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May 14, 2020 BSK Project G18-304-11F

Mr. Mark Williamson
AECOM
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Fresno, California 93720

SUBJECT: Addendum 2 to Geotechnical Engineering Investigation
Proposed Water Main Replacement TO #8 – Phase 3
Castor Street, Between West Avenue and Lane Street
Turlock, Stanislaus County, California

Dear Mr. Williamson:

This addendum presents additional information regarding our Geotechnical Engineering Investigation (BSK Project Number G18-304-11F, dated February 21, 2019) for the subject project located in Turlock, California. This addendum is based on information as outlined in our proposal GF18-17073B, dated March 20, 2020.

PROJECT UNDERSTANDING AND BACKGROUND

The project includes the removal of existing and installation of new water mains at an approximately 600-foot extension along Castor Street between the alleyways west and east of Farr Street in Turlock, California. Pavement reconstruction associated with the pipeline installation may consist of replacement in kind, replacement with overlay, or complete repave.

ADDITIONAL FIELD INVESTIGATION

The limited field exploration, conducted on April 17, 2020 consisted of a site reconnaissance and drilling two (2) exploratory test borings. The borings were drilled in the asphalt concrete roadway of Castor Street using a diamond bit core barrel and manually operated auger equipment, and in the unpaved alleyway using manually operated auger equipment. The borings were advanced to an approximate depth of 10 feet below ground surface (bgs). The approximate boring locations are presented on Figure 1. Details of the field exploration and the boring logs are provided in Appendix A.

ADDITIONAL LABORATORY TESTING

Laboratory testing of selected soil samples were performed to evaluate in-situ moisture and density, gradation, direct shear, R-Values, and corrosion potential. The in-situ moisture, dry density, and percent passing the No. 200 sieve test results are presented on the boring logs in Appendix A. Descriptions of the laboratory test methods and test results are provided in Appendix B.

ADDITIONAL RESULTS

Surface Conditions

The area of the proposed water main replacement was relatively flat through the 600-foot length of Castor Street. The asphalt pavement showed signs of distress including alligator cracking, potholes, and rutting. The street contained sidewalks, curbs and gutters. West of Farr Street the portion of the proposed alignment was unpaved. The general area of improvements included residential housing with landscaping including trees adjacent to the roadway with a railroad to the south.

Subsurface Soil Conditions

Borings were drilled in the unpaved alley at B-15 and through existing pavement at B-16. The roadway surface consisted of asphalt concrete underlain by silty gravel (assumed to be aggregate base). The aggregate base consisted of a silty gravel, and grain size distribution or other lab testing was not performed. Table 1 presents the measured pavement thickness in the borings.

Table 1: Boring Summaries

Boring	Approx. AC Thickness (inches)	Approx. AB Thickness (inches)
B-15	-	-
B-16	3	8

Notes:
AC: Asphalt Concrete
AB: Aggregate Base (Silty Gravel)

The predominant general soil profile consisted of silty sand to the depths of exploration, 10 feet bgs. Boring logs are presented in Appendix A and should be consulted for more details concerning subsurface conditions. Stratification lines were approximated by the field staff based on observations made at the time of drilling, while the actual boundaries between soil types may be gradual and soil conditions may vary at other locations. Groundwater was not encountered at the time of our exploration.

ADDITIONAL CONCLUSIONS

Based upon the data collected during this investigation and from a geotechnical engineering standpoint, it is our opinion that there are no soil conditions would preclude the construction of the proposed improvements. The referenced report may be used for the design and construction of the proposed improvements provided that the recommendations presented in this letter are incorporated into the project design and construction.

Conventional Pavement Section Recommendations

The following sections include recommendations for conventional pavement sections based on work performed on-site, and experience on adjacent parcels. Pavement section recommendations utilizing geogrid can be provided, if desired.

Laboratory testing performed on one (1) near surface sample: B-16 with an R-value of 58, respectively. The laboratory tests were performed in conformance with Caltrans Test Method 301.

BSK calculated the conventional pavement section thicknesses using a design subgrade R-Value of 50 and assumed Traffic Indexes. Pavement section thickness recommendations are presented in Table 3.

