Structural Geotechnical Report

IDOT PTB 202-016
Work Order #17
FAU 2843/Dixie Highway over Thorn Creek
Culvert Replacement (SN 016-8321)
Cook County, Illinois

Prepared for:

Illinois Department of Transportation

Illinois Department of Transportation
Job No. D-91-149-22

Project Design Engineer:
ABNA Engineering, INC.

Prepared by:

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July 24, 2024
Revised: September 5, 2024
Revised: June 20, 2025

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June 20, 2025

Mr. Abe Adewale
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Structural Geotechnical Report
IDOT PTB 202-016 Work Order #17
FAU 2843/Dixie Highway over Thorn Creek
Cook County, IL
Job No. D-91-149-22

Dear Mr. Adewale:

Attached is a copy of the Geotechnical Report for the above referenced project. The report provides a brief description of the site investigation, site conditions, and geotechnical recommendations for the proposed improvements. The site investigation included advancing three (3) borings to depths of 30 to 45 feet for the proposed culvert and one (1) retaining wall boring to a depth of 30 feet.

Should you have any questions or require additional information, please call us at 630-994-2600.

Sincerely,

A. Alyousef

Abdulaziz Alyousef, E.I.T.
Project Engineer

Dawn Edgell.

Dawn Edgell, P.E.
Sr. Project Engineer

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1.0 INTRODUCTION

GSG Consultants, Inc. (GSG) completed a geotechnical investigation for the proposed design and installation of a new 98.75-foot-long culvert. The structure will be located along Dixie Highway near Thorn Creek in Cook County, Illinois. The purpose of the investigation was to explore the subsurface conditions, to determine engineering properties of the subsurface soil, and develop design and construction recommendations for the proposed culvert. **Exhibit 1** shows the general project location.

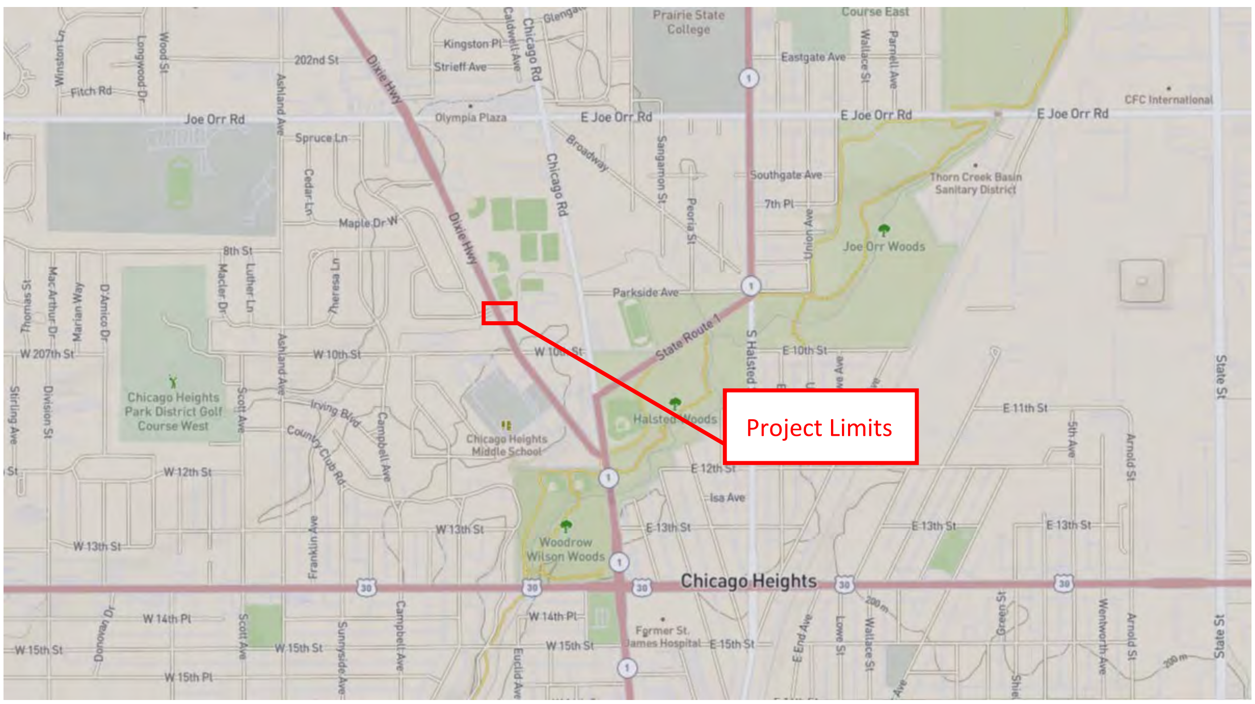


Exhibit 1: Project Location Map

1.1 Proposed Structure Information

Based on information provided by ABNA Engineers, INC., the proposed project is to replace the existing box culvert (SN 016-0926) and install a new 98.75-foot-long, triple cell concrete box culvert (SN 016-8321) with one 12' wide x 7' high cell and two flanking 8' wide x 7' high cells. Based on the General Plan & Elevation drawing (dated 4/2/25), the upstream and downstream invert elevations are 639.25 and 639.0 feet, respectively. The new culvert will be pre-cast concrete culverts. Based on the project profiles, there is an existing 24-inch diameter sanitary sewer line along Dixie Highway, perpendicular to the proposed culvert that will remain in place below the new culvert.

A retaining wall with an exposed height of approximately 7.5 feet is proposed along the north side of the creek, west of the culvert to minimize the right-of-way acquisition and negative impacts to adjacent residential properties.

1.2 Proposed Construction

The objective of this study was to explore and characterize the subsurface soil conditions to provide recommendations regarding the proposed improvements. The scope of this study includes the following:

1. Advance three (3) borings to depths of 30 to 45 feet for the proposed culvert.
2. Advance one (1) boring to a depth of 30 feet for the proposed retaining wall.
3. Perform a geotechnical laboratory testing program on selected representative soil samples obtained during the field investigation to evaluate relevant engineering parameters of the subsurface soils.
4. Perform engineering analysis and evaluation of the data collected during the field investigation and laboratory testing to develop geotechnical engineering design recommendations for the proposed improvements.

2.0 SITE SUBSURFACE EXPLORATION PROGRAM

This section describes the subsurface exploration program and laboratory testing program completed as part of this project. The subsurface exploration program was performed in accordance with applicable IDOT geotechnical manuals and procedures.

2.1 Subsurface Exploration Program

The subsurface soil investigation was conducted between June 28 and July 1, 2024, and included advancing three (3) soil borings for the proposed culvert to depths between 30 to 45 feet, and one (1) retaining wall boring to a depth of 30 feet. The soil boring locations were selected by GSG based on the location plans provided by ABNA and completed based on field conditions, utilities, and site accessibility. The existing ground surface elevations for the borings were based on the field survey performed by GSG using hand-held GPS equipment. The approximate locations of the soil borings are shown on the **Boring Location Plan (Appendix B)**. **Table 1** presents a list of the boring location information.

Table 1 – Summary of Subsurface Exploration Borings

Boring	Location*	Northing	Easting	Existing Ground Elevation (ft)	Depth (ft)
CB-01	West end	1,766,467	1,172,433	648.21	30.0
CB-02	Median	1,766,461	1,172,473	648.94	45.0
CB-03	East end	1,766,434	1,172,532	645.24	30.0
RWB-01	West end	1,766,460	1,172,407	648.35	30.0

* Relative to the existing culvert

The soil borings were drilled using a 7822DT Geoprobe drill rig (hammer efficiency 101.6%), with 3¼-inch I.D. hollow stem augers and automatic hammers. Soil sampling was performed according to AASHTO T 206, "Penetration Test and Split Barrel Sampling of Soils." Soil samples were obtained at 2.5-foot intervals to 30 feet, and at 5-foot intervals to the boring termination depth. GSG's field representative inspected, visually classified, and logged the soil samples during the subsurface exploration activities and performed unconfined compressive strength tests on cohesive soil samples using a calibrated RIMAC and hand penetrometer in accordance with IDOT procedures and requirements. Representative soil samples were collected from each sample interval, placed in jars, and returned to the laboratory for further testing and evaluation.

2.2 Laboratory Testing Program

All samples were inspected in the laboratory to verify the field classifications. A laboratory testing program was undertaken to characterize and determine engineering properties of the subsurface soils encountered. The following geotechnical laboratory tests were performed on representative soil samples:

- Moisture content - ASTM D 2216 / AASHTO T-265
- Atterberg Limits - ASTM D 4318 / AASHTO T-89 / AASHTO T-90
- Dry Unit Weight - ASTM D 7263

The laboratory tests were performed in accordance with test procedures outlined in the IDOT Geotechnical Manual (2020), and per ASTM and AASHTO requirements. Based on the laboratory test results, the soils encountered were classified according to the AASHTO and the Illinois Division of Highways (IDH) classification systems. The results of the laboratory testing program are shown along with the field test results on the Soil Boring Logs (**Appendix C**) and included in **Appendix D – Laboratory Test Results**.

2.3 Subsurface Soil Conditions

This section provides a brief description of the soils encountered in the boring performed. Variations in the general subsurface soil profile were noted during the drilling activities. Detailed descriptions of the subsurface soils are provided in the soil boring log. The soil boring logs provide specific conditions encountered at the boring locations. The soil boring logs include soil descriptions, stratifications, penetration resistance, elevations, location of the samples, and laboratory test data. Unless otherwise noted, soil descriptions indicated on the boring logs are visual identifications. The stratifications shown on the boring logs represent the conditions only at the actual boring location and represent the approximate boundary between subsurface materials; however, the actual transition may be gradual.

Culvert Borings

Borings CB-01 through CB-03 noted surface elevations ranging between 645.2 to 648.9 feet. Borings CB-01 and CB-03 were drilled in the shoulder of IL Route 68 and noted 2 inches of topsoil. Boring CB-02 was drilled in the center median of Dixie Highway and noted 10 inches of asphalt followed by 6 inches of concrete. Beneath the pavement section and topsoil, dark brown and gray silty clay fill materials with debris were noted to depths of 6 to 7 feet (El. 642.94 to 638.24 feet). Boring CB-03 noted gray gravel fill material at depths of 7 to 11 feet (El. 634.24 feet).

Beneath the fill materials, medium stiff to hard brown and gray silty clay was encountered to a depth of 11 feet (elevation 637.21 feet). Below the brown and gray silty clay, borings CB-01 and CB-03 encountered stiff to hard gray silty clay to the boring termination depths of 30 feet (El. 615.24 to 618.21 feet. Below a depth of 11 feet, boring CB-02 encountered predominantly loose to medium dense gray silty sand/sand to the boring termination depth of 45 feet, with a stiff to very stiff gray silty clay loam layer at depths of 21 to 26 feet. Boring CB-03 noted medium dense gray sand layer at depths of 21 to 26 feet.

The unconfined compressive strength values of the native brown and gray silty clay ranged between 0.6 tsf and 4.4 tons per square foot (tsf). The unconfined compressive strength values of the gray silty clay ranged between 1.0 tsf and 4.4 tsf, with an average strength of 2.23 tsf. The silty loam/ sand soil noted SPT-N values ranged between 7 and 21 blows per foot (bpf), with an average of 15 bpf.

Retaining Wall Boring

Borings RWB-01 was drilled at the northwest corner of the culvert and initially noted 2 inches of topsoil. Beneath the topsoil, brown, black and gray silty clay fill materials with debris were noted to depths of 6 feet (El. 642.35 feet).

