Subsurface Exploration Report

Bob Wallace Force Main
Huntsville, Alabama
June 7, 2016
Terracon Project No. E1165052

Prepared for:
Garver, USA
Huntsville, Alabama

Prepared by:
Terracon Consultants, Inc.
Huntsville, Alabama

June 7, 2016

Garver, USA
2125A Research Drive
Huntsville, AL 35801

Attn: Mr. Wes Cardwell, PE
E: WRCardwell@GarverUSA.com

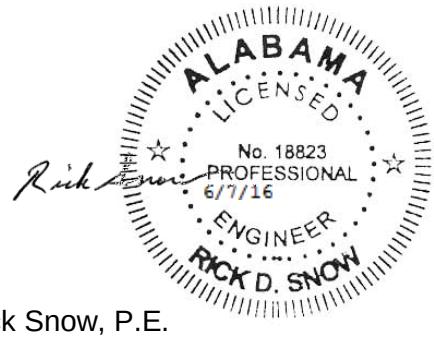
Re: Subsurface Exploration Report
Bob Wallace Force Main
Huntsville, Alabama
Terracon Project Number: E1165052

Dear Mr. Cardwell:

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above referenced project. This study was performed in general accordance with our proposal number PE1165052 (Revised) dated February 8, 2016. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.



Rick Snow, P.E.
Senior Project Engineer
AL: PE-18823

Frank Whitman, P.E.
Senior Project Engineer
AL: PE-23152

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SUBSURFACE EXPLORATION REPORT
BOB WALLACE FORCE MAIN
Huntsville, Alabama

Terracon Project No. E1165052
June 7, 2016

1.0 INTRODUCTION

This subsurface exploration has been performed for the proposed Bob Wallace Force Main located in Huntsville, Alabama. The exploration consisted of Eight (8) SPT borings at three street crossings and a creek crossing along the proposed alignment. These borings were completed to depths ranging from 13 to 40 feet below ground surface (BGS). Logs of the borings along with a site location map and boring location plan are included in Appendix A.

The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater conditions during drilling
- excavation conditions

2.0 PROJECT INFORMATION

2.1 Project Description and Location

We understand that the planned construction will consist of installing a new force main from the Bob Wallace Pump Station to the Spring Branch Waste Water Treatment plant, in Huntsville, Alabama. The planned force main will be installed primarily along existing right of way and utility easement crossing Pinhook Creek, Triana Boulevard, Patton Road and Goss Road. The boring locations were on each bank of the creek and within the shoulder areas or behind the curb and gutter along the roadways.

3.0 SUBSURFACE CONDITIONS

3.1 Geology

According to the Geological Survey of Alabama publication *Geologic Map of Alabama, Map 220*, the site is underlain by the Mississippian-aged Tuscumbia Limestone. The Tuscumbia Limestone consists of light gray partly oolitic limestone and very coarse bioclastic crinoidal limestone that commonly has locally abundant light gray chert nodules and concretions.

The Tuscumbia Limestone contains carbonate-based rock and is therefore soluble in slightly acidic groundwater. On a geologic time scale, weathering is typified by a chemical solutioning process that progresses along joints, fractures and bedding planes in the bedrock. This process often results in a highly irregular rock profile that contains deep weathered slots filled with soft soils. Voids or caves may also be present in the bedrock.

Surface depressions or sinkholes are formed when the soil overburden is lost into these subsurface caverns. Although no evidence of sinkhole activity was observed on the proposed site, it should be noted that this study does not preclude the possibility of future sinkhole occurrence within the area. Even an extensive drilling exploration program could not rule out the possibility of future sinkhole formation at the site. The owner must accept that there is some degree of risk in developing over carbonate rock geology.

3.2 Typical Profile

Based on the results of the borings, subsurface conditions on the project site can be generalized as follows.

Borings at the Pinhook Creek crossing, B-1 and B-2 encountered stiff to very stiff lean clay in the upper 3 to 3.5 feet. Soft lean clay was then encountered from about 8.5 to 9 feet below existing grades. Boring B-2 encountered auger refusal at 13 feet below existing grade and was then offset 10 feet to the north and the boring continued. Then stiff to hard cherty clay was encountered to the auger refusal depth of 32 feet at B-1 and boring termination depth of 40 feet below existing grades at B-2. Boring B-2 had a medium dense clayey sand layer between depths of 19 and 23 feet.

At the Triana Boulevard road crossing, Boring B-3 initially encountered medium stiff lean clay to about 4 feet and then stiff lean clay to around 7 feet below existing grades. The boring then encountered very stiff and hard lean with chert to auger refusal at 13 feet below existing grades. The boring was offset 5 feet to the north and encountered auger refusal at 13 feet, then offset 15 feet south and encountered auger refusal at 12 feet and finally offset 10 feet east and encountered auger refusal at 10 feet. The boring on the opposite side of Triana, Boring B-4, initially encountered lean clay to around 7 feet below existing grades and then very stiff and stiff cherty lean to fat clay to 28 feet below existing grades. The boring then encountered medium stiff fat clay with chert to auger refusal at 34 feet below existing grades.

