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Resources

AGREED TO:

Bidder First Name

Bidder Last Name

Nikki

Carr

Design  
Resources

Vendor  
Registration

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**Date:** July 24, 2020

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# **Geotechnical Data Report**

## **SAWS Water Resources Integration Pipeline Segment 3**

**San Antonio, Texas**

**Arias Job No. 2019-1138**



**Prepared For  
Freese & Nichols, Inc.**

**June 16, 2020**



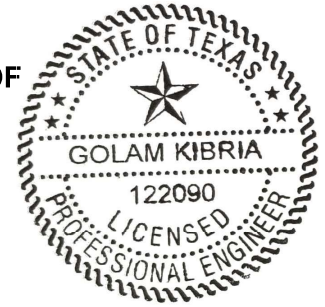
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## FINAL REVIEW

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF  
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A handwritten signature in blue ink that reads 'Christopher M. Szymczak'.

CHRISTOPHER M. SZYMCAK, P.E., 86396



A handwritten signature in blue ink that reads 'Golam Kibria'.

06/16/2020

GOLAM KIBRIA, PH.D., P.E., 122090

## GEOTECHNICAL DATA REPORT

FOR

**SAWS WATER RESOURCES INTEGRATION PIPELINE - SEGMENT 3**



## TABLE OF CONTENTS

	<b>Page</b>
INTRODUCTION.....	1
PROJECT REVIEW .....	1
SOIL BORINGS.....	1
LABORATORY TESTS .....	2
SUBSURFACE CONDITIONS.....	3
GENERAL COMMENTS .....	6
Subsurface Variations .....	6
Standard of Care .....	6
APPENDIX A: FIGURES.....	A-1
APPENDIX B: SOIL BORING LOGS AND KEY TO TERMS .....	B-1
APPENDIX C: SUMMARY OF ANALYTICAL TEST RESULTS .....	C-1
APPENDIX D: FIELD AND LABORATORY EXPLORATION .....	D-1
APPENDIX E: BORING LOGS FROM PREVIOUS STUDY .....	E-1

### **Figures**

- 1 Proposed Alignment of Segment 3
- 2 Bore Location Plan
- 3 Site Geologic Map
- 4 Soil Survey Map of the Project Area

## INTRODUCTION

The Geotechnical Data Report (GDR) presented herein is for the design and construction of the Segment 3 pipeline. Arias submitted the FINAL Geotechnical Data and Recommendations Report (GDRR) for the proposed project on July 5, 2011. We were contacted by Freese and Nichols, Inc. (FNI) on December 23, 2019 to prepare a separate Geotechnical Data Report (GDR) and Geotechnical Design Memorandum (GDM) using the previously submitted GDRR dated July 5, 2011. Accordingly, our services with respect to this phase of the project were outlined in the Executed Subconsultant Authorization dated April 29, 2020.

## PROJECT REVIEW

Arias performed a Geotechnical Study for the planned SAWS water resources integration pipeline in 2005. The integration pipeline is separated into three (3) segments that connect the Twin Oaks Water Treatment Plant in southwest Bexar County to the existing Anderson Pump Station. The Geotechnical Data and Recommendations Report (GDRR) (Arias Report No. 04SA-2118, dated June 30, 2005) included findings and recommendations for all three (3) segments of the pipeline. The original SAWS project was put on hold and was resumed in 2011 to complete the following phases: Study and Report, Preliminary Design, Final Design, Bidding, and Construction Phase. Accordingly, Arias was contacted to prepare a Final Geotechnical Report which was submitted on July 5, 2011. During submission of the FINAL report on July 5, 2011 (Arias Report No. 2009-816); the pipeline construction was anticipated to be completed by 2014. However, the project was put on hold again.

Arias was contacted by FNI on December 23, 2019 to submit a separate GDR and GDM using the previously submitted final report (Arias Report No. 2009-816, dated July 5, 2011) prepared for the proposed project. Our authorized scope of work at this phase of the project does not include drilling any additional borings.

This study includes about 74,000 linear feet of pipeline (designated as Segment 3) that extends from just west of Nelson Road and east of Macdona in south Bexar County to the Anderson Pump Station site located near the intersection of W. Loop 1604 N. and State Hwy 151 in western Bexar County. The proposed alignment of Segment 3 is indicated on Figure 1 included in Appendix A.

## SOIL BORINGS

### Boring Locations

Arias drilled nine (9) soil borings between March 18 and March 22, 2011. The soil borings, designated as Borings B-1 through B-9, were drilled to depths ranging from about 20 to 50 feet. The boring depths and preliminary locations were selected by FNI along the planned alignment. Arias located the borings in the field by referencing from preliminary drawings provided to us by FNI and by measuring from existing landmarks and property lines. The

approximate boring locations are indicated on the attached Boring Location Plans included as Figures 2a through 2f in Appendix A. The measured latitude and longitude coordinates obtained using a hand-held GPS unit are included on the boring logs in Appendix B.

Several of the borings along Segment 3 in western Bexar County were inaccessible at the time of the 2005 study and were not included in the previously submitted GDRR on June 1, 2005. In addition, the proposed alignment has been updated and re-routed to include areas previously not explored. The bore location plans, and logs gathered from the GDDR dated June 1, 2005 are included in Appendix E.

### **Soil Borings**

The soil borings were advanced with a truck-mounted drilling rig. In general, the soil samples were taken in continuous, 2-foot sample intervals to 10 feet, and then at 5-foot intervals thereafter to the boring completion depths. Cohesive soils were typically sampled by hydraulically pushing thin-walled sampling tubes in accordance with ASTM D1587. Granular soils or soil/rock samples that were too hard to be recovered using thin-walled tubes, were obtained using a split-barrel sampler (ASTM D1586). The sampling techniques are described in further detail in Appendix D. Upon completion of the sampling activities, the soil borings were backfilled, and the site cleaned as required.

### **Sample Handling**

The recovered samples were removed from the sampling device in the field and were packaged, sealed and transported to Arias' laboratory for additional evaluation. Descriptions of the samples were taken and documented in the form of field logs. N-values from SPT (Standard Penetration Test) sampling, along with a visual description of the recovered soils were documented on our field logs. The sample descriptions were modified based on the results of the laboratory testing and have been summarized on the borings logs, included in Appendix B.

## **LABORATORY TESTS**

### **General**

Arias determined the moisture content of representative samples. The Liquid Limit and Plastic Limit, collectively termed Atterberg Limits, were provided on representative samples to assist in classifying the soils in accordance with the Unified Soil Classification System. Sieve analysis was also provided on select samples. Laboratory testing was performed in general accordance with applicable ASTM standards and procedures. The results of the laboratory testing are presented on the attached boring logs. Laboratory testing was performed in general accordance with the procedures stated in Appendix D.

### Corrosivity Testing

A near-surface sample was obtained at each boring location for laboratory soil resistivity and analytical testing to provide an indication of the corrosion potential of buried utilities. The laboratory soil resistivity testing was provided in general accordance with ASTM G57. The other analytical parameters and laboratory test methods used in this study are summarized below in Table 1.

**Table 1. Summary of the Analytical Parameters Measured for this Study**

Analytical Parameter	Laboratory Method
pH	ASTM G51
Redox Potential	ASTM D1498
Sulfides	AWWA M27 or C105
Water Soluble Sulfate Content (ppm)	4500-SO <sub>4</sub> <sup>-2</sup> method
Water Soluble Chloride Content (ppm)	4500-Cl <sup>-</sup> method

The results of the analytical testing are summarized in Table C-1, included in Appendix C.

## SUBSURFACE CONDITIONS

### Geology

The Segment 3 portion of the pipeline included in this study has been mapped to include Quaternary and Tertiary alluvial deposits overlying Cretaceous formational limestone and clays. This section describes the geologic materials along the alignment and provides site considerations for pipeline installation within each respective geologic formation. The estimated locations of formational outcroppings along the alignment are shown on the attached Site Geologic Map included in Appendix A. The soil and geologic descriptions provided in this report are based on our interpretation of the available geologic information and the visual review of the recovered soil samples.

Uvalde Gravel Formation - The Uvalde Gravel Formation (Q-Tu) is regionally mapped to overly or 'cap' the formational soils within much of the project alignment. The Uvalde gravel is a continental deposit, considered to be Plio-Pleistocene in age, and locally consists of moderate to well cemented coarse sandy gravels with many cobbles. The upper weathered portion commonly contains clay. The thickness of the Uvalde gravel should be expected to vary from very thin up to 15 feet or more due to topographic expression.

The slopes in the areas underlain by Uvalde Gravel are moderate but become steeper where slopes are dissected by erosion. Because of the potential for increased permeability within the gravels relative to the expected much lower permeability's of the underlying marine deposits, a "perched" water zone could be encountered at the contact between the gravels and

underlying formational deposits. The “perched” water, especially during wet climatic periods, could lead to trench excavation difficulties without adequate means and methods employed by the Contractor.

Austin Chalk – Borings B-1 through B-3 encountered the Austin Chalk Formation (Kau), a marine deposit of upper Cretaceous age. The Austin Chalk in this area generally consists of a white to tan colored soft limestone or chalk with occasional clay units. A shallow groundwater table is not expected within this formation; however, a zone of “perched” or transient water could be encountered near or under Medio Creek. Voids and fractures are common within the Austin Chalk. These voids are normally small in size; however, cave-sized cavities can be encountered which may require remediation during trench excavation activities. Also, these voids can be associated with fractures that may cause concern for excavation sidewall stability.

Moderate to well cemented limestone beds are common within the Austin Chalk and should be expected during the pipeline construction. Rock excavation techniques will be required to excavate limestone and chalk.

Pecan Gap Chalk - The Pecan Gap Chalk (Kpg), a marine deposit of upper Cretaceous age, occurred at several of the boring locations (Borings B-5 through B-7). The Pecan Gap Chalk in this area generally consists of dense marlstone and tan formational clay units in a moderate to very weathered condition. The clay units are typically moderately to highly expansive. A shallow groundwater table is not expected within this formation; however, a zone of “perched” or transient water could be encountered near or under Medio Creek. Rock excavation techniques will likely be required to excavate marl or marlstone.

Navarro Formation – Geologic map indicates that the alignment crosses a fault near the vicinity of Dodge City Trail Road and Loop 1604 (Boring B-4), putting the Pecan Gap Chalk in direct contact with the younger Navarro Formation (Kknm) clays. Highly plastic clays of the Navarro formation were apparent at the Boring B-8 and B-9 locations. The Navarro, a marine deposit of upper Cretaceous age, consists of blocky tan formational clays commonly in a moderate to very weathered condition to depths of 15 feet or more. A dark gray claystone occurred below about 33 feet to 50 feet in Borings B-8 and B-9. The claystone is usually in a hard to very hard condition. The upper tan clays are known to be highly expansive and can contain significant amounts of gypsum. The regional geologic map indicates that a large portion of the Navarro within the project area is covered with shallow alluvial soils of the Uvalde Gravel.

The slopes are moderate in this section of the alignment but become steeper where bisected by ephemeral streams. The Navarro Formation typically does not contain groundwater, but expansive clays are known to exist in this formation, including bentonitic seams, which could create vertical movements of the trench sidewalls and bottoms from changing moisture contents following pipeline construction. Perched groundwater can occur at geologic contacts, particularly within alluvial soils that overlie the Navarro clay.

Midway Group – Geologic map shows presence of Midway Group (PAmi) near the southern end of the alignment. Midway Group consists of sand and clay. The clay is typically silty and sandy and is generally light gray to dark gray in color. The sand is glauconitic to very glauconitic in the lower part, argillaceous and poorly sorted. Please note that we did not encounter substantial amount of sand in our borings.

Other Structural Geologic Considerations - Faults of the Balcones Fault System are known to cross through the project area as shown on the Geologic Map included in Appendix A. The Balcones Fault System has not had any known surface activity following the end of the Miocene epoch, approximately 5 million years before present, and from a geologic point of view, the fault system is considered to be inactive and should pose no seismic risk to the proposed development. However, the faulting can result in abrupt changes to the materials encountered during excavation and trenching for the planned pipeline.

**Bexar County USDA Soils Descriptions**

Arias reviewed the USDA Bexar County Soil Survey Maps along the Segment 3 pipeline alignment. We have included a Soil Map (see Figure 4) in Appendix A showing the published USDA soil descriptions along the pipeline route. The USDA soil survey provides general information regarding the corrosion potential for the soil types commonly found in Bexar County. The relative corrosion potential for buried utilities based on the USDA soil types are summarized below:

**Table 2. Summary of the Soil Types and Relative Corrosion Potential for Utilities**

Symbol	Soil Name	Corrosion Potential Category
TaB	Eckrant Very Cobbly Clay	High
TaC	Eckrant Very Cobbly Clay	High
Tf	Tinn & Frio Soils	High
Tc	Tinn Clay	High
PaB	Patrick Soils	High
BsC	Whitewright-Austin	High
HuB	Houston Black Gravelly Clay	High
HuC	Houston Black Gravelly Clay	High
HuD	Houston Black Gravelly Clay	High
HsB	Houston Black Clay	High
HoD <sub>3</sub>	Heiden-Ferris Complex	High

### **Site Stratigraphy**

The soil conditions encountered in the soil borings varied along the project alignment. In general, the alignment encountered shallow limestone rock in the northern portion of the project (Borings B-1 and B-2), dense to very dense gravels with occasional limestone, clay, and claystone layers in Borings B-3 through B-7, and stiff to very hard clays in Borings B-8 and B-9. The site-specific subsurface conditions are described on the individual boring logs.

### **Groundwater**

Approximately 24 hours after drilling, groundwater was observed at a depth of about 9½ feet in Boring B-6 and at a depth of about 20½ feet in Boring B-9. No free groundwater was observed in the other borings advanced as part of this study. It should be noted that water levels may require several hours to several days to stabilize depending on the permeability of the soils, recent rainfall events, and/or seasonal conditions. Borings B-3 through B-8 encountered gravel seams and layers in the upper 4 to 16 feet that will provide a conduit for groundwater seepage during seasonally wet periods. We should note that the soil borings were drilled at a time when the San Antonio and surrounding areas were generally experiencing a drought. This could explain the absence of groundwater at some boring locations. Thus, provisions to intercept and divert “perched” water off-site should be made if this condition is encountered during construction.

## **GENERAL COMMENTS**

This report was prepared as an instrument of service for this project exclusively for the use of FNI, SAWS and the project design team. If the development plans change, or if different subsurface conditions are encountered during construction, we should be informed and retained to ascertain the impact of these changes on our recommendations. We cannot be responsible for the potential impact of these changes if we are not informed.

### **Subsurface Variations**

Soil and groundwater conditions may vary between and away from the sample boring locations. Transition boundaries or contacts, noted on the boring logs to separate material types, are approximate. Actual contacts may be gradual and vary at different locations. The Contractor should verify that similar conditions exist throughout the proposed area of excavation. If different subsurface conditions or highly variable subsurface conditions are encountered during construction, we should be notified in writing in order to evaluate the significance of the changed conditions relative to our recommendations.

