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REPORT OF A
GEOTECHNICAL EXPLORATION

Jammes Road Force Main Replacement
Duval County, Florida

November 21, 2018

PROJECT NO. 0930.1800260.0000
REPORT NO. 1626021

Prepared For:

J. Collins Engineernig Associates, LLC
12412 San Jose Boulevard – Suite 204
Jacksonville, Florida 32223

Prepared By:

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November 21, 2018

J. Collins Engineernig Associates, LLC
12412 San Jose Boulevard – Suite 204
Jacksonville, Florida 32223

Attention: Mr. John Collins

Reference: **REPORT OF A GEOTECHNICAL EXPLORATION**
Jammes Road Force Main Replacement
Jacksonville, Florida
UES Project No. 0930.1800260.0000 and Report No. 1626021

Dear Mr. Collins:

As requested, Universal Engineering Sciences, Inc. has completed a geotechnical exploration for the subject project. This report briefly presents our understanding of the proposed construction, describes the field exploration performed, presents the data obtained, and provides our geotechnical engineering evaluation of the subsurface conditions at the subject utility crossing with respect to the proposed construction.

PROJECT INFORMATION

Project information was provided to us in recent correspondence with you. We were provided with a copy of Construction Drawings for the project prepared by J. Collins Engineering Associates, LLC dated August 2018. These plans show the roadways located adjacent to the site and the proposed force main location.

We understand that the proposed construction will consist of replacing an existing force main along Jammes Road from Wilson Boulevard to just south of Harlow Road. It is assumed pipe depths will be approximately 10 feet or less below the existing pavement.

This report presents the soil conditions encountered on the basis of traditional geotechnical procedures for site characterization. The recovered samples were not examined, either visually or analytically, for chemical composition or environmental hazards. Universal Engineering Sciences would be pleased to perform these services if you desire.

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Our work did not address the potential for surface expression of deep geological conditions. This evaluation requires a more extensive range of field services than performed in this study. We will be pleased to conduct an investigation to evaluate the probable effect of the regional geology upon the proposed construction if you desire.

FIELD EXPLORATION

A field exploration was performed on November 8-12, 2018. The approximate boring locations are shown on the attached Boring Location Plan in Appendix A. The approximate boring locations were determined in the field by our personnel using taped measurements from existing features at the site, and should be considered accurate only to the degree implied by the method of measurement used. Samples of the soils encountered will be held in our laboratory for your inspection for 60 days unless we are notified otherwise.

To explore the subsurface conditions within the area of the proposed utility extension, we located and drilled five (5) Standard Penetration Test (SPT) borings to depths of 15 feet below the existing ground surface in general accordance with the methodology outlined in ASTM D 1586. A summary of this field procedure is included in Appendix A. Split-spoon soil samples recovered during performance of the boring were visually classified in the field and representative portions of the samples were transported to our laboratory for further evaluation.

LABORATORY EXPLORATION

Representative soil samples obtained during our field exploration were returned to our office and classified by a geotechnical engineer. The samples were visually classified in general accordance with ASTM D 2488 (Unified Soil Classification System).

Eight (8) fines content tests, eight (8) moisture content tests, and two (2) Atterberg limits tests were conducted in the laboratory on representative soil samples obtained from the borings. These tests were performed to aid in classifying the soils and to help quantify and correlate engineering properties. The results of these tests are presented on the Boring Logs in Appendix A. A brief description of the laboratory procedures used is also provided in Appendix A.

FINDINGS

Surface Conditions

The construction limits for the project are along Jammes Road between Wilson Boulevard to just south of Harlow Road in Duval County, Florida. These roads are paved and are bordered by both commercial development and wooded properties. There was no standing water observed at the time of our exploration.

General Soil Profile

The boring locations and detailed subsurface conditions are included in the Attachments on the Boring Location Plan and Boring Logs. The classifications and descriptions shown on the logs are generally based upon visual characterizations and laboratory results of the recovered soil samples. When reviewing these records, it should be understood that the soil conditions will vary across the site. The following table summarizes the soil conditions encountered.

TABLE 1A (Land Borings)
General Soil Profile

Typical depth (ft)		Soil Descriptions
From	To	
0	0.2 to 0.4	Asphalt (2.5" to 4.5")
0.2 to 0.4	0.7 to 1.3	Limerock (6.5" to 10.75")
0.7 to 1.3	2.8 to 4	Very loose to medium dense slightly silty fine sand (SP-SM) and slightly clayey fine sand (SP-SC)
2.8 to 4	6.5 to 12	Very loose to medium dense clayey to very clayey fine sand (SC) and very soft to very stiff clay (CL)
6.5 to 12	12 to 15	Loose to medium dense fine sand (SP) and slightly clayey fine sand (SP-SC)
12 to 15	15*	Very soft clay (CL)** and loose silty fine sand (SM)***

* Termination Depth of Deepest Boring
**Boring B-4
***Boring B-5
( ) Indicates Unified Soil Classification

The groundwater levels were encountered at the boring locations and recorded at the time of drilling at depths of 5.3 to 6.0 feet below the existing ground surface. The groundwater should be anticipated to fluctuate due to seasonal climatic variations, surface water runoff patterns, construction operations and other interrelated factors. We estimate the seasonal high water levels will occur approximately 2 feet above the level we encountered at the time of our exploration. These estimates are based upon our review of U.S.G.S. data, Duval County Soils Survey, and regional hydrogeology.

GEOTECHNICAL ENGINEERING EVALUATION AND RECOMMENDATIONS

Directional Drilling and Jack and Bore Construction Recommendations

Geotechnical information to aid in planning any directional drilling procedures for the specific boring locations is shown in Tables 2A to 2E below:

TABLE 2A DESIGN PARAMETERS (B-1)							
Typical Depth[1] (ft)		Total Unit Weight (pcf)	Friction Angle[2] (degrees)	Cohesion (psf)	Ko	Ka	Kp
From	To						
0	3.8	120	32	--	0.47	0.31	3.3
3.8	5	105	26	--	0.56	0.39	2.6
5	13	120	31	--	0.48	0.32	3.1
13	15	105	28	--	0.53	0.36	2.8

1) Depth below existing ground surface.
2) The indicated values are ultimate values. Appropriate factors of safety should be applied to these values for design purposes.