Borings B-5 and B-6 at the Patton Road crossing encountered medium stiff and stiff lean clay in the upper 3 to 4 feet. This was immediately underlain by medium stiff to very stiff lean clay (with some chert) to a depth of 23 feet below existing grades. Beneath this strata, the borings encountered stiff and very stiff cherty clay the boring termination depth of 40 feet below existing grades.

Borings B-6 and B-7 at the Goss Road crossing encountered medium stiff to very stiff lean clay from about 6 to 9 feet below existing grades. The borings then encountered fat clay with chert to about 18 feet below existing grades. Boring B-7 then encountered stiff to hard cherty clay to auger refusal at 37 feet below existing grades. Boring B-8 encountered the very stiff cherty clay to about 28 feet and then stiff and very stiff lean and fat clay to the boring termination depth of 40 feet below existing grades.

The following table indicates the depth and elevations of auger refusal.

Boring Number	Refusal Depth (ft)	Surface Elevation (ft)	Refusal Elevation (ft)
B-1	32.0	Estimated 580.0	548.0
B-3	13.0	Estimated 591.0	578.0
B-4	34.0	Estimated 591.0	557.0
B-7	37.0	Estimated 605.0	568.0

Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in situ, the transition between materials may be gradual. Details for each of the log can be found on the boring logs in Appendix A.

3.3 Groundwater

Test borings were observed during and immediately following drilling for the presence and level of groundwater. Groundwater was encountered during SPT drilling activities at most of the borings from depths off 15 to 32 feet below existing grades. The depth groundwater was encountered is noted on the boring logs. Due to the relatively short timeframe of field activities, groundwater may have not had sufficient time to stabilize. Please note that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors not evident at the time of measurement.

Some of the borings encountered gray and gray-mottled soils within 4 feet of the existing grades. These soils generally indicate seasonal groundwater levels.

The table below shows boring groundwater depths and elevations at the borings.

Boring Number	Groundwater Depth (ft)	Surface Elevation (ft)	Groundwater Elevation (ft)
B-1	23.0	Estimated 580.0	559.0
B-2	15.0	Estimated 581.0	566.0
B-4	18.0	Estimated 591.0	573.0
B-5	28.0	Estimated 589.0	561.0
B-6	32.0	Estimated 592.0	560.0
B-7	32.0	Estimated 605.0	573.0
B-8	24.0	Estimated 611.0	587.0

Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

4.0 CONSIDERATIONS FOR DESIGN AND CONSTRUCTION

4.1 Excavation Considerations

Based on the results of our field exploration, difficult to excavate materials (i.e., bedrock) will be encountered along the alignment. Four of the borings encountered auger refusal at depths of 13 to 37 feet below existing grades. Boring B-4 may have encountered a very hard chert bed or other obstruction at a depth of 13 feet based on the depth of rock at Boring B-5. Excavation techniques will vary based on the weathering of the materials, fracturing and jointing in the rock, and the overall stratigraphy of the feature. Our observations indicate hard bedrock condition. Therefore, we anticipate excavations in these conditions to require hammering with a pneumatic spade or blasting. The extent of rock removal will be dependent upon the elevation of bedrock and proposed final grades.

It should be noted that irregular bedrock surface conditions are common in carbonate rock geology. Therefore, areas of shallower bedrock than encountered in the borings will likely be encountered along the alignment. Also, voids or cavernous rock conditions are common in carbonate rock geology.

4.2 Temporary Slope Considerations

Temporary excavations will be required to install the force main. The grading contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

Shoring and bracing will be necessary for steeper or deeper excavations. Braced excavations can include a complicated design and construction process. A separate and extensive evaluation of subsurface conditions with regards to braced excavations should be conducted by the contractor(s) prior to beginning excavation. The design, evaluation, and construction of the shoring and bracing system is solely the responsibility of the contractor.

Proper management of groundwater seepage and surface water runoff around the excavations will also contribute to the stability of temporary slopes. Material removed from excavations should not be stockpiled within a distance of twenty-five (25) feet from the crest of temporary excavations. Furthermore, positive drainage should also be maintained with ditches or channels at the top and bottom of the slope. It is also very important to always keep these drainage channels free of dirt, debris and vegetation.

During construction, all temporary slopes should be regularly inspected for signs of movement or unsafe conditions. Soil slopes should be covered for protection from rain and surface runoff should be diverted away from the slopes.

