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REPORT OF
GEOTECHNICAL EXPLORATION
RECLAIMED WATER MAIN – GATE PARKWAY
JACKSONVILLE, FLORIDA
ECS PROJECT NO. 35-29099
CLIENT ID: 3581

Prepared for:

Mr. John Collins
J. Collins Engineering Associates, LLC
11516-3 San Jose Boulevard
Jacksonville, Florida 32223

Prepared by:

ECS Florida, LLC
7064 Davis Creek Road
Jacksonville, Florida 32256

August 6, 2019

August 6, 2019

Mr. John Collins, P.E.
J. Collins Engineering Associates, LLC
11516-3 San Jose Boulevard
Jacksonville, Florida 32223

Reference: Geotechnical Engineering Report
Reclaimed Water Main – Gate Parkway
Gate Parkway to Burnt Mill Road
Jacksonville, Florida
ECS Project No. 35-29099
Client ID: 3581

Dear Mr. John Collins:

ECS Florida, LLC (ECS) has completed the requested geotechnical exploration in general accordance with our proposal dated June 1st, 2018. The exploration was performed to evaluate the general subsurface conditions within the proposed reclaimed water main alignment and to provide earthwork recommendations. A summary of our findings and related recommendations is provided below for your convenience; however, this report should be considered in its entirety.

The soils encountered in our borings consist of fine sands (SP, SP-SM), and are suitable for supporting the pipeline system. It should be noted that high blow counts (exceeding 40 blows per foot) were encountered in several of the borings. Soils with blow counts exceeding 40 blows per foot may be difficult to excavate. The contractor should anticipate difficult digging conditions in these soils.

We appreciate the opportunity to be your geotechnical consultant on this phase of the project and look forward to providing the materials testing and observation that will be required during the construction phase. If you have any questions, or if we may be of any further service, please contact us.

Very truly yours,
ECS FLORIDA, LLC

Robert W. Clark, P.E.
Sr. Geotechnical Engineer
Registered, Florida No. 52210

Digitally signed by Robert W Clark
DN: c=US, o=ECS FLORIDA LLC, ou=A01427E0000016A7A03AC9500000D74, cn=Robert W Clark
Date: 2019.08.06 12:38:31 -04'00'

Mateus Costa Segura, E.I.
Staff Engineer

Robert W. Clark, P.E.
Senior Project Engineer
Registered, Florida No. 52210

Distribution: John Collins – J. Collins Engineering Associates, LLC 1 pdf

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1.0 PROJECT INFORMATION

1.1 Site Location and Project Description

The project site is located off of Burnt Mill Road and Gate Parkway from near the IKEA store to south of Deerwood Park Boulevard in Jacksonville, Florida. The general site location is shown on Figure 1.

At the time of our exploration, the areas adjacent to the existing road were mostly developed. The site was relatively level, and graded to drain to the stormwater collection system along the roads.

You provided project information via several discussions and an email dated July 10th, 2019. We were provided with a copy of a site plan for the subject site, prepared by you, last dated April, 2019. This plan indicated the cross-section and location of the proposed pipeline.

We understand the proposed pipeline consists of an open-cut extension in two sections of approximately 5,300 linear feet and 2,100 linear feet of 8-inch reclaimed water main. We were not provided detailed structural loading and grading information.

If the project information above is incorrect, then the recommendations in this report may need to be re-evaluated. We should be contacted if any of the above project information is incorrect so that we may reevaluate our recommendations.

2.0 FIELD EXPLORATION

We performed a field exploration on July 22, 2019. The approximate boring locations are indicated on the attached Field Exploration Plan (Figure 2). Our personnel determined the boring locations using taped measurements from existing roadways and site features. The boring locations on the referenced Field Exploration Plan should be considered accurate only to the degree implied by the method of measurement used.

2.1 SPT Borings

We located and performed 12 Standard Penetration Test (SPT) borings, drilled to a depth of approximately 10 feet below the existing ground surface, in general accordance with the methodology outlined in ASTM D 1586 to explore the subsurface conditions along the alignment of the proposed pipeline. Split-spoon soil samples recovered during performance of the borings were visually classified in the field and representative portions of the samples were transported to our laboratory for further evaluation. A summary of the field procedures is included in Appendix A.

3.0 LABORATORY TESTING

A geotechnical engineer classified representative soil samples obtained during our field exploration using the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488. A Key to the Soil Classification System is included in Appendix A.

Selected samples of the soils encountered during the field exploration were subjected to quantitative laboratory testing to better define the composition of the soils encountered and to provide data for correlation to their anticipated strength and compressibility characteristics. The laboratory testing determined the moisture and fines contents of selected soil samples. The results of the laboratory testing are shown in the Summary of Laboratory Test Data included in Appendix B. Also, these results are shown on the Generalized Subsurface Profiles on Figures 3 and 4 and on the Log of Boring records at the respective depths from which the tested samples were recovered.

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 General Soil Profile

A graphical presentation of the generalized subsurface conditions is presented on Figures 3 and 4. Detailed boring records are included in Appendix A. It should be understood that the soil conditions will vary between the boring locations. The following table summarizes the soil conditions encountered.

GENERAL SOIL PROFILE: ROADWAY (BORINGS B1 TO B12)			
TYPICAL DEPTH (ft)		SOIL DESCRIPTION	USCS[(1)]
FROM	TO		
0	0.6	Asphalt and Limerock Pavement Base	----
0.6	8	Loose to Very Dense Fine Sand and Fine Sand with Silt	SP, SP-SM
8	10	Loose to Very Dense Fine Sand	SP
(1) Unified Soil Classification System			

4.2 Groundwater Level

Groundwater was encountered at each boring location and recorded at the time of drilling at depths varying from about 5½ to 7 feet below the existing ground surface. We note that groundwater levels will fluctuate due to seasonal climatic variations, surface water runoff patterns, construction operations, and other interrelated factors. The groundwater depth at each boring location is noted on the Generalized Subsurface Profiles and on the Log of Boring records.

5.0 DESIGN RECOMMENDATIONS

5.1 General

Our geotechnical engineering evaluation of the site and subsurface conditions at the property, with respect to the planned construction and our recommendations for site preparation and pipeline support, are based on (1) our site observations, (2) the field and laboratory test data obtained, and (3) our understanding of the project information as presented in this report.

If the location of the reclaimed water main is significantly changed, please contact us so that we can review our recommendations. Also, the discovery of any site or subsurface conditions during construction that deviate from the data obtained during this geotechnical exploration should also be reported to us for our evaluation.

The recommendations in the subsequent sections of this report present design and construction techniques that are appropriate for the planned construction. We recommend that ECS be provided the opportunity to review the final plans and earthwork specifications to verify that our recommendations have been properly interpreted and implemented.

