



ECS Midwest, LLC

Geotechnical Engineering Report

Village of Villa Park

Proposed Lions Community Center Redevelopment

320 East Wildwood Avenue
Villa Park, Illinois 60181

ECS Project Number 16:14506

September 1, 2022





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Mr. Brian Roche
Superintendent of Park, Building & Grounds
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ECS Project No. 16:14506

Reference: Geotechnical Engineering Report
Village of Villa Park – Lion Community Center Redevelopment
320 East Wildwood Avenue
Villa Park, Illinois 60181

Dear Mr. Roche:

ECS Midwest, LLC (ECS) has completed the subsurface exploration, laboratory testing, and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our agreed to scope of work. This report presents our understanding of the geotechnical aspects of the project along with the results of the field exploration and laboratory testing conducted, and our design and construction recommendations.

It has been our pleasure to be of service to Village of Villa Park during the design phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase, and we would like to provide our services during construction phase operations as well to verify subsurface conditions assumed for this report. Should you have any questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,
ECS MIDWEST, LLC

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<https://ecslimited365.sharepoint.com/sites/16Chicago/16 GEO Rept 100139/Job 14000 - 14999/14185 - Heritage Woods of Deerfield - Senior Living Facility/Report/14185-Heritage Woods of Deerfield Preliminary Geotech Report.docx>

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- Important Information about This Geotechnical-Engineering Report

EXECUTIVE SUMMARY

This Executive Summary is solely provided to give a brief overview of the project findings. The summary is abbreviated. Information gleaned from the Executive Summary should not be utilized in lieu of reading the entire geotechnical report.

- The project is envisioned to consist of the construction of the two-story, slab-on-grade (i.e., with no basement) Villa Park Lions Community Center and its associated drive lane and parking lots.
- A shallow foundation system bearing in competent native soils or bearing on engineered fill or lean concrete overlying competent native soils may be designed for a maximum net allowable bearing pressure of 3,000 psf.
- The site soils can be characterized as Seismic Site Class D for seismic design considerations.

1.0 INTRODUCTION

The purpose of this report is to provide the results of our subsurface exploration and laboratory testing, engineering analyses, and geotechnical recommendations for the design of building foundations and floor slabs and pavements for the proposed development. Also included are geotechnical subgrade preparation, fill placement and general dewatering recommendations.

ECS provided its services in accordance with our Proposal No. 16:22182-GP dated July 1, 2022 and, as authorized by Mr. Brian Roche with Village of Villa Park on July 20, 2022 which includes our Terms and Conditions of Service.

This report contains the procedures and results of the subsurface exploration and laboratory testing programs, a description of existing site conditions, engineering analyses, and geotechnical recommendations for the design and construction.

The report includes the following items:

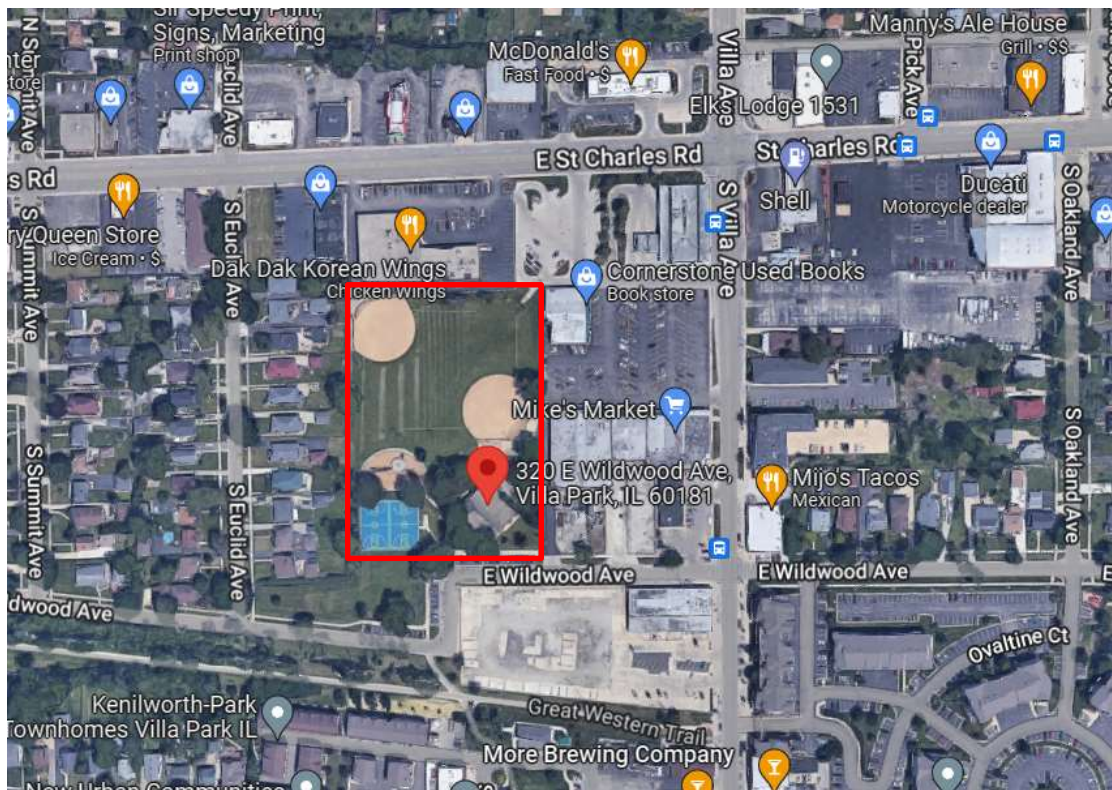
- A brief description of the field and laboratory test procedures and the results of testing conducted.
- A description of surface topographical features and site conditions.
- Copies of the existing pavement condition and subsurface exploration (boring logs, pavement cores).
- Recommendations for site preparation and construction of compacted fills, including an evaluation of on-site soils for use as compacted fills and delineation of potentially unsuitable soils at the time of sampling.
- Recommendations relative to the foundation type(s).
- Recommendations for the design and construction of soil-supported slabs.
- Recommendations for pavement construction recommended pavement sections (flexible pavement), subgrade preparation recommendations and drainage recommendations (as applicable).
- Recommendations for site preparation and construction of engineered fills, including an evaluation of on-site soils for use as engineered fills, and delineation of potentially unsuitable soils and/or soils exhibiting excessive moisture at the time of sampling.
- Considerations relative to groundwater control.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION/CURRENT SITE USE/PAST SITE USE

The proposed project site is located at 320 East Wildwood Avenue in Villa Park, Illinois. The site is bounded to the north and east by retail developments, to the south by East Wildwood Avenue and to the west by residential homes. The site is currently occupied by the existing Lions Park Community Recreation Center with associated buildings, a playground, basketball court, and ballfields that are envisioned to be demolished for the new recreation center.

From our review of the *Site Topographic Survey* prepared by V3 Engineers Scientists Surveyors dated July 1, 2022 and provided by you, the existing site grade ranges from El. 677 to El. 682 feet, MSL. The site location is shown below and on the Site Location Diagram in Appendix A:



Site Location Plan

2.2 PROPOSED CONSTRUCTION

ECS understands that the proposed development will consist of construction of the new Villa Park Lions Community Center which include a new two-story, slab-on-grade building to be located within the southern portion of the site. A loading area is planned on the east side of the proposed building. New parking lots are proposed to the east and southwest of the new building.

The information listed in the Table below summarizes our understanding of the structure and its loads based on the information provided to ECS via an email received on August 29, 2022:

BUILDING DESIGN INFORMATION		
Subject	Expectation	
Maximum Wall Loads	5 kips per foot	R
Maximum Column Footings	400 kips	R
Slab-on-Grade Load	100 psf live load (assumed)	B
Finished Floor Elevation	El. 682 (Within ± 2 feet of Existing Grades)	R

R: Reported by client and/or Design Team;

B: Based on ECS' Estimates

ECS anticipates that the proposed structure is planned to be supported by a shallow foundation system. The settlement tolerance of the proposed structures is anticipated to be approximately 1-inch total and $\frac{3}{4}$ -inch differential.

Pavement: Traffic volume values were not available at the time of this report. Based on our experience with similar projects, we have assumed a maximum daily volume of 100 passenger vehicles and one delivery truck for the light-duty pavements (i.e., 62,000 ESALs) and 300 passenger vehicles, two delivery trucks for heavy-duty pavements (i.e., 150,000 ESALs). Based on the existing site topography, it is assumed that approximately less than two feet of fill and cut will be needed to develop the pavement elevations independent of subgrade preparation recommendations.

If ECS' understanding of the project is not correct or the design changes, especially if the structural loads or elevations are different, please contact ECS so that we may review these changes and revise our recommendations, as appropriate.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION

The exploration procedures are described in greater detail in Appendix B including the insert titled *Subsurface Exploration Procedures: SPT*.

The field exploration was planned with the objective of characterizing the subsurface conditions in general geotechnical and geological terms, and to evaluate field and laboratory data to assist in the development of geotechnical recommendations. The boring locations were located and staked using a handheld GPS. The boring elevations were estimated from the provided *Site Topographic Survey* prepared by V3 Engineers Scientists Surveyors dated July 1, 2022. The approximate as-drilled boring locations are shown on the Boring Location Diagram in Appendix A.

Prior to drilling our subcontracted driller contacted the State of Illinois Utility One-Call Center, JULIE, to clear and mark underground utilities in the vicinity of the project site. As requested, ECS engaged a private utility clearance to clear the boring location for private utilities.

After utilities had been located and marked, ten (10) SPT soil borings were advanced below the ground surface. The borings were drilled by a subcontracted driller under the general guidance of ECS. Seven (7) borings were drilled to the planned depth of about 25 feet below the existing ground surface and the remaining three (3) soil borings were drilled within the parking area to a depth of about 10 feet below the existing ground surface. The drill crew utilized a truck-mounted drilling rig equipped with continuous flight hollow-stem augers to drill the borings.

The drill crew backfilled the boreholes at the completion of drilling. Additionally, the pavement surface was patched with cold mix asphalt or quick-set concrete. Borehole backfill settlement or expansion can and will occur over time. Monitoring the boreholes after the initial drilling activities is not within our scope. Settlement or expansion of the borehole backfill can create a trip hazard and should be carefully monitored by the client or property owner.

3.2 SUBSURFACE CHARACTERIZATION

Below is a generalized characterization of the subsurface materials encountered at the boring locations. Refer to the Boring Logs in Appendix B for subsurface information at a specific boring location. A Subsurface Soil Profile (cross-section) of select borings is also included in Appendix B.

GENERALIZED SUBSURFACE STRATIGRAPHY

Approximate Depth Range (ft.)	Stratum No.	Material Description	Calibrated Penetrometer Resistance (tsf)	Natural Moisture Content (%)	SPT ⁽¹⁾ N-values (bpf)
NA	NA	<p>Sand: 7 to 8 inches ± (observed at borings B-1 and B-10) or Wood chips: 5 inches ± (observed at boring B-3) or Topsoil: 3 to 11 inches or 2 inches ± of Bituminous Pavement over 3 inches of recycled asphalt over 6 inches of granular base (observed at boring B-4)</p>	NA	NA	NA
3 to 3½	I	(CL/ML) SILTY CLAY FILL , stiff to hard (Observed at Borings B-3 through B-8 and B-10)	1¾ - 5 ⁽²⁾	11-24 ⁽²⁾	4-11
10 to 25 (Terminus depth of the borings)	II	(CL) LEAN CLAY , stiff to hard	1-5	11-24	5-16

1. Standard Penetration Test.
2. Qps and SPT N Values in fill or possible fill may not be representative of actual in-situ conditions.

The soil stratification shown on the boring logs represents the soil conditions at the actual boring locations. Variations in the stratification can occur between sample intervals and boring locations. The subsurface conditions at other times and locations on the site may differ from those found at the boring locations. If different site conditions are encountered during construction, ECS should be contacted to review our recommendations relative to the new information.

3.3 GROUNDWATER OBSERVATIONS

Observations for free groundwater were made during sampling at each boring location. Drilling was performed utilizing Continuous flight Auger (CFA) until boring completion. In conventional drilling techniques drilling fluid is not injected into the boreholes to help support the soils. As such, the drillers can observe free-flowing groundwater flowing into/out of the boring locations.

Free groundwater levels were measured in our boring logs in Appendix B. Groundwater was encountered at boring locations during drilling operations at depths ranging from about 17 to 18½ feet below grades and upon completion at depths ranging from about 14 feet to 23 feet below grades.

Soils in the Midwest oxidize from brown to gray at the long-term groundwater level. Based on our subsurface exploration and local knowledge, the zone of color change, it is our interpretation that the long-term groundwater table is located at depths ranging from about 9 to 12 feet below current site grades, corresponding to about EL. 667 to El. 672½ feet above MSL at project site.

The highest groundwater observations are normally encountered in late winter and early spring and our current groundwater observations are not expected to be at the seasonal maximum water table. It should be noted that the groundwater level can vary based on seasonal change, precipitation, evaporation, surface run off and other factors not immediately apparent at the time of this exploration. Surface water runoff will be a factor during general construction, and steps should be taken during construction to control surface water runoff and to remove water that may accumulate in the proposed excavations as well as floor slab areas. Water levels were measured in our borings as noted on the soil boring logs in Appendix B.

