April 1, 2020
Project MM19064.05

Kent J. Kuper, PE
DuPage County – Division of Transportation
421 North County Farm Road
Wheaton, Illinois 60187

Subject: Geotechnical Report
Work Order #5: Hobson Road – 63rd Street Sidewalk Improvements
Woodridge, Illinois

Dear Mr. Kuper:

Introduction

Millennia Professional Services of Illinois, Inc., (MPS) is pleased to submit this geotechnical assessment report to DuPage County, Illinois, prepared for use in the design and construction of the proposed Hobson Road/63rd Street Sidewalk Improvements project in Woodridge, Illinois. The work was authorized by DuPage County through Work Order No. 5 (Section 19-GEOTK-05-EG), dated February 25, 2020.

Project Description

The project site is located both to the east and west of the I-355 northbound exit ramp that intersects 63rd Street, near Woodridge, Illinois. A geotechnical services scope comprised of soil borings and engineering recommendations was requested for a portion of the project for use in the design of a new retaining wall structure. The proposed retaining wall to the west of I-355 begins at Station 42+90 and terminates near Station 47+28. The proposed retaining wall to the east of I-355 begins at Station 54+00 and terminates near Station 58+64. Based on preliminary information provided by the County, we understand the retaining walls will be located at the top of the existing slope along 63rd Street and will have a maximum free-standing height of about 2.3 feet. The existing side slopes of the road embankments are understood to be as tall as 20 feet, with an inclination of about 3 feet horizontal (H) to 1 foot vertical (V).

Purpose and Scope

The purpose of the geotechnical services was to obtain information concerning subsurface conditions at the site to form conclusions and make engineering recommendations for the following geotechnical considerations:

- A general geologic reconnaissance of the site will be performed to observe for geotechnical conditions that might affect the design, construction, and performance of the retaining walls.
- Recommendations for shallow foundations for the retaining walls, including allowable bearing capacity, suitable bearing depth, and settlement considerations.
- Lateral earth pressure design parameters for use in the design of the retaining walls.
- Global stability assessment of the retaining walls at one section of each wall along the existing slope based on information provided by the County.
- The location and description of any potentially deleterious materials encountered at the boring locations that may interfere with construction progress or foundation performance.
- The potential impact of bedrock and groundwater, if encountered, on the design and construction.
- Recommendations for earthwork and other geotechnical construction procedures.
- Recommended observation, documentation and materials testing programs during construction of the structure.

Exploration

Four soil borings, designated as B-1 through -4, were drilled for the project on March 9, 2020 at locations agreed upon by both MPS and the County. Hollow stem auger drilling methods were used to drill the borings. A geotechnical specialist from Millennia documented the drilling and sampling procedures, and collected and classified the samples recovered. The approximate location of each boring is shown on the Boring Location Plan in Appendix A.

Sampling

Split-spoon and Shelby tube samples were recovered from the boring at this site. Split-spoon samples were recovered using a 2-inch outside diameter, split-barrel sampler in accordance with ASTM D 1586. Shelby tube samples were recovered using a 3-inch outside diameter, thin-walled tube sampler in accordance with ASTM D 1587. The sampling sequence for each boring is summarized on the Boring Log in Appendix B of this report.

Unconfined compression test values were estimated on selected split-spoon samples using a pocket penetrometer. Unconfined compression tests were also performed on selected split-spoon samples using a Rimac field testing machine. The resulting unconfined compressive strengths are reported on the boring logs.

Field Tests/Measurements

The following field tests and measurements were performed, unless otherwise noted, during the course of the subsurface exploration:

1. The boring locations were marked in the field by MPS by measuring from site features, as well as plans provided by the County.

2. Standard penetration tests were performed and resistances recorded during the recovery of each split-barrel sample.
3. Sample recovery measurements were made and recorded for each sampling attempt.
4. A field classification by color and texture was made for each recovered sample.
5. Observations for the presence of groundwater were made during drilling.

Laboratory Testing

The following laboratory tests were performed on selected samples recovered from the borings:

1. Visual descriptions by color and texture of each sample (ASTM D 2488).
2. Natural moisture content of each cohesive sample (ASTM D 2216).
3. Hand penetrometer estimations of the unconfined compressive strength of cohesive samples.
4. Dry density of selected Shelby tube samples (ASTM D 7263).
5. Unconfined compressive strength of selected Shelby tube samples (ASTM D 2166).

Data

The results of the field tests and measurements were recorded on field logs and appropriate data sheets in the field. These data sheets and logs contain information concerning the drilling methods, samples attempted and recovered, indications of the presence of various subsurface materials, and the observation of groundwater. The field logs and data sheets contain the engineer's interpretations of the conditions between samples, based on the performance of the equipment and cuttings brought to the surface by the drilling tools.

Data and observations from laboratory tests were recorded on laboratory data sheets during the course of the testing program. The results of the laboratory tests are summarized in the Boring Logs in Appendix B of this report.

The Boring Logs represent considered interpretation of the field and laboratory data. The analyses and conclusions contained in this report are based on field and laboratory test results and on the interpretations of the subsurface conditions as reported in the Boring Logs. Only data pertinent to the objectives of this report have been included on these Logs; therefore, these records should not be used for other purposes.

Generalized Subsurface Profile

The generalized subsurface profile is comprised of likely engineered fill overlying natural cohesive soil. The pavement section at Borings B-1 and B-3 consists of 3.5 inches of asphalt overlying 7.5 to 8.5 inches of Portland cement concrete and about 4 inches of crushed limestone. Approximately 12 to 14 inches of topsoil was encountered at Borings B-2 and -4.

Likely engineered fill was encountered at all of the boring locations at depths ranging from about 5.5 to 10.5 feet. The fill appears to be embankment material that was placed for the existing roadway. The fill consists of silty clay and silty clay loam. The consistency of the soil encountered generally varies from medium stiff to very stiff, based on N-values ranging from 7 to 18 blows per foot (bps) and hand penetrometer values varying from 1.0 to 4.5 tsf. Rimac testing yielded unconfined compressive strength values that range from 1.4 to 4.6 tons per square foot (tsf). Testing on Shelby tube samples obtained in the natural soil yielded undrained shear strength values ranging from 1.15 to 1.52 tsf. Moisture contents vary from 11 to 28 percent. Dry densities range from 104 to 120 pcf.