Beneath the fill, a layer of medium stiff to stiff, brown and gray silty clay was encountered to a depth of 13.5 feet (El. 634.85 feet), followed by stiff to hard gray silty clay to a depth of 28.5 feet (El. 619.85 feet). The boring then encountered loose gray sand to the boring termination depth.

The unconfined compressive strength values of the native brown and gray silty clay ranged between 0.8 tsf and 3.1 tons per square foot (tsf), with most values greater than 2.3 tsf. The unconfined compressive strength values of the gray silty clay ranged between 1.7 tsf and 4.4 tsf, with an average strength of 3.21 tsf.

2.4 Groundwater Conditions

Water levels were checked in each boring to determine the general groundwater conditions present at the site and were measured while drilling and after each boring was completed.

Groundwater was encountered in all four borings at depths between 6.0 to 16.0 feet below the existing ground surface. Groundwater was not encountered immediately after drilling.

Based on the color change from brown to gray, it is anticipated that the long-term groundwater level for the site is at 11 to 13.5 feet below grade (El. 634.2 to 637.9 feet). Perched water may also be present within the existing fill materials or any confined sand seam. Water level readings were made in the borehole at times and under conditions shown on the boring log and stated in the text of this report. However, it should be noted that fluctuations in groundwater level may occur due to variations in rainfall, other climatic conditions, or other factors not evident at the time measurements were made and reported herein.

3.0 GEOTECHNICAL ANALYSIS

This section provides GSG's geotechnical analysis and recommendations for the design of the proposed improvements based on the results of the field exploration, laboratory testing, and geotechnical analysis. Subsurface conditions in unexplored locations may vary from those encountered at the boring location. If the structure location, loadings, or elevations are changed, we request that GSG be contacted so that we may re-evaluate our recommendations.

3.1 Soil Parameters for Design

GSG determined the geotechnical parameters to be used for the project design based on the results of the field and laboratory test data on individual boring logs as well as our experience. Unit weights, friction angles, and shear strength parameters were estimated using standard penetration test (SPT) results for the fill and cohesionless soils and in-situ and laboratory test results for cohesive soils. Based on the field investigation data collected, generalized soil parameters for the culvert and retaining wall are presented in **Table 2a and 2b** for use in the design**.**

Table 2a – Summary of Soil Parameters for the Culvert (CB-01 through CB-03)

Depth / Elevation Range (feet)	Soil Description	In situ Unit Weight γ (pcf)	Undrained		Drained	
			Cohesion c (psf)	Friction Angle ϕ (°)	Cohesion c (psf)	Friction Angle ϕ (°)
	New Engineered Clay Fill	125	1,000	0	50	25
	New Engineered Granular Fill	125	0	30	0	30
0.0 – 6.0 (647.5 – 641.5)	Fill Dark Brown and Gray Silty Clay	138	2,300	0	230	28
6.0 – 11.0 (641.5 – 636.5)	Medium Stiff to Hard Brown and Gray Silty Clay	138	2,200	0	220	28
11.0 – 30.0 (636.5 – 617.5)	Stiff to Hard Gray Silty Clay	138	2,600	0	260	28
11.0 – 45.0 (637.9 – 603.9) ***CB-02 Only**	Loose to Medium Dense Gray Silty Sand/Sand	120	0	35	0	35

Depth / Elevation Range (feet)	Soil Description	In situ Unit Weight γ (pcf)	Undrained		Drained	
			Cohesion c (psf)	Friction Angle ϕ (°)	Cohesion c (psf)	Friction Angle ϕ (°)
21.0 – 26.0 (627.9 – 622.9) ***CB-02 Only**	Stiff Gray Silty Clay Loam	138	2,100	0	210	28
7.0 – 11.0 (638.2 – 634.2) ***CB-03 Only**	Fill Gray Gravel	120	0	31	0	31
21.0 – 26.0 (624.2 – 619.2) ***CB-03 Only**	Medium Dense Gray Sand	122	0	36	0	36

Table 2b – Summary of Soil Parameters for Retaining Wall (RWB-01)

Depth / Elevation Range (feet)	Soil Description	In situ Unit Weight γ (pcf)	Undrained		Drained	
			Cohesion c (psf)	Friction Angle ϕ (°)	Cohesion c (psf)	Friction Angle ϕ (°)
	New Engineered Clay Fill	125	1,000	0	50	25
	New Engineered Granular Fill	125	0	30	0	30
0.0 – 6.0 (648.3 – 642.3)	Fill Brown, Black, and Gray Silty Clay	138	6,000	0	600	28
6.0 – 13.5 (642.3 – 634.8)	Medium Stiff to Stiff Brown and Gray Silty Clay	138	2,300	0	230	28
13.5 – 28.5 (634.8 – 619.8)	Stiff to Hard Gray Silty Clay	138	3,200	0	320	28
28.5 – 30.0 (619.8 – 618.3)	Loose Gray Sand	110	0	29	0	29

3.2 Slope Stability

IDOT requires that slope stability analysis be performed in areas where the cut or fill heights will exceed 15 feet in height. Based on the design plan, the maximum cut height will be less than 15 feet; therefore, no slope stability analysis was required for the culvert design. Slope stability analysis for the proposed retaining wall is included in *Section 5.6*.

3.3 Seismic Considerations

The seismic hazard for the site was analyzed per the IDOT Geotechnical Manual, IDOT Bridge Design Manual, and AASHTO LRFD Bridge Design Specifications. As per the Bridge Manual, seismic data is not required for buried structures, however, is included for design of the proposed retaining wall.

The Seismic Soil Site Class was determined per the requirements of All Geotechnical Manual Users (AGMU) Memo 9.1, Design Guide for Seismic Site Class Determination, and the "Seismic Site Class Determination" Excel spreadsheet provided by IDOT. A global Site Class Definition was determined for this project, and was found to be Soil Site Class D.

The AASHTO Seismic Design Parameters program was used to determine the peak ground acceleration coefficient (PGA), and the short (S_{DS}) and long (S_{D1}) period design spectral acceleration coefficients for each of the proposed structures. For this section of the project, the S_{DS} and the S_{D1} were determined using 2020 AASHTO Guide Specifications as shown in **Table 3**. Given the site location and materials encountered, the potential for liquefaction is minimal.

Table 3 – Seismic Parameters

Building Code Reference	PGA	S_{DS}	S_{D1}
2020 AASHTO Guide for LRFD Seismic Bridge Design	0.044g	0.155g	0.093g

3.4 Organic Content

Soils that were encountered in the borings in which organic material was observed were noted on the boring logs by the field engineer. Traces of organic material were noted in the silty clay fill material at depths of 3.5 to 6.0 feet below grade. Typically, soils with an organic content in excess of 10 percent are considered unsuitable to remain below proposed project areas. Based on the soil borings and moisture data, it is not anticipated that highly organic soils will be encountered in subgrade soils for the proposed culvert replacement.

4.0 GEOTECHNICAL CULVERT DESIGN RECOMMENDATIONS

This section provides the results of GSG's geotechnical evaluation of the existing foundation system and design recommendations for the proposed culvert in accordance with the most current AASHTO LRFD 9th Edition (2020) and IDOT Geotechnical Manual (2020). The foundations for the proposed culvert must provide sufficient support to resist the dead and live loads.

4.1 Bearing Resistance

GSG evaluated the soils at the approximate bearing grade elevation of 638.0 to 638.25 feet (1 foot below the invert elevations) for the proposed culvert. The recommendations in this report are based on the GPE drawings provided by ABNA. For the design of the foundations for the culvert and headwall, the total live load, impact loads, and dead loads, including the load of the overburden soils, should be considered. Design should be completed in accordance with the design hydraulics report and the IDOT Culvert Manual (2017).

The subsurface investigation noted low strength silty clay, loose silty loam and various fill material at the assumed bearing elevation. Bearing resistance shall be evaluated at the strength limit state using load factors and factored bearing resistance. The bearing resistance factor, ϕ_b, for shallow foundations in clay and sand is 0.50, per AASHTO Table 10.5.5.2.2.1. The bearing resistance shall be checked for the extreme limit state with a resistance factor of 1.0. **Table 4** presents the recommended bearing resistance of suitable materials to support the proposed culvert.

A foundation system consisting of shallow spread footings could be used to support the proposed culvert and headwall and should be placed at a minimum depth of 3 feet below grade for Type L walls or 4 feet below finished grade for Type T Walls (in accordance with IDOT Culvert manual), for frost protection.

Table 4 – Recommended Bearing Resistance

Approximate Bearing/Invert Elevations (feet)	Nominal Bearing Resistance (ksf)	Factored Bearing Resistance (ksf)	Bearing Resistance for 1-inch Settlement Service Limit (ksf)
639.0 to 639.25	4.4	2.0	2.0

The subgrade soils at bearing grade should be evaluated per the guidelines provided in Section 8.9 of the IDOT Geotechnical Manual (2020) for suitability/workability prior to placing any portion of the proposed culvert. Based on the subsurface soil conditions, GSG anticipates undercuts will be necessary to reach suitable bearing soils at the bottom of the culvert as shown in **Table 5**.

Table 5 – Recommended Undercuts

Boring ID	Invert Elevation (ft)	Recommended Undercut Elevation (ft)	Comments
CB-01	639.25	637.21	Low Strength Silty Clay < 1.0 tsf
CB-02	639.13	635.44	Loose Silty Loam N < 6 bpf
CB-03	639.00	634.24	Existing Fill Silty clay with debris/ Fill gravel with debris

Undercut areas should be replaced with granular structural fill in accordance with IDOT standard construction requirements. This granular fill should consist of rockfill capped with CA-7, in accordance with the IDOT Culvert Manual. The lateral limit of the structural fill should extend a minimum of 1 foot beyond the edge of the footing, then an additional 1 foot laterally for every 2 feet of structural fill depth as depicted in **Exhibit 2**. The granular structural fill should be placed and compacted to a minimum of 95% of the maximum dry density, as determined by AASHTO T-180: Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures (ASTM D1557) in accordance with IDOT standard construction requirements.

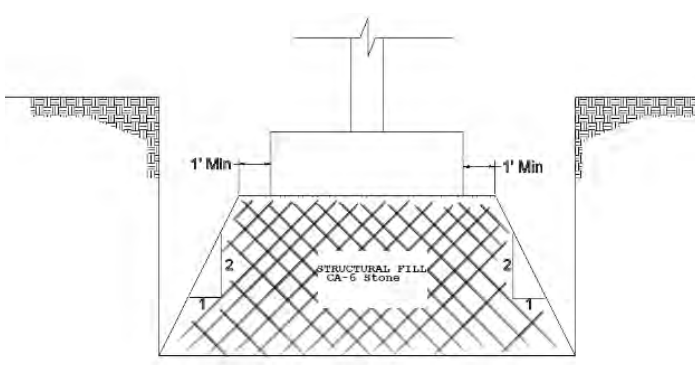


Exhibit 2: Structural Fill Placement below Footing

4.2 Lateral Load Resistance

The culvert headwall will be subject to uneven loading and should be evaluated for anticipated lateral loads. Lateral earth pressures for permanent underground structures will be dependent on the type of backfill used, whether it is in a drained or undrained state, as well as loading conditions. The proposed culvert should be designed using the at-rest earth pressure coefficients provided in **Table 6.**

The lateral earth pressures for the headwalls should be designed per the guidance provided in Section 4 of the IDOT Culvert Manual (2017). Wall sections that are independent of the culvert should be designed using the Rankine active earth pressure coefficient, K_a. Headwalls that are fixed to the culvert to resist movement should be designed using an at-rest earth pressure coefficient. Lateral design parameters for use in the design are provided in **Table 6**.