3.4 LABORATORY SERVICES

The laboratory services performed by ECS for this project included select tests performed on select samples retained from the field exploration. We also performed classification and index property tests on select representative soil samples. These tests included:

- Moisture content (ASTM D2216)
- Calibrated Penetrometer Resistance

The laboratory procedures are described in greater detail in Appendix B including the insert titled Laboratory Procedures. The results of the laboratory tests are included on the boring logs or separate test sheets in Appendix B.

Each soil sample was visually classified on the basis of texture and plasticity using ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedures), as a general guideline. After classification, the samples were grouped into the major zones noted on the boring logs in Appendix B. The USCS group symbols for each soil type are indicated in parentheses along with the soil descriptions. The stratification lines between strata on the boring logs are approximate; in-situ, the transitions may be gradual.

The soil samples will be retained in our laboratory for a period of 60 days, after which, they will be discarded, unless other instructions are received as to their disposal.

4.0 DESIGN RECOMMENDATIONS

The following Sections present our geotechnical design recommendations for foundations, soil supported slabs and seismic Site Class. Additional borings within the proposed building footprint will be necessary to finalize and verify the geotechnical recommendation for the proposed building.

4.1 FOUNDATIONS

The foundation analysis was developed using the information in the **Proposed Construction** section, the boring information, and the assumption the perimeter foundations will bear at least 3½ feet below the finished exterior grade and interior footings in heated areas will bear approximately 2 feet below the floor surface. Provided subgrades and engineered fills are prepared as discussed herein, the proposed structure may be supported by a conventional individual column (spread) footing and continuous wall (strip) footing shallow foundation system bearing on suitable native soil and/or engineered fill placed continuous from a suitable bearing native soil subgrade. The following parameters are recommended for foundation design.

SHALLOW FOUNDATION DESIGN ⁽¹⁾		
Design Parameter		Value
Net Allowable Bearing Pressure ⁽²⁾		3,000 psf
Minimum Foundation Width	Wall (Strip)	18 inches
	Column (Spread)	30 inches
Post-Construction Estimated Settlement	Total	Approximately 1 inch
	Differential	Approximately 3/4 inch

1. We recommend a structural engineer provide specific foundation details including footing dimensions, reinforcing, and other details.
2. The applied pressure in excess of the surrounding overburden soils above the base of the foundation and includes a factor of safety of 3.

Estimates of settlement for foundations bearing on engineered fill are dependent on the quality of fill placed. Factors which may affect the quality of fill include maximum loose lift thickness of the fills placed and the amount of compaction effort placed on each lift.

Footing pads are recommended to be directly and entirely supported by suitable bearing native soil and/or on engineered fill placed continuous from a suitable bearing native soil subgrade. The existing undocumented fill should not be used for support. Soils anticipated to be suitable for direct foundation support or as the subgrade for engineered fill and indirect foundation support should have parameters as noted in the following Table or greater, unless otherwise recommended by the geotechnical engineer:

TARGET BEARING MATERIAL PROPERTIES		
Bearing Capacity (psf)	Cohesive Soil	
	Comparative Consistency	Unconfined Compressive Strength (tsf)
3,000*	Very Stiff	1¾

The soils encountered at the boring locations are predominately cohesive. Earth-formed footing construction techniques will likely be feasible. Earth-formed footing construction techniques are not expected to be feasible unless cohesive soil is used to raise site grades.

Undercuts: The footings can be supported on the native soils encountered at foundation bearing elevation. Undocumented fill was encountered within the footprint of the proposed building location (Borings B-3 through B-7) extending to a depth of approximately 3 to 3½ feet below the ground surface. However, soil conditions may vary outside the boring locations where undercuts may be necessary. ECS is recommended to be retained to observe and test the foundation bearing grade as recommended in the **Foundation and Slab Observations** section. It is also recommended backfill of foundation undercuts be done as recommended in the **Earthwork Operations** section.

Suitable bearing soils for direct foundation support or as the subgrade for crushed aggregate engineered fill and indirect foundation support, where encountered at the boring locations at the approximate depths below the surface, are listed in the following Table:

Anticipated Depth for Suitable Foundation Bearing Soil ⁽¹⁾	
Test Boring	Approximate Depth Below Existing Ground Surface (feet)
B-1	3
B-2	2
B-3	3½
B-4	5½
B-5	3
B-6	3
B-7	3

1. Based on 3,000 psf maximum net allowable soil bearing pressure. The Frost Depth for the foundation bearing depth is as follows in this report. Hence, some undercuts will be nil.

Frost Depth: Footings should be placed at a depth to provide adequate frost cover protection. We recommend the perimeter footings be placed at a minimum depth of 3½ feet below finished exterior grade. Interior footings in heated areas can be placed at a minimum of 2 feet below grade provided suitable bearing soils are present and the foundations will not be subjected to freezing weather either during or after construction. Footings situated beyond the building which will not have the benefit of building heat must bear at least 3½ feet below the finished ground grade.

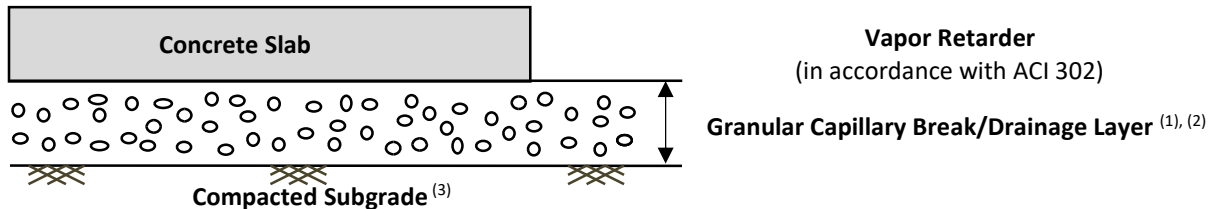
Settlement Considerations: Where foundations near each other bear at significantly different elevations, a greater potential exists for the foundations to act differentially across a shorter span. This movement over a shorter span may result in greater angular distortion, which would need to be accounted for by increasing the rigidity of the structure or designing the differential movement into the structure. Where the difference in loads or depth of influence between foundations near each other is significant, the foundations may need to be proportioned based on equivalent settlement rather than bearing capacity so that the differential settlement between foundations is kept within tolerable limits. If either of these conditions occur in the proposed structure, recommendations for providing increased rigidity or proportioning the foundations based on

equivalent settlement can be provided when details of the foundation system, such as loads, dimensions and locations, have been determined.

4.2 SLABS ON GRADE

Based on the assumed finished floor elevation of the building, the floor subgrade is expected to be undocumented fill soils and/or engineered fill used to backfill excavations.

Based on the anticipated subgrade soils and floor loading, the following graphic depicts our general soil-supported slab recommendations.



1. **Drainage Layer:** Minimum 6 inches thick
2. **Drainage Layer Material:** Gravel (GP, GW) having a maximum aggregate size of 1 inch, no more than 10 percent passing the No. 200 sieve, and follow the recommendations of ACI 302.
3. **Compacted Subgrade:** Compacted to at least 95 percent of the maximum dry density per ASTM D1557.

The structural engineer should determine the slab thickness and other requirements such as steel reinforcement. Provide adequate construction joints, contraction joints and isolation joints in the slab to reduce the impacts of cracking and shrinkage. Refer to the ACI 302.1R04 *Guide for Concrete Floor and Slab Construction* for additional information regarding concrete slab joint design. Reinforce the slab with welded wire fabric or include an appropriate fiber mesh admixture to help control shrinkage cracking.

We recommend slabs-on-grade be underlain by a granular drainage layer placed on a properly prepared subgrade as recommended in the **Site Construction Recommendations** section. The granular material will serve as a capillary break, which if properly designed and installed can assist in more uniform curing of concrete.

Inclusion of a vapor retarder should be considered if the building will contain moisture-sensitive floor coverings, equipment or materials. The vapor retarder will help reduce the potential of upward migration of water vapor from the soil into and through the concrete slab, which can contribute to excess humidity and microbial growth in the building. Where a vapor retarder is considered to help provide additional moisture protection, special attention should be given to the surface curing of the slabs to reduce uneven drying of the slabs and associated cracking and/or slab curling. The designer should consider the moisture sensitivity of floor coverings and finishes, and the potential effects of slab curling and cracking when determining if the vapor retarder will be in direct contact with the slab or beneath a layer of granular fill. The use of a blotter or cushion layer above the vapor retarder may be considered for project specific reasons. Refer to ACI 302.1R04 *Guide for Concrete Floor and Slab Construction* and ASTM E 1643 *Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs* for additional guidance on these issues.

Positive drainage around the perimeter of the proposed structures should be used to reduce the potential for water accumulation under the floor slab and foundation elements. Slope exterior grades adjacent to the building such that runoff is directed away from the building walls. Direct building downspouts away from the building walls/foundations. Direct slab and pavement surface runoff to appropriate stormwater infrastructure.

Subgrade Modulus: Provided the subgrade is prepared, and engineered fill and the granular drainage layer are placed as recommended in this report, design the slabs assuming an un-factored modulus of subgrade reaction, k_v1 , of:

- 150 psi/in for Alternative 1
- 100 psi/in for Alternative 2
- 75 psi/in for Alternative 3

These moduli of subgrade reaction values assumed are based on the recommended minimum drainage base thickness and correlation of index properties and soil type to historical 1 foot by 1 foot plate load tests. The modulus value used in design should be adjusted for areas larger than 1 foot by 1 foot.

Slab Isolation: Isolate ground-supported slabs from the foundations and foundation-supported elements of the structure to help reduce shear and bending stresses in the floor caused by differential movement between the foundations and slab. Where the structural configuration prevents the use of a free-floating slab, design the slab with suitable reinforcement and load transfer devices to preclude overstressing of the slab.

Frost Susceptible Areas: Frost susceptible soils were encountered at the site. To help reduce frost heave potential, consider additional insulation, installation of subgrade drainage, and/or replacement to the frost depth with non-frost-susceptible backfill in areas such as exterior sidewalks/flatwork and floor slab areas near doorways and entrance/exit vestibules. Slope pavement and ground surface grades away from the building and flatwork, to help reduce water infiltration and potential frost heave problems.

4.3 SEISMIC DESIGN CONSIDERATIONS

Seismic Site Classification: The 2015 International Building Code (IBC) requires the site be classified as Site Class A, B, C, D, E or F in accordance with Chapter 20 of ASCE 7 based on the site soil properties. The three parameters used to classify sites are shear wave velocity (v_s); undrained shear strength (s_u); and Standard Penetration Test (SPT) resistance (N-value). The seismic Site Class definitions for the weighted average of shear wave velocity, shear strength or SPT N-value in the upper 100 feet of the soil profile are listed below.

SEISMIC SITE CLASSIFICATION				
Site Class	Soil Profile Name	Shear Wave Velocity, Vs, (ft./s)	N-Value (bpf)	S _u Value (psf)
A	Hard Rock	Vs > 5,000 fps	N/A	N/A
B	Rock	2,500 < Vs ≤ 5,000 fps	N/A	N/A
C	Very dense soil and soft rock	1,200 < Vs ≤ 2,500 fps	>50	≥ 2,000
D	Stiff Soil Profile	600 ≤ Vs ≤ 1,200 fps	15 to 60	1,000 to 2,000
E	Soft Soil Profile	Vs < 600 fps	<15	≤ 1,000

Chapter 20 of ASCE 7 requires the Site Class be based on the upper 100 feet of the soil profile. The borings performed for this project were drilled to a maximum depth of 25 feet. Therefore, the conditions below this depth were assumed based on our experience with the soils in the general site vicinity and engineering judgment. It is our opinion the site soils can be characterized as Seismic Site Class D. If a more favorable Site Class is beneficial to the project, ECS would be pleased to discuss our ReMi testing capabilities in this regard.

Ground Motion Parameters: In addition to the seismic site classification noted above, ECS has determined the design spectral response acceleration parameters following the ASCE7-16 methodology. The Mapped Responses were estimated from the OSHPD Seismic Design Map website (<http://seismicmaps.org/>). The design responses for the short (0.2-sec, S_{D5}) and 1-second period (S_{D1}) are noted at the far right end of the following Table:

GROUND MOTION PARAMETERS [ASCE7-16 Method]								
Period (sec)	Mapped Spectral Response Accelerations (g)		Values of Site Coefficient for Site Class		Maximum Spectral Response Acceleration Adjusted for Site Class (g)		Design Spectral Response Acceleration (g)	
	S _s	0.126	F _a	1.6	S _{M5} = F _a S _s	0.201	S _{D5} = 2/3 S _{M5}	0.134
1.0	S ₁	0.064	F _v	2.4	S _{M1} = F _v S ₁	0.154	S _{D1} = 2/3 S _{M1}	0.102

Liquefaction: The subsurface profile consists primarily of clay soils. The subsurface conditions observed at the boring locations are considered to have a low liquefaction potential. Therefore, it is our opinion that additional exploration regarding liquefaction potential is not necessary.