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

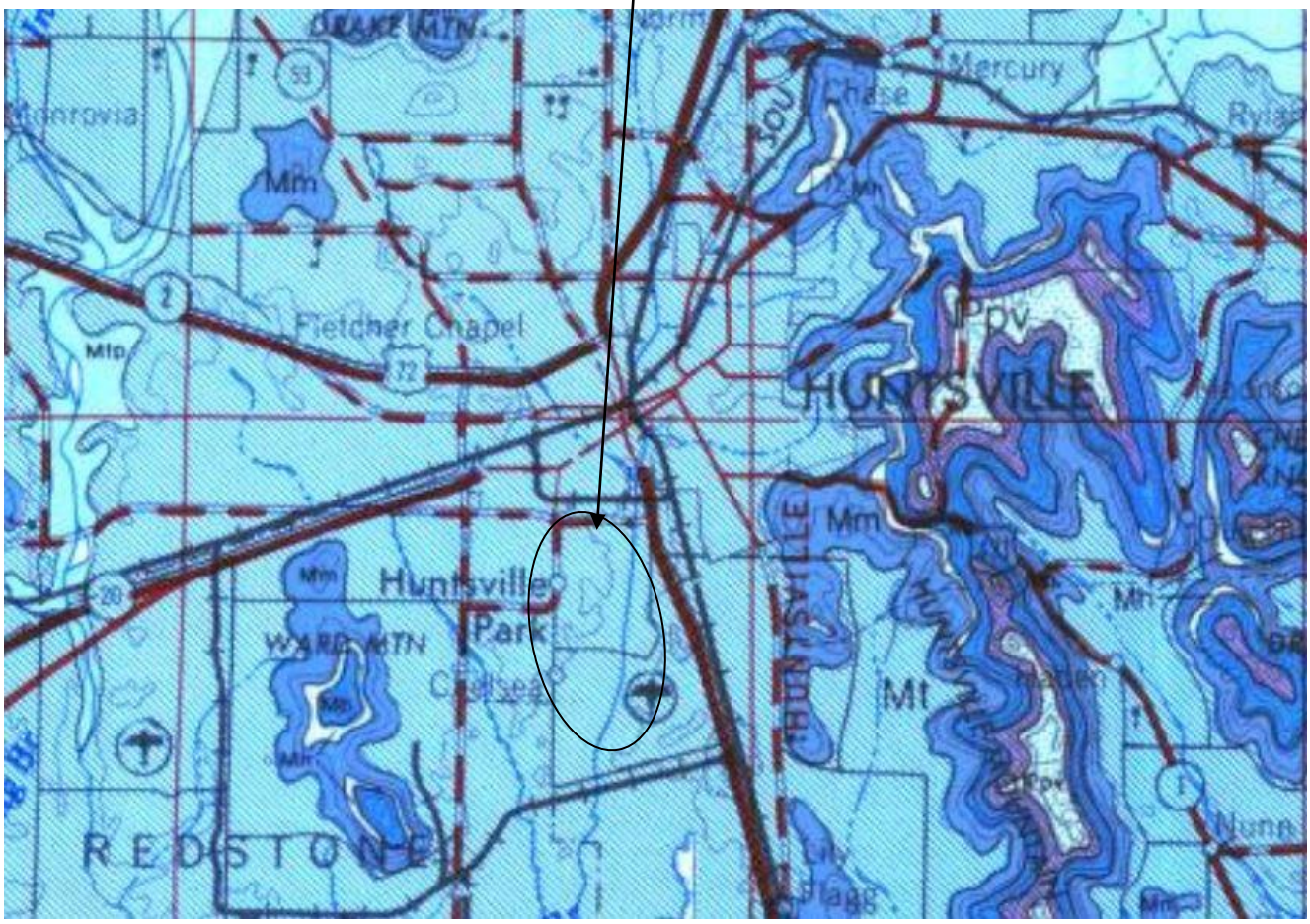
The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site

safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A
FIELD EXPLORATION

Project Location



N

Mt	Tuscumbia Limestone Light-gray limestone, partly oolitic near top; fine- to very coarse-grained bioclastic crinoidal limestone common; light-gray chert nodules and concretions are scattered throughout and are abundant locally. The apparent thickness of the formation in this province varies due to differential dissolution of the carbonate in the unit.

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: RDS	Project No. E1165052	Terracon Consulting Engineers & Scientists 26670 Success Dr. SW, Suite F Madison, Alabama 35756 PH. (256) 584-5461 FAX. (256) 584-5467	Geologic Map	Exhibit
Drawn by: RDS	Scale: N.T.S		BOB WALLACE FORCE MAIN HUNTSVILLE, ALABAMA	A-1
Checked by: MFW	File Name: E1165052 GM			
Approved by: MFW	Date: 5/26/2016			