Table 3: Conventional Pavement Section Recommendations
(R-Value = 50, 20-yr design life)

Traffic Index	Conventional Section	
	HMA (feet)	AB (feet)
5.0 or less	0.25	0.35
6.0	0.30	0.35
7.0	0.35	0.40
8.0	0.40	0.55

Notes: HMA: Hot Mix Asphalt
AB: Caltrans Class 2 Aggregate Base (Minimum R-Value = 78)
ASB: Caltrans Class 2 Aggregate Subbase (Minimum R-Value = 50)

Hot mix asphalt, Class 2 aggregate base, and Class 2 aggregate subbase should conform to and be placed in accordance with the latest revision of Caltrans Standard Specifications. It is recommended subgrade be scarified to a depth of 12 inches, moisture conditioned to at or above optimum and compacted to at least 95% maximum density, based on ASTM D1557 prior to placing new aggregate base section.

Surface Drainage Control

Final grading around the improvements must provide for positive and enduring drainage. Ponding of water must not be allowed on or near footing surfaces. Saturation of the soils immediately adjacent to or below improvements must not be allowed. The drainage channel must be kept open and allow water to be directed away from the improvements.

LIMITATIONS

The findings of this report are valid as of the present. However, changes in the conditions of the Site can occur with the passage of time, whether caused by natural processes or the work of man, on this property or adjacent property. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation, governmental policy or the broadening of knowledge.

BSK has prepared this report for the exclusive use of the Client and members of the project design team. The report has been prepared in accordance with generally accepted geotechnical engineering practices which existed in Stanislaus County at the time the report was written. No other warranties either expressed or implied are made as to the professional advice provided under the terms of BSK's agreement with Client and included in this report.

CLOSING

BSK appreciates the opportunity to be of service to you on this project. If you have any questions, or would like additional information, please call us at (559) 497-2880.

Respectfully submitted,
BSK Associates

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NMP/OML/cc

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FIGURES

Figure 4: Boring Location Map (Sheet 9 of 9)

APPENDICES

Appendix A: Field Exploration

Soil Classification Chart and Log Key
Boring Logs: Boring B-15/B-16

Appendix B: Laboratory Testing

Table B-1: Summary of Minus #200 Wash Test Results
Figure B-1: Direct Shear Test Results
Figure B-2: R-Value Test Results

FIGURES

P:\FRS\Active\GEO\G18304-11F - Water Main Replacement Turlock\Graphics\Phase 3\G18-304-11F_Phase 3.dwg User:tgonzalez Plotted:Apr 15, 2020 - 9:36am Last Save:Sep 17, 2019 - 1:44pm