4.4 PAVEMENT CONSTRUCTION CONSIDERATIONS

The following Sections provide recommendations for new pavement construction:

4.4.1 New Pavement Construction

Subgrade Characteristics: A California Bearing Ratio (CBR) test is commonly used to determine soil support parameters for pavement design. Based on the test borings, it appears the pavement subgrade soils will mainly consist of native clay and silty clay fill. The silty clay soil at the test borings was found to generally exhibit stiff to hard consistencies at the anticipated subgrade. A design CBR value of 3 was assumed in developing the recommended minimum pavement sections. The pavement design recommendations assume the subgrade consists of suitable materials evaluated by ECS, and the subgrade is prepared as recommended in the Subgrade Preparation and Earthwork Operations sections of this report. Areas of undercut may be needed due to the undocumented fill,

and if the subgrade is subjected to construction traffic disturbance or if construction is during adverse weather conditions.

Based on the anticipated usage of the parking lot and traffic loads and existing pavement sections encountered at the boring locations, ECS recommends the minimum pavement and granular subbase material thicknesses listed in the Table below:

NEW PAVEMENT SECTION RECOMMENDATIONS				
Pavement Material	Compacted Material Thicknesses (Inches)			
	Flexible Pavement		Rigid Pavement	
	Heavy Duty	Light Duty	Heavy Duty	Light Duty
Hot Mix Asphalt ¹ Surface Course	1½	1½	--	--
Hot Mix Asphalt ¹ Binder Course	2½	1½	--	--
Portland Cement Concrete ²	--	--	6	5
Crushed Aggregate Base Course ³	9	8	8	6
Total Pavement Section Thickness	13	11	14	11

1. Section 406 of IDOT Standard Specification for Road and Bridge Construction.
2. Section 420 of IDOT Standard Specification for Road and Bridge Construction.
3. Section 351 of IDOT Standard Specification for Road and Bridge Construction. If crushed gravel or some other material is used in lieu of crushed limestone, the material may have a lower structural coefficient and a thicker base may be required.

The light-duty flexible pavement section is recommended for automobile parking stalls. The heavy-duty pavement section is recommended for frequent traffic areas such as entrance/exit drive, where trucks frequently turn and park, drive aisles and points of ingress or egress. If the design traffic loads become available, please contact ECS so we can review and revise (if appropriate) the minimum pavement section recommendations in the Table above.

The crushed granular base course should be compacted to at least 95 percent of the maximum dry density obtained in accordance with ASTM D1557, Modified Proctor Method. The hot mix asphalt should be compacted to a minimum of 93 percent of the maximum theoretical density value.

Pavement Drainage Considerations: An important consideration with the design and construction of pavements is surface and subsurface drainage. Where standing water develops, either on the pavement surface or within the base course layer, softening of the subgrade and other problems related to the deterioration of the pavement can be expected. Based on our estimated groundwater level, we consider surface water infiltration would be the main source of water to be considered for pavement design on this project.

Shape or crown the final pavement surface to properly direct surface water to suitable on or off-site storm water drainage infrastructure. Properly slope the clay pavement subgrade to avoid dips or pockets where water may become trapped. Dips in the silty clay subgrade could result in a

“bathtub” effect, which may trap water and potentially soften the subgrade. The subgrade in areas requiring undercut and backfill with granular soils are recommended to be graded to drain toward a drain tile. The drain tile should be sloped a minimum of ½ to 1 percent to discharge to nearby storm sewers, drainage ditches or other appropriate drainage facilities. Install edge drains where site grades slope toward the pavement edge to reduce the potential for water to enter the base course layer. Slope edge drains to the nearest appropriate drainage facility. Water that accumulates and ponds on the subgrade surface can lead to deterioration of the subgrade soils, reduction of the base course support characteristics and pavement heave. Good drainage should help reduce the possibility of the subgrade materials being wet over a long period of time.

To reduce the potential for shallow perched water to develop in areas of the site, install “stub” or “finger” drains around catch basins and in other low-lying areas of the parking lot to reduce the accumulation of water above and within the subgrade soils and aggregate base. Consider installation of pavement edge drains or trench drains to reduce the accumulation of water within the base course and on the subgrade soils.

Pavement Maintenance Considerations: A sound maintenance program should be implemented to help maintain and enhance the performance of pavements and help attain the design service life. A preventative maintenance program should be started early in the pavement life to be effective. The “*standard in the industry*” supported by research indicates that preventative maintenance should typically begin within 2 to 5 years of the placement of pavement. Failure to perform preventative maintenance will reduce the service life of the pavement and increase the costs for corrective maintenance and full pavement rehabilitation. Seal joints and cracks with elastomeric caulk in a timely manner to help reduce water infiltration thru the pavement section into the base course layer, which may result in softening of the subgrade and deterioration of the pavement. Observe pavements for distresses, such as cracks, depressions, and poor drainage, at least twice a year, typically once in the spring and once in the fall.

Pavement Construction Weather Restrictions: Daily temperatures from mid-November to April can often stay below 40°F, limiting the days that bituminous placement can occur. In this region, bituminous plants may close during the months of December, January, and/or February if particularly cold weather conditions prevail. However, this can change based on year-to-year temperature fluctuations.

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 SUBGRADE PREPARATION

The method of site preparation will depend on some factors that were unknown at the time this report was prepared, which may include weather before and during construction, the possibility of subsurface conditions not revealed by the borings, and the final details of the proposed development.

5.1.1 Existing Utilities

Locate existing utilities. Relocate utilities planned to be maintained outside the proposed building area, if possible. For utilities not reused, cap-off and removed, or properly abandon in-place in accordance with local codes and ordinances. Backfill excavations for utilities to be removed in the influence zone of new construction with engineered fill. Grading operations must be done carefully so that existing utilities are not damaged or disturbed. Check utility invert elevations, depths and sizes relative to the planned foundation elevations to determine what specific concerns are present.

5.1.2 Stripping and Grubbing

The subgrade preparation should include stripping topsoil, pavement, including the gravel base, along with any other soft or otherwise unsuitable materials from the 10-foot expanded building limits, and 5 feet beyond the toe of engineered fills, where feasible. Call on ECS to observe and document that unsuitable surficial materials have been removed prior to the placement of engineered fill or construction of structures. The project team may choose to stockpile the existing pavement gravel base for reuse as engineered fill.

ECS recommends the subgrade not be exposed to the elements or construction traffic for a prolonged period of time as the subgrade may become disturbed and/or softened. If the slab and pavement sections are not planned to be constructed within a few days after exposing the final design subgrade, consideration should be given to leaving the subgrade approximately 1 foot above the final design subgrade, where feasible, to help reduce softening of the design subgrade soil.

5.1.3 Existing Undocumented Fill

Existing undocumented fill was encountered at several of the boring locations to an approximate depth of 5 feet below existing site grade. Information regarding the placement and compaction of the existing fill is not known. With undocumented fill there is an inherent risk for the owner that generally stems from the potential for unsuitable material to exist within the fill or to be buried by the fill that was not found by the boring exploration, which could go undetected. This risk of unforeseen conditions cannot be eliminated without complete removal of the existing fill but can be reduced by performing the recommended testing and evaluation. Using undocumented material for support would require acceptance of risk by the owner. It is not the geotechnical engineer's responsibility to accept the risk, but rather to inform others of the risk so that they may make a judgment as to what level of cost versus performance risk is acceptable to them.

Fill in Slab Areas: Considering the anticipated slab loads and because complete removal and replacement of the existing possible fill may be cost prohibitive, and the owner may be willing to

accept some risk, three alternatives for subgrade preparation in slab areas with varying anticipated cost and level of risk are provided.

- **Alternative 1 (Complete Removal and Replacement of Undocumented Fill):** Completely remove undocumented fill materials from slab areas and replace with engineered fill. Note that removal and replacement of the possible fill material could require excavations of approximately 5 feet below existing site grade (potentially deeper in unexplored areas of the project site). This option carries a low risk of poor slab performance but is anticipated to have the greatest construction costs of the alternatives presented.
- **Alternative 2 (Partial Removal and Replacement):** Considering the anticipated relatively light floor loads, to reduce the depths of undercut, but also with a low risk of poor slab performance, the project team could consider removal of the existing undocumented fill material to a minimum depth of 2 feet below the final slab subgrade elevation and replacing it with granular engineered fill to help provide a more uniform subgrade. The undercut subgrade should be scarified and recompacted to at least 95 percent of the material's maximum dry density prior to placement of granular engineered fill. Granular fill such as well-graded crushed stone aggregate is recommended to be used.
- **Alternative 3 (Proofroll and Replace as Needed):** After the site has been stripped and the subgrade has been exposed, the subgrade should be proofrolled as recommended in the **Proofrolling** section below. This alternative will only identify near surface soils that are unsuitable for slab support, and unidentified deeper pockets of unsuitable fill could lead to poor performance of the slab. This alternative is expected to have the lowest construction costs of the alternatives presented, but also has a low to moderate risk of poor slab performance.

Fill in Foundation Areas: ECS recommends complete removal and replacement of undocumented existing fill beneath foundations. If test pits or foundation excavations reveal the material to be native undercut may not be necessary.

5.1.4 Proofrolling

Prior to fill placement or other construction on subgrades, the subgrades should be evaluated by ECS. Thoroughly proofroll the exposed subgrade with construction equipment having a minimum axle load of 10 tons (e.g., fully loaded tandem-axle dump truck). Traverse the subgrade with the proofroll equipment in two perpendicular (orthogonal) directions with overlapping passes of the vehicle. This procedure is intended to assist identification of yielding subgrade materials.

Unstable or pumping subgrade areas identified during the proofroll should be repaired prior to the placement of subsequent engineered fill or other construction materials. Unstable subgrade repair methods, such as undercutting, or moisture conditioning and recompaction, or chemical stabilization, should be discussed with ECS to determine the appropriate procedures with regard to the existing conditions causing the instability. Test pits may be excavated to explore the shallow subsurface materials in the area of the instability to help determine the appropriate remedial action to stabilize the subgrade.

Seasonal reduction of the near surface soil strength can occur during wet times of the year (such as during the spring and fall months) or immediately following extended periods of rain. This may

result in additional unstable or pumping subgrade areas. Some undercutting or repair of unstable subgrade soils should be anticipated during slab and pavement subgrade preparation. Dependent on the results of proofroll observations, undercuts of as much as 1 to 2 feet may be necessary to develop a suitable subgrade. The method of subgrade repair or improvement chosen may be influenced by several factors such as weather and schedule, as well as the area, depth and nature of the unstable subgrade soils. Depending on the aforementioned and other factors, potential subgrade repair methods are described below, but the actual depth of subgrade undercut and/or stabilization method should be determined at the time of construction.

Scarification and Compaction: Soils can be scarified, moisture conditioned (i.e., dried or wetted) to within a narrow range of the material's optimum moisture content and compacted. Scarification and compaction are generally most applicable where very shallow unstable conditions are encountered and at times when the soil can be properly dried or wetted to within a narrow range of the material's optimum moisture content.

Undercut and Replacement: We recommend soft or yielding soils be evaluated in approximately 6 to 12-inch intervals to help limit the volume of undercuts. If soft or yielding soils are identified, the contractor should remove only 6 to 12 inches of material at a time in the subject area and then proofroll/evaluate the undercut subgrade to determine if additional undercut is needed. This may take more time but could potentially reduce the removal of more soil than necessary. Use of a geogrid could also be considered to reduce undercut depths. A geogrid, if used, should be placed after underground work, such as utility construction, is complete. Do not operate equipment on the geogrid until after engineered fill is placed above it. Depending on the conditions at the time of repair, use of an aggregate engineered fill, such as crushed stone, crushed concrete, or gravel, may be needed.

5.1.5 Site Temporary Dewatering

Surface Water: The surface of the site should be kept properly graded to enhance drainage of the surface water to appropriate discharge or storage areas during construction. We recommend that an attempt be made to enhance the natural drainage without interrupting its pattern.

Subsurface Water: Groundwater observations are described in the **Groundwater Observations** section of this report. It appears the hydrostatic groundwater level at this site may be approximately 9 to 12 feet below grade (corresponding to about 667 to EL. 672½ feet above MSL). Excavations for new conventional shallow foundations are not expected to extend below the groundwater level encountered at the boring locations. Based upon the results of the subsurface exploration and proposed construction, we believe construction dewatering at this site will be mainly to remove accumulated runoff water and perched water.

5.2 EARTHWORK OPERATIONS

5.2.1 Engineered Fill

Product Submittals: Prior to placement of engineered fill, representative bulk samples (typically at least 50 to 100 pounds) of on-site and off-site borrow per material type should be submitted to ECS for laboratory testing, which may include natural moisture content, organic content, grain-size distribution, Atterberg limits, and moisture-density relationships for compaction. Import material

should be tested prior to being hauled to the site to determine if it complies with project specifications. Alternatively, Proctor data from other accredited laboratories can be submitted if the test results are within the last 90 days.