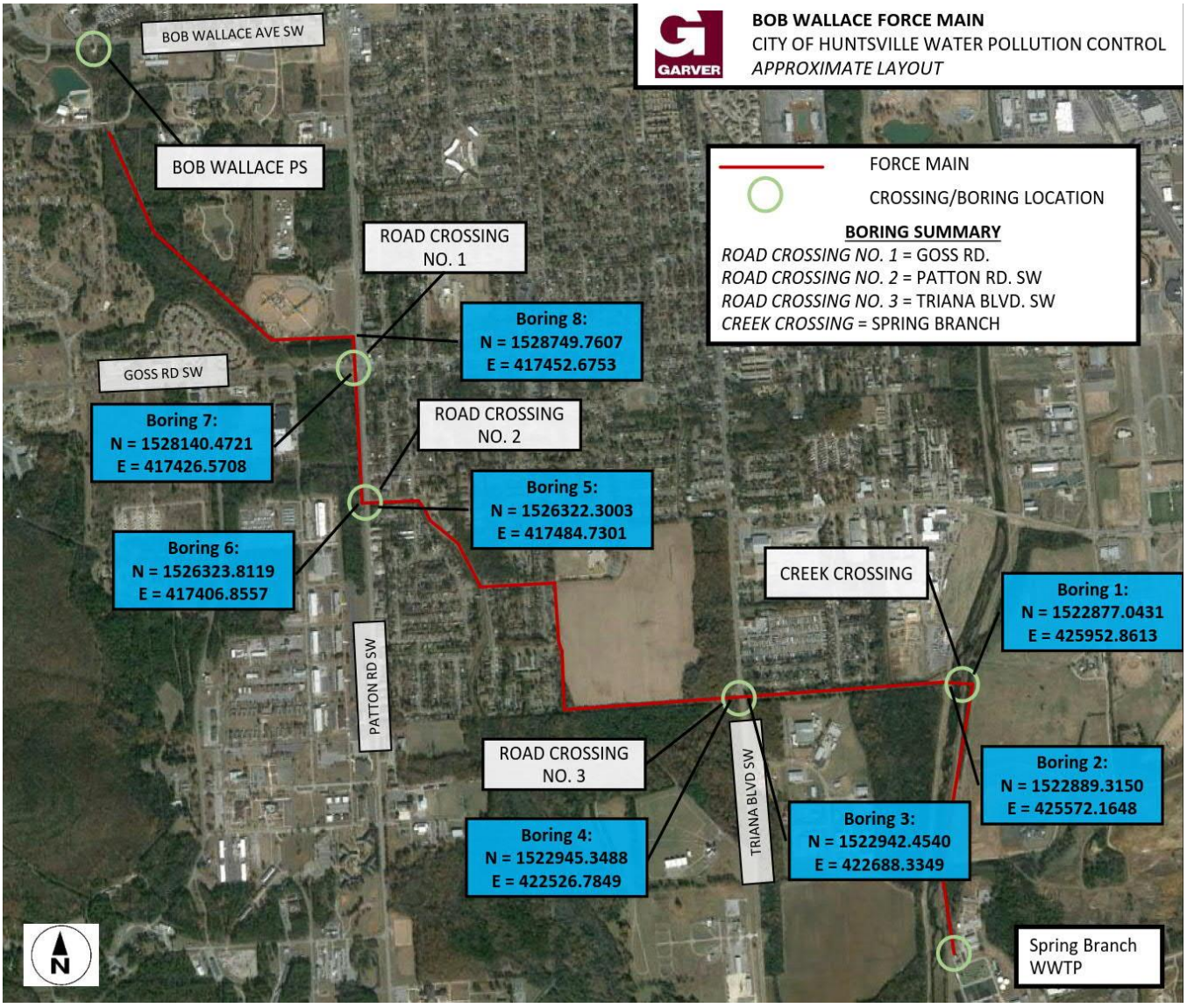


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: RDS	Project No. E1165052	Terracon Consulting Engineers & Scientists	Boring Location Plan
Drawn by: RDS	Scale: N.T.S	26670 Success Dr. SW, Suite F Madison, Alabama 35756	BOB WALLACE FORCE MAIN HUNTSVILLE, ALABAMA
Checked by: MFW	File Name: E1165052 BLP	PH. (256) 584-5461 FAX. (256) 584-5467	Exhibit A-2
Approved by: MFW	Date: 5/26/2016		

Field Exploration Description

The proposed boring locations were surveyed in the field by Garver. Ground surface elevations indicated in this report were interpolated from google maps at the locations provided by the client. The locations and elevations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were drilled with a Mobile B-47 track-mounted rotary drill rig using hollow-stem augers to advance the boreholes. Samples of the soil encountered in the borings were obtained using the split-barrel sampling procedures using a spinning cat-head SPT hammer.

In the split-barrel sampling procedure, the number of blows required to advance a standard 2-inch O.D. split-barrel sampler the last 12 inches of the typical total 18-inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance value (SPT-N). This value is used to estimate the in situ relative density of cohesionless soils and consistency of cohesive soils.

The samples were tagged for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification. Information provided on the boring logs attached to this report includes soil descriptions, consistency evaluations, boring depths, sampling intervals, and groundwater conditions. The borings were backfilled with auger cuttings prior to the drill crew leaving the site.

A field log of each boring was prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. Final boring logs included with this report represent the engineer's interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.

BORING LOG NO. B-1

PROJECT: Bob Wallace Force Main

CLIENT: Garver USA
Hunstville, Alabama

SITE: Bob Wallace Avenue
Huntsville, Alabama

LOCATION

Northing: 1522877.0431 Easting: 425952.8613

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3		**TOPSOIL (3 inches)**							
		SANDY LEAN CLAY WITH GRAVEL (CL), brown, very stiff			X	6-9-11 N=20	14		
3.0									
		LEAN CLAY (CL), grayish brown, soft			X	3-2-2 N=4	27		
5.0			5						
		SANDY LEAN CLAY WITH GRAVEL (CL), grayish brown, soft			X	2-2-2 N=4	25		
9.0					X	2-13-10 N=23	13		
		SANDY LEAN CLAY (CL), with chert, brown and gray, very stiff	10						
13.0									
		CHERTY CLAY (CL), yellowish brown, hard			X	14-20-18 N=38	25		
18.0			15						
		CHERTY CLAY (CL), yellowish brown, very stiff			X	7-8-13 N=21	28		
23.0			20	▽					
		CHERTY CLAY (MUD) (CL), brown, stiff			X	7-8-3 N=11	26		
			25						