5.2 Pipeline Support Recommendations

Based on the results of our exploration, we consider the subsurface conditions at the site capable for support of the proposed pipeline structure when constructed upon properly prepared subgrade soil, provided the site preparation and earthwork construction recommendations outlined in Section 6.0 of this report are performed.

6.0 EARTHWORK RECOMMENDATIONS

Earthwork as outlined in this section should be performed to provide more uniform bearing conditions, to reduce the potential for post-construction settlements of the planned pipeline.

Note that high blow counts (exceeding 40 blows per foot) were encountered in several of the borings. Soils with blow counts exceeding 40 blows per foot may be difficult to excavate. The contractor should anticipate difficult digging conditions in these soils.

6.1 Clearing

Prior to construction, the location of existing underground utilities within the construction area should be established. Provisions should then be made to relocate interfering utilities to appropriate locations. Underground pipes that are not properly removed or plugged may serve as conduits for subsurface erosion, which may subsequently lead to excessive settlement of overlying structures.

6.2 Temporary Groundwater Control

The borings encountered groundwater at depths varying from about 5½ to 7 feet below the existing ground surface at the time of our exploration. Depending on the depth of excavation and the groundwater level at the time of construction, it may be necessary to install temporary groundwater control measures to dewater the area to facilitate the excavation and compaction processes. The groundwater control measures should be determined by the contractor. The water table should be maintained at least 2 feet below the required depth of excavation. The dewatering system should not be decommissioned backfill has reached a height of 2 feet above the groundwater levels at the time of construction.

6.3 Excavation Protection

Excavation work will be required to meet OSHA Excavation Standard Subpart P regulations, Type C Soils. Any support structures should be designed according to OSHA sheeting and bracing requirements. We recommend a Florida registered Professional Engineer design the sheeting/bracing system.

6.4 Compaction of Bottom of Excavation

After installing the temporary groundwater control measures, and achieving the required depth of excavation, the exposed fine sands (SP) and fine sands with silt (SP-SM) should be compacted by the use of hand-operated equipment. Typically, the material should exhibit moisture contents within ±2 percentage points of the Modified Proctor optimum moisture content (ASTM D 1557) during the compaction operations. Compaction should continue until densities of at least 95 percent of the Modified Proctor maximum dry density (ASTM D 1557) have been achieved within the upper one foot below the exposed surface within the pipeline and manhole structures excavation.

Should the bearing level 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.

6.5 Structural Backfill and Compaction of Structural Backfill

Structural backfill within the pipeline excavation should be placed in loose lifts not exceeding six inches in thickness and compacted by the use of hand-operated compaction equipment. However, structural backfill may be placed in loose lifts not exceeding 12 inches in thickness and compacted by the hand-operated compaction equipment at elevations greater than 12 inches above the top of pipe. Structural backfill placed within 5 feet of the manhole structure walls should be placed in 6-inch-thick loose lifts and

compacted with hand-held equipment. Outside of this 5-foot zone, backfill may be placed in 12-inch-thick lifts and compacted with appropriate equipment. Care should be taken not to damage the structure walls.

Structural backfill is defined as a non-plastic, inorganic, granular soil having less than 10 to 12 percent material passing the No. 200 mesh sieve and containing less than 4 percent organic material. The sandy soils (SP, SP-SM) excavated for the structure may be used as backfill. Typically, the backfill material should exhibit moisture contents within ±2 percentage points of the Modified Proctor optimum moisture content (ASTM D 1557) during the compaction operations. Compaction should continue until densities of at least 95 percent of the Modified Proctor maximum dry density (ASTM D 1557) have been achieved within each 6- or 12-inch-thick lift of the compacted structural backfill.

7.0 QUALITY CONTROL TESTING

A representative number of field in-place density tests should be performed in each 6-inch thick lift of compacted backfill and in the upper 12 inches below the bearing levels along the pipeline alignment. The density tests are considered necessary to verify that satisfactory compaction operations have been performed. We recommend density testing be performed at one location for every 200 linear feet of pipeline.