Satisfactory Engineered Fill Materials: Engineered fills should consist of materials free of debris with the following engineering properties:

ENGINEERED FILL INDEX PROPERTIES		
Subject		Property
Plasticity	Upper 4 feet in Building Areas and Upper 2 feet in Pavement Areas	LL ≤ 40, PI ≤ 15
	Below 4 feet in Building Areas and Below 2 feet in Pavement Areas	LL ≤ 50, PI ≤ 20
Max. Particle Size		3 inches
Max. Organic Content		5 percent

Open-graded materials, such as coarser sands, and gravels (SP and GP), which contain increased void space in their mass may need to be encapsulated within a filter geotextile. If the fill is to provide low-frost susceptible characteristics, it must be classified as a clean GW, GP, SW or SP per Unified Soil Classification System (ASTM D-2487), and must be properly drained.

Unsatisfactory Materials: Unsatisfactory engineered fill materials, which do not satisfy the requirements for suitable materials, include topsoil and organic materials (PT, OH, OL), frost susceptible silt (ML), and high plasticity soils elastic silt (MH) and fat clay (CH).

Pea gravel is not recommended to be used as engineered fill. Pea gravel has round/smooth characteristics, no fines and does not interlock when compacted, which makes it more susceptible to future movement and instability resulting in excessive and variable settlement.

On-Site Borrow Suitability: The on-site soil may be feasible to use as engineered fill but should be further evaluated by ECS prior to its use. On-site soil used as engineered fill must not contain more than 5 percent organic matter as determined by ASTM D2974, and must be free of frozen matter, deleterious materials, over-sized material (maximum 3-inch particle diameter), or chemicals that may result in the material being classified as “contaminated.” Some conditions at the time of construction, such as wet or freezing weather, may preclude the use of on-site soil, and use of an imported less moisture sensitive or less frost susceptible granular material may be needed. The engineered fill materials is recommended to be checked by ECS prior to placement. Sorting to remove over-sized material (i.e., cobbles and boulders) or rubble is expected to be needed prior to re-use of on-site soil as engineered fill.

It may be feasible to reuse the existing base course material as base course or subbase for the new pavement but should be checked by ECS after the material is exposed and prior to its use. The existing granular base material that is planned to be reused as fill should be stripped clean (e.g., not mixed with bituminous material, subgrade soils and other foreign materials) and stockpiled separately. Prior to its reuse, the material is recommended to be tested, such as with grain-size distribution tests. Depending on the base course properties a reduced structural coefficient may be needed for design, which would require additional base course or a thicker hot mix asphalt section.

5.2.2 Compaction

Subgrade Benching: Place fill material in horizontal lifts. Where fill materials will be placed to widen existing embankment fills, or placed up against sloping ground, the soil subgrade should be scarified, and the new fill benched and keyed into the existing material. Place and compact fill on a 3 (H):1 (V) or flatter slope, or step or bench as required to flatten.

Engineered Fill Compaction: Place and compact engineered fill in appropriate thickness loose lifts as recommended below. Beyond these areas, achieve compaction of at least 90 percent. Give as much importance to the moisture content requirements of the material as the density requirements during placement and compaction considering the moisture sensitivity of the soil.

ENGINEERED FILL COMPACTION RECOMMENDATIONS		
Subject		Recommendation
Compaction Standard		Modified Proctor, ASTM D1557
Recommended Compaction		95 percent of Max. Dry Density
Moisture Content	Fine-grained	-3 to +3 % points of the material's optimum value
	Coarse-grained	-3 to +3 % points of the material's optimum value

ECS understands site conditions or project constraints occur where open-graded aggregate engineered fill is used. If open-graded aggregate material is considered, the installation should be observed by ECS on a full-time basis during placement operations. Open-graded aggregates do not contain fine particles and therefore cannot be tested with a nuclear gauge or similar equipment to determine the appropriateness of compaction. The material should be compacted until no further vertical and lateral movement is noted, and until the stone “closes up” and interlock is observed. Where open-graded aggregate material is used, we recommend at least the top 4 inches of engineered fill consist of well-graded aggregate material as a “choking” layer. Consideration should be given to placing a non-woven geotextile fabric as a separator between the open-graded and well-graded materials to help reduce the potential for migration of fines into the open-graded material.

Compaction equipment suitable to the material type being compacted should be used. Sheepsfoot compaction equipment should be suitable for the fine-grained soils (clays). A vibratory steel drum roller should be used for compaction of coarse-grained soils (sands and gravels) as well as to help seal compacted surfaces. Vibratory compaction methods should be done with caution near the water table because an unstable subgrade condition could develop. Static compaction and thinner lifts may be needed near the water table.

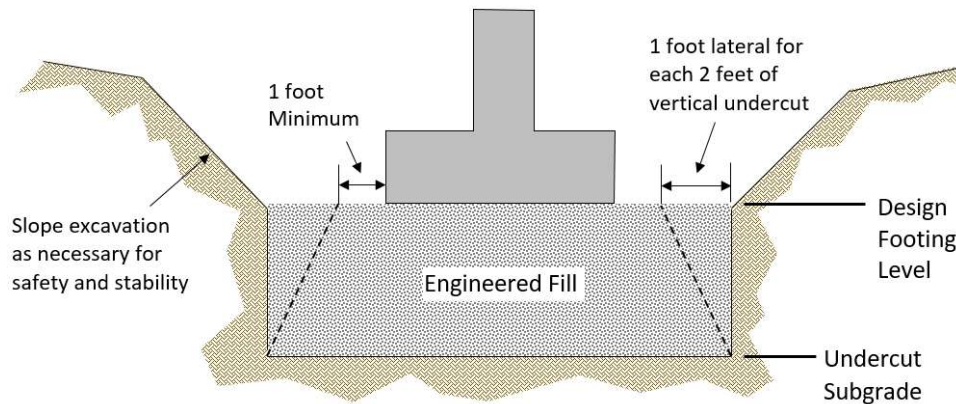
The maximum loose lift thickness depends upon the type of compaction equipment used. For isolated excavations around footing locations or within utility excavations, a hand tamper will likely be required. Listed below are generally recommended maximum loose lift thicknesses for compaction based on the utilized compaction equipment.

RECOMMENDED LOOSE LIFT THICKNESSES	
Equipment	Maximum Loose Lift Thickness (inches)
Large/Heavy, Self-Propelled Equipment	8 to 12
Small, Self-Propelled or Remote Controlled (Rammax, etc.)	6 to 8
Hand Operated (Plate Tampers, Jumping Jacks, Wacker-Packers)	4 to 6

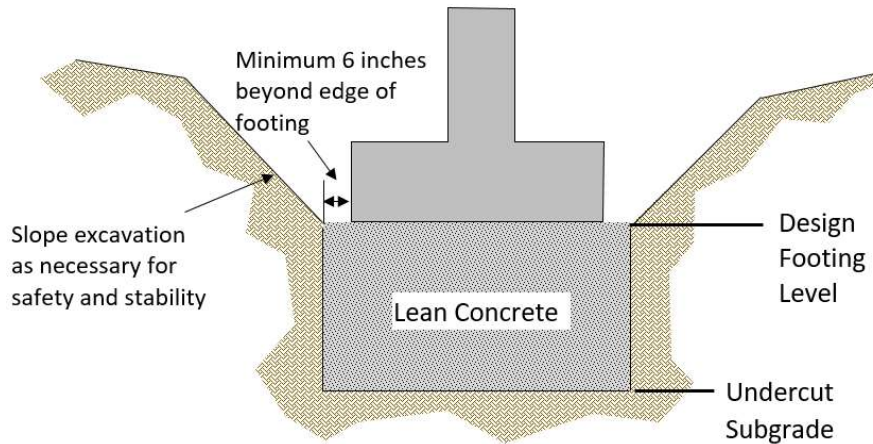
1. Density testing during fill placement is important to check and document that the specified compaction is being achieved. Thinner lifts and/or more compactive energy may be needed to achieve the required degree of compaction.

In confined areas such as utility trenches, portable compaction equipment and thin lifts of 4 inches or less may be required to achieve specified degrees of compaction.

Engineered Fill Below Foundations: Recompact unsuitable bearing soils encountered at the proposed foundation bearing grade or within the foundation influence zone, if feasible, or removed to a suitable bearing subgrade and to a lateral extent, as conceptually illustrated below. The zone of the engineered fill placed below the foundations is recommended to extend 1 foot beyond the outside edges of the footings and from that point, outward laterally 1 foot for every 2 feet of fill thickness below the footing.



Alternatively, backfill undercuts with lean concrete ($f'_c \geq 1,000$ psi at 28 days) up to the original design bottom of footing elevation. The original footing is recommended to be constructed on top of the hardened lean concrete. If lean concrete is utilized the excavation is recommended to be 1 foot wider than the footing (6 inches on each side), as conceptually illustrated below, and the lean concrete should be allowed to sufficiently harden prior to placement of the foundation concrete. Use of lean mix concrete to limit lateral over-excavation may not be effective due to caving of excavation sidewalls in the granular soil.



Fill Placement Considerations: Do not place fill materials on frozen soils, on frost-heaved soils, on excessively wet soils, or soils that are otherwise unstable. Borrow fill materials should not contain frozen materials at the time of placement, and all frozen or frost-heaved soils should be removed prior to placement of engineered fill or other fill soils and aggregates. Excessively wet soils or aggregates should be scarified, aerated, and moisture conditioned.

Excavation Safety: Make and maintain excavations and slopes in accordance with OSHA excavation safety standards. The Contractor is solely responsible for designing and constructing stable, temporary excavations and slopes and should shore, slope, or bench the sides of the excavations and slopes as required to maintain stability of both the excavation sides and bottom. The Contractor's responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. In some cases, the use of shoring, bracing, or trench boxes may be required. ECS is providing this information solely as a service to our client. ECS is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

Existing Fill Considerations: Existing fill was encountered at the boring locations. Unsuitable materials may be buried beneath the site surface not identified by the borings. Questionable material encountered is recommended to be evaluated by ECS to determine if removal and replacement with engineered fill is necessary. Alteration to the recommendations of this report may be needed, if conditions different than those noted on the boring logs are revealed.

Bidding/Estimating Considerations: Contractors bidding or undertaking work at the site should examine the results of the subsurface exploration, satisfy themselves as to the adequacy of the information for bidding and construction, make their own interpretation of the data, and consider the effect it may have on their cost proposal, construction techniques, schedule, and equipment capabilities. Furthermore, contractors should complete additional fieldwork and investigation they deem necessary to properly prepare a cost proposal for the site work. Soil borings do not provide the same wide-scale view of the subsurface conditions that is obtained during site grading, excavation or other aspects of earthwork construction. Additional scope may be required to obtain more detailed subsurface information needed for earthwork bid preparation, which could include test pits to better understand the lateral and vertical extents of the subsurface materials of concern

such as existing undocumented fill. Even with this additional information, budget contingencies should be carried in construction to help cover potential variations in subsurface conditions.

5.3 FOUNDATION AND SLAB OBSERVATIONS

Protection of Foundation Excavations: Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for too long a time. Foundation concrete should be placed the same day that excavations are made. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, a 2 to 3-inch thick “mud mat” of “lean” concrete should be placed on the bearing soils before the placement of reinforcing steel.

Footing Subgrade Observations: The recommendations of this report are predicated upon ECS checking the suitability of the in-situ foundation support soils during construction. The suitability of the actual bearing grade is recommended to be observed and tested to check that the soils are as indicated by the borings and are suitable to support the recommended maximum net allowable bearing pressure.

Slab Subgrade Observation and Testing: Call on ECS to observe and test exposed subgrade within the expanded building limits prior to engineered fill placement and slab construction to check that adequate subgrade preparation has been achieved as recommended in the Subgrade Preparation section.

5.4 UTILITY INSTALLATIONS

Utility Subgrades: The soils encountered at the boring locations are expected to be generally suitable for support of utility pipes. The pipe subgrade should be observed and tested by ECS to check the suitability of the materials encountered at the time of construction. Remove existing fill, soft, loose or otherwise unsuitable materials encountered at the utility pipe subgrade elevation and replace with suitable compacted engineered fill or pipe bedding material.

Utility Backfilling: The granular bedding material should be at least 4 inches thick, but not less than that specified by the project drawings and specifications. Granular bedding is recommended to consist of IDOT CA-6, CA-7 or similar. Fill placed for support of the utilities, as well as backfill over the utilities, should satisfy the recommendations for engineered fill given in this report. Cover material and backfill material is recommended to follow the provisions of this report.

We do not recommend flood compaction of the backfill, especially within a cohesive soil excavation, where cohesive soils are used as backfill, and/or where a shallow water table exists. Mechanical compaction is recommended and preferred since it generally provides more uniform compaction than flood compaction.

6.0 CLOSING

ECS has prepared this report to guide geotechnical-related design and construction aspects of the project. We performed these services in accordance with the standard of care expected of professionals in the industry performing similar services on projects of like size and complexity at this time in the region. No other representation expressed or implied, and no warranty or guarantee is included or intended in this report.

The description of the proposed project is based on information provided to ECS. If this information is inaccurate, either because of our interpretation of the documents provided, or site or design changes that may occur later, ECS should be contacted so that we can review our recommendations and provide additional or alternate recommendations as may be required to reflect the proposed construction.

We recommend ECS review the project's plans and specifications so that we may evaluate consistency of those plans/specifications with the intent of the geotechnical report recommendations.