REFERENCE IMAGE: Google Earth

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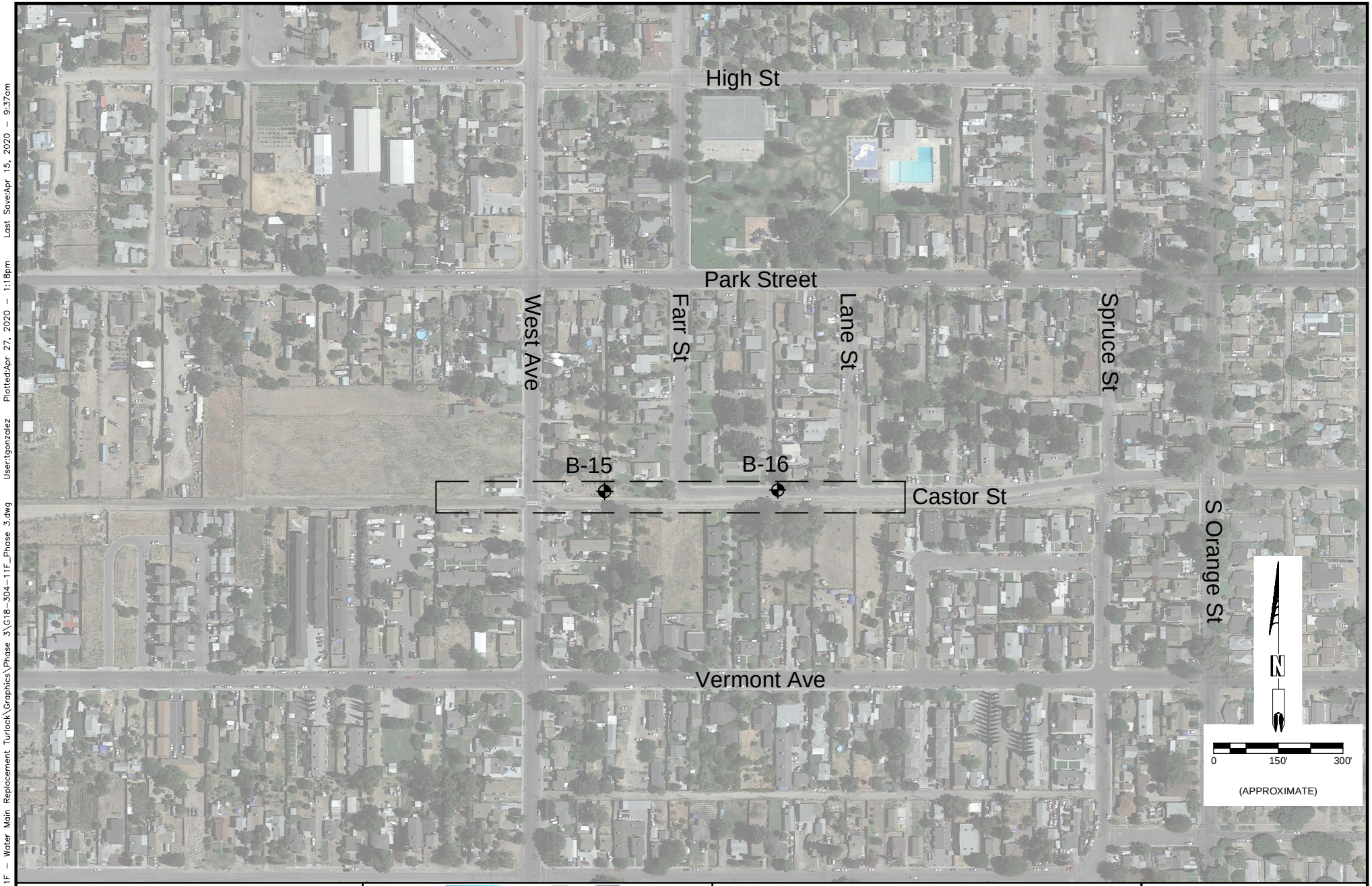
SITE VICINITY MAP

Water Main Replacement - TO 8
Phase 3
Park Street
Turlock, California

FIGURE 1

JOB NO. G18-304-11F
DATE April 15, 2020
DR. BY TG
CH. BY NP
SCALE AS SHOWN
SHEET NO. 1
OF 1 SHEETS



LEGEND:

APPROXIMATE BORING LOCATIONS
B- 16

APPROXIMATE WATER LINE ALIGNMENT

REFERENCE IMAGE: Google Earth

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BORING LOCATION MAP

Water Main Replacement - TO 8
Phase 3
Park Street
Turlock, California

FIGURE 4

JOB NO. G18-304-11F
DATE April 27, 2020
DR. BY TG
CH. BY NP
SCALE AS SHOWN
SHEET NO. 9
OF 9 SHEETS

APPENDIX A

Field Exploration

MAJOR DIVISIONS				TYPICAL NAMES
COARSE GRAINED SOILS More than Half > #200 sieve	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES
		GRAVELS WITH OVER 15% FINES	GM	SILTY GRAVELS, POORLY GRADED GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS
			SP	POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 15% FINES	SM	SILTY SANDS, POOORLY GRADED SAND-SILT MIXTURES
			SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES
FINE GRAINED SOILS More than Half < #200 sieve	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACIOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

■	Modified California	RV	R-Value
⊠	Standard Penetration Test (SPT)	SA	Sieve Analysis
☒	Split Spoon	SW	Swell Test
◪	Pushed Shelby Tube	TC	Cyclic Triaxial
▯	Auger Cuttings	TX	Unconsolidated Undrained Triaxial
✋	Grab Sample	TV	Torvane Shear
⊘	Sample Attempt with No Recovery	UC	Unconfined Compression
CA	Chemical Analysis	(1.2)	(Shear Strength, ksf)
CN	Consolidation	WA	Wash Analysis
CP	Compaction	(20)	(with % Passing No. 200 Sieve)
DS	Direct Shear	▽	Water Level at Time of Drilling
PM	Permeability	▼	Water Level after Drilling(with date measured)
PP	Pocket Penetrometer		

