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GEOTECHNICAL REPORT
DRAINAGE JUNCTION CHAMBER (S2-5)
US 41 AND STEARNS SCHOOL ROAD
16-00222-02-CH
GURNEE, LAKE COUNTY, ILLINOIS

7/14/2022

Prepared for:

Baxter & Woodman
8678 Ridgefield Road
Crystal Lake, IL 60012

GEOTECHNICAL REPORT
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1.0 INTRODUCTION

Interra, Inc. (INTERRA) was tasked by Baxter & Woodman Inc., based in Crystal Lake, Illinois to conduct subsurface soil investigation and prepare the Geotechnical Report to aid in the design of the Drainage Junction Chamber Structure (Structure No. S2-5) for the above referenced project in Gurnee, Illinois. A Roadway Geotechnical Report (RGR) dated 1/10/2022 was previously submitted for this project.

2.0 PROJECT SCOPE

INTERRA's scope of work included locating and drilling one (1) geotechnical soil boring to a depth of 40.0 feet from the existing ground surface; performing associated laboratory tests on collected soil samples; preparation of Geotechnical Report in accordance with IDOT Geotechnical Manual 2020.

3.0 SITE DESCRIPTION

The project section is located within Unincorporated Lake County near the Village of Gurnee, Warren Township, Lake County and defined as Township T45N, Range 11E, Sections 24, Libertyville Quadrangle. The approximate coordinates of the proposed drainage junction chamber are 42.392815 North and 87.930189 West, Stn. 1099+35, 39.4' RT. The ground surface elevation is approximately 695.5 feet and the proposed RIM elevation is 695.0 feet. The proposed invert elevations are 688.92 feet (NE), 689.40 (SW), 689.47 (W) and 689.47 (E).

4.0 FIELD INVESTIGATION

One soil boring (DJB-01) was located on the south of Sterns School Road. Prior to drilling, the

drilling sub-contractor Geocon Professional Services (GEOCON) contacted the local one-call utility clearance service (JULIE) and PASSAGE to clear underground utilities.

The boring was drilled to a depth of 40 feet with a track mounted drill rig Deidrich D-50 turbo. INTERRA's geologist was present during the drilling to collect and log the soil samples. The boring was drilled, and samples were collected in general accordance with the guidelines in the IDOT Geotechnical Manual. Soil sampling was performed per AASHTO T-206, "Penetration Test and Split Barrel Sampling of Soils". Soil sampling was performed at 2.5-foot intervals up to 30.0 feet depth. After 30.0 feet depth, soil sampling was performed at 5.0-foot intervals. The soil samples were taken in conjunction with the Standard Penetration Test where a driving resistance to a standard 2" split-spoon sampler indicates the relative density of granular materials and consistency of cohesive soils. Soil specimens from the borings were visually classified in accordance with the AASHTO and IDOT textural classification systems. Also, unconfined compressive strength tests were performed on cohesive samples using an Illinois modified RIMAC tester. In addition to the split spoon samples, two (2) Shelby tube samples were collected from the borehole for performing laboratory tests. Water level readings were taken during drilling and immediately after the completion of drilling.

5.0 LABORATORY TESTING

All laboratory testing was performed in accordance with IDOT and/or AASHTO standard methods for testing. Moisture content tests were performed for all soil samples and Unconfined Compressive Strength tests were performed on the Shelby tube samples. Shelby Tube sample taken from 8.5 to 10.5 feet depth was damaged, and Unconfined Compressive Strength testing was not done on this sample. Pocket Penetrometer test was performed on this Shelby tube sample to estimate the Unconfined Compressive Strength. Shelby tube sample DJB01-ST-12 between the depths of 28.5 feet and 30.5 feet was tested for unconfined compressive strength in the laboratory.

The soil boring log indicating the blow counts, moisture content and soil description is included in Appendix A of this report. The boring log includes the results of the laboratory testing. Laboratory test reports are presented in Appendix B.

6.0 SUBSURFACE CONDITIONS

Boring DJB-01 encountered 6 inches of topsoil at the surface, followed by stiff brownish black silty clay up to 3.0 feet depth. This was underlain by stiff to very stiff brown silty clay up to 10.5 feet. Very stiff to stiff gray silty clay was encountered between 10.5- and 21.0-feet depths. This was underlain by very stiff to hard gray clay up to 33.0 feet. Below this was stiff gray clay up to the exploration depth of 40.0'.