TABLE 2B DESIGN PARAMETERS (B-2)							
Typical Depth[1] (ft)		Total Unit Weight (pcf)	Friction Angle[2] (degrees)	Cohesion (psf)	Ko	Ka	Kp
From	To						
0	3.5	110	30	--	0.50	0.33	3.0
3.5	6.5	105	--	1500	1.0	1.0	1.0
6.5	15	105	29	--	0.52	0.35	2.9

1) Depth below existing ground surface.
2) The indicated values are ultimate values. Appropriate factors of safety should be applied to these values for design purposes.

TABLE 2C DESIGN PARAMETERS (B-3)							
Typical Depth[1] (ft)		Total Unit Weight (pcf)	Friction Angle[2] (degrees)	Cohesion (psf)	Ko	Ka	Kp
From	To						
0	3.5	120	31	--	0.48	0.32	3.1
3.5	7	105	--	1200	1.0	1.0	1.0
7	9.5	110	32	--	0.47	0.31	3.3
9.5	12.5	105	29	--	0.52	0.35	2.9
12.5	15	110	32	--	0.47	0.31	3.3

1) Depth below existing ground surface.
2) The indicated values are ultimate values. Appropriate factors of safety should be applied to these values for design purposes.

TABLE 2D DESIGN PARAMETERS (B-4)							
Typical Depth[1] (ft)		Total Unit Weight (pcf)	Friction Angle[2] (degrees)	Cohesion (psf)	Ko	Ka	Kp
From	To						
0	4	120	31	--	0.48	0.32	3.1
4	6.5	105	--	1000	1.0	1.0	1.0
6.5	8.2	110	29	--	0.52	0.35	2.9
8.2	14	105	29	--	0.52	0.35	2.9
14	15	100	--	250	1.0	1.0	1.0

1) Depth below existing ground surface.
2) The indicated values are ultimate values. Appropriate factors of safety should be applied to these values for design purposes.

TABLE 2E DESIGN PARAMETERS (B-5)							
Typical Depth[1] (ft)		Total Unit Weight (pcf)	Friction Angle[2] (degrees)	Cohesion (psf)	Ko	Ka	Kp
From	To						
0	2.8	120	31	--	0.48	0.32	3.1
2.8	3.2	100	--	750	1.0	1.0	1.0
3.2	5	110	--	2500	1.0	1.0	1.0
5	8	100	--	1000	1.0	1.0	1.0
8	12	110	29	--	0.52	0.35	2.9
12	15	105	27	--	0.55	0.38	2.7

1) Depth below existing ground surface.
2) The indicated values are ultimate values. Appropriate factors of safety should be applied to these values for design purposes.

The above parameters are based on the field data and limited laboratory testing data obtained from the site. It should be anticipated that soil strength parameters will vary between boring locations and may transition gradually between adjacent soil layers. Seams and layers of denser/harder of looser/softer soils may be encountered within the soil layers shown above.

Launching and Receiving Pit Preparation

Based on our evaluation of the soil conditions encountered in this area, we offer the following recommendations for the proposed construction.

1. The proposed construction area should be dewatered as necessary and excavated to the required pit depths. Excavation work will be required to meet OSHA Excavation Standard Subpart P regulations, Type C Soils. Either a braced sheet pile structure or an excavation with temporary side slopes cut back at 1.5 horizontal to 1.0 vertical can be implemented, depending on the specific project requirements. The side slope of 1.5 horizontal to 1.0 vertical is contingent upon the dewatering system adequately controlling slope seepage. Sheet piling should be designed according to OSHA sheeting and bracing requirements. We recommend a Florida registered Professional Engineer design the sheeting/bracing system.

2. A dewatering system will likely be required for the project. The water table should be maintained at least two feet below the proposed bottom of the required excavation. The dewatering system should not be decommissioned until the excavation is backfilled two feet above the groundwater level at the time of construction.

3. The natural soil and backfill in the excavation bottom should be densified using hand-operated compaction equipment once the drilling procedures are completed. Based on the boring data, the soils classified at slightly clayey fine sand (SP-SC) and slightly silty fine sand (SP-SM) that may be excavated from the pits areas, can be used as structural backfill. The soils classified as clayey sand (SC), silty sand (SM), and sandy clay (CL) should not be used as structural backfill due to the high fines and moisture content. Compaction should continue until a minimum density of 95 percent of the soils Modified Proctor maximum dry density (ASTM D 1557) has been achieved to a depth of one foot and in each lift of backfill.

4. All backfill should be placed in level lifts not exceeding six inches loose thickness. The fine sands and fine sands with silt excavated from the pits may be used as backfill. Any large roots should be removed prior to placing backfill.

Dewatering

The groundwater levels were encountered at a depth range of 5.3 to 6.0 feet below the ground surface. Based on the water conditions encountered, the need for dewatering operations may be necessary. The actual method(s) of dewatering should be determined by the contractor. Regardless of the method(s) used, we suggest drawing down the water level at least two feet below the bottom of the excavations to preclude "pumping" and /or compaction related problems with the subgrade soils.

Dewatering should be accomplished with the knowledge that the permeability of the soils decreases with increasing silt and clay content. The sand (SP) type soils can

usually be dewatered by well pointing. Permeability values for these type soils generally range from low 10^{-5} cm/sec to high 10^{-2} cm/sec.

Open Cut Site Preparation Procedures

We recommend the following site preparation procedures for open cut construction:

1. Implement temporary groundwater control measures. It is recommended the groundwater be maintained at least 18 inches below compacted surfaces, and also 18 inches below the depths of excavation required. Temporary groundwater control measures should be the responsibility of the contractor.

2. Excavate to the proposed bearing level. Maintain a minimum separation of at least one foot between the utility bearing depths and the top of the clayey fine sand (SC), silty fine sand (SM), or clay (CL). Clayey fine sand present within the recommended separation zone should be over-excavated and replaced with compacted structural backfill. Compact the exposed surface of sandy soils within the excavations with lightweight, hand equipment until a density of at least 95 percent of the Modified Proctor maximum dry density (ASTM D-1557) is achieved within the upper one foot. We recommend the compacted soils have a moisture content within 2 percent of the optimum value as determined by the Modified Proctor maximum dry density (ASTM-D1557). Please note that clayey fine sand (SC) and clay (CL) could be difficult to work with during wet conditions due to its inherent natural moisture. The project budget should account for these possible difficult construction operations.