Table 6 – Lateral Load Resistance Soil Parameters for Culvert

Depth / Elevation Range (feet)	Soil Description	Unit Weight γ	Friction Angle ϕ	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)	At-Rest Earth Pressure Coefficient (K_o)
	New Engineered Clay Fill	125	20	0.41	2.46	0.58
	New Engineered Granular Fill	125	30	0.33	3	0.5
0.0 – 6.0 (647.5 – 641.5)	Fill Dark Brown and Gray Silty Clay	138	28	0.36	2.77	0.53
6.0 – 11.0 (641.5 – 636.5)	Medium Stiff to Hard Brown and Gray Silty Clay	138	28	0.36	2.77	0.53
11.0 – 30.0 (636.5 – 617.5)	Stiff to Hard Gray Silty Clay	138	28	0.36	2.77	0.53
11.5 – 45.0 (636.5 – 602.5) ***CB-02 ONLY**	Loose to Medium Dense Gray Silty Sand/Sand	120	35	0.27	3.69	0.43
21.0 – 26.0 (624.0 – 621.5) ***CB-02 ONLY**	Stiff Gray Silty Clay Loam	138	28	0.36	2.77	0.53

Depth / Elevation Range (feet)	Soil Description	Unit Weight γ	Friction Angle ϕ	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)	At-Rest Earth Pressure Coefficient (K_o)
7.0 – 11.0 (640.5 – 636.5) ***CB-03 ONLY**	Fill Gray Gravel	120	31	0.32	3.12	0.48
21.0 – 26.0 (626.5 – 621.5) ***CB-03 ONLY**	Medium Dense Gray Sand	122	36	0.26	3.85	0.41

Note: The earth pressure values should only be used for designs using level backfill behind the walls.

4.3 Settlement

The existing roadway profile is approximately 7.5 feet higher than the new wingwall footings. The anticipated settlement at the wingwalls will be less than 0.5 inches based on an anticipated design bearing pressure of 2,000 psf.

4.4 Scour Analysis

Scour analysis is not warranted for closed bottom box culvert per All Bridge Designers memo 14.2, dated November 7, 2014. Therefore, no additional scour analysis is warranted.

4.5 Drainage Recommendations

The headwalls should be designed to prevent the buildup of hydrostatic forces. This can be done with the construction of a base drain and back drain to collect and remove surface water away from the face of the retaining wall. Geocomposite Wall Drain or open grade stone with a geotextile fabric system should be placed over the entire length of the back face of the wall. If a drain cannot be installed behind the wall, hydrostatic pressures should be accounted for with the lateral design of the headwall.

5.0 GEOTECHNICAL WALL DESIGN RECOMMENDATIONS

This section provides GSG's geotechnical recommendations for the design of the proposed retaining wall based on the results of the field exploration, laboratory testing, and geotechnical analyses, and information provided by the designer.

5.1 Retaining Wall Type Recommendations

It is anticipated that the proposed retaining wall will be constructed within cut section of the existing grades along the sidewalk along Hawthorne Lane. There are various types of retaining walls that could be utilized in cut areas. This section discusses earth retaining structure types that could be considered for the proposed project. Typical wall types are described in the section below.

5.2 Cast in Place (CIP) Wall

Cast-in-place (CIP) concrete cantilever retaining walls are typically used in fill areas, as they generally require that the area behind the wall be excavated to facilitate construction. However, in cut areas, they can be designed as an L-type wall to reduce excavations behind the wall. In addition, they can be designed to resist the lateral loading without the use of tie-backs by changing the geometry or type of the foundation. The walls can be built with a variety of textured surfaces and colors for aesthetics. Although a CIP concrete wall is a feasible option, construction scheduling should be considered.

5.3 Soldier Pile Wall

Soldier pile and lagging wall is typically used in cut areas where the existing ground surface needs to be maintained during construction or when a near vertical excavation is needed. The wall may be constructed with driven steel piles or steel piles placed in drilled holes and backfilled with concrete.

5.4 Driven Sheet Pile Wall

Sheet pile walls are typically used in cut areas when continuous support must be provided to maintain existing structures or other adjacent facilities. This type of wall can also be covered with CIP panels for aesthetics. The installation of sheet pile walls requires the use of specialty equipment to drive the piles into the ground. As the retaining walls are not anticipated be greater than 15 feet in height, tie-backs will likely not be required for design.

5.5 Recommended Wall Type

Based on the information provided and location of the wall within a cut area, GSG recommends that either a sheet pile or soldier pile wall could be considered due to the limited ROW available and existing utilities in the area. GSG evaluated the global and external stability and settlement for wall to determine the suitability of the recommended retaining wall type for this project. The wall section should be analyzed to determine adequate factors of safety relative to overturning failure. The soldier pile or sheet pile wall should be designed by a licensed structural engineer.

5.6 Sheet Pile Wall Design

Due to the presence of very stiff to hard clays, there is potential need for a heavier sheet pile section with a minimum thickness of 0.4 inches to alleviate any damage to the pile section during driving. Grade 50 steel should be used for the sheet pile. The interlocks could be partially clogged during driving and after installation due to fine soil particle migration. The steel sheet piles may be subject to potential corrosion. Corrosion rates are typically a function of temperature, soil pH, access to oxygen, and chemistry of the environment surrounding the pile. As the wall is intended to remain in place as a long-term wall, corrosion deterioration should be evaluated on the sheet pile wall design.

5.7 Soldier Pile Wall Design

Soldier pile walls are typically used in areas when the existing soils will be excavated out, minimizing additional costs of over-excavation and backfill. The soldier pile wall can be covered with precast panels for aesthetics. The installation of soldier pile walls requires the use of specialty equipment to drive the piles into the ground or to be drilled and cast-in-place where more lateral support is needed.

The soldier piles can either be driven or placed in drilled holes and backfilled with concrete (auger cast). For auger cast construction, construction of the borehole can be affected by the ground water level and hard material. Due to the anticipated long-term groundwater elevation and predominantly clay soils in the upper portion of the borings, significant groundwater issues are not anticipated for construction. Perched water may be present in the upper fill soil layers.

5.7.1 Lateral Earth Pressure and Loading

The wall should be designed to withstand earth and live lateral earth pressures. The lateral earth pressures on retaining wall depend on the type of wall (i.e. restrained or unrestrained), the type of backfill and the method of placement against the wall, and the magnitude of surcharge weight on the ground surface adjacent to the wall. The active earth pressure coefficient (Ka), and the passive earth pressure coefficient (Kp) were determined in accordance with AASHTO Section 3.11.5.3 and 3.11.5.4. Soil design properties for use in design of the wall are provided in **Table 7** for the proposed retaining wall location.

Table 7 – Lateral Load Resistance Soil Parameters for Retaining Wall

Depth / Elevation Range (feet)	Soil Description	Unit Weight γ	Friction Angle ϕ	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)	At-Rest Earth Pressure Coefficient (K_o)
	New Engineered Clay Fill	125	20	0.41	2.46	0.58
	New Engineered Granular Fill	125	30	0.33	3	0.5
0.0 – 6.0 (648.3 – 642.3)	Fill Brown, Black, and Gray Silty Clay	138	28	0.36	2.77	0.53
6.0 – 13.5 (642.3 – 634.8)	Medium Stiff to Stiff Brown and Gray Silty Clay	138	28	0.36	2.77	0.53
13.5 – 28.5 (634.8 – 619.8)	Stiff to Hard Gray Silty Clay	138	28	0.36	2.77	0.53
28.5 – 30.0 (619.8 – 618.3)	Loose Gray Sand	110	29	0.35	2.88	0.52

Note: The earth pressure values should only be used for designs using level backfill behind the walls.

Traffic and other surcharge loads should be included in the design of the retaining wall as applicable. A live load surcharge shall be applied to act on the surface of the backfill within a distance equal to one-half the wall height behind the back face of the wall in accordance with AASHTO 3.11.6.4.

Retaining wall design should include a drainage system to allow movement of any water behind the walls, and not allowing hydrostatic (seepage) pressures to develop in the active soil wedge behind the walls. This could be accomplished by placing a Geocomposite Wall Drain over the entire length of the back face of the walls connected to a perforated drainpipe and backfilling a minimum of 2 feet of free draining materials, Porous Granular Embankment, as measured laterally from the back of the wall. The backfill should be placed in accordance with the IDOT SSRBC.

Heavy compaction equipment should not be allowed closer than five (5) feet to the retaining wall to prevent inducing high lateral earth pressures and causing wall yielding and/or other damage. The passive lateral earth pressure coefficient (Kp) from the upper 3.5 feet of level backfill at the toe of the wall should be neglected, unless the soil is confined or protected by a concrete slab or well drained pavement. The passive lateral earth pressure coefficient from the upper 3.5 feet of soil for a descending slope at the wall toe should also be neglected, regardless of any surface protection.

5.8 Global Slope Stability

The retaining wall should be designed for external stability of the wall system. The parameters in **Table 8** were used to evaluate the global stability of the anticipated soldier pile walls.

Table 8 –Solider Pile Wall Description

Description	Value
Maximum exposed height of the retaining wall (H)	7.5 feet
Minimum anticipated embedment length	10.0 feet
Minimum pile tip elevation	630.40 feet

The total height of the wall should be based on structural analysis performed by a Licensed Structural Engineer in the State of Illinois.

SLIDE2 is a comprehensive slope stability analysis software used to evaluate the proposed wall based on the limit equilibrium method. Circular failure analyses were evaluated using the simplified Bishop analyses methods for the short term (undrained) and long term (drained) conditions for the proposed retaining walls. The results of the analyses are shown in **Table 9**.

Table 9 – Retaining Wall Global Slope Stability Analyses Results

Analysis Exhibit	Analysis Type	Factor of Safety	Minimum Factor of Safety
Exhibit 1	Circular – Short Term	11.6	1.7
Exhibit 2	Circular – Long Term	4.2	1.7

Based on the analyses performed, the proposed retaining wall meets the minimum factor of safety of 1.7 in cut areas. Copies of the slope stability analyses are included in the Slope Stability Analyses Exhibits (**Appendix E**).

6.0 CONSTRUCTION CONSIDERATIONS

All work performed for the proposed project should conform to the requirements in the IDOT Standard Specifications for Road and Bridge Construction (SSRBC) (2022) and the IDOT Subgrade Stability Manual (2005). Any deviation from the requirements in the manuals above should be approved by the design engineer.

6.1 Site Preparation

Any pavement materials or topsoil encountered during construction should be stripped and stockpiled as per Section 211.03 of the IDOT Standard Specifications for Road and Bridge Construction (SSRBC). The topsoil should be separated from other materials being stockpiled onsite for reuse or haul-off. Stripping of any trees, brush, vegetation, and topsoil may also be necessary at the proposed improvement location

6.2 Scour Considerations

To help prevent local erosion, it is recommended to place stone riprap at the end of the culvert. This will help prevent sediments from entering and accumulating in the culvert, reduce long term maintenance, and provide protection to the streambed at the interface.

