

GFAC TEXAS PLLC 8155 East 46th Street Tulsa, Oklahoma 74145 Phone: 918-622-7021

October 24, 2022

Mr. Micah Hargrave, P.E. Freese and Nichols, Inc. 2711 North Haskell, Suite 3300 Dallas, TX 75204

Subject: Subsurface Exploration and Laboratory Testing Services 21st Street Water Line Replacement East 21st Street, Riverside to Peoria Tulsa, Oklahoma Project No. G2022072

Dear Mr. Hargrave:

GFAC TEXAS PLLC (GFAC) is pleased to present the results of the subsurface exploration and laboratory testing performed for the proposed 21st Street Water Line Replacement in Tulsa, Oklahoma.

The subsurface exploration was completed on September 27, 2022. The exploration consisted of six (6) borings drilled to approximate depths ranging from 15 to 17 feet below the existing ground surface levels. The borings were drilled near the locations requested by Freese and Nichols, Inc., which are indicated on the attached Boring Location Diagram(s). The borings were completed using a truck mounted (CME 55) rotary drill rig using continuous flight augers to advance the boreholes. Representative samples were obtained by tube sampling procedures in general accordance with ASTM D 1587 and the split-barrel sampling procedures in general accordance with ASTM D 1586. The split-barrel sampling procedure utilizes a standard 2-inch O.D. split-barrel sampler that is driven into the bottom of the boring with a 140-pound auto-hammer falling a distance of 30 inches. The number of blows required to advance the sampler the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Resistance Value (N). These "N" values are indicated on the boring logs at their depth of occurrence and provide an indication of the consistency and relative density of the material.

Boring logs included with this letter, present such data as soil descriptions, consistency and relative density evaluations, depths, sampling intervals and observed groundwater conditions. Conditions encountered in each of the borings were monitored and recorded by the field engineer. Field logs included visual classification of the materials encountered during drilling, as well as drilling characteristics. Our final boring logs represent the engineer's interpretation

of the field logs combined with laboratory observation and testing of the samples. Stratification boundaries indicated on the boring logs were based on observations during our fieldwork, an extrapolation of information obtained by examining samples from the borings and comparisons of soils with similar engineering characteristics. Locations of these boundaries are approximate, and the transitions between soil types may be gradual rather than clearly defined.

Laboratory tests were performed on samples selected by representatives of GFAC and approved by Freese and Nichols, Inc. Laboratory tests were performed in general accordance with the applicable standards. The results are presented on the attached boring logs, the Summary of Laboratory Testing Results sheets, Grain Size Distribution Sheets, and the Unconfined Compressive Strength Test Reports.

If you have questions regarding the content of this letter or require additional information, please contact the undersigned.

Sincerely, *GFAC TEXAS PLLC Certificate of Authorization #8119; Exp. 6/30/2024*

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Dale L. Kelley II, P.E. Senior Project Engineer

Attachments: Boring Location Diagrams Boring Logs Summary of Laboratory Testing Results Grain Size Distribution Sheets Unconfined Compressive Strength Test Reports

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Brian K. Marick, P.E. Principal Engineer



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G2022072

Tulsa, Oklahoma

October 5, 2022



GFAC ENGINEERING Not to Scale

Boring locations are approximate.

Boring Location Diagram 21st Street Water Line Replacement East 21st Street, Riverside to Peoria Tulsa, Oklahoma G2022072 October 5, 2022





GFAC ENGINEERING Not to Scale

Boring locations are approximate.

Boring Location Diagram 21st Street Water Line Replacement East 21st Street, Riverside to Peoria Tulsa, Oklahoma G2022072 October 5, 2022



Plate СЛ

G2022072

Tulsa, Oklahoma

October 5, 2022





Plate 7

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PRO		UMBER G2022072	PROJECT		ATION E	East 21st S	er Line Street.	Rivers	side to	Peoria	a. Tuls	sa. OK	
DAT	E STAR	TED 9/27/22 COMPLETED 9/27/22	GROUND	ELEV				HOLE	SIZE	6 inc	hes		
DRIL	LING C	ONTRACTOR	GROUND	WATE		_S:							
DRIL	LING M	ETHOD	AT		OF DRILL	.ING [)ry						
LOG	GED BY	PWV CHECKED BY _DLK	AT	end o	F DRILL	NG D	ry						
NOT	ES Lat	: 36.133319, Lon: -95.989995	AFT	ER DF	RILLING								
0 DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	Texas Cone Penetrometer	BLOW COUNTS (N VALUE)	Uncon. Strength (psf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	LIMIT LIMIT			FINES CONTENT (%)
		TOPSOIL	-										
-	-	FILL - Sandy Silt with gravel and broken concrete, moist, brown	ss 1	83		10-9-10 (19)							
		FILL - Broken Concrete, Limestone Gravel				10.15.9							
	-	SANDY SILTY CLAY, moist, very soft, brown, dark brown	2	67		(23)							
		- dark brown below 4.6 feet											
			SS 3	100		0-1-1 (2)			19	24	17	7	69
		LEAN CLAY, moist, very soft, dark brown trace gray, orange	SS 4	100		0-1-1 (2)			21	26	17	9	90
	-	LEAN CLAY with sand, moist, very soft, dark brown trace gray											
			SS 5	100		0-0-0 (0)			24	27	18	9	84
960 BA36 - GINI 310 03 LAB.901 - 10/24		Bottom of borehole at 15.0 feet.											

