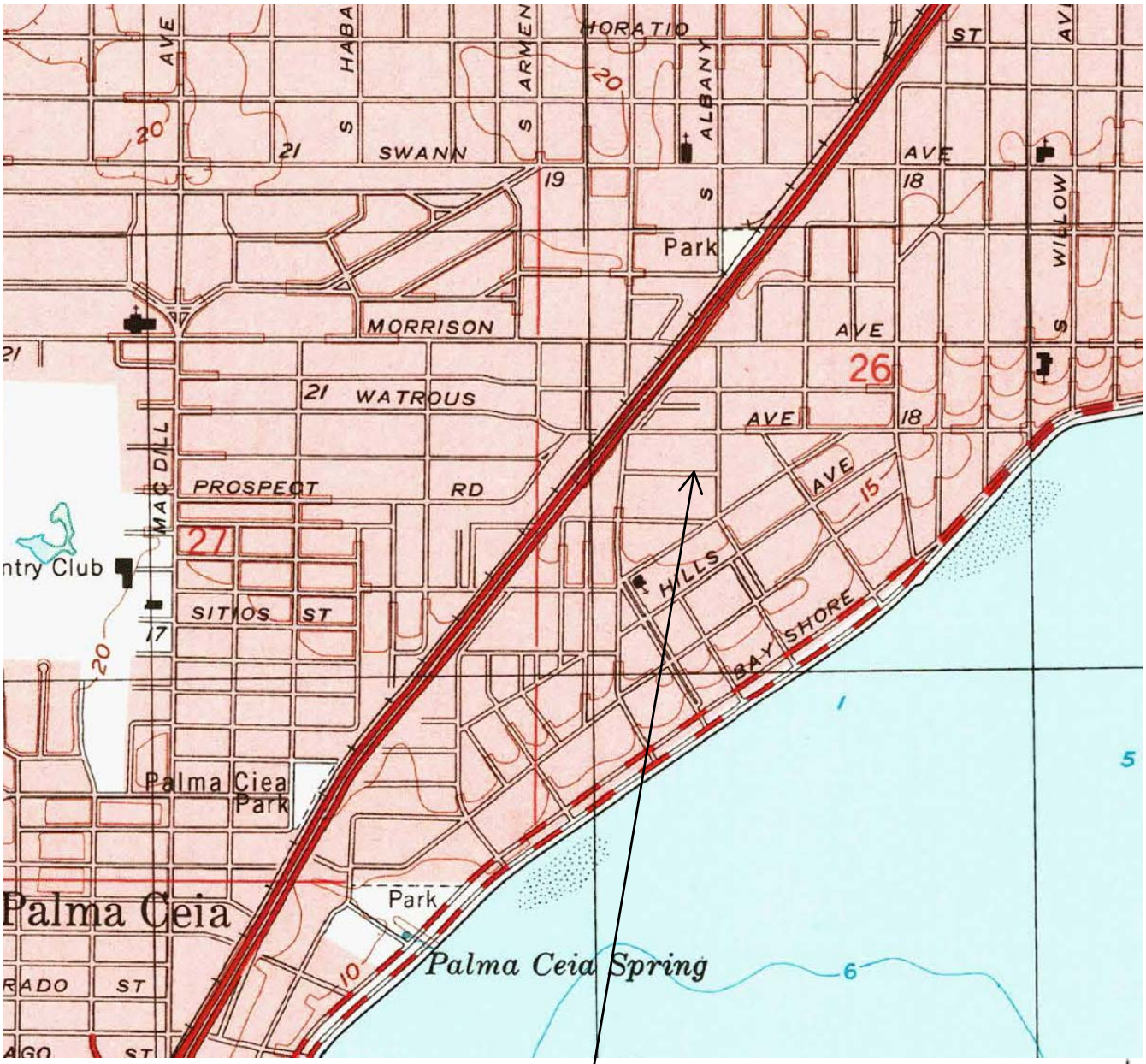
The analysis and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated. Regardless of the thoroughness of a geotechnical exploration, there is always a possibility that conditions between borings will be different from those at specific boring locations and that conditions will not be as anticipated by the designers or contractors. In addition, the construction process itself may alter soil conditions. AREHNA is not responsible for the conclusions, opinions or recommendations made by others based on the data presented in this report.