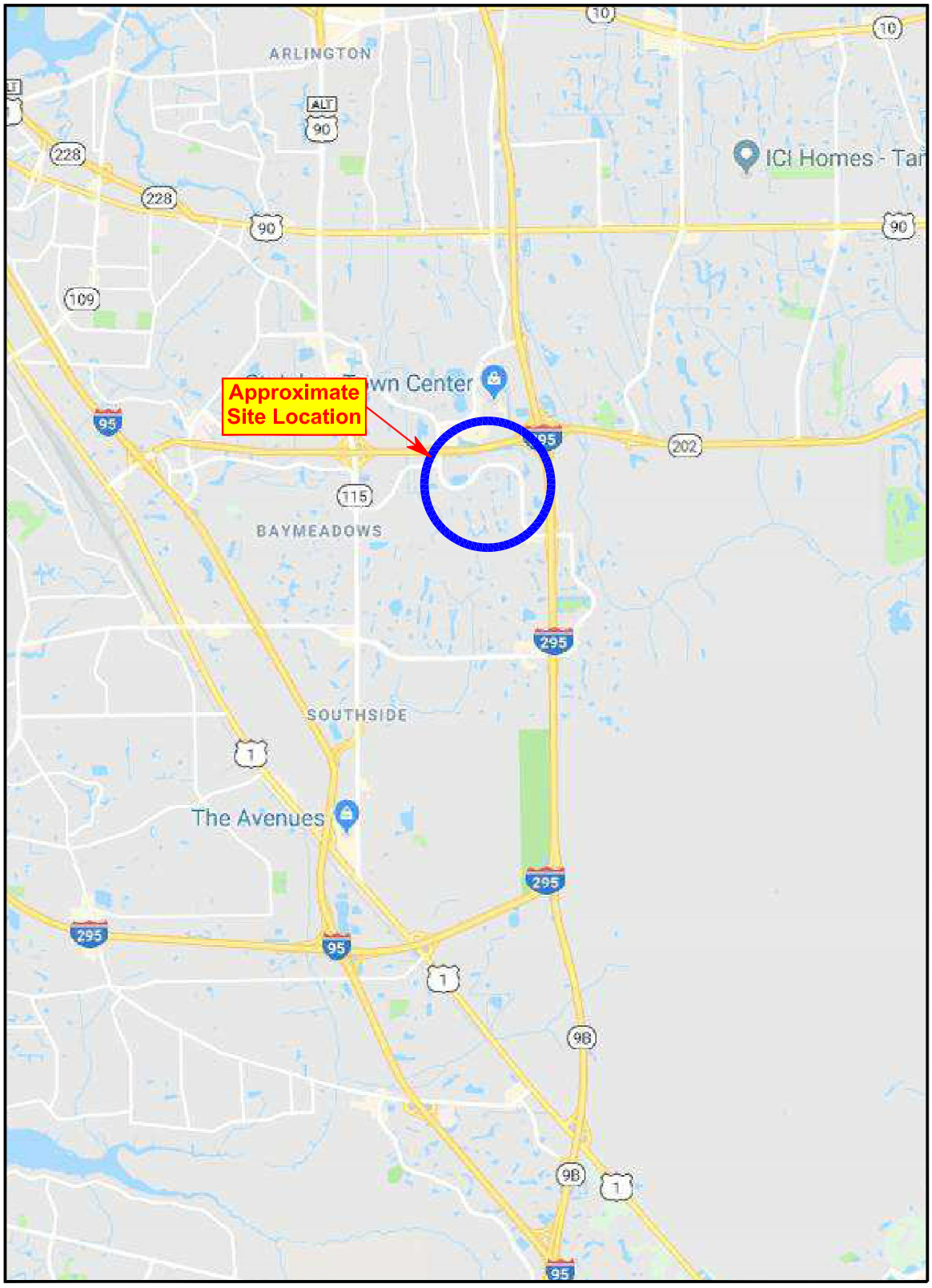
8.0 REPORT LIMITATIONS

Our geotechnical exploration has been performed, our findings obtained, and our recommendations prepared, in accordance with generally accepted geotechnical engineering principles and practices. ECS is not responsible for any independent conclusions, interpretation, opinions, or recommendations made by others based on the data contained in this report.

Our scope of services was intended to evaluate the soil conditions within the zone of soil influenced by the pipeline bearing conditions. Our scope of services does not address geologic conditions, such as sinkholes or soil conditions existing below the depth of the soil borings.

This report does not reflect any variations that may occur adjacent to or between soil borings. The discovery of any site or subsurface condition during construction that deviates from the data obtained during this geotechnical exploration should be reported to us for our evaluation. Also, in the event of any change to the locations of the pipelines, please contact us so that we can review our recommendations. We recommend that we be provided the opportunity to review the earthwork specifications to verify that our recommendations have been properly interpreted and implemented.

FIGURES



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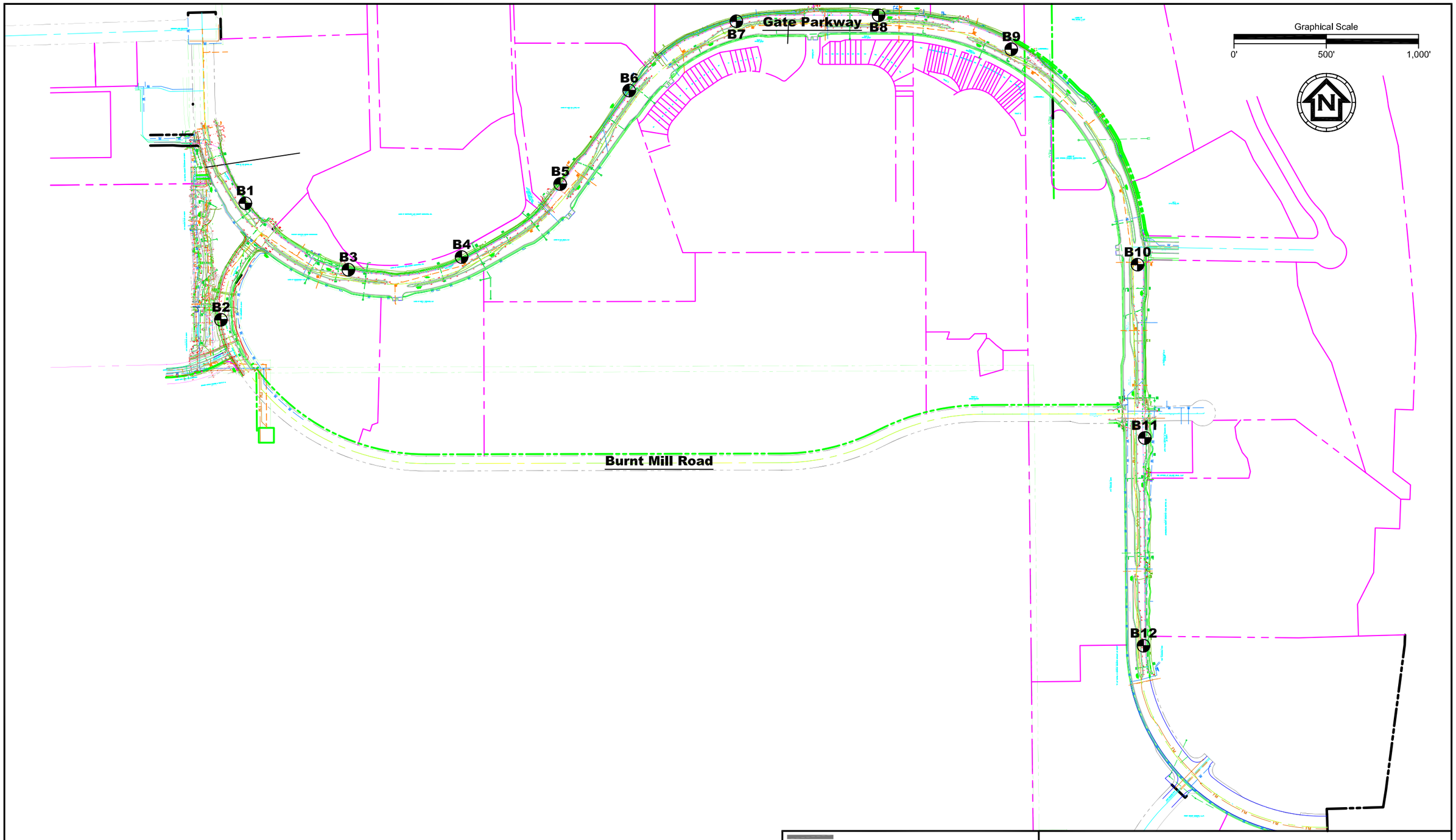
Site Location Plan