Natural silty clays were encountered beneath the fill at Borings B-2 and -4. Trace amounts of gravel were observed within the natural soil. Isolated layers of sandy gravel were observed at depths of 19 and 26 feet at Boring B-2. The consistency of the soil encountered generally varies from stiff to very stiff, based on N-values ranging from 13 to 25 blows per foot (bps) and hand penetrometer values varying from 1.5 to 4.5 tsf. Rimac testing yielded unconfined compressive strength values that range from 1.2 to 4.3 tons per square foot (tsf). Moisture contents vary from 13 to 20 percent.

Groundwater

Groundwater was observed during drilling and at completion at Borings B-1 through -3, at depths ranging from approximately 3 to 19 feet below the ground surface.

Groundwater information at each boring location is reported on the Boring Logs. The groundwater level may fluctuate due to seasonal variations, variations in the water level within the creek channel, and other considerations that may not have been evident at the time the measurements were made.

Shallow Foundations

The current plan is to support the new wall on spread footing foundations. We understand the wall foundations will be constructed into the side of the existing embankment at the top of the roadway. Based on the soil borings provided to MPS, the foundations may be designed for a factored bearing pressure (pressure in excess of adjacent overburden pressure) of up to 1,500 pounds per square foot (psf) for structural dead load plus maximum live load. For the soil conditions encountered at the site, a bearing resistance factor of 0.45 was applied. The foundations should bear on firm natural soil or on structural fill placed and compacted in accordance with the recommendations provided later in this report.

Unless otherwise specified by local codes, the footings should be constructed at least 42 inches below the exterior finish grade to provide protection against the detrimental effects of seasonal moisture variations and frost penetration.

The loads imposed by the foundations are expected to result in some compression of the supporting materials. Based on the conditions encountered at the boring locations, the expected structural loads, and good construction practice, maximum settlements are not expected to exceed about one inch, with differential settlements of up to approximately half the total. The majority of the settlement should take place during construction, as the loads are applied to the subgrade.

Lateral Earth Pressures

Lateral earth pressure parameters are provided for the design of the retaining wall. Structures that are restricted from movement at the top should be designed to resist at-rest earth pressures. Structures that are free to move and deflect at the top may be designed to resist active earth pressures.

Earth pressures are a function of the excavation configuration and the backfill materials. Other than the granular drainage materials placed directly behind the wall, it has been assumed that the backfill will be comprised of imported earth fill materials. Recommendations for acceptable borrow soil are presented later in this report. The following design parameters are recommended for backfill materials within the entire appropriate earth pressure zone:

Lateral Earth Pressure Parameters

Parameter		Granular Soil, Crushed Stone		Cohesive Soil	
		Earth Pressure Coefficient	Equivalent Fluid Pressure	Earth Pressure Coefficient	Equivalent Fluid Pressure
Active	Drained	0.27	35 pcf	0.42	50 pcf
	Submerged		80 pcf		85 pcf
At-Rest	Drained	0.42	55 pcf	0.58	70 pcf
	Submerged		90 pcf		95 pcf
Passive	Drained	3.71	480 pcf	2.40	295 pcf
	Submerged		310 pcf		205 pcf
Soil Moist Unit Weight		130 pcf		120 pcf	
Angle of Internal Friction		35°		25°	
Assumed Surcharge Condition		None		None	
Slope Profile		Horizontal		Horizontal	

pcf = pounds per cubic foot.

Resistance to sliding may be analyzed using a friction factor of 0.3 for concrete placed on the typical soils indicated by the boring logs provided. No factor of safety has been included in the values presented above.

Submerged values should be used for the calculation of lateral pressures for those portions of the walls that extend below the highest level of anticipated groundwater or floodwater elevation in consideration of the possibility of water being trapped behind the wall after a rapid drawdown event. The values for submerged fluid pressure for active and at-rest conditions include hydrostatic pressures.

Significant horizontal movement is sometimes necessary to develop the full values of passive pressure; typically the passive values stated are reduced by up to one-half for design. Based on preliminary plans and drawings provided by the County, we understand the retaining wall will constructed at the top of the existing roadway embankment. This configuration will offer little to no passive resistance from the slope face.

The effects of vertical surcharge or seismic loads, or sloping ground behind vertical structures, are not included for the stated fluid pressures. Vertical loading may be accounted for by assuming that a lateral force equal to 0.5 times the vertical load will act at the midpoint of the structure.

Global Stability Considerations

Slope stability was modeled mathematically using limit equilibrium procedures in which trial failure surfaces through the soil mass are selected and analyzed. The forces that resist movement of the mass above a given surface are compared to the forces that tend to cause movement of this mass. If the resisting forces are greater than the driving forces, then the factor of safety for this set of conditions is proportionally greater than 1.0. STABL, a computer program developed for the Federal Highway Administration, was used to perform the limit equilibrium analyses for a large number of trial failure surfaces.

Table 1.
Summary of Global Stability Results

Analysis Near Stations 43+50 and 55+00	Minimum Computed Factor of Safety	
	Short Term	Long-Term
3H:1V	3.2	2.1
2H:1V	2.6	1.5

The minimum desired safety factor with regard to the potential for massive, global slope failure is typically 1.5 for both short term and long term conditions. On this basis, the results of the stability assessments at the sections summarized above are considered acceptable.

The clay soils found at the site can be potentially highly erosive, a mechanism of soil movement unrelated to global stability. Future erosion and shallow, superficial slumps are always a possibility, despite the results of advanced computer modeling for slope stability. Maintaining healthy vegetation, along with appropriate erosion control practices, will reduce the potential for these issues to become problematic.

In addition, the geotechnical conditions between the boring locations are essentially unknown. If the contractor exposes conditions during excavation and other earthwork activities that differ from those indicated at the boring locations, MPS should be notified to assess the effect (if any) of the unanticipated conditions upon the findings of the global slope stability assessment.

Slopes with inclinations as steep as 2H:1V, if applicable to this site, may require benching into the existing side slope to adequately construct the grades, and reduce the potential for slippage along the contact surface with new fill materials.