6.3 Site Excavation

Before proceeding with construction, all existing underground utility lines or structures that will interfere with construction should be completely relocated from the proposed construction areas. Where possible, existing utility lines that are to be abandoned in place should be removed and/or plugged with cement grout. All excavations resulting from underground utilities or structure removal activities should be cleaned of loose and disturbed materials, including all previously placed backfill, and backfilled with suitable fill materials in accordance with the requirements of this section. During the clearing and stripping operations, positive surface drainage should be maintained to prevent the accumulation of water.

Site excavations are expected to encounter various types of soils as described in the Subsurface Exploration section of this report. The contractor will be responsible for providing a safe excavation during the construction activities of the project. All excavations should be conducted in accordance with applicable federal, state, and local safety regulations, including, but not limited to the Occupational Safety and Health Administration (OSHA) excavation safety standards. In accordance with OSHA Regulation 29 CFR 1926 Subpart P Appendix B, the maximum allowable slopes for excavations less than 20 feet should be completed per the OSHA Excavation Slopes shown in **Table 10**. Excavations made in layered soil systems shall use the maximum allowable slope for each layer as prescribed in the OSHA Regulation. Excavations greater than 20 feet deep should be designed by a registered professional engineer; any shoring or bracing systems should be designed by a licensed structural engineer.

Table 10 – OSHA Excavation Slopes

Soil or Rock Type	Maximum Allowable Slope (H:V) for less than 20 feet
Stable Rock	Vertical (90^{o})
Type A	¾:1 (53 ^{o})
Type B	1:1 (45 ^{o})
Type C	1 ½:1 (34 ^{o})

Excavation stability and soil pressures on temporary shoring are dependent on soil conditions, depth of excavations, installation procedures, and the magnitude of any surcharge loads on the ground surface adjacent to the excavation. Surcharge loads from the excavated materials, construction equipment, and vehicles should be included in the design of the excavation system. Excavation near existing structures and underground utilities should be performed with extreme care to avoid undermining existing structures.

If water seepage occurs during excavation or where wet conditions are encountered such that the water cannot be removed with conventional sumping, GSG recommends placing open grade stone similar to IDOT CA-7 to stabilize the bottom of the excavation below the water table. The CA-7 stone should be placed 12 inches above the water table, in 12-inch lifts, and should be compacted with the use of a heavy smooth drum roller or heavy vibratory plate compactor until stable. The remaining portion of the excavation beneath the footings should be backfilled using approved structural fill consisting of granular materials such as IDOT CA-6.

6.4 Borrow Material and Compaction Requirements

If borrow material is to be used for onsite construction, it should conform to Section 204 "Borrow and Furnish Excavations" of the IDOT SSRBC (2022). The fill material should be free of organic matter and debris and should be placed and compacted in accordance with Section 205, Embankment, of the IDOT Construction Manual. Earth-moving operations should be avoided during excessively cold or wet weather to avoid freezing of softening subgrade soils. All backfill materials around the culvert must be pre-approved by the site engineer. Backfill materials for undercut areas beneath the culvert should be placed in 8 inches loose lifts and should be compacted to 95% of the maximum dry density as determined by AASTHO T-180, Modified Proctor Method.

6.5 Groundwater Management

The long-term groundwater is anticipated to be 11 to 13.5 feet below grade (El. 634.2 to 637.9 feet). GSG does not anticipate significant groundwater related issues during construction, however excavations may be impacted by the creek level at time of construction. Perched water may also be encountered in the existing fill materials. If rainwater run-off or groundwater is accumulated at the base of excavations, the contractor should remove accumulated water using conventional sump pit and pump procedures and maintain a dry and stable excavation. The location of the sump should be determined by the contractor based on field conditions. During earthmoving activities at the site, grading should be performed to ensure that drainage is maintained throughout the construction period. Water should not be allowed to accumulate in the foundation area either during or after construction. Undercut and excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater or surface run-off. Grades should be sloped away from the excavations to minimize runoff from entering.

6.6 Temporary Soil Retention

A Temporary Soil Retention System (TSRS) should be used for any excavations. The TSRS should be designed in accordance with the IDOT Bridge Design Manual, Section 3.13.1, Temporary Sheet Piling Design, Temporary Soil Retention Systems, and Braced Excavations and the IDOT Design Guide. The design of the temporary earth retention system is the responsibility of the contractor. The contractor should submit the TSRS plans to the structural design team for review prior to commencing construction of the TSRS. Based on the loose granular soils and variable fill materials encountered at the site, temporary sheet piles are not recommended.

7.0 LIMITATIONS

This report has been prepared for the exclusive use of the Illinois Department of Transportation and its consultant team. The recommendations provided in the report are specific to the project described herein and are based on the information obtained from the soil boring location within the proposed project limits. The analyses have been performed and the recommendations provided in this report are based on subsurface conditions determined at the location of the boring. This report may not reflect all variations that may occur outside the boring location or at some other time, the nature and extent of which may not become evident until during the time of construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and review the recommendations presented herein.

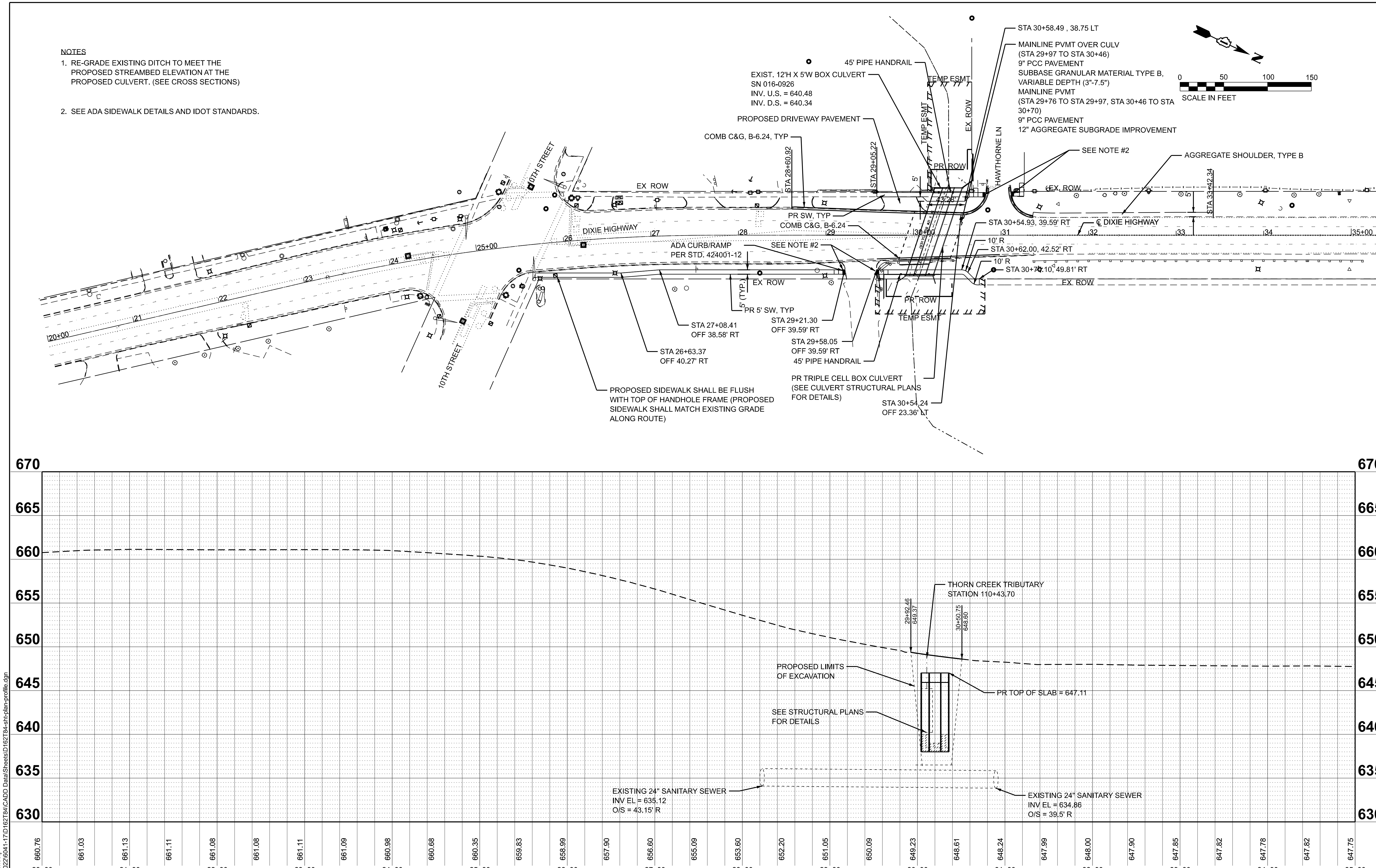
APPENDIX A

PROPOSED PLAN &

PROFILE

NOTES
1. RE-GRADE EXISTING DITCH TO MEET THE PROPOSED STREAMBED ELEVATION AT THE PROPOSED CULVERT. (SEE CROSS SECTIONS)

2. SEE ADA SIDEWALK DETAILS AND IDOT STANDARDS.



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ABNA DESIGN FIRM REG. 184.002117

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	DRAWN - ABD	REVISED -	**DEPARTMENT OF TRANSPORTATION**	**PLAN AND PROFILE**
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F.A.U RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
2843	FAU 2843 22 CR	COOK	57	10
		CONTRACT NO. 62T84		
		ILLINOIS FED. AID PROJECT		

FAU 2843 22 CR

Benchmark:
Existing Structure: A single 12' W x 5' H cell concrete box culvert (S.N. 016-0926) located just south of Hawthorne Ln. The culvert construction date and section is unknown. The culvert will be replaced with a triple box culvert (S.N. 016-8321) comprised of a 12' W x 7' H main cell and 8'W x 7'H flanking cells, with all cells embedded 1' and the two flanking cells include a wier wall at the upstream face.

Traffic to be maintained using staged construction.

No salvage.

LOADING HL-93

Allow 50#/sq. ft. for future wearing surface.