Reclaimed Water Main - Gate Parkway

Jacksonville, Florida

Date: 07/29/19	Project No.: 35-29099	Figure 1

JAS - 35-29099



LEGEND

Approximate Location of Standard Penetration Test (SPT) Boring

ECS Florida, LLC
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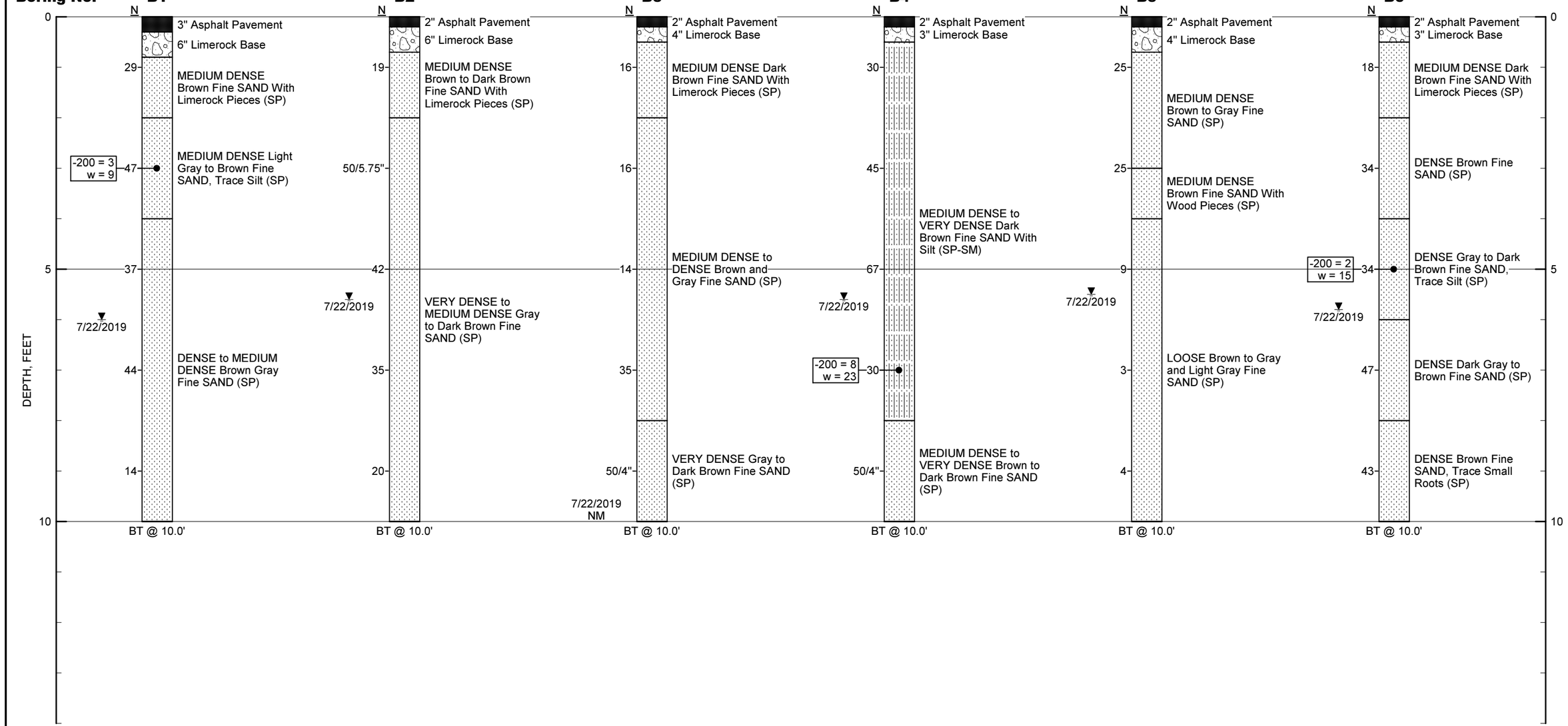
Field Exploration Plan

Reclaimed Water Main - Gate Parkway

Jacksonville, Florida

Date: 07/31/19	Project No.: 35-29099	Figure 2

JAS - 35-29099



LEGEND

- Fine SAND (SP)
- Fine SAND With Silt (SP-SM)
- Asphalt Pavement
- Limerock Base

N	Standard Penetration Resistance, Blows/Foot	BT	Boring Terminated at Depth Below Grade
SP	Unified Soil Classification System	-200	% Passing No. 200 U.S. Standard Sieve
▼	Groundwater Level at Time of Drilling	w	Natural Moisture Content (%)
NM	Groundwater Level not Measured on Date Drilled	50/5"	Number of Blows to Drive Split Spoon Sample in Inches

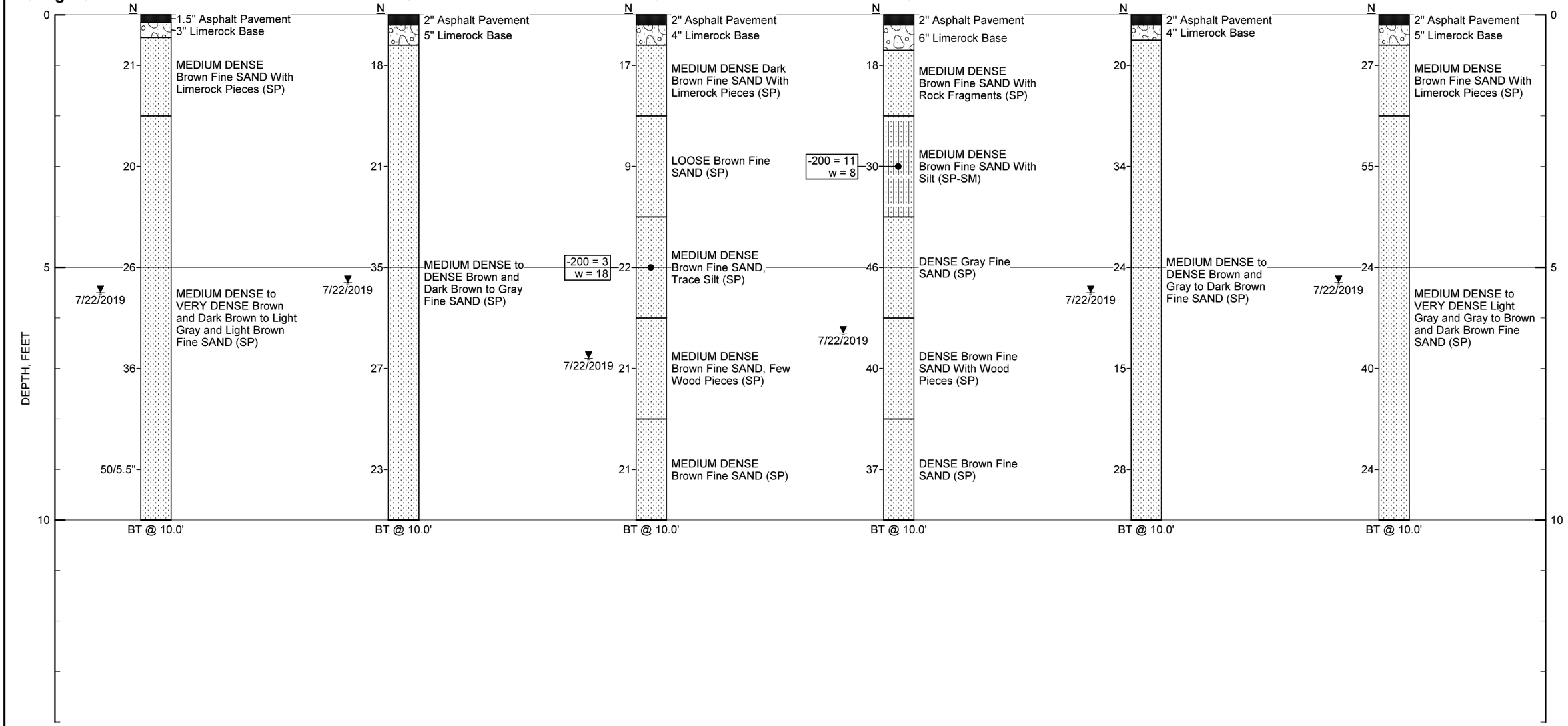
Generalized Subsurface Profiles

Reclaimed Water Main - Gate Parkway

Jacksonville, Florida

ECS

DATE: 7/31/19 | PROJ. NO.: 35-29099 | Figure 3



LEGEND

- Fine SAND (SP)
- Fine SAND With Silt (SP-SM)
- Asphalt Pavement
- Limerock Base