   Should the soils experience pumping and soil strength loss during the compaction operations, compaction work should be immediately terminated and (1) the disturbed soils removed and backfilled with dry structural fill soils which are then compacted, or (2) the excess moisture content within the disturbed soils allowed to dissipate before recompacting.

   FDOT No. 57 stone placed below the pipeline bearing depths in a thickness of one foot can be used in lieu of compacted structural backfill. It is recommended the stone be fully wrapped with a geotextile filter fabric such as Mirafi 140N, or equivalent. The excavations should be performed in accordance with OSHA specifications.

3. Test the compacted surface within the upper one foot for density at a frequency of not less than one test per 300 linear feet of pipeline.

4. Place fill material, as required. The fill should consist of "clean," fine sand with less than 5 percent soil fines. You may use fill materials with soil fines between 5 percent and 10 percent, but strict moisture control may be

required. Place fill in uniform 10 to 12-inch loose lifts and compact each lift to a minimum density of 95 percent of the Modified Proctor maximum dry density. We recommend the compacted soils have a moisture content within 2 percent of the optimum value as determined by the Modified Proctor maximum dry density (ASTM-D1557).

5. Perform compliance tests within each lift of fill at a frequency of not less than one test per 300 linear feet of pipeline.

Borrow Suitability

The borings were planned, in part, to provide an indication of the suitability of excavated soils from the proposed construction for use as structural backfill beneath placement areas. Based on the boring results and classification of the soil samples, the soil described as slightly silty fine sand (SP-SM) and slightly clayey fine sand (SP-SC) are considered suitable for use as structural backfill depending on the moisture content of the soils at the time of placement and compaction. It should be understood that all soils excavated from below the water table may be excessively wet and may require stockpiling or spreading to dry prior to placement and compaction. Soils described as slightly silty fine sand (SP-SM) and slightly clayey fine sand (SP-SC) may take longer to dry than the soils described as fine sand (SP). The soils classified as clayey fine sand (SC), silty fine sand (SM), and clay (CL) are not considered suitable for structural backfill material due to their plasticity characteristics and inherent moisture-related instability. Although not suitable for structural fill, due to excessive organic content, the topsoil materials may be used in landscape areas as long as positive drainage is maintained.

Pavement Reconstruction

It is understood that pavement reconstruction will be performed in accordance with City of Jacksonville or FDOT details. If required, we can provide more detailed recommendations for pavement construction.

LIMITATIONS

During the early stages of most construction projects, geotechnical issues not addressed in this report may arise. Because of the natural limitations inherent in working with the subsurface, it is not possible for a geotechnical engineer to predict and address all possible problems. An Geotechnical Business Council (GBC) publication, "Important Information About Your Geotechnical Engineering Report" appears in Appendix B, and will help explain the nature of geotechnical issues.

We trust this report meets your needs and addresses the geotechnical issues associated with the proposed construction. We appreciate the opportunity to have

worked with you on this project and look forward to a continued association. Please do not hesitate to contact us if you should have any questions, or if we may further assist you as your plans proceed.

Respectfully submitted,

UNIVERSAL ENGINEERING SCIENCES
Certificate of Authorization No. 549

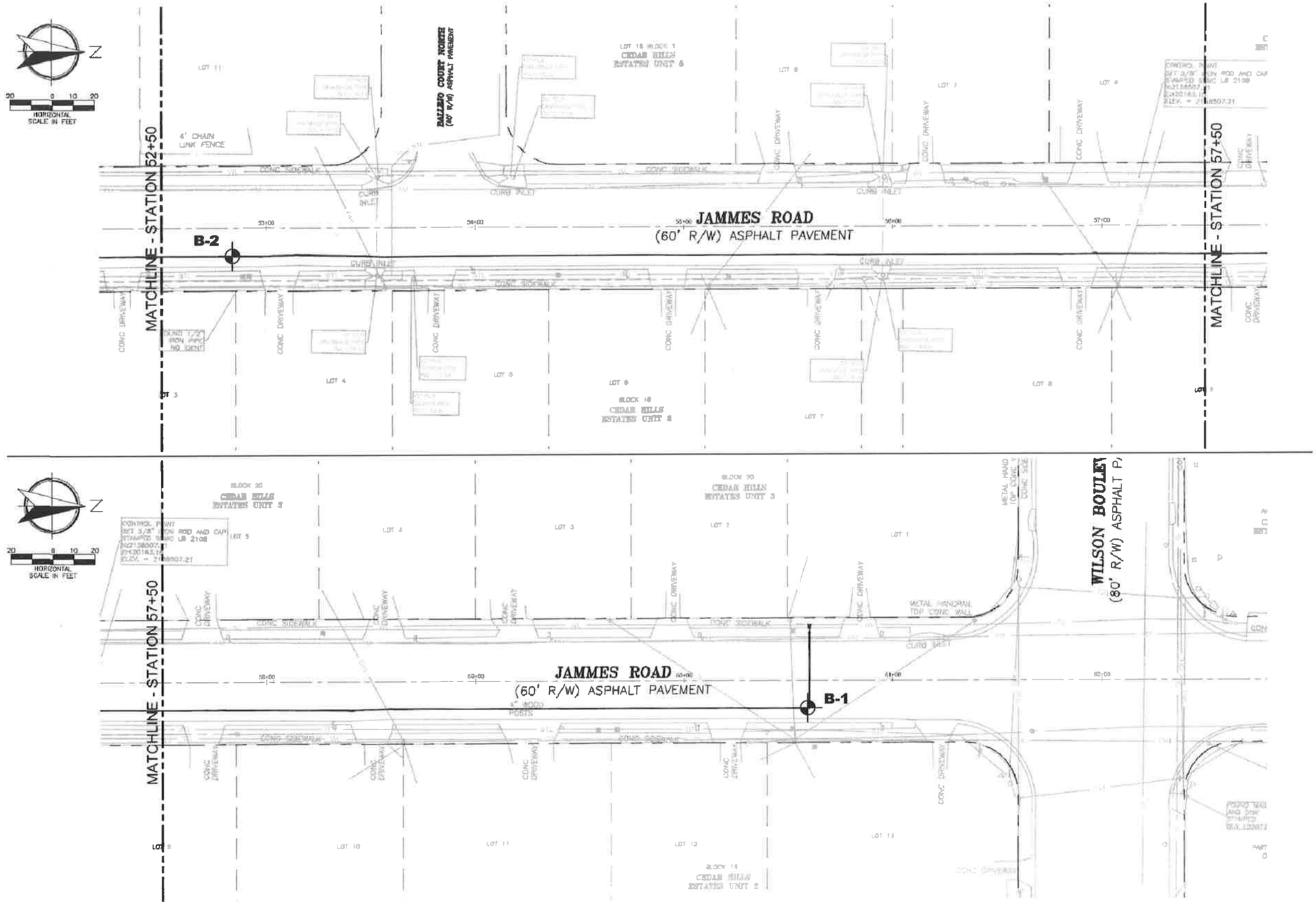
Stephen R. Weaver, P.E.
Geotechnical Services Manager
FL P.E. Number 37389
Date: 11/21/18