Field observations and quality assurance testing during earthwork and foundation installation are an extension of, and integral to, the geotechnical design. We recommend that ECS be retained to apply our expertise throughout the geotechnical phases of construction, and to provide consultation and recommendations should issues arise.

ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

APPENDIX A - Drawings & Reports

Site Location Diagram
Boring Location Diagram

Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors

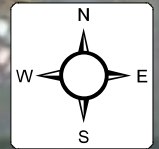


SITE LOCATION DIAGRAM VILLA PARK LIONS COMMUNITY CENTER


320 EAST WILDWOOD AVENUE, VILLA PARK, ILLINOIS
VILLAGE OF VILLA PARK

ENGINEER SRB1
SCALE AS NOTED
PROJECT NO. 16:14506
FIGURE 1 OF 1
DATE 8/19/2022

Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors



Legend

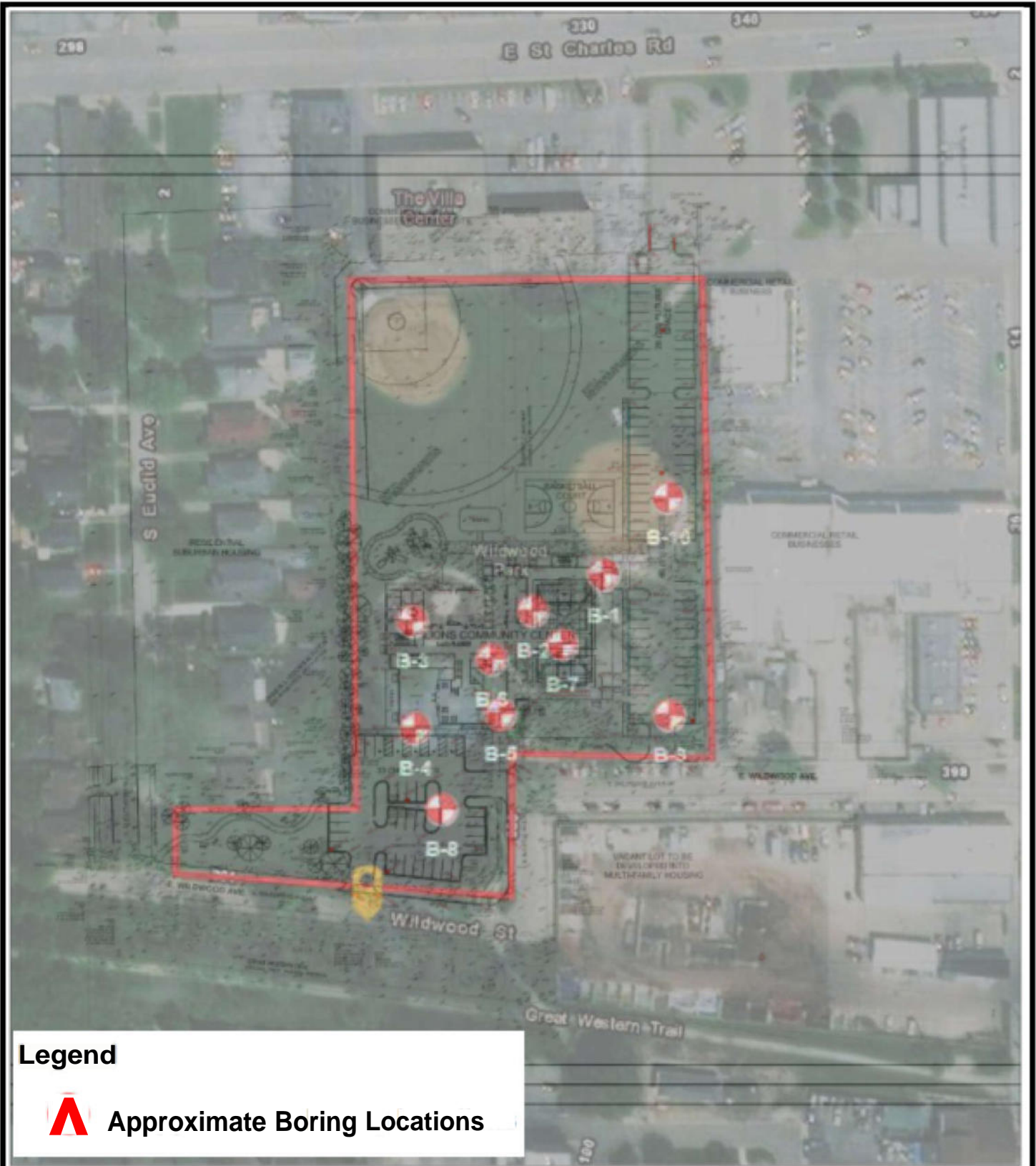
 Approximate Boring Locations



BORING LOCATION DIAGRAM VILLA PARK LIONS COMMUNITY CENTER

320 EAST WILDWOOD AVENUE, VILLA PARK, ILLINOIS
VILLAGE OF VILLA PARK

ENGINEER SRB1
SCALE AS NOTED
PROJECT NO. 16:14506
FIGURE 1 OF 1
DATE 8/19/2022



Legend

 **Approximate Boring Locations**



**BORING LOCATION DIAGRAM VILLA
PARK LIONS COMMUNITY CENTER**

**320 EAST WILDWOOD AVENUE, VILLA PARK,
VILLAGE OF VILLA PARK**

ENGINEER SRB1
SCALE AS NOTED
PROJECT NO. 16:14506
FIGURE 1 OF 1
DATE 8/30/2022

APPENDIX B - Field & Laboratory Operations

SPT Soil Boring Logs

Subsurface Soil Profile

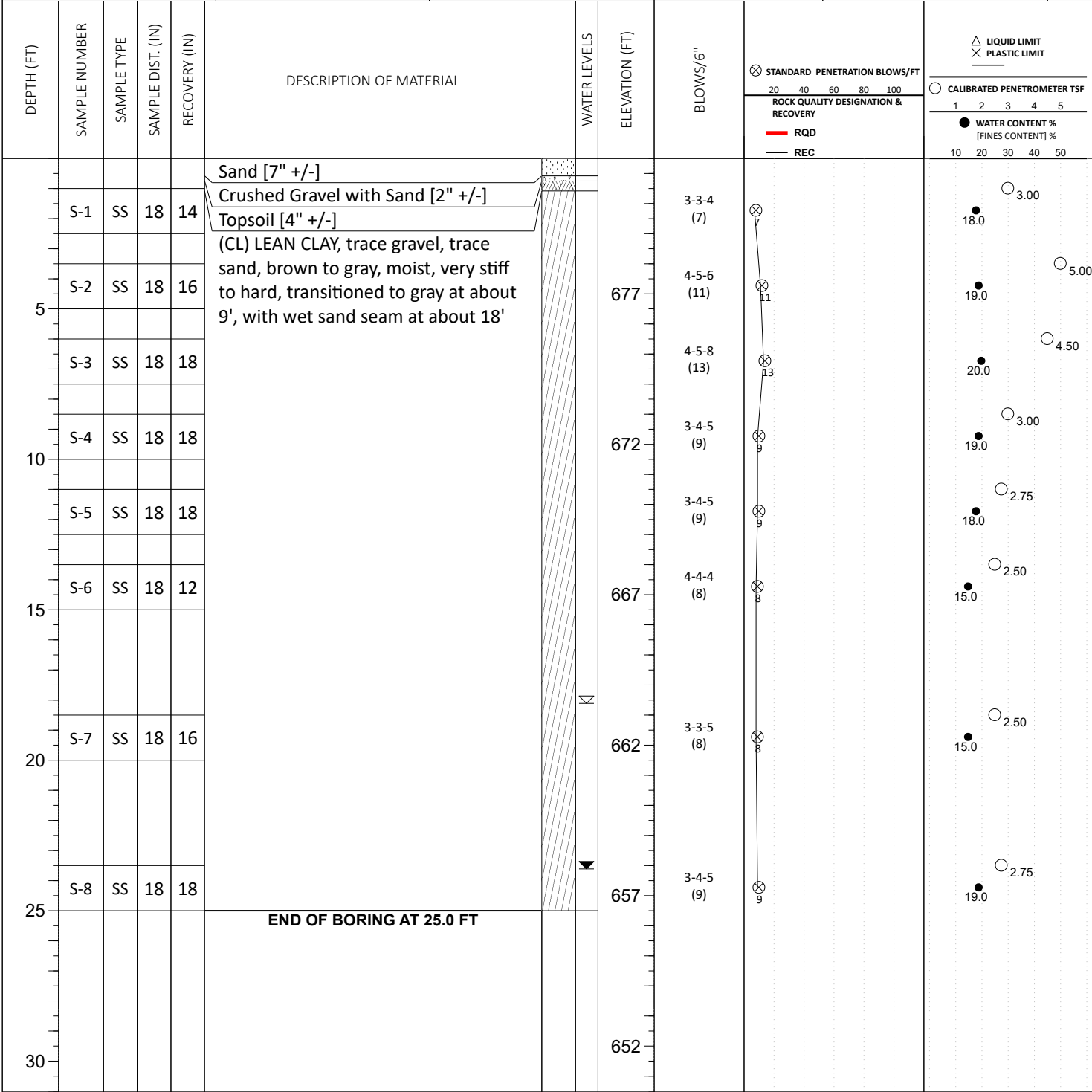
Reference Notes for Boring Logs

Subsurface Exploration Procedures: SPT

Laboratory Testing Procedures: Index Testing

SITE LOCATION:
320 East Wildwood Avenue, Villa Park, Illinois 60181

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				BOTTOM OF CASING



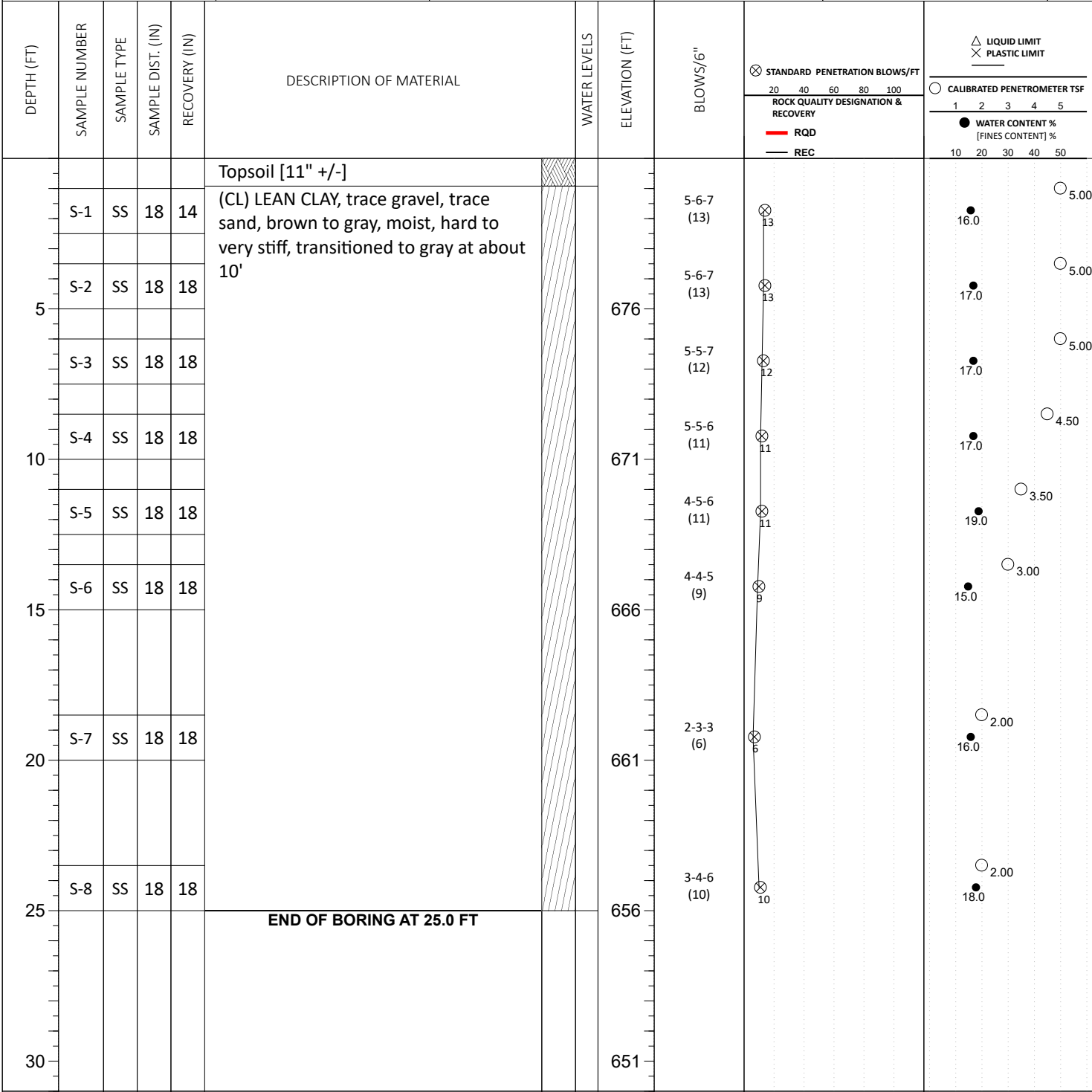
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GEOTECHNICAL BOREHOLE LOG

SITE LOCATION:
320 East Wildwood Avenue, Villa Park, Illinois 60181

NORTHING: 4350409.9	EASTING: 1260704.4	STATION:	SURFACE ELEVATION: 681.00	LOSS OF CIRCULATION
				BOTTOM OF CASING

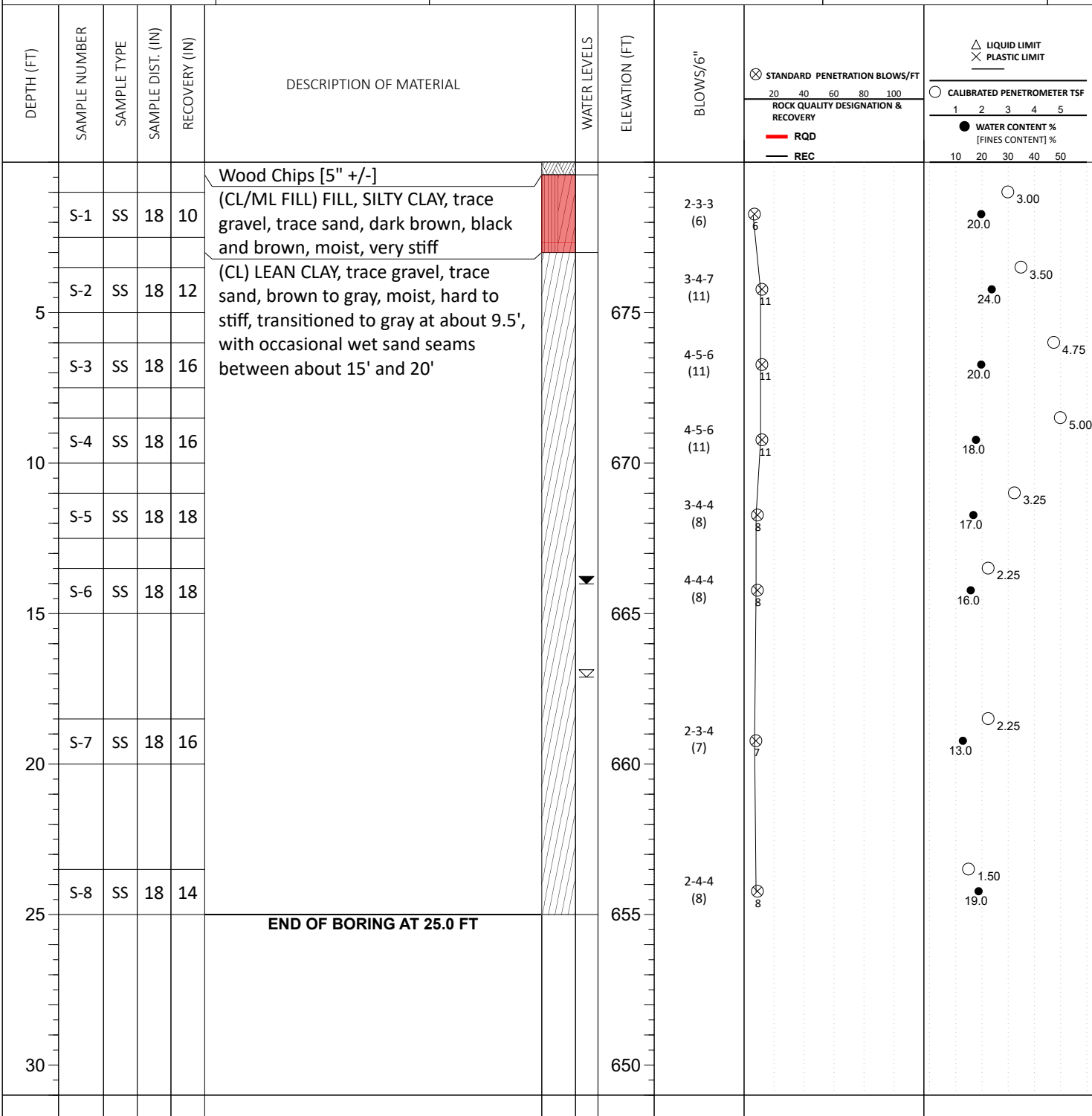


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

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<input checked="" type="checkbox"/> WL (Stabilized)	LOGGED BY: PW2	

GEOTECHNICAL BOREHOLE LOG

SITE LOCATION: 320 East Wildwood Avenue, Villa Park, Illinois 60181			LOSS OF CIRCULATION 	
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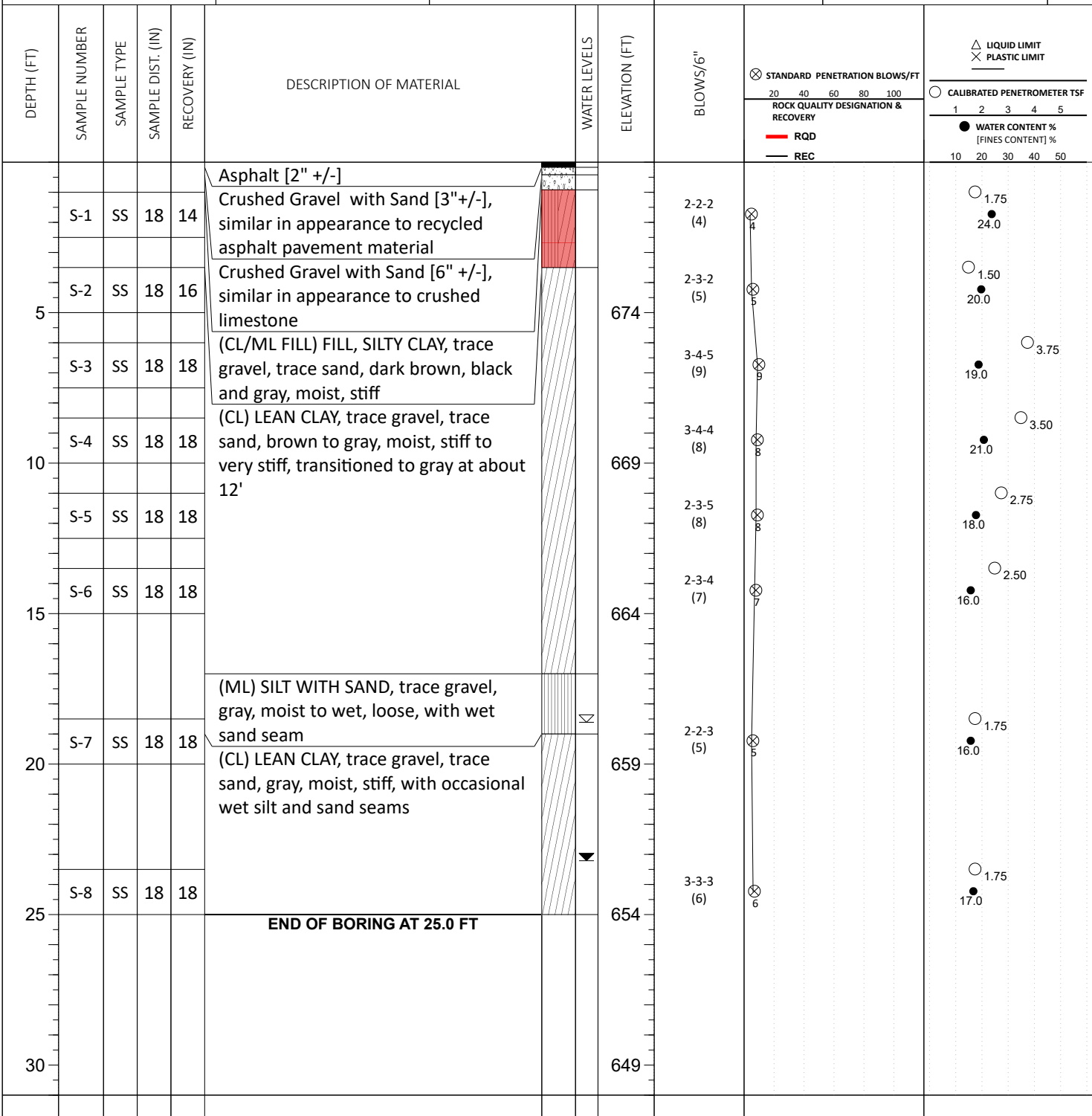
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▼ WL (Completion)	13.90	BORING COMPLETED:	Aug 11 2022	HAMMER TYPE:	Automatic
▽ WL (Seasonal High Water)		EQUIPMENT:	Truck	LOGGED BY:	PW2
▽ WL (Stabilized)				DRILLING METHOD:	CFA

GEOTECHNICAL BOREHOLE LOG

SITE LOCATION:
320 East Wildwood Avenue, Villa Park, Illinois 60181

NORTHING: 4350298.9	EASTING: 1260581.8	STATION:	SURFACE ELEVATION: 679.00	LOSS OF CIRCULATION
				BOTTOM OF CASING



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

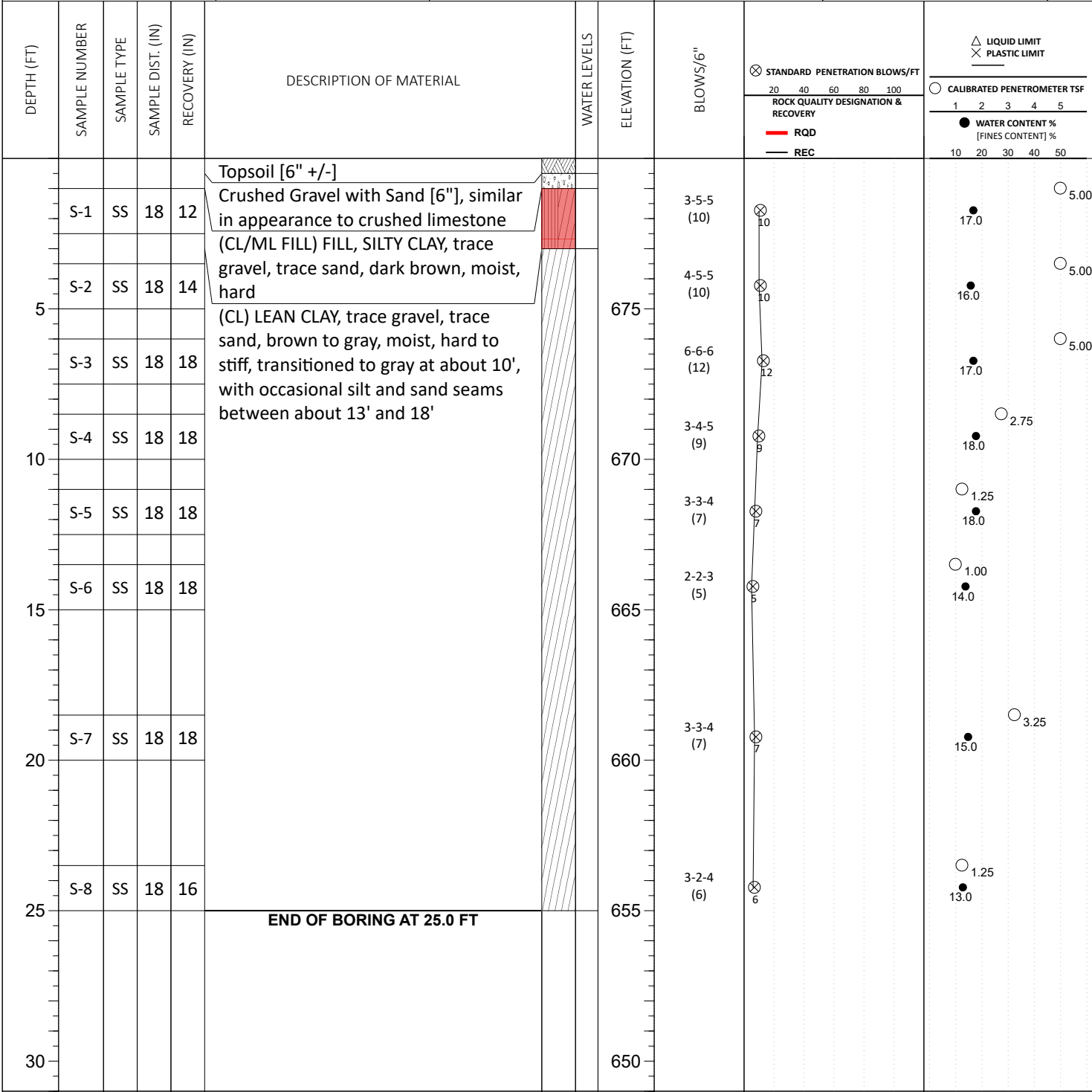
∇ WL (First Encountered) 18.50 ▼ WL (Completion) 23.10 ∇ WL (Seasonal High Water) ∇ WL (Stabilized)	BORING STARTED: Aug 10 2022 BORING COMPLETED: Aug 10 2022 EQUIPMENT: Truck	CAVE IN DEPTH: HAMMER TYPE: Automatic DRILLING METHOD: CFA LOGGED BY: PW2
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GEOTECHNICAL BOREHOLE LOG