Temporary Excavations

Constructing the retaining wall foundations will require excavating into the existing side slope of the embankment fill that supports Hobson Road/63rd Street. MPS recommends that excavations be performed in accordance with Occupational Safety and Health Administration (OSHA) regulations, and any other applicable regulatory agencies. In accordance with the OSHA excavation regulations, the cohesive soil encountered at the boring locations would be classified as Type C materials. Portions of the retaining wall may be constructed below or within a few feet horizontally of existing utilities. Some of these utilities are likely backfilled with granular material. The granular backfill may contain free water and could be unstable when excavating beneath or adjacent to it. The undermining of these utilities and the adjacent area could occur due to running and caving of the granular backfill and surrounding soils. It will likely be necessary to make adjustments to soil classifications and excavation methods in response to conditions encountered, as the work proceeds.

Worker safety and classification of the soil for excavations are responsibilities of the contractor, and will require continuous judgment as the excavations proceed and the soil is exposed. Where the excavation lies within the zone of influence of existing pavements, buildings, slabs, utilities, or other structures, the integrity of those elements must be maintained by a properly designed earth retention system, underpinning, or other suitable means.

Fill Material

The required site and structural fill and backfill may be constructed using the materials available from on-site excavations. Any organic matter or other deleterious materials found within the wall backfill should be segregated and removed. Fill material from off-site borrow sources may also be used, but should be approved by MPS prior to placement. In general, structural fill should consist of low plasticity lean clays or clayey silts with a liquid limit of less than 50 and a plasticity index of less than 25.

At the time of construction, the moisture content of the fill materials may be variable, and may not be within the range considered necessary for proper placement and compaction. Prior to compaction, some of the soil may require moisture content adjustment. During warm weather, moisture reduction can generally be accomplished by disking, or otherwise aerating, the soil. When air-drying is not feasible, a moisture-reducing chemical additive, such as “Code L” lime dust, could be incorporated into the cohesive soil. Lime dust is a caustic material that should be used with caution by a contractor experienced with its application. MPS should be consulted to assess the effectiveness of any additive and to recommend the amount and methods for application.

If earthwork is performed during a period of dry weather, some of the fill may require the addition of moisture prior to compaction. This should be performed in a controlled manner using a tank truck with a spray bar, and the moistened soil should be thoroughly blended with a disk or pulverizer to produce a uniform moisture content. Repeated passages of the equipment may be required to achieve a reasonably uniform moisture content.

If this project is constructed during the winter season, fill materials should be carefully observed to see that no ice or frozen soils are placed as fill or remain in the base materials upon which fill is placed.

Fill Placement

Fill for general site grading should be placed in layers not exceeding eight inches in loose thickness and compacted to the required dry density. Backfill compacted by handheld equipment should be placed in layers not greater than six inches. The layer thickness may be increased if tests indicate that compaction could be achieved uniformly throughout the layer using a greater thickness.

At the time of compaction, fill should generally be within 3 percent, wet or dry, of the optimum moisture content of the material as determined by the standard Proctor compaction test, ASTM D 698. Fill should be compacted to a dry density of not less than 95 percent of the standard Proctor maximum dry density of the material.

Backfill placed immediately behind the retaining wall should be compacted with hand-operated compaction equipment and not large self-propelled or machine-operated equipment. Operation of large pieces of equipment adjacent to the wall can cause higher lateral pressures than those recommended herein for design. Compaction should be reduced within approximately one foot of the wall. Walls should be observed periodically during backfilling for signs of movement. If movement is detected, it may be necessary to provide bracing and/or change backfilling procedures.

Subgrade Protection

Construction areas should be properly drained in order to reduce or prevent surface runoff from collecting on the subgrade. Any ponded water on the exposed subgrade should be removed immediately. To prevent unnecessary disturbance of the subgrade soils, trucks and other heavy construction vehicles should be restricted from traveling through the finished subgrade area. If disturbed areas develop, they should be reworked and compacted as previously described.

Foundation Excavations

Footings should be excavated with a smooth-edged, clawless bucket to reduce disturbance of the bearing surface. Footing excavations should be kept dry, and foot traffic in the excavation should be kept to a minimum, in consideration of the sensitive nature of the subgrade soils. Any loose or soft material that accumulates or develops at the footing subgrade should be removed prior to the placement of concrete. If zones of soft soil are encountered at the footing support level, they should be removed and replaced with properly compacted fill, or the footings should be deepened to bear on stiffer soils.

Encountering significant groundwater inflow is not expected for this project.

Footings should be cast as soon as possible after the excavation is complete; alternatively, a thin mat of lean concrete could be placed in the excavation bottom to protect the bearing surface.

Open graded "Clean" Crushed Limestone and Sand Backfill

Sand and gravel available from local borrow pits, and crushed limestone from quarries, are common construction material in the general region. There is a misconception among some builders that open-graded (also known as "clean") limestone and other granular materials do not require compaction when placed as fill or backfill. Settlement of such granular materials that had not been compacted when originally placed is a common cause of damage to foundations and concrete slabs, including the development of substantial gaps beneath the concrete caused by the settlement.

Any crushed rock, gravel, or sand placed as structural fill or backfill that will underlie future foundations, floor slabs, walkways, or pavements must be placed in lifts (layers) of controlled loose thickness and compacted in accordance with the recommendations that appear in this report. Open-graded and well-graded limestone, gravel, and sand should be compacted with a vibratory compactor, whether a self-propelled roller, backhoe-mounted plate, or walk-behind sled.

Construction Phase Services

It is recommended that MPS review the final plans and specifications for the project prior to bid solicitation in order to determine the relationship of the geotechnical information presented in this report with the final design of the facility. This additional service is recommended in order to reduce construction phase problems that might otherwise arise in the field and result in construction delays or change orders.

Documenting observations and performing materials testing during construction of foundations, retaining walls, pavements, and other structures that are supported by earth materials is an integral aspect of the geotechnical engineering process. The geotechnical engineering profession is based on the "Observational Method," through which design assumptions and recommendations, based on limited drilling and sampling data, can be verified or modified in response to actual conditions observed as the materials are exposed by construction equipment.