APPENDIX A

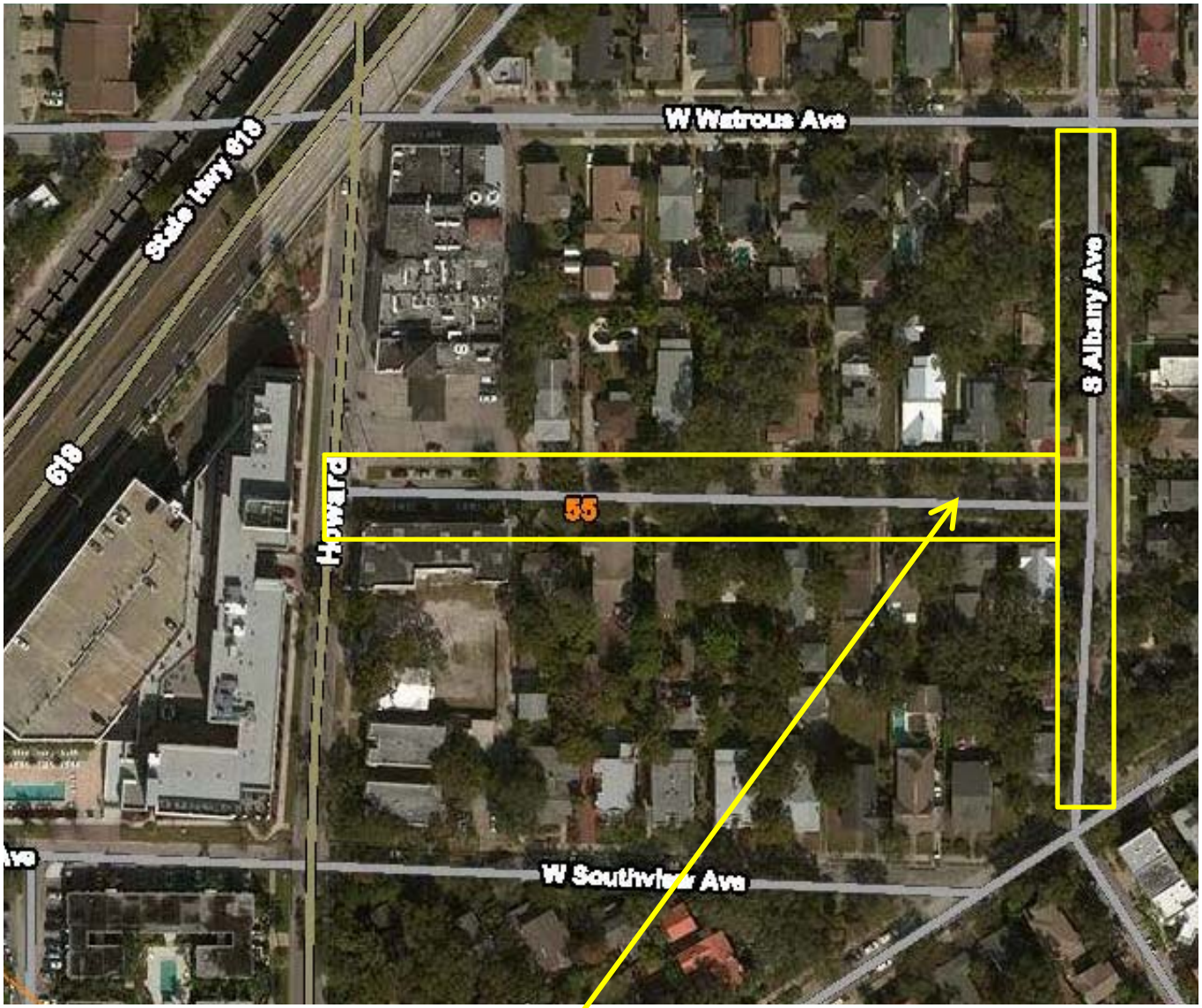
Project Site Location Map – Figure 1
USGS Topographic Survey – Figure 2
USDA Soil Survey – Figure 3



