Geotechnical Data Report

North Burleson Street Improvements
W. Center Street to Market Place Ave
Kyle, Texas

Arias Project No. 2013-756

Prepared For:
Freese and Nichols, Inc.

August 2014

13581 Pond Springs Road, Suite 210, Austin, Texas 78729 • Phone: (512) 428-5550 • Fax: (512) 428-5525

August 26, 2014
Arias Project No. 2013-756 Via Email: Jessica.Rodriguez@freese.com

Ms. Jessica Rodriguez, P.E.
Senior Project Manager
Freese and Nichols, Inc.
10431 Morado Circle
Building 5, Suite 300
Austin, Texas 78759

RE: Geotechnical Data Report
North Burleson Street Improvements
W. Center Street to Market Place Ave
Kyle, Texas

Dear Ms. Rodriguez:

Arias & Associates, Inc. (Arias) is pleased to submit this Geotechnical Data Report (GDR) of findings for the above referenced project. Our services were performed as outlined in our proposal dated September 23, 2013, and formally authorized in Subconsultant Authorization Agreement executed May 13, 2014.

The GDR is a compilation of geotechnical boring and laboratory testing data obtained to date for this project, and a description of geologic and stratigraphic conditions encountered at the site. The scope of the study was to provide geotechnical engineering criteria for use in pavement thickness design and earthwork recommendations. Geotechnical recommendations for pavements and earthwork are provided under separate cover in a Geotechnical Design Memorandum.

Arias sincerely appreciates the opportunity to be part of the design team and look forward to our continued association throughout final design and construction phases. Please do not hesitate to contact us regarding this report, or if we may be of further service.

Sincerely,
ARIAS & ASSOCIATES, INC.
TBPE Registration No. F-32

STATE OF TEXAS
REBECCA A. RUSSO
91271
LICENSED
PROFESSIONAL ENGINEER

Rebecca A. Russo, P.E.
Senior Geotechnical Engineer

Rene P. Gonzales, P.E.
Project Manager

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PROJECT INFORMATION

The project will consist of roadway improvements to approximately 1.4 miles of N. Burleson Street, from W. Center Street to Market Place Avenue in Kyle, Texas. Currently, the majority of the project (approximately 1.3 miles) will be along existing Right of Way (ROW), and about 0.1 miles will include new ROW and new roadway construction. The existing ROW consists of 2-lane roadway with bar ditches. Proposed construction will include 3 lanes with a center turn lane, curb and gutter drainage improvements, and culvert crossing at an unnamed tributary of Plum Creek. A *Vicinity Map* showing the project site location is presented on Figure 1 of Appendix A. A summary of the project information is given in the table below.

Table 1: Project Summary

Project	North Burleson Street Improvements
Project Location	N. Burleson St. from W. Center to Market Place Ave
Proposed Development	1.4 Miles of Roadway Improvements: 1.3 Miles of existing Right of Way 0.1 Miles of new Right of Way
Proposed Construction	Roadway Widening to 3-lane with curb-and-gutter Culvert crossing at unnamed tributary

FIELD EXPLORATION

A total of 10 borings were drilled at the approximate locations shown on the *Boring Location Plan* presented on Figure 2 in Appendix A. The borings were drilled to depths of 7.3 to 20 feet below existing grade. A summary of the boring drilling information is presented in the following table.

Table 2: Boring Summary Table

Boring Designation	Drill Depth, ft	Drill Date	Groundwater Depth ATD, ft	Notes
B-1	9	6/2/2014	6	
B-2	10.5	6/2/2014	5.5	
B-3	10	5/29/2014		
B-4	15	6/2/2014	8.5	
B-5	9.5	6/2/2014	6.5	
B-6	7.3	5/29/2014	5 (2 ft after drilling)	Boring terminated at 7.3 feet due to possible utility trench

Boring Designation	Drill Depth, ft	Drill Date	Groundwater Depth ATD, ft	Notes
B-7	20	6/2/2014		
B-8	10	6/5/2014		
B-9	10	5/29/2014	3	
B-10	9	6/2/2014	4	

Notes:

1) ATD – At the Time of Drilling.
2) Drill Depth is depths below ground surface at the time of the geotechnical study.

The borings were generally sampled using the split-barrel sampler while performing the Standard Penetration Test (ASTM D 1586) at approximately 2 foot intervals and material was obtained from the cuttings as the borings were advanced (ASTM D 1452). Select samples were also obtained using seamless push tubes for cohesive strata (ASTM D 1587). Rock core sampling (ASTM D 2113) of the limestone stratum was performed in 6 of the 10 borings to obtain rock quality designation (ASTM D 6032) and to obtain limestone samples for laboratory testing. The boring depths were measured from below the existing ground surface at the time of drilling. A truck-mounted drill rig using air and rotary drilling methods together with the sampling tool noted was used to obtain the subsurface soil/rock samples. After completion of drilling, the boreholes were backfilled using the auger cuttings and bentonite mixture.

Detailed descriptions of subsurface conditions encountered in the borings are presented on the Logs of Borings included in Appendix B. Keys to terms and symbols used on the boring logs are included in Appendix B, following the logs of borings. Sample type and interval are included on the individual soil boring logs at the respective sample depth. An Arias' representative visually logged each recovered sample and selected representative samples for laboratory testing.

SPT N-values for those intervals where the sampler was advanced for a 12-inch penetration after the initial 6-inch seating are shown on the individual boring logs. Descriptions of field testing procedures are included in Appendix B, following the boring logs and keys to terms and symbols. GPS coordinates (horizontal datum NAD 83) obtained using a hand-held GPS device are shown on the boring logs, and should be considered approximate. Drilling and groundwater notes are also shown on the boring logs.

Soil classifications and borehole logging were conducted during the exploration by one of our field engineering technicians working under the supervision of our Geotechnical Engineer. Final soil classifications, as seen on the boring logs included in Appendix B, were determined in the laboratory based on laboratory and field test results and applicable ASTM procedures.

LABORATORY TESTING

The laboratory testing was performed on representative samples to determine soil water content, Atterberg Limits (ASTM D4318), grain size analyses (ASTM D422) and unconfined compression strength tests on rock core samples (ASTM D7012). In addition to classification and strength testing, one CBR (California Bearing Ratio) test was conducted on a bulk sample obtained from auger cuttings in boring B-6. The results of the CBR test and Proctor compaction test (ASTM D698), as well as plasticity and gradation curves are included in Appendix C. A description of laboratory procedures is included in Appendix C, following the data.

The soil laboratory testing for this project was done in accordance applicable ASTM procedures with the specifications and definitions for these tests listed in the Appendix C. Remaining soil samples recovered from this exploration will be routinely discarded following submittal of this report.

SUBSURFACE CONDITIONS

Area geology, generalized stratigraphy and groundwater conditions are discussed in the following sections. The subsurface and groundwater conditions are based on conditions encountered at the boring locations to the depths explored. A *Geologic Map* is presented on Figure 4 in Appendix A.

Area Geology

According to published geologic mapping[1], the site is underlain by surficial clay remnants and limestone of the Austin Group of Limestones. The Austin limestone is usually described as chalk, and is comprised of chalky limestone, clayey limestone, limestone, and marl (a hard calcareous clay). Unweathered Austin is gray to light gray in color, and becomes tan with weathering. Surficial weathered remnants typically consist of tan and brown fat and lean clay.

Referring to the Geologic Map, it can be seen the project site is situated near a fault between the Austin Group of Limestone and the Pecan Gap Formation of the Taylor Group just east of IH-35. Surficial outcropping of Del Rio / Georgetown undivided is mapped to the west. In faulted regions, it is not uncommon for smaller secondary faulting with surficial expressions of nearby formations to be encountered along the project alignment, with the possible presence of highly plastic potentially expansive clay (Taylor, Del Rio), or relatively hard limestone (Buda). Further, the presence of faulting oftentimes promotes the passage of groundwater from upgradient sources.

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1 Barnes, V.E. (1974), "Geologic Atlas of Texas, Austin and Seguin Sheets," Second Printing 1995, Bureau of Economic Geology, The University of Texas at Austin, map and explanatory bulletin.

Site Stratigraphic and Engineering Properties

Subsurface conditions can be best understood by a thorough review of the *Boring Logs* included in Appendix B and the *Generalized Subsurface Profile* which precedes the boring logs. In general, the borings encountered surficial fill material (in 8 of the 10 borings) underlain by fat and lean clay, transitioning to weathered limestone and limestone of the Austin Group. The generalized stratigraphic conditions and engineering properties are summarized in the table below.

Table 3: Generalized Stratigraphic Conditions

Stratum	Depth (ft)	Material Type	Index Test		N
I	0 - 7.5 Avg 4.2	FILL – Dark brown FAT CLAY (CH) to CLAYEY GRAVEL (GC) with sand	PI= 23 to 51 Avg 39	N200= 25 to 82 Avg 50	PP=1.5 to 4.5 Avg 2.2 tsf N=6, 7, 4, 8
IIa	1 - 7.5 to 3 to 10	CWLS – Tan LEAN CLAY (CL) to CLAYEY SAND (SC)	PI= 8 to 20 Avg 16	N200= 25 to 53 Avg 36	N=6 to 50/3" (average 50+)
IIb	4 to 4.5	ALLUVIUM – Light gray sandy FAT CLAY (CH)	PI=32	N200=79	PP=4.0
III	3 - 10 to BTD Avg 5.5	Tan LIMESTONE (Austin Group)	REC= 78 to 100 Avg 93	RQD= 23 to 100 Avg 58	N=50/2" to 50/3" UC= 111 to 595 Avg UC=225, 165*
* Excluded high value of 595 tsf from average.					

Where:

Depth	-	Depth from existing ground surface at the time of geotechnical study, feet
PI	-	Plasticity Index, %
N200	-	Percent passing U.S. Standard No. 200 sieve, %
PP	-	Pocket Penetrometer, tsf
N	-	Standard Penetration Test (SPT) blow count value, blows per foot (bpf)
Avg	-	Average Value
BTD	-	Boring Termination Depth
CWLS	-	Completely Weathered Limestone

Groundwater

Groundwater was encountered in 7 of the 10 borings at depths of 3 to 8.5 feet below grade at the time of drilling. Boring B-6 had groundwater at 2-ft depth after drilling. Due to the proximity of the site to nearby creeks and mapped geologic faulting, it is anticipated that groundwater will be present during construction along portions of the alignment. For construction planning purposes, the presence of shallow groundwater should be made known to the contractor, particularly in the vicinity of borings B-4 and B-10 near site creeks, and B-6 which may be due to groundwater traveling in utility backfill or sourced from nearby faulting, or both. Permanent drainage beneath pavements may be necessary depending on final roadway grades, and will be addressed under separate cover in the Geotechnical Design Memorandum.