Selecting the same firm that provided the geotechnical engineering services to also perform observation and materials testing services during construction results in decreased risk to the owner and entire design team. The geotechnical firm is most familiar with the site and can recognize unanticipated conditions that might otherwise adversely affect construction progress or structure performance. MPS has a staff of experienced field technicians and a geotechnical and materials testing laboratory equipped to support a wide variety of construction projects. After the project plans and specifications have been prepared, MPS requests the opportunity to submit a proposal to perform the specified construction observation and materials testing services.

For this project, it is recommended that MPS be retained by DuPage County during construction to perform the following observations and field tests:

1. Observation and documentation of fill and backfill placement, along with compaction testing for conformance with the project specifications.
2. Observation and documentation of foundation excavations and subgrade conditions.

3. Quality assurance testing of fresh concrete delivered to the site and compressive strength testing of concrete cylinders cast on site for conformance with the project specifications.

These quality assurance services should help to verify design assumptions and to maintain construction procedures in accordance with the contract plans, specifications, and good construction/engineering practice.

Closing

This report has been prepared for DuPage County, for use in the design and construction of the proposed Hobson Road/63rd Street Sidewalk Improvements in Woodridge, Illinois. This report has been prepared in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made to the professional advice and recommendations included herein. This report is not for use by parties other than those named or for purposes other than those stated herein. It may not contain sufficient information for the use of other parties or for other purposes.

If there is a substantial lapse of time between the submission of this report and the start of work at the site, or if conditions have changed due to natural causes or construction operations at or adjacent to the site, this report should be reviewed by MPS to determine the applicability of the analyses and recommendations considering the changed conditions and time lapse. The report should also be reviewed by MPS if changes occur in structure location, size, and type, or in the planned loads, elevations, grading plans, and project concepts.

These analyses and recommendations are based on data obtained from site reconnaissance, the borings provided for this study and other pertinent information presented herein. This report does not reflect any variations between, beyond, or below the borings. Should such variations become evident, it may be necessary to re-evaluate the recommendations of this report after performing on-site observation during the construction period and noting the characteristics of any such variation.

We appreciate this opportunity to be of service to you and would be pleased to discuss any aspect of this preliminary report with you at your convenience.

Sincerely,

Millennia Professional Services of Illinois, Ltd.

Jacob A. Schaeffer, P.E.
Project Manager

LICENSED PROFESSIONAL ENGINEER
4-1-2020
JACOB ALLEN SCHAEFFER
062.068397
STATE OF ILLINOIS

Attachment A: Boring Location Plan
Attachment B: Boring Logs and Laboratory Test Results
Attachment C: Slope Stability Profiles

Appendix A:
Figure 1: Boring Location Plan

Millennia Professional Services
11 Executive Drive #12, Fairview Heights, IL
Phone: (618) 624-8610
Fax: (618) 624-8611
Project No.: MM19064.05

N	**FIGURE 1: BORING LOCATION PLAN**			
	Hobson Rd./63rd St. Sidewalk Improvements Woodridge, Illinois			
Approximate Boring Location: ◉	Drawn by:	J. Schaeffer	Checked by:	J. Kottemann
Image obtainted from Google Earth *Not to scale	Project No.:	MM19064.05	Date:	3/30/2020

Appendix B: Boring Logs and Laboratory Test Results

BORING NUMBER B-1

Millennia Professional Services

CLIENT DuPage County

PROJECT NAME Hobson Rd. / 63rd St. Sidewalk Improvements

PROJECT NUMBER MM19064.05

PROJECT LOCATION Woodridge, IL

DATE STARTED 3/10/20 **COMPLETED** 3/10/20

GROUND ELEVATION **HOLE SIZE** inches

DRILLING CONTRACTOR TSC

GROUND WATER LEVELS:

DRILLING METHOD HSA

▽ **AT TIME OF DRILLING** 3.00 ft

LOGGED BY E. Mueller **CHECKED BY** J. Schaeffer

▼ **AT END OF DRILLING** 4.00 ft

NOTES

AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Asphalt (3.5")	AU 1									
		Portland Cement Concrete (7.5")										
		Crushed limestone (4.0")	SS 2	11	2-3-5 (8)	1.5		18				
		FILL: Brown, Silty Clay										
		▽ ▼ - unconfined compression test Qu = 1.31 tsf	ST 3	67			120	13				
5												
		- gray, trace gravel below 5.5 ft. - Rimac Qu = 4.4 tsf	SS 4	83	4-6-8 (14)	4.5		12				
		- dark gray below 8.0 ft. - Rimac Qu = 4.6 tsf	SS 5	83	4-8-11 (19)	4.5		11				
10												

Bottom of borehole at 10.0 feet.

BORING NUMBER B-2

Millennia Professional Services

CLIENT DuPage County		**PROJECT NAME** Hobson Rd. / 63rd St. Sidewalk Improvements	
PROJECT NUMBER MM19064.05		**PROJECT LOCATION** Woodridge, IL	
DATE STARTED 3/10/20	**COMPLETED** 3/10/20	**GROUND ELEVATION**	**HOLE SIZE** inches
DRILLING CONTRACTOR TSC		**GROUND WATER LEVELS:**	
DRILLING METHOD HSA		∇ **AT TIME OF DRILLING** 19.00 ft	
LOGGED BY E. Mueller	**CHECKED BY** J. Schaeffer	▼ **AT END OF DRILLING** 18.50 ft	
NOTES		**AFTER DRILLING** ---	

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		TOPSOIL (12.0")	AU 1									
		FILL: Brown, Silty Clay	SS 2	78	2-3-5 (8)	2.5		27				
5		- unconfined compression test Qu = 1.52 tsf	ST 3	75		4.5	120	17				
		Brown and gray, Silty Clay - Rimac Qu = 2.1 tsf	SS 4	94	4-6-9 (15)	3.5		16				
10		- Rimac Qu = 3.1 tsf	SS 5	94	3-5-8 (13)	3.0		14				
		- Rimac Qu = 4.0 tsf	SS 6	100	5-6-9 (15)	4.0		14				
15		- Rimac Qu = 3.1 tsf	SS 7	100	4-8-10 (18)	3.0		15				
		- Rimac Qu = 1.6 tsf - gray below 16.5 ft.	SS 8	94	4-5-9 (14)	2.5		13				
20		Gray, Sandy Gravel	SS 9	56	5-8-9 (17)			11				
		Gray, Silty Clay - Rimac Qu = 1.2 tsf	SS 10	72	3-7-15 (22)	1.8		19				
25		- Rimac Qu = 1.3 tsf	SS 11	83	6-7-8 (15)	1.5		20				
		Brown and gray, Sandy Gravel	SS 12	72	24-25-18 (43)			6				
30		Dark gray, Silty Clay - Rimac Qu = 4.3 tsf	SS 13	83	2-9-16 (25)	4.5		15				

Bottom of borehole at 30.0 feet.