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	LIEF ROJ			PROJEC		<u>- 21513</u>	ast 21st 9	<u>er Line</u> Street	River	aceme side to	Peori	a Tul	sa Ok	, ,
		STAF	COMPLETED 9/27/22 COMPLETED 9/27/22	GROUNI) ELEV			511001,	HOLE	SIZE	6 inc	hes	5a, Or	<u> </u>
D	RILL	LING	CONTRACTOR GFAC	GROUNI	WATE	RLEVE	LS:							
D	RILL		IETHOD CFA 6"	AT	TIME	of Drill	_ING [Dry						
L	OGG	GED B	Y PWV CHECKED BY DLK	AT		F DRILL	ING D	iry						
N	OTE	S _La	t: 36.133275, Lon: -95.987112	AF	TER DF	RILLING								
DEPTH	(#)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	Texas Cone Penetrometer	BLOW COUNTS (N VALUE)	Uncon. Strength (psf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	LIMIT LIMIT			FINES CONTENT (%)
		~~~	ASPHALT - 2 3/4 inches											
-	-		<u>FILL - Limestone Screenings - 2 inches</u> <u>/     FILL - Silty Sand, moist, orange, brown</u> <u>/     SILTY SAND, moist, loose, tan, brown</u>	ss 1	83		4-3-2 (5)	_						
	-			ss 2	83		1-2-3 (5)			10	NP	NP	NP	30
			SILTY SAND, moist, loose, brown, orange trace tan	4										
	<u>5</u> -			ss 3	78		2-3-3 (6)	-		9	NP	NP	NP	30
	-		- medium dense below 7.5 feet					_						
	-		SILTY CLAYEY SAND, moist, medium dense, brown, red		83		4-7-5 (12)	_						
	-													
	-		LEAN CLAY, moist, stiff, gray trace orange, brown	ss 5	100		2-4-6 (10)	_						
	-		- very stiff below 15 feet	ST 6	100			27240	112	18	32	16	16	96
		<u>\/////</u>	Bottom of borehole at 17.0 fact											

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С	IEN	IT Fre	eese and Nichols, Inc	PRO	JECT	NAME	21st S	Street Wat	er Line	Repla	aceme	ent			
PF	SOJ	ECT N	UMBER _ G2022072	PRO	JECT			East 21st S	Street,	Rivers	side to	Peoria	a, Tuls	sa, OK	, 
	ATE	STAR	TED         9/27/22         COMPLETED         9/27/22	GRC				<u>c.</u>		HOLE	SIZE	<u>6 inc</u>	hes		
		ING C		GRU			R LEVEL	_3: INGΓ	)rv						
	GG	ED B	PWV CHECKED BY DLK		AT	END O	FDRILLI	ING D	ry						
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DEPTH	ر (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMDI E TVDE	NUMBER	RECOVERY % (RQD)	Texas Cone Penetrometer	BLOW COUNTS (N VALUE)	Uncon. Strength (psf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT LIMIT		FINES CONTENT (%)
			TOPSOIL												
			FILL - Sandy Silt, dry, brown, orange		SS 1	83		6-7-8 (15)							
	-				SS 2	89		2-2-1 (3)	-		12	22	17	5	82
	5_		- medium stiff below 5 feet	X	SS 3	0		2-3-4 (7)	-						
	-		LEAN CLAY, moist, medium stiff, tan						-						
	0			X	SS 4	0		2-2-3 (5)	-		19	34	15	19	89
			LEAN CLAY, moist, very stiff, gray, orange	-											
1 I	-				ST 5	100			9740	107	21	38	17	21	96
EU BASE - GINI SILI US LAD.GUI - 10/24/2	_		Bottom of borehole at 15.0 feet.												

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DA	TE	STAR	red         9/27/22         COMPLETED         9/27/22	GRO	DUND	ELEV				HOLE	SIZE	6 inc	hes		
DR	ILL	ING CO	ONTRACTOR GFAC	GRO	DUND	WATE	R LEVEL	.S:							
DR	ILL	ING M	ETHOD _CFA 6"		AT	TIME C	of Drill	.ING [	)ry						
LO	GG	ED BY	PWV CHECKED BY DLK		AT	END O	F DRILLI	NG D	ry						
NO	TES	<b>S</b> _Lat	: 36.133150, Lon: -95.981749	-	AF		RILLING		1						
DEPTH	(#)	GRAPHIC LOG	MATERIAL DESCRIPTION		SAMPLE IYPE NUMBER	RECOVERY % (RQD)	Texas Cone Penetrometer	BLOW COUNTS (N VALUE)	Uncon. Strength (psf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)				FINES CONTENT (%)