SRW/sw

Jacob Fuller
Staff Geotechnical Engineer

APPENDIX A

BORING LOCATION PLAN
BORING LOGS
KEY TO BORING LOGS
FIELD EXPLORATION PROCEDURES
LABORATORY TESTING PROCEDURES



CLIENT:
J. COLLINS ENGINEERING ASSOCIATES

GEOTECHNICAL EXPLORATION
JAMMES ROAD FORCE MAIN REPLACEMENT
JACKSONVILLE, FLORIDA

BORING LOCATION PLAN

DRAWN BY: TW	DATE: 11/20/18
CHECKED BY: PM	DATE: 11/20/18
SCALE: AS SHOWN	
PROJECT NO: 0930.1800260.0000	REPORT NO:

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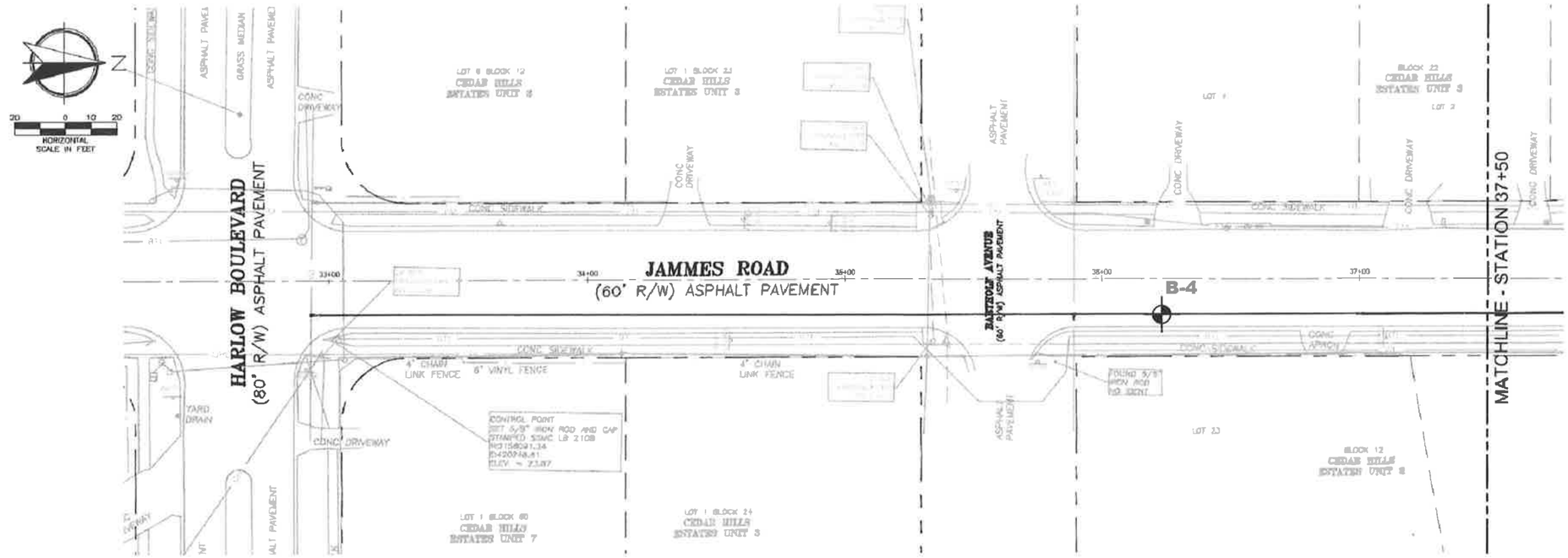
PAGE NO:
FIGURE 1



CLIENT: J. COLLINS ENGINEERING ASSOCIATES

GEOTECHNICAL EXPLORATION
JAMMES ROAD FORCE MAIN REPLACEMENT
JACKSONVILLE, FLORIDA

BORING LOCATION PLAN

DRAWN BY: TW	DATE: 11/20/18
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SCALE: AS SHOWN	
PROJECT NO: 0930.1800260.0000	REPORT NO:

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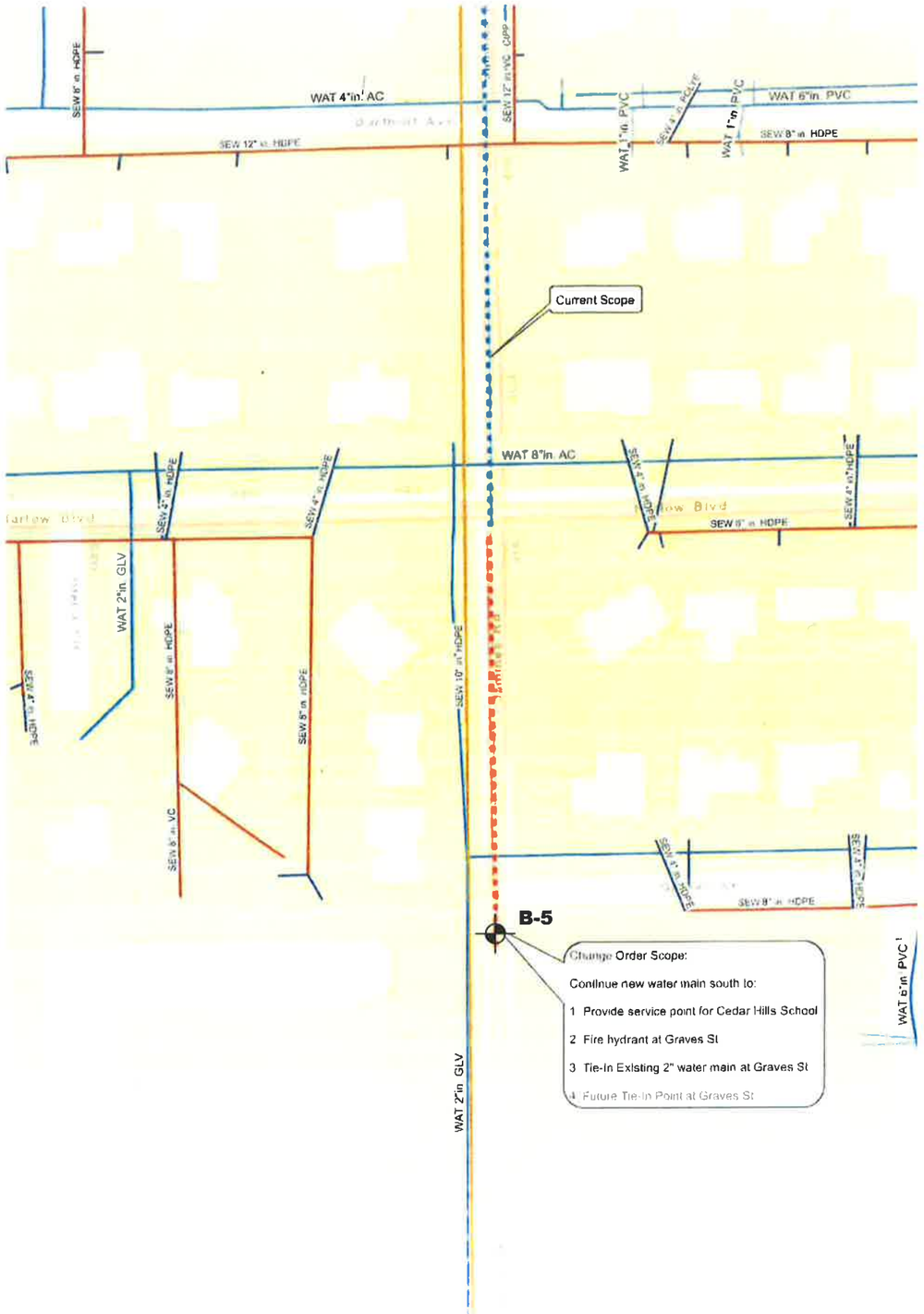
FIGURE 2



North

LEGEND

SPT BORING LOCATIONS

CLIENT: J. COLLINS ENGINEERING ASSOCIATES

DRAWN BY: TW	DATE: 11/20/18
CHECKED BY: PM	DATE: 11/20/18
SCALE: N.T.S.	
PROJECT NO: 0930.1800260.0000	REPORT NO:

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BORING LOCATION PLAN

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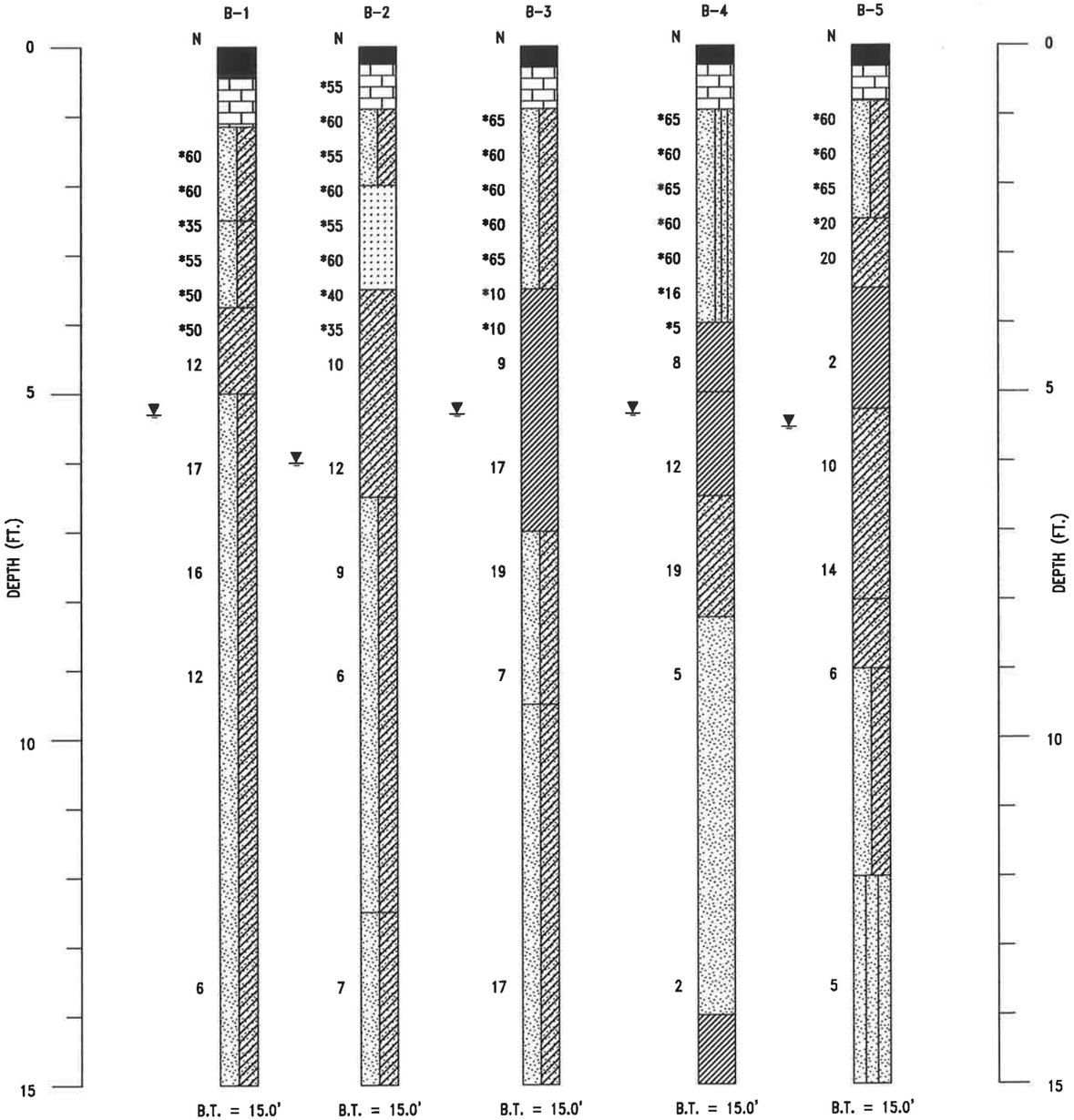
FIGURE 3