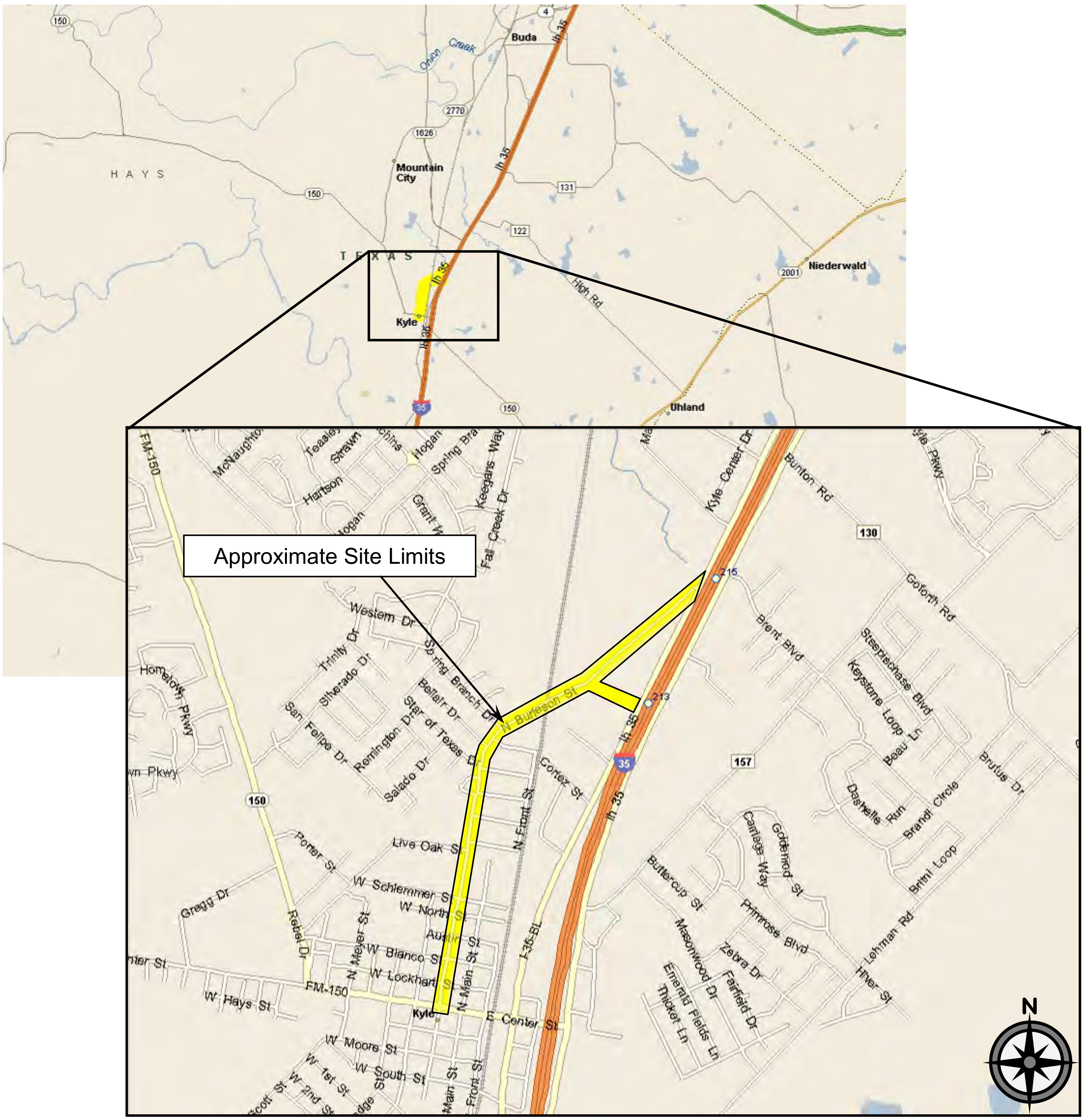
Groundwater levels will often change significantly over time and should be verified immediately prior to construction. Water levels in open boreholes may require several hours to several days to stabilize depending on the permeability of the soils. Groundwater levels at this site may differ during construction because fluctuations in groundwater levels can result from seasonal conditions, rainfall, drought, or temperature effects. Pockets or seams of gravels, sands, silts or open fractures and joints can store and transmit “perched” groundwater flow or seepage.

LIMITATIONS

It should be noted that the subsurface conditions consider those conditions discovered at the specific boring locations. *Significant variations in soil and groundwater conditions between and beyond the borings often exist and can occur at this site.* Transition boundaries or contacts, noted on the boring logs to separate soil types, are approximate. Actual contacts may be gradual and vary at different locations. If conditions encountered during construction indicate more variation than established as a result of this study, we should be contacted to evaluate the significance of the changed conditions relative to our descriptions.

This report was prepared for this project exclusively for the use of Freese and Nichols, Inc. and the design team. If different subsurface conditions are encountered, we should be informed and retained to ascertain the impact of these changes on the date included in this report. We cannot be responsible for the potential impact of these changes if we are not informed. This report has been prepared in accordance with generally accepted geotechnical engineering practice with a degree of care and skill ordinarily exercised by reputable geotechnical engineers and geologists practicing in this area.

APPENDIX A: FIGURES



VICINITY MAP

North Burleson Street
from West Center Street to Market Place Avenue
Kyle, Texas

Figure 1

1 of 1

ARIAS GEOPROFESSIONALS
13581 Pond Springs Road, Suite 210, Austin, Texas 78729
Phone: (512) 428-5550 • Fax: (512) 428-5525

Date: June 18, 2014	Job No.: 2013-756
Drawn By: TAS	Checked By: RAR
Approved By: RPG	Scale: N.T.S.

ARIAS GEOPROFESSIONALS

13581 Pond Springs Road, Suite 210, Austin, Texas 78729
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OVERALL BORING LOCATION PLAN

North Burleson Street
from West Center Street to Market Place Avenue
Kyle, Texas

Job No.: 2013-756
Scale: N.T.S.
Date: June 18, 2014
Drawn By: TAS
Checked By: RAR
Approved By: RPG

Figure 2

1 of 1

ARIAS GEOPROFESSIONALS
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BORING LOCATION PLAN

North Burleson Street
from West Center Street to Market Place Avenue
Kyle, Texas

Job No.:	2013-756
Scale:	N.T.S.
Date:	June 23, 2014
Drawn By:	TAS
Checked By:	RAR
Approved By:	RPG

Figure 2a

DISCLAIMER: This drawing is for illustration only and should not be used for design or construction purposes. All locations are approximate.

ARIAS GEOPROFESSIONALS
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Phone: (512) 428-5550 • Fax: (512) 428-5525

BORING LOCATION PLAN

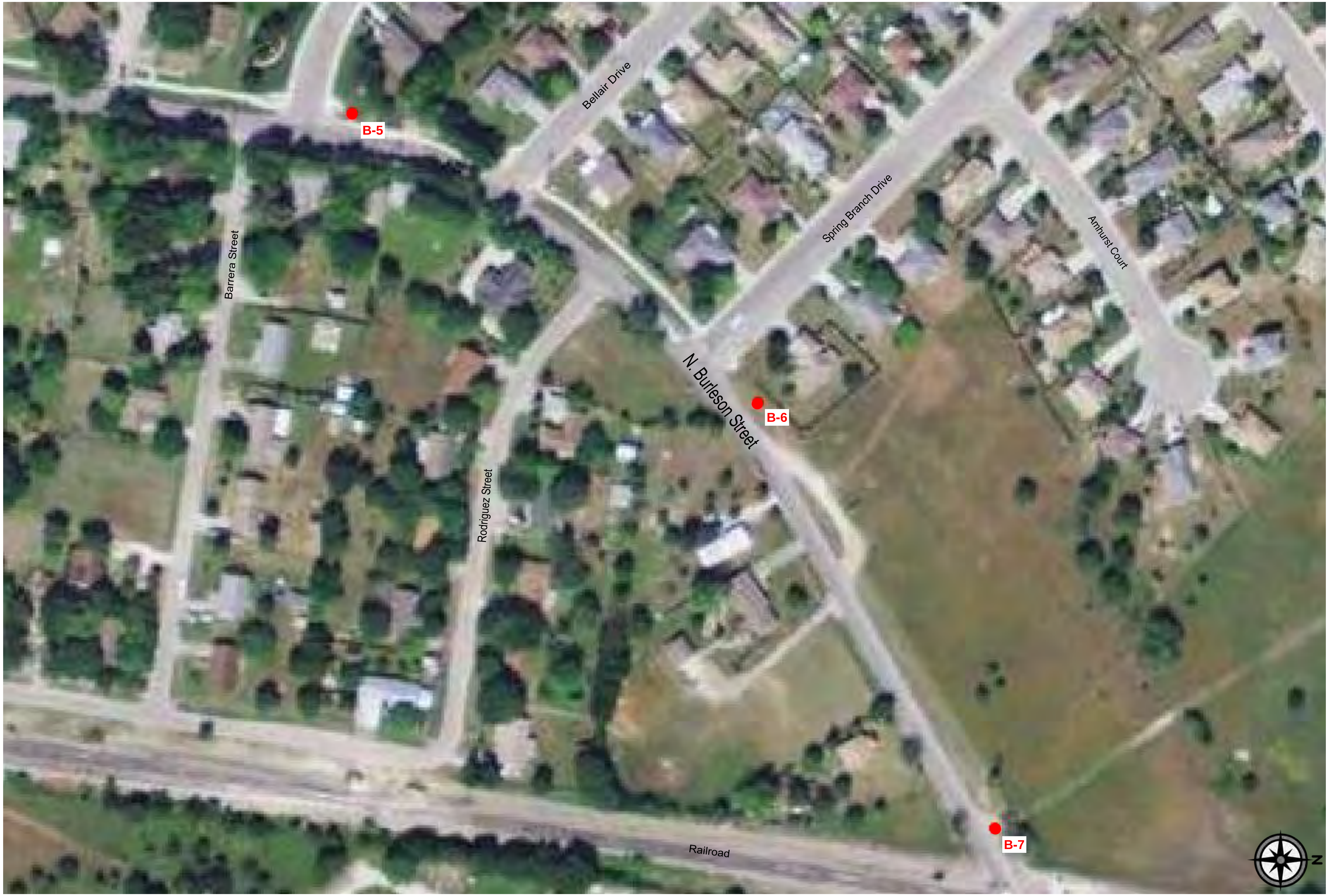
North Burleson Street
from West Center Street to Market Place Avenue
Kyle, Texas

Job No.:	2013-756
Scale:	N.T.S.
Date:	June 18, 2014
Drawn By:	TAS
Checked By:	RAR
Approved By:	RPG

Figure 2b

2 of 4

DISCLAIMER: This drawing is for illustration only and should not be used for design or construction purposes. All locations are approximate.