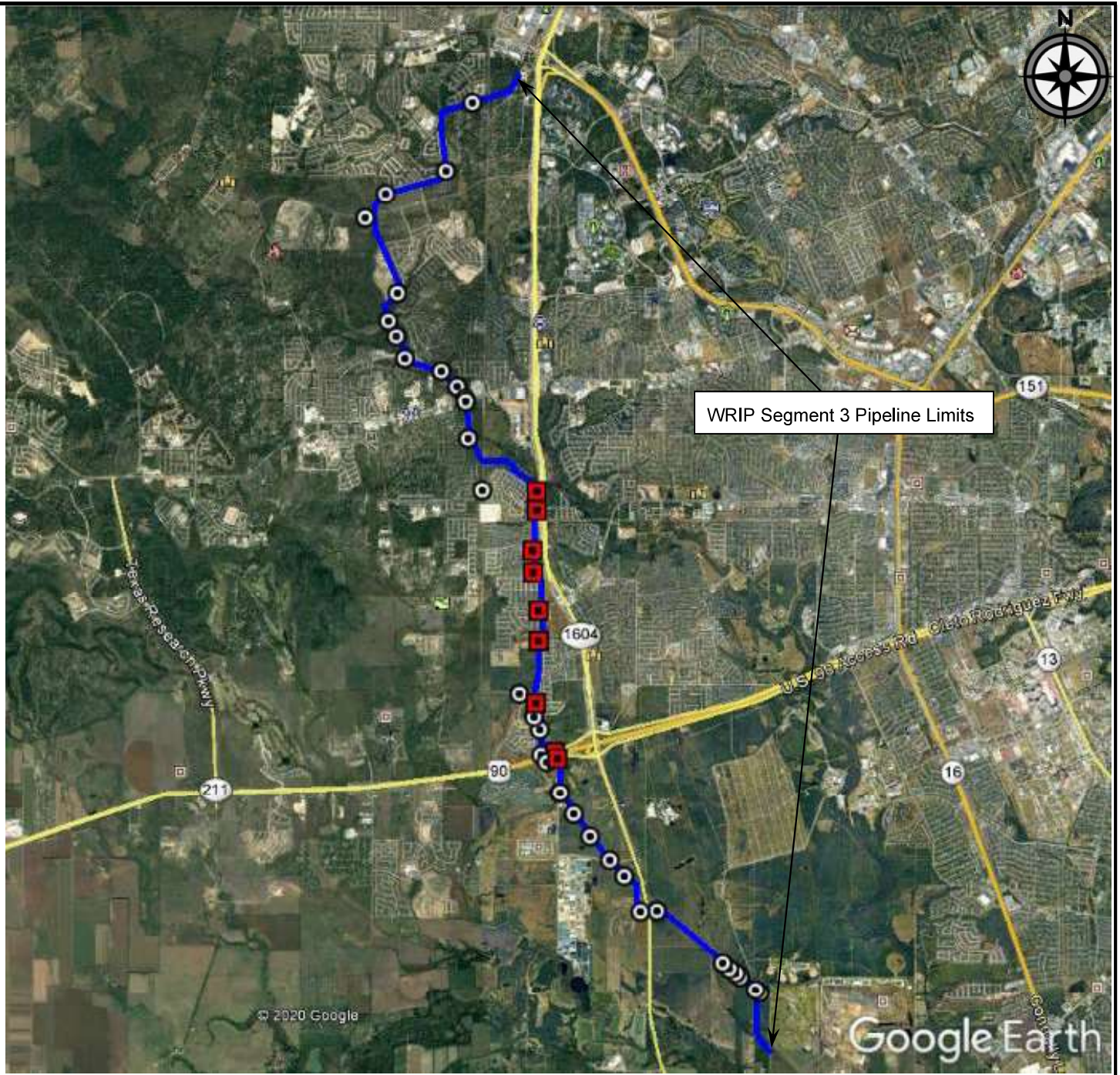
### **Standard of Care**

Subject to the limitations inherent in the agreed scope of services as to the degree of care and amount of time and expenses to be incurred, and subject to any other limitations contained in the agreement for this work, Arias has performed its services consistent with that level of care

and skill ordinarily exercised by other professional engineers practicing in the same locale and under similar circumstances at the time the services were performed.



## **APPENDIX A: FIGURES**



Borings Drilled for 2005 Study    ○

Borings Drilled for 2011 Study    ■



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### VICINITY MAP

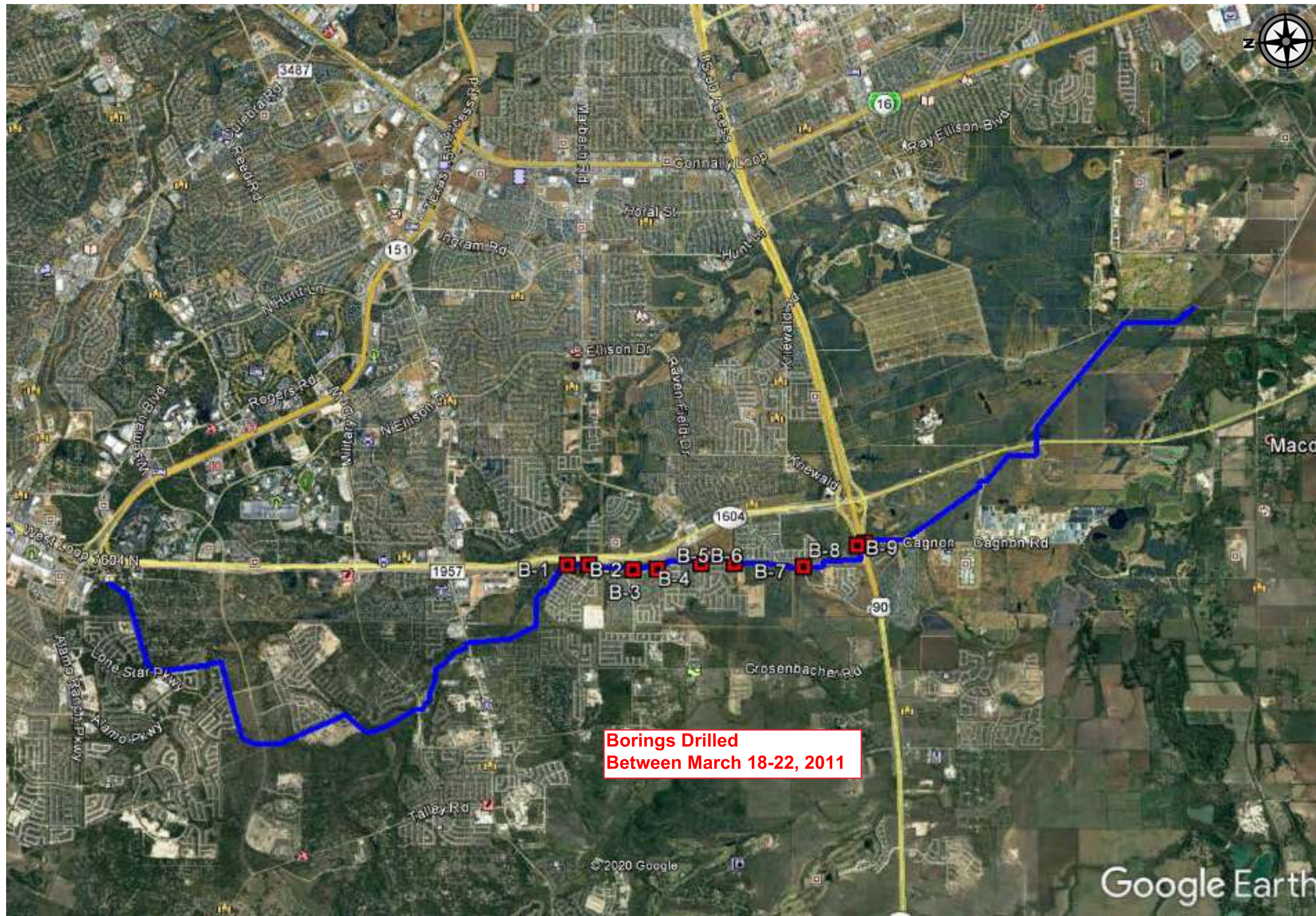
SAWS Water Resources Integration Program  
(WRIP) Pipeline – Segment 3  
San Antonio, TX

Date: June 15, 2020	Job No.: 2019-1138
Drawn By: RWL	Checked By: GK
Approved By: GK	Scale: N.T.S.

**Figure 1**



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**BORING LOCATION PLAN**

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 San Antonio, TX

Job No.:	2019-1138
Scale:	N.T.S.
Date:	June 16, 2020
Drawn By:	RWL
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**Figure 2**  
1 of 1



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**Borings Drilled  
Between March 18-22, 2011**



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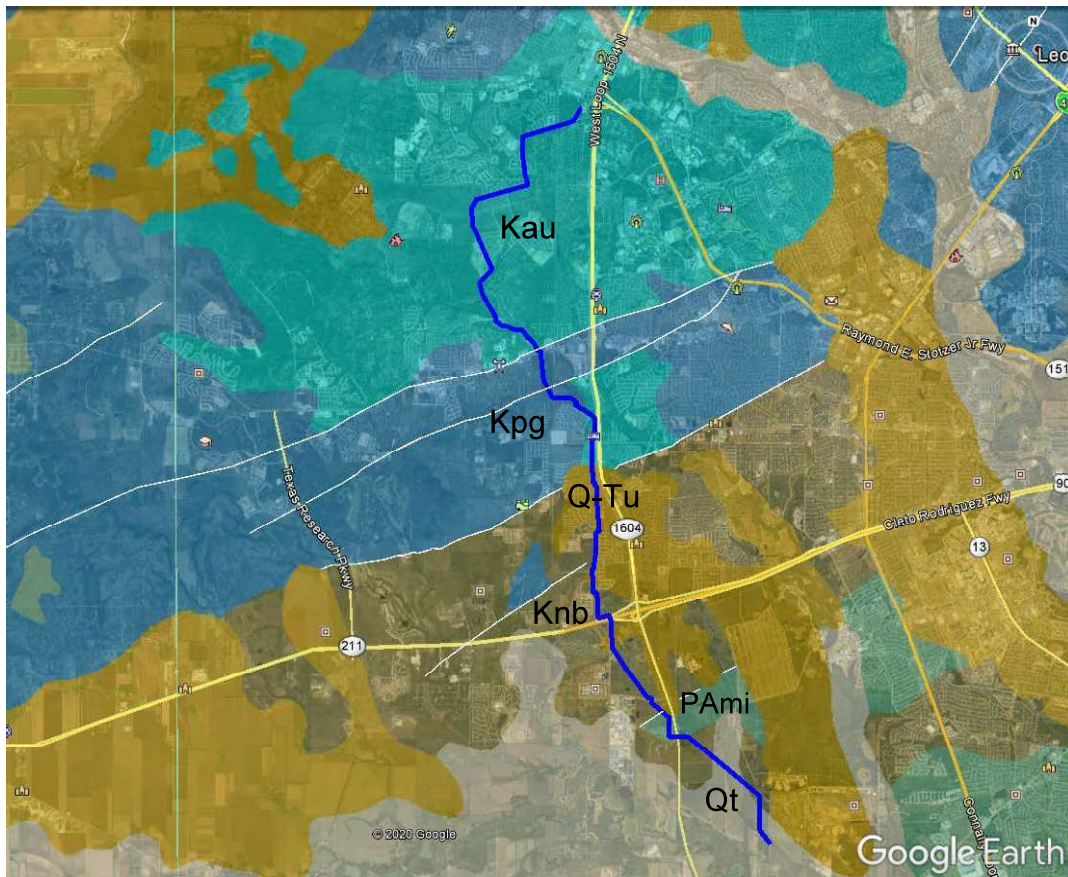
**BORING LOCATION PLAN**

SAWS Water Resources Integration  
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Job No.:	2019-1138
Scale:	N.T.S.
Date:	June 16, 2020
Drawn By:	RWL
Checked By:	GK
Approved By:	GK

**Figure 2**  
1 of 1





**LEGEND**

<u>Symbol</u>	<u>Name</u>	<u>Age</u>
Qt	Fluvialite Terrace Deposits	Quaternary Period / Holocene
Kau	Austin Chalk	Upper Cretaceous Period
Kpg	Pecan Gap Chalk	Upper Cretaceous Period
Q-Tu	Uvalde Gravel	Quaternary Period
Knb	Navarro Group and Marlbrook Marl	Upper Cretaceous Period
PAmi	Midway Group	Tertiary Period



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**GEOLOGIC MAP**

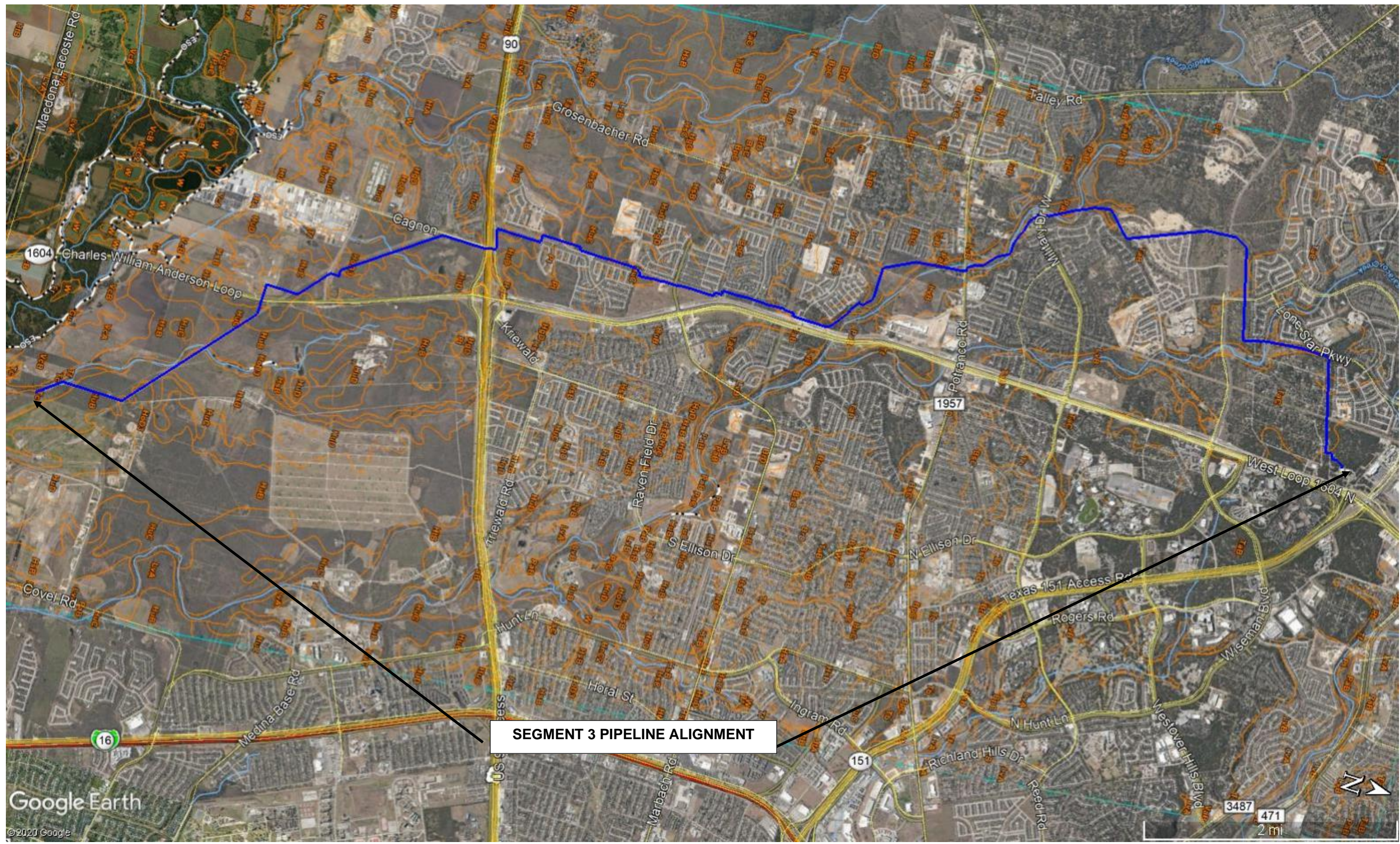
SAWS Water Resources Integration Program  
 (WRIP) Pipeline – Segment 3  
 San Antonio, TX