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

DESIGN STRESSES
(Retaining Wall)

FIELD UNITS

f'c = 3,500 psi (Wall Cap)
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (Sheet Piling - ASTM A572 Grade 50)

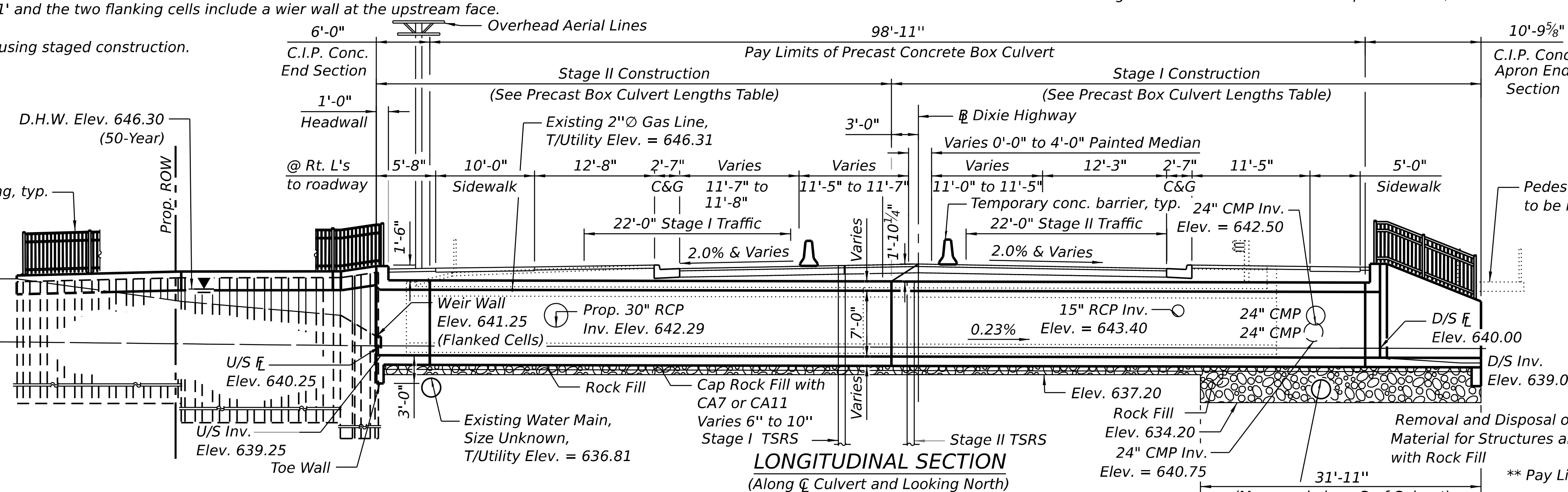
DESIGN STRESSES
(Culvert)

FIELD UNITS

f'c = 3,500 psi
fy = 50,000 psi (M270 Gr. 50)
fy = 60,000 psi (Reinforcement)

PRECAST UNITS

f'c = 5,000 psi
fy = 65,000 psi (Welded Wire Reinforcement)



LONGITUDINAL SECTION

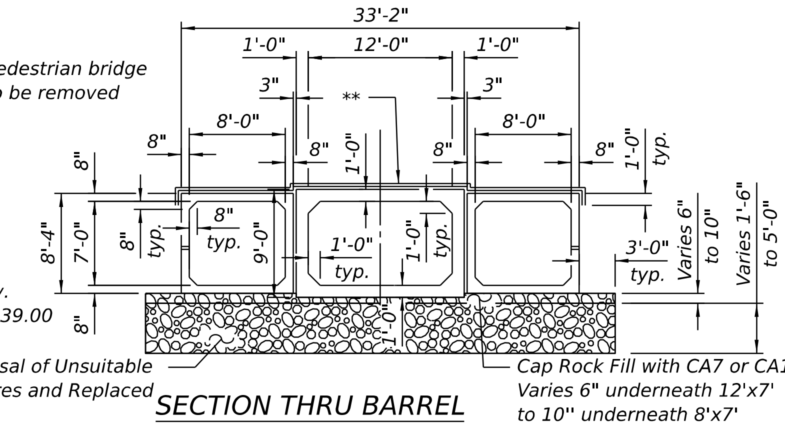
(Along ℄ Culvert and Looking North)

Pipes shown penetrating culvert wall are to North and South culverts only.

GREGORY J. HATLESTAD, S.E.
081-005562

EXP 11/30/2026

DATE ____________



SECTION THRU BARREL

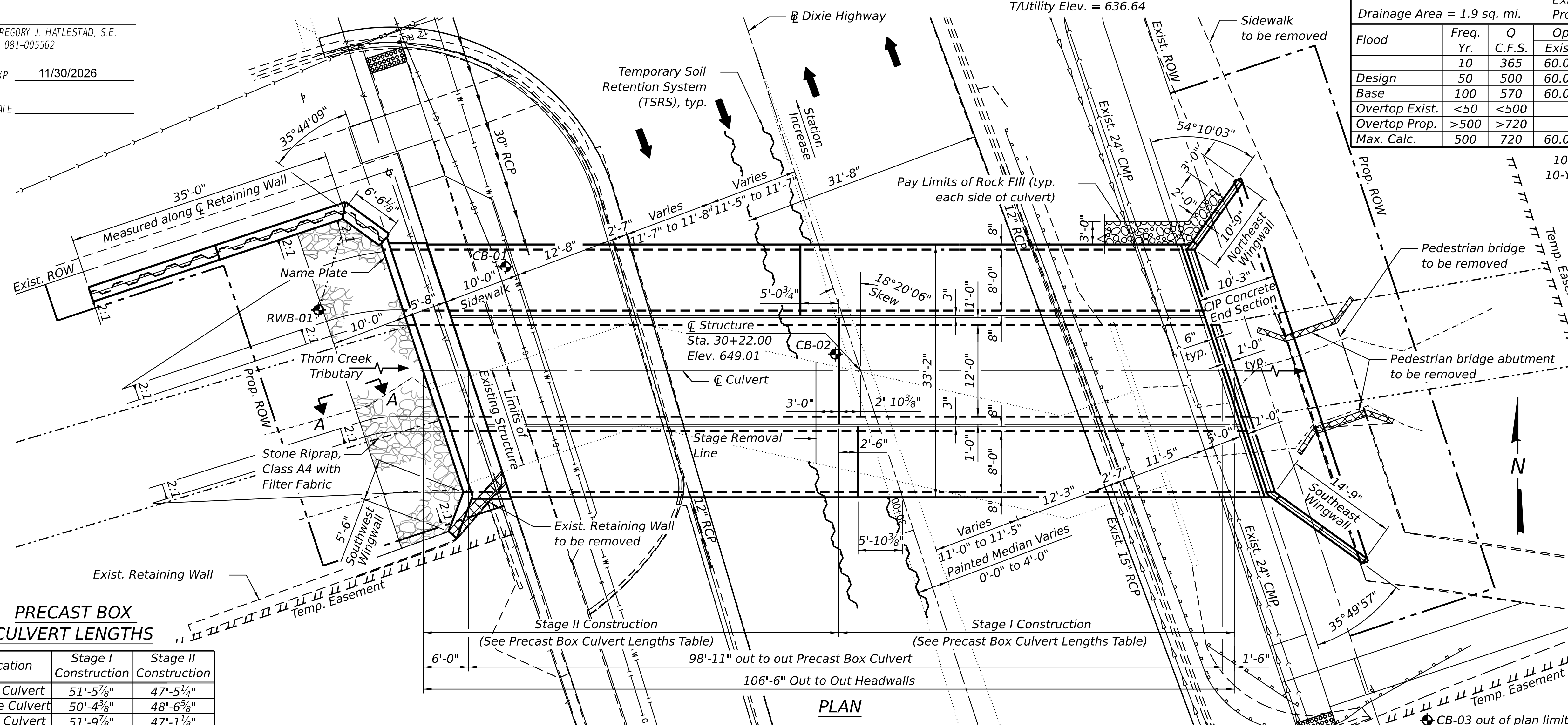
** Pay Limits for Membrane Waterproofing for Buried Concrete Structures

WATERWAY INFORMATION

Drainage Area = 1.9 sq. mi.
Exist. Overtopping Elev. 647.80 at Sta. 34+97.44
Prop. Overtopping Elev. 647.80 at Sta. 34+97.44

Flood	Freq. Yr.	Q C.F.S.	Opening Ft² Exist.	Opening Ft² Prop.	Nat. H.W.E.	Head - Ft. Exist.	Head - Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
	10	365	60.0	139.0	645.9	0.9	0.0	646.8	645.9
Design	50	500	60.0	152.0	646.3	1.8	0.0	648.1	646.3
Base	100	570	60.0	152.0	646.5	1.5	0.1	648.0	646.6
Overtop Exist.	<50	<500							
Overtop Prop.	>500	>720							
Max. Calc.	500	720	60.0	152.0	646.9	1.3	0.2	648.2	647.1

10-Year Velocity through Existing Structure = 6.1 ft/s
10-Year Velocity through Proposed Structure = 2.6 ft/s
2-Yr. Flow Rate = 225 ft³/s

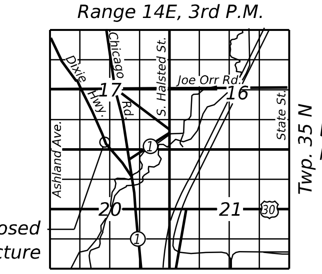


PLAN

LEGEND

- Soil Boring
- Exist. Underground Sanitary Sewer
- Exist. Storm Sewer
- Prop. Storm Sewer
- Exist. Underground Water
- Exist. Underground Gas line
- Exist. Aerial Lines

Range 14E, 3rd P.M.



LOCATION SKETCH

PRECAST BOX CULVERT LENGTHS

Location	Stage I Construction	Stage II Construction
North Culvert	51'-5⅞"	47'-5¼"
Middle Culvert	50'-4⅜"	48'-6⅝"
South Culvert	51'-9⅞"	47'-1⅛"

GENERAL PLAN & ELEVATION
DIXIE HIGHWAY OVER
THORN CREEK TRIBUTARY
FAU 2843 22 CR
COOK COUNTY
STATION 30+22.00
STRUCTURE NO. 016-8321

CZAPLICKI LOPEZ, PLLC
201 KENMARE DRIVE
BURR RIDGE, ILLINOIS 60527
630-915-8861
DESIGN FIRM NO: 184.008135

USERNAME = RogiannHansen	DESIGNED - KLK	REVISED -
	CHECKED - GJH	REVISED -
PLOT SCALE = 16.0000 ' / in.	DRAWN - RMH	REVISED -
PLOT DATE =	CHECKED - GJH	REVISED -

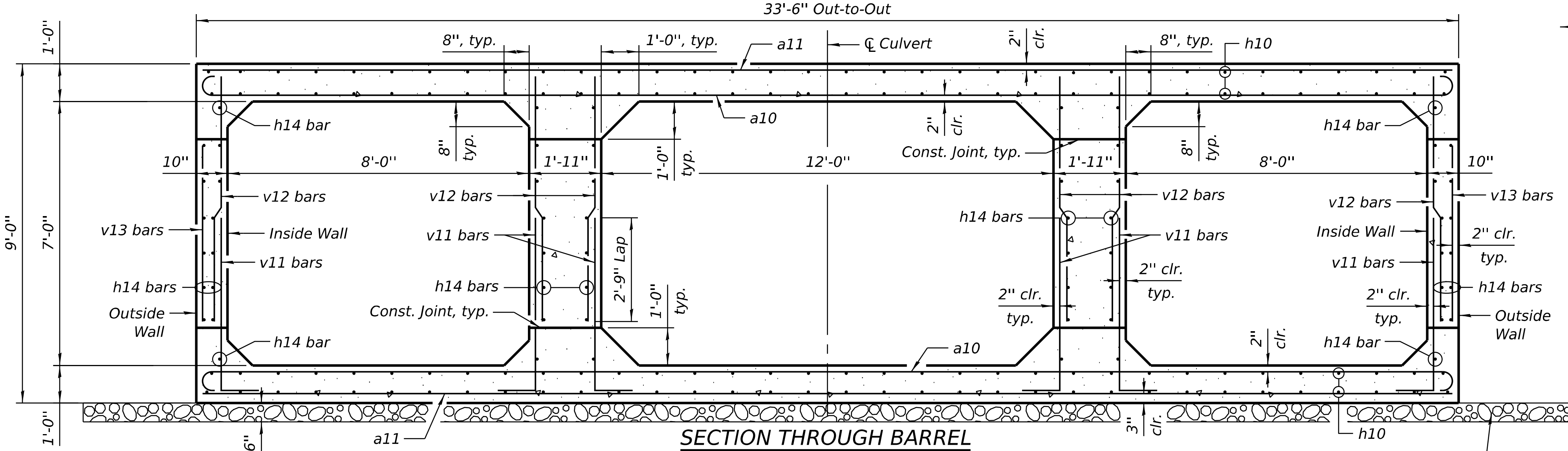
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 1 OF 15 SHEETS