N	Standard Penetration Resistance, Blows/Foot
SP	Unified Soil Classification System
▼	Groundwater Level at Time of Drilling
NM	Groundwater Level not Measured on Date Drilled
BT	Boring Terminated at Depth Below Grade
-200	% Passing No. 200 U.S. Standard Sieve
w	Natural Moisture Content (%)
50/5"	Number of Blows to Drive Split Spoon Sample in Inches

Generalized Subsurface Profiles

Reclaimed Water Main - Gate Parkway

Jacksonville, Florida

DATE: 7/31/19 | PROJ. NO.: 35-29099 | Figure 4

-2

APPENDIX A

SOIL BORING LOGS
FIELD EXPLORATION PROCEDURES
KEY TO SOIL CLASSIFICATION

Project No.: 35-29099
Boring No.: B1
Sheet 1 of 1

LOG OF BORING

Project: Reclaimed Water Main - Gate Parkway
Client: J. Collins Engineering Associates, LLC
Drill Rig: 102A
Driller: T. Watkins
Boring Location: See Field Exploration Plan
Drill Rod: AWJ
Drill Mud: Super Gel-X
Casing Size:
Length of Casing:
Groundwater Depth: 6 ft Time: Drilling Date: 7/22/19
Boring Begun: 7/22/19
Boring Completed: 7/22/19

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT / MOISTURE CONTENT / LIQUID LIMIT (%)	SHEAR STRENGTH (ksf)
	0		3" Asphalt Pavement	10					
			6" Limerock Base	10					
1			MEDIUM DENSE Brown Fine SAND With Limerock Pieces (SP)	19	29				
				20					
			MEDIUM DENSE Light Gray to Brown Fine SAND, Trace Silt (SP)	22					
2				20					
				27	47		3		
				30					
			DENSE to MEDIUM DENSE Brown Gray Fine SAND (SP)	20					
3	5			20					
				17	37				
				21					
				15					
4				19					
				25	44				
				30					
				5					
5				7					
				7	14				
	10			7					
			Boring Terminated @ 10 ft.						
	15								
	20								

SHEAR STRENGTH (ksf)
- Pocket Penetrometer Undisturbed Sample
- Pocket Penetrometer Disturbed Sample
- Torvane
- Unconfined Compression
- Triaxial Compression

PLASTIC LIMIT / MOISTURE CONTENT / LIQUID LIMIT (%): 0 10 20 30 40
SHEAR STRENGTH (ksf): 0 1 2

Remarks

LOG OF BORING NM 35-29099.GPJ ELLIS ASSOCIATES.GDT 8/5/19

Project No.: 35-29099
Boring No.: B2
Sheet 1 of 1

LOG OF BORING

Project: Reclaimed Water Main - Gate Parkway
Client: J. Collins Engineering Associates, LLC
Drill Rig: 102A
Driller: T. Watkins
Boring Location: See Field Exploration Plan
Drill Rod: AWJ
Drill Mud: Super Gel-X
Casing Size:
Length of Casing:
Groundwater Depth: 5.6 ft Time: Drilling Date: 7/22/19
Boring Begun: 7/22/19
Boring Completed: 7/22/19

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT ○ / MOISTURE CONTENT + / LIQUID LIMIT ◇ (%) 0 10 20 30 40	SHEAR STRENGTH (ksf) 0 1 2
	0		2" Asphalt Pavement	7					
			6" Limerock Base	9					
1			MEDIUM DENSE Brown to Dark Brown Fine SAND With Limerock Pieces (SP)	10	19				
				10					
			VERY DENSE to DENSE Gray Fine SAND (SP)	25					
2				37					
				50/5.75"	50/5.75"				
				10					
				15					
3	5			27	42				
				32					
				7					
				12					
4				23	35				
				27					
			MEDIUM DENSE Dark Brown Fine SAND (SP)	8					
				10					
5				10	20				
				13					
	10		Boring Terminated @ 10 ft.						
	15								
	20								

SHEAR STRENGTH (ksf)
- ⊙ Pocket Penetrometer Undisturbed Sample
- ◔ Pocket Penetrometer Disturbed Sample
- ▼ Torvane
- ● Unconfined Compression
- ⊠ Triaxial Compression

Remarks

Project No.: 35-29099
Boring No.: B3
Sheet 1 of 1

LOG OF BORING

Project: Reclaimed Water Main - Gate Parkway
Client: J. Collins Engineering Associates, LLC
Drill Rig: 102A
Driller: T. Watkins
Boring Location: See Field Exploration Plan
Drill Rod: AWJ
Drill Mud: Super Gel-X
Casing Size:
Length of Casing:
Groundwater Depth: NM Time: Drilling Date: 7/22/19
Boring Begun: 7/22/19
Boring Completed: 7/22/19

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT ○ / MOISTURE CONTENT + / LIQUID LIMIT ◇ (%)	SHEAR STRENGTH (ksf)
	0		2" Asphalt Pavement	6					
			4" Limerock Base	7					
1			MEDIUM DENSE Dark Brown Fine SAND With Limerock Pieces (SP)	9	16				
				12					
			MEDIUM DENSE Brown Fine SAND (SP)	10					
2				6					
				10	16				
				12					
			MEDIUM DENSE to DENSE Gray to Brown Fine SAND (SP)	6					
				7					
3	5			7	14				
				14					
				7					
				10					
4				25	35				
				30					
			VERY DENSE Gray to Dark Brown Fine SAND (SP)	24					
				45					
5				50/4"	50/4"				
	10		Boring Terminated @ 10 ft.						
	15								
	20								

SHEAR STRENGTH (ksf)
- Pocket Penetrometer Undisturbed Sample
- Pocket Penetrometer Disturbed Sample
- Torvane
- Unconfined Compression
- Triaxial Compression

MOISTURE CONTENT (%): 0 10 20 30 40
SHEAR STRENGTH (ksf): 0 1 2

Remarks NM = Groundwater Level Not Measured at Time of Drilling.