SOIL CLASSIFICATION CHART AND LOG KEY

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Project: Water Main Replacement Turlock

Location:

Project No.: G18-304-11F

Logged By: S. Jue

Checked By: N. Popenoe

Boring: **B- 15**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
1								SM	**Silty SAND** - brown, moist, fine to medium grained sand	
2										
3				102.9	4.8					ø = 29°, c = 0.27 ksf
4										
5				112.6	6.3					
6										
7									... strongly cemented	
8									... grayish brown	
9										
10									Boring terminated at approximately 10 feet bgs. Borehole backfilled with soil cuttings. No groundwater encountered.	
11										
12										
13										
14										

Drilling Contractor: BSK Associates
Drilling Method: Hand Auger
Drilling Equipment: 6" diamond core barrel
Date Started: 4/17/20
Date Completed: 4/17/20

Surface Elevation:
Sample Method: 2.5-inch I.D. modified
Groundwater Depth: Not Encountered
Completion Depth: 10 Feet
Borehole Diameter: 4"

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Project: Water Main Replacement Turlock

Location:

Project No.: G18-304-11F

Logged By: S. Jue

Checked By: N. Popenoe

Boring: **B-16**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
0									**Ashpalt concrete** - 3"	
									Silty Aggregate Base - 8", brown, moist, loose, fine to coarse grained gravel	
1								SM	**Silty SAND** - brown, moist, fine to medium grained sand	
2										
3										
4				100.5	2.8	31				
5									... strongly cemented	
6										
7										
8									Boring terminated at approximately 10 feet bgs. Borehole backfilled with soil cuttings. No groundwater encountered.	
9										
10										
11										
12										
13										
14										

Drilling Contractor: BSK Associates
Drilling Method: Hand Auger
Drilling Equipment: 6" diamond core barrel
Date Started: 4/17/20
Date Completed: 4/17/20

Surface Elevation:
Sample Method: 2.5-inch I.D. modified
Groundwater Depth: Not Encountered
Completion Depth: 7.5 Feet
Borehole Diameter: 4"

APPENDIX B

Laboratory Testing

APPENDIX B

LABORATORY TESTING RESULTS

Moisture-Density Tests

The field moisture content, as a percentage of dry weight of the soils, was determined by weighing the samples before and after oven drying in accordance with ASTM D2216 test procedures. Dry densities, in pounds per cubic foot, were also determined for undisturbed core samples in general accordance with ASTM D 2937 test procedures. Test results are presented on the boring logs in Appendix A.

Direct Shear Test

One (1) Direct Shear Test was performed on a relatively undisturbed soil samples obtained at the time of drilling in the area of planned construction. The tests were conducted to determine the soil strength characteristics. The standard test method is ASTM D3080, Direct Shear Test for Soil under Consolidated Drained Conditions. The direct shear test results are presented graphically on Figure B-1.

Minus #200 Wash Tests

One (1) #200 Wash Test was performed on a selected soil sample obtained at the time of drilling in the area of planned construction. The test was performed to determine the amount of fine material present in the subsurface material. The test was performed in general accordance with ASTM Test Method D1140. The test results are presented in Table B-1 and the boring logs in Appendix A.

Table B-1: Summary of Minus #200 Wash Test Results

Test Location	Percent Fines
B-16 @ 0-5 feet bgs	31

R-Value Test

One (1) R-value test was performed on selected soil samples. The test was performed in general conformance with California Department of Transportation's Test Method (CT) 301. The results of the test are presented on Figure B-2.