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water encountered at 23' at time of drilling*

Terracon

Boring Started: 5/20/2016 Boring Completed: 5/20/2016

Drill Rig: Mobile B-47 Driller: Chambers Excavating

Project No.: E1165052

BORING LOG NO. B-1

PROJECT: Bob Wallace Force Main

CLIENT: Garver USA
Hunstville, Alabama

SITE: Bob Wallace Avenue
Huntsville, Alabama

LOCATION

Northing: 1522877.0431 Easting: 425952.8613

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	CHERTY CLAY (MUD) (CL), brown, stiff *(continued)*							
28.0								
	CHERTY CLAY (MUD) (CL), with chert, brown and gray, stiff							
					6-3-7 N=10	31		
		30						
32.0								
	Auger Refusal at 32 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water encountered at 23' at time of drilling*

Terracon

Boring Started: 5/20/2016 Boring Completed: 5/20/2016

Drill Rig: Mobile B-47 Driller: Chambers Excavating

Project No.: E1165052

BORING LOG NO. B-2

PROJECT: Bob Wallace Force Main

CLIENT: Garver USA
Hunstville, Alabama

SITE: Bob Wallace Avenue
Huntsville, Alabama

LOCATION

Northing: 1522889.315 Easting: 425572.1648

DEPTH		SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.2	**TOPSOIL and GRAVEL (2 inches)**					
	SANDY LEAN CLAY WITH GRAVEL (CL), brown, stiff		7-8-7 N=15	16		
3.5						
	SANDY LEAN CLAY (CL), grayish brown, soft		2-2-1 N=3	25		
6.0						
	SANDY LEAN CLAY (CL), brown and gray, soft		2-2-1 N=3	7		
8.5						
	SANDY LEAN CLAY (CL), with chert, gray, stiff		5-6-8 N=14	19		
13.0						
	SANDY LEAN CLAY (CL), with chert, reddish brown, medium stiff		2-4-4 N=8	27		
19.0						
	CLAYEY SAND WITH GRAVEL (SC), brown and red, medium dense		4-8-8 N=16	29		
23.0						
	CHERTY CLAY (MUD) (CL), reddish brown, stiff		6-6-8 N=14	36		

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:
Boring encountered auger refusal at 13' and was relocated 10' to the north.

WATER LEVEL OBSERVATIONS

Water encountered at 15' at time of drilling

Terracon

Boring Started: 5/20/2016 Boring Completed: 5/20/2016

Drill Rig: Mobile B-47 Driller: Chambers Excavating

Project No.: E1165052

BORING LOG NO. B-2

PROJECT: Bob Wallace Force Main

CLIENT: Garver USA
Hunstville, Alabama

SITE: Bob Wallace Avenue
Huntsville, Alabama

LOCATION

Northing: 1522889.315 Easting: 425572.1648

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	CHERTY CLAY (MUD) (CL), reddish brown, stiff *(continued)*							
28.5								
	CHERTY CLAY (MUD) (CL), brown and gray, very stiff	30			22-9-17 N=26	62		
	to stiff	35			5-7-4 N=11	50		
37.0								
	CHERTY CLAY (MUD) (CL), brown, stiff	40			5-5-10 N=15	37		
40.0								
	Boring Terminated at 40 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water encountered at 15' at time of drilling*

Terracon

Boring Started: 5/20/2016 Boring Completed: 5/20/2016

Drill Rig: Mobile B-47 Driller: Chambers Excavating

Project No.: E1165052

BORING LOG NO. B-3

PROJECT: Bob Wallace Force Main

CLIENT: Garver USA
Hunstville, Alabama

SITE: Bob Wallace Avenue
Huntsville, Alabama

LOCATION

Northing: 1522942.454 Easting: 422688.3349

DEPTH		FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	**TOPSOIL (3 inches)**				
	SANDY LEAN CLAY WITH GRAVEL (CL), brown, medium stiff	5-3-3 N=6	12		
4.0	**SANDY LEAN CLAY (CL)**, with chert, yellowish brown with gray mottling, stiff	5-5-7 N=12	29		
7.0	**SANDY LEAN CLAY (CL)**, with chert, yellowish brown and gray, very stiff	6-8-10 N=18	27		
9.0	**CHERTY CLAY (CL)**, yellowish brown and white, hard	8-14-22 N=36	27		
13.0	***Auger Refusal at 13 Feet***				

DEPTH (Ft.): 5, 10

WATER LEVEL OBSERVATIONS

SAMPLE TYPE

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:
Offset boring 5' north encountered auger refusal at 13'.
Offset boring 15' south encountered auger refusal at 12'.
Offset boring 10' east encountered auger refusal at 10'.