CLIENT: Village of Villa Park	PROJECT NO.: 16:14506	BORING NO.: B-05	SHEET: 1 of 1	
PROJECT NAME: Villa Park Lions Community Center	DRILLER/CONTRACTOR: I.E. Xploration			

SITE LOCATION: 320 East Wildwood Avenue, Villa Park, Illinois 60181	LOSS OF CIRCULATION
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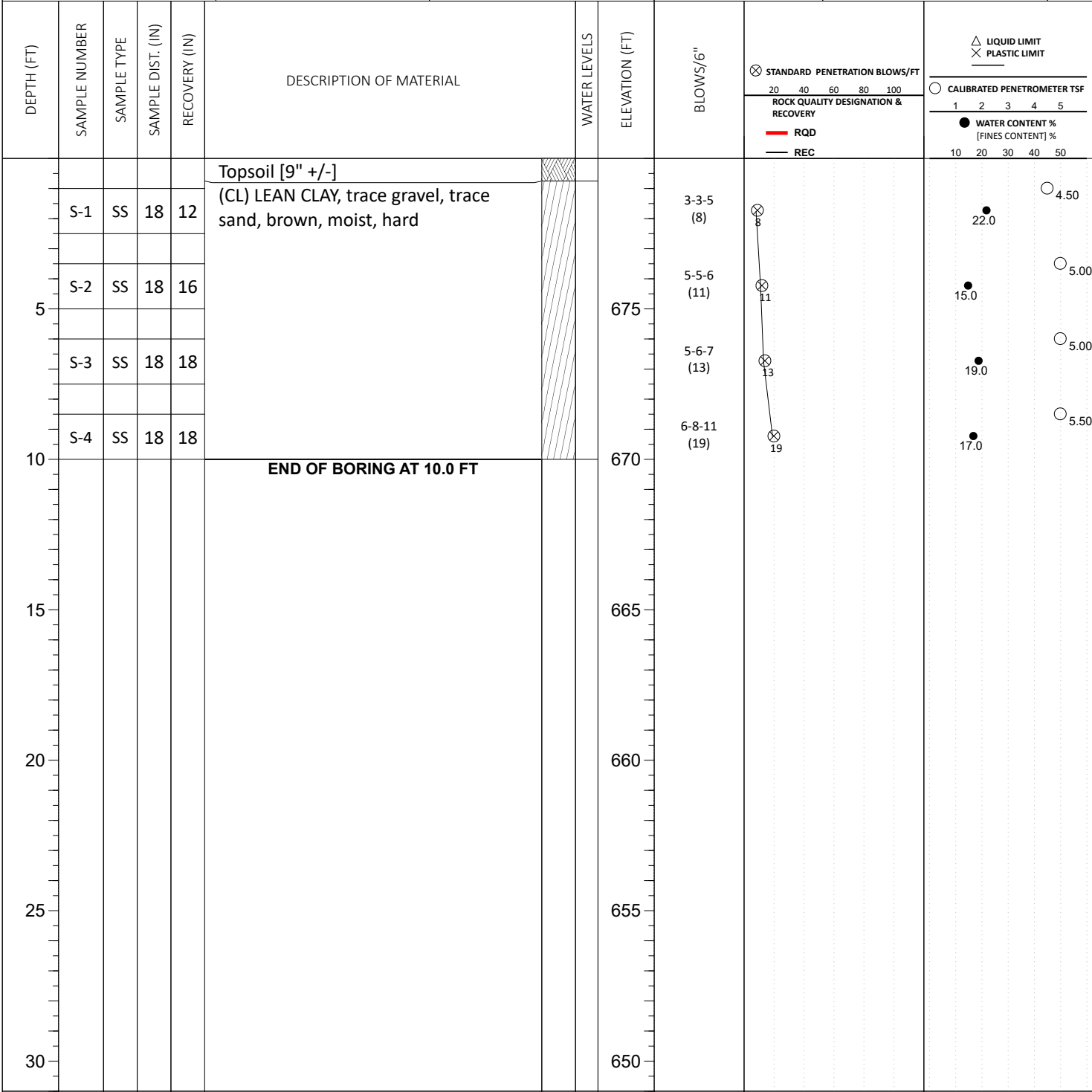
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

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∇ WL (Seasonal High Water)		EQUIPMENT:	Truck	DRILLING METHOD: CFA
∇ WL (Stabilized)		LOGGED BY:	PW2	

GEOTECHNICAL BOREHOLE LOG

CLIENT: Village of Villa Park	PROJECT NO.: 16:14506	BORING NO.: B-09	SHEET: 1 of 1	
PROJECT NAME: Villa Park Lions Community Center	DRILLER/CONTRACTOR: I.E. Xploration			

SITE LOCATION: 320 East Wildwood Avenue, Villa Park, Illinois 60181			LOSS OF CIRCULATION 	
NORTHING: 4350301.1	EASTING: 1260834.9	STATION:	SURFACE ELEVATION: 680.00	BOTTOM OF CASING



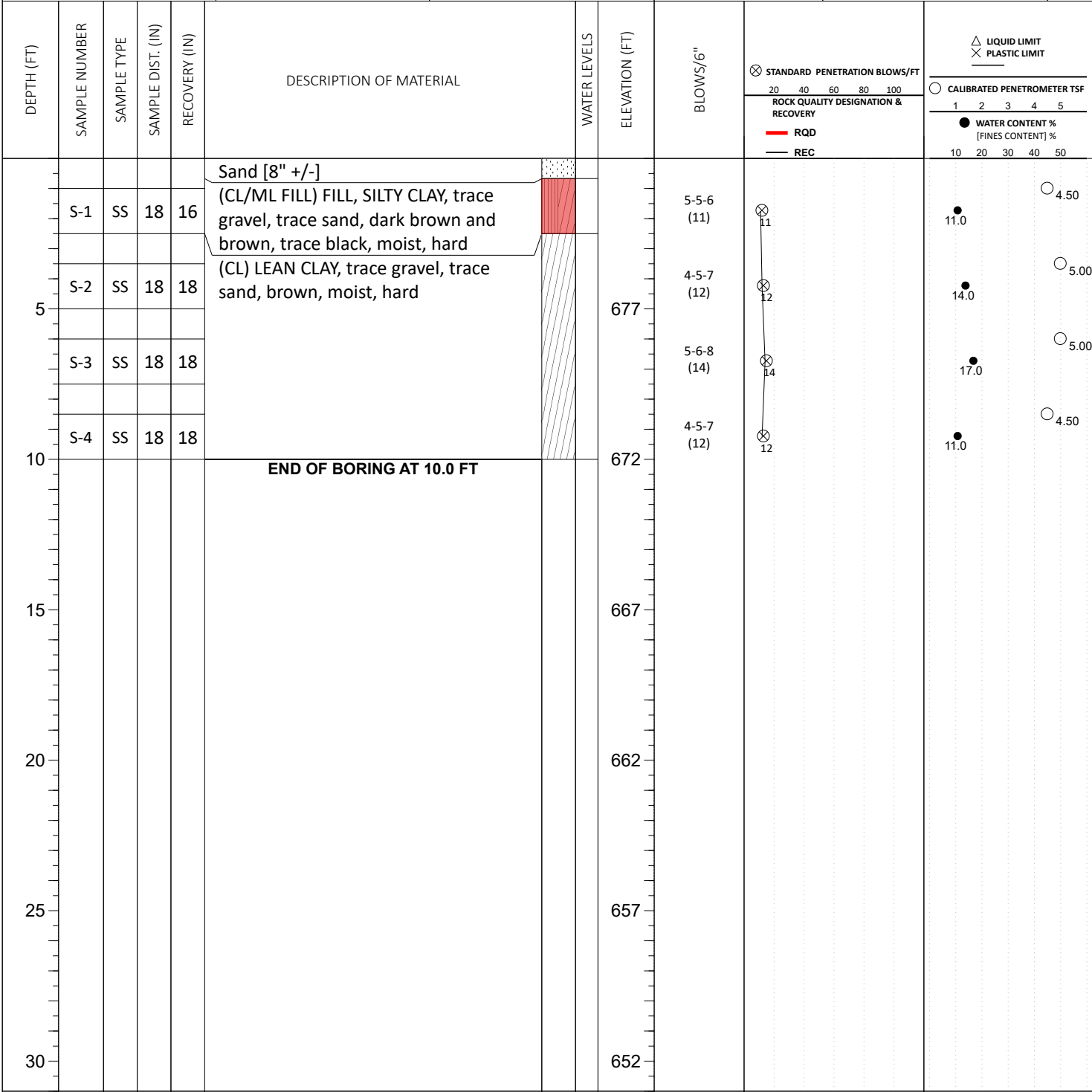
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

<input checked="" type="checkbox"/> WL (First Encountered)	Dry	BORING STARTED:	Aug 11 2022	CAVE IN DEPTH:
<input checked="" type="checkbox"/> WL (Completion)	Dry	BORING COMPLETED:	Aug 11 2022	HAMMER TYPE: Automatic
<input checked="" type="checkbox"/> WL (Seasonal High Water)		EQUIPMENT:	LOGGED BY:	DRILLING METHOD: CFA
<input checked="" type="checkbox"/> WL (Stabilized)		Truck	PW2	

GEOTECHNICAL BOREHOLE LOG

SITE LOCATION:
320 East Wildwood Avenue, Villa Park, Illinois 60181

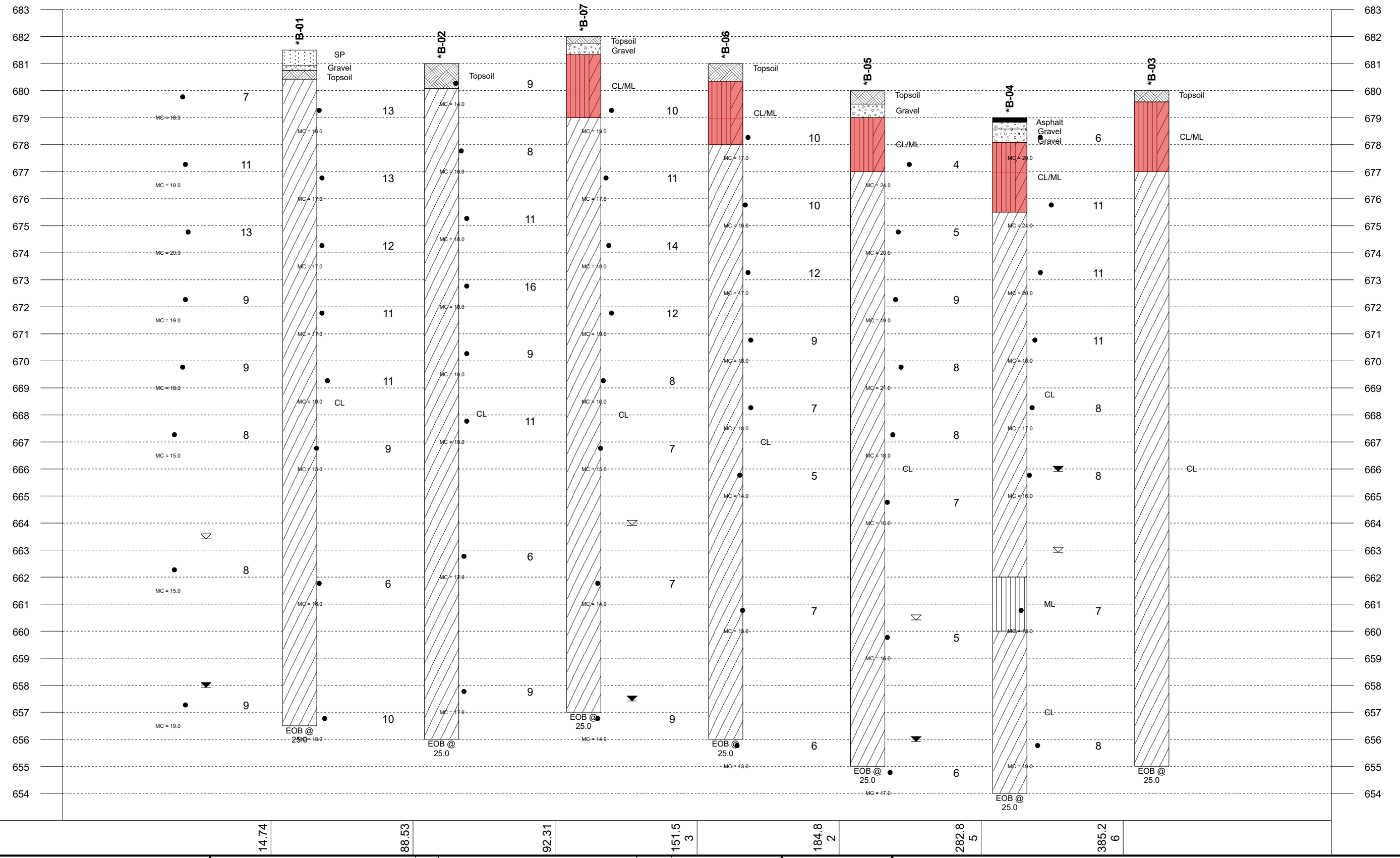
NORTHING: 4350515.5	EASTING: 1260842.8	STATION:	SURFACE ELEVATION: 682.00	LOSS OF CIRCULATION
				BOTTOM OF CASING