Groundwater Information

Groundwater elevations were recorded during drilling and immediately after completion of drilling at all boring locations. Boring DJB-01 did not encounter ground water during or immediately after drilling. The boreholes were backfilled with auger cuttings and bentonite chips immediately after completion of drilling. Since the boreholes were backfilled immediately after drilling, the water levels reported may not represent the long-term groundwater levels. Changes in water levels should be expected due to seasonal variations and precipitation.

7.0 ANALYSIS AND RECOMMENDATIONS

The drainage junction chamber inverts are anticipated between 5.5 feet and 6.5 feet below the existing ground surface. Soils at this depth generally consist of very stiff silty clays. Groundwater was not encountered at the anticipated bottom of foundation depth.

Bearing Capacity and Settlement

Design loads for the proposed construction were not provided. However, for analyses purposes, it is estimated that the approximate bearing pressure applied to the foundation soils will be 1000 psf at an approximate depth of seven feet below existing grade. Foundation soils at this elevation can be designed for a factored bearing resistance of 3000 psf, which includes an LRFD Resistance

Factor of 0.45. Since there is no change in grade because of the proposed construction, settlements are not expected to be greater than one inch.

We do not anticipate any major undercuts for the proposed drainage junction chamber. Localized undercuts may become necessary if unsuitable soils are noted during excavation. The extent of undercuts should be determined by the field engineer or engineering technician. If any unsuitable soils are encountered, we recommend undercutting the unsuitable soils and replacing with CA1 or CA2. A woven geotextile fabric should be used below the aggregate improvement for ground stabilization (IDOT Section 1080.02). The aggregate shall be capped with minimum 6 inches of CA 6 or when groundwater is present, with CA 7.

Construction of the drainage junction chamber shall be in accordance with the local municipal standards and specifications or in their absence the relevant IDOT Standard Specifications. Excavation and foundation shall be in accordance with Article 550.04 and backfilling in accordance with Article 550.07.

8.0 CONSTRUCTION CONSIDERATIONS

The contractor can consider temporary ditches, sumps, granular drainage blankets and other methods to control surface water infiltration and ground water and provide a dry condition for construction.

Temporary shoring, if required during the stage construction is feasible by using simple cantilevered temporary sheet piling. A temporary 1:1 excavation for construction clearance has an adequate factor of safety. Steeper slopes should not be used. All excavations must be performed in accordance with local and federal regulations.

9.0 CLOSURE

The analysis and recommendations submitted in this report are based upon the data obtained from one (1) soil boring performed at the location indicated on the Borehole Location Plan, project information provided to INTERRA and from any other information discussed in this report. This report does not reflect any variations that may occur between these boreholes. In performing subsurface explorations, specific information is obtained at specific locations at specific times. It is a well-known fact that variations in soil and rock conditions exist on most sites between borehole locations. Also, groundwater levels vary from time to time. The nature and extent of variations may not become evident until the course of construction. If project characteristics change or if variations in the subsurface conditions appear evident, it will be necessary for a re-evaluation of the recommendations of this report.

We appreciate the opportunity to be of service to you. Should you need additional information or clarifications, please call us at (630) 754-8700.

Yours truly,

INTERRA, INC.

Ashok Guntaka, EI
Project Manager

Reshma Chirakkara, Ph.D.
Staff Engineer

Sanjeev Bandi, Ph.D., PE
Principal Engineer

07/14/22

STATE OF ILLINOIS
SANJEEVAREDDY
BANDI
062-051187
LICENSED
PROFESSIONAL ENGINEER

REFERENCES

AASHTO 2020, LRFD Bridge Design Specifications, 9th Edition 2020, American Association of State Highway and Transportation Officials, Washington, DC.

IDOT 2020, Geotechnical Manual, Illinois Department of Transportation.

IDOT 2016, Culvert Manual, Illinois Department of Transportation.

IDOT 2016, Standard Specifications for Road and Bridge Construction. Illinois Department of Transportation.

IDOT 2012, Bridge Manual, Bureau of Bridges and Structures, Illinois Department of Transportation.

Kolata, D. R., 2005, Bedrock Geology of Illinois, Illinois Map 14, Illinois State Geological Survey.

U.S.G.S. 2014, National Seismic Hazard Maps. http://earthquake.usgs.gov/research/hazmaps/

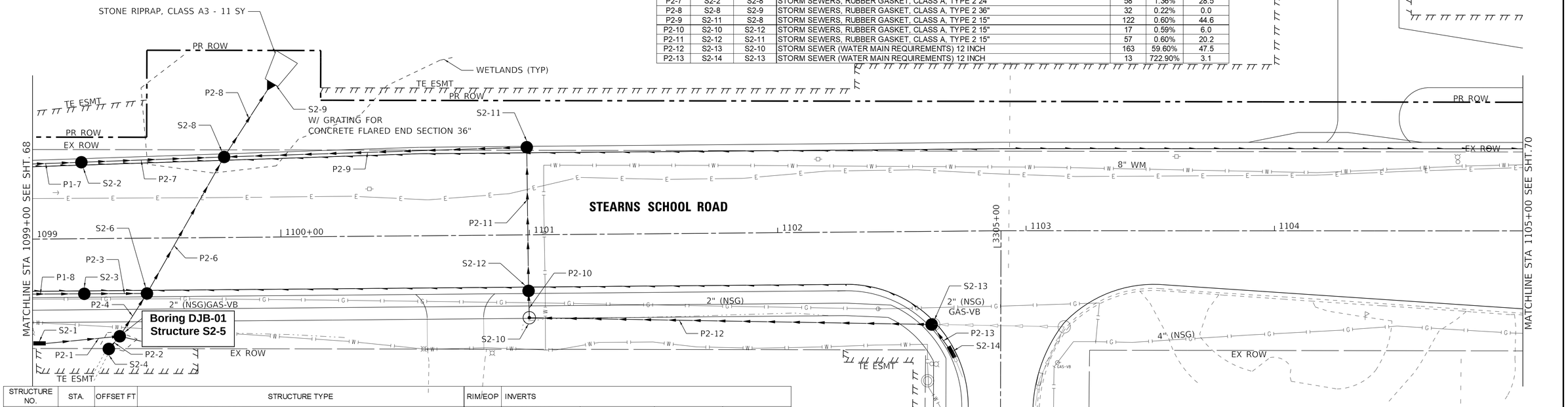
Coduto, Donald P., 1994, Foundation Design, Prentice Hall, Inc.

Appendix A

Borehole Location Plan

Soil Boring Logs

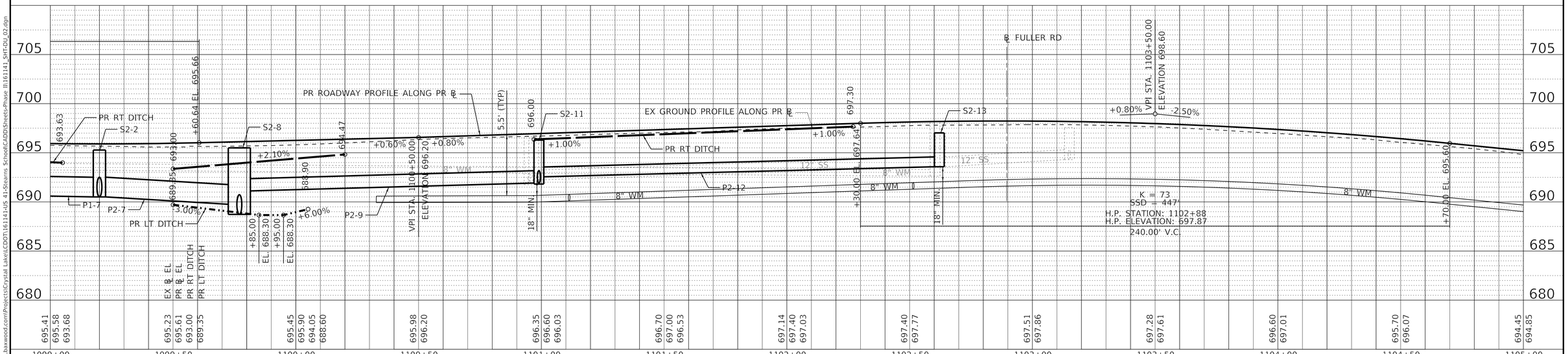
PIPE NO.	FROM	TO	PIPE TYPE	LENGTH FT	SLOPE %	TRENCH BACKFILL CU YD
P2-1	S2-1	S2-5	STORM SEWER (WATER MAIN REQUIREMENTS) 12 INCH	30	1.57%	0.0
P2-2	S2-4	S2-5	STORM SEWERS, CLASS A, TYPE 1 EQUIVALENT ROUND-SIZE 30"	7	0.45%	0.0
P2-3	S2-3	S2-6	STORM SEWERS, RUBBER GASKET, CLASS A, TYPE 2 18"	25	0.71%	10.4
P2-4	S2-5	S2-6	STORM SEWER (WATER MAIN REQUIREMENTS) 36 INCH	20	0.44%	13.4
P2-5	S2-7	S2-5	STORM SEWER (WATER MAIN REQUIREMENTS) 12 INCH	16	3.32%	0.0
P2-6	S2-6	S2-8	STORM SEWERS, RUBBER GASKET, CLASS A, TYPE 2 36"	63	0.73%	45.0
P2-7	S2-2	S2-8	STORM SEWERS, RUBBER GASKET, CLASS A, TYPE 2 24"	58	1.36%	28.5
P2-8	S2-8	S2-9	STORM SEWERS, RUBBER GASKET, CLASS A, TYPE 2 36"	32	0.22%	0.0
P2-9	S2-11	S2-8	STORM SEWERS, RUBBER GASKET, CLASS A, TYPE 2 15"	122	0.60%	44.6
P2-10	S2-10	S2-12	STORM SEWERS, RUBBER GASKET, CLASS A, TYPE 2 15"	17	0.59%	6.0
P2-11	S2-12	S2-11	STORM SEWERS, RUBBER GASKET, CLASS A, TYPE 2 15"	57	0.60%	20.2
P2-12	S2-13	S2-10	STORM SEWER (WATER MAIN REQUIREMENTS) 12 INCH	163	59.60%	47.5
P2-13	S2-14	S2-13	STORM SEWER (WATER MAIN REQUIREMENTS) 12 INCH	13	722.90%	3.1



STRUCTURE NO.	STA.	OFFSET FT	STRUCTURE TYPE	RIM/EOP	INVERTS			
S2-1	1099+05	42.0' RT	INLETS, TYPE A, TYPE 8 GRATE	693.63	689.94 12" NE			
S2-2	1099+20	30.7' LT	CATCH BASINS, TYPE A, 5'-DIAMETER, TYPE 24 FRAME AND GRATE	694.92	690.15 24" W	690.15 24" E		
S2-3	1099+21	22.0' RT	CATCH BASINS, TYPE A, 4'-DIAMETER, TYPE 24 FRAME AND GRATE	695.12	690.48 18" W	690.48 18" E		
S2-4	1099+30	44.3' RT	MANHOLES, TYPE A, 6'-DIAMETER, TYPE 8 GRATE	692.41	689.43 24"x38" NE	689.50 EX 18" SW		
S2-5	1099+35	39.4' RT	PRECAST CONCRETE JUNCTION CHAMBER	695.00	688.92 36" NE	689.40 24"x38" SW	689.47 12" W	689.47 12" E
S2-6	1099+46	21.0' RT	MANHOLES, TYPE A, 8'-DIAMETER, TYPE 24 FRAME AND GRATE	695.17	688.83 36" SW	690.30 18" W	688.83 36" NE	
S2-7	1099+50	43.0' RT	INLETS, TYPE A, TYPE 8 GRATE	693.00	689.99 12" W			
S2-8	1099+77	31.0' RT	MANHOLES, TYPE A, 9'-DIAMETER, TYPE 24 FRAME AND GRATE	695.14	688.37 36" NE	688.37 36" SW	689.37 24" W	690.73 15" E
S2-9	1099+96	61.1' LT	PRECAST REINFORCED CONCRETE FLARED END SECTIONS 36"		688.30 36" SW			
S2-10	1101+00	33.3' RT	MANHOLES, TYPE A, 1'-DIAMETER, TYPE 1 FRAME, CLOSED LID	696.42	692.00 15" N	692.25 12" E		
S2-11	1100+99	33.0' LT	CATCH BASINS, TYPE A, 4'-DIAMETER, TYPE 24 FRAME AND GRATE	695.93	691.46 15" W	691.56 15" S		
S2-12	1101+00	21.0' RT	CATCH BASINS, TYPE A, 4'-DIAMETER, TYPE 24 FRAME AND GRATE	696.18	691.90 15" N	691.90 15" S		
S2-13	1102+62	37.4' RT	CATCH BASINS, TYPE A, 4'-DIAMETER, TYPE 11 FRAME AND GRATE	696.66	693.22 EX 12" E	693.22 12" W	693.26 12" SE	
S2-14	1102+70	48.5' RT	INLETS, TYPE A, TYPE 11 FRAME AND GRATE	697.09	694.23 12" NW			