WATER LEVEL OBSERVATIONS
No water encountered at time of drilling

Terracon

Boring Started: 5/23/2016 Boring Completed: 5/23/2016
Drill Rig: Mobile B-47 Driller: Chambers Excavating
Project No.: E1165052

BORING LOG NO. B-4

PROJECT: Bob Wallace Force Main

CLIENT: Garver USA
Hunstville, Alabama

SITE: Bob Wallace Avenue
Huntsville, Alabama

LOCATION

Northing: 1522945.3488 Easting: 422526.7849

DEPTH		SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.2	**TOPSOIL (2 inches)**					
	SANDY LEAN CLAY WITH GRAVEL (CL), yellowish brown, stiff		3-6-3 N=9	18		
4.0						
	SANDY LEAN CLAY WITH GRAVEL (CL), gray, very stiff		5-7-9 N=16	20		
7.0						
	SANDY LEAN CLAY (CL), with chert, yellowish brown and red with gray mottling, very stiff		5-9-12 N=21	25		
9.0						
	SANDY LEAN CLAY (CL), with chert, red and gray, very stiff		9-17-12 N=29	27		
13.0						
	SANDY FAT CLAY (CH), with chert, yellowish red and gray, stiff		5-4-6 N=10	31		
18.0						
	SANDY FAT CLAY (CH), with chert and gravel, light brown and gray, medium stiff		7-4-2 N=6	34		
			3-4-3 N=7	44		

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Water encountered at 18' at time of drilling

Terracon

Boring Started: 5/23/2016 Boring Completed: 5/23/2016

Drill Rig: Mobile B-47 Driller: Chambers Excavating

Project No.: E1165052

BORING LOG NO. B-4

PROJECT: Bob Wallace Force Main

CLIENT: Garver USA
Hunstville, Alabama

SITE: Bob Wallace Avenue
Huntsville, Alabama

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	Northing: 1522945.3488 Easting: 422526.7849							
	SANDY FAT CLAY (CH), with chert and gravel, light brown and gray, medium stiff *(continued)*							
	28.0							
	SANDY FAT CLAY, with chert (MUD), tan, medium stiff				WOR-4-3 N=7			
		30						
	34.0							
	Auger Refusal at 34 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Water encountered at 18' at time of drilling

Terracon

Boring Started: 5/23/2016 | Boring Completed: 5/23/2016

Drill Rig: Mobile B-47 | Driller: Chambers Excavating

Project No.: E1165052

BORING LOG NO. B-5

PROJECT: Bob Wallace Force Main

CLIENT: Garver USA
Hunstville, Alabama

SITE: Bob Wallace Avenue
Huntsville, Alabama

LOCATION

Northing: 1526322.3003 Easting: 417484.7301

DEPTH		FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	**TOPSOIL (3 inches)**				
	LEAN CLAY (CL), brown, medium stiff	3-3-3 N=6	16		
4.0					
	SANDY LEAN CLAY (CL), with chert, yellowish brown and gray, very stiff	6-9-8 N=17	15		
6.0					
	SANDY LEAN CLAY (CL), with chert, yellowish brown and gray, stiff	6-5-6 N=11	22		
9.0					
	SANDY FAT CLAY (CH), with chert, reddish brown, gray and white, stiff	3-5-5 N=10	35		
14.0					
	SANDY FAT CLAY (CH), with chert, yellowish brown, very stiff	11-8-8 N=16	30		
18.0					
	LEAN CLAY (CL), with chert, brown, very stiff	5-8-11 N=19	26		
23.0					
	CHERTY CLAY (CL), brown, stiff	11-8-7 N=15	33		

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Water encountered at 28' at time of drilling

Terracon

Boring Started: 5/23/2016 Boring Completed: 5/23/2016

Drill Rig: Mobile B-47 Driller: Chambers Excavating

Project No.: E1165052

BORING LOG NO. B-5

PROJECT: Bob Wallace Force Main

CLIENT: Garver USA
Hunstville, Alabama

SITE: Bob Wallace Avenue
Huntsville, Alabama

LOCATION

Northing: 1526322.3003 Easting: 417484.7301

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	CHERTY CLAY (CL), brown, stiff *(continued)*		▽					
29.0	**CHERTY CLAY (CL)**, brown, very stiff				13-12-13 N=25	30		
		30						
					10-10-17 N=27	45		
		35						
40.0					11-11-8 N=19	32		
	Boring Terminated at 40 Feet	40						

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water encountered at 28' at time of drilling*

Terracon

Boring Started: 5/23/2016 Boring Completed: 5/23/2016

Drill Rig: Mobile B-47 Driller: Chambers Excavating

Project No.: E1165052

BORING LOG NO. B-6

PROJECT: Bob Wallace Force Main

CLIENT: Garver USA
Hunstville, Alabama

SITE: Bob Wallace Avenue
Huntsville, Alabama

LOCATION

Northing: 1526323.8119 Easting: 417406.8557

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.2		**TOPSOIL (2 inches)**							
		SANDY LEAN CLAY WITH GRAVEL and ASPHALT PIECES (Fill) (CL), brown, stiff			X	3-7-8 N=15	12		
3.0									
		SANDY LEAN CLAY (CL), with chert, yellowish brown and gray, medium stiff			X	2-3-3 N=6	28		
6.0			5						
		LEAN CLAY (CL), light brown and gray, medium stiff, (petroleum odor)			X	2-2-3 N=5	21		
8.5									
		SANDY LEAN CLAY (CL), with chert, yellowish brown and gray, very stiff, (petroleum odor)			X	17-10-11 N=21	24		
13.0			10						
		SANDY LEAN CLAY (CL), yellowish brown with yellow and black mottling, stiff			X	3-6-6 N=12	27		
18.0			15						
		SANDY FAT CLAY (CH), with chert, yellowish brown, stiff			X	3-5-7 N=12	32		
23.0			20						
		CHERTY CLAY (CL), yellowish brown, stiff			X	7-5-6 N=11	36		
			25						

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water encountered at 32' at time of drilling*

Terracon

Boring Started: 5/23/2016 Boring Completed: 5/23/2016

Drill Rig: Mobile B-47 Driller: Chambers Excavating

Project No.: E1165052

BORING LOG NO. B-6

PROJECT: Bob Wallace Force Main

CLIENT: Garver USA
Hunstville, Alabama

SITE: Bob Wallace Avenue
Huntsville, Alabama

LOCATION

Northing: 1526323.8119 Easting: 417406.8557

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	CHERTY CLAY (CL), yellowish brown, stiff *(continued)*							
28.0								
	CHERTY CLAY (CL), brown, stiff	30			10-8-7 N=15	27		
			▽					
34.0								
	CHERTY CLAY (CL), brown, very stiff	35			11-11-9 N=20	23		
40.0								
	Boring Terminated at 40 Feet	40			6-7-9 N=16	26		

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water encountered at 32' at time of drilling*

Terracon

Boring Started: 5/23/2016 Boring Completed: 5/23/2016

Drill Rig: Mobile B-47 Driller: Chambers Excavating

Project No.: E1165052

BORING LOG NO. B-7

PROJECT: Bob Wallace Force Main

CLIENT: Garver USA
Hunstville, Alabama

SITE: Bob Wallace Avenue
Huntsville, Alabama

LOCATION

Northing: 1528140.4721 Easting: 417426.5708

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.2		**TOPSOIL (2 inches)**							
		LEAN CLAY WITH GRAVEL (CL), reddish brown, stiff			X	6-5-4 N=9	10		
3.0									
		LEAN CLAY (CL), tan, medium stiff			X	4-3-3 N=6	22		
6.0			5						
		FAT CLAY (CH), tan and gray, medium stiff			X	3-3-4 N=7	24		
9.0					X	3-5-5 N=10	28		
		SANDY FAT CLAY (CL), with chert, tan and gray, stiff	10						
14.0					X	5-8-10 N=18	28		
		SANDY FAT CLAY (CL), with chert, yellowish brown, very stiff	15						
18.0									
		CHERTY CLAY (CL), yellowish brown, stiff			X	5-5-7 N=12	33		
23.0			20						
		CHERTY CLAY (CL), yellowish brown, very stiff			X	14-10-9 N=19	32		
			25						

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Water encountered at 32' at time of drilling

Terracon

Boring Started: 5/23/2016 Boring Completed: 5/23/2016

Drill Rig: Mobile B-47 Driller: Chambers Excavating

Project No.: E1165052

BORING LOG NO. B-7

PROJECT: Bob Wallace Force Main

CLIENT: Garver USA
Hunstville, Alabama

SITE: Bob Wallace Avenue
Huntsville, Alabama

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	Northing: 1528140.4721 Easting: 417426.5708							
	CHERTY CLAY (CL), yellowish brown, very stiff *(continued)*							
	29.5			X	9-10-50/0.2' N=50+	43		
	CHERTY CLAY (CL), yellowish brown, hard	30	▽					
	33.0			X	7-10-11 N=21	44		
	CHERTY CLAY (CL), yellowish brown, very stiff	35						
	37.0							
	Auger Refusal at 37 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water encountered at 32' at time of drilling*

Terracon

Boring Started: 5/23/2016 | Boring Completed: 5/23/2016
Drill Rig: Mobile B-47 | Driller: Chambers Excavating
Project No.: E1165052

BORING LOG NO. B-8

PROJECT: Bob Wallace Force Main

CLIENT: Garver USA
Hunstville, Alabama

SITE: Bob Wallace Avenue
Huntsville, Alabama

LOCATION

Northing: 1528749.7607 Easting: 417452.6753

DEPTH		FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.2	**TOPSOIL (2 inches)**				
	LEAN CLAY (CL), red, medium stiff	4-2-4 N=6	19		
4.0	**LEAN CLAY (CL)**, red, stiff	3-5-5 N=10	26		
7.0	**LEAN CLAY (CL)**, red, very stiff	6-9-10 N=19	28		
9.0	**FAT CLAY (CH)**, yellowish brown with gray mottling, very stiff	5-7-11 N=18	31		
14.0	**SANDY FAT CLAY (CH)**, with chert, yellowish brown with gray mottling, very stiff	8-8-11 N=19	30		
18.0	**SANDY FAT CLAY (CH)**, with chert, yellowish brown with gray and white mottling, medium stiff	3-4-4 N=8	39		
24.0	**CHERTY CLAY (CL)**, tan and white, very stiff	4-8-8 N=16	37		