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BORING LOCATION PLAN

North Burleson Street
from West Center Street to Market Place Avenue
Kyle, Texas

Job No.:	2013-756
Scale:	N.T.S.
Date:	June 18, 2014
Drawn By:	TAS
Checked By:	RAR
Approved By:	RPG

Figure 2c

BORING LOCATION PLAN

North Burleson Street
from West Center Street to Market Place Avenue
Kyle, Texas

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GEOPROFESSIONALS
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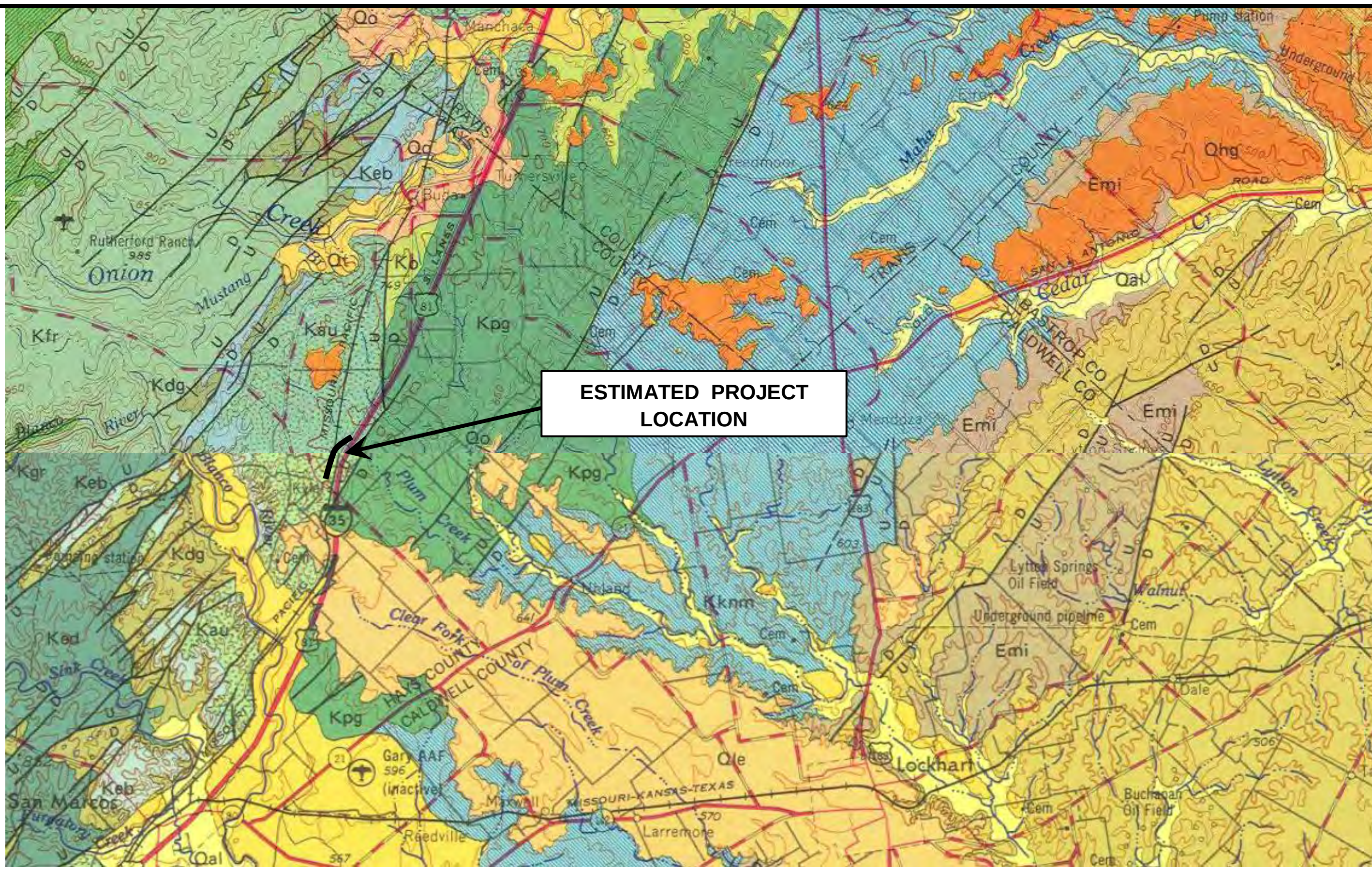
Phone: (512) 428-5550 • Fax: (512) 428-5525

Job No.:	2013-756
Scale:	N.T.S.
Date:	June 18, 2014
Drawn By:	TAS
Checked By:	RAR
Approved By:	RPG

Figure 2d



PORTION OF GEOLOGIC ATLAS OF TEXAS
(Austin and Seguin Sheet)

N

LEGEND

Symbol	Name	Age
Qal	Alluvium	Quaternary Period / Recent
Qt/Qo/Qhg	Fluviatile Terrace Deposits	Quaternary Period / Pleistocene
Emi	Midway Group	Quaternary Period / Eocene
Kknm	Navarro Formation	Upper Cretaceous Period
Kpg	Pecan Gap Chalk	Upper Cretaceous Period
Kau	Austin Chalk	Upper Cretaceous Period
Keb	Eagle Ford and Buda Limestone	Upper Cretaceous Period
Kdg	Del Rio Clay and Georgetown	Lower Cretaceous Period
Kfr	Fredericksburg Group	Lower Cretaceous Period
Kgr(u)	Glen Rose Formation (Upper)	Lower Cretaceous Period

U / D — Fault Segment with Indication of Relative Movement

ARIAS GEOPROFESSIONALS

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GEOLOGIC MAP

North Burleson Street
from West Center Street to Market Place Avenue
Kyle, Texas

Date: August 21, 2014	Job No.: 2013-756
Drawn By: PPL	Checked By: RAR
Approved By: RPG	Scale: N.T.S.

Figure 3

Photo 1 – Boring B-1 near W. Center Street, facing north.

Photo 2 – Boring B-2, facing south.

ARIAS GEOPROFESSIONALS

13581 Pond Springs Road, Suite 210, Austin, Texas 78729
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SITE PHOTOS

North Burleson Street Improvements
W. Center to Market Place Ave
Kyle, Texas

Date: August 23, 2014	Job No.: 2013-756
Drawn By: RAR	Checked By: RAR
Approved By: JSL	Scale: N.T.S.

Figure 4

Photo 3 – Boring B-7, facing northeast, note sanitary sewer manhole (utility). Person in photo is utility locator.

Photo 4 – Drilling of B-9, facing north.

ARIAS GEOPROFESSIONALS
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Phone: (512) 428-5550 • Fax: (512) 428-5525

SITE PHOTOS

North Burleson Street Improvements
W. Center to Market Place Ave
Kyle, Texas

Date: August 23, 2014	Job No.: 2013-756
Drawn By: RAR	Checked By: RAR
Approved By: RPG	Scale: N.T.S.

Figure 4

APPENDIX B: SOIL BORING LOGS AND KEY TO TERMS

Arias & Associates, Inc.
13581 Pond Springs Rd, S210
Austin, TX 78729
Phone: 512.428.5550
Fax: 512.428.5525

SUBSURFACE DIAGRAM

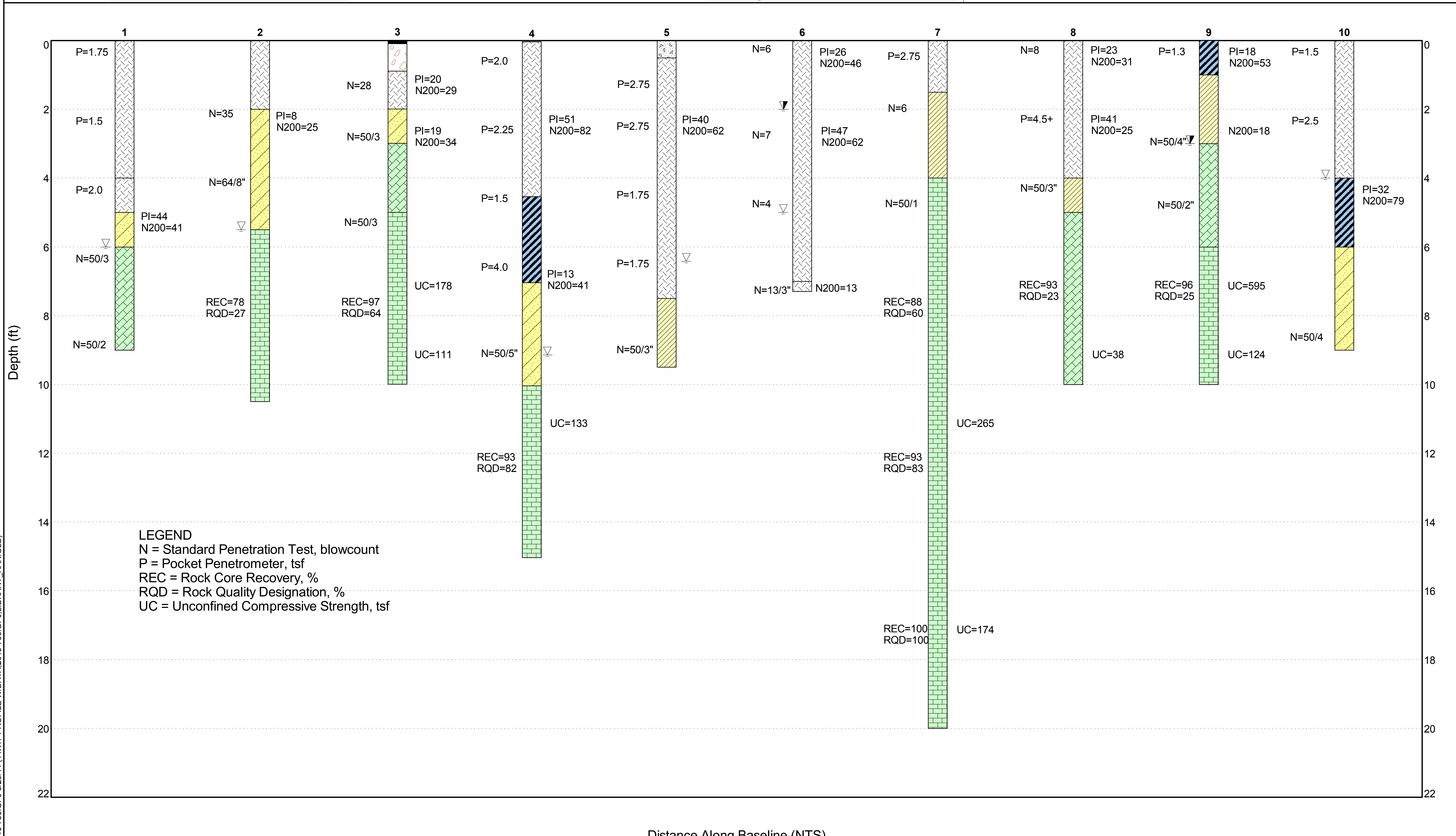
CLIENT Freese & Nichols, Inc.

