AMERICAN ENGINEERING TESTING, INC.

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REPORT OF GEOTECHNICAL EXPLORATION AND REVIEW

Proposed Guardian Pest Solutions Buildings

Halvor Lane and US Highway 2
Superior, Wisconsin

AET Project No. 07-06007

Date:

June 6, 2014

Prepared for:

Guardian Pest Solutions
701 East 4th Street
Duluth, Minnesota 55805

www.amengtest.com

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June 6, 2014

Mr. Jason Wick, President
Guardian Pest Solutions
701 East 4th Street
Duluth, Minnesota 55805

RE: Report of Geotechnical Exploration and Review
Proposed Guardian Pest Solutions Buildings
Halvor Lane and US Highway 2
Superior, Wisconsin
AET Project No. 07-06007

Dear Mr. Wick:

We are pleased to present the results of our subsurface exploration program and geotechnical review for your new business buildings. These services were performed following your acceptance of our proposal to you dated April 25, 2014.

We are submitting two bound copies and one unbound copy of this report to you. This report is the instrument of service defined in our proposal.

We have enjoyed working with you on this phase of the project. Please contact us if you have questions about this report or require further assistance.

Sincerely,

American Engineering Testing, Inc.

Taryn J. Kuusisto, EIT
Staff Engineer II

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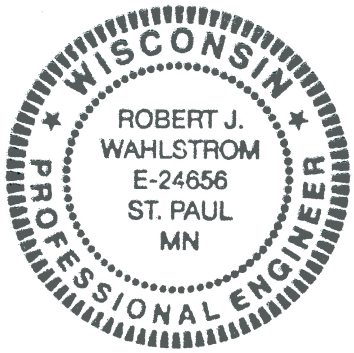

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1.0 INTRODUCTION

Guardian Pest Solutions is planning the construction of several new business buildings in Winter Business Park in Superior, Wisconsin. To assist with planning and design, Mr. Jason Wick, President, requested American Engineering Testing, Inc. (AET) to conduct a subsurface exploration program at the site and perform a geotechnical engineering review for the project. This report presents the results of the above services, and provides our engineering recommendations based on this data.

2.0 SCOPE OF SERVICES

AET's services were performed according to our proposal to Guardian Pest Solutions dated April 25, 2014, and authorized by Mr. Wick on April 28, 2014. The authorized scope consists:

- Performing arranging for the location of existing public underground utilities through Wisconsin's Diggers Hotline service;
- Performing eight standard penetration test (SPT) borings in general accordance with ASTM designation D 1586;
- Advancing six of the SPT borings to a maximum depth of 16 feet and the other two borings to 11 feet;
- Screening soil samples obtained from the SPT borings for organic vapors with a field photoionization detector (PID);
- Performing visual-manual classification and limited laboratory testing of the recovered soil samples according to ASTM: D2487 and D2488; and
- Preparing a geotechnical engineering report based on our engineering review of the test boring data.

3.0 PROJECT INFORMATION

The project will include the construction of an office and warehouse building on Parcel I in Winter Business Park. We understand the office building will be a single-story, slab-on-grade structure covering approximately 6,000 square feet, with a planned future addition to the east. There are also plans for a future building to be located to the east of the office building. The warehouse will be a single-story, slab-on-grade structure covering approximately 12,000 square feet, with a planned future addition to the east. We assume the planned future building additions and added building will also be single-story, slab-on-grade structures.

There will be a parking lot to the south of the office building and to the east of the warehouse, with a drive lane along the north and east edge of the property.

Our foundation design assumptions include a minimum factor of safety of 3 with respect to localized shear or base failure of the bearing soils. We assume the structures will be able to tolerate total settlements up to 1 inch, and differential settlements over a 30 foot distance up to ½ inch for footings of approximately equal size and load.

This information represents our understanding of the proposed construction. This information is an integral part of our engineering review. It is important that we be contacted if there are changes from that described so that we can evaluate whether modifications to our recommendations are appropriate.

4.0 SUBSURFACE EXPLORATION AND TESTING

4.1 Field Exploration Program

Our subsurface exploration program for the project consisted of performing eight standard penetration testing (SPT) borings on May 13 and 14, 2014. The approximate boring locations are

shown on Figure 1 in Appendix A. The number and locations of the borings were requested by Guardian Pest Solutions. AET recommended the boring depths based on our understanding of the project. AET marked the boring locations in the field based using the dimensioned site plan provided by Guardian Pest Solutions. Surface elevations at the boring locations were measured in the field by AET personnel using a reference elevation of 100.0 feet assigned to the top nut of the fire hydrant located at the southwest corner of the site, on the south side of Halvor Lane.

Prior to performing the test borings, we contacted Wisconsin Diggers Hotline to locate public underground utilities at the site. We advanced the borings using 3¼-inch inside diameter hollow-stem augers. Please refer to Appendix A for details on the drilling and sampling methods, the classification methods, and the water level measurement details.

The boring logs are found in Appendix A and contain information concerning soil layering, geologic description, moisture condition, and USCS classifications. Relative density or consistency is also noted for the natural soils, which are based on the standard penetration resistance (N-value).

4.2 Soil Classification

We visually-manually classified the samples based on texture and plasticity according to the Unified Soil Classification System (USCS) (ASTM D2488). We also performed hand penetrometer tests on the clay samples from the borings. Data sheets describing the USCS System, the descriptive terminology, and the symbols used on the boring logs are included in Appendix A.

5.0 SITE CONDITIONS

5.1 Surface Observations

The site is currently grass covered. Based on our boring elevations, the site is relatively flat.

5.2 Subsurface Soils/Geology

5.2.1 Building Borings

Test borings B-01 through B-06 were performed for the proposed and future buildings. The general subsurface profile indicated by the test boring logs is 1 to 4½ feet of existing fill, overlying lacustrine deposits. The existing fill consists of organic to slightly organic fat clay, silt, and organic lean clay. The upper 7.5 to 13 feet of the lacustrine deposits is composed of firm to stiff fat clay. Layers of medium dense silty sand and sand are present directly below the fat clay and these sand layers extend to the termination depth of the test borings.

5.2.2 Pavement Borings

Test borings B-07 and B-08 were advanced in the areas of the proposed parking lot. These borings encountered about 1 to 2 feet of fill or topsoil at the surface. The topsoil consists of organic clay, and the fill consists of a mixture of fat clay, silty sand and organic clay. The underlying soil consists of lacustrine deposits composed of firm to stiff fat clay with laminations of gray silt.

5.3 Groundwater

We did not encounter groundwater in the borings prior to backfilling the boreholes. Groundwater levels, hydrostatic and perched, will vary in elevation seasonally and annually depending on local precipitation, infiltration, and runoff. The presence or absence of groundwater will depend in part on precipitation, snow melt, and infiltration prior to construction.

5.4 Environmental Screening

All of the soil boring samples were screened with a field photoionization detector (PID) to document the presence of organic vapors that can indicate potential contamination. Also soil samples were observed for any staining or odors indicative of potential contamination. The sand in boring B-05 had PID readings of 15, 187, and 441 parts per million (ppm) and the fat clay in boring B-07 had PID readings of 2 and 8. Samples from the remaining borings had no detection of organic vapors above background levels.

Selected samples exhibiting elevated PID readings were collected and submitted to a laboratory for chemical analysis of organic compounds. The results of this analysis are presented in a separate report.

6.0 RECOMMENDATIONS

6.1 Project Approach

Based on the subsurface conditions found in our borings and on our understanding of the project, it is our opinion that the proposed buildings can be supported on conventional spread-footing foundations after proper site preparation has taken place. Site preparation should include the complete removal of the existing fill and other unsuitable soils that may be encountered within building areas. Subcut areas where soft or disturbed soils have been removed should be replaced with compacted engineered fill. Further details of our recommendations are presented below.

6.2 Site Preparation

6.2.1 Excavation

To prepare the building areas for foundation and slab support, we recommend removing existing fill, topsoil, and other unsuitable soils that may be encountered in these areas. The following table provides estimated minimum depths of subcutting at the test boring locations to remove

unsuitable soils in floor slab areas.

Table 1. Minimum Subcut Depths

Test Boring	Ground Surface Elevation (feet)	Minimum Subcut Depth (feet)	Subcut Elevation (feet)
B-01	94.9	1.0	93.9
B-02	95.1	4.0	91.1
B-03	96.1	4.5	91.6
B-04	95.0	3.5	91.5
B-05	94.3	2.0	92.3
B-06	95.2	1.5	93.7

The actual depths of subcutting required will vary beyond the boring locations. A geotechnical engineer should perform observations during construction to determine actual subcutting requirements, which could be deeper or shallower than anticipated.

If the subcutting extends below the proposed foundation grade, the excavation bottom and resultant engineered fill system must be oversized laterally beyond the planned outside edges of the foundations to properly support the lateral loads exerted by that foundation. This lateral extension of engineered fill should at least be equal to the vertical depth of fill needed to attain foundation grade at that location (i.e., 1:1 lateral oversize).

We recommend the final 2 feet of the excavations be removed with a backhoe having a smooth-edge bucket (rather than a toothed bucket). The purpose of this is to avoid tearing and disturbing the base soils.

Where fat clay is exposed at the bottom of any excavation, the contractor should not permit the soil to dry below its natural moisture content before placing new fill or concrete; also any excess moisture that forms from precipitation should be removed. If fat clay is allowed to dry, it will shrink, and then swell upon regaining moisture after being covered; conversely if fat clay becomes wet during construction it can swell and then shrink upon losing moisture at a later time. Swelling pressures generated by fat clay can be sufficient to heave footings, slabs, and pavements. We recommend the moisture sensitive condition of the fat clay during construction at the site be discussed with the general contractor and the excavator at a pre-construction meeting.

6.2.2 Fill Placement and Compaction

For new fill supporting the building footings and floor slabs, we recommend using an engineered fill consisting of non-frozen, soil or granular material free of organics, boulders, rubble, and debris. Any fill that becomes frozen should be removed and replaced with unfrozen engineered fill. All engineered fill should be placed in thin lifts compacted to a minimum density of 95% of the Modified Proctor dry density.

The existing fill and clay on the project site that is void of organics can be re-used as engineered fill provided these soils have a moisture content suitable for meeting compaction requirements. Moisture conditioning will likely be required to obtain sufficient compaction for excavated clayey soils used as engineered fill. Conditioning of clayey soils to reduce soil moisture is generally difficult under wet and/or cool climatic conditions, which often prevail in the Superior area.

6.2.3 Foundation Design

The single-story buildings and additions proposed for the project site can be supported on conventional spread footings bearing on undisturbed stiff naturally-occurring fat clay (CH), or on

engineered fill placed directly on these firm to stiff natural soils. We recommend that continuous strip footings have a minimum width of 20 inches and that column pads have a minimum dimension of 3 feet.

We recommend that perimeter foundations for heated buildings bear at least 6 feet below final exterior grade. Footings around unheated buildings or areas should extend at least 7 feet below final grade. Interior column pad footings for heated structures can be set 18 to 24 inches below the top of floor slab.

Based on the subsurface conditions we encountered, and provided our recommendations are followed, it is our opinion the foundations for the currently planned buildings can be designed for a net maximum allowable soil bearing pressure of 3,000 psf. For the proposed future building, we recommend a net maximum allowable soil bearing pressure of 2,000 psf be used for the design of shallow foundations. It is our judgment that these design pressures will provide a factor of safety of at least 3 against bearing capacity failure of the soil. With this design we estimate maximum total building settlement of 1 inch or less, and differential settlements over a 30-foot distance up to 1/2 inch, if the bearing soils are not soft, wet, disturbed, or frozen at the time of construction.

6.2.4 Floor Slab Design

Interior backfill in underslab utility trenches and in footing trenches should be per our recommendations presented in Section 6.2.2 of this report.

Based on a subgrade prepared as discussed in Section 6.2, a modulus of subgrade reaction of 150 pounds per cubic inch can be used to design the floor slab thickness and reinforcement. A higher

modulus value can be used where the slab is constructed on engineered fill consisting of sand having no more than 8% material passing the #200 sieve size.

We recommend that a vapor retarder be placed under the floor slabs; the purpose of a vapor retarder is to reduce the potential for the upward migration of water vapor from the soil into and through the concrete slab. Water vapor migrating upward through the slab can damage floor coverings such as the carpeting, wood, or paint/sealers and contribute to excess humidity and microbial growth in the building. Various methods of vapor retarder construction are described in Part 2, Section 302 of the American Concrete Institute *Manual of Concrete Practice*.

The slab-on-grade should be designed and constructed following the recommendations of the Portland Cement Association and the American Concrete Institute. The slabs should have construction joints/control joints at spacings recommended by the Portland Cement Association and the American Concrete Institute to mitigate, but not eliminate, slab curling and cracking. The floor slabs should be cast independent of the foundation walls of the building to allow relative movement of the slabs and footings to occur without causing excessive distress to the structure.

6.2.5 Exterior Slabs and Sidewalks

Where exterior slabs and sidewalks abut the building, we recommend that the clayey soils be subcut to a depth of 4 feet below bottom of slab/sidewalk and replaced with non-frost susceptible (NFS) granular fill. This NFS fill subbase layer should consist of sand, or a sand and gravel mix, having less than 5% passing the No. 200 sieve. The purpose of this is to reduce the potential for the characteristic heave that can occur when clayey soils freeze each winter. This fill should be compacted to at least 95% of the maximum Modified Proctor dry density. If this NFS fill is used, we further recommend placing drain pipes at the base of the NFS fill zone to prevent the buildup of moisture in the fill from infiltrating water. The pipes should be connected to a suitable

discharge location (such as the storm sewers) to remove any water entering the fill layer.

6.3 Bituminous Pavement Recommendations

6.3.1 Pavement Subgrade Preparation

We recommend that the existing surficial organic fill, and wet/soft soils be removed from below pavement areas. The clay subgrade soils should be proof rolled with a loaded dump truck under the direction of a geotechnical engineer or engineering technician; all soft areas that rut or deflect 1-inch or more should be corrected by either subcutting the soft soils and replacing it with engineered fill, or by scarification, drying, and recompaction of the soft soils before placing any new fill.

Where fill is needed in pavement areas, it should consist of non-organic clayey soils or WisDOT 305 dense-graded base course, placed in loose lifts 8 to 10 inches thick, with each lift mechanically compacted to at least 95% of the maximum Modified Proctor dry density. Open-graded granular fill with a low percent passing the No. 200 sieve should not be used due to the potential for the accumulation of water above the relatively impermeable underlying clayey/silty subgrade.

We recommend that a geosynthetic separation/stabilization fabric be placed between the clayey subgrade soils and the overlying dense-graded base course. The fabric should conform to the requirements of WisDOT 645, Type SAS.

The dense-graded base course should consist of WisDOT 305, 1-1/4 inch gradation. The base course should be placed directly over the geosynthetic fabric and prepared subgrade, and should be compacted to at least 95% of the maximum Modified Proctor Density.

With subgrade preparation as described above, the project civil engineer may design the pavement using a California Bearing Ratio (CBR) value of 5.

6.3.2 Pavement Maintenance

Regardless of the subgrade preparation and design, the owner should expect that cracks will appear in the bituminous pavement within 1 to 3 years after construction due to thermal expansion and contraction, and due to the loss of volatiles from the bituminous cement. These cracks cannot be avoided, and they should be cleaned annually and filled with a hot bituminous sealant. