STRUCTURE GEOTECHNICAL REPORT

Proposed Retaining Wall

Structure Number 049-W089

IDOT Project D-91-086-16, PTB 178-001, Contract 62B65

City of Lake Forest

Lake County, Illinois

Prepared for:

Knight E/A
221 North LaSalle Street
Suite 300
Chicago, Illinois 60601

Prepared by:

Geo Services, Inc.
805 Amherst Court
Suite 204
Naperville, Illinois 60565
(630) 305-9186

JOB NO. 16017

04/17/19

Geo Services, Inc.
Geotechnical, Environmental and Civil Engineering
An MBE - DBE Firm

April 17, 2019

Knight E/A
221 North LaSalle Street, Suite 300
Chicago, IL 60601

Attn: Mr. Robert F. Mack, PE, CFM

GSI Project No. 16017

Re: Structure Geotechnical Report
Proposed Retaining Wall
Structure # 049-W089
IDOT Project No. D-91-086-16, PTB# 178-001, Contract 62B65
Lake Forest, IL.

Dear Mr. Mack:

The following report presents the geotechnical analysis and recommendations for the construction of the proposed Retaining Wall SN 049-W089 located at approximate Station 53+60 to Station 54+85 (north of the proposed IDOT Pump Station #38) along EB Deerpath Road, near the southwest quadrant of Deerpath Road and Ahwahnee Lane in Lake County, Illinois. A total of three (3) retaining wall borings (RW-03, RW-04 and RW-05) were completed at the site by Geo Services, Inc. (GSI). Copies of these boring logs, along with its location plan are included in this report.

If there are any questions regarding the information submitted herein, please do not hesitate to contact us.

Very truly yours,

GEO SERVICES, Inc.

ANDREW J. PTAK
062-052031
LICENSED
PROFESSIONAL
ENGINEER
STATE OF ILLINOIS

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approved 11/30/19

enc.

TABLE OF CONTENTS

SECTION 01: INTRODUCTION

The following report presents the results of the geotechnical investigation performed for the proposed retaining wall located at the southwest quadrant of Deerpath Road and Ahwahnee Lane in Lake County, Illinois. This report is based upon the boring information obtained (RW-03, RW-04 and RW-05) which were drilled in the month of March, 2019 at the proposed retaining wall site.

Boring locations were selected by Geo Services, Inc. and were reviewed and approved by Knight E/A. Boring locations were laid out in the field by GSI personnel at the proposed locations using a GPS handheld device. Offsets were made by the GSI field personnel, where borings were inaccessible to the drill rig at the pre-marked boring locations. Elevations of the as-drilled borings were taken from topographic information provided by Knight E/A and are shown on the boring logs.

The project is located in Lake Forest, Lake County, Illinois with the following range/township information: T44N R12E, Section 32. The project location is shown on the boring location map included in the Appendix.

This report includes a site location map, boring location diagrams and boring logs, as well as descriptions of soil and groundwater conditions, recommendations pertaining to the design and construction of the retaining wall and general construction considerations for the site.

SECTION 02: PROJECT DESCRIPTION

The proposed retaining wall will be 110 ft. long constructed along the south side of Deerpath road, extending from Station 53+71 to 54+81 (north of the proposed IDOT Pump Station #38), located at the Southwest quadrant of Deerpath Road and Ahwahnee Lane in Lake County, Illinois. Based on the plan and cross-section drawings provided by the designer (Knight E/A), the proposed retaining wall will be a cut wall, which will retain embankment heights ranging from 4 to 8 feet. In addition, the wall will have a retained embankment side slope of 1V:3H. The proposed retaining wall will be supported on shallow foundation per drawings provided by the designer (Knight E/A).

Based on the wall geometry provided by Knight E/A and assumed traffic surcharge of 250 pounds per square foot (psf), we estimate a factored bearing pressure of 3.6 kips per square foot (ksf) at bearing elevations 656 to 662 feet, using Load Resistance Factored Design (LRFD) method.

SECTION 03: SUBSURFACE INVESTIGATION PROCEDURES

Borings RW-03, RW-04 and RW-05 were performed during the month of March, 2019. The borings were drilled using a truck mounted drilling rig equipped with a CME automatic hammer, advanced by hollow stem augers to depths of 10 feet, and then switched to rotary drilling to completion. Representative soil samples were obtained employing split spoon sampling procedures in accordance with AASHTO Method T-206. Samples obtained in the field were brought to our laboratory for further examination and testing.

Split spoon sampling involves driving a 2.0-inch outside diameter split-barrel sampler into the soil with a 140-pound weight falling freely through a distance of 30 inches. Blow counts are recorded at 6" intervals and the blow counts are shown on the boring logs. The number of blows required to advance the sampler the last 12 inches is termed the Standard Penetration Resistance (N). The N-value is an indication of the relative density of the soil.

Table 1 below lists the borings completed for the proposed Retaining Wall SN 049-W089.

Table 1 – Summary of Subsurface Exploration

Locations	Boring No.	Station (Offset)	Boring Depth (ft.)	Existing Ground Elevation (feet)
Deerpath Road	RW-03	53+29 (16.80 ft. Right)	50.0	658.40
Deerpath Road	RW-04	54+03 (16.20 ft. Right)	50.0	661.80
Deerpath Road	RW-05	54+58 (11.20 ft. Right)	50.0	664.50

SECTION 04: LAB TESTING PROGRAM

The test procedures were performed in accordance with test procedures discussed in the IDOT Geotechnical Manual. All split-spoon samples obtained from the drilling operation were visually classified in the field. Cohesive samples were tested in the field for unconfined compressive strength using an IDOT modified RIMAC test device and/or calibrated penetrometer.

The soil testing program included performing water content, density and either unconfined compression and/or calibrated penetrometer tests on the cohesive samples recovered. Water content tests were performed on the non-cohesive samples

recovered. These tests were performed upon representative portions of the samples obtained in the field. The results of the above testing, along with a visual classification of the material based upon both the Illinois textural classification and the AASHTO Soil Classification System, are indicated on the boring logs.

SECTION 05: SOIL AND GROUNDWATER CONDITIONS

5.1 Soil Conditions

Boring logs can be found in Appendix C. The stratification lines shown on the boring logs represent the approximate boundary between soil types, and the actual transition may be gradual.

The retaining wall borings were drilled in the right lane of EB Deerpath Road. The pavement at borings RW-03 and RW-04 consists of 6 inches of asphalt and 6 inches of concrete. The pavement at boring RW-05 consists of 6 inches of asphalt, overlying 6 inches of crushed stone sub base material. Immediately below the pavement section, stiff to hard clay loam with gravel fill materials were encountered to a depth of 2 to 5 feet below ground level. Beneath the fill materials, the boring transitions to medium stiff to hard clay to boring termination at elevations ranging from 609 to 614 feet. A 5-foot stratum of medium dense clayey sand was also noted within the clay strata at boring RW-04 at approximate elevation 620 feet.

Moisture contents of the cohesive soils ranged from mid-teens to low twenties. Granular soils had moisture contents at mid-teens.

5.2 Groundwater Conditions

The boring was dry to a depth of 10 feet prior to switching to rotary drilling techniques. Due to the nature of rotary-wash drilling, it was not possible to obtain accurate water level readings below 10 feet of depth or after drilling. We estimate the long term water table at approximate elevations 656 to 661 feet based on the coloration change of soils from brown and gray to gray. Fluctuations in the amount of water accumulated and in the hydrostatic water table can be anticipated depending on variations in precipitation and surface runoff. The brown color of the soil is typically caused by oxidation that occurs above the long term water level. This color transition did not occur at a consistent elevation in all of the borings, which may indicate seasonal fluctuations from the above average rainfall and climatic conditions or impacts from the drainage of the surrounding area.

SECTION 06: ANALYSIS

6.1 Settlement

Based on the plans and cross-sections provided by Knight E/A, the drawings show that the retaining wall will be a cut wall to retain the existing embankment soils ranging from 4 to 8 feet high. Based on the soil conditions (borings RW-03, RW-04 and RW-05) encountered at the wall alignment where shallow foundations are proposed, settlement is estimated to be less than 0.3 inch using a maximum embankment height of approximately 8 feet as worst-case scenario. The estimated settlements are within the permissible levels and not an issue.

6.2 Slope Stability

Slope stability of the proposed retaining walls were calculated using the cross-section drawings provided by Knight E/A, normal and high water level conditions, and assuming undrained and drained soil strengths. Based on the soil profile, the maximum retained embankment height of approximately 8 feet, and water level conditions, the Factors of Safety (FOS) were calculated to be greater than 1.7 for both short and long-term conditions; this satisfies the FOS requirement for a cut embankment per IDOT requirements.

6.3 Bearing Capacity

The base of foundation footing elevations for the wall sections to be supported on shallow foundations have been estimated based on the plans and cross-sections provided by Knight E/A. A summary of the bearing analyses for the wall is provided in Table 2.

Table 2 – Factored Bearing Resistance Summary (for Shallow Foundations)

Borings	Bearing Material Description (Qu=tsf, wc=%)	Approx. Base of Foundation Elevation (feet)	Recommended Factored Bearing Resistance (psf) [1]
RW-03	Clay Loam-Very Stiff (Qu=2.3 tsf, wc=19%)	656.8	5,500
RW-04	Clay Loam-Very Stiff (Qu=2.5 tsf, wc=17%)	659.0	6,000
RW-05	Clay Loam-Very Stiff (Qu=4.5 tsf, wc=16%)	662.0	8,000

Note: 1. Factored Bearing Resistance is computed for a resistance factor of 0.45 (for clays) per AASTHO LRFD Bridge Manual, Table 10.5.5.2.2-1.

SECTION 07: FOUNDATION RECOMMENDATIONS

7.1 Shallow Foundation Recommendations

It is planned that the precast modular (gravity wall) retaining wall is to be supported on shallow foundations. Based on the soil conditions provided in the borings, the use of spread footing foundations for support is feasible for the proposed retaining wall.

Plans and cross-section drawings show that the bottom of the retaining wall footing foundation will be based at approximate elevation 656.8 to 662.0 feet. Based on our analyses of soil bearing resistance (as summarized in **Table 2 - Bearing Summary**) and estimated settlements, the upper subgrade soils (stiff to very stiff clays) are suitable for support of the retaining wall with a recommended factored bearing resistance of 4,500 to 8,000 psf (summarized in **Table 2).** No undercuts are anticipated at these areas based on the soils obtained.

Soils shall be verified in the field at the time of construction by an experienced Geotechnical Engineer or representative. Actual extents of any remedial treatments shall be determined at this time. If soils with less than adequate bearing strength are noted at the foundation level during footing construction, the weaker soils encountered at the base of the footings shall be undercut to reach suitable bearing soils, and the undercut area filled with lean concrete or an approved compacted structural (granular) fill material. Any undercutting and backfilling procedures shall be in accordance with Section 205 of the IDOT Standard Specifications for Road and Bridge Construction.

Any structural fill utilized to support footings shall be extended at least 12 inches beyond the proposed footing limits and then 1 foot horizontally for each 1 foot of fill placed below the base of the footing. Any new fill shall consist of inorganic material free of debris. Suitable fill materials include crushed granular materials corresponding to IDOT gradation CA-1, CA-6 or CA-7.

Structural fill shall be placed in loose lifts having a maximum 8 inches thickness. CA-6 shall be compacted to a minimum of 95% of the maximum dry density obtained in accordance with ASTM Standard D-1557, modified Proctor method. The moisture content of the fill shall be controlled within +2% of the optimum moisture content. CA-1 and CA-7 materials can be compacted by placing in lifts and rolling with a smooth drum vibratory compactor or thoroughly tamping with a backhoe bucket.

All soils which become softened or loosened at the base of foundation excavation areas or subgrade areas should be carefully re-compacted or removed prior to placement of foundation concrete. No foundation concrete should be placed in areas of ponded water or frozen soil.

The following Table 3 may be used for design of the retaining wall and temporary earth retaining systems.

Table 3 – Soil Parameters for Lateral Resistance

Material (Approx. Elevation, feet)	Unit Weight (pcf)	Drained Friction Angle (°)	Undrained Cohesion (psf)	Lateral Modulus of Subgrade Reaction (pci)	Strain
Hard Clay (663 to 652)	125	32	4,500	2,000	0.004
Very Stiff Clay (652 to 620)	125	28	2,000	750	0.005
Medium Dense Clayey Sand (620 to 614)	125	28	n/a	120	--
Stiff Clay (614 to 608)	125	28	1,600	750	0.006

Note: 1. Values recommended for use in design from L-pile Software Manual.

7.2 General Wall Design

Fill behind the retaining wall shall be placed in compliance with Section 205 of the IDOT Standard Specifications for Road and Bridge Construction. Backfill behind the wall shall consist of a compacted, free-draining granular material. A proper drainage system shall be designed and provided behind cantilever wall designs.

For the design of flexible walls, it is recommended that a lateral active earth pressure of 40 psf per foot of depth be used above the water table assuming a free-draining granular backfill is utilized. For cohesive soils, a lateral active earth pressure of 55 psf per foot should be used. For non-flexible walls with granular backfill, a lateral at-rest pressure of 50 psf per foot should be used, assuming proper drainage. For cohesive soils, a lateral at-rest pressure of 65 psf per foot should be used.

Allowances should be made for any surcharge loads adjacent to the retaining structure. Drainage shall be provided behind the wall. The bases of the retaining walls are to be founded in natural clay material. According to the NAVFAC Design Manual 7.2, a value of 0.34 may be used for the coefficient of friction between the concrete base and drained cohesive soils (this assumes a concrete base on the stiff cohesive soils). Assuming granular fill, a friction angle of 28 degrees may be used for the concrete on granular fill, leading to a coefficient friction value of 0.53. We recommend a resistance factor against sliding of 0.8 to be used based on LRFD Manual procedures Section 10.6.3.4.

To provide adequate frost protection, we recommend the bottom of the modular-block, gravity wall footing be at a minimum of 3.5 feet below final grade.

SECTION 08: GENERAL CONSTRUCTION CONSIDERATIONS

The temporary soil retention system shall be designed by the Contractor (or as directed by the Engineer) as specified in Section 522 of the IDOT Standard Specifications. All excavations should be performed in accordance with the latest Occupational Safety and Health Administration (OSHA) requirements. Allowances should be made for any surcharge loads adjacent to the excavation areas. The information provided below should not be interpreted to mean that Geo Services, Inc. is assuming responsibility for construction site safety or the contractor's activities. Construction site safety is the sole responsibility of the contractor, who should also be solely responsible for the means, methods, and sequencing of construction operations.

The OSHA Occupational Safety and Health Standards-Excavations classify soils into three basic types (e.g. Type A, B, and C). Depending upon the soil type, OSHA requirements for temporary excavation slopes range from 3/4H to 1V (horizontal to vertical) for Type A soils, 1H to 1V for Type B soils, and 1-1/2H to 1V for Type C soils. Per OSHA, any excavation extending to a depth of more than 20 feet shall be designed by a licensed professional engineer. Based upon the subsurface conditions encountered at most boring locations, the excavations will extend through predominately stiff to very stiff cohesive soil (embankment fill) and into native medium stiff to very stiff cohesive soils. The cohesive fill material sampled in the borings typically exhibited unconfined compressive strengths in excess of 0.5 tsf. Cohesive soils having unconfined compressive strengths greater than 0.5 tsf but less than 1.5 tsf classify as Type B soils according to OSHA regulations. OSHA recommends a maximum slope inclination of 1 horizontal to 1 vertical for temporary excavations in Type B cohesive soils. Considerations should be given to the allowable construction easement when developing the excavation plan. Particular caution should be exercised if excavations are performed near existing utility lines. Existing backfill for utility lines is often poorly compacted and the limits of the old excavation form a ready failure surface. The OSHA trench safety guidelines for adequate side slopes based on the soil types may not apply in these situations.

SECTION 09: GENERAL QUALIFICATIONS

The analysis and recommendations presented in this report are based upon the data obtained from the soil borings performed at the indicated locations and from any other information discussed in this report. This report does not reflect any variations that may occur between borings or across the site. In addition, the soil samples cannot be relied on to accurately reflect the strata variations that usually exist between sampling locations. The nature and extent of such variations may not become evident until construction. If variations appear evident, it will be necessary to reevaluate the recommendations of the report. In addition, it is recommended that Geo Services Inc. be retained to perform construction observation and thereby provide a complete professional geotechnical engineering service through the observational method.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No other warranties, either expressed or implied, are intended or made. In the event that any changes in the nature, design or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report modified or verified in writing by the geotechnical engineer. Also note that Geo Services Inc. is not responsible for any claims, damages, or liability associated with any other party's interpretation of this report's subsurface data or reuse of the report's subsurface data or engineering analyses without the express written authorization of Geo Services Inc.

APPENDIX A

GENERAL NOTES

GENERAL NOTES

CLASSIFICATION

American Association of State Highway & Transportation Officials (AASHTO) System used for soil classification.

Cohesionless Soils

Relative Density	No. of Blows per foot N
Very Loose	0 to 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	Over 50

TERMINOLOGY

Streaks are considered to be paper thick. **Lenses** are considered to be less than 2 inches thick. **Layers** are considered to be less than 6 inches thick. **Stratum** are considered to be greater than 6 inches thick.

Cohesive Soils

Consistency	Unconfined Compressive Strength - qu (tsf)
Very Soft	Less than 0.25
Soft	0.25 - 0.5
Medium Stiff	0.5 - 1.0
Stiff	1.0 - 2.0
Very Stiff	2.0 - 4.0
Hard	Over 4.0

DRILLING AND SAMPLING SYMBOLS

SS:	Split Spoon 1-3/8" I.D., 2" O.D.	HS:	Housel Sampler
ST:	Shelby Tube 2" O.D., except where noted	WS:	Wash Sample
AS:	Auger Sample	FT:	Fish Tail
DB:	Diamond Bit - NX: BX: AX	RB:	Rock Bit
CB:	Carboloy Bit - NX: BX: AX	WO:	Wash Out
OS:	Osterberg Sampler		

Standard "N" Penetration: Blows per foot of a 140 lb. hammer falling 30" on a 2" O.D. Split Spoon

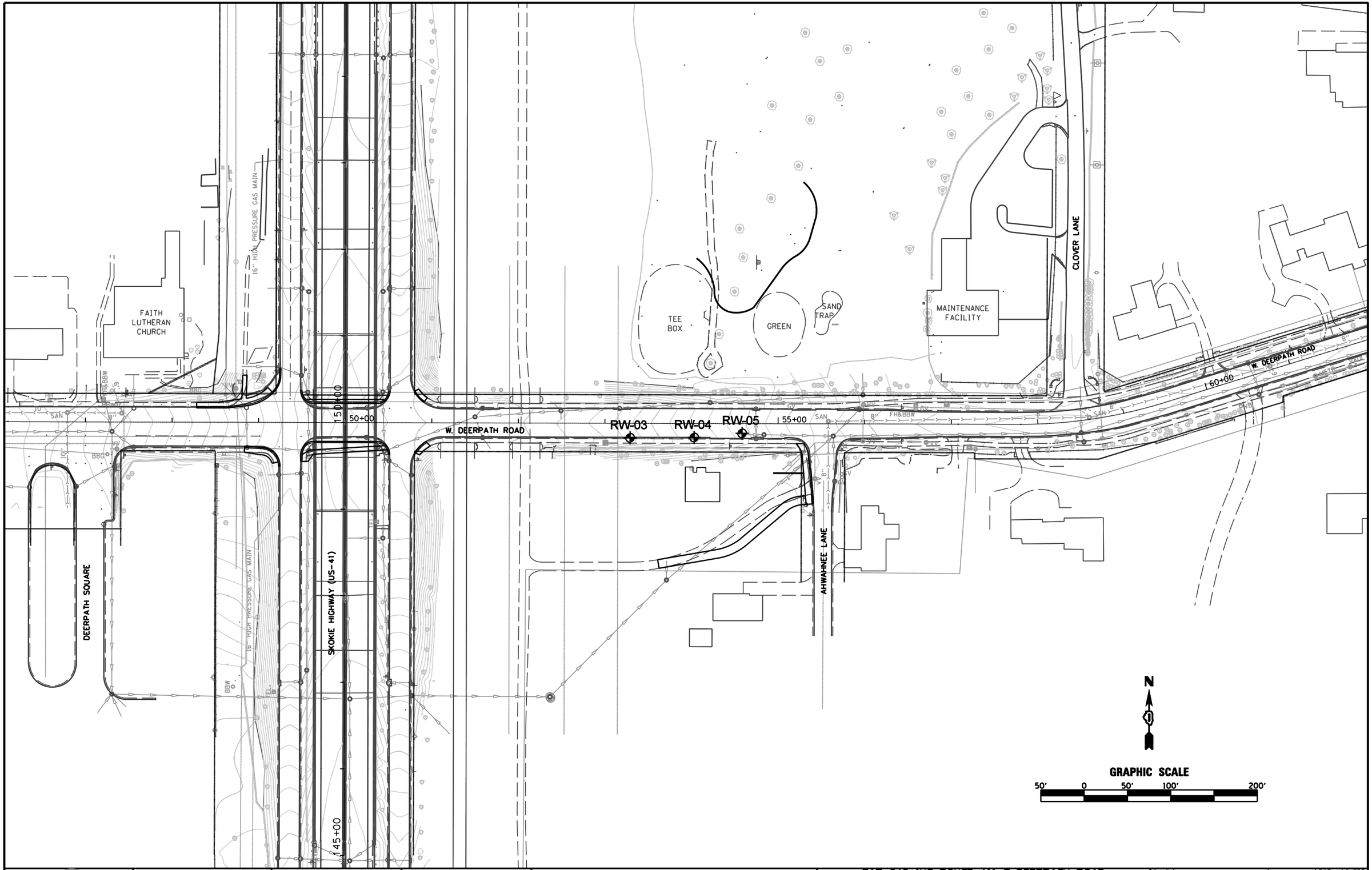
WATER LEVEL MEASUREMENT SYMBOLS

WL:	Water	WD:	While Drilling
WCI:	Wet Cave In	BCR:	Before Casing Removal
DCI:	Dry Cave In	ACR:	After Casing Removal
WS:	While sampling	AB:	After Boring

Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. In pervious soils, the indicated elevations are considered reliable ground water levels. In impervious soils, the accurate determination of ground water elevations is not possible in even several days observation, and additional evidence on ground water elevations must be sought.

APPENDIX B

SOIL BORING PLAN



Geo Services, Inc.
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805 Amherst Court, Suite 204
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(630) 355-2838

USER NAME = #USER#	DESIGNED - RWC	REVISED -
	DRAWN - RWC	REVISED -
PLOT SCALE = #SCALE#	CHECKED - AJP	REVISED -
PLOT DATE = #DATE#	DATE - 4/1/2019	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

FAP 346 (US ROUTE 41) @ DEERPATH ROAD
RETAINING WALL No. 1
SOIL BORING LOCATION DIAGRAM

SCALE 1"=100' | SHEET 1 OF 1 SHEETS | STA. 53+71.42 TO STA. 54+81.42

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
346	(130S): (21&21S)-1	LAKE	1	1
IDOT PROJECT No. D-91-086-16		CONTRACT NO. 62B65		
ILLINOIS	FED. AID PROJECT			

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APPENDIX C

SOIL BORING LOGS

Geo Services, Inc.
Geotechnical, Environmental & Civil Engineering
805 Amherst Court, Suite 204
Naperville, Illinois 60565
(630) 355-2838

SOIL BORING LOG

GSI Job No. 16017

Date 3/25/19

ROUTE FAP 346 **DESCRIPTION** Retaining Wall **LOGGED BY** TZ

SECTION _____ **LOCATION** NW 1/4, **SEC.** 32, **TWP.** T44N, **RNG.** R12E, 3rd **PM**

COUNTY Lake **DRILLING METHOD** Hollow Stem Auger/Rotary **HAMMER TYPE** CME Automatic

STRUCT. NO. _____
Station _____

BORING NO. RW-03
Station 53+29
Offset 16.80ft Right
Ground Surface Elev. 658.40 ft

Surface Water Elev. n/a ft
Stream Bed Elev. n/a ft

Groundwater Elev.:
First Encounter Dry to -10.0 ft
Upon Completion n/a ft
After _____ **Hrs.** _____ ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
6.0" ASPHALT, 6.0" CONCRETE			
657.40			
CLAY LOAM with Gravel-brown & gray-medium dense (Fill)	14		
	12		14
	5		
655.40			
CLAY LOAM-gray-very stiff	3		
	4	2.3	19
-5	6	B	
652.90			
CLAY-gray-medium stiff to stiff	3		
	4	1.2	21
	5	B	
	3		
	4	1.2	18
-10	6	B	
	3		
	4	0.5	18
	5	B	
	3		
	4	1.1	21
-15	6	B	
	3		
	5	0.9	19
	6	B	
	3		
	4	0.7	23
-20	6	B	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CLAY-gray-medium stiff to stiff *(continued)*			
	3		
	4	1.3	22
	6	B	
	2		
	2	0.5	22
-25	3	P	
	2		
	3	0.5	22
	4	P	
	6		
	11	2.6	17
-30	13	B	
	4		
	6	1.2	20
-35	11	B	
	6		
	7	1.2	20
-40	11	B	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, from 137 (Rev. 8-99)

Z:\PROJECTS\2016\16017 KNIGHT EA, IDOT PUMP STATION 38 FAP 346 (PTB 178, ITEM 1)\16017 BORING LOGS\16017_LOG.GPJ 4/1/19

Geo Services, Inc.
Geotechnical, Environmental & Civil Engineering
805 Amherst Court, Suite 204
Naperville, Illinois 60565
(630) 355-2838

SOIL BORING LOG

GSI Job No. 16017

Date 3/25/19

ROUTE FAP 346 **DESCRIPTION** Retaining Wall **LOGGED BY** TZ

SECTION _____ **LOCATION** NW 1/4, **SEC.** 32, **TWP.** T44N, **RNG.** R12E, 3rd **PM**

COUNTY Lake **DRILLING METHOD** Hollow Stem Auger/Rotary **HAMMER TYPE** CME Automatic

STRUCT. NO. _____
Station _____

BORING NO. RW-03
Station 53+29
Offset 16.80ft Right
Ground Surface Elev. 658.40 **ft**

Surface Water Elev. n/a **ft**
Stream Bed Elev. n/a **ft**

Groundwater Elev.:
First Encounter Dry to -10.0 **ft**
Upon Completion n/a **ft**
After _____ **Hrs.** _____ **ft**

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
CLAY-gray-medium stiff to stiff *(continued)*				
	4			
	8	0.8	19	
-45	12	B		
	4			
End Of Boring @ -50.0'. Boring backfilled with cuttings.	8	0.7	21	
608.40 -50	13	B		
-55				
-60				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, from 137 (Rev. 8-99)

Z:\PROJECTS\2016\16017 KNIGHT EA, IDOT PUMP STATION 38 FAP 346 (PTB 178, ITEM 1)\16017 BORING LOGS\16017_LOG.GPJ 4/1/19

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SECTION _____ **LOCATION** NW 1/4, **SEC.** 32, **TWP.** T44N, **RNG.** R12E, 3rd **PM**

COUNTY Lake **DRILLING METHOD** Hollow Stem Auger/Rotary **HAMMER TYPE** CME Automatic

STRUCT. NO. _____
Station _____

BORING NO. RW-04
Station 54+03
Offset 16.20ft Right
Ground Surface Elev. 661.80 ft

Surface Water Elev. n/a ft
Stream Bed Elev. n/a ft

Groundwater Elev.:
First Encounter Dry to -10.0 ft
Upon Completion n/a ft
After _____ **Hrs.** _____ ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
660.80			
6.0" ASPHALT, 6.0" CONCRETE			
	3		
CLAY LOAM-brown & gray-very stiff	4 7	2.5 B	17
becoming gray @ -3.0'	5		
-5	8 11	3.0 B	15
	5		
	7 10	2.9 B	15
653.80			
CLAY-gray-medium stiff to stiff	4		
-10	5 7	1.2 B	19
	3		
	4 5	0.5 B	21
	3		
-15	5 6	1.5 B	20
	3		
	4 6	1.5 P	21
	3		
-20	4 5	1.0 P	20

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CLAY-gray-medium stiff to stiff *(continued)*			
	2		
	3 3	0.5 P	24
	ST		
		1.0 P	22
-25			
	3		
	4 7	0.6 B	23
	4		
-30	5 6	1.9 B	22
629.80			
CLAY LOAM-gray-stiff to very stiff			
	5		
-35	11 16	3.8 B	14
	9		
-40	13 14	1.5 B	14

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, from 137 (Rev. 8-99)

Z:\PROJECTS\2016\16017 KNIGHT EA, IDOT PUMP STATION 38 FAP 346 (PTB 178, ITEM 1)\16017 BORING LOGS\16017_LOG.GPJ 4/1/19

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SOIL BORING LOG

GSI Job No. 16017

Date 3/25/19

ROUTE FAP 346 **DESCRIPTION** Retaining Wall **LOGGED BY** TZ

SECTION _____ **LOCATION** NW 1/4, **SEC.** 32, **TWP.** T44N, **RNG.** R12E, 3rd **PM**

COUNTY Lake **DRILLING METHOD** Hollow Stem Auger/Rotary **HAMMER TYPE** CME Automatic

STRUCT. NO. _____
Station _____

BORING NO. RW-04
Station 54+03
Offset 16.20ft Right
Ground Surface Elev. 661.80 **ft**

Surface Water Elev. n/a **ft**
Stream Bed Elev. n/a **ft**

Groundwater Elev.:
First Encounter Dry to -10.0 **ft**
Upon Completion n/a **ft**
After _____ **Hrs.** _____ **ft**

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CLAY LOAM-gray-stiff to very stiff *(continued)*				
619.80				
CLAYEY SAND & GRAVEL-gray-medium dense		9		
		5 7		9
	-45			
614.80				
CLAY-gray-stiff		5		
End Of Boring @ -50.0'. Boring backfilled with cuttings.		6 9	1.6 B	20
611.80	-50			
	-55			
	-60			

Z:\PROJECTS\2016\16017 KNIGHT EA, IDOT PUMP STATION 38 FAP 346 (PTB 178, ITEM 1)\16017 BORING LOGS\16017_LOG.GPJ 4/1/19

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, from 137 (Rev. 8-99)

Geo Services, Inc.
Geotechnical, Environmental & Civil Engineering
805 Amherst Court, Suite 204
Naperville, Illinois 60565
(630) 355-2818

SOIL BORING LOG

GSI Job No. 16017

Date 3/26/19

ROUTE FAP 346 **DESCRIPTION** Retaining Wall **LOGGED BY** TZ

SECTION _____ **LOCATION** NW 1/4, **SEC.** 32, **TWP.** T44N, **RNG.** R12E, 3rd **PM**

COUNTY Lake **DRILLING METHOD** Hollow Stem Auger/Rotary **HAMMER TYPE** CME Automatic

STRUCT. NO. _____
Station _____

BORING NO. RW-05
Station 54+58
Offset 11.20ft Right
Ground Surface Elev. 664.50 ft

Surface Water Elev. n/a ft
Stream Bed Elev. n/a ft

Groundwater Elev.:
First Encounter Dry to -10.0 ft
Upon Completion n/a ft
After _____ **Hrs.** _____ ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
				6.0" ASPHALT, 6.0" CRUSHED STONE
663.50				
	4			CLAY LOAM with Gravel-brown & gray-hard (Fill)
	5 7	4.5 P	16	
661.50				
				CLAY LOAM-brown & gray-very stiff to hard
	4			
	7 10	3.5 P	18	
-5				
				becoming gray @ -35.5'
	6			
	10 15	4.0 B	18	
	6			
	9 15	3.4 B	15	
-10				
654.00				
				CLAY-gray-medium stiff to stiff
	5			
	9 13	1.6 B	18	
	5			
	7 9	0.5 B	20	
-15				
	4			
	6 7	1.3 B	19	
	4			
	5 6	0.5 B	20	
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
				CLAY-gray-medium stiff to stiff *(continued)*
	4			
	6 9	1.1 B	21	
	5			
	6 9	0.8 P	22	
-25				
	4			
	6 8	1.2 B	22	
	5			
	7 9	1.2 B	25	
-30				
	8			
	11 15	1.5 P	19	
-35				
	7			
	8 12	1.5 P	23	
-40				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, from 137 (Rev. 8-99)

Z:\PROJECTS\2016\16017 KNIGHT EA, IDOT PUMP STATION 38 FAP 346 (PTB 178, ITEM 1)\16017 BORING LOGS\16017_LOG.GPJ 4/1/19

Geo Services, Inc.
Geotechnical, Environmental & Civil Engineering
805 Amherst Court, Suite 204
Naperville, Illinois 60565
(630) 355-2838

SOIL BORING LOG

GSI Job No. 16017

Date 3/26/19

ROUTE FAP 346 **DESCRIPTION** Retaining Wall **LOGGED BY** TZ

SECTION _____ **LOCATION** NW 1/4, **SEC.** 32, **TWP.** T44N, **RNG.** R12E, 3rd **PM**

COUNTY Lake **DRILLING METHOD** Hollow Stem Auger/Rotary **HAMMER TYPE** CME Automatic

STRUCT. NO. _____
Station _____

BORING NO. RW-05
Station 54+58
Offset 11.20ft Right
Ground Surface Elev. 664.50 **ft**

Surface Water Elev. n/a **ft**
Stream Bed Elev. n/a **ft**

Groundwater Elev.:
First Encounter Dry to -10.0 **ft**
Upon Completion n/a **ft**
After _____ **Hrs.** _____ **ft**

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
CLAY-gray-medium stiff to stiff *(continued)*				
	8			
	10	1.3	23	
-45	17	B		
	7			
End Of Boring @ -50.0'. Boring backfilled with cuttings. 614.50 -50	8 12	1.0 B	16	
-55				
-60				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, from 137 (Rev. 8-99)

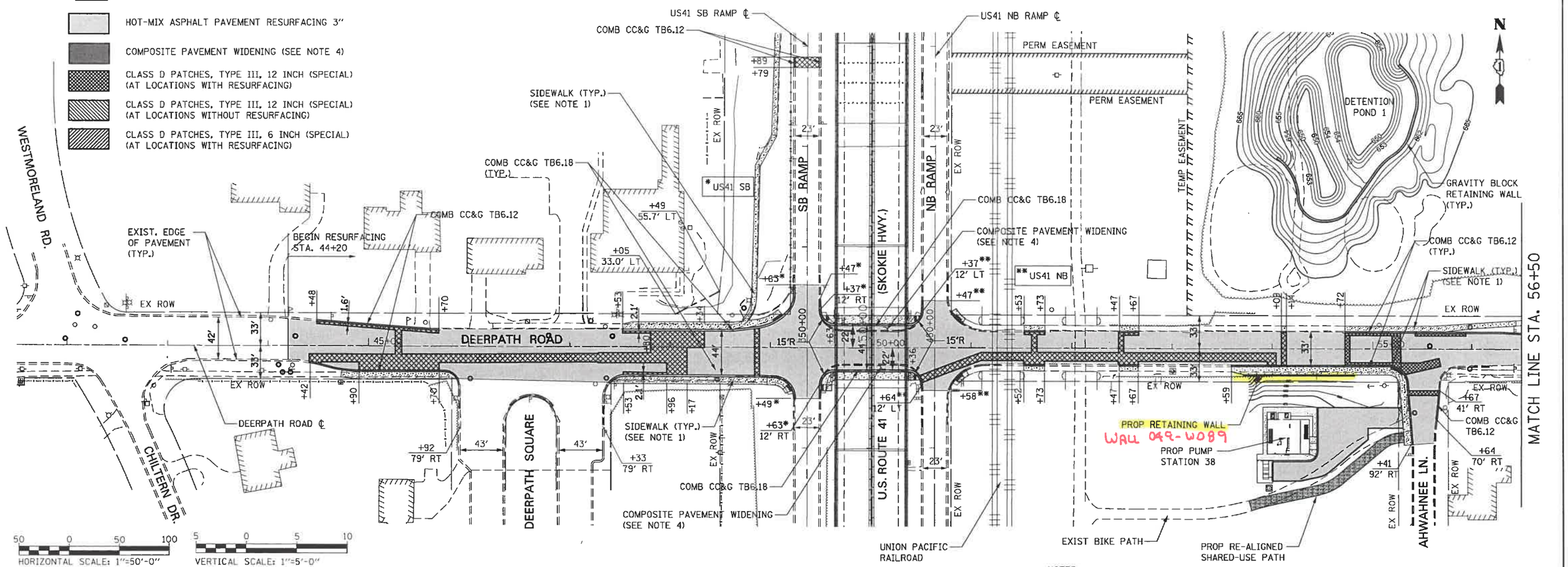
Z:\PROJECTS\2016\16017 KNIGHT EA, IDOT PUMP STATION 38 FAP 346 (PTB 178, ITEM 1)\16017 BORING LOGS\16017_LOG.GPJ 4/1/19

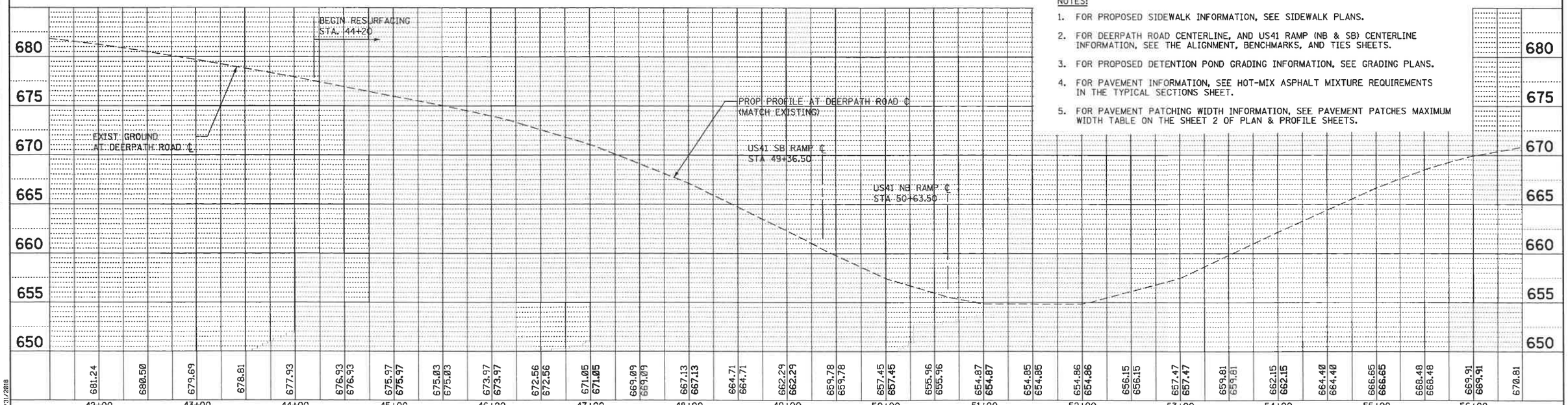
APPENDIX D

GENERAL PLAN AND ELEVATION DRAWINGS FOR RETAINING WALL SN 049-W089

LEGEND

- HOT-MIX ASPHALT PAVEMENT RESURFACING 3"
- COMPOSITE PAVEMENT WIDENING (SEE NOTE 4)
- CLASS D PATCHES, TYPE III, 12 INCH (SPECIAL) (AT LOCATIONS WITH RESURFACING)
- CLASS D PATCHES, TYPE III, 12 INCH (SPECIAL) (AT LOCATIONS WITHOUT RESURFACING)
- CLASS D PATCHES, TYPE III, 6 INCH (SPECIAL) (AT LOCATIONS WITH RESURFACING)





NOTES:

1. FOR PROPOSED SIDEWALK INFORMATION, SEE SIDEWALK PLANS.
2. FOR DEERPATH ROAD CENTERLINE, AND US41 RAMP (NB & SB) CENTERLINE INFORMATION, SEE THE ALIGNMENT, BENCHMARKS, AND TIES SHEETS.
3. FOR PROPOSED DETENTION POND GRADING INFORMATION, SEE GRADING PLANS.
4. FOR PAVEMENT INFORMATION, SEE HOT-MIX ASPHALT MIXTURE REQUIREMENTS IN THE TYPICAL SECTIONS SHEET.
5. FOR PAVEMENT PATCHING WIDTH INFORMATION, SEE PAVEMENT PATCHES MAXIMUM WIDTH TABLE ON THE SHEET 2 OF PLAN & PROFILE SHEETS.

PLAN: SURVEYED, ALIGNMENT CHECKED, RT. OF WAY CHECKED, NOTE BOOK, NO. ____, ADD FILE NAME, BY, DATE

PROFILE: SURVEYED, PLOTTED, PLOTTED CHECKED, B.M. NOTED, STRUCTURE NO(S)/PMS QTY(S), NOTE BOOK, NO. ____, BY, DATE

PLOT DATE = 10/31/2018

KNIGHT Engineers & Architects

USER NAME = dbarnes	DESIGNED	REVISED -
	DRAWN	REVISED -
PLOT SCALE = 1@100	CHECKED JWM	REVISED -
PLOT DATE = 10/31/2018	DATE 11/02/2018	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

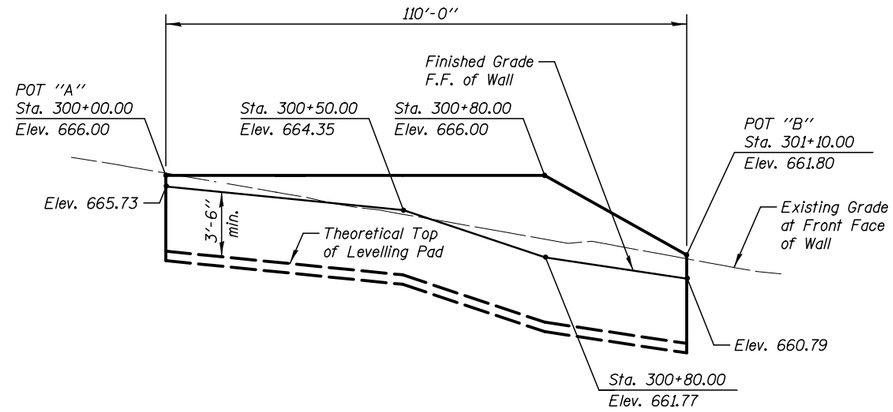
ROADWAY PLAN AND PROFILE
DEERPATH ROAD

SCALE: | SHEET 1 OF 2 SHEETS | STA. 44+20 | TO STA. 56+50

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
F346 U1245	(21&21S)-I	LAKE	256	44
		CONTRACT NO. 62B65		
		ILLINOIS FED. AID PROJECT		

Bench Mark: Benchmark "C" Sta. 74+42.06, 23.4' Lt
Brass Disk on NE Corner of Bridge, Deerpath Road over Skokie River Elev. 666.74 (NAVD 88)

Existing Structure: None



ELEVATION

INDEX OF DRAWINGS

SHT NO.	TITLE
SD-1	General Plan and Elevation
SD-2	Typical Cross Section

DESIGN SPECIFICATIONS

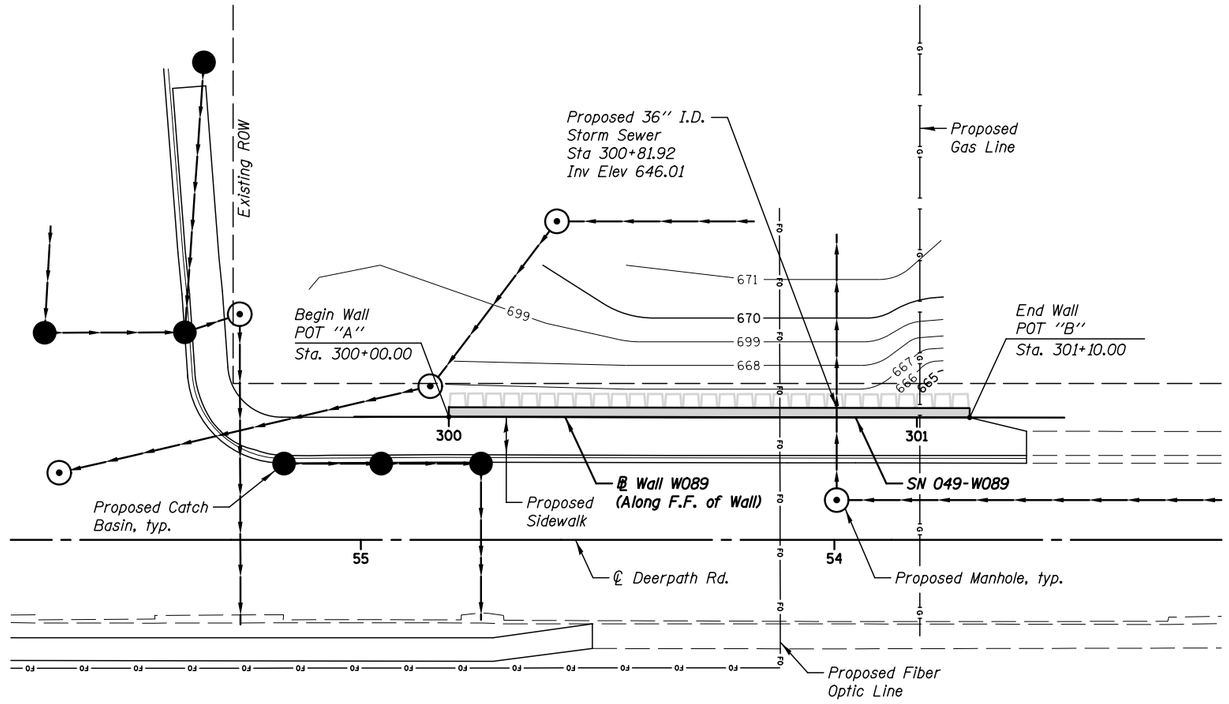
2017 AASHTO LRFD Bridge Design Specifications,
Customary U.S. Units, 8th Edition

DESIGN STRESSES

PRECAST UNITS

f'_c = 4,500 psi

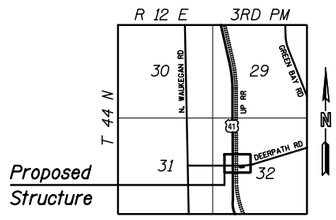
℄ Wall W089
(Offsets from ℄ Deerpath Rd. to F.F. of Wall)
POT "A"
Sta. 300+00.00 - ℄ Wall W089 =
Sta. 54+81.42, 25.98' Rt. - ℄ Deerpath Rd.
POT "B"
Sta. 301+10.00 - ℄ Wall W089 =
Sta. 53+71.42, 25.83' Rt. ℄ Deerpath Rd.



PLAN

Legend

- Soil Borings
- F.F. Front Face
- B.F. Back Face
- POT Point on Tangent



LOCATION SKETCH

GENERAL PLAN & ELEVATION
DEERPATH ROAD
F.A.P. RTE. 346 SEC. (21&21S)-I
LAKE COUNTY
STA. 53+71 TO 54+81
STRUCTURE NO. 049-W089

PLOT DATE = 4/26/2019

KNIGHT
Engineers & Architects

		DESIGNED - RS	REVISED
		CHECKED - LAS	REVISED
SCALE - NONE		DRAWN - RS	REVISED
DATE - 4/16/2019		CHECKED - LAS	REVISED

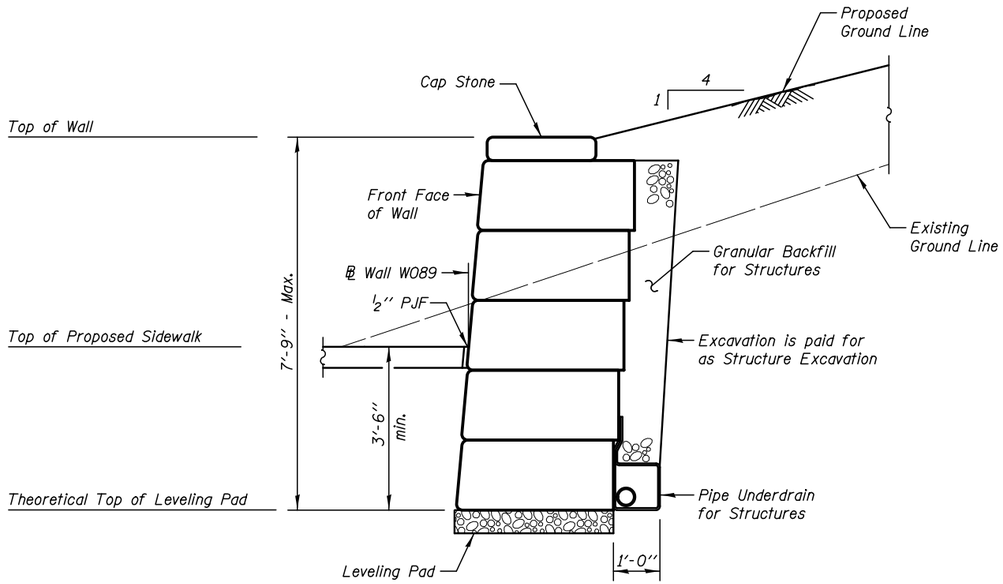
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

GENERAL PLAN AND ELEVATION
STRUCTURE NUMBER 049-W089
SHEET NO. SD-1 OF 2 SHEETS

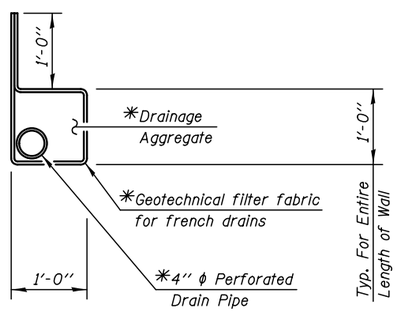
F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
346	(21&21S)-I	LAKE		
		CONTRACT NO. 62B65		
	ILLINOIS FED. AID PROJECT			

TOTAL BILL OF MATERIAL

ITEM	UNIT	TOTAL
Structure Excavation	Cu. Yd.	76.0
Precast Modular Retaining Wall	Sq. Ft.	617.0
Granular Backfill For Structures	Cu. Yd.	20.0
Pipe Underdrains For Structures 4''	Foot	110.0



TYPICAL WALL SECTION



UNDERDRAIN DETAIL

*Cost Included with ''Pipe Underdrains for Structures''

PLOT DATE = 4/26/2019

KNIGHT
Engineers & Architects

	DESIGNED - RS	REVISED	
	CHECKED - LAS	REVISED	
SCALE - NONE	DRAWN - RS	REVISED	
DATE - 4/16/2019	CHECKED - LAS	REVISED	

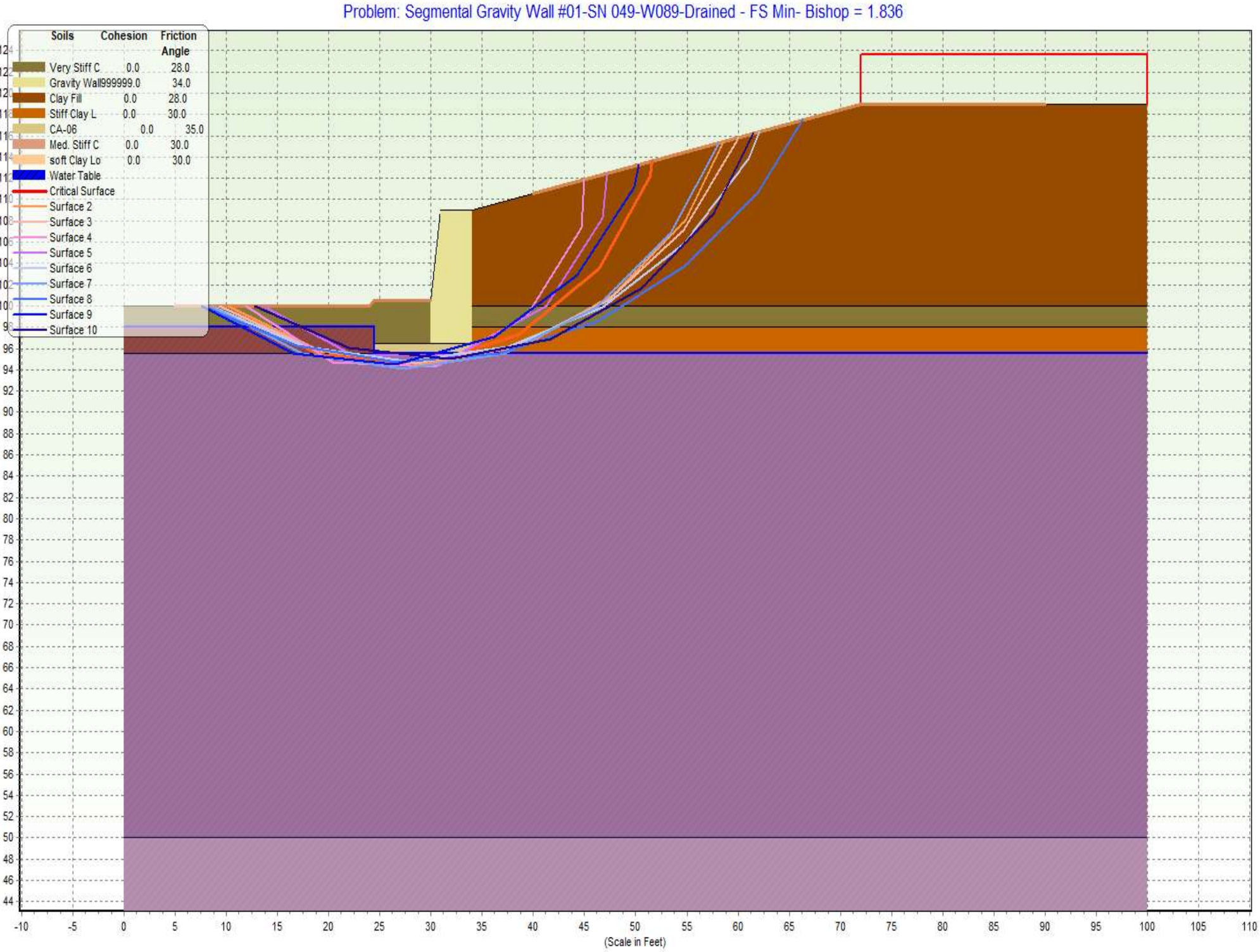
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

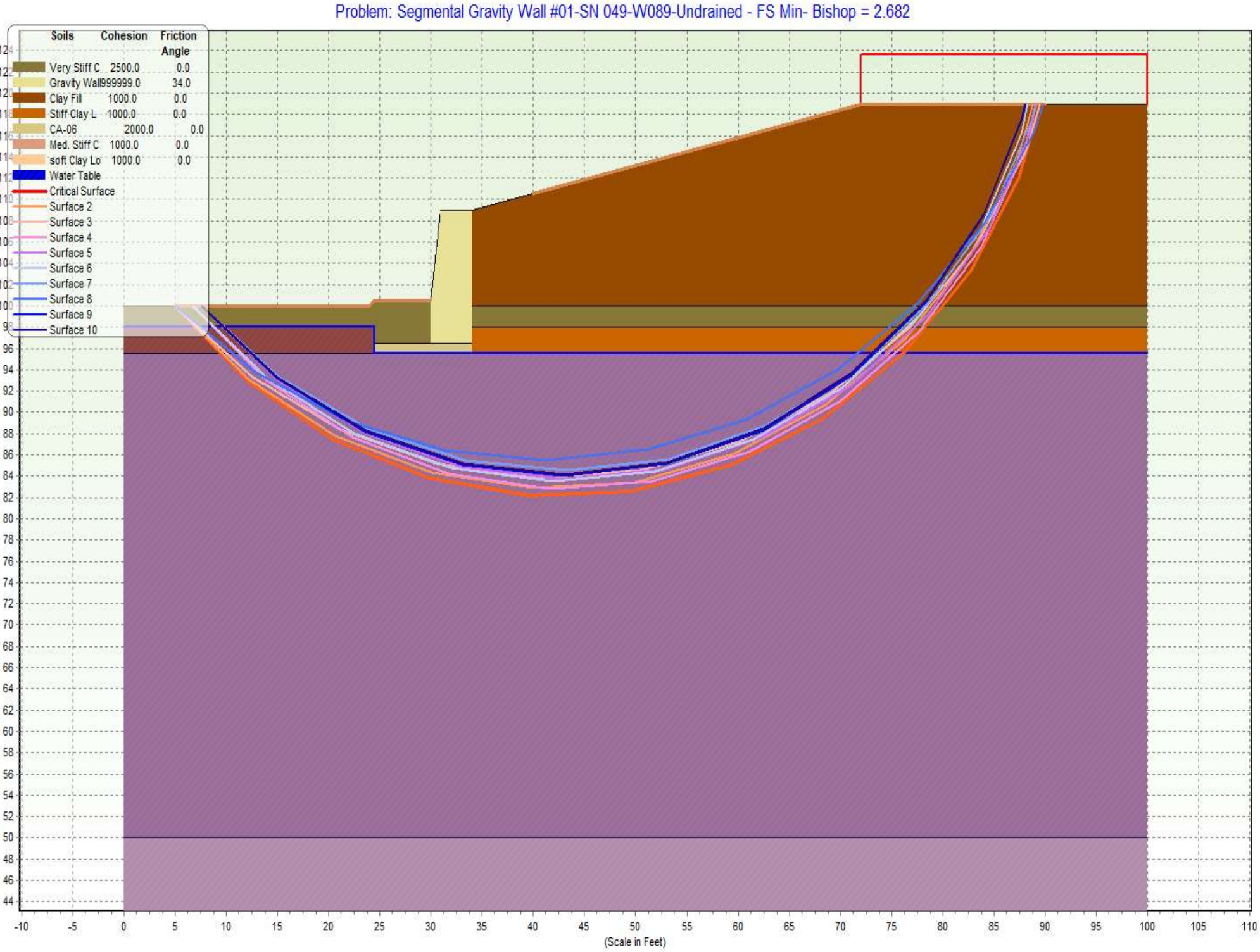
TYPICAL CROSS SECTION
STRUCTURE NUMBER 049-W089
SHEET NO. SD-2 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
346	(21&21S)-I	LAKE		
		CONTRACT NO. 62B65		
	ILLINOIS FED. AID PROJECT			

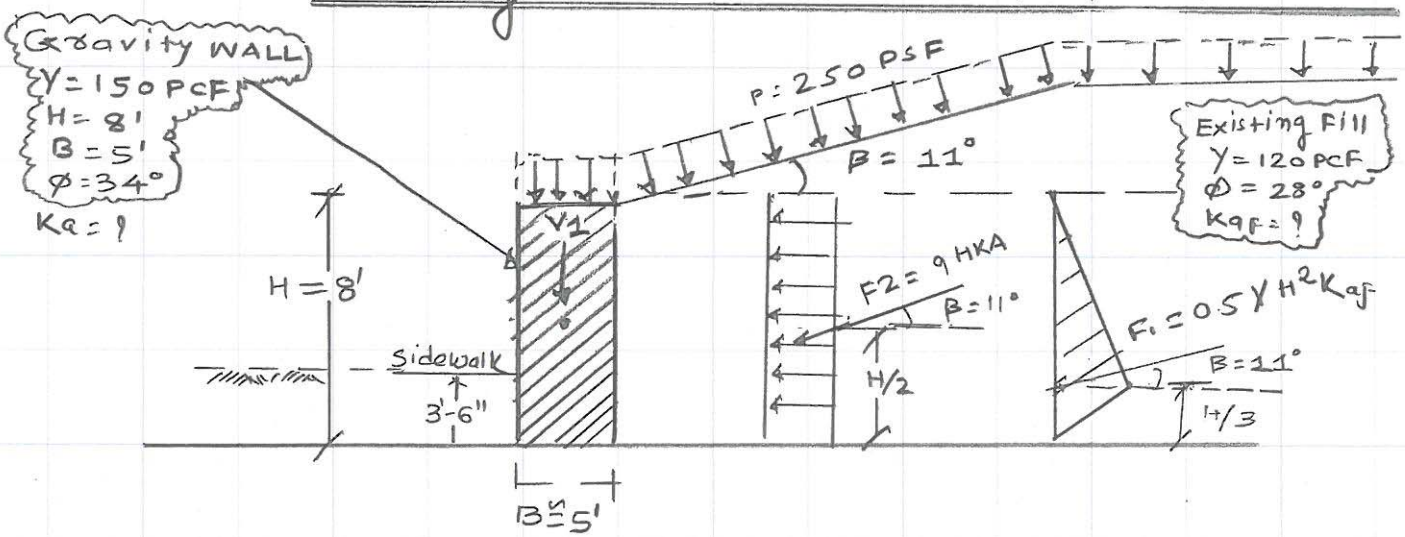
APPENDIX E

GLOBAL STABILITY CALCULATION


Problem: Segmental Gravity Wall #01-SN 049-W089-Drained - FS Min- Bishop = 1.836
Soils
Cohesion
Friction Angle
Very Stiff C 0.0 28.0
Gravity Wall999999.0 34.0
Clay Fill 0.0 28.0
Stiff Clay L 0.0 30.0
CA-06 0.0 35.0
Med. Stiff C 0.0 30.0
soft Clay Lo 0.0 30.0
Water Table
Critical Surface
Surface 2
Surface 3
Surface 4
Surface 5
Surface 6
Surface 7
Surface 8
Surface 9
Surface 10
(Scale in Feet)


Problem: Segmental Gravity Wall #01-SN 049-W089-Undrained - FS Min- Bishop = 2.682
Soils
Cohesion
Friction Angle
Very Stiff C 2500.0 0.0
Gravity Wall 999999.0 34.0
Clay Fill 1000.0 0.0
Stiff Clay L 1000.0 0.0
CA-06 2000.0 0.0
Med. Stiff C 1000.0 0.0
soft Clay Lo 1000.0 0.0
Water Table
Critical Surface
Surface 2
Surface 3
Surface 4
Surface 5
Surface 6
Surface 7
Surface 8
Surface 9
Surface 10
(Scale in Feet)

PROBLEM : Calculate Earth pressure & Soil Bearing For Retaining Wall S.N# 049-W089



Given / Assumption:

γ = unit weight of gravity wall = 150 PCF

γ = unit weight of retained/Fdn soil = 120 PCF

φ = For reinforced zone = 34°

φ = For retained + Fdn zone = 28°

β = Angle of Backfill inclin = 11°

Surcharge Load = 250 PCF

Soil @ Prop. grade ele CLAY LOAM TO CLAY

φ = 2.3 TSF
C = 2.3 KSF
} @ RW-03

H = Height of gravity wall = 8 FT

B = Width of wall @ Base = 5 FT

φ MAX LOAD Factors (per table 3.10.1.1.-1 & 3.10.1.1-2)

L.L : strength limit State = 1.75

Variable Earth Pressure (RWall) = 1.35

H2 Earth Pressure (Active) = 1.50

H2 Earth Pressure (At rest) = 1.35

Calculation :- Earth pressure Co-efficient

Vertical Components (Gravity wall)

K_a = Active Earth pressure

$= \tan^2(45 - \phi/2)$

$= \tan^2(45 - 34/2)$

$= \tan^2(28)$

$\boxed{K_a = 0.283}$

Horizontal Components (Retained zone) (Existing soil)

$F1 = \left(\frac{1}{2} \gamma H^2 K_{af}\right) \times \cos\beta$

$F2 = (\gamma . H . K_{af}) \times \cos\beta$

$$K_{af} = \cos\beta \left(\frac{\cos\beta - \sqrt{\cos^2\beta - \cos^2\phi}}{\cos\beta + \sqrt{\cos^2\beta - \cos^2\phi}} \right)$$

$$= \cos 11 \left(\frac{\cos 11 - \sqrt{\cos^2 11 - \cos^2 28}}{\cos 11 + \sqrt{\cos^2 11 - \cos^2 28}} \right)$$

$$= 0.98 \left(\frac{0.98 - \sqrt{0.96 - 0.78}}{0.98 + \sqrt{0.96 - 0.78}} \right)$$

$$= 0.98 \left(\frac{0.56}{1.40} \right)$$

$\boxed{K_{af} = 0.39}$

Vertical weights ⇝ Gravity wall & Surcharge

1) Weight of gravity wall $= V_1 = \gamma \cdot H \cdot B$

$= 150_{pcf} \times 8' \times 5'$

$= 6000$ psf

$= 6.0$ KSF

2) $V_q = L.L \times (L - d)$

$= (250\ psf)(5'-0)$

$= 1250$ psf

$= 1.25$ KSF

Total Vertical weights Σ vertical $= 6.0$ KSF $+ 1.25$ KSF

$=$

Σ vertical $= 7.25$ KSF

Horizontal Forces: ⇝ Soil & Surcharge Forces

$F_1 = \frac{1}{2} \gamma H^2 K_{af}$

$= \left(\frac{1}{2}\right)(120)(8)^2(0.39)$

$F_1 = 1497.6$ PSF

$F_1 \cong 1.5$ KLF

$F_{1H} = F_1 \cos \beta$

$= 1.5 (\cos 11)$

$F_{1H} = 1.47$ KLF

$F_1V = F_1 \cdot \sin\beta$

$= (1.5)(\sin 11)$

$= (1.5)(0.191)$

$= 0.2865$

$F_1V \simeq 0.29$ KLF

$F_2 = 9 \cdot H \cdot K_{af}$

$= (250\text{ psf})(8')(0.39)$

$F_2 = 0.78$ KLF

$F_{2H} = F_2 \cdot \cos\beta$

$= (0.78)(\cos 11)$

$= (0.78)(0.98)$

$F_{2H} = 0.77$ KLF

$F_{2V} = (F_2) \cdot (\sin\beta)$

$= (0.78)(\sin 11^\circ)$

$= (0.78)(0.191)$

$F_{2V} = 0.15$ KLF

Σ Driving Force =

$\Sigma F_H = F_{1H} + F_{2H}$
$= 1.47 + 0.77$
$= 2.24$ KLF

Σ Factored driving Forces:
$= (1.47)(1.5) + (0.77)(1.75)$
$= (2.21) + (1.35)$
$= 3.56$ KLF

Σ Resistance Force

$\Sigma F_V = V_1 + V_2 + F_{1V} + F_{2V}$
$= 6.0 + 1.25 + 0.29 + 0.15$
$= 7.69$ KLF

Note: shear strength alone Wall Base < shear caused by Tanϕ of gravity wall
$=$ Tan 34° X 7.69
$= 5.19$ KLF ← controls.

Therefore, Use 5.19 KLF For resisting Force.