			ASPHALT - 2 1/2 inches												
-	T T		FILL - Sandy Silty Clay, moist, brown, red	$\frac{1}{7}$											
-			SILTY CLAY, moist, soft, brown		SS 1	83		4-3-2 (5)							
			- brown, orange below 3.1 feet		SS 2	100		1-1-2 (3)			15	22	17	5	86
			LEAN CLAY, moist, soft to medium stiff, orange, brown		SS 3	89		2-1-3 (4)			15	30	18	12	91
					SS 4	83		2-2-2 (4)			12	28	17	11	87
			SILTY CLAY with sand, moist, soft, orange, brown	-	1										
- 67.90 7 7 1					SS 5	78		1-1-2 (3)			14	22	17	5	71
2EU BASE - GINT STU US LAB.GUT - 10/24/			Bottom of borehole at 15.0 feet.												

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DATE	ES	ST	ART	ED _9/27/22         COMPLETED _9/27/22	GR	OUND	ELEV	ATION _			HOLE	SIZE	6 inc	hes		
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NOT	GE	ED S	l at	<u>PWV</u> CHECKED BY <u>DLK</u> 36 133176 Lon: -95 978974				IF DRILLI	NG <u></u> D	ry						
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DEPTH (ft)		GRAPHIC	POG	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	Texas Cone Penetrometer	BLOW COUNTS (N VALUE)	Uncon. Strength (psf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	LIQUID			FINES CONTEN (%)
0				ASPHALT - 6 inches												
Ļ		, s 	X	CONCRETE - 5 inches		/				-						
	XX-	X	×4-	SANDY SILT moist soft to medium stiff brown	$\mathbb{Y}$	ss	89		3-2-2							
-	-7			SANDY LEAN CLAY, moist, medium stiff, brown trace		1			(4)							
				orange	$\nabla$				0.0.0							
				- brown, orange below 3.2 feet	X	2	89		(6)			14	26	15	11	66
	÷				$\vdash$					-						
5	2			SILT with sand, moist, soft to medium stiff, orange, brown	{											
					$\nabla$	99			2_2_2	1						
	-				ľŇ	3	78		(4)							
2020					$\vdash$	N				-						
	_			- medium stiff below 7.5 feet												
						/				-						
2-	-				IX	SS	89		2-2-4			14	21	18	3	76
10					$\square$	4			(0)							
	-															
ODEI		$\prod$			-											
	-			LEAN CLAY, moist, medium stiff, orange, brown												
0.0						/				1						
- 67.0					X	SS   5	56		2-3-3 (6)			15	30	16	14	90
15	l			Bottom of borehole at 15.0 feet	/ \											
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D		STAR	TED         9/27/22         COMPLETED         9/27/22	GRO	UND	ELEV	ATION _			HOLE	SIZE	6 inc	hes		
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	•														
-	-		SILTY SAND, dry, loose, brown	$\mathbb{X}$	SS 1	72		8-3-2 (5)	-		4	NP	NP	NP	42
WATERLINE.GF	-		SILTY SAND, dry, very loose, brown		SS 2	83		1-1-2 (3)			5	NP	NP	NP	35
2151 SIREEI	5_			M	SS	02		2-2-3	-						
s/G202207	-		SAND with silt, moist, loose, brown, orange trace red	М	3	00		(5)							
	_		SANDY LEAN CLAY, moist, medium stiff, brown, orange trace gray												
	- 10			$\mathbb{N}$	SS 4	100		2-2-4 (6)			16	24	11	13	55
	_														
	-		CLAYEY SAND, moist, very loose to loose, brown, orange trace gray												
22 08:29 - C:\L	- 15			$\mathbb{N}$	SS 5	100		2-2-2 (4)			15	24	15	9	48
JEO BASE - GINT STU US LAB.GUT - 10/24.			Bottom of borehole at 15.0 feet.												

#### Summary of Laboratory Testing Results

Project Name:East 21st Street Water Line ReplacementProject Location:East 21st Street, Riverside to Peoria, Tulsa, OKProject No.:G2022072