LEGEND

SX-X	DRAINAGE STRUCTURE
PX-X	STORM SEWER
	PIPE UNDERDRAINS, TYPE 2 4"



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BAXTER & WOODMAN Consulting Engineers

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

DRAINAGE & UTILITIES
STEARNS SCHOOL ROAD

SCALE: 1"=20' | SHEET 2 OF 3 SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
	16-00222-02-CH	LAKE	154	69
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			

Interra, Inc.
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SOIL BORING LOG

Date 6/10/22

ROUTE US 41 and Stearn School Road **DESCRIPTION** Drainage Junction Chamber **LOGGED BY** Sponaugle

SECTION 16-00222-02-CH **LOCATION** 25' east of existing culvert

COUNTY Lake County **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** Automatic

STRUCT. NO. _____
Station _____

BORING NO. DJB-01
Station 1099+35
Offset 39.40ft RT
Ground Surface Elev. 695.50 ft

Surface Water Elev. _____ ft
Stream Bed Elev. _____ ft

Groundwater Elev.:
First Encounter Dry ft
Upon Completion Dry ft
After _____ **Hrs.** _____ ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				TOPSOIL (6")
695.00				Stiff, brownish black SILTY CLAY, trace gravel, moist
	3			
	3		31.0	
	3	1.2 S		
692.50				Stiff, brown SILTY CLAY, moist
	3			
-5	3		27.2	
	4	1.5 B		
690.00				Very stiff, brown SILTY CLAY, moist
	3			
	4		17.0	
	5	2.1 S		
				Shelby Tube 8.85-10.5'
			19.7	
-10		3.5 P		
685.00				Very stiff, gray SILTY CLAY, moist
	4			
	7		14.2	
	10	2.6 B		
	3			
	4		18.0	
-15	6	2.0 B		
	3			
	5		15.1	
	7	2.3 B		
677.50				Stiff, gray SILTY CLAY, trace gravel, moist
	5			
	6		15.7	
-20	8	1.5		
				Stiff, gray SILTY CLAY, trace gravel, moist *(continued)*
674.50				Very stiff, gray CLAY, trace gravel, moist
	5			
	6		16.0	
	7	2.0 P		
	6			
	7		16.2	
-25	14	2.4 B		
	3			
	3		12.8	
	5	2.1 B		
667.50				Hard, gray CLAY, trace gravel, moist
				Shelby Tube 28.5'-30.5'
			17.4	
-30		4.9 B		
662.50				Stiff, gray CLAY, moist
	4			
	6		14.1	
-35	7	1.7 B		
	4			
	6		15.7	
655.50 -40	7	1.5		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)

Appendix B

Laboratory Test Reports

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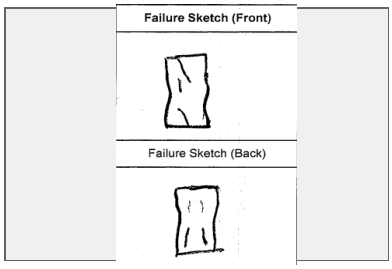
UNCONFINED COMPRESSIVE STRENGTH (ASTM D 2166)