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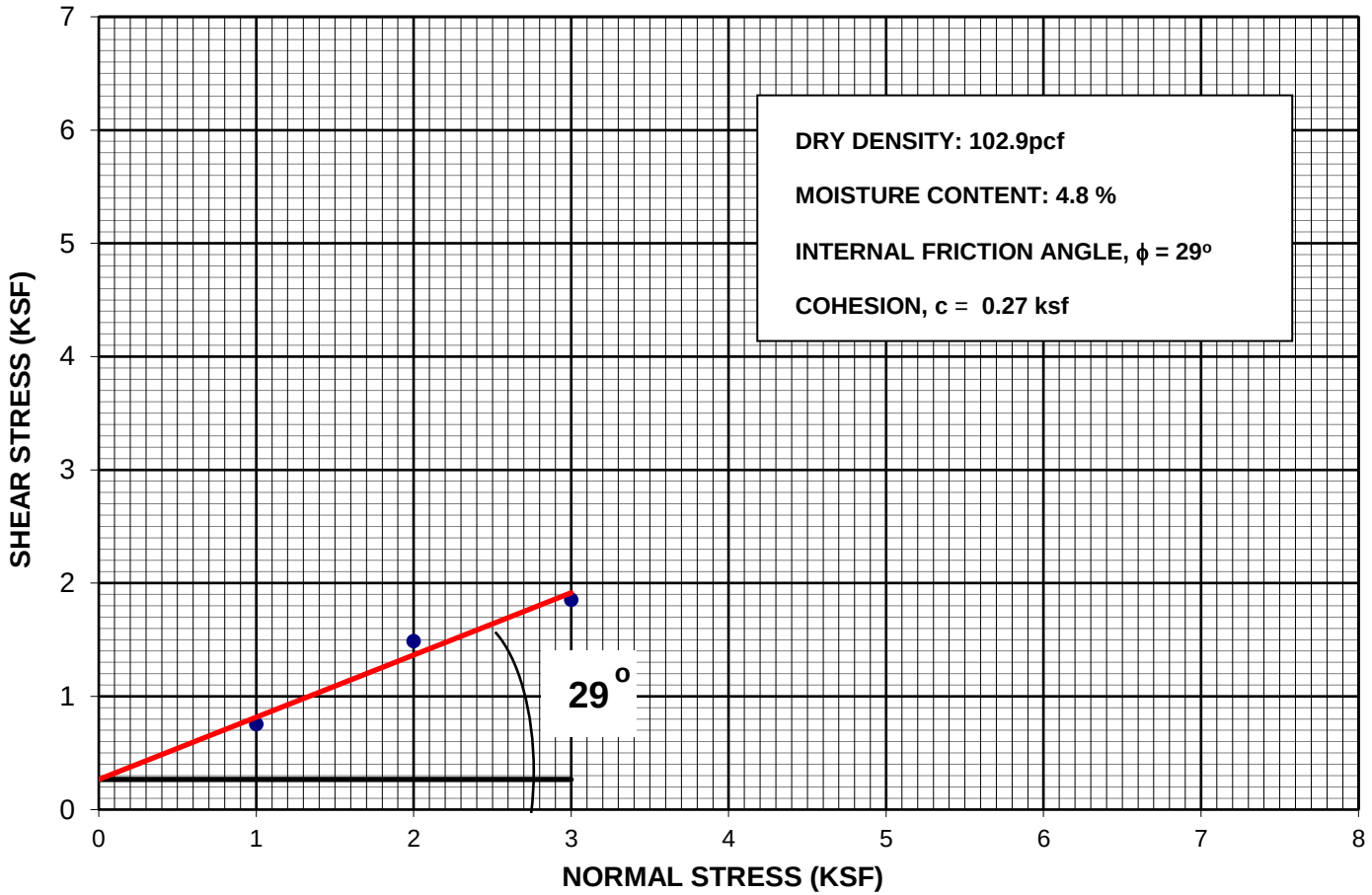
FIGURE B-1

Direct Shear Test

ASTM D-3080

Project Name:	Water Main Replace. Turlock	**Sampled By:**	S.Jue	**Sample Date:**	4/17/2020
		Tested By:	D.Messfin	**Test Date:**	4/23/2020
Project Number:	G18 - 304 - 11F	**Lab Tracking ID:**	N/A	**Report Date:**	5/14/2020
Sample Location:	B - 15 @ 2.5'	**Sample Description:**	Silty SAND (SM) brown,moist,fine to med. Grained		

SHEAR STRENGTH DIAGRAM



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Standard Test Methods for Resistance R-Value and Expansion Pressure of Compacted Soil