BORING NUMBER B-3

Millennia Professional Services

CLIENT DuPage County
PROJECT NAME Hobson Rd. / 63rd St. Sidewalk Improvements
PROJECT NUMBER MM19064.05
PROJECT LOCATION Woodridge, IL
DATE STARTED 3/10/20 **COMPLETED** 3/10/20
GROUND ELEVATION **HOLE SIZE** inches
DRILLING CONTRACTOR TSC
GROUND WATER LEVELS:
DRILLING METHOD HSA
▽ **AT TIME OF DRILLING** 5.00 ft
LOGGED BY E. Mueller **CHECKED BY** J. Schaeffer
▼ **AT END OF DRILLING** 6.50 ft
NOTES
AFTER DRILLING ---

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0	TOPSOIL (14.0")	AU 1									
	Possible FILL: Brown and gray, Silty Clay Loam	SS 2	100	3-3-4 (7)	2.5		24				
5	▽	ST 3	33		2.0	104	19				
	▼ - Rimac Qu = 1.4 tsf	SS 4	61	5-5-5 (10)	1.5		25				
10		SS 5	28	3-4-4 (8)	1.0		28				
	Gray, Silty Clay, trace gravel - Rimac Qu = 3.5 tsf	SS 6	94	4-8-10 (18)	4.5		13				
15	- Rimac Qu = 3.3 tsf	SS 7	94	4-6-9 (15)	3.0		16				
	- Rimac Qu = 3.7 tsf	SS 8	94	3-6-9 (15)	3.0		22				
20	- Rimac Qu = 3.6 tsf	SS 9	94	4-6-8 (14)	3.0		17				
	- Rimac Qu = 1.9 tsf	SS 10	56	5-12-9 (21)	2.0		18				
25	- Rimac Qu = 2.4 tsf	SS 11	83	5-6-9 (15)	2.0		16				
	- Rimac Qu = 2.2 tsf	SS 12	83	5-6-11 (17)	2.0		14				
30	- Rimac Qu = 1.7 tsf	SS 13	33	5-6-9 (15)	1.5		20				

Bottom of borehole at 30.0 feet.

BORING NUMBER B-4

Millennia Professional Services

CLIENT DuPage County

PROJECT NAME Hobson Rd. / 63rd St. Sidewalk Improvements

PROJECT NUMBER MM19064.05

PROJECT LOCATION Woodridge, IL

DATE STARTED 3/10/20 **COMPLETED** 3/10/20

GROUND ELEVATION **HOLE SIZE** inches

DRILLING CONTRACTOR TSC

GROUND WATER LEVELS:

DRILLING METHOD HSA

AT TIME OF DRILLING --- - dry

LOGGED BY E. Mueller **CHECKED BY** J. Schaeffer

AT END OF DRILLING --- - dry

NOTES

AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Asphalt (3.5")	AU 1									
		Portland Cement Concrete (8.5")										
		Crushed limestone (4.0")	SS 2	72	4-8-10 (18)	4.5		14				
		Brown, Silty Clay, trace gravel - Rimac Qu = 4.5 tsf - unconfined compression test Qu = 1.15 tsf	ST 3	67		4.5	110	19				
5		- Rimac Qu = 4.0 tsf	SS 4	72	6-6-7 (13)	4.5		14				
10		- Rimac Qu = 4.3 tsf	SS 5	83	5-6-7 (13)	4.5		21				

Bottom of borehole at 10.0 feet.

GENERAL NOTES

The number of borings is based on topographic and geologic factors: the magnitude of loading; the size, shape, and value of the structure; consequences of failure; and other factors. The type and sequence of sampling is selected to reduce the possibility of undiscovered anomalies and increase drilling efficiency. Attempts are made to detect and/or identify occurrences during drilling and sampling such as encountering water, boulders, gas, zones of lost circulation, relative ease or resistance of drilling progress, unusual sample recovery, variation in driving resistance, unusual odors, etc. However, lack of mention of such variations does not preclude their presence.

Although attempts are made to obtain stabilized groundwater levels, the levels shown on the Boring Logs may not have stabilized, particularly in more permeable cohesive soils. Consequently, the indicated groundwater levels may not represent present or future levels. Groundwater levels may vary significantly over time due to effects of precipitation, infiltration, or other factors not evident at the times indicated.

Unless otherwise noted, soil classifications indicated on the Boring Logs are based on visual observations and are not the result of classification tests. Although visual classifications are performed by experienced technicians or engineers, classifications so made may not be conclusive.

Generally, variations in texture less than one foot in thickness will be described as seams while thicker strata will be logged as individual strata. However, minor anomalies and changes of questionable lateral extent may appear only in the verbal description. The lines indicating changes in strata on the Boring Logs are approximate boundaries only as the actual material change may be between samples or may be a gradual transition.

Samples chosen for laboratory testing are selected in such a manner so as to determine selected physical characteristics of each material encountered. However, as samples are recovered only intermittently and only representative samples are tested, the results of such tests may not conclusively represent the characteristics of all subsurface materials present.