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**Figure 3**



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**SOIL SURVEY MAP**

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**Figure 4**  
1 of 4





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### SOIL SURVEY MAP

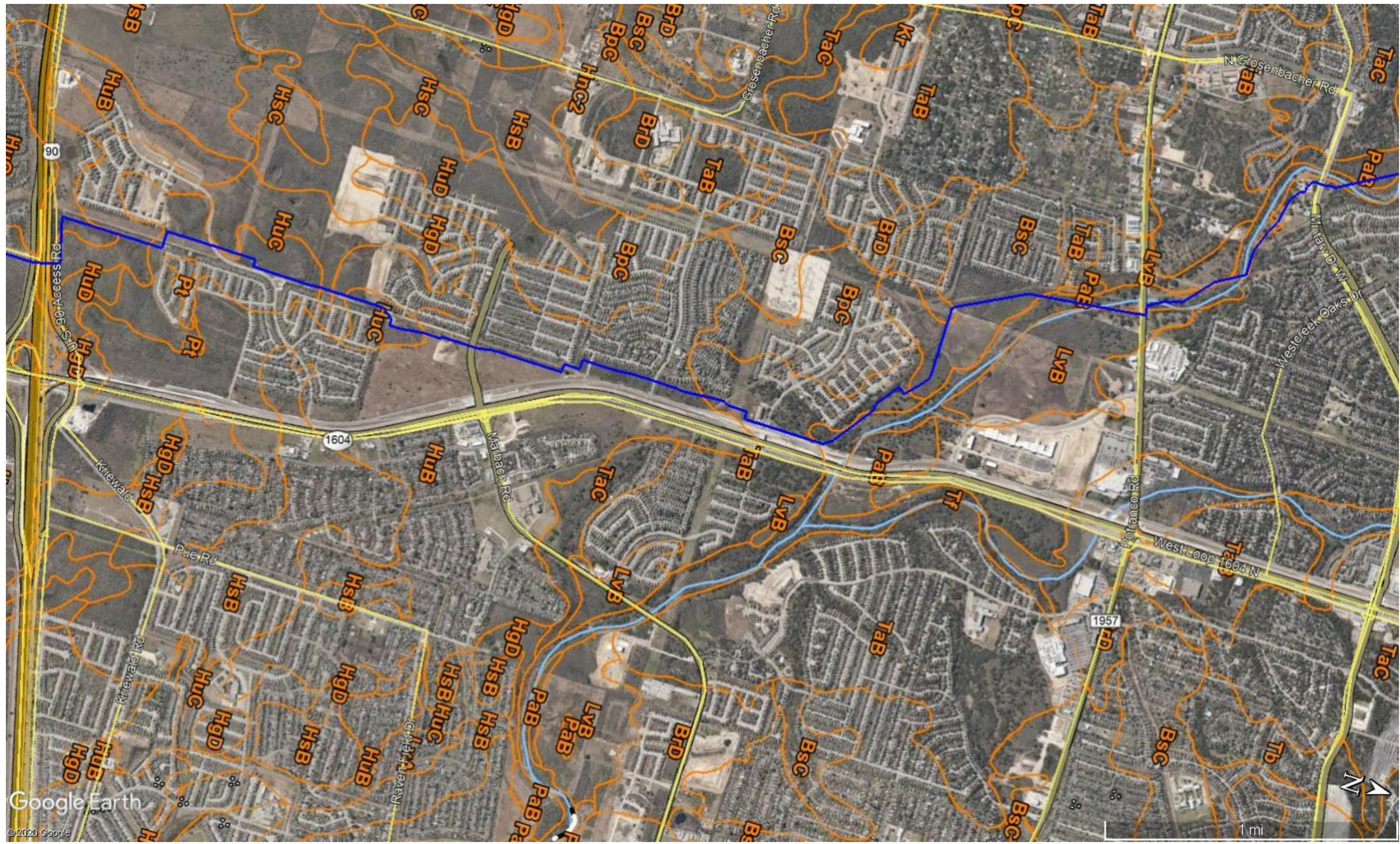
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**Figure 4**  
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### SOIL SURVEY MAP

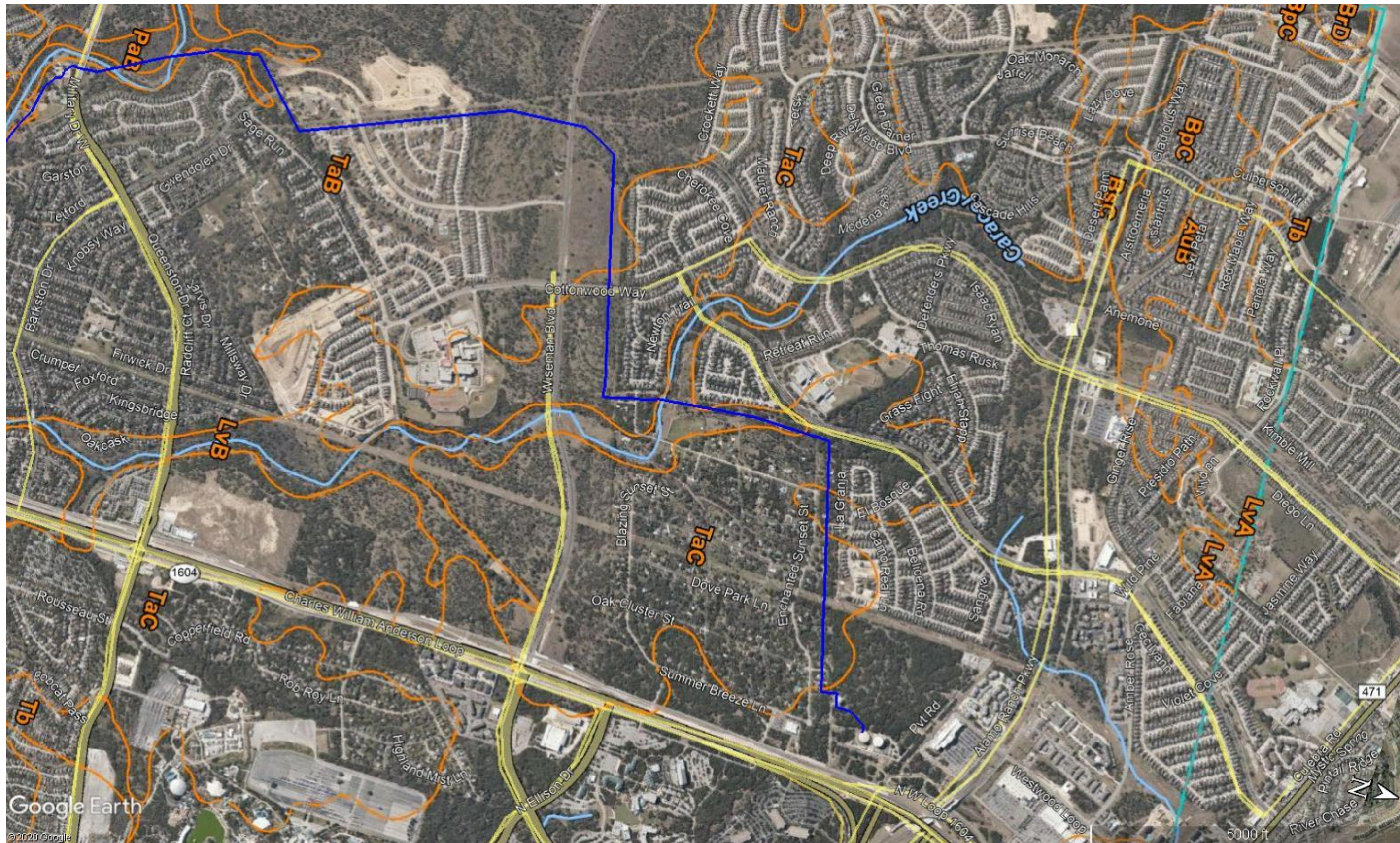
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 San Antonio, TX

Job No.:	2019-1138
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**Figure 4**  
3 of 4



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### SOIL SURVEY MAP

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 Program (WRIP) Pipeline – Segment 3  
 San Antonio, TX

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**Figure 4**  
4 of 4



## **APPENDIX B: SOIL BORING LOGS AND KEY TO TERMS**

# Boring Log No. B-1



**Project: SAWS Water Resources Integration Program**  
**Project 1: Pipeline, Segment 3**  
**San Antonio, Texas**

Sampling Date: 3/21/11

Coordinates: N29°25'10.3" W98°42'38.2"

Location: See Boring Location Plan

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200
Clayey GRAVEL (GC), brown and tan, very dense, with sand LIMESTONE, tan, very hard	0	SS	12	24	46	22	50/6"	25
	5	SS	8				**50/0"	
	5	SS	8				**50/0"	
	10	SS	10				**50/0"	
	10	SS	9				**50/1"	
	10	GB	8	14	23	9		
CLAYSTONE, reddish brown, very hard	15	SS	18				**50/0"	
	20	SS	35	25	83	58	**50/3"	69
LIMESTONE, tan, very hard	25	SS	10				**50/0"	
	30	SS	10				**50/1"	
	35	SS	12				**50/0"	
	40	SS	13				**50/1"	
	45	SS	14				**50/1"	
	49.6	SS	13				**50/0"	

-with 8" clay seam at 41'

Borehole terminated at 49.6 feet

Groundwater Data:  
During drilling: Not encountered

Field Drilling Data:  
Logged By: R. Arizola  
Driller: Eagle Drilling, Inc.  
Equipment: Truck-mounted drill rig  
Dry-auger drilling: 0 ft to 49.6 ft  
Coordinates: Hand-held GPS Unit

### Nomenclature Used on Boring Log

Split Spoon (SS)      Grab Sample (GB)

WC = Water Content (%)      \*\* = Blow Counts During Seating Penetration  
 PL = Plastic Limit  
 LL = Liquid Limit      -200 = % Passing #200 Sieve  
 PI = Plasticity Index  
 N = SPT Blow Count

2009-816.GPJ 4/27/11 (BORING LOG SA10-01.ARIASSA10-01.GDT.LIBRARY2010.GLB)

# Boring Log No. B-2



**Project: SAWS Water Resources Integration Program**  
**Project 1: Pipeline, Segment 3**  
**San Antonio, Texas**

Sampling Date: 3/18/11

Coordinates: N29°25'0" W98°42'38.1"

Location: See Boring Location Plan

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	N	-200
CLAY (CL), brown, hard, with gravel	0	SS	12	**50/3"	83
WEATHERED LIMESTONE, tan, with interbedded hard seams and layers	5	SS	10	**50/1"	
	10	SS	11	**50/2"	
	11	SS	12	**50/6"	
	12	SS	5	**50/0"	
LIMESTONE, tan, very hard	13	GB	7		
	14	SS	7	**50/1"	
	15	SS	11	**50/4"	
-with weathered seams and layers below 16'					
Borehole terminated at 18.9 feet					

Groundwater Data:  
 During drilling: Not encountered

Field Drilling Data:  
 Logged By: R. Arizola  
 Driller: Eagle Drilling, Inc.  
 Equipment: Truck-mounted drill rig  
 Dry-auger drilling: 0 ft to 18.9 ft  
 Coordinates: Hand-held GPS Unit

### Nomenclature Used on Boring Log

Split Spoon (SS)
  Grab Sample (GB)

WC = Water Content (%)  
 N = SPT Blow Count  
 \*\* = Blow Counts During Seating Penetration  
 -200 = % Passing #200 Sieve

2009-816.GPJ 4/27/11 (BORING LOG SA10-01.ARIASSA10-01.GDT.LIBRARY2010.GLB)

# Boring Log No. B-3



**Project: SAWS Water Resources Integration Program**  
**Project 1: Pipeline, Segment 3**  
**San Antonio, Texas**

Sampling Date: 3/18/11

Coordinates: N29°24'38.8" W98°42'40.7"

Location: See Boring Location Plan

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200
Sandy CLAY (CL), brown and tan, very stiff, with gravel (possibly fill)	0	SS	12	21	43	22	18	57
CLAY (CL), tan, hard, with calcarous deposits	5	SS	17				37	
Clayey GRAVEL (GC), tan, dense, with sand -very dense below 6'	5	SS	8				37	
	6	SS	5	16	23	7	50/6"	26
	7	SS	6				**50/6"	
	10	GB	3					
WEATHERED LIMESTONE, tan, with hard seams and layers	15	SS	11	14	39	25	50/5"	90
	18.8	SS	9				**50/3"	

Borehole terminated at 18.8 feet

Groundwater Data:  
During drilling: Not encountered

Field Drilling Data:  
Logged By: R. Arizola  
Driller: Eagle Drilling, Inc.  
Equipment: Truck-mounted drill rig  
Dry-auger drilling: 0 ft to 18.8 ft  
Coordinates: Hand-held GPS Unit

### Nomenclature Used on Boring Log

Split Spoon (SS)      Grab Sample (GB)

WC = Water Content (%)      \*\* = Blow Counts During Seating Penetration  
 PL = Plastic Limit  
 LL = Liquid Limit      -200 = % Passing #200 Sieve  
 PI = Plasticity Index  
 N = SPT Blow Count

2009-816.GPJ 4/27/11 (BORING LOG SA10-01, ARIASSA10-01.GDT, LIBRARY2010.GLB)

# Boring Log No. B-4



**Project: SAWS Water Resources Integration Program**  
**Project 1: Pipeline, Segment 3**  
**San Antonio, Texas**

Sampling Date: 3/18/11

Coordinates: N29°24'27.2" W98°42'40.3"

Location: See Boring Location Plan

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200
Clayey GRAVEL (GC), dark brown, medium dense, with sand  -tan, with many calcareous deposits, 4' to 8'  -very dense below 6'  -tan, silty, below 8'	5	SS	12	19	42	23	25	45
	10	SS	12				13	
	15	SS	7				25	
	20	SS	4				62	
	20	SS	9	17	25	8	50/6"	31
CLAY (CH), tan, very stiff, with calcareous deposits	20	GB	20					
	20	SS	32	27	82	55	19	99
Borehole terminated at 20 feet								

2009-816.GPJ 4/27/11 (BORING LOG SA10-01, ARIASSA10-01.GDT, LIBRARY2010.GLB)

**Groundwater Data:**  
 During drilling: Not encountered

**Field Drilling Data:**  
 Logged By: R. Arizola  
 Driller: Eagle Drilling, Inc.  
 Equipment: Truck-mounted drill rig  
 Dry-auger drilling: 0 ft to 20 ft  
 Coordinates: Hand-held GPS Unit

**Nomenclature Used on Boring Log**

Split Spoon (SS)     
  Grab Sample (GB)

Thin-walled tube (T)

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

# Boring Log No. B-5



Project: **SAWS Water Resources Integration Program**  
**Project 1: Pipeline, Segment 3**  
**San Antonio, Texas**

Sampling Date: 3/18/11

Coordinates: N29°24'6.2" W98°42'37.1"

Location: See Boring Location Plan

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200
CLAY (CL), dark brown, very stiff, gravelly	0 - 1	SS	9				25	
Clayey GRAVEL (GC), tan, very dense, with sand	1 - 2	SS	4				53	
	2 - 5	SS	4	15	32	17	67	21
	5 - 6	SS	4				**50/5"	
	6 - 10	SS	9				50/6"	46
	10 - 11	GB	4					
	11 - 15	SS	5				**50/6"	
CLAY (CL), tan, hard	15 - 20	SS	14	15	34	19	49	96

Borehole terminated at 20 feet

Groundwater Data:  
 During drilling: Not encountered

Field Drilling Data:  
 Logged By: R. Arizola  
 Driller: Eagle Drilling, Inc.  
 Equipment: Truck-mounted drill rig  
 Dry-auger drilling: 0 ft to 20 ft  
 Coordinates: Hand-held GPS Unit

### Nomenclature Used on Boring Log

Split Spoon (SS)     
  Grab Sample (GB)

WC = Water Content (%)      \*\* = Blow Counts During Seating Penetration  
 PL = Plastic Limit  
 LL = Liquid Limit      -200 = % Passing #200 Sieve  
 PI = Plasticity Index  
 N = SPT Blow Count

2009-816.GPJ 4/27/11 (BORING LOG SA10-01.ARIASSA10-01.GDT.LIBRARY2010.GLB)

# Boring Log No. B-6



**Project: SAWS Water Resources Integration Program**  
**Project 1: Pipeline, Segment 3**  
**San Antonio, Texas**

Sampling Date: 3/21/11

Coordinates: N29°23'50.2" W98°42'37"

Location: See Boring Location Plan

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200
Clayey GRAVEL (GC), brown, medium dense -clay (CH), very stiff, with sand and gravel, 2' to 6'  -tan, dense, with sand, below 6'	5	SS	13	20	58	38	25	43
	5	SS	14				33	
	5	SS	16	19	77	58	18	83
	5	SS	15				34	
	5	SS	16	16	49	33	49	35
CLAY (CL), tan and gray, hard, sandy    -very hard below 23'	5	GB	15					
	5	SS	13				48	
	5	SS	24	18	45	27	18	67
	5	SS	15					**50/2"
	5	SS	19				59	
CLAY (CH), grayish brown, hard	5	SS	22	25	71	46	41	95
	5	SS	21				42	
	5	SS	25				60	
CLAY (CH), light gray, very hard, with sand and gypsum deposits	5	SS	22	32	131	99	50/6"	85
	5	SS	22	32	131	99	50/6"	85

Borehole terminated at 49.5 feet

**Groundwater Data:**

First encountered during drilling: 20.3-ft depth

After 24hrs: At 9.5-ft depth (20-ft open borehole depth)

**Field Drilling Data:**

Logged By: R. Arizola

Driller: Eagle Drilling, Inc.

Equipment: Truck-mounted drill rig

Dry-auger drilling: 0 ft to 49.5 ft

Coordinates: Hand-held GPS Unit

**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

\*\* = Blow Counts During Seating Penetration

-200 = % Passing #200 Sieve

2009-816.GPJ 4/27/11 (BORING LOG SA10-01.ARIASSA10-01.GDT.LIBRARY2010.GLB)



# Boring Log No. B-7



**Project: SAWS Water Resources Integration Program**  
**Project 1: Pipeline, Segment 3**  
**San Antonio, Texas**

Sampling Date: 3/18/11

Coordinates: N29°23'17.1" W98°42'38.6"

Location: See Boring Location Plan

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200
CLAY (CL), tan and gray, stiff to very stiff, with sand	1	SS	21				15	
	20	SS	20	18	47	29	26	82
Sandy CLAY (CL), reddish brown, with ferrous deposits	5	SS	8				18	
	9	SS	9	15	34	19	64	68
CLAYSTONE, Reddish tan, very hard, with cemented seams and layers	10	SS	6				**50/6"	
	13	GB	6	13	32	19		55
	15	SS	6				**50/6"	
CLAY (CH), tan and gray, hard	19	SS	19	18	63	45	58	88
	Borehole terminated at 20 feet							

Groundwater Data:  
 During drilling: Not encountered

Field Drilling Data:  
 Logged By: R. Arizola  
 Driller: Eagle Drilling, Inc.  
 Equipment: Truck-mounted drill rig  
 Dry-auger drilling: 0 ft to 20 ft  
 Coordinates: Hand-held GPS Unit

### Nomenclature Used on Boring Log

Split Spoon (SS)     
  Grab Sample (GB)

WC = Water Content (%)      \*\* = Blow Counts During Seating Penetration  
 PL = Plastic Limit  
 LL = Liquid Limit      -200 = % Passing #200 Sieve  
 PI = Plasticity Index  
 N = SPT Blow Count

2009-816.GPJ 4/27/11 (BORING LOG SA10-01.ARIASSA10-01.GDT.LIBRARY2010.GLB)

# Boring Log No. B-8



**Project: SAWS Water Resources Integration Program**  
**Project 1: Pipeline, Segment 3**  
**San Antonio, Texas**

Sampling Date: 3/22/11

Coordinates: N29°22'51.1" W98°42'26.9"

Location: See Boring Location Plan

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	DD	Uc
Sandy CLAY (CH), dark brown, stiff, with gravel	.....	SS	17	22	85	63		14	59		
	.....	SS	30					35			
Clayey GRAVEL (GC), brown, dense	5	SS	21					24	62		
CLAY (CH), light tan, very stiff, with calcareous deposits	.....	SS	20	19	70	51		18			
	.....	T	27				3.25			93	2.28
CLAY (CH), tan, very stiff to hard, with gypsum and calcareous deposits	.....	T	29	25	85	60	5				
	.....	T	30				4				
CLAY (CH), tan, hard	15	T	30				4				
CLAY (CH), gray and brown, hard, with gypsum deposits	.....	T	24				8				
	.....	T	25				7.25			99	4.19
	.....	T	26				7.5				
	.....	T	26				7.5				
CLAY (CH), light gray, hard, with gypsum deposits	.....	T	9	26	88	62	7.5				
	.....	SS	24					32			
-very hard below 43'	.....	SS	23					58			
	.....	SS	24	27	82	55		55			

Borehole terminated at 50 feet

**Groundwater Data:**  
 During drilling: Not encountered

**Field Drilling Data:**  
 Logged By: R. Arizola  
 Driller: Eagle Drilling, Inc.  
 Equipment: Truck-mounted drill rig  
 Dry-auger drilling: 0 ft to 50 ft  
 Coordinates: Hand-held GPS Unit

**Nomenclature Used on Boring Log**

Split Spoon (SS)
  Thin-walled tube (T)

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

2009-816.GPJ 4/27/11 (BORING LOG SA10-01.ARIASSA10-01.GDT.LIBRARY2010.GLB)

# Boring Log No. B-9



**Project: SAWS Water Resources Integration Program**  
**Project 1: Pipeline, Segment 3**  
**San Antonio, Texas**

Sampling Date: 3/22/11

Coordinates: N29°22'47.6" W98°42'25.4"

Location: See Boring Location Plan

Backfill: Cuttings

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	DD	Uc
CLAY (CH), gray and brown, stiff, with sand and gravel (possibly fill)	0	SS	22					14			
	5	SS	22	30	82	52		18	77		
	10	SS	20					11			
CLAY (CH), tan and gray, firm -stiff at 8' -very stiff below 10'	10	SS	28					6			
	15	SS	32	34	75	41		9	88		
CLAY (CH), light gray, hard  -with slickensides at 28'  -with gypsum deposits at 33'  -very hard below 43'	15	T	31	38	89	51	5.25				
	20	T	34				4.25			82	1.59
	25	T	33				5.5				
	30	T	36	42	111	69	6.25				
	35	T	24				6.25				
	40	SS	24					41			
	45	SS	22	29	79	50		65	99		
50	SS	22						70			

Borehole terminated at 50 feet




















**Groundwater Data:**

First encountered during drilling: 44-ft depth  
 After 24hrs: At 20.5-ft depth (31.7-ft open borehole depth)  
 Field Drilling Data:  
 Logged By: R. Arizola  
 Driller: Eagle Drilling, Inc.  
 Equipment: Truck-mounted drill rig  
 Dry-auger drilling: 0 ft to 50 ft  
 Coordinates: Hand-held GPS Unit

**Nomenclature Used on Boring Log**

- Split Spoon (SS)
- Thin-walled tube (T)
- 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)

# KEY TO CLASSIFICATION SYMBOLS USED ON BORING LOGS

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

## **APPENDIX C: SUMMARY OF ANALYTICAL TEST RESULTS**

**TABLE C-1  
LABORATORY CORROSIVITY AND RESISTIVITY DATA**

<b>Sample Location</b>	<b>Sample Depth (ft)</b>	<b>Redox Potential (millivolts)</b>	<b>Sulfide* (mg/kg)</b>	<b>WS Sulfate (mg/kg)</b>	<b>WS Chloride (mg/kg)</b>	<b>PH</b>	<b>Laboratory Resistivity (ohm-cm)</b>
1	0-2	144	neg.	<50	75	8.0	2,353.5
2	0-2	326	neg.	51.6	300	7.9	1,176.7
3	0-2	172	neg.	<50	150	7.8	1,799.7
4	0-2	383	neg.	<50	100	7.9	1,592.1
5	0-2	371	neg.	<50	100	8.0	6,922.0
6	0-2	359	neg.	250	125	7.9	761.4
7	0-2	356	neg.	356	175	8.0	415.3
8	0-2	499	neg.	279	100	7.3	415.3
9	0-2	491	neg.	1140	175	7.4	276.9

**NOTES:**

**mg/kg = milligrams per kilogram**

**ohm-cm = ohms-centimeters**

**Sulfide\* = Method calls for result to be indicated as positive or negative.**

## **APPENDIX D: FIELD AND LABORATORY EXPLORATION**

## FIELD AND LABORATORY EXPLORATION

The field exploration program included drilling at selected locations within the site and intermittently sampling the encountered materials. The boreholes were drilled air rotary. Samples of encountered materials were obtained using a split-barrel sampler while performing the Standard Penetration Test (ASTM D 1586) or ASTM D1587 for a thin-walled tube sampler technique. 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.

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:

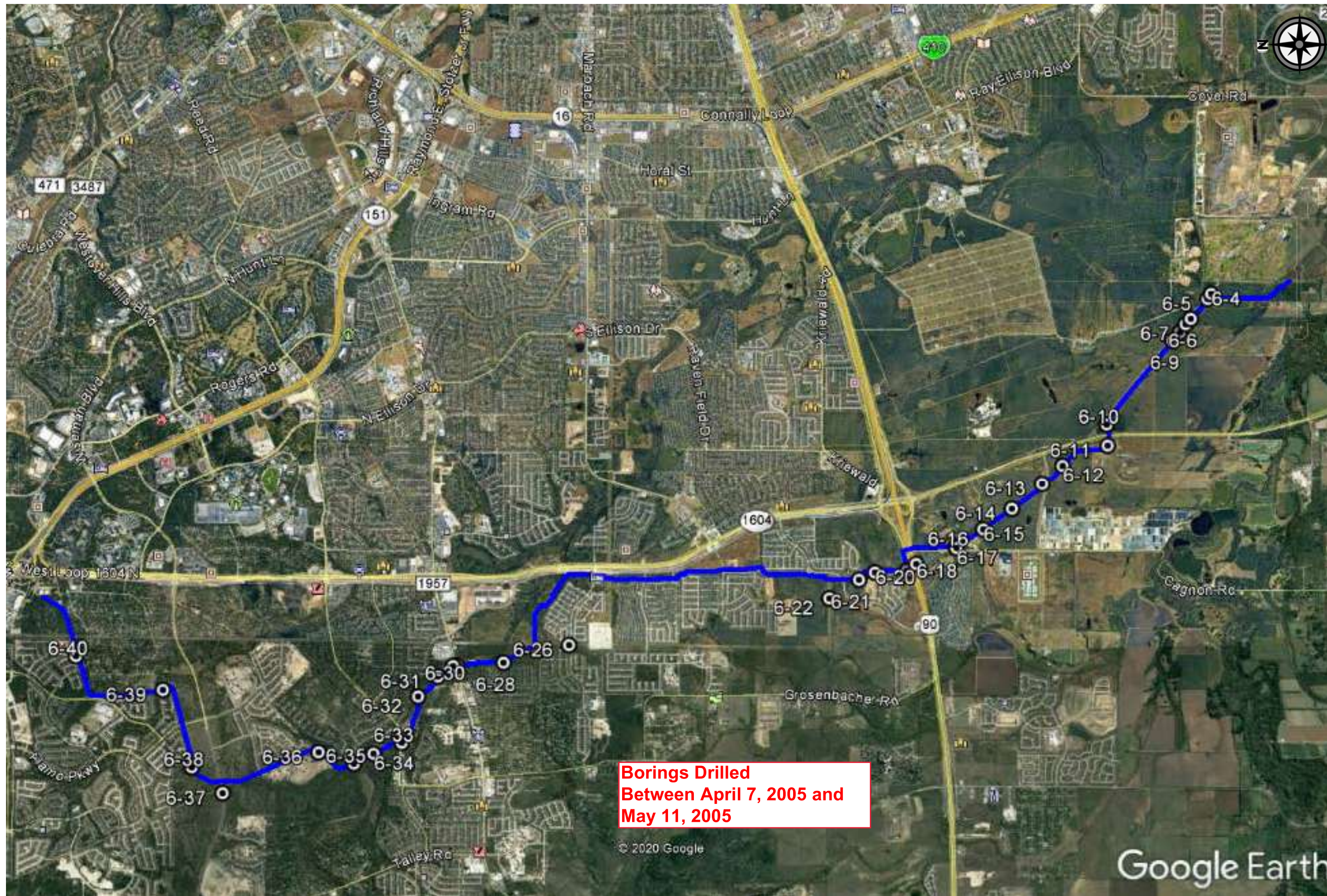
Test Name	Test Method	Log Designation
Water (moisture) content of soil and rock by mass	ASTM D 2216	wc
Liquid limit, plastic limit, and plasticity index of soils	ASTM D 4318	PL, LL, PI
Amount of material in soils finer than the No. 200 sieve	ASTM D 1140	-200
Unconfined Compressive Strength of soil	ASTM D 2166	Uc



**APPENDIX E: BORING LOGS FROM PREVIOUS STUDY**



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**Borings Drilled  
Between April 7, 2005 and  
May 11, 2005**



142 Chula Vista, San Antonio, Texas 78232  
Phone: (210) 308-5884 • Fax: (210) 308-5886

**BORING LOCATION PLAN**

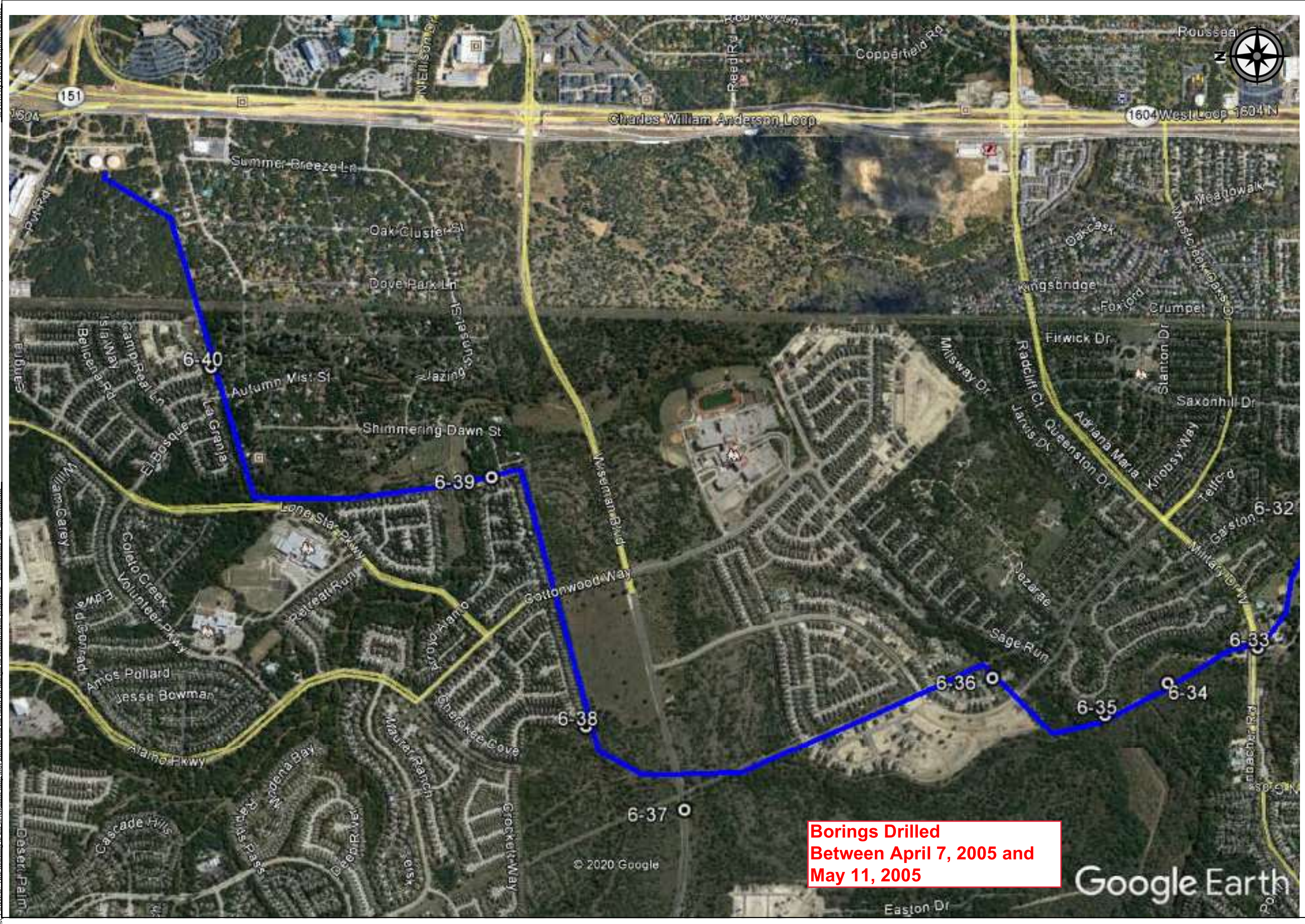
SAWS Water Resources Integration  
Program (WRIP) Pipeline – Segment 3  
San Antonio, TX

Job No.:	2019-1148
Scale:	N.T.S.
Date:	June 15, 2020
Drawn By:	RWL
Checked By:	GK
Approved By:	GK

**Figure 2**  
1 of 5



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142 Chula Vista, San Antonio, Texas 78232  
 Phone: (210) 308-5884 • Fax: (210) 308-5886

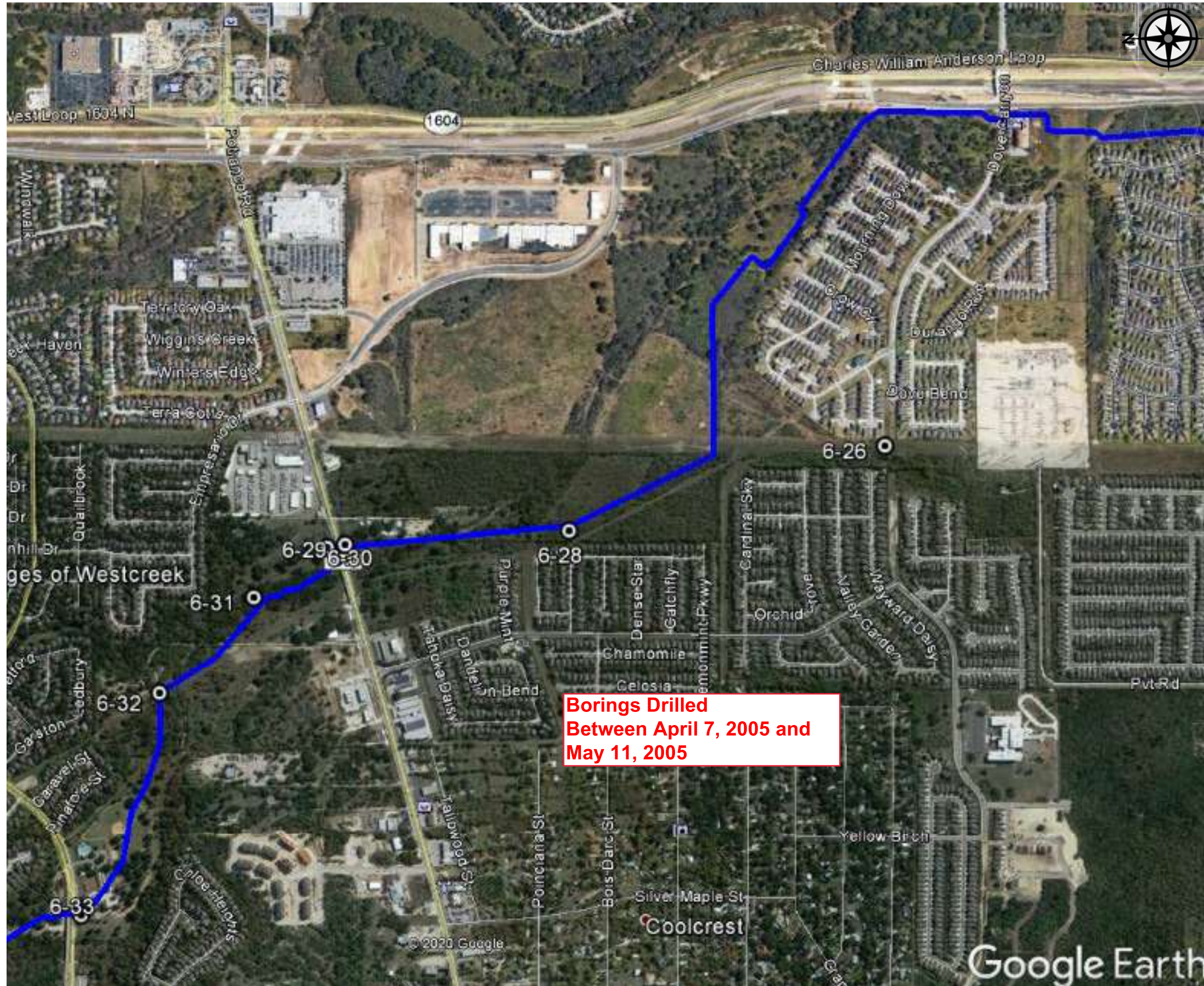
**BORING LOCATION PLAN**

SAWS Water Resources Integration  
 Program (WRIP) Pipeline – Segment 3  
 San Antonio, TX

Job No.:	2019-1148
Scale:	N.T.S.
Date:	June 15, 2020
Drawn By:	RWL
Checked By:	GK
Approved By:	GK

**Figure 2**  
2 of 5





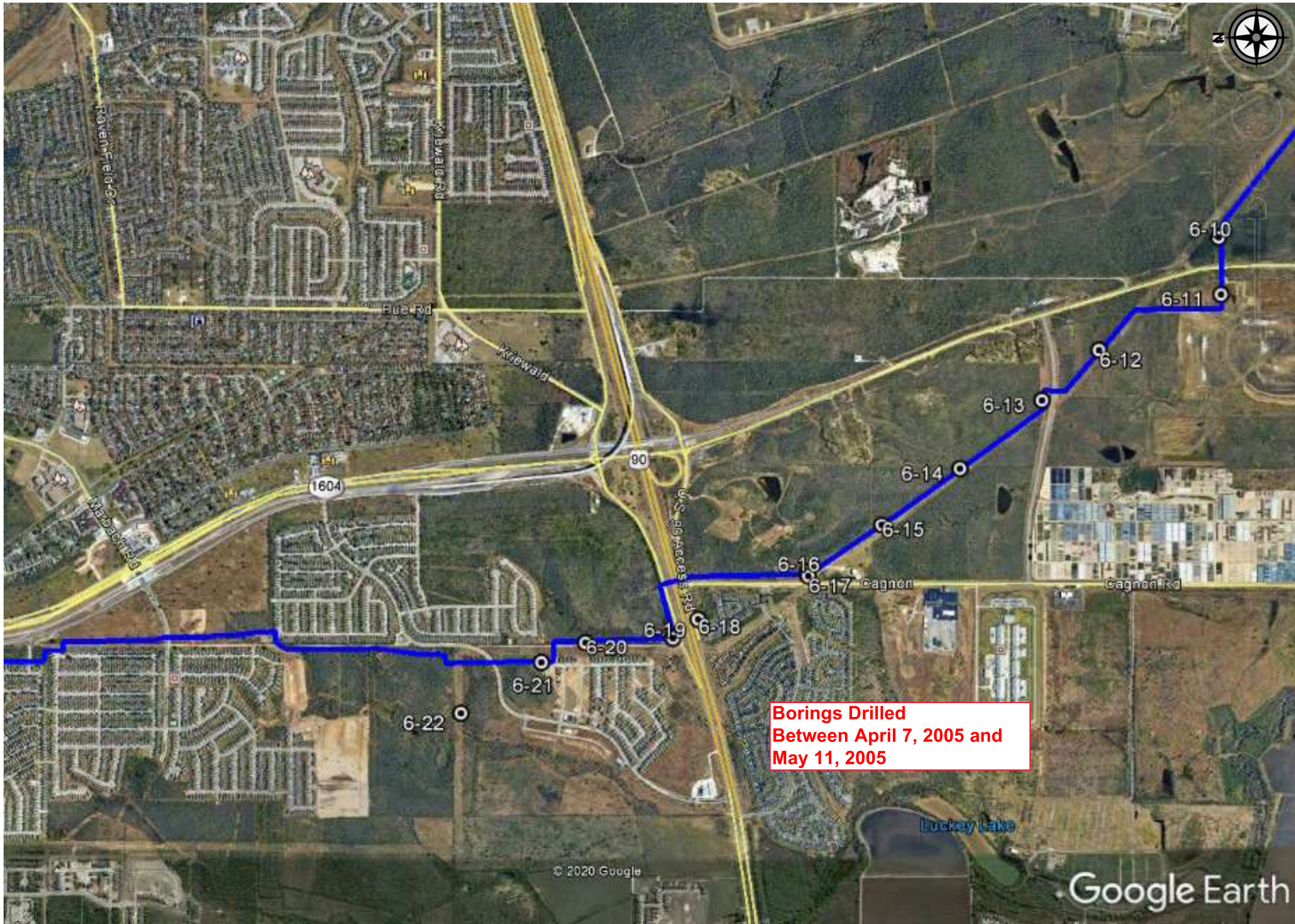
**BORING LOCATION PLAN**

SAWS Water Resources Integration  
 Program (WRIP) Pipeline – Segment 3  
 San Antonio, TX

Job No.:	2019-1148
Scale:	N.T.S.
Date:	June 15, 2020
Drawn By:	RWL
Checked By:	GK
Approved By:	GK

**Figure 2**





142 Chula Vista, San Antonio, Texas 78232  
 Phone: (210) 308-5884 • Fax: (210) 308-5886

**BORING LOCATION PLAN**

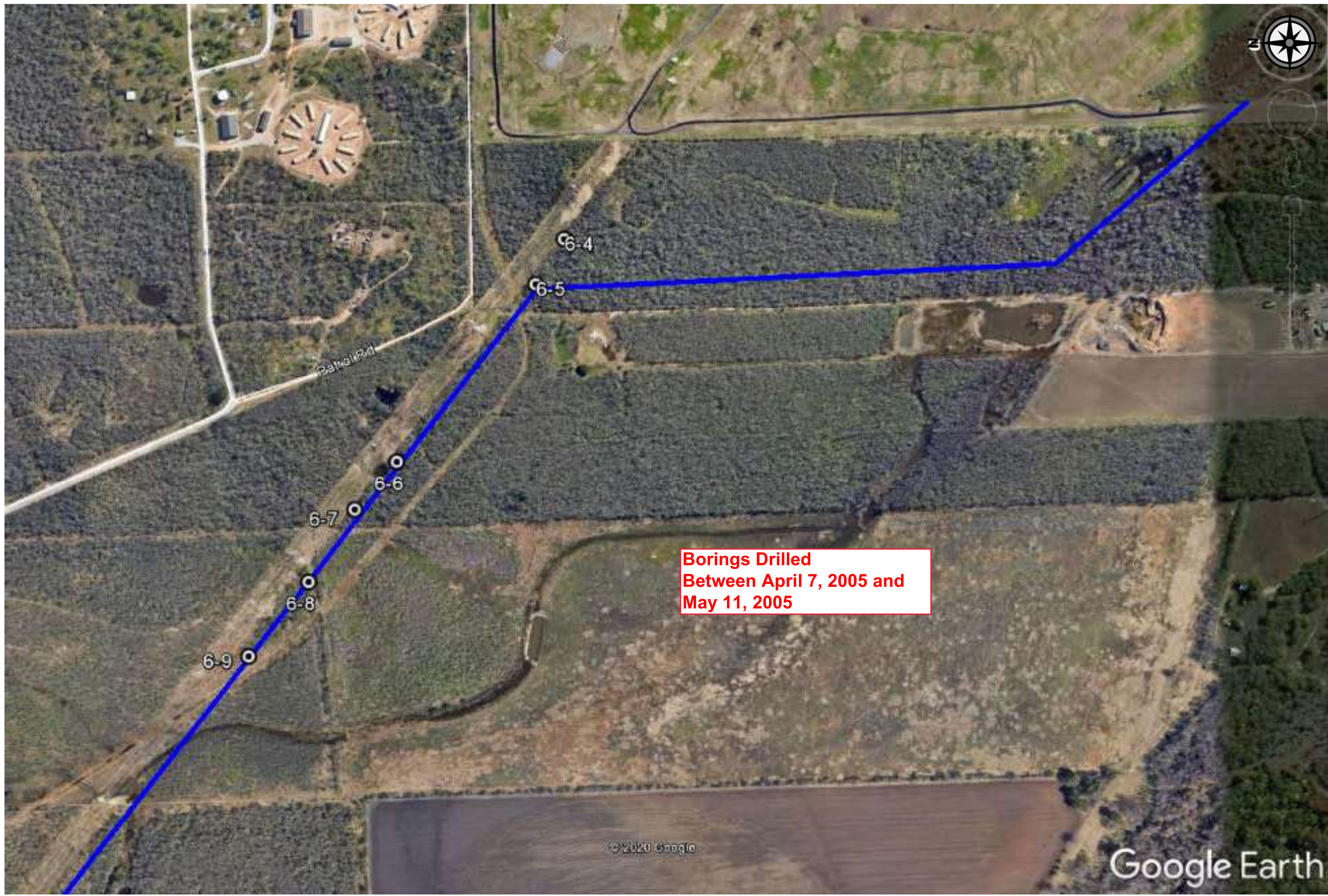
SAWS Water Resources Integration  
 Program (WRIP) Pipeline – Segment 3  
 San Antonio, TX

Job No.:	2019-1148
Scale:	N.T.S.
Date:	June 15, 2020
Drawn By:	RWL
Checked By:	GK
Approved By:	GK

**Figure 2**



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**BORING LOCATION PLAN**

SAWS Water Resources Integration  
Program (WRIP) Pipeline – Segment 3  
San Antonio, TX

Job No.: 2019-1148
Scale: N.T.S.
Date: June 15, 2020
Drawn By: RWL
Checked By: GK
Approved By: GK

**Figure 2**  
5 of 5



# Boring Log No. 6-4



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: JWM Elev.:  
 Sampling Date: 5/10/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
CLAY (CH), with Sand and Gravel, dark brown, hard	1	1: SS	14					29	
Clayey GRAVEL (GC), with Sand, tan, very dense	2	2: SS	9	26	71	45		54	
	3	3: SS	4					50/5"	
	4	4: SS	3					**50/6"	
	5	5: SS	4					**50/6"	
	6	6: SS	9	15	45	30		50/6"	
	7	7: SS	12					**50/6"	
CLAY (CL), with Sand, trace Gravel, green, very hard	8	8: SS	11	16	31	15		50/6"	70
	9	9: ST	17				8.5		
CLAY (CH), grayish tan trace green, hard	10	10: ST	24					10	
	11	11: ST	25					10	
	12	12: ST	21	24	57	33	10.5		
	13	13: ST	21					10	
	14	14: ST	22	25	58	33	10		
	15	15: ST	23					9	
	16	16: ST	23						
Completion Depth: 49.7 ft.									