PROJECT NUMBER 2013-756

PROJECT NAME North Burleson Street

PROJECT LOCATION See Boring Location Plan

Fill Material | USCS Clayey Sand | Weathered Limestone
Limestone | Asphalt | Base Material
USCS Low Plasticity Clay | USCS High Plasticity Clay | Concrete



2013-756.GPJ 8/20/14 (11X17 PROFILE W/DATA,2013-756.GPJ,LIBRARY_RAR.GLB)

Boring Log No. B-1

Project: **North Burleson Street**
From W. Center to Market Place Avenue
Kyle, Texas

Location: See Boring Location Plan

Sampling Date: 6/2/14

Coordinates: N29°59'20.87" W97°52'38.35"

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
[FILL] FAT CLAY (CH) with sand and gravel, stiff, dark brown with reddish tan, moist with limestone fragments		T					1.75		
		T					1.5		
[FILL] CLAYEY GRAVEL with Sand (GC), dark gray with tan, moist with limestone fragment and coarse sand	5	T	17	21	65	44	2.0		41
[CWLS] CLAYEY SAND (SC), very dense, tan and light gray, moist		SS						50/3"	
[AUSTIN] Weathered CHALK, tan and light gray		SS						50/2"	

Borehole terminated at 9 feet

Groundwater Data:
First encountered during drilling: 6-ft depth

Field Drilling Data:
Coordinates: Hand-held GPS Unit
Logged By: R. Russo
Driller: Austin Geo-Logic
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 9 ft

Nomenclature Used on Boring Log

Thin-walled tube (T) — Split Spoon (SS) — ▽ Water encountered during drilling

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
-200 = % Passing #200 Sieve

2013-756.GPJ 8/26/14 (BORING LOG SA12-02,ARIASSA12-01.GDT,LIBRARY_RAR.GLB)

Boring Log No. B-2

Project: **North Burleson Street**
From W. Center to Market Place Avenue
Kyle, Texas

Location: See Boring Location Plan

Sampling Date: 6/2/14

Coordinates: N29°59'26.94" W97°52'36.66"

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200	REC	RQD
[FILL] SILTY SAND (SM), brown, dry with gravel.		T								
[CWLS] CLAYEY SAND (SC), dense to very dense, tan, with limestone fragments.		SS	16	21	29	8	35	25		
	5	SS					64/8"			
[AUSTIN] LIMESTONE, tan and light gray, moderately hard with clay partings, weathered layers and discontinuities.		RC							78	27
	10									

Borehole terminated at 10.5 feet

Groundwater Data:
First encountered during drilling: 5.5-ft depth

Field Drilling Data:
Coordinates: Hand-held GPS Unit
Logged By: R. Russo
Driller: Austin Geo-Logic
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 5.5 ft
Rock core: 5.5 - 10.5 ft

Nomenclature Used on Boring Log

Thin-walled tube (T)
Split Spoon (SS)
Water encountered during drilling
Rock Core (RC)

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
N = SPT Blow Count

-200 = % Passing #200 Sieve
RQD = Rock Quality Designation
REC = % Recovery

2013-756.GPJ 8/26/14 (BORING LOG SA12-02,ARIASSA12-01.GDT,LIBRARY_RAR.GLB)

Boring Log No. B-3

Project: **North Burleson Street**
From W. Center to Market Place Avenue
Kyle, Texas

Location: See Boring Location Plan

Sampling Date: 5/29/14

Coordinates: N29°59'34.28" W97°52'34.73"

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200	DD	Uc	REC	RQD
1" Asphalt over 8" BASE		GB										
[FILL] CLAYEY GRAVEL with Sand (GC), medium dense, dark brown and tan		SS	7	17	37	20	28	29				
[CWLS] CLAYEY SAND with Gravel (SC), very dense, light tan and gray		SS	11	18	37	19	50/3"	34				
Weathered LIMESTONE, light tan and gray	5	SS	6				50/3"					
[AUSTIN] LIMESTONE, tan, moderately hard with clay partings, weathered layers and discontinuities. *-light gray from 7 to 8 ft*	10	RC							147 (UW) 143 (UW)	178 111	97	64

Borehole terminated at 10 feet

Groundwater Data:
During drilling: Not encountered

Field Drilling Data:
Coordinates: Hand-held GPS Unit
Logged By: W. Persyn
Driller: Austin Geo-Logic
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 5 ft
Rock core: 5 - 10 ft

Nomenclature Used on Boring Log

Grab Sample (GB) Split Spoon (SS)
Rock Core (RC)

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
N = SPT Blow Count
-200 = % Passing #200 Sieve
DD = Dry Density (pcf)
Uc = Compressive Strength (tsf)
RQD = Rock Quality Designation
REC = % Recovery
UW = Unit Weight (pcf)

2013-756.GPJ 8/26/14 (BORING LOG SA12-02,ARIASSA12-01.GDT,LIBRARY_RAR.GLB)

Boring Log No. B-4

Project: **North Burleson Street From W. Center to Market Place Avenue Kyle, Texas**	Sampling Date: 6/2/14
	Coordinates: N29°59'40.05" W97°52'34.45"
Location: See Boring Location Plan	Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	DD	Uc	REC	RQD
[FILL] FAT CLAY (CH) with sand, stiff, dark brown, moist with organics, scattered coarse sand and gravel.		T					2.0						
		T	31	22	73	51	2.25		82				
SANDY FAT CLAY (CH), stiff, gray to light gray, moist with ferrous staining	5	T					1.5						
		T	11	13	26	13	4.0		41				
[CWLS] CLAYEY SAND with Gravel (SC), medium dense to very dense, tan, with limestone fragments ▽		SS						50/5"					
[AUSTIN] LIMESTONE, tan, moderately hard with clay partings, weathered layers and discontinuities.	10		8							147 (UW)	133		
		RC										93	82
	15												

Borehole terminated at 15 feet

Groundwater Data:
First encountered during drilling: 8.5-ft depth

Field Drilling Data:
Coordinates: Hand-held GPS Unit
Logged By: R. Russo
Driller: Austin Geo-Logic
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 10 ft
Rock core: 10 - 15 ft

Nomenclature Used on Boring Log

Thin-walled tube (T) — Split Spoon (SS) — ▽ Water encountered during drilling

Rock Core (RC)

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)

N = SPT Blow Count
-200 = % Passing #200 Sieve
DD = Dry Density (pcf)
Uc = Compressive Strength (tsf)
RQD = Rock Quality Designation

REC = % Recovery
UW = Unit Weight (pcf)

2013-756.GPJ 8/26/14 (BORING LOG SA12-02,ARIASSA12-01.GDT,LIBRARY_RAR.GLB)

Boring Log No. B-5

Project:	**North Burleson Street** **From W. Center to Market Place Avenue** **Kyle, Texas**	Sampling Date:	6/2/14
		Coordinates:	N29°59'53.1" W97°52'31.79"
Location:	See Boring Location Plan	Backfill:	Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
4" Conc. sidewalk									
[FILL] FAT CLAY (CH) with sand and gravel, stiff to very stiff, dark brown with tan and gray, with sand and gravel layers.		T					2.75		
		T	30	18	59	41	2.75		62
- increased gravel from 4.5 to 5 feet	5	T					1.75		
		T					1.75		
- abundant gravel at 7 to 8 feet									
[CWLS] SANDY LEAN CLAY (CL), stiff, tan, wet		SS						50/3"	

Borehole terminated at 9.5 feet

Groundwater Data:
First encountered during drilling: 6.5-ft depth

Field Drilling Data:
Coordinates: Hand-held GPS Unit
Logged By: R. Russo
Driller: Austin Geo-Logic
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 9.5 ft

Nomenclature Used on Boring Log

Thin-walled tube (T) | Split Spoon (SS) | Water encountered during drilling

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)

N = SPT Blow Count
-200 = % Passing #200 Sieve

Boring Log No. B-6

Project: **North Burleson Street**
From W. Center to Market Place Avenue
Kyle, Texas

Location: See Boring Location Plan

Sampling Date: 5/29/14

Coordinates: N29°59'57.77" W97°52'27.99"

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200
[FILL] GRAVELLY FAT CLAY (CH), firm, brown and tan, wet intermixed with clayey sand and gravel		SS	16 24	22	48	26	6	45
		SS	26	19	66	47	7	62
	5	SS					4	
		GB	38					
[FILL] CONCRETE, tan, possible flowable fill		SS	22				13/3"	13

Borehole terminated at 7.3 feet

Groundwater Data:
First encountered during drilling: 5-ft depth
After 30 minutes: 2-ft depth
Field Drilling Data:
Coordinates: Hand-held GPS Unit
Logged By: W. Persyn
Driller: Austin Geo-Logic
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 7.3 ft

Nomenclature Used on Boring Log

Split Spoon (SS) | Grab Sample (GB) | ▽ Water encountered during drilling | ▼ Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
N = SPT Blow Count

-200 = % Passing #200 Sieve

2013-756.GPJ 8/26/14 (BORING LOG SA12-02,ARIASSA12-01.GDT,LIBRARY_RAR.GLB)

Boring Log No. B-7

Project: **North Burleson Street**
From W. Center to Market Place Avenue
Kyle, Texas

Location: See Boring Location Plan

Sampling Date: 6/2/14

Coordinates: N30°0'0.49" W97°52'22.31"

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PP	N	DD	Uc	REC	RQD
[FILL] CLAYEY SAND (SC), brown to reddish tan, moist with gravel.		T		2.75					
SANDY LEAN CLAY (CL), firm, tan to reddish tan, wet with limestone fragments.		SS			6				
[AUSTIN] CHALK, tan to light gray, moderately hard with clay partings, weathered layers and discontinuities.	5	SS			50/1"				
		RC	7					88	60
	10	RC	6			146 (UW)	265	93	83
	15	RC	7			150 (UW)	174	100	100
	20								

Borehole terminated at 20 feet

Groundwater Data:
During drilling: Not encountered

Field Drilling Data:
Coordinates: Hand-held GPS Unit
Logged By: R. Russo
Driller: Austin Geo-Logic
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 5 ft
Rock core: 5 - 20 ft

Nomenclature Used on Boring Log

Thin-walled tube (T)
Split Spoon (SS)
Rock Core (RC)

WC = Water Content (%)
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
DD = Dry Density (pcf)
Uc = Compressive Strength (tsf)
RQD = Rock Quality Designation
REC = % Recovery
UW = Unit Weight (pcf)

2013-756.GPJ 8/26/14 (BORING LOG SA12-02,ARIASSA12-01.GDT,LIBRARY_RAR.GLB)

Arias & Associates, Inc.