Unconfined Compressive Strength of Cohesive Soil

Project Name: Hobson Rd./63rd St. Sidewalk Improvements Project Number: MM19064.05

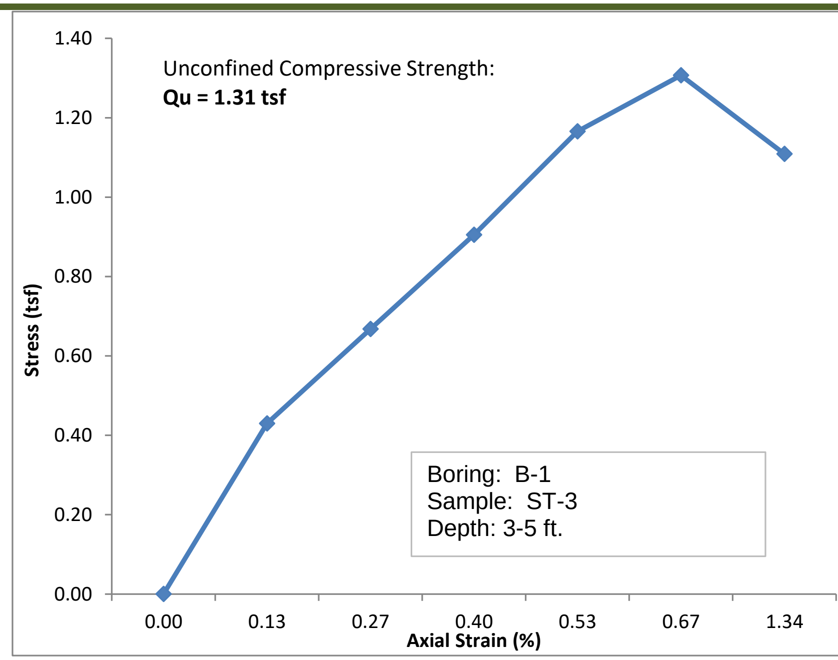
MILLENNIA PROFESSIONAL SERVICES

General Information

Soil Description:	CL	Mass of Tare (g):	41.4	Wet Unit Weight (pcf)	135.83
Sample Number:	ST-3	Mass of Tare + Moist Soil (g):	149.3	Dry Unit Weight (pcf)	120.03
Moist Mass of Specimen (g):	919.9	Mass of Tare + Dry Soil (g):	136.75		
Specimen Length (in):	4.19	Moisture Content (%):	13.2		
Specimen Diameter (in):	2.8	Sample Area (in²):	6.1575		

Sample Data

Displacement (in)	Load (lbs)	Strain (ε)	Corrected Area (ft²)	Stress (σ) (tsf)
0	0	0.0000	0.0428	0.0000
0.0056	36.8	0.0013	0.0428	0.4297
0.0112	57.26	0.0027	0.0429	0.6678
0.0168	77.71	0.0040	0.0429	0.9050
0.0224	100.2	0.0053	0.0430	1.1654
0.028	112.5	0.0067	0.0430	1.3067
0.056	96.1	0.0134	0.0433	1.1087



Unconfined Compressive Strength of Cohesive Soil

Project Name: Hobson Rd./63rd St. Sidewalk Improvements Project Number: MM19064.05

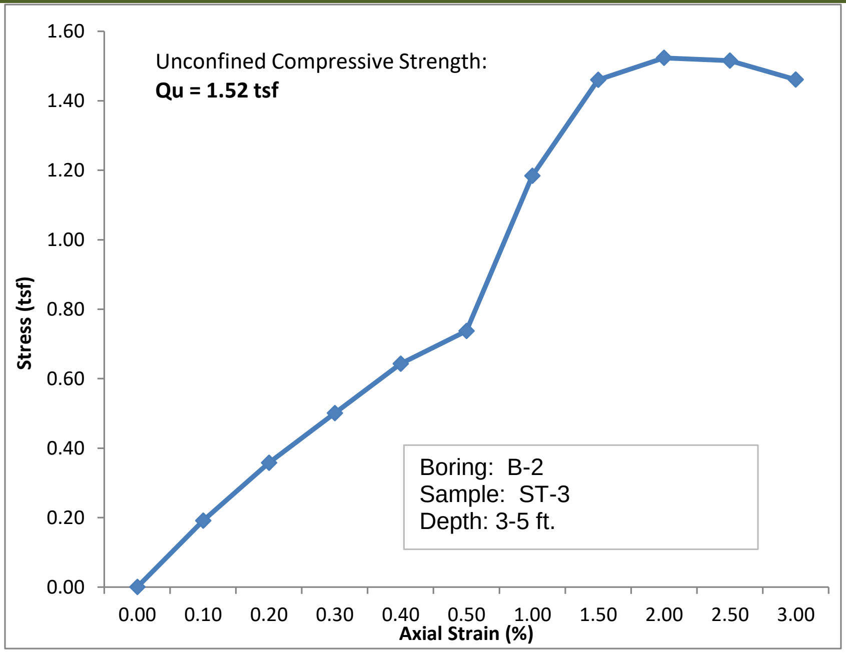
MILLENNIA PROFESSIONAL SERVICES

General Information

Soil Description:	CL	Mass of Tare (g):	51.7	Wet Unit Weight (pcf)	139.60
Sample Number:	ST-3	Mass of Tare + Moist Soil (g):	196.2	Dry Unit Weight (pcf)	119.71
Moist Mass of Specimen (g):	1263.6	Mass of Tare + Dry Soil (g):	175.61		
Specimen Length (in):	5.6	Moisture Content (%):	16.6		
Specimen Diameter (in):	2.8	Sample Area (in²):	6.1575		

Sample Data

Displacement (in)	Load (lbs)	Strain (ε)	Corrected Area (ft²)	Stress (σ) (tsf)
0	0	0.0000	0.0428	0.0000
0.0056	16.36	0.0010	0.0428	0.1911
0.0112	30.68	0.0020	0.0428	0.3580
0.0168	42.95	0.0030	0.0429	0.5007
0.0224	55.2	0.0040	0.0429	0.6429
0.028	63.4	0.0050	0.0430	0.7376
0.056	102.25	0.0100	0.0432	1.1837
0.084	126.79	0.0150	0.0434	1.4603
0.112	132.93	0.0200	0.0436	1.5233
0.14	132.93	0.0250	0.0439	1.5155
0.168	128.84	0.0300	0.0441	1.4613



Unconfined Compressive Strength of Cohesive Soil

Project Name: Hobson Rd./63rd St. Sidewalk Improvements   Project Number: MM19064.05