LEGEND

- Asphalt
- Limerock
- Sand (SP)
- Slightly Clayey Sand (SP–SC)
- Slightly Silty Sand (SP–SM)
- Clayey Sand (SC)
- Slightly Silty Sand with Hardpan (Hardpan) (HP)
- Clay (CL)
- Groundwater Table
- BT Boring Termination Depth
- N SPT Blow Count

CLIENT: J. COLLINS ENGINEERING ASSOCIATES

DRAWN BY: TW | DATE: 11/20/18

CHECKED BY: JF | DATE: 11/20/18

SCALE: AS SHOWN

PROJECT NO: 0930.1800260.0000 | REPORT NO:

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SOIL BORING PROFILES

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FIGURE 4

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BORING LOG

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JAMMES ROAD FORCE MAIN REPLACEMENT
JACKSONVILLE, FLORIDA

BORING DESIGNATION: **B-1** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

CLIENT: J. COLLINS ENGINEERING ASSOCIATES
LOCATION: SEE BORING LOCATION PLAN
REMARKS: *STATIC CONE PENETROMETER READING IN KG/CM2

G.S. ELEVATION (ft):
WATER TABLE (ft): 5.3
DATE OF READING: 11/12/18
EST. W.S.W.T. (ft):

DATE STARTED: 11/12/18
DATE FINISHED: 11/12/18
DRILLED BY: S. TORRES/DANIEL
TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./ DAY)	ORG. CONT. (%)
0						ASPHALT 4 1/2"						
						LIMEROCK 10 3/4"						
			*60			Medium dense brown slightly Clayey fine SAND with trace Hardpan (SP-SC)						
			*60									
			*35			Medium dense reddish-orange to gray slightly Clayey fine SAND (SP-SC)	6.3	18.2				
			*55									
			*50			Medium dense reddish-orange to gray Clayey fine SAND (SC)						
			*50									
5				▼		Medium dense to loose orangish-brown to light brown to orange slightly Clayey fine SAND (SP-SC)						
		3-5-7	12									
		7-10-7	17									
		4-8-8	16									
10		4-5-7	12									
15		2-3-3	6									

BORING_LOG 0930.1800260.0000-JAMMES ROAD FORCE MAIN REPLACEMENT.GPJ UNIENGSC.GDT 11/20/18

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JAMMES ROAD FORCE MAIN REPLACEMENT
JACKSONVILLE, FLORIDA

BORING DESIGNATION: **B-2** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

CLIENT: J. COLLINS ENGINEERING ASSOCIATES
LOCATION: SEE BORING LOCATION PLAN
REMARKS: *STATIC CONE PENETROMETER READING IN KG/CM2

G.S. ELEVATION (ft):
WATER TABLE (ft): 6.0
DATE OF READING: 11/12/18
EST. W.S.W.T. (ft):

DATE STARTED: 11/12/18
DATE FINISHED: 11/12/18
DRILLED BY: S. TORRES/DANIEL
TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./DAY)	ORG. CONT. (%)
0						ASPHALT 2 1/2"						
						LIMEROCK 6 1/2"						
			*55			Brown slightly Clayey fine SAND (SP-SC)						
			*60									
			*55									
			*60			Dark reddish-brown slightly Silty fine SAND (SP-SM) (Hardpan)						
			*55									
			*60									
			*40			Gray to reddish-orange very Clayey fine SAND (SC)						
			*35									
5						PP=2.0 tsf						
		4-4-6	10	▼			37.8	21.8	39	25		
						Medium dense to loose orangish-gray slightly Clayey fine SAND (SP-SC)						
		5-6-6	12									
		4-4-5	9									
10												
		3-3-3	6									
						Loose orange slightly Clayey fine SAND (SP-SC)						
15		3-4-3	7									

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PROJECT: GEOTECHNICAL EXPLORATION
JAMMES ROAD FORCE MAIN REPLACEMENT
JACKSONVILLE, FLORIDA

BORING DESIGNATION: **B-3** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

CLIENT: J. COLLINS ENGINEERING ASSOCIATES
LOCATION: SEE BORING LOCATION PLAN
REMARKS: *STATIC CONE PENETROMETER READING IN KG/CM2

G.S. ELEVATION (ft):
WATER TABLE (ft): 5.3
DATE OF READING: 11/12/18
EST. W.S.W.T. (ft):

DATE STARTED: 11/12/18
DATE FINISHED: 11/12/18
DRILLED BY: S. TORRES/DANIEL
TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./DAY)	ORG. CONT. (%)
0						ASPHALT 3"						
						LIMEROCK 7"						
			*65			Medium dense brown to orangish-brown to light brown slightly Clayey fine SAND (SP-SC)						
			*60									
			*60									
			*60									
			*65									
			*10			Loose orange and reddish-gray Sandy CLAY (CL)						
			*10									
5				▼								
		2-4-5	9									
						Medium dense orange brown slightly Clayey fine SAND (SP-SC)						
		7-8-9	17									
		7-9-10	19				12.0	23.2				
10						Loose to medium dense light gray to gray slightly Clayey fine SAND (SP-SC)						
		5-3-4	7									
15		3-8-9	17									