Σ Factored resisting Force = ΣF_V =
$\Sigma F_V = [(6.0)(1.35) + (1.25)(1.75) + (0.29)(1.50) + (0.15)(1.75)]$ Tan 34°
$= [8.1 + 2.19 + 0.435 + 0.26]$ Tan 34°
$= [10.99]$ Tan 34°
$= 7.41$ KLF

Moments @ point A :

Vertical Force x Arm Length = Resistance M_R

$= 7.25 \text{ KLF} \times B/2$

$= 7.25 \times \frac{5}{2}$

$= 18.13 \text{ KLF} = \Sigma M_R$

Horizontal Force x Arm Length

$F_{1H} = F_1 H \times H/3$

$= 1.47 \times 8/3$

$= 3.92 \text{ KLF}$

$F_{2H} = F_{2H} \times H/2$

$= 0.77 \times 8/2$

$= 3.08 \text{ KLF}$

Σ of Moment of overturn $= 3.92 + 3.08$

$= 7.0 \text{ KLF}$

Factored Resisting Moment $= \psi \times M_R$

$= 1.35 \times 18.13 \text{ KLF}$

$= 24.47 \text{ KLF}$

Factored overturning Moment $= \psi \times M_o$

$= (3.92 \times 1.5) + (3.08)(1.75)$

$= 5.88 + 5.39$

$= 11.27 \text{ KLF}$

Eccentricity : (e)

$$e = \frac{B}{2} - (M_R - M_o) / R$$

$$= \frac{5}{2} - (24.47 - 11.27) / 9.79$$

$$= 2.5 - 1.35$$

$$\boxed{e = 1.15}$$

$R = \Sigma_{Vertical} \times 1.35$
$= 7.25 \times 1.35$
$= 9.79$ KLF

Check Eccentricity $e < B/4$

$= 1.15 < 5/4$

$= 1.15 < 1.25$

$=$ ✓ OK

Sliding: $\frac{\Sigma F_V}{\Sigma F_H} =$

$$= \frac{\left[(6.0)(1.35) + (1.25)(1.75) + (0.29)(1.50) + (0.15)(1.75)\right] \times \tan 34^\circ}{(1.41)(1.5) + (0.77)(1.75)}$$

$$= \frac{7.42 \text{ KLF}}{3.56 \text{ KLF}}$$

$= 2.1 > 1$

✓ OK

Max Bearing pressure = σ_v

$$\sigma_v = \frac{R}{(B - 2e)}$$

$$= \frac{9.79}{(5 - 2(1.15))}$$

$$= \frac{9.79}{2.7}$$

$$\boxed{\sigma_v = 3.62 \text{ KSF}}$$

Maximum net Bearing capacity of soils @ RW-03

$q_u = c \cdot N_c$ [Eq. 18.2 per Foundation Engineering $N_c = 5.1$)

$= 2,300 \times 5.1$

$q_u = 11,730$ psf

Factored max. Soil Bearing, $q_R = q_u \times 0.5$

$= 11,730 \times 0.5$

$q_R = 5865$ psf

$\cong 5.5$ ksf

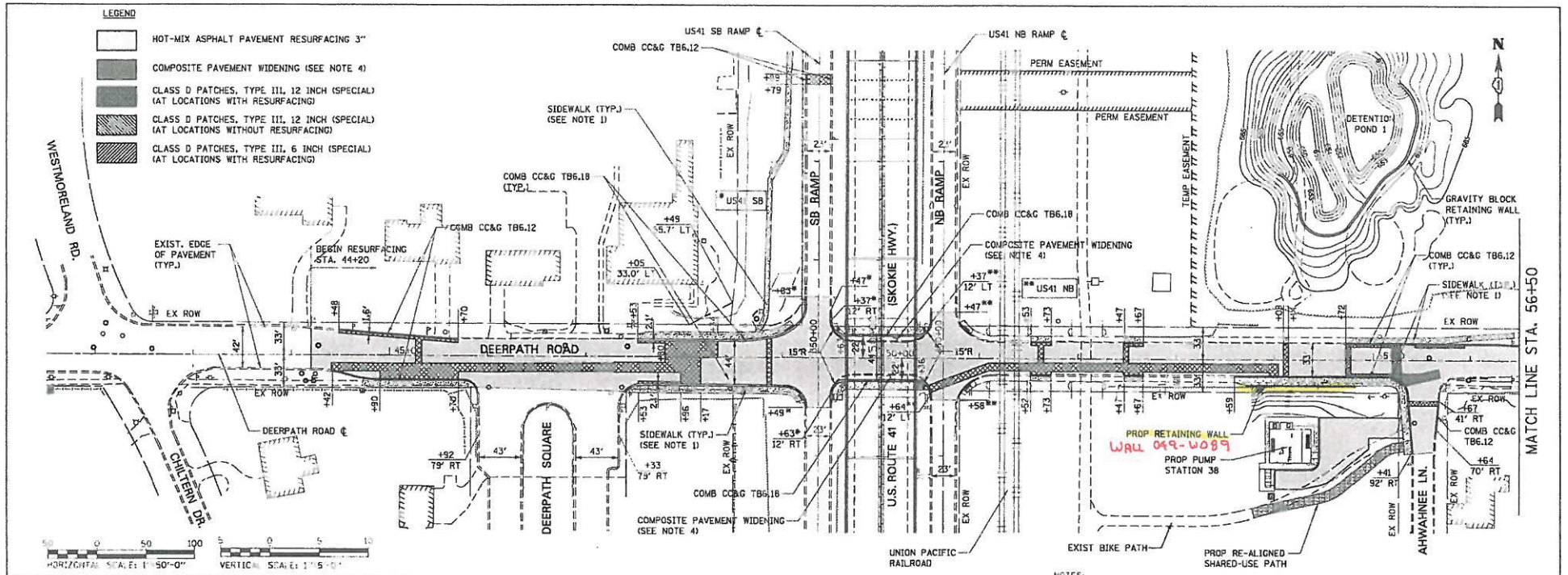
* Used 5.5 ksf in SGR For Wall # 01 (SN-049-W089)

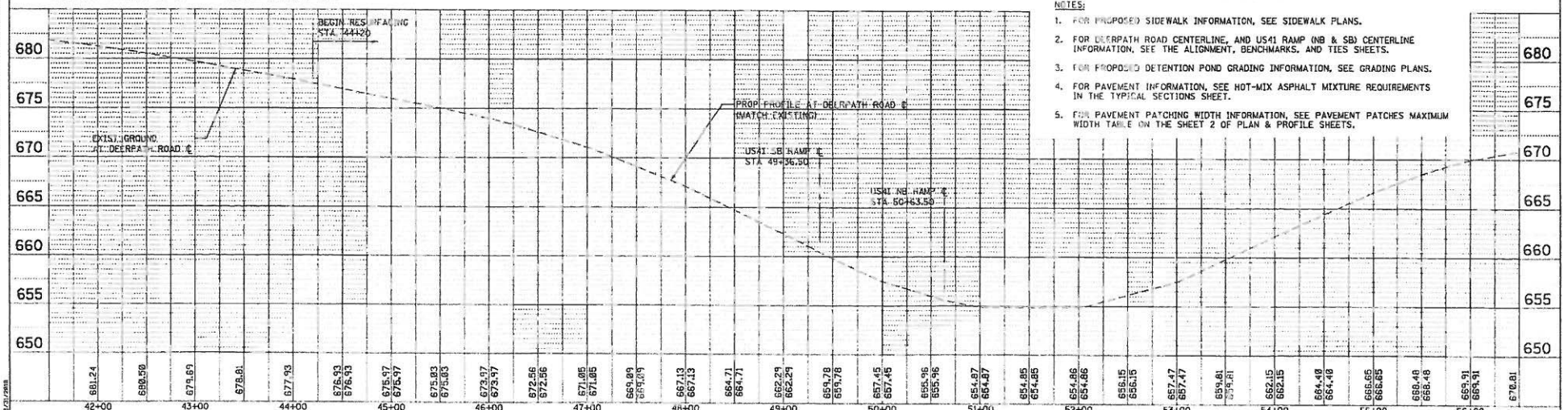
Factored max Soil bearing $q_R >$ Max Bearing pressure σ_v

$q_R > \sigma_v$

$5.5 > 3.62$

ok





NOTES:

1. FOR PROPOSED SIDEWALK INFORMATION, SEE SIDEWALK PLANS.
2. FOR DEERPATH ROAD CENTERLINE, AND US41 RAMP (NB & SB) CENTERLINE INFORMATION, SEE THE ALIGNMENT, BENCHMARKS, AND TIES SHEETS.
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4. FOR PAVEMENT INFORMATION, SEE HOT-MIX ASPHALT MIXTURE REQUIREMENTS IN THE TYPICAL SECTIONS SHEET.
5. FOR PAVEMENT PATCHING WIDTH INFORMATION, SEE PAVEMENT PATCHES MAXIMUM WIDTH TABLE ON THE SHEET 2 OF PLAN & PROFILE SHEETS.

KNIGHT Engineers & Architects

USER NAME = dberres | PLOT SCALE = 1/100 | PLOT DATE = 10/31/2018

DESIGNED | DRAWN | CHECKED JNM | DATE 11/02/2018

REVISED - | REVISED - | REVISED - | REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

ROADWAY PLAN AND PROFILE
DEERPATH ROAD

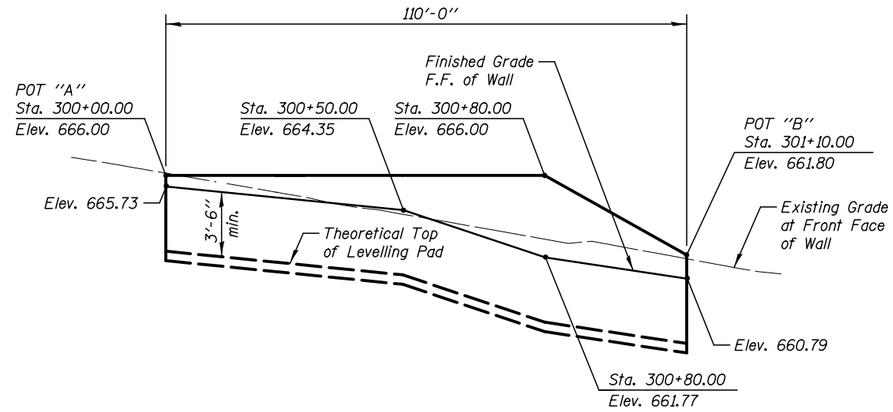
SCALE: | SHEET 1 OF 2 SHEETS | STA. 44+20 | TO STA. 56+60

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
FAU	0018(215)-I	LAKE	256	44

CONTRACT NO. 62865
ILLINOIS FED. AID PROJECT

Bench Mark: Benchmark "C" Sta. 74+42.06, 23.4' Lt
Brass Disk on NE Corner of Bridge, Deerpath Road over Skokie River Elev. 666.74 (NAVD 88)