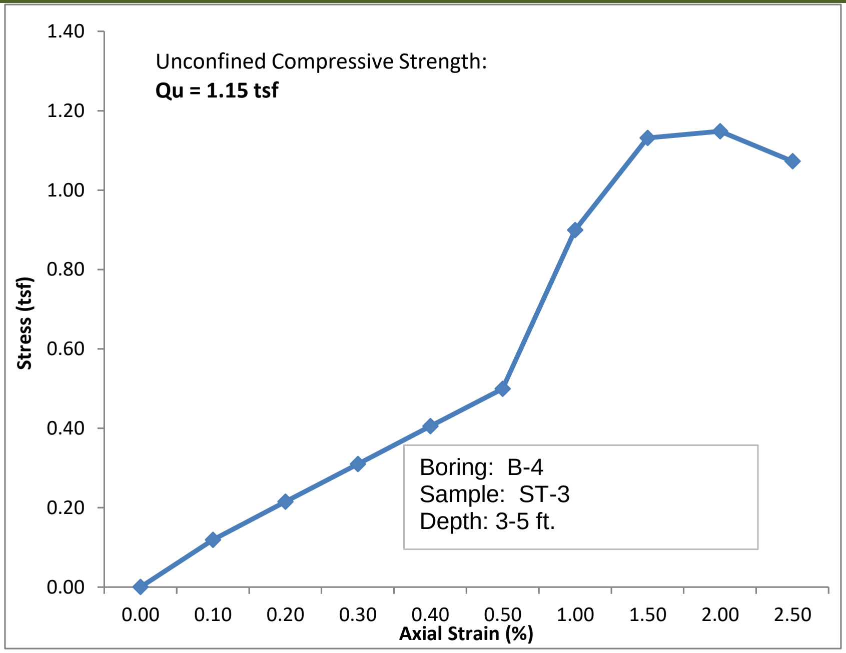
MILLENNIA PROFESSIONAL SERVICES

General Information

Soil Description:	CL	Mass of Tare (g):	42.1	Wet Unit Weight (pcf)	130.7
Sample Number:	ST-3	Mass of Tare + Moist Soil (g):	272.2	Dry Unit Weight (pcf)	110.2
Moist Mass of Specimen (g):	1183.4	Mass of Tare + Dry Soil (g):	236.0		
Specimen Length (in):	5.6	Moisture Content (%):	18.6		
Specimen Diameter (in):	2.8	Sample Area (in²):	6.2		

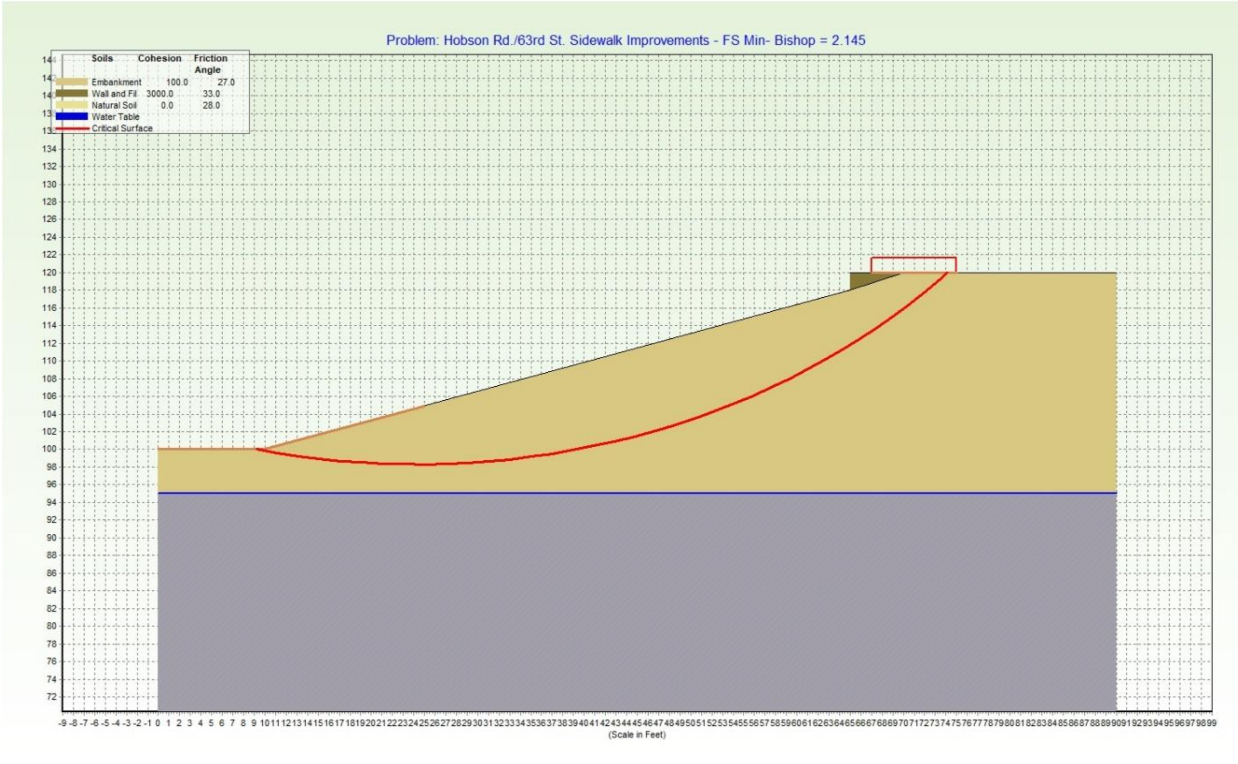
Sample Data

Displacement (in)	Load (lbs)	Strain (ε)	Corrected Area (ft²)	Stress (σ) (tsf)
0	0	0.0000	0.0428	0.0000
0.0056	10.2	0.0010	0.0428	0.1191
0.0112	18.4	0.0020	0.0428	0.2147
0.0168	26.6	0.0030	0.0429	0.3101
0.0224	34.8	0.0040	0.0429	0.4053
0.028	42.9	0.0050	0.0430	0.4991
0.056	77.7	0.0100	0.0432	0.8995
0.084	98.2	0.0150	0.0434	1.1310
0.112	100.2	0.0200	0.0436	1.1482
0.14	94.1	0.0250	0.0439	1.0728