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

<input checked="" type="checkbox"/> WL (First Encountered)	Dry	BORING STARTED: Aug 11 2022	CAVE IN DEPTH:
<input checked="" type="checkbox"/> WL (Completion)	Dry	BORING COMPLETED: Aug 11 2022	HAMMER TYPE: Automatic
<input checked="" type="checkbox"/> WL (Seasonal High Water)		EQUIPMENT: Truck	LOGGED BY: PW2
<input checked="" type="checkbox"/> WL (Stabilized)			DRILLING METHOD: CFA

GEOTECHNICAL BOREHOLE LOG



Legend Key

- Topsoil
- Gravel or Conglo...
1
- Poorly Graded SAND
- SILTY CLAY
- Lean CLAY
- Asphalt
- SILT

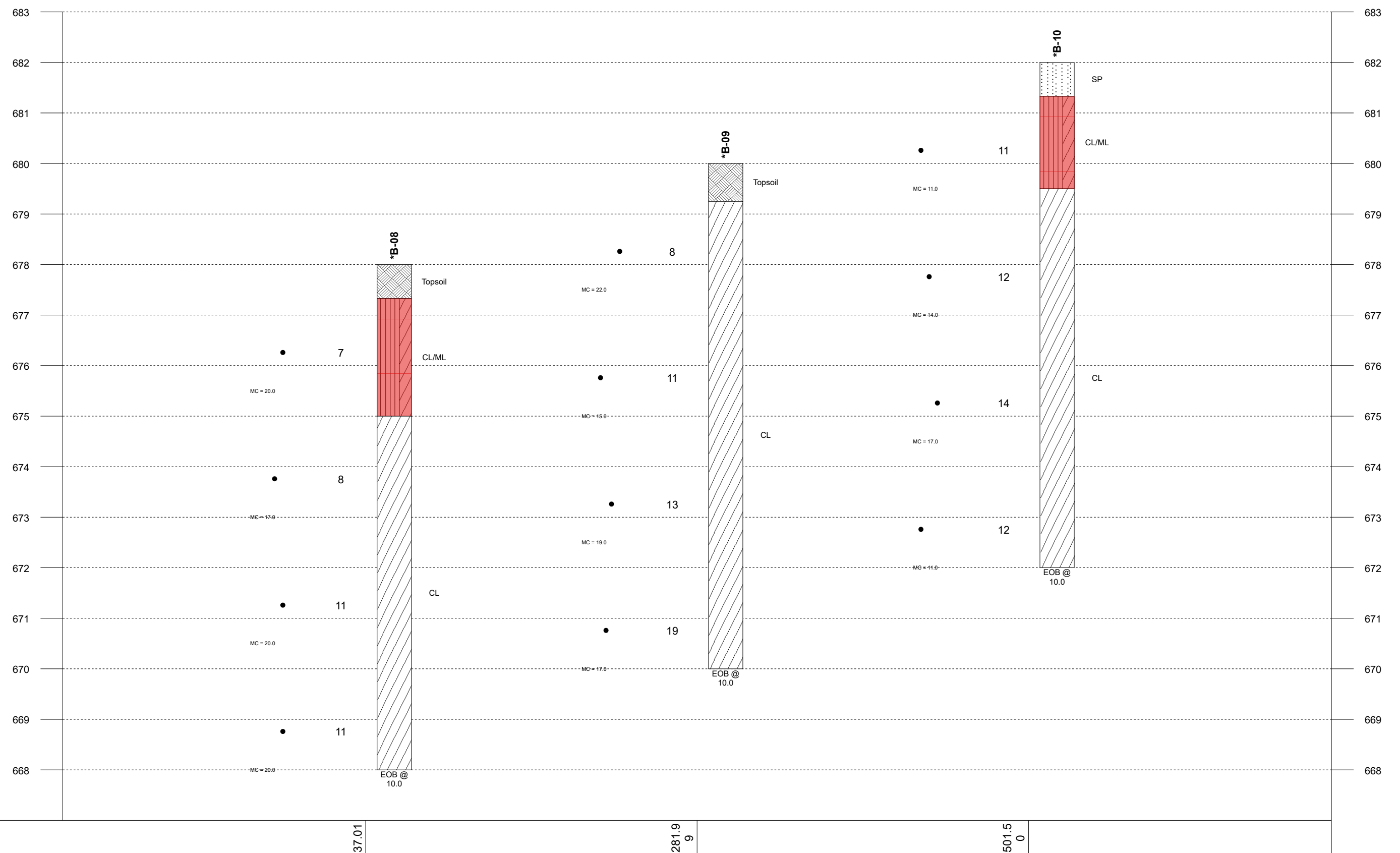
Notes:
 1- EOB: END OF BORING AR: AUGER REFUSAL SR: SAMPLER REFUSAL.
 2- THE NUMBER BELOW THE STRIPS IS THE DISTANCE ALONG THE BASELINE.
 3- SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
 4- STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).

Plastic Limit	Water Content	Liquid Limit
X	●	△
[FINES CONTENT%]		
	BOTTOM OF CASING	
	LOSS OF CIRCULATION	
	WL (First Encountered)	
	WL (Completion)	
	WL (Estimated Seasonal High Water)	
	WL (Stabilized)	

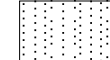


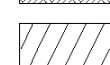
	Fill
	Possible Fill
	Probable Fill
	Rock



GENERALIZED SUBSURFACE SOIL PROFILE Section line 1	
Villa Park Lions Community Center	
Village of Villa Park	
320 East Wildwood Avenue, Villa Park, Illinois 60181	
Project No: 16:14506	Date: 08/29/2022



Legend Key

-  Poorly Graded SAND
-  SILTY CLAY
-  Topsoil
-  Lean CLAY

Notes:
 1- EOB: END OF BORING AR: AUGER REFUSAL SR: SAMPLER REFUSAL.
 2- THE NUMBER BELOW THE STRIPS IS THE DISTANCE ALONG THE BASELINE.
 3- SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
 4- STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).

Plastic Limit	Water Content	Liquid Limit	▽ WL (First Encountered)	 Fill
X	●	△	▼ WL (Completion)	 Possible Fill
[FINES CONTENT%]			▽ WL (Estimated Seasonal High Water)	 Probable Fill
 BOTTOM OF CASING			▽ WL (Stabilized)	 Rock
 LOSS OF CIRCULATION				



GENERALIZED SUBSURFACE SOIL PROFILE Section line 2
(Parking Lot Borings)

Villa Park Lions Community Center
 Village of Villa Park
 320 East Wildwood Avenue, Villa Park, Illinois 60181

Project No: 16:14506 Date: 08/19/2022

REFERENCE NOTES FOR BORING LOGS

MATERIAL ^{1,2}	
	ASPHALT
	CONCRETE
	GRAVEL
	TOPSOIL
	VOID
	BRICK
	AGGREGATE BASE COURSE
	GW WELL-GRADED GRAVEL gravel-sand mixtures, little or no fines
	GP POORLY-GRADED GRAVEL gravel-sand mixtures, little or no fines
	GM SILTY GRAVEL gravel-sand-silt mixtures
	GC CLAYEY GRAVEL gravel-sand-clay mixtures
	SW WELL-GRADED SAND gravelly sand, little or no fines
	SP POORLY-GRADED SAND gravelly sand, little or no fines
	SM SILTY SAND sand-silt mixtures
	SC CLAYEY SAND sand-clay mixtures
	ML SILT non-plastic to medium plasticity
	MH ELASTIC SILT high plasticity
	CL LEAN CLAY low to medium plasticity
	CH FAT CLAY high plasticity
	OL ORGANIC SILT or CLAY non-plastic to low plasticity
	OH ORGANIC SILT or CLAY high plasticity
	PT PEAT highly organic soils

DRILLING SAMPLING SYMBOLS & ABBREVIATIONS			
SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation %
HSA	Hollow Stem Auger		

PARTICLE SIZE IDENTIFICATION		
DESIGNATION	PARTICLE SIZES	
Boulders	12 inches (300 mm) or larger	
Cobbles	3 inches to 12 inches (75 mm to 300 mm)	
Gravel:	Coarse	¾ inch to 3 inches (19 mm to 75 mm)
	Fine	4.75 mm to 19 mm (No. 4 sieve to ¾ inch)
Sand:	Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
	Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
	Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")	<0.074 mm (smaller than a No. 200 sieve)	

COHESIVE SILTS & CLAYS		
UNCONFINED COMPRESSIVE STRENGTH, QP ⁴	SPT ⁵ (BPF)	CONSISTENCY ⁷ (COHESIVE)
<0.25	<2	Very Soft
0.25 - <0.50	3 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

RELATIVE AMOUNT ⁷	COARSE GRAINED (%) ⁸	FINE GRAINED (%) ⁸
Trace	≤5	≤5
With	10 - 20	10 - 25
Adjective (ex: "Silty")	25 - 45	30 - 45

GRAVELS, SANDS & NON-COHESIVE SILTS	
SPT ⁵	DENSITY
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

WATER LEVELS ⁶	
	WL (First Encountered)
	WL (Completion)
	WL (Seasonal High Water)
	WL (Stabilized)

FILL AND ROCK			
FILL	POSSIBLE FILL	PROBABLE FILL	ROCK

¹Classifications and symbols per ASTM D 2488-17 (Visual-Manual Procedure) unless noted otherwise.

²To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.

³Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-FILL)].

⁴Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).

⁵Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf). SPT correlations per 7.4.2 Method B and need to be corrected if using an auto hammer.

⁶The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.

⁷Minor deviation from ASTM D 2488-17 Note 14.

⁸Percentages are estimated to the nearest 5% per ASTM D 2488-17.



SUBSURFACE EXPLORATION PROCEDURE: STANDARD PENETRATION TESTING (SPT)

ASTM D 1586

Split-Barrel (Split-Spoon) Sampling

Standard Penetration Testing, or **SPT**, is the most frequently used subsurface exploration test performed worldwide. This test provides samples for identification purposes as well as a measure of penetration resistance, or N-Value. The N-Value, or blow counts, when corrected and correlated, can approximate engineering properties of soils used for geotechnical design and engineering purposes.

SPT Procedure:

- Involves driving a 2-inch outside diameter hollow tube (split-spoon) into the ground by dropping a 140-lb hammer a height of 30 inches at desired depth
- Recording the number of hammer blows required to drive the split-spoon a distance of 12 inches (in 3 or 4 Increments of 6 inches each)
- Auger is advanced* and an additional SPT is performed
- One SPT test is typically performed every 2½ to 5 feet.
- Obtain a 1⅜-inch diameter soil sample



**Drilling Methods May Vary – The predominate drilling methods used for SPT are open hole fluid rotary drilling and hollow-stem auger drilling.*



LABORATORY PROCEDURES:

Index Testing

Moisture content determination was performed on select fine-grained soil samples in accordance with ASTM D 2216.

Calibrated hand penetrometer tests (Qp) were performed on select cohesive soil samples. In the hand penetrometer test, the unconfined compressive strength of a soil sample is estimated, to a maximum of 4.5 or 6 tons per square foot (tsf), depending on the penetrometer model, by measuring the resistance of a soil sample to penetration by a small, calibrated, spring-loaded cylinder.

Atterberg limits determination was performed on select fine-grained soil samples in accordance with ASTM D 4319. The Atterberg limits are a basic measure of the critical water contents of a fine-grained soil: its **liquid limit**, **plastic limit**, and **shrinkage limit**. Depending on its water content, a soil may appear in one of four states: solid, semi-solid, plastic and liquid. In each state, the consistency and behavior of a soil is different and consequently so are its engineering properties. Atterberg limits can also be used to help distinguish between silt and clay, and to distinguish between different types of silts and clays.

Particle size distribution, also referred to as gradation or sieve analysis, refers to the proportions by dry mass of a soil particles distributed over specified particle-size ranges. The particle size distribution is used to help classify soils for engineering purposes. Particle size distribution determination was performed on select fine-grained soil samples in accordance with ASTM D 421, D 422 and/or D 1140.

A **loss on ignition (LOI)** test is used to estimate the organic content of the soil. In the LOI test a dry sample is heated to 440° C to burn off organic matter within the sample. The lost weight is compared to the initial dry weight to estimate the percentage of organics in the material. LOI determination was performed in accordance with ASTM D 2974.

APPENDIX C - Supplemental Report Documents

Important Information about This Geotechnical-Engineering Report

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer

will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the “Findings” Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site’s subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report’s Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals’ misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals’ plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note*

conspicuously that you’ve included the material for information purposes only. To avoid misunderstanding, you may also want to note that “informational purposes” means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled “limitations,” many of these provisions indicate where geotechnical engineers’ responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a “phase-one” or “phase-two” environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer’s services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer’s recommendations will not of itself be sufficient to prevent moisture infiltration.* **Confront the risk of moisture infiltration** by including building-envelope or mold specialists on the design team. **Geotechnical engineers are not building-envelope or mold specialists.**



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