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BORING LOG

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JAMMES ROAD FORCE MAIN REPLACEMENT
JACKSONVILLE, FLORIDA

BORING DESIGNATION: **B-4** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

CLIENT: J. COLLINS ENGINEERING ASSOCIATES
LOCATION: SEE BORING LOCATION PLAN
REMARKS: *STATIC CONE PENETROMETER READING IN KG/CM2

G.S. ELEVATION (ft):
WATER TABLE (ft): 5.3
DATE OF READING: 11/12/18
EST. W.S.W.T. (ft):

DATE STARTED: 11/12/18
DATE FINISHED: 11/12/18
DRILLED BY: S. TORRES/DANIEL
TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./ DAY)	ORG. CONT. (%)
0						ASPHALT 2 3/4"						
						LIMEROCK 6 1/2"						
			*65			Medium dense brown slightly Silty fine SAND (SP-SM)						
			*60									
			*65									
			*60									
			*60									
			*16									
			*5			Very soft dark gray Silty CLAY with orange seams (CL)						
5				▼		Firm gray Sandy CLAY (CL)						
		3-4-4	8									
						Medium dense gray to orangish-brown Clayey fine SAND (SC)						
		4-5-7	12				16.1	19.6				
						Medium dense to loose light gray fine SAND (SP)						
		7-9-10	19									
10												
		2-2-3	5									
						Very soft dark gray Silty CLAY (CL)						
15		5-1-1	2				79.3	45.4				

BORING_LOG 0930.1800260.0000-JAMMES ROAD FORCE MAIN REPLACEMENT.GPJ UNIENGSC.GDT 11/20/18

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0930.1800260.0000
REPORT NO.:	
PAGE:	A-1

PROJECT: GEOTECHNICAL EXPLORATION
JAMMES ROAD FORCE MAIN REPLACEMENT
JACKSONVILLE, FLORIDA

BORING DESIGNATION: **B-5** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

CLIENT: J. COLLINS ENGINEERING ASSOCIATES
LOCATION: SEE BORING LOCATION PLAN
REMARKS: *STATIC CONE PENETROMETER READING IN KG/CM2

G.S. ELEVATION (ft):
WATER TABLE (ft): 5.5
DATE OF READING: 11/12/18
EST. W.S.W.T. (ft):

DATE STARTED: 11/12/18
DATE FINISHED: 11/12/18
DRILLED BY: S. TORRES/DANIEL
TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./DAY)	ORG. CONT. (%)
0						ASPHALT 3"						
						LIMEROCK 7"						
			*60			Medium dense brown slightly Clayey fine SAND (SP-SC)						
			*60									
			*65									
			*20			Medium dense grayish-brown to orange very Clayey fine SAND (SC)						
		5-10-10	20			Stiff orangish-gray CLAY (CL)						
5				▼		Very loose to medium dense dark gray very Clayey fine SAND (SC)						
		1-1-1	2									
		2-4-6	10									
						Medium dense gray Clayey fine SAND (SC)						
		5-7-7	14			Loose gray slightly Clayey fine SAND with Clay layers (SP-SC)						
10		3-3-3	6				11.5	27.4				
						Loose grayish-brown Clayey Silty fine SAND (SM)						
15		3-2-3	5				12.9	23.7				

BORING_LOG 0930.1800260.0000-JAMMES ROAD FORCE MAIN REPLACEMENT.GPJ UNIENGSC.GDT 11/21/18

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KEY TO BORING LOGS

SYMBOLS AND ABBREVIATIONS

SYMBOL	DESCRIPTION
N-Value	No. of Blows of a 140-lb. Weight Falling 30 Inches Required to Drive a Standard Spoon 1 Foot
WOR	Weight of Drill Rods
WOH	Weight of Drill Rods and Hammer
	Sample from Auger Cuttings
	Standard Penetration Test Sample
	Thin-wall Shelby Tube Sample (Undisturbed Sampler Used)
RQD	Rock Quality Designation
	Stabilized Groundwater Level
	Seasonal High Groundwater Level (also referred to as the W.S.W.T.)
NE	Not Encountered
GNE	Groundwater Not Encountered
BT	Boring Terminated
-200 (%)	Fines Content or % Passing No. 200 Sieve
MC (%)	Moisture Content
LL	Liquid Limit (Atterberg Limits Test)
PI	Plasticity Index (Atterberg Limits Test)
NP	Non-Plastic (Atterberg Limits Test)
K	Coefficient of Permeability
Org. Cont.	Organic Content
G.S. Elevation	Ground Surface Elevation

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS More than 50% retained on the No. 200 sieve*	GRAVELS 50% or more of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		GRAVELS WITH FINES	GM	Silty gravels and gravel-sand-silt mixtures
			GC	Clayey gravels and gravel-sand-clay mixtures
	SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS 5% or less passing No. 200 sieve	SW**	Well-graded sands and gravelly sands, little or no fines
			SP**	Poorly graded sands and gravelly sands, little or no fines
		SANDS with 12% or more passing No. 200 sieve	SM**	Silty sands, sand-silt mixtures
			SC**	Clayey sands, sand-clay mixtures
FINE-GRAINED SIOLS 50% or more passes the No. 200 sieve*	SILTS AND CLAYS Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diamicaceous fine sands or silts, elastic silts
			CH	Inorganic clays or clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
			PT	Peat, muck and other highly organic soils

*Based on the material passing the 3-inch (75 mm) sieve
** Use dual symbol (such as SP-SM and SP-SC) for soils with more than 5% but less than 12% passing the No. 200 sieve

RELATIVE DENSITY
(Sands and Gravels)
Very loose – Less than 4 Blow/Foot
Loose – 4 to 10 Blows/Foot
Medium Dense – 11 to 30 Blows/Foot
Dense – 31 to 50 Blows/Foot
Very Dense – More than 50 Blows/Foot

CONSISTENCY
(Silts and Clays)
Very Soft – Less than 2 Blows/Foot
Soft – 2 to 4 Blows/Foot
Firm – 5 to 8 Blows/Foot
Stiff – 9 to 15 Blows/Foot
Very Stiff – 16 to 30 Blows/Foot
Hard – More than 30 Blows/Foot

RELATIVE HARDNESS
(Limestone)
Soft – 100 Blows for more than 2 Inches
Hard – 100 Blows for less than 2 Inches