Groundwater During Drilling: None Observed  
 Dry and Caved at 27.25 ft. after 24 hour wait

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

SN = Sample Type and No.      LL = Liquid Limit (%)  
 ST = Shelby Tube Sample      PI = Plasticity Index  
 SS = Split Spoon Sample      PP = Pocket Penetrometer (tsf)  
 WC = Water Content (%)      -200 = % Passing #200 Sieve  
 N = SPT Blow Counts  
 \*\* = Blow Counts During Seating Penetration  
 PL = Plastic Limit (%)

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05

# Boring Log No. 6-5



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: JWM Elev.:  
 Sampling Date: 5/10/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
CLAY (CH), trace Sand and Gravel, dark brown, hard	0	1: ST	19	25	62	37	10		
Clayey GRAVEL (GC), with Sand, light brown, dense to very dense	5	2: SS	15					36	
	10	3: SS	12					45	23
	15	4: SS	6					50/4"	
	20	5: SS	10					50/5"	
	25	6: SS	3					**50/6"	
	30	7: SS	5					**50/6"	
	35	8: SS	13	20	36	16		50/6"	
Sandy CLAY (CL), green, very hard	40	9: SS	13					**50/6"	
	45	10: SS	27					38	
CLAY (CH), tan and gray, hard	50	11: ST	23	25	50	25	10		
	55	12: ST	22				10.5		
	60	13: ST	22	24	36	12	10		
CLAY (CL), tan and gray, hard	65	14: ST	22				10		
	70	15: ST	23 26	23	49	26	8		
Completion Depth: 49.7 ft.									

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05

Groundwater During Drilling: None Observed  
 Dry and Caved at 47.17 ft. after 24 hour wait

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

- SN = Sample Type and No.
- ST = Shelby Tube Sample
- SS = Split Spoon Sample
- WC = Water Content (%)
- N = SPT Blow Counts
- \*\* = Blow Counts During Seating Penetration
- PL = Plastic Limit (%)
- LL = Liquid Limit (%)
- PI = Plasticity Index
- PP = Pocket Penetrometer (tsf)
- 200 = % Passing #200 Sieve



# Boring Log No. 6-6



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: JWM Elev.:  
 Sampling Date: 5/10/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N
CLAY (CH), trace Sand and Gravel, dark brown, very stiff	0 - 1	1: SS	20	22	69	47		16
GRAVEL (GP), with Clay and Sand, tan, dense to medium dense	1 - 5	2: SS	21					39
Sandy CLAY (CL), with Gravel, tan, hard	5 - 8	3: SS	8					27
CLAY (CH), trace Sand calcareous deposits and iron oxide deposits, grayish tan, hard to very hard	8 - 10	4: ST	18	20	50	30	12.5	
	10 - 14	5: ST	14				14+	
	14 - 15	6: ST	15	21	57	36	8.5	
-trace Gravel	15 - 20	7: SS	20	21	54	33		77
Sandy CLAY (CL), with sand pockets, trace Gravel, tannish green, very hard to hard	20 - 25	8: SS	19					**50/4"
	25 - 30	9: SS	22					45
	30 - 35	10: SS	24					40
CLAY (CH), with Sand, tannish green, hard to very stiff	35 - 40	11: ST	24				7	
	40 - 45	12: ST	25	21	57	36	9	
-tannish gray	45 - 50	13: ST	27				6.5	
	50 - 50.7	14: ST	26	24	73	49	4	
Completion Depth: 49.7 ft.								

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05

Groundwater During Drilling: None Observed  
 Dry and Caved at 47.67 ft. after 24 hour wait

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

- SN = Sample Type and No.
- ST = Shelby Tube Sample
- SS = Split Spoon Sample
- WC = Water Content (%)
- N = SPT Blow Counts
- \*\* = Blow Counts During Seating Penetration
- PL = Plastic Limit (%)
- LL = Liquid Limit (%)
- PI = Plasticity Index
- PP = Pocket Penetrometer (tsf)

# Boring Log No. 6-7



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/29/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	DD	Uc
CLAY (CH), with Sand, trace Gravel, dark gray brown, hard	1	1: SS	15					11	78		
	2	2: ST	24	20	72	52	10.5				
Sandy CLAY (CL), some Gravel, light brown, very hard	5	3: SS	15					51	63		
Clayey GRAVEL (GC), with Sand, light brown, very dense	4	4: SS	5	13	48	35		**50/6"			
	10	5: SS	12					50/6"			
	6	6: SS	9					61	27		
CLAY (CH), with Sand, trace Gravel, tan and green, hard	15	7: ST	19	16	60	44	7.25		78	115	6.9
Sandy CLAY (CH), green, hard	20	8: ST	16				9				
	25	9: ST	19				10				
	30	10: ST	26	21	66	45	8		45	101	1.8
Clayey SAND (SC), tan and green, very dense	35	11: ST	17				4.5				
	40	12: ST	24				7.25				
	45	13: ST	24	19	60	41	7.25		47	6	5.8
	50	14: ST	20				8.75				
Completion Depth: 49.5 ft.	50										

Groundwater During Drilling: None Observed  
 Final Reading of 47.58 ft. after 24 hr. wait  
 Hole Caved at 44 ft. after 24 hours

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

- SN = Sample Type and No.
- ST = Shelby Tube Sample
- SS = Split Spoon Sample
- WC = Water Content (%)
- N = SPT Blow Counts
- \*\* = Blow Counts During Seating Penetration
- PL = Plastic Limit (%)
- LL = Liquid Limit (%)
- PI = Plasticity Index
- PP = Pocket Penetrometer (tsf)
- 200 = % Passing #200 Sieve
- DD = Dry Density (pcf)
- Uc = Unconfined Compression Test (tsf)

BORING LOG 04SA-2118-WITHOUT FIELD ID GPJ ARIAS.GDT 6/1/05



# Boring Log No. 6-8



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/29/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	DD	Uc
CLAY (CH), some Sand and Gravel, dark gray brown, hard  -very stiff from the 2' to 4' interval	1	1: ST	21	19	63	44	5.5				
	2										
	4	2: ST	24				3.75		83		
Sandy CLAY (CH), some Gravel, light brown, very hard	6	3: ST	18				9.75			107	10.2
	8	4: SS	14	16	56	40		50/6"	68		
	10	5: SS	12					53			
Clayey GRAVEL (GC), with Sand, tan, very dense	12	6: SS	4					84/11"			
	14	7: SS	6					75			
	16	8: SS	6					64			
	18										
Sandy CLAY (CH), tan, hard	20	9: SS	17					35			
Completion Depth: 20 ft.											

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05

Groundwater During Drilling: None Observed

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

- SN = Sample Type and No.
- ST = Shelby Tube Sample
- SS = Split Spoon Sample
- WC = Water Content (%)
- N = SPT Blow Counts
- PL = Plastic Limit (%)
- LL = Liquid Limit (%)
- PI = Plasticity Index
- PP = Pocket Penetrometer (tsf)
- 200 = % Passing #200 Sieve
- DD = Dry Density (pcf)
- Uc = Unconfined Compression Test (tsf)

# Boring Log No. 6-9



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 5/2/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
CLAY (CH), trace Sand and Gravel, dark gray brown, hard  -very stiff from the 2.5' to 4' interval  -light brown  -trace iron oxide deposits	1	1: ST	16	23	69	46	12		
	2								
	4	2: SS	20					23	92
	6								
	8	4: ST	21				8		95
	10								
	12	6: ST	22				8.75		
	14								
	16	7: ST	23				7.25		
	18								
	20	8: ST	22	18	76	58	4.25		
Completion Depth: 20 ft.									

Groundwater During Drilling: None Observed

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

SN = Sample Type and No.      PP = Pocket Penetrometer (tsf)  
 ST = Shelby Tube Sample      -200 = % Passing #200 Sieve  
 SS = Split Spoon Sample  
 WC = Water Content (%)  
 N = SPT Blow Counts  
 PL = Plastic Limit (%)  
 LL = Liquid Limit (%)  
 PI = Plasticity Index

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05



# Boring Log No. 6-10



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/7/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	-200	DD	Uc
Sandy CLAY (CL), trace Gravel, hard, Fill	0	1: ST	7	17	69	52	8.75			
CLAY (CH), trace Sand and Gravel, tan some gray, very stiff, Fill -gray brown and tan, hard from the 4' to 6' interval	5	2: ST	24				2.75	91		
	10	3: ST	24	21	70	49	5.5			
	15	4: ST	22				4	91		
	20	5: ST	14	15	43	28	7.75			
CLAY (CL), some Sand, calcareous and iron oxide deposits, Possible Fill, hard	25	6: ST	19				5			
	30	7: ST	28	23	69	46	4.25	89	100	2.5
CLAY (CH), trace Gravel and Sand, hard  -trace iron oxide deposits, grayish tan	35	8: ST	19				12.5			
	40	9: ST	20				13		112	8.1
	45	10: ST	19	22	69	47	12			
	50	11: ST	18				15		112	3.0
-tan and gray	55	12: ST	19				12	93		
	60	13: ST	21				10			
CLAYSTONE, dark gray	65	14: ST	22	25	82	57	10			
Completion Depth: 49.5 ft.	49.5									

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05

Groundwater During Drilling: None Observed  
 Hole Caved at 49 ft. after 24 hours

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

- SN = Sample Type and No.
- ST = Shelby Tube Sample
- WC = Water Content (%)
- PL = Plastic Limit (%)
- LL = Liquid Limit (%)
- PI = Plasticity Index
- PP = Pocket Penetrometer (tsf)
- 200 = % Passing #200 Sieve
- DD = Dry Density (pcf)
- Uc = Unconfined Compression Test (tsf)

# Boring Log No. 6-11



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/7/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	DD	Uc
CLAY (CH), trace Sand and Gravel, gray brown, very stiff	1	1: ST	21	20	60	40	3.25				
CLAY (CH), trace Sand, dark gray brown, very stiff to hard	2	2: ST	23				3.25		92		
-trace calcareous deposits, grayish tan	5	3: ST	22	17	61	44	3.5				
-trace Gypsum	4	4: ST	17				5.5			111	6.2
	10	5: SS	21	23	66	43	7.75	77	100		
	6	6: SS	19				10	73			
-trace iron oxide deposits	15	7: ST	20				13				
	8	8: ST	18	20	62	42	12.25				
	20										
	9	9: ST	18				11			138	6.3
	25										
	10	10: ST	19				13.5		100		
	30										
	11	11: ST									
	35										
-tannish gray	12	12: ST	21	23	80	57	11.25				
	40										
	13	13: ST	20				13				
	45										
	14	14: ST	21				11.75		99	136	4.9
	50										
Completion Depth: 50 ft.											

Groundwater During Drilling: None Observed  
 Hole Caved at 49 ft. after 24 hours

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

- SN = Sample Type and No.
- ST = Shelby Tube Sample
- SS = Split Spoon Sample
- WC = Water Content (%)
- N = SPT Blow Counts
- PL = Plastic Limit (%)
- LL = Liquid Limit (%)
- PI = Plasticity Index
- PP = Pocket Penetrometer (tsf)
- 200 = % Passing #200 Sieve
- DD = Dry Density (pcf)
- Uc = Unconfined Compression Test (tsf)

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/7/05



# Boring Log No. 6-12



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/28/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	DD	Uc
CLAY (CL), with Sand and Gravel, dark brown	2	1: ST	7						64		
GRAVEL (GP), with Clay and Sand, tan, very dense	4	2: SS	4					73			
Clayey GRAVEL (GC), with Sand, tan, medium dense	6	3: SS	8					24			
CLAY (CH), tan and gray, hard	8	4: ST	6				13.25				
-Chalk Seam	10	5: ST	18				7.5	98	110	3.8	
-with Sand, trace calcareous deposits and iron oxide deposits, some green	12	6: SS	19					33			
	14	7: ST	19				10				
	16	8: ST	17				13.5				
	18	9: ST	18	17	68	51	9.25				
Completion Depth: 19.5 ft.	20										

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05

Groundwater During Drilling: None Observed

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

- SN = Sample Type and No.
- ST = Shelby Tube Sample
- SS = Split Spoon Sample
- WC = Water Content (%)
- N = SPT Blow Counts
- PL = Plastic Limit (%)
- LL = Liquid Limit (%)
- PI = Plasticity Index
- PP = Pocket Penetrometer (tsf)
- 200 = % Passing #200 Sieve
- DD = Dry Density (pcf)
- Uc = Unconfined Compression Test (tsf)

# Boring Log No. 6-13



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/7/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	DD	Uc
CLAY (CH), with Sand, trace Gravel and calcareous deposits, gray brown, hard -very stiff from the 2' to 4' interval  -tan  -tan and gray          -trace iron oxide deposits	1	1: ST	26				5.5		83		
	2	2: ST	22	19	60	41	2				
	5	3: SS	17					51			
	4	4: ST	22				9		98		
	10	5: ST	22	21	59	38	6.5				
	15	6: ST	21				6.5				
	16	7: ST	16				7				
	20	8: ST	24	22	65	43	9.5			106	6.9
	25	9: ST	21				12.5				
	30	10: ST	20				14				
	35	11: ST	19				15		100	68	19.2
	40	12: ST	18				9.25				
	45	13: ST	19	20	58	38	14				
	50	14: ST	17				12.5				
Completion Depth: 50 ft.											

Groundwater During Drilling: None Observed  
 Hole Caved at 48.5 ft. after 24 hours

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

- SN = Sample Type and No.
- ST = Shelby Tube Sample
- SS = Split Spoon Sample
- WC = Water Content (%)
- N = SPT Blow Counts
- PL = Plastic Limit (%)
- LL = Liquid Limit (%)
- PI = Plasticity Index
- PP = Pocket Penetrometer (tsf)
- 200 = % Passing #200 Sieve
- DD = Dry Density (pcf)
- Uc = Unconfined Compression Test (tsf)

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/7/05



# Boring Log No. 6-14



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: JK Elev.:  
 Sampling Date: 4/27/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
CLAY (CL), with Sand, trace Gravel, dark brown, hard to very stiff	2	1: ST	16	19	37	18	14		
	4	2: ST	25				3.75		80
Sandy CLAY (CL), with Gravel, tan, hard	4								
Clayey GRAVEL (GC), tan, medium dense	6	3: ST	10				5		64
	6	4: SS						14	
CLAY (CH), tan, hard	6								
	8	5: ST	25	20	61	41	4.25		
	10	6: ST	26				4.5		100
	12	7: ST	24				5.5		
	14								
	16	8: ST	23				6		
	18								
	18	9: ST	23				8.25		
	20								
Completion Depth: 19.5 ft.	20								

Groundwater During Drilling: None Observed

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

SN = Sample Type and No.      PP = Pocket Penetrometer (tsf)  
 ST = Shelby Tube Sample      -200 = % Passing #200 Sieve  
 SS = Split Spoon Sample  
 WC = Water Content (%)  
 N = SPT Blow Counts  
 PL = Plastic Limit (%)  
 LL = Liquid Limit (%)  
 PI = Plasticity Index

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05

# Boring Log No. 6-15



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: JK Elev.:  
 Sampling Date: 4/27/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
CLAY (CH), with Sand, trace Gravel, dark brown, hard	.....	1: ST	20	20	54	34	9.5		
	.....	2: ST	24				4.25		78
Gravelly CLAY (CH), with Sand, gray brown, stiff	5	3: SS	21	17	61	44		14	70
CLAY (CH), trace Sand, tan and gray, very stiff to hard	.....	4: SS	22					21	
	.....	5: ST	31	22	76	54	4		
	.....	6: ST	31				5.25		98
	.....	7: ST	28	26	78	52	7.75		
	.....	8: ST	31				9.25		
	.....	9: ST	30				11.25		
	.....	10: ST	30				13		
CLAYSTONE, tan and gray	.....	11: ST	32	33	72	39	11.75		
	.....	12: ST	32				6		
	.....	13: ST	32	34	74	40	12		99
	.....	14: GB	33				13.5		
Completion Depth: 49 ft.	50								

Groundwater During Drilling: None Observed

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

SN = Sample Type and No.      PI = Plasticity Index  
 ST = Shelby Tube Sample      PP = Pocket Penetrometer (tsf)  
 SS = Split Spoon Sample      -200 = % Passing #200 Sieve  
 GB = Grab Bag Sample  
 WC = Water Content (%)  
 N = SPT Blow Counts  
 PL = Plastic Limit (%)  
 LL = Liquid Limit (%)

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05



# Boring Log No. 6-16



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/8/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	DD	Uc
Clayey GRAVEL (GC), with Sand, gray brown, very dense to dense -light reddish tan	1	1: SS	3	24	71	47		59	50		
	2	2: SS	10					72			
	5	3: SS	9	18	27	9		49	32		
Sandy CLAY (CL), some Gravel and calcareous deposits, light reddish tan, hard	4	4: SS	19					35			
	10	5: SS	4					**50/6"			
Clayey GRAVEL (GC), with Sand, light grayish tan, very dense	6	6: SS	4					**50/6"			
Clayey SAND (SC), with Gravel, tan, very dense	7	7: SS	3					**50/4"			
	15	8: SS	5	13	26	13		**50/5"	46		
	20	9: SS	6					**50/5"			
	25	10: SS	9	15	39	24		86	40		
-trace iron oxide deposits	30	11: ST	15				9.75				
	35	12: ST	19	19	65	46	9.25				
	40	13: ST	20				9.75				
	45	14: ST	20				13.25				
	50	15: ST	21	23	70	47	14.25			104	4.2
CLAYSTONE, tan and gray	50										
-tan	50										
Completion Depth: 49.5 ft.											

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05

Groundwater During Drilling: None Observed  
 Hole Caved at 49 ft. after 24 hours

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

- SN = Sample Type and No.
- ST = Shelby Tube Sample
- SS = Split Spoon Sample
- WC = Water Content (%)
- N = SPT Blow Counts
- \*\* = Blow Counts During Seating Penetration
- PL = Plastic Limit (%)
- LL = Liquid Limit (%)
- PI = Plasticity Index
- PP = Pocket Penetrometer (tsf)
- 200 = % Passing #200 Sieve
- DD = Dry Density (pcf)
- Uc = Unconfined Compression Test (tsf)

# Boring Log No. 6-17



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/8/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	DD	Uc
Clayey SAND (SC), with calcareous deposits, tan some gray brown, Fill	1	1: ST	23	24	31	7	7				
Sandy CLAY (CL), with calcareous deposits, tan, very stiff	2	2: ST	17				3.5				
Clayey GRAVEL (GC), with Sand and calcareous deposits, tan, dense	5	3: SS	7					41	49		
Sandy CLAY (CL), with calcareous deposits, tan and white, hard to very hard	4	4: ST	14				6				
	10	5: ST	16	13	26	13	5.75				
	15	6: ST	15				6				
	15	7: ST	12	12	29	17	8.5				
	20	8: SS	11	14	32	18		50/4"	64		
	25	9: SS	10					**50/4"			
CLAYSTONE, tan and gray	30	10: SS	17					**50/6"			
-grayish tan	35	11: SS	23				9.75	73/10"			
-gray	40	12: ST	22	20	64	44	9.5			104	5.5
-tan	45	13: ST	22				11.25				
-some gray	56	14: ST	24				9.25				
Completion Depth: 49.5 ft.	56										

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05

Groundwater During Drilling: None Observed  
 Hole Caved at 48.5 ft. after 24 hours

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

- SN = Sample Type and No.
- ST = Shelby Tube Sample
- SS = Split Spoon Sample
- WC = Water Content (%)
- N = SPT Blow Counts
- \*\* = Blow Counts During Seating Penetration
- PL = Plastic Limit (%)
- LL = Liquid Limit (%)
- PI = Plasticity Index
- PP = Pocket Penetrometer (tsf)
- 200 = % Passing #200 Sieve
- DD = Dry Density (pcf)
- Uc = Unconfined Compression Test (tsf)



# Boring Log No. 6-18



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/11/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	-200	DD	Uc
CLAY (CH), with iron oxide deposits, some Sand and Gravel, grayish tan and reddish brown, hard -some calcareous deposits, very stiff from the 2' to 10' interval -grayish tan  -greenish tan  -grayish tan  -trace calcareous deposits, tannish gray  -gray  -grayish tan	1	ST	17	24	79	55	13			
	2	ST	37				2			
	5	ST	36	31	97	66	2.25		87	1.4
	4	ST	36				2.75	91		
	10	ST	36				4			
	6	ST	31				5			
	15	ST	27	25	95	70	6.25	100	94	4.4
	20	ST	20				8.5			
	25	ST	25				8.75			
	30	ST	29	26	77	51	7.5			
	35	ST	29				7.75			
	40	ST	27				6.5	99		
	45	ST	27				5.25			
	CLAYSTONE	50	ST	27	24	86	62	7.75		98
Completion Depth: 49.5 ft.										

BORING LOG 04SA-2118-WITHOUT FIELD ID GPJ ARIAS\_GDT 6/1/05

Groundwater Observed at 43 ft. during drilling  
 Final Reading of 17.75 ft. after 24 hr. wait  
 Hole Caved at 39.75 ft. after 24 hours

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

- SN = Sample Type and No.
- ST = Shelby Tube Sample
- WC = Water Content (%)
- PL = Plastic Limit (%)
- LL = Liquid Limit (%)
- PI = Plasticity Index
- PP = Pocket Penetrometer (tsf)
- 200 = % Passing #200 Sieve
- DD = Dry Density (pcf)
- Uc = Unconfined Compression Test (tsf)

# Boring Log No. 6-19



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/11/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	DD	Uc
Clayey GRAVEL (GC), with Sand, gray brown and tan, dense, Fill	0	1: SS	8	19	77	58		31	46		
CLAY (CH), trace Sand, gray brown, very stiff to hard	5	2: ST	35				3				
	10	3: ST	35				3				
-trace calcareous deposits	15	4: ST	34	21	67	46	2.5		95	106	2.0
	20	5: ST	20				6				
	25	6: ST	28				5				
	30	7: ST	33				6				
-trace iron oxide deposits, tannish gray	35	8: ST	33	28	86	58	4.5			79	1.9
	40	9: ST	31				7				
	45	10: ST	28				7.25		91		
-trace Gypsum, gray	50	11: ST	32				8				
	55	12: ST	28	24	77	53	8.75			87	3.0
	60	13: ST	31				5.75				
	65	14: ST	31				8		100		
Completion Depth: 49.5 ft.											

Groundwater During Drilling: None Observed  
 Hole Caved at 38 ft. after 24 hours

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

- SN = Sample Type and No.
- ST = Shelby Tube Sample
- SS = Split Spoon Sample
- WC = Water Content (%)
- N = SPT Blow Counts
- PL = Plastic Limit (%)
- LL = Liquid Limit (%)
- PI = Plasticity Index
- PP = Pocket Penetrometer (tsf)
- 200 = % Passing #200 Sieve
- DD = Dry Density (pcf)
- Uc = Unconfined Compression Test (tsf)

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS GDT 6/1/05



# Boring Log No. 6-20



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: JK Elev.:  
 Sampling Date: 4/28/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	DD	Uc
CLAY (CH), with Gravel, trace Sand, dark brown, stiff to very stiff  -hard from the 2' to 6' interval	2	1: SS	16	22	90	68		8			
	4	2: ST	25				6.75		77		
	6	3: ST	26				5.25			96	4.9
	8	4: ST	11	17	71	54	2.5				
Clayey GRAVEL (GC), with Sand, tan, very dense to dense	10	5: SS						81			
	10	6: SS	9					43	41		
CLAY (CH), tan and gray, hard	12	7: ST	13	17	71	54	6.75			114	5.6
	14	8: ST	15				7				
	16	9: ST	25				5.25				
	18	10: ST	29				5.75				
Completion Depth: 19.5 ft.	20										

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05

Groundwater During Drilling: None Observed

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

- SN = Sample Type and No.
- ST = Shelby Tube Sample
- SS = Split Spoon Sample
- WC = Water Content (%)
- N = SPT Blow Counts
- PL = Plastic Limit (%)
- LL = Liquid Limit (%)
- PI = Plasticity Index
- PP = Pocket Penetrometer (tsf)
- 200 = % Passing #200 Sieve
- DD = Dry Density (pcf)
- Uc = Unconfined Compression Test (tsf)



# Boring Log No. 6-21



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: JK Elev.:  
 Sampling Date: 4/28/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	-200	DD	Uc
CLAY (CH), with Sand, dark gray, hard	1	1: ST	17				5.5	79		
	2									
	4	2: ST	20	17	51	34			105	3.0
Calcareous CLAY (CH), with Sand, tan, hard	6						4.75			
	8									
	10	5: ST	14				10.25			
	12									
	14	6: ST	11	14	48	34	12.25	85	117	6.1
	16									
CLAY (CH), tan, hard	18									
	20	8: ST	22				5.5			
	22									
Completion Depth: 19.5 ft.	20									

Groundwater During Drilling: None Observed

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

- SN = Sample Type and No.
- ST = Shelby Tube Sample
- WC = Water Content (%)
- PL = Plastic Limit (%)
- LL = Liquid Limit (%)
- PI = Plasticity Index
- PP = Pocket Penetrometer (tsf)
- 200 = % Passing #200 Sieve
- DD = Dry Density (pcf)
- Uc = Unconfined Compression Test (tsf)

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05

# Boring Log No. 6-22



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/28/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
CLAY (CH), trace Sand and Gravel, dark brown, hard to very stiff	2	1: ST	18	21	81	60	4.5		
	4	2: ST	31				2		89
	6	3: ST	32				2.75		
	8	4: SS	31	25	74	49		21	86
Clayey GRAVEL (GC), with Sand, tan, very dense to medium dense	10	5: SS	18					65	
	12	6: SS	14					22	
	14	7: SS	19					30	
	16	8: ST	44				5.5		
CLAY (CH), tan and light brownish gray, hard  -tan and gray	18								
	20	9: ST	24	23	94	71	9		98
	20	Completion Depth: 20 ft.							

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS GDT 6/7/05

Groundwater Observed at 11 ft. during drilling  
 Final Reading of 18.06 ft. after 24 hr. wait  
 Hole Caved at 17.83 ft. after 24 hours

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

- SN = Sample Type and No.
- ST = Shelby Tube Sample
- SS = Split Spoon Sample
- WC = Water Content (%)
- N = SPT Blow Counts
- PL = Plastic Limit (%)
- LL = Liquid Limit (%)
- PI = Plasticity Index
- PP = Pocket Penetrometer (tsf)
- 200 = % Passing #200 Sieve



# Boring Log No. 6-23



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/28/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	DD	Uc
CLAY (CH), trace Sand and Gravel, dark gray brown, hard	1	1: ST	19	17	59	42	5.5				
	2										
	4	2: ST	22				6		96		
CLAY (CL), some Sand and iron oxide deposits, trace calcareous deposits, tan, hard	6	3: ST	18	61	67	6	13			113	8.3
	8	4: ST	13				14		86		
	10	5: ST	14	15	49	34	14			114	7.7
MARLSTONE, tan, very dense	12	6: ST	12				14				
	14	7: ST	10				19				
	16	8: SS	8					**50/5"			
-olive tan	18										
	19	9: SS	10	14	42	28		50/6"			
Completion Depth: 19.5 ft.	20										

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS GDT 6/7/05

- Groundwater During Drilling: None Observed
- Grab Bag Sample (GB)
  - Shelby Tube Sample (ST)
  - Split Spoon Sample (SS)
  - Water encountered during drilling
  - Delayed water reading

**Refer to Appendix for Additional Information**

SN = Sample Type and No.	LL = Liquid Limit (%)
ST = Shelby Tube Sample	PI = Plasticity Index
SS = Split Spoon Sample	PP = Pocket Penetrometer (tsf)
WC = Water Content (%)	-200 = % Passing #200 Sieve
N = SPT Blow Counts	DD = Dry Density (pcf)
** = Blow Counts During Seating Penetration	Uc = Unconfined Compression Test (tsf)
PL = Plastic Limit (%)	

# Boring Log No. 6-29



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: JWM Elev.:  
 Sampling Date: 5/11/05

Soil Description	Depth (ft)	SN	WC	N	-200
GRAVEL (GP), with Clay and Sand, some asphalt, brown, Fill	.....	1: GB	3		5
	.....	2: GB	3		
Clayey GRAVEL (GC), with Sand, brown, medium dense	5	3: SS	16	25	25
	.....	4: SS		**10/0"	
LIMESTONE, tan, very dense	.....	5: GB	6		
	.....	6: SS		**10/0"	
	10	7: GB	12		
	.....	8: SS		**10/0"	
	.....	9: GB	4		
	.....	10: SS		**10/0"	
	15	11: GB	21		
CLAY (CL), tan	.....	12: SS		**10/0"	
	20	13: GB	23		
MARLSTONE, tan, very dense	.....	14: SS	15	**50/4"	
	25	.....			
	.....	15: SS	19	**50/5"	55
	30	.....			
	.....	16: SS	20	**50/6"	47
	35	.....			
	.....	17: SS	21	**50/2"	
40	.....				
.....	18: SS	19	**50/3"		
45	.....				
.....	19: SS	17	**50/2"		
Completion Depth: 48.67 ft.	50	.....			