COT Marjory Avenue Tampa, Florida	AREHNA | Engineering, Inc. 5012 West Lemon Street, Tampa, FL 33609 Phone 813.944.3464 ▪ Fax 813.944.4959	PROJECT SITE LOCATION MAP	
Client: City of Tampa Project: B-15-008 Date: 3/6/2015		Designed By: KSL Checked By: JEP Drawn By: KCA	FIGURE 1



COT Marjory Avenue Tampa, Florida	AREHNA | Engineering, Inc. 5012 West Lemon Street, Tampa, FL 33609 Phone 813.944.3464 ▪ Fax 813.944.4959	USGS TOPOGRAPHIC SURVEY	
Client: City of Tampa Project: B-15-008 Date: 3/6/2015		Designed By: KSL Checked By: JEP Drawn By: KCA	FIGURE **2**



Soil Mapping Unit
55 – Tavares-Urban land complex, 0 to 5 percent slopes

N

COT Marjory Avenue
Tampa, Florida

Client: City of Tampa
Project: B-15-008
Date: 3/6/2015

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USDA SOIL SURVEY

Designed By: KSL
Checked By: JEP
Drawn By: KCA

FIGURE
3

APPENDIX B

Report of Core Borings/Boring Location Plan
Laboratory Test Results – Table 1
Field and Laboratory Procedures

SCALE: N.T.S.

LEGEND

1: ASPHALT

2: PAVERS

3: LIMEROCK BASE

4: DARK GRAY, LIGHT GRAY, BROWN, AND LIGHT BROWN FINE SAND AND SLIGHTLY CLAYEY FINE SAND (A-3)

5: LIGHT BROWN AND GRAY FINE SAND WITH SOME LIMEROCK FRAGMENTS (A-3)

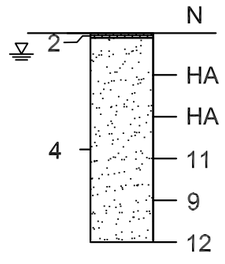
6: GRAY CLAYEY FINE SAND (A-2-7)

NOTES:
- APPROXIMATE SPT/CORE BORING LOCATION
- N SPT 'N' VALUE
- RC ROCK CORE
- HA HAND AUGER
- WATER TABLE

GRANULAR MATERIALS- RELATIVE DENSITY	SPT (BLOWS/FT)
VERY LOOSE	LESS THAN 4
LOOSE	5-10
MEDIUM	11-30
DENSE	31-50
VERY DENSE	GREATER THAN 50

SILTS AND CLAYS CONSISTENCY	SPT (BLOWS/FT)
VERY SOFT	LESS THAN 2
SOFT	3-4
FIRM	5-8
STIFF	9-15
VERY STIFF	16-30
HARD	30-50
VERY HARD	GREATER THAN 50

BORING NO. = B-1
DATE = 2/26/15



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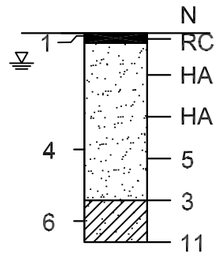

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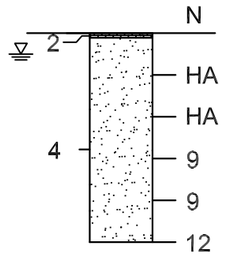

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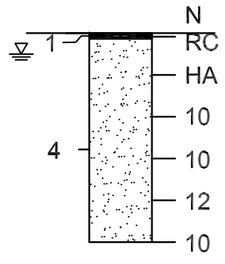

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DRAWN BY:	KSL	3/4/15
CHECKED BY:	JEP	3/4/15
SUPERVISED BY:		

REPORT OF CORE BORINGS/BORING LOCATION PLAN	PROJECT NO.	SHEET NO.
MARJORY AVENUE: BORINGS B-01 THROUGH B-04 TAMPA, FL	B-15-008	1

SCALE: N.T.S.