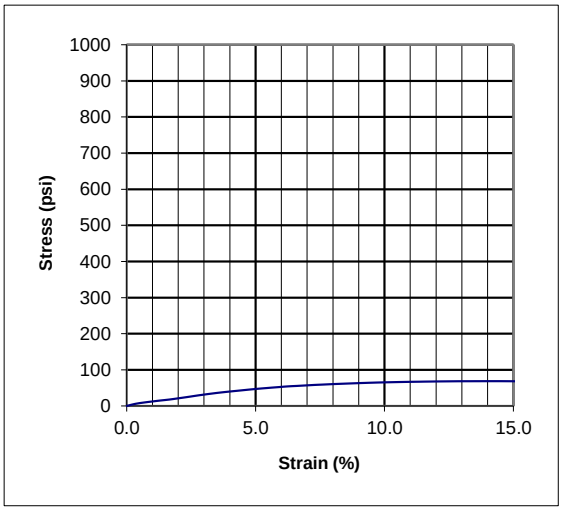
Project	Stearns School Road at US 41 Geotechnical Borings - Baxter Woodman						
Client	Baxter & Woodman, 8678 Ridgefield Road, Crystal Lake, IL 60012						
File No.	8076	**Sample No.**	DJB 01-ST-12	**Date Tested**	6/20/22	**Tested By**	BKP
						QC By	AB

Date Sample Received	6/15/22
Description of Soil	Gray silty clay
Location	28.5'-30.5'

Type of Sample	ST	
Average Height =	15.42	cm
Average Diameter =	7.24	cm
Height/Diameter Ratio =	2.13	
Wet Sample Weight=	1378.82	g
Wet Density =	2.17	g/cc
Moisture Content =	17.4	%
Dry Density =	1.85	g/cc
Strain Rate =	1.00	%/min



Failure Image



Unconfined Compressive Strength =	68.55	psi
	4.94	**tsf**
Shear Strength =	34.27	psi
	2.47	tsf
Strain at Failure =	14.2	%

Remarks:

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Test ID	69092

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Engineering • Inspection • Testing

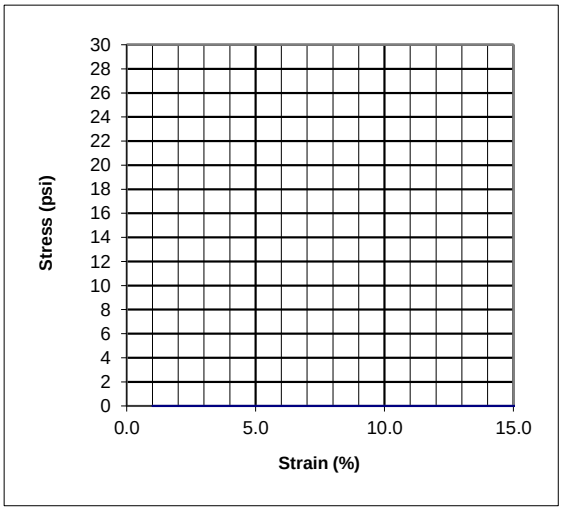
UNCONFINED COMPRESSIVE STRENGTH (ASTM D 2166)

Project	Stearns School Road at US 41 Geotechnical Borings - Baxter Woodman						
Client	Baxter & Woodman, 8678 Ridgefield Road, Crystal Lake, IL 60012						
File No.	8076	**Sample No.**	DJB 01-ST-04	**Date Tested**	6/21/22	**Tested By**	BKP
						QC By	AB

Date Sample Received	6/15/22
Description of Soil	Brown silty clay
Location	8.5'-10.5'

Type of Sample		
Average Height =		cm
Average Diameter =		cm
Height/Diameter Ratio =		
Wet Sample Weight=		g
Wet Density =		g/cc
Moisture Content =		%
Dry Density =		g/cc
Strain Rate =		%/min

Failure Image



Unconfined Compressive Strength =		psi **tsf**
Shear Strength =		psi tsf
Strain at Failure =		%

Remarks:

Damaged sample, test could not be done.Pocket penetrometer reading at the top of the sample = 3.5 tsf