F.A.U RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
2843	FAU 2843 22 CR	COOK	57	29

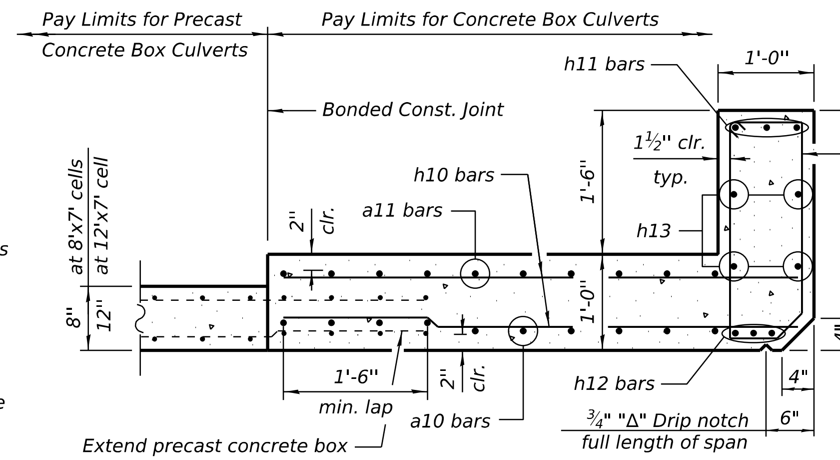
CONTRACT NO. 62T84

ILLINOIS FED. AID PROJECT



SECTION THROUGH BARREL

Dimensions taken at right ∠'s to ℄ Culvert



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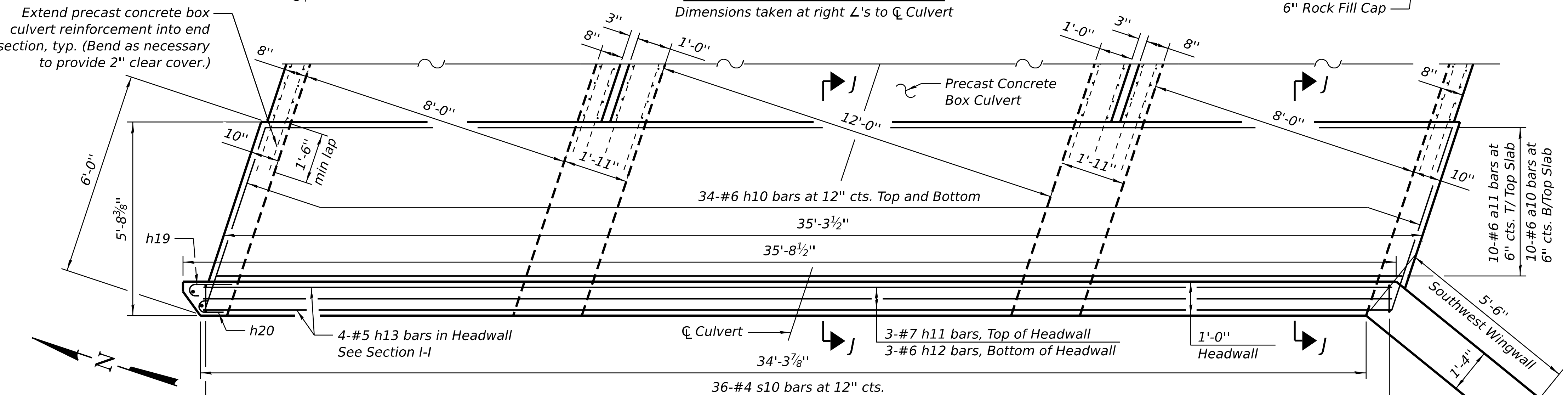
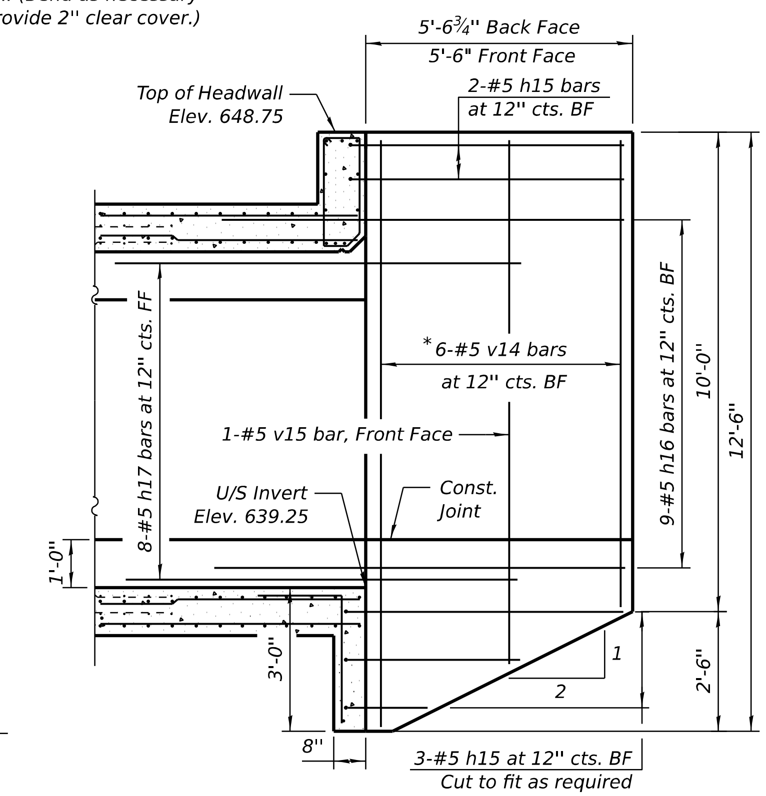
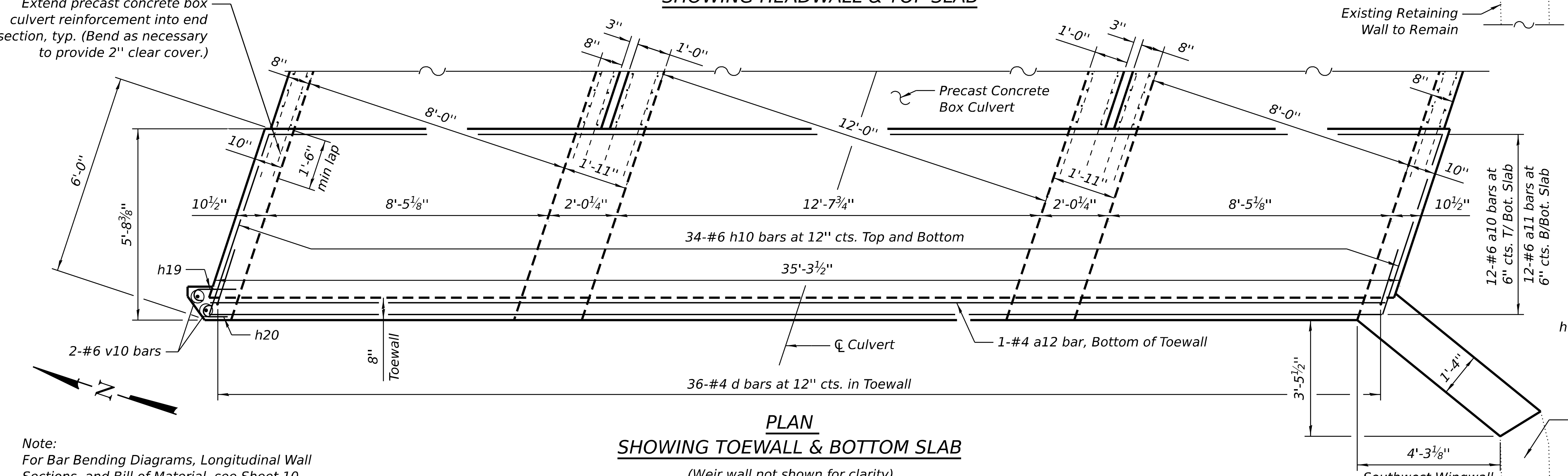


PLAN
SHOWING HEADWALL & TOP SLAB



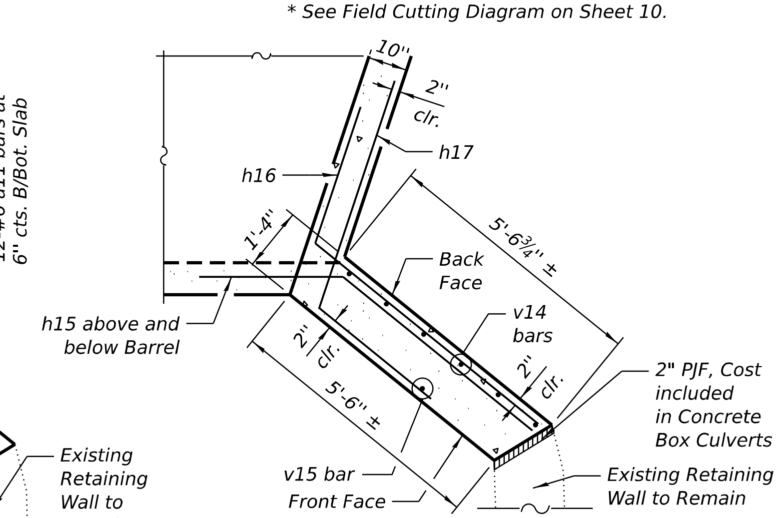
SW WINGWALL ELEVATION

* See Field Cutting Diagram on Sheet 10.



PLAN
SHOWING TOEWALL & BOTTOM SLAB

(Weir wall not shown for clarity)



SW WINGWALL PLAN

Note:
For Bar Bending Diagrams, Longitudinal Wall Sections, and Bill of Material, see Sheet 10.