LEGEND

1: ASPHALT

2: PAVERS

3: LIMEROCK BASE

4: DARK GRAY, LIGHT GRAY, BROWN, AND LIGHT BROWN FINE SAND AND SLIGHTLY SILTY FINE SAND (A-3)

5: LIGHT BROWN AND GRAY FINE SAND WITH SOME LIMEROCK FRAGMENTS (A-3)

6: GRAY CLAYEY FINE SAND (A-2-7)

NOTES:

APPROXIMATE SPT/CORE BORING LOCATION
N SPT 'N' VALUE
RC ROCK CORE
HA HAND AUGER
WATER TABLE

GRANULAR MATERIALS- RELATIVE DENSITY	SPT (BLOWS/FT)
VERY LOOSE	LESS THAN 4
LOOSE	5-10
MEDIUM	11-30
DENSE	31-50
VERY DENSE	GREATER THAN 50

SILTS AND CLAYS CONSISTENCY	SPT (BLOWS/FT)
VERY SOFT	LESS THAN 2
SOFT	3-4
FIRM	5-8
STIFF	9-15
VERY STIFF	16-30
HARD	30-50
VERY HARD	GREATER THAN 50

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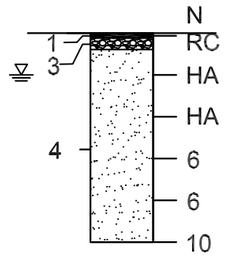
DATE = 2/26/15



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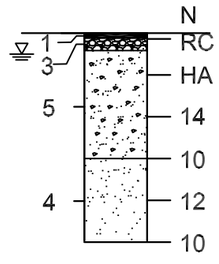

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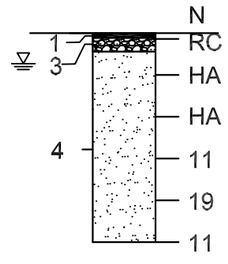

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CHECKED BY:	JEP	3/4/15
SUPERVISED BY:		

REPORT OF CORE BORINGS/BORING LOCATION PLAN	PROJECT NO.	SHEET NO.
MARJORY AVENUE: BORINGS B-05 THROUGH B-07 TAMPA, FL	B-15-008	2

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS

City of Tampa - Stormwater Division
W. Marjory Avenue – S. Howard Avenue to S. Albany Avenue
Tampa, FL

AREHNA Project No.: B-15-008

Boring No.	Sample Depth (feet)	Percent Moisture Content	Percent Finer (-200 sieve)
B-1	0.0 – 2.0	26.7	4.8
B-1	8.0 – 10.0	17.7	9.5
B-2	8.0 – 10.0	17.4	14.1

FIELD PROCEDURES

Standard Penetration Test (SPT) Borings

The SPT borings are performed in general accordance with ASTM D-1586, "Penetration Test and Split-Barrel Sampling of Soils." A rotary drilling process is used and bentonite drilling fluid is circulated in the boreholes to stabilize the sides and flush the cuttings. At regular intervals, the drilling tools are removed and soil samples are obtained with a standard 2-feet long, 2-inch diameter split-tube sampler. The sampler is first seated 6 inches and then driven an additional foot with blows of a 140-pound hammer falling under its own weight a distance of 30 inches. The number of hammer blows required to drive the sampler the final foot is designated the "Penetration Resistance." The penetration resistance, when properly interpreted, is an index to the soil strength and density.

Auger Boring

The auger borings are performed in general accordance with ASTM D-1452, “Standard Practice for Soil Investigation and Sampling by Auger Borings”. Auger borings are advanced manually using a bucket-type hand auger. The soils encountered are identified, in the field, from cuttings brought to the surface by the augering process. Representative soil samples from the auger borings are placed in glass jars and transported to our laboratory where they are examined by an engineer for classification.

LABORATORY PROCEDURES

Water Content

The water content is the ratio, expressed as a percentage, of the weight of water in a given mass of soil to the weight of the solid particles. This test is conducted in general accordance with FM 1-T265.

Fines Content

In this test, the sample is dried and then washed over a No. 200 mesh sieve. The percentage of soil by weight passing the sieve is the percentage of fines or portion of the sample in the silt and clay size range. This test is conducted in general accordance with ASTM D-1140.