MODIFIERS

These modifiers Provide Our Estimate of the Amount of Minor Constituents (Silt or Clay Size Particles) in the Soil Sample
Trace – 5% or less
With Silt or With Clay – 6% to 11%
Silty or Clayey – 12% to 30%
Very Silty or Very Clayey – 31% to 50%

These Modifiers Provide Our Estimate of the Amount of Organic Components in the Soil Sample
Trace – Less than 3%
Few – 3% to 4%
Some – 5% to 8%
Many – Greater than 8%

These Modifiers Provide Our Estimate of the Amount of Other Components (Shell, Gravel, Etc.) in the Soil Sample
Trace – 5% or less
Few – 6% to 12%
Some – 13% to 30%
Many – 31% to 50%

FIELD EXPLORATION PROCEDURES

Standard Penetration Test Borings

The penetration borings were made in general accordance with the latest revision of ASTM D 1586, "Penetration Test and Split-Barrel Sampling of Soils". The borings were advanced by rotary drilling techniques using a circulating bentonite fluid for borehole flushing and stability. At 2 ½ to 5 foot intervals, the drilling tools were removed from the borehole and a split-barrel sampler inserted to the borehole bottom and driven 18 inches into the soil using a 140 pound hammer falling on the average 30 inches per hammer blow. The number of blows for the final 12 inches of penetration is termed the "penetration resistance, blow count, or N-value". This value is an index to several in-place geotechnical properties of the material tested, such as relative density and Young's Modulus.

After driving the sampler 18 inches (or less if in hard rock-like material), the sampler was retrieved from the borehole and representative samples of the material within the split-barrel were placed in glass jars and sealed. After completing the drilling operations, the samples for each boring were transported to our laboratory where they were examined by our engineer in order to verify the driller's field classification.

LABORATORY TESTING PROCEDURES

Natural Moisture Content

The water content of the sample tested was determined in general accordance with the latest revision of ASTM D 2216. The water content is defined as the ratio of "pore" or "free" water in a given mass of material to the mass of solid material particles.

Percent Fines Content

The percent fines or material passing the No. 200 mesh sieve of the sample tested was determined in general accordance with the latest revision of ASTM D 1140. The percent fines are the soil particles in the silt and clay size range.

Atterberg Limits

The Atterberg Limits consist of the Liquid Limit (LL) and the Plastic Limit (PL). The LL and PL were determined in general accordance with the latest revision of ASTM D 4318. The LL is the water content of the material denoting the boundary between the liquid and plastic states. The PL is the water content denoting the boundary between the plastic and semi-solid states. The Plasticity Index (PI) is the range of water content over which a soil behaves plastically and is denoted numerically by as the difference between the LL and the PL. The water content of the sample tested was determined in general accordance with the latest revision of ASTM D 2216. The water content is defined as the ratio of "pore" or "free" water in a given mass of material to the mass of solid material particles.

APPENDIX B

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

CONSTRAINTS AND RESTRICTIONS

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/ or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GEOTECHNICAL BUSINESS COUNCIL
of the Geoprofessional Business Association

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@geoprofessional.org www.geoprofessional.org

CONSTRAINTS AND RESTRICTIONS

WARRANTY

Universal Engineering Sciences has prepared this report 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.

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 the Boring Location Plan. This report does not reflect any variations which 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.

CHANGED CONDITIONS

We recommend that the specifications for the project require that the contractor immediately notify Universal Engineering Sciences, as well as the owner, when subsurface conditions are encountered that are different from those present in this report.

No claim by the contractor for any conditions differing from those anticipated in the plans, specifications, and those found in this report, should be allowed unless the contractor notifies the owner and Universal Engineering Sciences of such changed conditions. Further, we recommend that all foundation work and site improvements be observed by a representative of Universal Engineering Sciences to monitor field conditions and changes, to verify design assumptions and to evaluate and recommend any appropriate modifications to this report.

MISINTERPRETATION OF SOIL ENGINEERING REPORT

Universal Engineering Sciences 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 the conclusions or recommendations based upon the data presented are made by others, those conclusions or recommendations are not the responsibility of Universal Engineering Sciences.

CHANGED STRUCTURE OR LOCATION

This report was prepared in order to aid in the evaluation of this project and to assist the architect or engineer in the design of this project. If any changes in the design or location of the structure as outlined in this report are planned, or if any structures are included or added that are not discussed in the report, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions modified or approved by Universal Engineering Sciences.

USE OF REPORT BY BIDDERS

Bidders who are examining the report prior to submission of a bid are cautioned that this report was prepared as an aid to the designers of the project and it may affect actual construction operations.

Bidders are urged to make their own soil borings, test pits, test caissons or other investigations to determine those conditions that may affect construction operations. Universal Engineering Sciences cannot be responsible for any interpretations made from this report or the attached boring logs with regard to their adequacy in reflecting subsurface conditions which will affect construction operations.

STRATA CHANGES

Strata changes are indicated by a definite line on the boring logs which accompany this report. However, the actual change in the ground may be more gradual. Where changes occur between soil samples, the location of the change must necessarily be estimated using all available information and may not be shown at the exact depth.

OBSERVATIONS DURING DRILLING

Attempts are made to detect and/or identify occurrences during drilling and sampling, such as: water level, boulders, zones of lost circulation, relative ease or resistance to drilling progress, unusual sample recovery, variation of driving resistance, obstructions, etc.; however, lack of mention does not preclude their presence.

WATER LEVELS

Water level readings have been made in the drill holes during drilling and they indicate normally occurring conditions. Water levels may not have been stabilized at the last reading. This data has been reviewed and interpretations made in this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, tides, and other factors not evident at the time measurements were made and reported. Since the probability of such variations is anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based upon such assumptions of variations.

LOCATION OF BURIED OBJECTS

All users of this report are cautioned that there was no requirement for Universal Engineering Sciences to attempt to locate any man-made buried objects during the course of this exploration and that no attempt was made by Universal Engineering Sciences to locate any such buried objects. Universal Engineering Sciences cannot be responsible for any buried man-made objects which are subsequently encountered during construction that are not discussed within the text of this report.

TIME

This report reflects the soil conditions at the time of investigation. If the report is not used in a reasonable amount of time, significant changes to the site may occur and additional reviews may be required.