LOG OF BORING NM 35-29099.GPJ ELLIS ASSOCIATES.GDT 8/5/19

Project No.: 35-29099
Boring No.: B4
Sheet 1 of 1

LOG OF BORING

Project: Reclaimed Water Main - Gate Parkway
Client: J. Collins Engineering Associates, LLC
Drill Rig: 102A
Driller: T. Watkins
Boring Location: See Field Exploration Plan
Drill Rod: AWJ
Drill Mud: Super Gel-X
Casing Size:
Length of Casing:
Groundwater Depth: 5.6 ft Time: Drilling Date: 7/22/19
Boring Begun: 7/22/19
Boring Completed: 7/22/19

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT / MOISTURE CONTENT / LIQUID LIMIT (%)	SHEAR STRENGTH (ksf)
	0		2" Asphalt Pavement	9					
			3" Limerock Base	15					
1			MEDIUM DENSE to VERY DENSE Dark Brown Fine SAND With Silt (SP-SM)	15	30				
				15					
				19					
2				20					
				25	45				
				35					
				32					
3	5			40					
				27	67				
				27					
				8					
4				8			8	+	
				22	30				
				32					
			MEDIUM DENSE to VERY DENSE Brown to Dark Brown Fine SAND (SP)	42					
5				50/4"					
					50/4"				
	10		Boring Terminated @ 10 ft.						
	15								
	20								

SHEAR STRENGTH (ksf): Pocket Penetrometer Undisturbed Sample; Pocket Penetrometer Disturbed Sample; Torvane; Unconfined Compression; Triaxial Compression

Remarks

LOG OF BORING NM 35-29099.GPJ ELLIS ASSOCIATES.GDT 8/5/19

Project No.: 35-29099
Boring No.: B5
Sheet 1 of 1

LOG OF BORING

Project: Reclaimed Water Main - Gate Parkway
Client: J. Collins Engineering Associates, LLC
Drill Rig: 102A
Driller: T. Watkins
Boring Location: See Field Exploration Plan
Drill Rod: AWJ
Drill Mud: Super Gel-X
Casing Size:
Length of Casing:
Groundwater Depth: 5.5 ft Time: Drilling Date: 7/22/19
Boring Begun: 7/22/19
Boring Completed: 7/22/19

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT ○ / MOISTURE CONTENT + / LIQUID LIMIT ◇ (%)	SHEAR STRENGTH (ksf)
	0		2" Asphalt Pavement	4					
			4" Limerock Base	9					
1			MEDIUM DENSE Brown to Gray Fine SAND (SP)	16	25				
				15					
				13					
				15					
2			MEDIUM DENSE Brown Fine SAND With Wood Pieces (SP)	10	25				
				13					
			LOOSE Brown to Gray Fine SAND (SP)	9					
				5					
3	5			4	9				
				3					
			LOOSE Light Gray Fine SAND (SP)	2					
				2					
4				1	3				
				2					
				1					
				2					
5				2	4				
				2					
	10		Boring Terminated @ 10 ft.						
	15								
	20								

SHEAR STRENGTH (ksf)
- Pocket Penetrometer Undisturbed Sample
- Pocket Penetrometer Disturbed Sample
- Torvane
- Unconfined Compression
- Triaxial Compression

Remarks

LOG OF BORING NM 35-29099.GPJ ELLIS ASSOCIATES.GDT 8/5/19

Project No.: 35-29099
Boring No.: B6
Sheet 1 of 1

LOG OF BORING

Project: Reclaimed Water Main - Gate Parkway
Client: J. Collins Engineering Associates, LLC
Drill Rig: 102A
Driller: T. Watkins
Boring Location: See Field Exploration Plan
Drill Rod: AWJ
Drill Mud: Super Gel-X
Casing Size:
Length of Casing:
Groundwater Depth: 5.8 ft Time: Drilling Date: 7/22/19
Boring Begun: 7/22/19
Boring Completed: 7/22/19

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT / MOISTURE CONTENT / LIQUID LIMIT (%)	SHEAR STRENGTH (ksf)
	0		2" Asphalt Pavement	8					
			3" Limerock Base	8					
1			MEDIUM DENSE Dark Brown Fine SAND With Limerock Pieces (SP)	10	18				
				12					
			DENSE Brown Fine SAND (SP)	12					
				16					
2				18	34				
				20					
			DENSE Gray to Dark Brown Fine SAND, Trace Silt (SP)	18					
				18					
3	5			16	34		2	+	
			▼	16					
			DENSE Dark Gray to Brown Fine SAND (SP)	16					
				24					
4				23	47				
				18					
			DENSE Brown Fine SAND, Trace Small Roots (SP)	14					
				16					
5				27	43				
				32					
	10		Boring Terminated @ 10 ft.						
	15								
	20								

SHEAR STRENGTH (ksf)
- Pocket Penetrometer Undisturbed Sample
- Pocket Penetrometer Disturbed Sample
- Torvane
- Unconfined Compression
- Triaxial Compression

MOISTURE CONTENT (%): 0 10 20 30 40
SHEAR STRENGTH (ksf): 0 1 2

Remarks

LOG OF BORING NM 35-29099.GPJ ELLIS ASSOCIATES.GDT 8/5/19

Project No.: 35-29099
Boring No.: B7
Sheet 1 of 1

LOG OF BORING

Project: Reclaimed Water Main - Gate Parkway
Client: J. Collins Engineering Associates, LLC
Drill Rig: 102A
Driller: T. Watkins
Boring Location: See Field Exploration Plan
Drill Rod: AWJ
Drill Mud: Super Gel-X
Casing Size:
Length of Casing:
Groundwater Depth: 5.5 ft Time: Drilling Date: 7/22/19
Boring Begun: 7/22/19
Boring Completed: 7/22/19

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE
	0		1.5" Asphalt Pavement	7			
			3" Limerock Base	9			
1			MEDIUM DENSE Brown Fine SAND With Limerock Pieces (SP)	12	21		
				14			
			MEDIUM DENSE Brown Fine SAND (SP)	12			
				11			
2				9	20		
				13			
			MEDIUM DENSE Dark Brown Fine SAND (SP)	8			
				11			
3	5			15	26		
				21			
			DENSE to VERY DENSE Light Gray to Light Brown Fine SAND (SP)	18			
				18			
4				18	36		
				32			
				52			
				38			
5				50/5.5"	50/5.5"		
	10		Boring Terminated @ 10 ft.				
	15						
	20						

PLASTIC LIMIT ○ | MOISTURE CONTENT + (%) | LIQUID LIMIT ◇
0 10 20 30 40

SHEAR STRENGTH (ksf)
0 1 2
⊙ Pocket Penetrometer Undisturbed Sample
◕ Pocket Penetrometer Disturbed Sample
▼ Torvane
● Unconfined Compression
⊠ Triaxial Compression