DEPTH (Ft.): 5, 10, 15, 20, 25

WATER LEVEL OBSERVATIONS: ▽ at 24'

SAMPLE TYPE: X

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water encountered at 24' at time of drilling*

Terracon

Boring Started: 5/24/2016 Boring Completed: 5/24/2016

Drill Rig: Mobile B-47 Driller: Chambers Excavating

Project No.: E1165052

BORING LOG NO. B-8

PROJECT: Bob Wallace Force Main

CLIENT: Garver USA
Hunstville, Alabama

SITE: Bob Wallace Avenue
Huntsville, Alabama

LOCATION

Northing: 1528749.7607 Easting: 417452.6753

GRAPHIC LOG	DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		CHERTY CLAY (CL), tan and white, very stiff *(continued)*							
	28.0								
		SANDY FAT CLAY (CH), with chert, tan, stiff	30		X	4-5-7 N=12	37		
	33.0								
		FAT CLAY (CH), with chert, tan, stiff	35		X	6-7-7 N=14	40		
	39.0								
	40.0	**FAT CLAY (CH)**, with chert, tan, very stiff	40		X	15-10-8 N=18	37		
		Boring Terminated at 40 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water encountered at 24' at time of drilling*

Terracon

Boring Started: 5/24/2016 Boring Completed: 5/24/2016

Drill Rig: Mobile B-47 Driller: Chambers Excavating

Project No.: E1165052

APPENDIX B
LABORATORY INFORMATION

Laboratory Testing

Soil samples were tested in the laboratory to measure their moisture content to aid in visually classifying the soil. The test results are provided on the boring logs included in Appendix A.

Descriptive classifications of the soils indicated on the boring logs are in accordance with the enclosed General Notes and the Unified Soil Classification System. Also shown are estimated Unified Soil Classification Symbols. A brief description of this classification system is attached to this report. Classification of the samples not tested in the laboratory was by visual manual procedures.

APPENDIX C
SUPPORTING DOCUMENTS

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING


Auger


Split Spoon


Shelby Tube


Macro Core


Ring Sampler


Rock Core


Grab Sample


No Recovery

WATER LEVEL


Water Initially Encountered


Water Level After a Specified Period of Time


Water Level After a Specified Period of Time

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	Hand Penetrometer
(T)	Torvane
(b/f)	Standard Penetration Test (blows per foot)
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength, Qu, tsf**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 0.25	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	0.25 to 0.50	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	0.50 to 1.00	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	1.00 to 2.00	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	2.00 to 4.00	15 - 30	19 - 42
			Hard	> 4.00	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

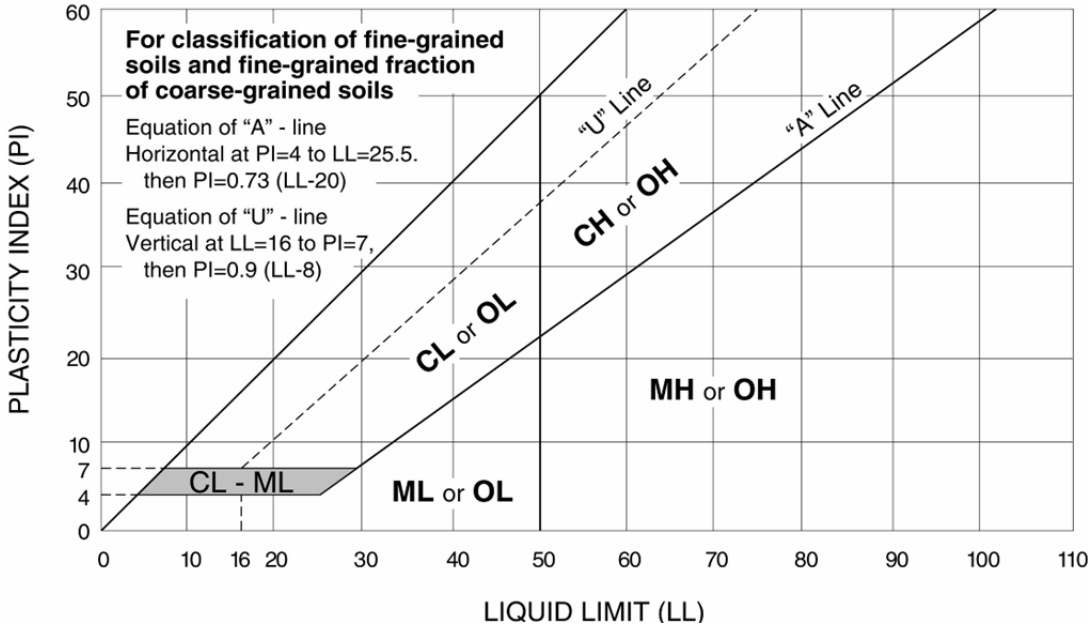
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



Terracon

Exhibit C-2