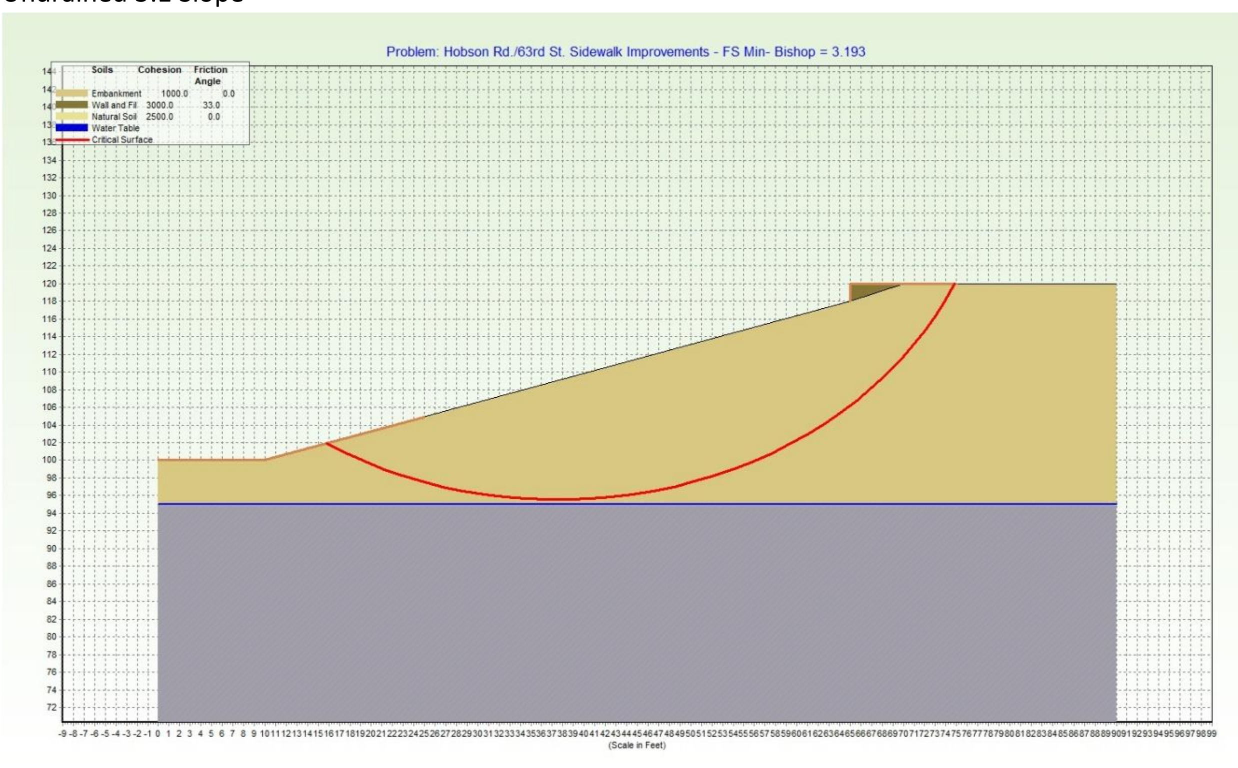


Appendix C: Slope Stability Profiles

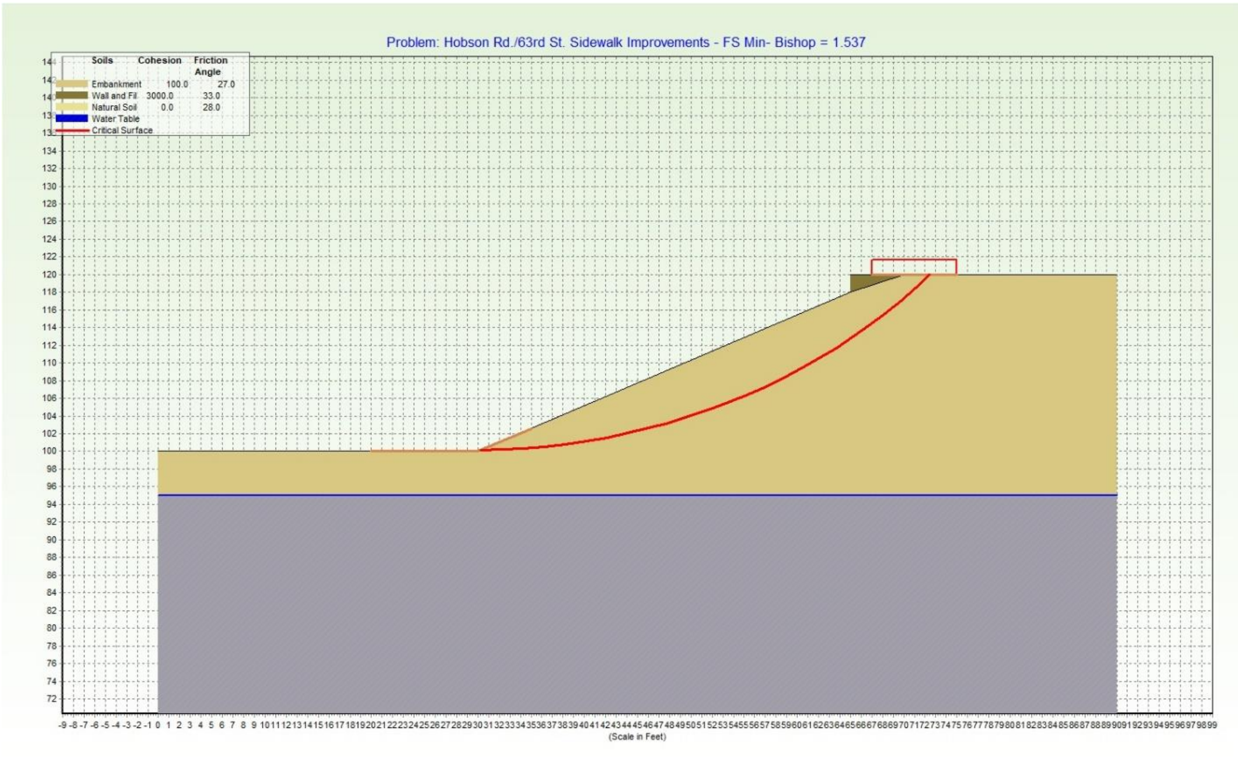
Drained 3:1 Slope



Undrained 3:1 Slope



Drained 2:1 Slope



Undrained 2:1 Slope