Remarks

LOG OF BORING NM 35-29099.GPJ ELLIS ASSOCIATES.GDT 8/5/19

Project No.: 35-29099
Boring No.: B8
Sheet 1 of 1

LOG OF BORING

Project: Reclaimed Water Main - Gate Parkway
Client: J. Collins Engineering Associates, LLC
Drill Rig: 102A
Driller: T. Watkins
Boring Location: See Field Exploration Plan
Drill Rod: AWJ
Drill Mud: Super Gel-X
Casing Size:
Length of Casing:
Groundwater Depth: 5.3 ft Time: Drilling Date: 7/22/19
Boring Begun: 7/22/19
Boring Completed: 7/22/19

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE
	0		2" Asphalt Pavement	7			
			5" Limerock Base	9			
1			MEDIUM DENSE Brown Fine SAND (SP)	9	18		
				12			
			MEDIUM DENSE to DENSE Dark Brown Fine SAND (SP)	7			
2				10			
				11	21		
				9			
				11			
3	5			15			
				20	35		
				22			
				11			
4				12			
				15	27		
			DENSE Dark Brown to Gray Fine SAND (SP)	9			
				5			
			MEDIUM DENSE Dark Brown Fine SAND (SP)	7			
5				16	23		
	10			18			
			Boring Terminated @ 10 ft.				
	15						
	20						

PLASTIC LIMIT ○ | MOISTURE CONTENT + (%) | LIQUID LIMIT ◇
0 10 20 30 40

SHEAR STRENGTH (ksf)
⊙ Pocket Penetrometer Undisturbed Sample
◕ Pocket Penetrometer Disturbed Sample
▼ Torvane
● Unconfined Compression
⊠ Triaxial Compression
0 1 2

Remarks

LOG OF BORING NM 35-29099.GPJ ELLIS ASSOCIATES.GDT 8/5/19

Project No.: 35-29099
Boring No.: B9
Sheet 1 of 1

LOG OF BORING

Project: Reclaimed Water Main - Gate Parkway
Client: J. Collins Engineering Associates, LLC
Drill Rig: 102A
Driller: T. Watkins
Boring Location: See Field Exploration Plan
Drill Rod: AWJ
Drill Mud: Super Gel-X
Casing Size:
Length of Casing:
Groundwater Depth: 6.8 ft Time: Drilling Date: 7/22/19
Boring Begun: 7/22/19
Boring Completed: 7/22/19

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT / MOISTURE CONTENT / LIQUID LIMIT (%)	SHEAR STRENGTH (ksf)
	0		2" Asphalt Pavement	7					
			4" Limerock Base	7					
1			MEDIUM DENSE Dark Brown Fine SAND With Limerock Pieces (SP)	10	17				
				8					
			LOOSE Brown Fine SAND (SP)	5					
				5					
2				4	9				
				5					
			MEDIUM DENSE Brown Fine SAND, Trace Silt (SP)	7					
				10					
3	5			12	22		3	+	
				19					
			MEDIUM DENSE Brown Fine SAND, Few Wood Pieces (SP)	10					
				10					
4				11	21				
				6					
			MEDIUM DENSE Brown Fine SAND (SP)	5					
				6					
5				15	21				
				20					
	10		Boring Terminated @ 10 ft.						
	15								
	20								

SHEAR STRENGTH (ksf)
- Pocket Penetrometer Undisturbed Sample
- Pocket Penetrometer Disturbed Sample
- Torvane
- Unconfined Compression
- Triaxial Compression

PLASTIC LIMIT / MOISTURE CONTENT / LIQUID LIMIT (%): 0 10 20 30 40
SHEAR STRENGTH (ksf): 0 1 2

Remarks

Project No.: 35-29099
Boring No.: B10
Sheet 1 of 1

LOG OF BORING

Project: Reclaimed Water Main - Gate Parkway
Client: J. Collins Engineering Associates, LLC
Drill Rig: 102A
Driller: T. Watkins
Boring Location: See Field Exploration Plan
Drill Rod: AWJ
Drill Mud: Super Gel-X
Casing Size:
Length of Casing:
Groundwater Depth: 6.3 ft Time: Drilling Date: 7/22/19
Boring Begun: 7/22/19
Boring Completed: 7/22/19

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT / MOISTURE CONTENT / LIQUID LIMIT (%)	SHEAR STRENGTH (ksf)
	0		2" Asphalt Pavement	7					
			6" Limerock Base	7					
1			MEDIUM DENSE Brown Fine SAND With Rock Fragments (SP)	11	18				
				12					
			MEDIUM DENSE Brown Fine SAND With Silt (SP-SM)	8					
2				13					
				17	30		11	+	
				21					
	5		DENSE Gray Fine SAND (SP)	20					
				22					
3				24	46				
				20					
			DENSE Brown Fine SAND With Wood Pieces (SP) ▼	15					
				18					
4				22	40				
				20					
			DENSE Brown Fine SAND (SP)	8					
				16					
5				21	37				
				32					
	10		Boring Terminated @ 10 ft.						
	15								
	20								

SHEAR STRENGTH (ksf)
- Pocket Penetrometer Undisturbed Sample
- Pocket Penetrometer Disturbed Sample
- Torvane
- Unconfined Compression
- Triaxial Compression

0 10 20 30 40 (%)
0 1 2

Remarks

LOG OF BORING NM 35-29099.GPJ ELLIS ASSOCIATES.GDT 8/5/19

Project No.: 35-29099
Boring No.: B11
Sheet 1 of 1

LOG OF BORING

Project: Reclaimed Water Main - Gate Parkway
Client: J. Collins Engineering Associates, LLC
Drill Rig: 102A
Driller: T. Watkins
Boring Location: See Field Exploration Plan
Drill Rod: AWJ
Drill Mud: Super Gel-X
Casing Size:
Length of Casing:
Groundwater Depth: 5.5 ft Time: Drilling Date: 7/22/19
Boring Begun: 7/22/19
Boring Completed: 7/22/19

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT ○ / MOISTURE CONTENT + / LIQUID LIMIT ◇ (%)	SHEAR STRENGTH (ksf)
	0		2" Asphalt Pavement	7					
			4" Limerock Base	7					
1			MEDIUM DENSE Brown Fine SAND (SP)	13	20				
				15					
			DENSE Gray Fine SAND (SP)	14					
				16					
2				18	34				
				22					
			MEDIUM DENSE Dark Brown Fine SAND (SP)	10					
				12					
3	5			12	24				
				14					
				6					
				7					
4				8	15				
				10					
				9					
				12					
5				16	28				
				20					
	10		Boring Terminated @ 10 ft.						
	15								
	20								

Pocket Penetrometer Undisturbed Sample
Pocket Penetrometer Disturbed Sample
Torvane
Unconfined Compression
Triaxial Compression