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CZAPLICKI LOPEZ, PLLC
201 KENMARE DRIVE
BURR RIDGE, ILLINOIS 60527
630-915-8861
DESIGN FIRM NO: 184.008135

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		CHECKED	- GJH	REVISED	-
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PLOT DATE	=	CHECKED	- GJH	REVISED	-

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

UPSTREAM END SECTION DETAILS I
STRUCTURE NO. 016-8321

SHEET 9 OF 15 SHEETS

F.A.U RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
2843	FAU 2843 22 CR	COOK	57	37
		CONTRACT NO. 62T84		
		ILLINOIS	FED. AID PROJECT	

3/26/2025 11:35:49 AM

APPENDIX B

BORING LOCATION PLAN

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TIME = 11:37:17 AM
SHEET SIZE = 17x11 (in.)
PLOT SCALE = 200.0000 ' / in.
USER NAME = aalyousef

GSG CONSULTANTS, INC.
735 E. REMINGTON RD, SCHAUMBURG, IL 60173
TEL: +1630.994.2600 | WWW.GSG-CONSULTANTS.COM

USER NAME	= aalyousef	DESIGNED	-	AA
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PLOT SCALE	= 200.0000 ' / in.	CHECKED	-	DE
PLOT DATE	= 7/24/2024	DATE	-	07/17/2024

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

DIXIE HIGHWAY OVER THORN CREEK - CULVERT REPLACEMENT

BORING LOCATION PLAN

SCALE: 1:50 | SHEET 1 OF 1 SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
--	--	COOK	1	1

CONTRACT NO. 202-016

ILLINOIS | FED. AID PROJECT

APPENDIX C

SOIL BORING LOG

Illinois Department of Transportation
Division of Highways
GSG Consultants

SOIL BORING LOG

Date 6/28/24

ROUTE	FAU 2843	**DESCRIPTION**	Culvert Boring	**LOGGED BY**	DV
SECTION		**LOCATION**	, SEC. , TWP. , RNG. , Latitude 41.5146092, Longitude -087.6462054		
COUNTY	Cook	**DRILLING RIG**	Geoprobe	**HAMMER TYPE**	AUTO
		DRILLING METHOD	HSA	**HAMMER EFF (%)**	101.6

STRUCT. NO.	016-8321
Station	N/A
BORING NO.	CB-01
Station	30+50
Offset	40.00ft LT
Ground Surface Elev.	648.21 ft
Surface Water Elev.	N/A ft
Stream Bed Elev.	N/A ft
Groundwater Elev.:	
First Encounter	639.7 ft ▼
Upon Completion	N/A ft
After ___ Hrs.	N/A ft

Description	Elev. (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
2 inches of Topsoil	648.04				
Dark Brown, Moist to Very Moist FILL: SILTY CLAY, with sand, trace gravel, trace concrete			4 3 3	1.7 B	19
		-5	2 1 1	1.3 B	28
	642.21				
Medium Stiff Brown, Moist SILTY CLAY, trace gravel (CL/ML)			1 1 1	0.8 B	24
▼		-10	0 2 3	0.6 B	21
	638.21				
Proposed culvert downstream invert elevation at 638.00 feet	637.21				
Stiff to Hard Gray, Moist SILTY CLAY, trace gravel, trace sand (CL/ML)			4 5 7	4.0 B	18
		-15	4 2 2	3.1 B	20
			2 5 5	2.9 B	20
		-20	3 4 6	4.2 B	19
Stiff to Hard Gray, Moist SILTY CLAY, trace gravel, trace sand (CL/ML) *(continued)*			3 4 7	3.8 B	21
		-25	3 5 7	3.3 B	20
			3 5 7	3.1 B	20
	618.21	-30	3 3 4	1.7 B	19
End of Boring		-35			
		-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)

Illinois Department of Transportation
Division of Highways
GSG Consultants

SOIL BORING LOG

Date 7/1/24

ROUTE	FAU 2843	**DESCRIPTION**	Culvert Boring
LOGGED BY	TS	**SECTION**	
LOCATION	, SEC. , TWP. , RNG. , Latitude 41.5145914, Longitude -087.6460607	**COUNTY**	Cook
DRILLING RIG	Geoprobe	**HAMMER TYPE**	AUTO
DRILLING METHOD	HSA	**HAMMER EFF (%)**	101.6
STRUCT. NO.	016-8321	Station	N/A
BORING NO.	CB-02	Station	30+25
Offset	2.00ft LT	Ground Surface Elev.	648.94 ft
Surface Water Elev.	N/A ft	Stream Bed Elev.	N/A ft
Groundwater Elev.: First Encounter	632.9 ft ▼	Upon Completion	N/A ft
After ___ Hrs.	N/A ft		

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
10 inches of Asphalt	648.10				
6 inches of Concrete	647.61		5 4 3	4.2 B	20
Brown and Gray, Moist FILL: SILTY CLAY, trace gravel, trace sand, trace organics, trace wood Concrete fragments between 4 to 5 feet		-5	10 11 17	3.5 P	20
	642.94				
Very Stiff to Hard Brown and Gray, Moist SILTY CLAY, trace gravel (CL/ML)			3 3 3	3.1 B	25
Sand seam at 9.5 feet		-10	3 3 4	4.4 S	21
	638.25				
Proposed culvert midpoint invert elevation at 638.12 feet	637.94				
Loose Dark Gray, Moist SILTY LOAM, trace gravel (ML)			3 3 3		19
	635.44				
Medium Dense Dark Gray, Moist to Wet SILTY SAND, with gravel (SM)		-15	2 3 4		21
▼			9 6 6		14
		-20	11 13 8		10

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	627.94				
Stiff to Very Stiff Dark Gray, Moist SILTY CLAY LOAM, with sand, trace gravel (ML/CL)			3 6 8	2.7 B	24
		-25	3 6 8	1.7 B	17
	622.94				
Medium Dense Gray, Moist SAND, with gravel (SP)			13 9 9		15
		-30	16 10 9		10
		-35	5 6 9		9
		-40	4 6 8		9

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)

Illinois Department of Transportation
Division of Highways
GSG Consultants

SOIL BORING LOG

Date 7/1/24

ROUTE FAU 2843 **DESCRIPTION** Culvert Boring **LOGGED BY** TS

SECTION **LOCATION** , SEC. , TWP. , RNG. ,
Latitude 41.5145914, **Longitude** -087.6460607

COUNTY Cook **DRILLING RIG** Geoprobe **HAMMER TYPE** AUTO
DRILLING METHOD HSA **HAMMER EFF (%)** 101.6

STRUCT. NO. 016-8321
Station N/A

BORING NO. CB-02
Station 30+25
Offset 2.00ft LT
Ground Surface Elev. 648.94 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft

Groundwater Elev.:
First Encounter 632.9 ft ▼
Upon Completion N/A ft
After ___ **Hrs.** N/A ft

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Medium Dense Gray, Moist SAND, with gravel (SP) *(continued)*				
		8 7 7		8
603.94	-45			
End of Boring				
	-50			
	-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)

Illinois Department of Transportation
Division of Highways
GSG Consultants

SOIL BORING LOG

Date 6/28/24

ROUTE FAU 2843 **DESCRIPTION** Culvert Boring **LOGGED BY** DV

SECTION **LOCATION** , SEC. , TWP. , RNG. ,
Latitude 41.5145158, **Longitude** -087.6458451

COUNTY Cook **DRILLING RIG** Geoprobe **HAMMER TYPE** AUTO
DRILLING METHOD HSA **HAMMER EFF (%)** 101.6

STRUCT. NO. 016-8321
Station N/A

BORING NO. CB-03
Station 29+50
Offset 45.00ft RT
Ground Surface Elev. 645.24 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft

Groundwater Elev.:
First Encounter 639.2 ft ▼
Upon Completion N/A ft
After ___ **Hrs.** N/A ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
2 inches of Topsoil	645.08				
Brown and Gray - Moist FILL: SILTY CLAY, with sand, trace gravel, trace wood, trace asphalt			4 3 6	3.8 B	17
Push rock at 3.5 feet		-5	25 24 19		21
	639.24 ▼				
Gray and Black - Moist FILL: SILTY CLAY, trace gravel, trace asphalt	638.25		3 3 14	1.3 B	25
Proposed culvert upstream elevation at 638.25 feet	638.24				
Gray - Moist FILL: GRAVEL, trace sand, trace brick		-10	5 4 3		10
	634.24				
Stiff to Very Stiff Light Gray, Moist SILTY CLAY, trace gravel (CL/ML)			3 3 5	3.1 B	22
		-15	3 4 6	2.8 B	20
			3 2 3	1.9 B	21
		-20	3 4 15	2.1 B	16
	624.24				
Medium Dense Gray, Moist to Wet SAND, with silt, trace gravel (SP/SM)			5 5 12		18
		-25	3 5 8		14
	619.24				
Stiff Gray, Moist SILTY CLAY, trace gravel, trace sand (CL/ML)			2 3 4	1.5 B	25
	615.24	-30	0 3 20	1.0 B	22
End of Boring					
		-35			
		-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)

Illinois Department of Transportation
Division of Highways
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SOIL BORING LOG

Date 6/28/24

ROUTE FAU 2843 **DESCRIPTION** Retaining Wall Boring **LOGGED BY** DV

SECTION **LOCATION** , SEC. , TWP. , RNG. ,
Latitude 41.5145904, **Longitude** -087.6463013

COUNTY Cook **DRILLING RIG** Geoprobe **HAMMER TYPE** AUTO
DRILLING METHOD HSA **HAMMER EFF (%)** 101.6

STRUCT. NO. N/A
Station N/A

BORING NO. RWB-01
Station 30+52
Offset 65.00ft LT
Ground Surface Elev. 648.35 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft

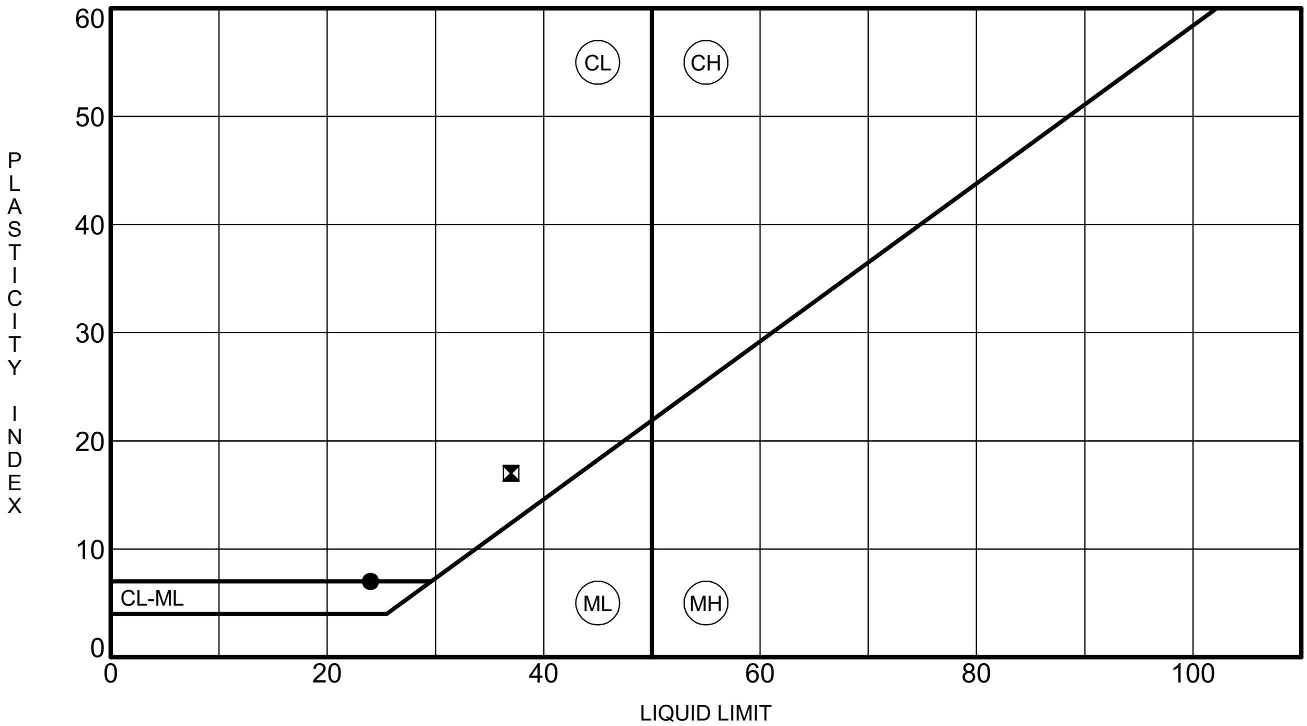
Groundwater Elev.:
First Encounter 639.8 ft ▼
Upon Completion N/A ft
After ____ **Hrs.** N/A ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
2 inches of Topsoil	648.18				
Brown, Gray, and Black - Moist FILL: SILTY CLAY, trace wood, trace gravel, trace brick			4		
			4	5.8	17
			3	B	
			7		
			5	6.3	18
		-5	5	B	
	642.35				
Medium Stiff to Stiff Brown and Gray, Moist to Very Moist SILTY CLAY, trace gravel, trace sand (CL/ML)			3		
			3	3.1	20
			4	B	
▼			0		
			1	0.8	32
		-10	1	B	
			2		
			3	1.3	18
			3	B	
	634.85				
Stiff to Hard Gray, Moist SiLTY CLAY, trace gravel (CL/ML)			4		
			4	1.7	20
		-15	6	B	
			3		
			5	2.3	19
			7	B	
			3		
			6	4.2	19
		-20	7	B	
Stiff to Hard Gray, Moist SiLTY CLAY, trace gravel (CL/ML) *(continued)*			4		
			5	4.2	20
			8	B	
			3		
			6	4.4	17
		-25	8	B	
Sand seam at 26 feet			4		
			5	2.5	19
			8	B	
	619.85				
Loose Gray, Wet SAND, with silt, trace gravel (SP/SM)			3		
			3		23
	618.35	-30	2		
End of Boring					
		-35			
		-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)

APPENDIX D

LABORATORY TEST RESULTS



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**CB-02**	**11.00**	**24.0**	**17.0**	**7.0**		
⧗	**RWB-01**	**8.50**	**37.0**	**20.0**	**17.0**		

Illinois Department of Transportation

Division of Highways
GSG Consultants

ATTERBERG LIMITS' RESULTS

Route: FAU 2843

Section:

County: Cook

ATTERBERG LIMITS DIXIE HIGHWAY CULVERT.GPJ IL DOT.GDT 7/23/24

GSG CONSULTANTS, INC.