Job No.: 2013-756

Boring Log No. B-8

Project: **North Burleson Street**
From W. Center to Market Place Avenue
Kyle, Texas

Location: See Boring Location Plan

Sampling Date: 6/5/14

Coordinates: N30°0'3.42" W97°52'15.2"

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	DD	Uc	REC	RQD
[FILL] CLAYEY GRAVEL (GC), loose to medium dense, dark brown and tan, with sand and subrounded gravel		SS	14	25	48	23		8	30				
		T	17	26	67	41	4.5+		24				
[CWLS] SANDY LEAN CLAY (CL), hard, tan	5	SS						50/3"					
[AUSTIN] Weathered LIMESTONE, tan to gray, soft to moderately hard, with marl layers, and alternating tan and gray layers.		RC										93	23
	10		13							139 (UW)	38		

Borehole terminated at 10 feet

Groundwater Data:
During drilling: Not encountered

Field Drilling Data:
Coordinates: Hand-held GPS Unit
Logged By: R. Russo
Driller: Austin Geo-Logic
Equipment: Truck-mounted drill rig

Hand Auger: 0 - 1 ft

Nomenclature Used on Boring Log

Split Spoon (SS) — Thin-walled tube (T) — Rock Core (RC)

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
-200 = % Passing #200 Sieve
DD = Dry Density (pcf)
Uc = Compressive Strength (tsf)
RQD = Rock Quality Designation
REC = % Recovery
UW = Unit Weight (pcf)

Boring Log No. B-9

Project: **North Burleson Street**
From W. Center to Market Place Avenue
Kyle, Texas

Location: See Boring Location Plan

Sampling Date: 5/29/14

Coordinates: N30°0'0.05" W97°52'9.27"

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	DD	Uc	REC	RQD
FAT CLAY (CH), stiff, dark brown		T	27	21	40	19	1.3		53				
SANDY LEAN CLAY (CL), hard, tan		SS	11					50/4"	18				
Weathered LIMESTONE, light tan and light gray, with clay seams and layers	5	SS	16					50/2"					
[AUSTIN] LIMESTONE, tan, moderately hard with clay partings, weathered layers and discontinuities.	10	RC								153 (UW) 145 (UW)	595 124	96	25

Borehole terminated at 10 feet

Groundwater Data:
First encountered during drilling: 3-ft depth
After 30 minutes: 3-ft depth
Field Drilling Data:
Coordinates: Hand-held GPS Unit
Logged By: W. Persyn
Driller: Austin Geo-Logic
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 5 ft
Rock core: 5 - 10 ft

Nomenclature Used on Boring Log

Thin-walled tube (T)
Split Spoon (SS)
Rock Core (RC)
▽ Water encountered during drilling
▼ Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
-200 = % Passing #200 Sieve
DD = Dry Density (pcf)
Uc = Compressive Strength (tsf)
RQD = Rock Quality Designation
REC = % Recovery
UW = Unit Weight (pcf)

2013-756.GPJ 8/26/14 (BORING LOG SA12-02,ARIASSA12-01.GDT,LIBRARY_RAR.GLB)

Arias & Associates, Inc.

Job No.: 2013-756

Boring Log No. B-10

Project: **North Burleson Street**
From W. Center to Market Place Avenue
Kyle, Texas

Location: See Boring Location Plan

Sampling Date: 6/2/14

Coordinates: N30°0'11.48" W97°52'4.08"

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
[FILL] FAT CLAY (CH), stiff, dark brown, moist with coarse sand and small angular gravel.		T					1.5		
		T					2.5		
FAT CLAY (CH) with sand, stiff, light gray to tan, moist with coarse sand and small angular gravel.	5	T	18	17	50	33			79
CLAYEY SAND (SC), tan to light gray, wet		T							
		SS						50/4"	

Borehole terminated at 9 feet

Groundwater Data:
First encountered during drilling: 4-ft depth

Field Drilling Data:
Coordinates: Hand-held GPS Unit
Logged By: R. Russo
Driller: Austin Geo-Logic
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 9 ft

Nomenclature Used on Boring Log

Thin-walled tube (T) — Split Spoon (SS) — ▽ Water encountered during drilling

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
-200 = % Passing #200 Sieve

2013-756.GPJ 8/26/14 (BORING LOG SA12-02,ARIASSA12-01.GDT,LIBRARY_RAR.GLB)

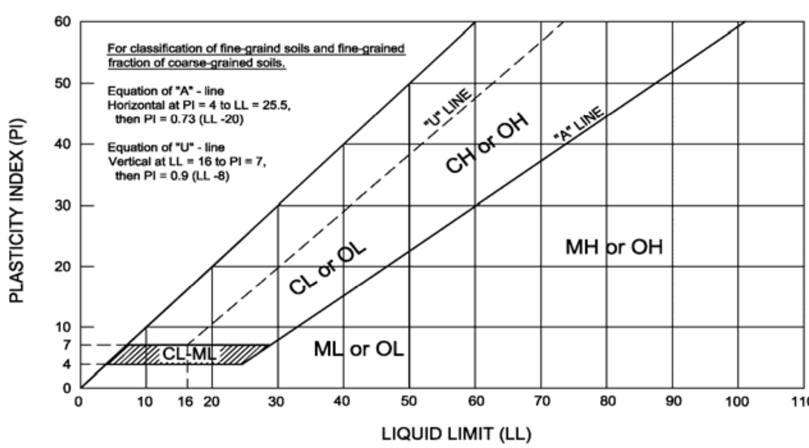
KEY TO TERMS AND SYMBOLS USED ON BORING LOGS

MAJOR DIVISIONS					GROUP SYMBOLS	DESCRIPTIONS
COARSE-GRAIND SOILS	More than half of material LARGER than No. 200 Sieve size	GRAVELS	More than Half of Coarse fraction is LARGER than No. 4 Sieve size	Clean Gravels (little or no Fines)	GW	Well-Graded Gravels, Gravel-Sand Mixtures, Little or no Fines
					GP	Poorly-Graded Gravels, Gravel-Sand Mixtures, Little or no Fines
				Gravels with Fines (Appreciable amount of Fines)	GM	Silty Gravels, Gravel-Sand-Silt Mixtures
					GC	Clayey Gravels, Gravel-Sand-Clay Mixtures
		SANDS	More than half of Coarse fraction is SMALLER than No. 4 Sieve size	Clean Sands (little or no Fines)	SW	Well-Graded Sands, Gravelly Sands, Little or no Fines
					SP	Poorly-Graded Sands, Gravelly Sands, Little or no Fines
				Sands with Fines (Appreciable amount of Fines)	SM	Silty Sands, Sand-Silt Mixtures
					SC	Clayey Sands, Sand-Clay Mixtures
GINE-GRAIND SOILS	More than half of material SMALLER than No. 200 Sieve size	SILTS & CLAYS		Liquid Limit less than 50	ML	Inorganic Silts & Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts with Slight Plasticity
					CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
		SILTS & CLAYS		Liquid Limit greater than 50	MH	Inorganic Silts, Micaceous or Diatomaceous Fine Sand or Silty Soils, Elastic Silts
					CH	Inorganic Clays of High Plasticity, Fat Clays
FORMATIONAL MATERIALS		SANDSTONE				Massive Sandstones, Sandstones with Gravel Clasts
		MARLSTONE				Indurated Argillaceous Limestones
		LIMESTONE				Massive or Weakly Bedded Limestones
		CLAYSTONE				Mudstone or Massive Claystones
		CHALK				Massive or Poorly Bedded Chalk Deposits
		MARINE CLAYS				Cretaceous Clay Deposits
		GROUNDWATER			▼	Indicates Final Observed Groundwater Level
					▽	Indicates Initial Observed Groundwater Location

Density of Granular Soils	
Number of Blows per ft., N	Relative Density
0 - 4	Very Loose
4 - 10	Loose
10 - 30	Medium
30 - 50	Dense
Over 50	Very Dense

Consistency and Strength of Cohesive Soils		
Number of Blows per ft., N	Consistency	Unconfined Compressive Strength, q_u (tsf)
Below 2	Very Soft	Less than 0.25
2 - 4	Soft	0.25 - 0.5
4 - 8	Medium (Firm)	0.5 - 1.0
8 - 15	Stiff	1.0 - 2.0
15 - 30	Very Stiff	2.0 - 4.0
Over 30	Hard	Over 4.0

PLASTICITY CHART (ASTM D 2487-11)



KEY TO TERMS AND SYMBOLS USED ON BORING LOGS

TABLE 1 Soil Classification Chart (ASTM D 2487-11)

Criteria of Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification	
				Group Symbol	Group Name[B]
COARSE-GRAIND 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 ≥ 4 and 1 ≤ Cc ≤ 3[D]	GW	Well-Graded Gravel[E]
			Cu < 4 and/or [Cc < or Cc > 3][D]	GP	Poorly-Graded Gravel[E]
		Gravels with Fines (More than 12% fines[C])	Fines classify as ML or MH	GM	Silty Gravel[E,F,G]
			Fines classify as CL or CH	GC	Clayey Gravel[E,F,G]
	Sands (50% or more of coarse fraction passes No. 4 sieve)	Clean Sands (Less than 5% fines[H])	Cu ≥ 6 and 1 ≤ Cc ≤ 3[D]	SW	Well-Graded Sand[I]
			Cu < 6 and/or [Cc < or Cc > 3][D]	SP	Poorly-Graded Sand[I]
		Sands with Fines (More than 12% fines[H])	Fines classify as ML or MH	SM	Silty Sand[F,G,I]
			Fines classify as CL or CH	SC	Clayey Sand[F,G,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/Liquid & #10 < 0.75	OL	Organic Clay[K,L,M,N]
					Organi 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 on or above "A" line	MH	Elastic Silt[K,L,M]
		organic	Liquid limit - oven dried/Liquid & #10 < 0.75	OH	Organic Clay[K,L,M,P]
					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 (75mm) sieve
[B] If field sample contained cobbles or boulders, or both, add "with bcobble sor 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] $Cu = D_{60}/D_{10}$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[E] If soil contains ≥ 15% sand, add "with sand" to group name
[F] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM
[G] If fines are organic, add "with organic fines" to group name
[H] Sand 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

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name
[J] If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay
[K] If soil contains 15% to < 30% 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

TERMINOLOGY

Boulders	Over 12-inches (300mm)
Cobbles	12-inches to 3-inches (300mm to 75mm)
Gravel	3-inches to No. 4 sieve (75mm to 4.75mm)
Sand	No. 4 sieve to No. 200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing No. 200 sieve (0.075mm)
Calcareous	Containing appreciable quantities of calcium carbonate, generally nodular

Parting	Inclusion < 1/8-inch thick extending through samples
Seam	Inclusion 1/8-inch to 3-inches thick extending through sample
Layer	Inclusion > 3-inches thick extending through sample

Stratified	Alternating layers of varying material or color with layers at least 6mm thick
Laminated	Alternating layers of varying material or color with the layers less than 6mm thick
Fissured	Breaks along definite planes of fracture with little resistance to fracturing
Slickensided	Fracture planes appear polished or glossy sometimes striated
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay
Homogeneous	Same color and appearance throughout

KEY TO TERMS AND SYMBOLS USED ON BORING LOGS

Hardness Classification of Intact Rock

Class	Hardness	Field Test	Approximate Range of Uniaxial Compression Strength kg/cm^2 ($tons/ft^2$)
I	Extremely hard	Many blows with geologic hammer required to break intact specimen.	> 2,000
II	Very hard	Hand held specimen breaks with hammer end of pick under more than one blow.	2,000 – 1,000
III	Hard	Cannot be scraped or pealed with knife, hand held specimen can be broken with single moderate blow with pick.	1,000 – 500
IV	Soft	Can just be scraped or peeled with knife. Indentations 1mm to 3mm show in specimen with moderate blow with pick.	500 – 250
V	Very soft	Material crumbles under moderate blow with sharp end of pick and can be peeled with a knife, but is too hard to hand-trim for triaxial test specimen.	250 – 10

Rock Weathering Classifications

Grade	Symbol	Diagnostic Features
Fresh	F	No visible sign of Decomposition or discoloration. Rings under hammer impact.
Slightly Weathered	WS	Slight discoloration inwards from open fractures, otherwise similar to F.
Moderately Weathered	WM	Discoloration throughout. Weaker minerals such as feldspar decomposed. Strength somewhat less than fresh rock, but cores cannot be broken by hand or scraped by knife. Texture preserved.
Highly Weathered	WH	Most minerals somewhat decomposed. Specimens can be broken by hand with effort or shaved with knife. Core stones present in rock mass. Texture becoming indistinct, but fabric preserved.
Completely Weathered	WC	Minerals decomposed to soil, but fabric and structure preserved (Saprolite). Specimens easily crumbled or penetrated.
Residual Soil	RS	Advanced state of decomposition resulting in plastic soils. Rock fabric and structure completely destroyed. Large volume change.

Rock Discontinuity Spacing

Description for Structural Features: Bedding, Foliation, or Flow Banding	Spacing	Description for Joints, Faults or Other Fractures
Very thickly (bedded, foliated, or banded)	More than 6 feet	Very widely (fractured or jointed)
Thickly	2 – 6 feet	Widely
Medium	8 – 24 inches	Medium
Thinly	2½ – 8 inches	Closely
Very thinly	¾ – 2½ inches	Very closely
Description for Micro-Structural Features: Lamination, Foliation, or Cleavage	**Spacing**	**Descriptions for Joints, Faults, or Other Fractures**
Intensely (laminated, foliated, or cleaved)	¼ – ¾ inch	Extremely close
Very intensely	Less than ¼ inch	

Engineering Classification for in Situ Rock Quality

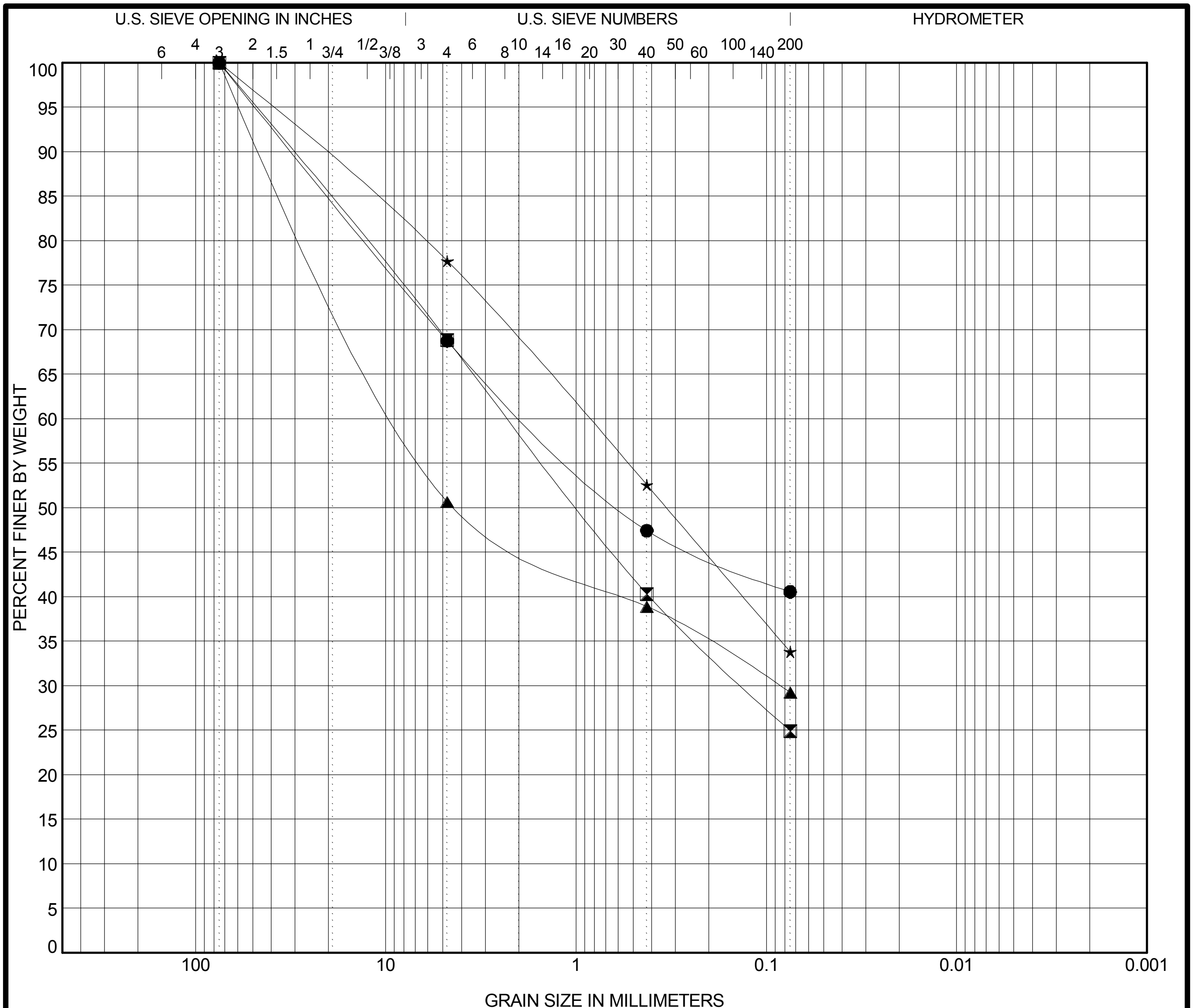
RQD %	Velocity Index	Rock Mass Quality
90 – 100	0.80 – 1.00	Excellent
75 – 90	0.60 – 0.80	Good
50 – 75	0.40 – 0.60	Fair
25 – 50	0.20 – 0.40	Poor
0 – 25	0 – 0.20	Very Poor

FIELD EXPLORATORY PROCEDURES

The field exploration program included drilling at selected locations within the site and intermittently sampling the encountered materials. The boreholes were drilled using either single flight auger (ASTM D 1452) or hollow-stem auger (ASTM D 6151). Samples of encountered materials were obtained using a split-barrel sampler while performing the Standard Penetration Test (ASTM D 1586), or by taking material from the auger as it was advanced (ASTM D 1452). The sample depth interval and type of sampler used is included on the soil boring log. Arias' field representative visually logged each recovered sample and placed a portion of the recovered sampled into a plastic bag for transport to our laboratory.

SPT N values and blow counts for those intervals where the sampler could not be advanced for the required 18-inch penetration are shown on the soil boring log. If the test was terminated during the 6-inch seating interval or after 10 hammer blows were applied used and no advancement of the sampler was noted, the log denotes this condition as blow count during seating penetration. Penetrometer readings recorded for thin-walled tube samples that remained intact also are shown on the soil boring log.

APPENDIX C: LABORATORY TESTING



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring	Elev	Depth	Classification	LL	PL	PI	Cc	Cu
●	**1**		**4.0**	**CLAYEY GRAVEL with SAND (GC)**	**65**	**21**	**44**		
⧗	**2**		**2.0**	**CLAYEY SAND with GRAVEL (SC)**	**29**	**21**	**8**		
▲	**3**		**1.0**	**CLAYEY GRAVEL with SAND (GC)**	**37**	**17**	**20**		
★	**3**		**2.5**	**CLAYEY SAND with GRAVEL (SC)**	**37**	**18**	**19**		

	Boring	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**1**	**4.0**	**75**	**1.763**			**31.2**	**28.2**	**40.6**	
⧗	**2**	**2.0**	**75**	**2.245**	**0.133**		**31.1**	**43.9**	**24.9**	
▲	**3**	**1.0**	**75**	**8.007**	**0.086**		**49.3**	**21.4**	**29.3**	
★	**3**	**2.5**	**75**	**0.866**			**22.3**	**43.9**	**33.8**	

Silt and clay fractions were determined using 0.002 mm as the maximum particle size for clay.

Arias & Associates, Inc.
13581 Pond Springs Rd, S210
Austin, TX 78729
Phone: 512.428.5550
Fax: 512.428.5525

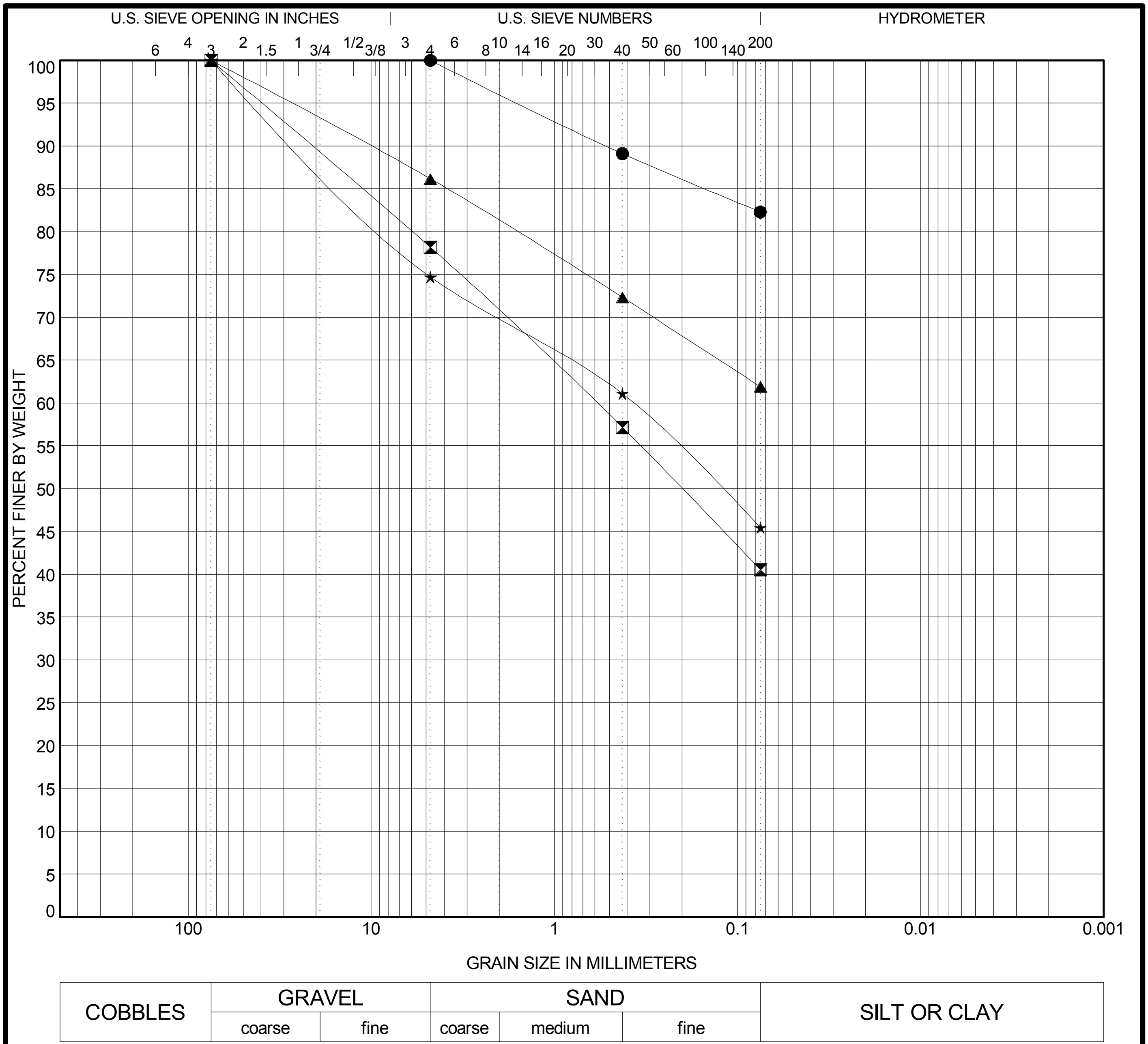
GRAIN SIZE DISTRIBUTION

Project: North Burleson Street

Location: See Boring Location Plan

Job No.: 2013-756

2013-756.GPJ 8/23/14 (GRAIN SIZE ARIAS.US LAB.GDT LIBRARY_RAR.GLB)



	Boring	Elev	Depth	Classification	LL	PL	PI	Cc	Cu
●	4		2.0	**FAT CLAY with SAND (CH)**	73	22	51		
⧗	4		6.0	**CLAYEY SAND with GRAVEL (SC)**	26	13	13		
▲	5		2.0	**SANDY FAT CLAY (CH)**	59	18	41		
★	6		0.0	**CLAYEY SAND with GRAVEL (SC)**	48	22	26		

	Boring	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	4	2.0	4.75				0.0	17.7	82.3	
⧗	4	6.0	75	0.588			21.8	37.6	40.5	
▲	5	2.0	75				13.8	24.3	61.9	
★	6	0.0	75	0.376			25.3	29.2	45.5	

Silt and clay fractions were determined using 0.002 mm as the maximum particle size for clay.

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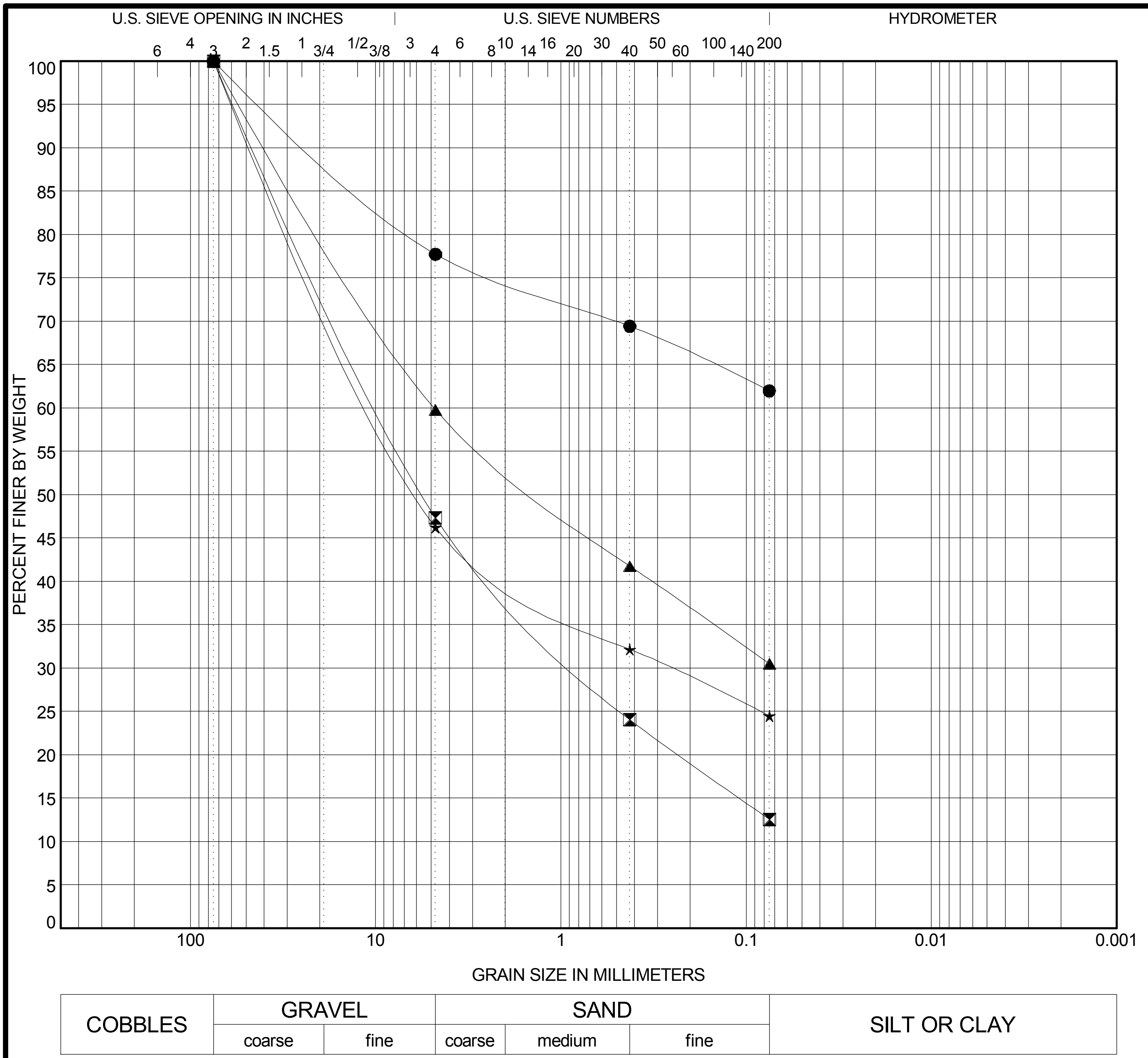
GRAIN SIZE DISTRIBUTION

Project: North Burleson Street

Location: See Boring Location Plan

Job No.: 2013-756

2013-756.GPJ 8/23/14 (GRAIN SIZE ARIAS.US_LAB.GDT.LIBRARY_RAR.GLB)



	Boring	Elev	Depth	Classification	LL	PL	PI	Cc	Cu
●	6		2.5	**GRAVELLY FAT CLAY with SAND (CH)**	**66**	**19**	**47**		
⧗	6		7.0						
▲	8		0.0	**CLAYEY GRAVEL with SAND (GC)**	**48**	**25**	**23**		
★	8		2.0	**CLAYEY GRAVEL with SAND (GC)**	**67**	**26**	**41**		

	Boring	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	6	2.5	75				22.3	15.7	62.0	
⧗	6	7.0	75	9.214	0.788		52.6	34.8	12.6	
▲	8	0.0	75	4.813			40.2	29.3	30.5	
★	8	2.0	75	9.621	0.261		53.7	21.8	24.5	

Silt and clay fractions were determined using 0.002 mm as the maximum particle size for clay.

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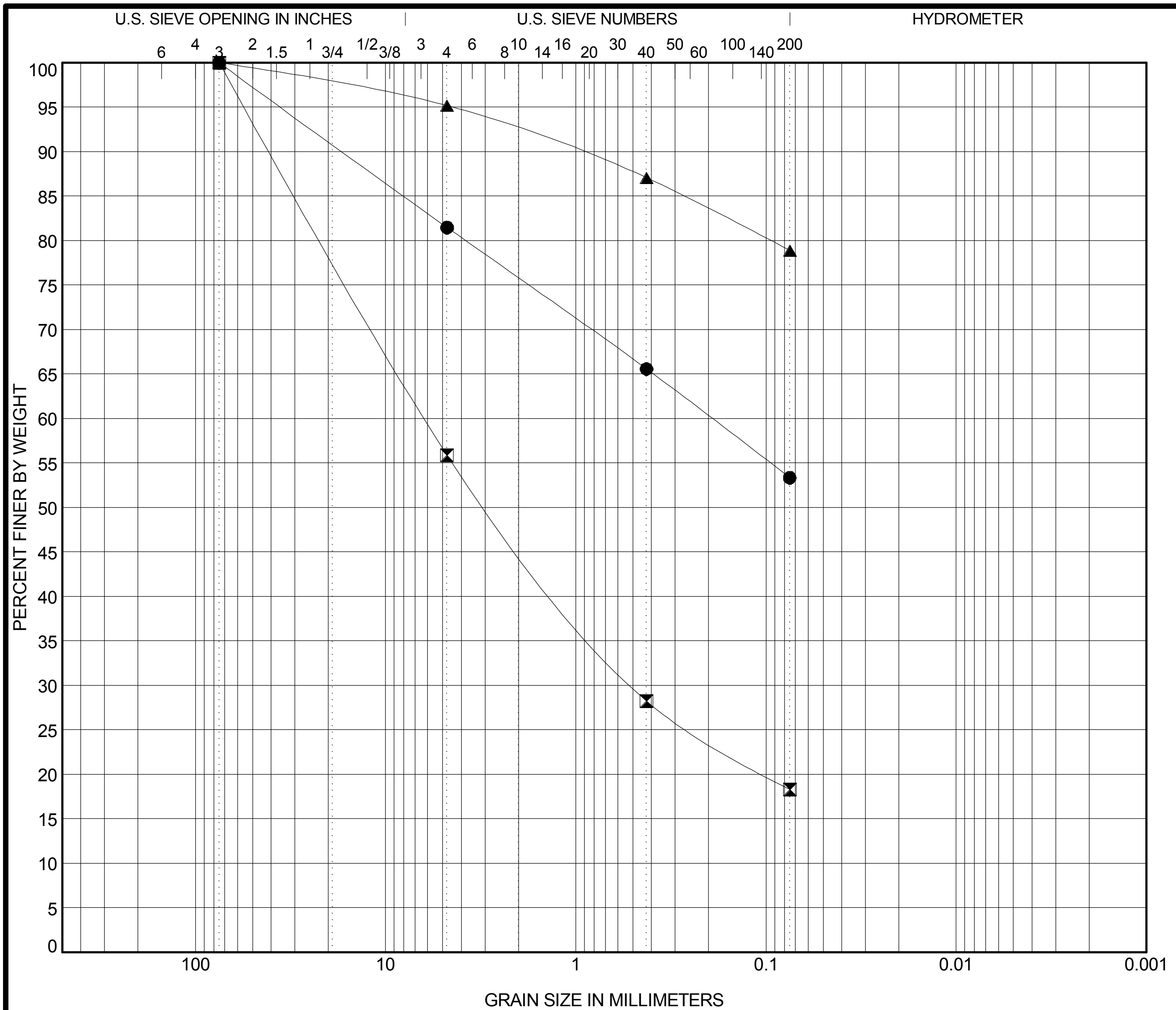
GRAIN SIZE DISTRIBUTION

Project: North Burleson Street

Location: See Boring Location Plan

Job No.: 2013-756



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring	Elev	Depth	Classification	LL	PL	PI	Cc	Cu
●	**9**		**0.0**	**SANDY LEAN CLAY with GRAVEL (CL)**	**40**	**21**	**19**		
⧗	**9**		**2.5**						
▲	**10**		**4.0**	**FAT CLAY with SAND (CH)**	**50**	**17**	**33**		

	Boring	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**9**	**0.0**	**75**	**0.193**			**18.5**	**28.1**	**53.3**	
⧗	**9**	**2.5**	**75**	**6.14**	**0.496**		**44.1**	**37.6**	**18.3**	
▲	**10**	**4.0**	**75**				**4.8**	**16.3**	**78.9**	

Silt and clay fractions were determined using 0.002 mm as the maximum particle size for clay.

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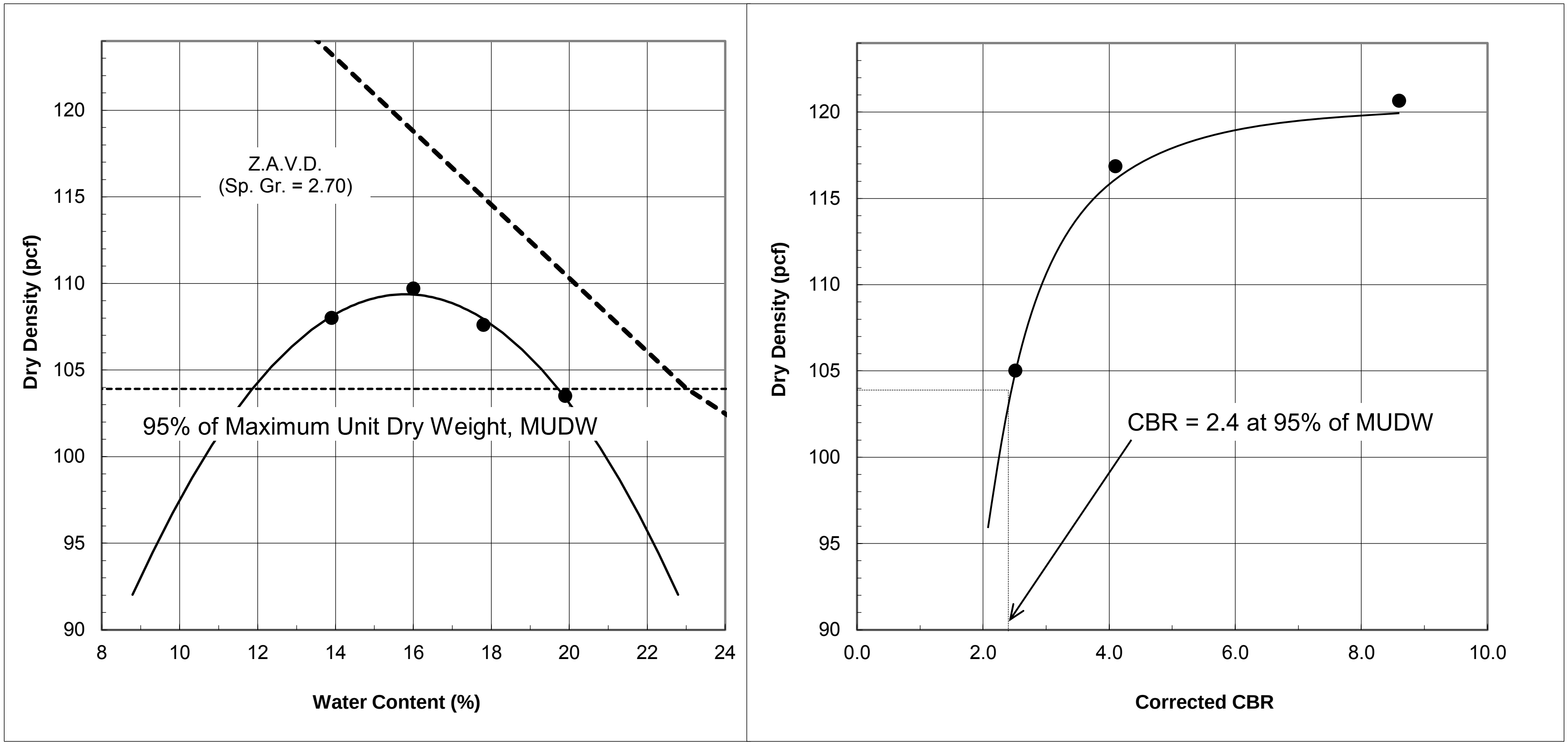
GRAIN SIZE DISTRIBUTION

Project: North Burleson Street

Location: See Boring Location Plan

Job No.: 2013-756

Arias & Associates, Inc.



Sample:	1	**Optimum Water Content:**	15.8 %		**% SWELL**
Test Method:	ASTM D698, Method C	**Maximum Unit Dry Weight:**	109.4 pcf	**72 blows:**	1.4
Material:	Dark Brown Clayey Sand with Gravel (SC)	**Liquid Limit:**	33	**56 blows:**	1.7
		Plasticity Index:	16	**25 blows:**	1.7
		% Passing #200 Sieve:	33		

MOISTURE-DENSITY AND CBR TEST RESULTS
N. BURLESON ROAD IMPROVEMENTS
KYLE, TEXAS

Arias Project No. 2013-756

LABORATORY TESTING PROCEDURES

Arias performed soil mechanics laboratory tests on selected samples to aid in soil classification and to determine engineering properties. Tests commonly used in geotechnical exploration, the method used to perform the test, and the column designation on the boring log where data are reported are summarized as follows:

Test Name	Test Method	Log Designation
Water (moisture) content of soil and rock by mass	ASTM D 2216	WC
Liquid limit, plastic limit, and plasticity index of soils	ASTM D 4318	PL, LL, PI
Amount of material in soils finer than the No. 200 sieve	ASTM D 1140	-200

The laboratory results are reported on the soil boring logs.

One Proctor compaction test (ASTM D698) was performed on a bulk sample obtained from boring B-6 for the purpose of running a CBR. The test is performed by placing loose soil into a standardized compaction mold in lifts and using a hammer of specified size and energy to compact the soil. The sample is weighed and dried, and the dry density is then calculated. This process is repeated for a range of soil moisture contents to develop a density versus moisture content relationship. From this relationship, the theoretical maximum dry density can be determined which occurs at a specific moisture content referred to as the optimum moisture content.

Once the moisture density relationship is determined, a sample is remolded to a density near 95% of the maximum theoretical dry density, and near optimum moisture. The CBR test (ASTM D1883) is conducted by driving a 3-square inch piston into the remolded sample at a specified rate, and recording the load required to drive the piston into the remolded sample. This “punching shear” test provides data that is a semi-empirical index of the strength and deflection characteristics of a soil correlated with pavement performance to establish design curves for pavement thickness.

APPENDIX D: ASFE INFORMATION

Important Information about Your

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 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 your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the 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.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of 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,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- 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 study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the 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 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 construction recommendations included in your report. *Those 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 recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower 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. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing 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 Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors 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 contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors 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 contractors do not 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.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental 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 geoenvironmental 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, a number of 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 ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE
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