0 10 20 30 40
0 1 2

Remarks

LOG OF BORING NM 35-29099.GPJ ELLIS ASSOCIATES.GDT 8/5/19

Project No.: 35-29099
Boring No.: B12
Sheet 1 of 1

LOG OF BORING

Project: Reclaimed Water Main - Gate Parkway
Client: J. Collins Engineering Associates, LLC
Drill Rig: 102A
Driller: T. Watkins
Boring Location: See Field Exploration Plan
Drill Rod: AWJ
Drill Mud: Super Gel-X
Casing Size:
Length of Casing:
Groundwater Depth: 5.3 ft Time: Drilling Date: 7/22/19
Boring Begun: 7/22/19
Boring Completed: 7/22/19

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT ○ / MOISTURE CONTENT + / LIQUID LIMIT ◇ (%)	SHEAR STRENGTH (ksf)
	0		2" Asphalt Pavement	9				0 10 20 30 40	0 1 2
			5" Limerock Base	12					
1			MEDIUM DENSE Brown Fine SAND With Limerock Pieces (SP)	15	27				
				17					
			VERY DENSE Light Gray Fine SAND (SP)	25					
				25					
2				30	55				
				27					
			MEDIUM DENSE Gray to Brown Fine SAND (SP)	25					
				14					
3	5		▼	10	24				
				30					
			MEDIUM DENSE to VERY DENSE Dark Brown Fine SAND (SP)	14					
				16					
4				24	40				
				32					
				14					
				12					
5				12	24				
				50/5.5"					
	10		Boring Terminated @ 10 ft.						
	15								
	20								

SHEAR STRENGTH (ksf)
- Pocket Penetrometer Undisturbed Sample
- Pocket Penetrometer Disturbed Sample
- Torvane
- Unconfined Compression
- Triaxial Compression

Remarks

LOG OF BORING NM 35-29099.GPJ ELLIS ASSOCIATES.GDT 8/5/19

FIELD EXPLORATION PROCEDURES

Standard Penetration Test (SPT) Borings

The Standard Penetration Test (SPT) 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 (or "wash-n-chop") drilling techniques. At 2 ½ to 5 foot intervals, 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 hammer 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 containerized 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. The retrieved samples will be kept in our facility for a period of six (6) months unless directed otherwise.

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KEY TO SOIL CLASSIFICATION

Description of Compactness or Consistency in Relation
To Standard Penetration Resistance

Granular Materials		
Relative Density	**Safety Hammer SPT N-Value (Blow/Foot)**	**Automatic Hammer SPT N-Value (Blow/Foot)**
Very Loose	Less than 4	Less than 3
Loose	4 – 10	3 – 8
Medium Dense	10 – 30	8 – 24
Dense	30 – 50	24 – 40
Very Dense	Greater than 50	Greater than 40

Silts and Clays		
Consistency	**Safety Hammer SPT N-Value (Blow/Foot)**	**Automatic Hammer SPT N-Value (Blow/Foot)**
Very Soft	Less than 2	Less than 1
Soft	2 – 4	1 – 3
Firm	4 – 8	3 – 6
Stiff	8 – 15	6 – 12
Very Stiff	15 – 30	12 – 24
Hard	Greater than 30	Greater than 24

DESCRIPTION OF SOIL COMPOSITION**

(Unified Soil Classification System)

MAJOR DIVISION		Group Symbol	LABORATORY CLASSIFICATION CRITERIA		SOIL DESCRIPTION
			FINER THAN 200 SIEVE %	SUPPLEMENTARY REQUIREMENTS	
Coarse grained (over 50% by weight coarser than No. 200 sieve)	Gravelly soils (over half of coarse fraction larger than No. 4)	GW	<5*	D_{60}/D_{10} greater than 4, $D_{30}^2/(D_{60} \times D_{10})$ between 1 & 3	Well graded gravels, sandy gravels
		GP	<5*	Not meeting above gradation for GW	Gap graded or uniform gravels, sandy gravels
		GM	>12*	PI less than 4 or below A-line	Silty gravels, silty sandy gravels
		GC	>12*	PI over 7 above A-line	Clayey gravels, clayey sandy gravels
	Sandy soils (over half of coarse fraction finer than No. 4)	SW	<5*	D_{60}/D_{10} greater than 6, $D_{30}^2/(D_{60} \times D_{10})$ between 1 & 3	Well graded sands, gravelly sands
		SP	<5*	Not meeting above gradation requirements	
		SM	>12*	PI less than 4 or below A-line	Silty sands, silty gravelly sands
		SC	>12*	PI over 7 and above A-line	Clayey sands, clayey gravelly sands
Fine grained (over 50% by weight finer than No. 200 sieve)	Low compressibility (liquid limit less than 50)	ML	Plasticity chart		Silts, very fine sands, silty or clayey fine sands, micaceous silts
		CL	Plasticity chart		Low plasticity clays, sandy or silty clays
		OL	Plasticity chart, organic odor or color		Organic silts and clays of low plasticity
	High compressibility (liquid limit more than 50)	MH	Plasticity chart		Micaceous silts, diatomaceous silts, volcanic ash
		CH	Plasticity chart		Highly plastic clays and sandy clays
		OH	Plasticity chart, organic odor or color		Organic silts and clays of high plasticity
Soils with fibrous organic matter		PT	Fibrous organic matter; will char, burn or glow		Peat, sandy peats, and clayey peat

* For soils having 5 to 12 percent passing the No. 200 sieve, use a dual symbol such as SP-SM.
** Standard Classification of Soils for Engineering Purposes (ASTM D 2487)

SAND/GRAVEL DESCRIPTION MODIFIERS	
Modifier	**Sand/Gravel Content**
Trace	<15%
With	15% to 29%
Sandy/Gravelly	>29%

ORGANIC MATERIAL MODIFIERS	
Modifier	**Organic Content**
Trace	1% to 2%
Few	2% to 4%
Some	4% to 8%
Many	>8%

SILT/CLAY DESCRIPTION MODIFIERS	
Modifier	**Silt/Clay Content**
Trace	<5%
With	5% to12%
Silty/Clayey	13% to 35%
Very	>35%

APPENDIX B

LABORATORY DATA
LABORATORY TEST PROCEDURES

SUMMARY OF LABORATORY TEST RESULTS

Project: Reclaimed Water Main -Gate Parkway
Client: J. Collins Engineering Associates LLC
Project No.: 29099

Boring/ Sample No.	Sample Depth (ft.)	Organic Content %	Fines Content %	Natural Moisture Content %	Atterberg Limits			
					Liquid Limit %	Plastic Limit %	Plasticity Index	
B6 - 3	4-6		2.2	15				
B4 - 4	6-8		8.2	23				
B10 - 2	2-4		11.0	8				
B9 - 3	4-6		2.9	18				
B1 - 2	2-4		2.5	9				

LABORATORY TEST PROCEDURES

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.

Natural Moisture Content

The water content of the sample tests 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.