Existing Structure: None



ELEVATION

INDEX OF DRAWINGS

SHT NO.	TITLE
SD-1	General Plan and Elevation
SD-2	Typical Cross Section

DESIGN SPECIFICATIONS

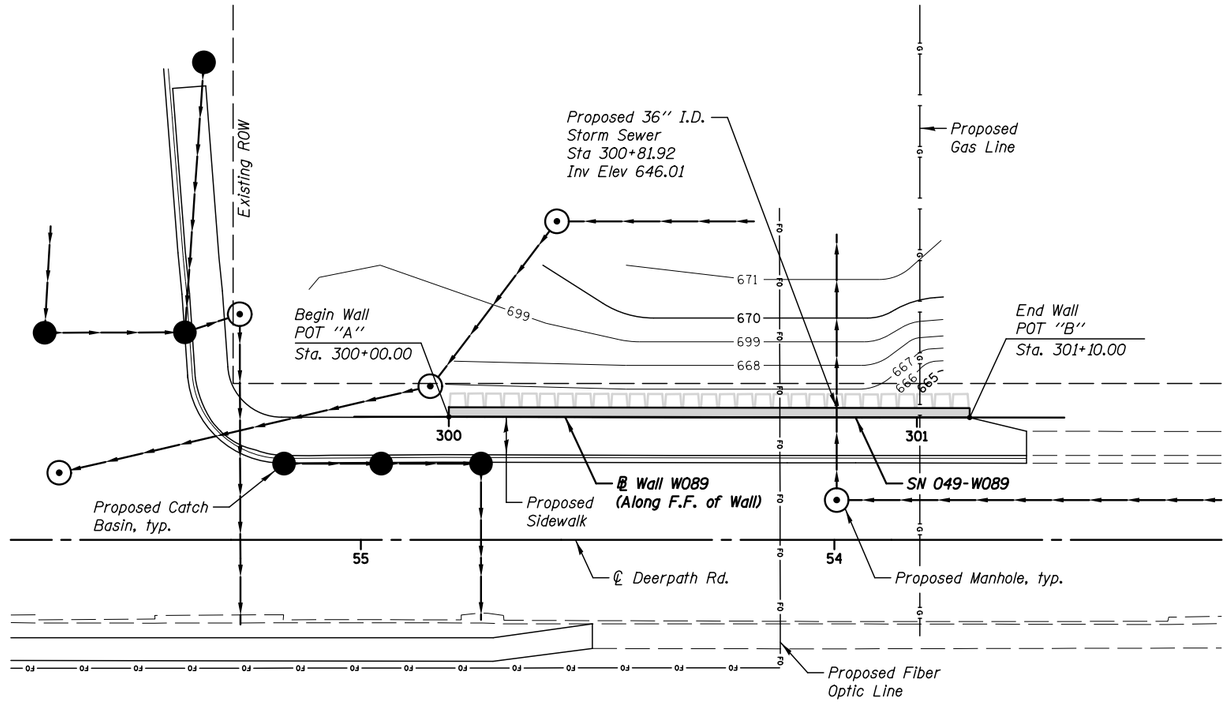
2017 AASHTO LRFD Bridge Design Specifications,
Customary U.S. Units, 8th Edition

DESIGN STRESSES

PRECAST UNITS

f'_c = 4,500 psi

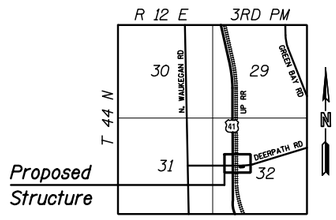
℄ Wall W089
(Offsets from ℄ Deerpath Rd. to F.F. of Wall)
POT "A"
Sta. 300+00.00 - ℄ Wall W089 =
Sta. 54+81.42, 25.98' Rt. - ℄ Deerpath Rd.
POT "B"
Sta. 301+10.00 - ℄ Wall W089 =
Sta. 53+71.42, 25.83' Rt. ℄ Deerpath Rd.



PLAN

Legend

- Soil Borings
- F.F. Front Face
- B.F. Back Face
- POT Point on Tangent



LOCATION SKETCH

GENERAL PLAN & ELEVATION
DEERPATH ROAD
F.A.P. RTE. 346 SEC. (21&21S)-I
LAKE COUNTY
STA. 53+71 TO 54+81
STRUCTURE NO. 049-W089

PLOT DATE = 4/26/2019

KNIGHT
Engineers & Architects

		DESIGNED - RS	REVISED
		CHECKED - LAS	REVISED
SCALE - NONE		DRAWN - RS	REVISED
DATE - 4/16/2019		CHECKED - LAS	REVISED

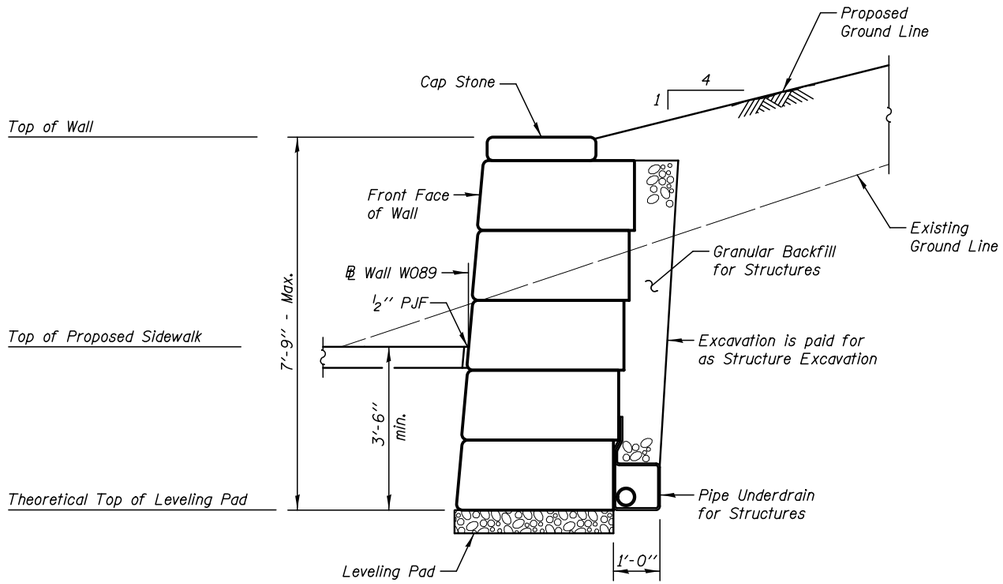
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

GENERAL PLAN AND ELEVATION
STRUCTURE NUMBER 049-W089
SHEET NO. SD-1 OF 2 SHEETS

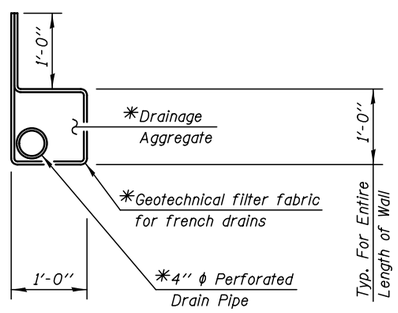
F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
346	(21&21S)-I	LAKE		
		CONTRACT NO. 62B65		
	ILLINOIS FED. AID PROJECT			

TOTAL BILL OF MATERIAL

ITEM	UNIT	TOTAL
Structure Excavation	Cu. Yd.	76.0
Precast Modular Retaining Wall	Sq. Ft.	617.0
Granular Backfill For Structures	Cu. Yd.	20.0
Pipe Underdrains For Structures 4''	Foot	110.0



TYPICAL WALL SECTION



UNDERDRAIN DETAIL

*Cost Included with ''Pipe Underdrains for Structures''

PLOT DATE = 4/26/2019

KNIGHT
Engineers & Architects

	DESIGNED - RS	REVISED	
	CHECKED - LAS	REVISED	
SCALE - NONE	DRAWN - RS	REVISED	
DATE - 4/16/2019	CHECKED - LAS	REVISED	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

TYPICAL CROSS SECTION
STRUCTURE NUMBER 049-W089
SHEET NO. SD-2 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
346	(21&21S)-I	LAKE		
		CONTRACT NO. 62B65		
	ILLINOIS FED. AID PROJECT			

Geo Services, Inc.
Geotechnical, Environmental & Civil Engineering
805 Amherst Court, Suite 204
Naperville, Illinois 60565
(630) 355-2818

GSI Job No. 16017

SOIL BORING LOG

Date 3/25/19

ROUTE FAP 346 DESCRIPTION Retaining Wall LOGGED BY TZ

SECTION _____ LOCATION NW 1/4, SEC. 32, TWP. T44N, RNG. R12E, 3rd PM

COUNTY Lake DRILLING METHOD Hollow Stem Auger/Rotary HAMMER TYPE CME Automatic

STRUCT. NO. _____
Station _____

BORING NO. RW-03
Station 53+29
Offset 16.80ft Right
Ground Surface Elev. 658.40 ft

Surface Water Elev. n/a ft
Stream Bed Elev. n/a ft

Groundwater Elev.:
First Encounter Dry to -10.0 ft
Upon Completion n/a ft
After ____ Hrs. ____ ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				6.0" ASPHALT, 6.0" CONCRETE
				657.40
	14			CLAY LOAM with Gravel-brown &
	12		14	gray-medium dense (Fill)
	5			656.8 Fdn grade ele
				655.40
				CLAY LOAM-gray-very stiff
	3			
-5	4	2.3	19	
	6	B		
				652.90
				CLAY-gray-medium stiff to stiff
	3			
	4	1.2	21	
	5	B		
	3			
-10	4	1.2	18	
	6	B		
	3			
	4	0.5	18	
	5	B		
	3			
	4	1.1	21	
-15	6	B		
	3			
	5	0.9	19	
	6	B		
	3			
	4	0.7	23	
-20	6	B		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				CLAY-gray-medium stiff to stiff
				(continued)
	3			
	4	1.3	22	Assumed Soil $q_P = 2.3$
	6	B		Calculated Based on
	2			Blow count = N = 17
	2	0.5	22	12+5 = 17/6
-25	3	P		= 2.83
	2			≅ 2.3 KSF
	3	0.5	22	Similar to other bor
	4	P		
	6			
	11	2.6	17	
-30	13	B		
	4			
	6	1.2	20	
-35	11	B		
	6			
	7	1.2	20	
-40	11	B		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, from 137 (Rev. 8-99)

Z:\PROJECTS\2016\16017 KNIGHT EA, IDOT PUMP STATION 38 FAP 346 (PTB 178, ITEM 1)\16017 BORING LOGS\16017_LOG.GPJ 4/1/19

Geo Services, Inc.
Geotechnical, Environmental & Civil Engineering
805 Amherst Court, Suite 204
Naperville, Illinois 60565
(630) 355-2838

GSI Job No. 16017

SOIL BORING LOG

Date 3/25/19

ROUTE FAP 346 DESCRIPTION Retaining Wall LOGGED BY TZ

SECTION _____ LOCATION NW 1/4, SEC. 32, TWP. T44N, RNG. R12E, 3rd PM

COUNTY Lake DRILLING METHOD Hollow Stem Auger/Rotary HAMMER TYPE CME Automatic

STRUCT. NO. _____
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BORING NO. RW-03
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Offset 16.80ft Right
Ground Surface Elev. 658.40 ft

Surface Water Elev. n/a ft
Stream Bed Elev. n/a ft

Groundwater Elev.:
First Encounter Dry to -10.0 ft
Upon Completion n/a ft
After ____ Hrs. ____ ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CLAY-gray-medium stiff to stiff *(continued)*		4		
	-45	8 12	0.8 B	19
		4		
End Of Boring @ -50.0'. Boring backfilled with cuttings. 608.40	-50	8 13	0.7 B	21
	-55			
	-60			

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