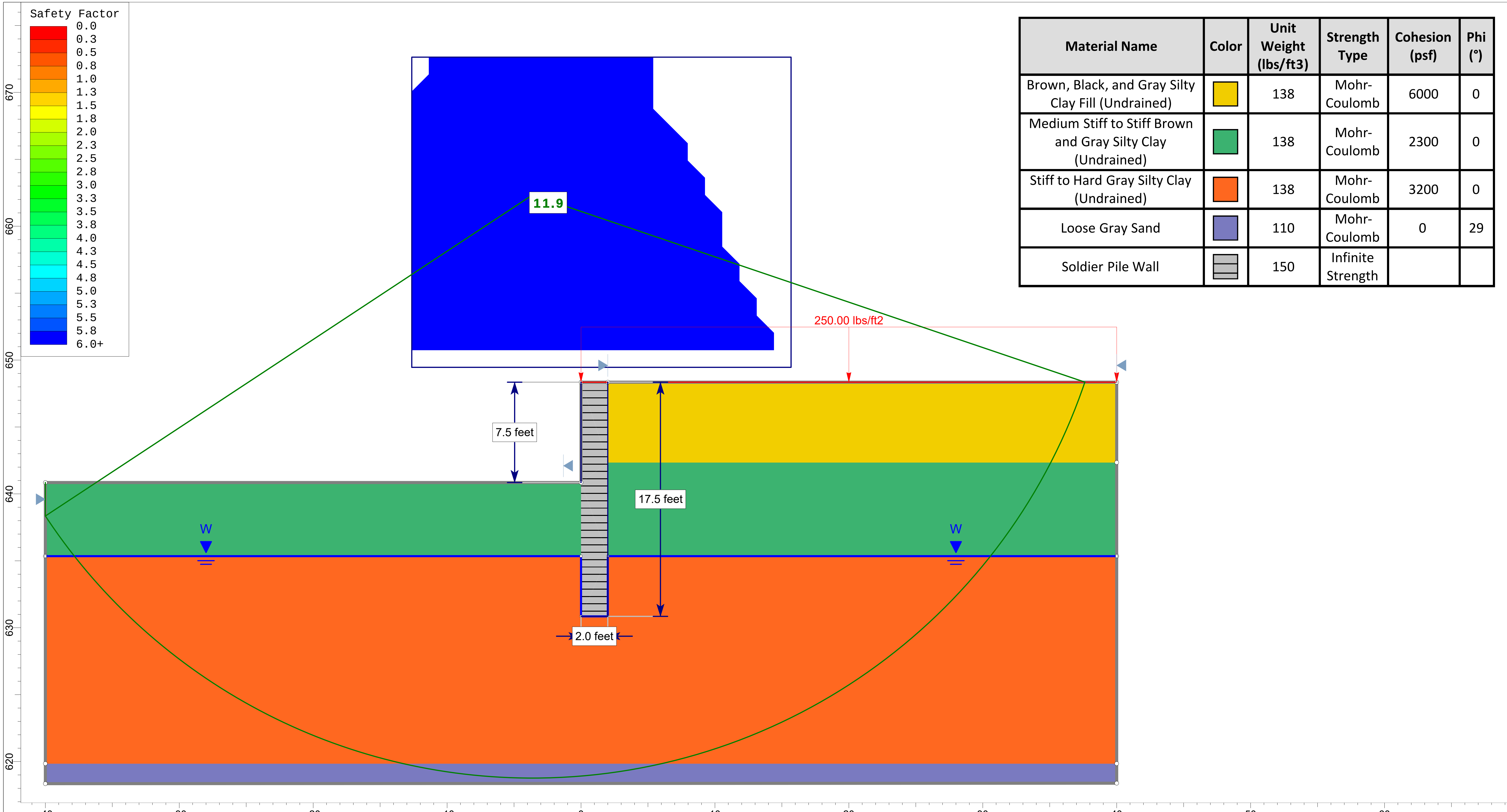
735 Remington Road
Schaumburg, IL 60173
Tel: 630.994.2600
www.gsg-consultants.com

Table D-1 – Dry Unit Weight

Boring ID	Sample Depth (ft)	Dry Unit Weight (pcf)	Wet Unit Weight (pcf)
RWB-01	13.5-15.0	109.5	131.7

APPENDIX E

SLOPE STABILITY ANALYSIS



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)
Brown, Black, and Gray Silty Clay Fill (Undrained)		138	Mohr-Coulomb	6000	0
Medium Stiff to Stiff Brown and Gray Silty Clay (Undrained)		138	Mohr-Coulomb	2300	0
Stiff to Hard Gray Silty Clay (Undrained)		138	Mohr-Coulomb	3200	0
Loose Gray Sand		110	Mohr-Coulomb	0	29
Soldier Pile Wall		150	Infinite Strength		

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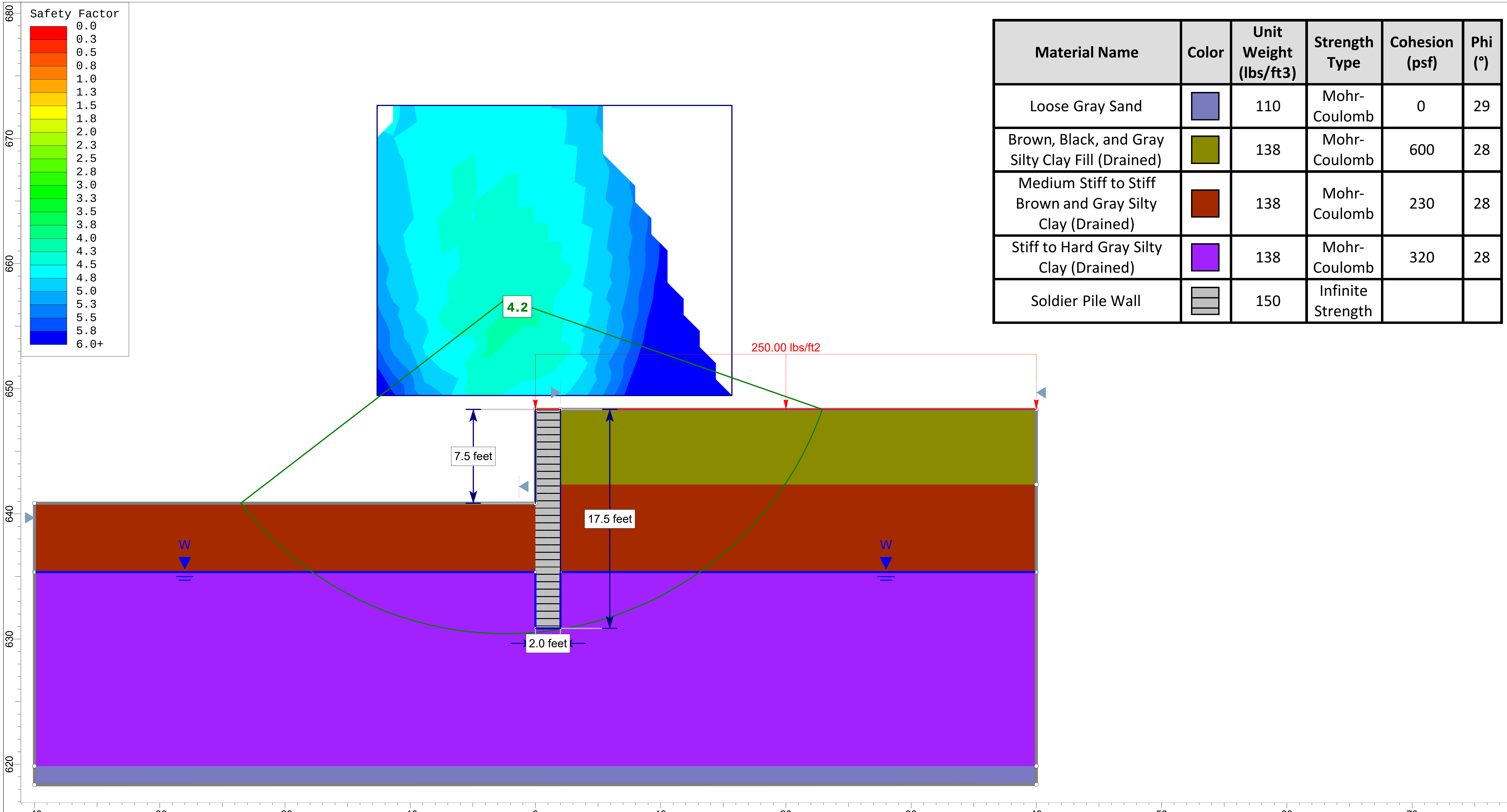
SLIDEINTERPRET 9.031

Project	Slide2 - An Interactive Slope Stability Program
Analysis Description	Exhibit A - Circular Failure Short Term - Soldier Pile Wall - Undrained
Drawn By	AA
Company	GSG Consultants, Inc
Date	7/16/2024, 11:00:05 AM
File Name	Soldier Pile Wall2.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)
Loose Gray Sand		110	Mohr-Coulomb	0	29
Brown, Black, and Gray Silty Clay Fill (Drained)		138	Mohr-Coulomb	600	28
Medium Stiff to Stiff Brown and Gray Silty Clay (Drained)		138	Mohr-Coulomb	230	28
Stiff to Hard Gray Silty Clay (Drained)		138	Mohr-Coulomb	320	28
Soldier Pile Wall		150	Infinite Strength		

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SLIDEINTERPRET 9.031

Project	Slide2 - An Interactive Slope Stability Program
Analysis Description	Exhibit B - Circular Failure Long Term - Soldier Pile Wall - Drained
Drawn By	AA
Company	GSG Consultants, Inc
Date	7/16/2024, 11:00:05 AM
File Name	Soldier Pile Wall2.slmd