Boring	Sample	Depth	Description	USCS	AASHTO	OSI	Moisture	At	terberg Lin	nits				Sie	ve Analy	/sis			
								LL	PL	PI	1-1/2"	1"	3/4"	3/8"	#4	#10	#40	#100	#200
B-1	SS-3	5-6.5	Sandy Silty Clay	CL-ML	A-4(2)	6.9	19	24	17	7									68.8
B-1	SS-4	8.5-10	Lean Clay	CL	A-4(6)	8.8	21	26	17	9									90.4
B-1	SS-5	13.5-15	Lean Clay with sand	CL	A-4(6)	9.0	24	27	18	9									83.7
B-2	SS-2	2.5-4	Silty Sand	SM	A-2-4	0.0	10	NP	NP	NP					100	99	79	34	29.9
B-2	SS-3	5-6.5	Silty Sand	SM	A-2-4	0.0	9	NP	NP	NP					100	100	76	33	30.2
B-2	ST-6	15-17	Lean Clay	CL	A-6(15)	12.8	18	32	16	16									96.0
B-3	SS-2	2.5-4	Silty Clay with Sand	CL-ML	A-4(2)	6.4	12	22	17	5						100	99	87	81.7
B-3	SS-4	8.5-10	Lean Clay	CL	A-6(16)	14.4	19	34	15	19									88.6
B-3	ST-5	13-15	Lean Clay	CL	A-6(20)	16.0	21	38	17	21									96.0
B-4	SS-2	2.5-4	Silty Clay	CL-ML	A-4(2)	6.4	15	22	17	5									85.9
B-4	SS-3	5-6.5	Lean Clay	CL	A-6(14)	13.2	15	30	18	12									91.3
B-4	SS-4	8.5-10	Lean Clay	CL	A-6(8)	10.0	12	28	17	11									86.9
B-4	SS-5	13.5-15	Silty Clay with Sand	CL-ML	A-4(1)	6.0	14	22	17	5									71.0
B-5	SS-2	2.5-4	Sandy Lean Clay	CL	A-6(4)	8.4	14	26	15	11									65.7
B-5	SS-4	8.5-10	Silt with Sand	ML	A-4(0)	5.4	14	21	18	3						100	99	83	76.2
B-5	SS-5	13.5-15	Lean Clay	CL	A-6(11)	11.6	15	30	16	14									89.8
B-6	SS-1	0.5-2	Silty Sand	SM	A-4(0)	0.7	4	NP	NP	NP									41.5
B-6	SS-2	2.5-4	Silty Sand	SM	A-4(0)	-	5	NP	NP	NP									35.2
B-6	SS-4	8.5-10	Sandy Lean Clay	CL	A-6(4)	7.6	16	24	11	13									55.3
B-6	SS-5	13.5-15	Clayey Sand	SC	A-4(1)	4.5	15	24	15	9					100	100	95	54	47.7
						1													



### **GRAIN SIZE DISTRIBUTION**

CLIENT Freese and Nichols, Inc

PROJECT NAME 21st Street Water Line Replacement

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CLIENT Freese and Nichols, Inc

**PROJECT NAME** 21st Street Water Line Replacement

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CLIENT Freese and Nichols, Inc

PROJECT NAME _21st Street Water Line Replacement

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CLIENT Freese and Nichols, Inc

PROJECT NAME _21st Street Water Line Replacement

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#### **Unconfined Compressive Strength Test Report**

Client: Freese & Nichols, Inc. 2711 North Haskell Avenue Suite #300 Dallas, TX 75204		Project:         October 10, 2022           Project:         21st Street Water Line Replacement           Tulsa, OK
	Test Specification: ASTM D 2	166
Project: 21st Street Water Line Replacement Project No.: <u>G2022072</u> Boring No.: <u>B-2</u>	 Sample No.: ST-6	Date Tested:         10/10/2022           Tested By:         BB           Sample Depth         15.0 - 17.0
Sample Description: Lean Clay, gray trace orange, brown	1	
Atterberg Limits:       LL=       32       PL=         Percentage of Fines:       96         USCS Classification(%)       CL         Sample Type:       Undisturbed         Initial Diameter (inches):       2.871         Initial Height (inches):       5.608         Height-Diameter Ratio:       2.0	<u>16</u> PI= <u>16</u>	Moisture Content(%):17.7Wet Density (pcf):132.1Dry Density (pcf):112.2Specific Gravity (assumed):2.71Saturation (%):94
30000 25000 20000 15000 5000 5000 0 0 0 0 0 0 0 0 0 0	2 rain (%)	
Axial Strain @ Failure (%):2.81		



#### **Unconfined Compressive Strength Test Report**