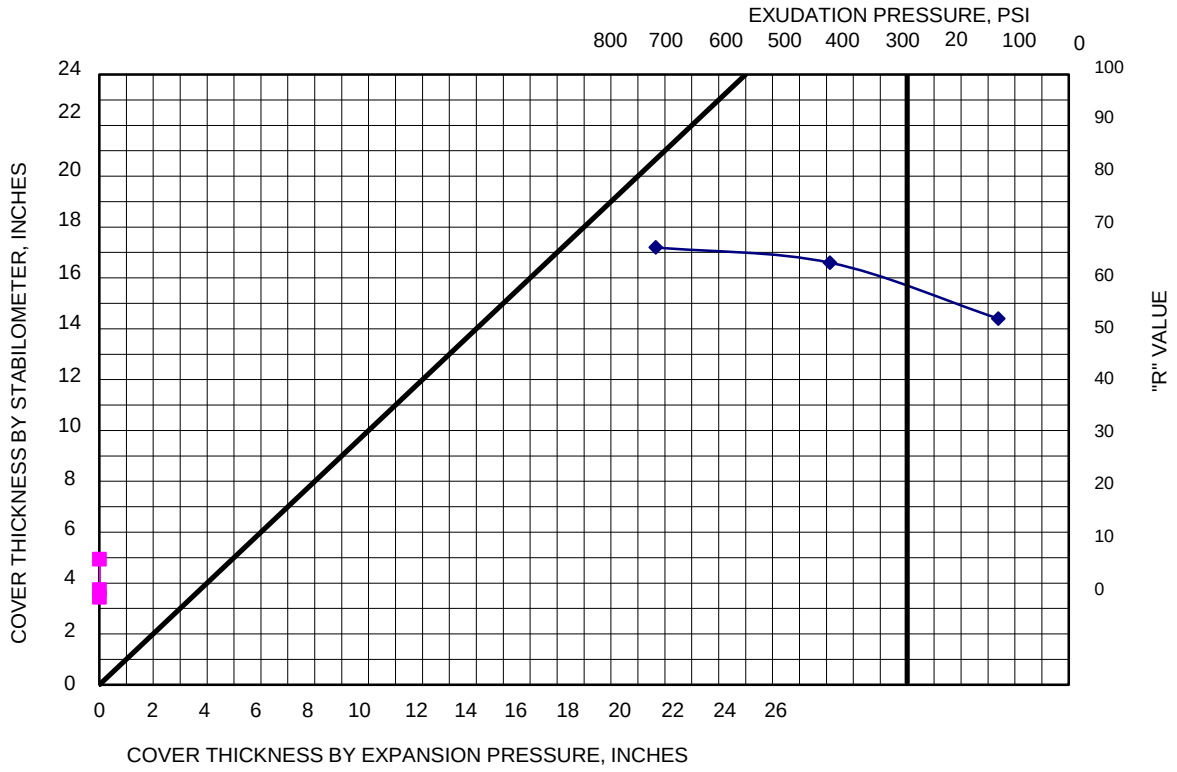
ASTM D-2844

FIGURE B-2

700 22nd St.
Bakersfield, CA 93301
Ph: (661) 327-0670
Fax: (661) 324-4217

Project Name: Water Main Replacement
Project Number: G18-304-11F
Lab Tracking ID: B20-060
Sample Location: B-16 @ 0.0-5.0 feet bgs

Sample Date: 4/17/2020
Test Date: 4/28/2020
Report Date: 5/14/2020
Tested By: ILT Remotigue



Sample Description: SM:SILTY SAND; brown; fine to Coarse; moist.

SPECIMEN	A	B	C
EXUDATION PRESSURE, LOAD (lb)	9631.2	5572	1643.9
EXUDATION PRESSURE, PSI	767	444	131
EXPANSION, * 0.0001 IN	0.0058	0.0055	0.0029
EXPANSION PRESSURE, PSF	0	0	0
STABILOMETER PH AT 2000 LBS	37	38	53
DISPLACEMENT	4.2	4.63	4.7
RESISTANCE VALUE "R"	66	63	52
"R" VALUE CORRECTED FOR HEIGHT	66	63	52
% MOISTURE AT TEST	8.2	9.2	10.2
DRY DENSITY AT TEST, PCF	119.2	120.0	119.3
"R" VALUE AT 300 PSI EXUDATION PRESSURE	**58**		
"R" VALUE BY EXPANSION PRESSURE TI = 4.0, GF=1.50	**N/A**		

Reviewed By: *Ian Leo T. Remotigue*