Groundwater Observed at 13 ft. during drilling  
 Final Reading of 12.08 ft. after 24 hr. wait  
 Hole Caved at 38.67 ft. after 24 hours

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

SN = Sample Type and No.  
 SS = Split Spoon Sample  
 GB = Grab Bag Sample  
 WC = Water Content (%)  
 N = SPT Blow Counts  
 \*\* = Blow Counts During Seating Penetration  
 -200 = % Passing #200 Sieve

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05



# Boring Log No. 6-30



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/19/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200
Gravelly CLAY (CH), with Sand, gray brown, hard	0 - 1	1: SS	8	14	51	37	43	
Clayey SAND (SC), with Gravel, gray brown, very dense  -tan	1 - 2	2: SS	4				51	26
	2 - 3	3: SS	9				**50/2"	
	3 - 4	4: SS					**10/0"	
	4 - 5	5: GB	3					
MARLSTONE, tan, very dense	5 - 6	6: SS	12	13	24	11	**50/3"	
	6 - 7	7: SS	10				**50/4"	
	7 - 8	8: SS	5				**50/2"	
	8 - 9	9: SS					**10/0"	
	9 - 10	10: GB	6	14	26	12		
	10 - 11	11: SS	17				**50/5"	
	11 - 12	12: SS	13				**50/1"	
	12 - 13	13: SS	10				**50/2"	
	13 - 14	14: SS	18	17	22	5	**50/4"	
	14 - 15	15: SS	17				50/3"	
	15 - 16	16: SS	17				**50/4"	
	16 - 17	17: SS	10				**50/2"	
	Completion Depth: 48.7 ft.	50						

Groundwater Observed at 37 ft. during drilling  
 Dry and Caved at 30.25 ft. after 24 hours

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

SN = Sample Type and No.      LL = Liquid Limit (%)  
 SS = Split Spoon Sample      PI = Plasticity Index  
 GB = Grab Bag Sample      -200 = % Passing #200 Sieve  
 WC = Water Content (%)  
 N = SPT Blow Counts  
 \*\* = Blow Counts During Seating Penetration  
 PL = Plastic Limit (%)

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05



# Boring Log No. 6-31



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/20/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200
Sandy CLAY (CH), some Gravel, dark brown, very stiff  -with Gravel, dense from the 4.5' to 6' interval, reddish brown	1	1: SS	4				25	55
	2	2: SS	10	16	54	38	24	
	3	3: SS	10				36	
	4	4: SS	14				27	
	5	5: SS	17	40	50	10	21	
Clayey GRAVEL (GC), with Sand, reddish brown, very dense	6	6: SS	13				65/10"	42
	7	7: SS	17				**50/3"	
Gravelly CLAY (CL), with Sand, reddish brown, very hard	8	8: SS					**10/0"	
	9	9: GB	18					
MARLSTONE, tan, very dense	10	10: SS	15				**50/2"	
	11	11: SS	13				**50/1"	
	12	12: SS	9				**50/1"	
	13	13: SS					**10/0"	
	14	14: GB	27					
	15	15: SS	12				**50/1"	
	16	16: SS					**10/0"	
	17	17: GB	20	14	25	11		
	18	18: SS	12				**50/2"	
	Completion Depth: 48.7 ft.	50						

Groundwater Observed at 12 ft. during drilling  
 Final Reading of 12.33 ft. after 24 hr. wait

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

SN = Sample Type and No.      LL = Liquid Limit (%)  
 SS = Split Spoon Sample      PI = Plasticity Index  
 GB = Grab Bag Sample      -200 = % Passing #200 Sieve  
 WC = Water Content (%)  
 N = SPT Blow Counts  
 \*\* = Blow Counts During Seating Penetration  
 PL = Plastic Limit (%)

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS GDT 6/1/05

# Boring Log No. 6-32



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/20/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200
Gravelly CLAY (CH), with Sand, dark brown, hard  -reddish brown	2	1: SS	12	24	62	38	27	
	4	2: SS	21				31	63
Gravelly CLAY (CL), with Sand, reddish brown, hard	6	3: SS	10	21	49	28	31	
Clayey GRAVEL (GC), with Sand, light reddish tan, very dense  -tan	8	4: SS	13				**50/3"	19
	10	5: SS	18				**50/2"	
	12	6: SS	16				**50/3"	
	14	7: SS	18				**50/2"	
	16	8: SS					**10/0"	
	16	9: GB	24					
	18							
MARLSTONE, tan, very dense	20	10: SS					**10/0"	
	20	11: GB	18					
Completion Depth: 20 ft.								

Groundwater Observed at 7 ft. during drilling  
 Final Reading of 7.75 ft. after 24 hr. wait

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

- SN = Sample Type and No.
- SS = Split Spoon Sample
- GB = Grab Bag Sample
- WC = Water Content (%)
- N = SPT Blow Counts
- \*\* = Blow Counts During Seating Penetration
- PL = Plastic Limit (%)
- LL = Liquid Limit (%)
- PI = Plasticity Index
- 200 = % Passing #200 Sieve

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05



# Boring Log No. 6-33



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/11/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200
Gravelly CLAY (CL), with Sand, gray brown to tan, very hard, Fill	0 - 1	1: SS	12	20	49	29	56	
Sandy CLAY (CL), with Gravel, tan mottled brown, hard	1 - 5	2: SS	17				47	50
Clayey GRAVEL (GC), with Sand, tan and reddish brown, dense to very dense	5 - 3	3: SS	9				44	
	3 - 4	4: SS	13				50/5"	
MARLSTONE, tan, very dense	4 - 5	5: SS	15				**10/0"	
	5 - 10	6: GB	15	14	25	11	**10/0"	
	10 - 7	7: SS	12				**10/0"	
	7 - 8	8: GB	12				**10/0"	
	15 - 9	9: SS	11				**10/0"	
	9 - 10	10: GB	11				**10/0"	63
	20 - 11	11: SS	12				**10/0"	
	11 - 12	12: GB	12				**10/0"	
	25 - 13	13: SS	16	13	25	12	**10/0"	
	13 - 14	14: GB	16	13	25	12	**10/0"	
	30 - 15	15: SS	11				**50/2"	
35 - 16	16: SS	9				**50/2"		
40 - 17	17: SS	5				**50/2"		
45 - 18	18: SS	18				**10/0"		
18 - 19	19: GB	18				**10/0"		
50 - 20	20: SS	16	14	25	11	**10/0"	87	
20 - 21	21: GB	16	14	25	11	**10/0"	87	
Completion Depth: 49 ft.	49							

Groundwater During Drilling: None Observed  
 Final Reading of 16.83 ft. after 24 hr. wait  
 Hole Caved at 34.5 ft. after 24 hours

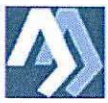
- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

SN = Sample Type and No.      LL = Liquid Limit (%)  
 SS = Split Spoon Sample      PI = Plasticity Index  
 GB = Grab Bag Sample      -200 = % Passing #200 Sieve  
 WC = Water Content (%)  
 N = SPT Blow Counts  
 \*\* = Blow Counts During Seating Penetration  
 PL = Plastic Limit (%)

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS GDT 6/7/05

# Boring Log No. 6-34



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/19/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200
Clayey SAND (SC), with Gravel, gray brown mottled brown, medium dense, Fill	5	1: SS	19	20	25	5	28	
		2: SS	13				22	34
		3: SS	12	18	50	32	20	
CLAY (CL), with Sand, trace Gravel, gray brown mottled brown, very hard, Fill	10	4: SS	10				**50/1"	
		5: SS	9				**50/3"	
		6: SS	9				**50/3"	
MARLSTONE, gray, very dense	15	7: SS	11				**50/3"	
		8: SS	10				**50/4"	
	20	9: SS	13				**50/4"	
		10: SS					**10/0"	
	25	11: GB	13					
		12: SS	11				**50/2"	
	30							
		13: SS					**10/0"	
	35	14: GB	13	31	24	NP		
		15: SS					**10/0"	
	40	16: GB	11					82
		17: SS	9				**50/1"	
45								
	18: SS					**10/0"		
50	19: GB	10	38	26	NP			

Completion Depth: 50 ft.

Groundwater During Drilling: None Observed

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

- SN = Sample Type and No.
- SS = Split Spoon Sample
- GB = Grab Bag Sample
- WC = Water Content (%)
- N = SPT Blow Counts
- \*\* = Blow Counts During Seating Penetration
- PL = Plastic Limit (%)
- LL = Liquid Limit (%)
- PI = Plasticity Index
- NP = Non-plastic
- 200 = % Passing #200 Sieve

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS GDT 6/7/05



# Boring Log No. 6-35



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/19/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
Clayey GRAVEL (GC), with Sand, dark brown mottled tan, dense to medium dense, Fill  -light reddish brown mottled dark brown  -trace brick  -dense from the 6.5' to 10' interval	1	1: SS	7	24	42	18		41	
	2								
	4	2: SS	5					44	30
	6	3: SS	10	15	39	24		26	
	8	4: SS	11	16	24	8		35	
	10	5: SS	14					21	71
MARLSTONE, tan, dense to very dense	12								
	14	6: SS	16					30	
	16								
	18	7: ST	18				8.75		
	20	8: SS	19					75/9"	
Completion Depth: 19.8 ft.	20								

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05

Groundwater During Drilling: None Observed

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

- SN = Sample Type and No.
- ST = Shelby Tube Sample
- SS = Split Spoon Sample
- WC = Water Content (%)
- N = SPT Blow Counts
- PL = Plastic Limit (%)
- LL = Liquid Limit (%)
- PI = Plasticity Index
- PP = Pocket Penetrometer (tsf)
- 200 = % Passing #200 Sieve

# Boring Log No. 6-36



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/21/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N
Clayey GRAVEL (GC), with Sand, gray brown, very hard	1	1: SS	8	22	38	16	50/1"
	2	2: SS	11				50/3"
MARLSTONE, tan, very dense	3	3: SS	19				**50/5"
	4						
	5	4: SS					**10/0"
	6	5: GB	8	16	22	6	
	7	6: SS					**10/0"
	8	7: GB	4				
	9	8: SS	12				**50/6"
	10						
	11	9: SS	12				**50/5"
	12						
	13	10: SS	10				**50/4"
	14						
15	11: SS	12				**50/2"	
16							
17							
18							
19	12: SS	12	5	26	21	**50/3"	
Completion Depth: 18.8 ft.	20						

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05

Groundwater During Drilling: None Observed

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

### Refer to Appendix for Additional Information

SN = Sample Type and No.      LL = Liquid Limit (%)  
 SS = Split Spoon Sample      PI = Plasticity Index  
 GB = Grab Bag Sample  
 WC = Water Content (%)  
 N = SPT Blow Counts  
 \*\* = Blow Counts During Seating Penetration  
 PL = Plastic Limit (%)



# Boring Log No. 6-37



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/20/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200	
Clayey SAND (SC), with Gravel, dark brown mottled tan, Fill	1	1: ST	9	17	39	22	14			
	2	2: ST	13				11		80	
CLAY (CL), with Sand, some Gravel, dark brown, hard, Fill	5	3: ST	13				7.75			
MARLSTONE, tan, very dense	4	4: SS	15	26	32	6		77		
	5	5: SS	10					**50/4"		
	6	6: SS						**10/0"		
	7	7: GB	4							
	8	8: SS						**10/0"		
	9	9: GB	5							
	10	10: SS						**10/0"		
	11	11: GB	6							
	12	12: SS						**10/0"		
	13	13: GB	6							
	14	14: SS	15	17	30	13		50/4"		
	15	15: SS	9					**50/1"		
	16	16: SS	9					**50/1"		
	17	17: SS	10					**50/2"		
	18	18: SS	11					**50/2"		
	Completion Depth: 48.7 ft.	50								

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS GDT 6/7/05

Groundwater During Drilling: None Observed

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

SN = Sample Type and No.      PL = Plastic Limit (%)  
 ST = Shelby Tube Sample      LL = Liquid Limit (%)  
 SS = Split Spoon Sample      PI = Plasticity Index  
 GB = Grab Bag Sample      PP = Pocket Penetrometer (tsf)  
 WC = Water Content (%)      -200 = % Passing #200 Sieve  
 N = SPT Blow Counts  
 \*\* = Blow Counts During Seating Penetration

# Boring Log No. 6-38



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/21/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200
Clayey SAND (SC), (Marl used as Fill), dark brown mottled tan, medium dense, Fill	2	1: SS	19				11	32
	4	2: SS	25	27	47	20	31	
MARLSTONE, tan, very dense	6	3: SS	16				79/11"	
	8	4: SS	13				**50/4"	84
	10	5: SS	8				**50/3"	
	12	6: SS	10				50/5"	
	14	7: SS	8				**50/4"	
	16	8: SS	11	19	44	25	87/9"	
	18	9: SS	6	11	30	19	**50/2"	
Completion Depth: 18.7 ft.	20							

Groundwater During Drilling: None Observed

**Refer to Appendix for Additional Information**

SN = Sample Type and No.      PI = Plasticity Index  
 SS = Split Spoon Sample      -200 = % Passing #200 Sieve  
 WC = Water Content (%)  
 N = SPT Blow Counts  
 \*\* = Blow Counts During Seating Penetration  
 PL = Plastic Limit (%)  
 LL = Liquid Limit (%)

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05



# Boring Log No. 6-39



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/21/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200
CLAY (CH), trace Sand and Gravel, dark gray brown, very stiff, Fill	2	1: SS	25				16	90
Sandy CLAY (CH), with Gravel, trace calcareous deposits, reddish brown, hard, Fill	4	2: ST	16	22	62	40		
CLAY (CL), reddish brown mottled tan, hard, Fill	6	3: SS	12	19	47	28	27	
MARLSTONE, tan, very dense	8	4: SS	10				**50/1"	
	10	5: SS					**10/0"	
	12	6: GB	6					
	14	7: SS					**10/0"	
	16	8: GB	10					
	18	9: SS					**10/0"	
	20	10: GB	9					
	22	11: SS					**10/0"	
	24	12: GB	11	16	21	5		
	26							
	28							
30								
Completion Depth: 18.5 ft.								

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/7/05

Groundwater During Drilling: None Observed

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

- SN = Sample Type and No.
- ST = Shelby Tube Sample
- SS = Split Spoon Sample
- GB = Grab Bag Sample
- WC = Water Content (%)
- N = SPT Blow Counts
- \*\* = Blow Counts During Seating Penetration
- PL = Plastic Limit (%)
- LL = Liquid Limit (%)
- PI = Plasticity Index
- 200 = % Passing #200 Sieve

# Boring Log No. 6-40



Address: Carrizo Aquifer Program  
 Gonzales County, Texas  
 Location: See Boring Location Plan

Project: Water Supply Pipeline-Segment IV  
 Logged By: DM Elev.:  
 Sampling Date: 4/21/05

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200
CLAY (CH), trace Sand and Gravel, dark gray brown, hard, Fill	2	1: SS	16	26	62	36	30	
Clayey GRAVEL (GC), with Sand, very dense	4	2: SS	9	18	23	5	50/4"	
MARLSTONE, tan, very dense	6	3: SS	15				**50/5"	
	8	4: SS	16				**50/6"	57
	10	5: SS	15				**50/2"	
	12	6: SS					**10/0"	
	12	7: GB	9					
	14							
	16	8: SS	13	15	25	10	**50/3"	
	18							
	18	9: SS	11				**50/3"	
Completion Depth: 18.8 ft.	20							

BORING LOG 04SA-2118-WITHOUT FIELD ID.GPJ ARIAS.GDT 6/1/05

Groundwater During Drilling: None Observed

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

**Refer to Appendix for Additional Information**

SN = Sample Type and No.      LL = Liquid Limit (%)  
 SS = Split Spoon Sample      PI = Plasticity Index  
 GB = Grab Bag Sample      -200 = % Passing #200 Sieve  
 WC = Water Content (%)  
 N = SPT Blow Counts  
 \*\* = Blow Counts During Seating Penetration  
 PL = Plastic Limit (%)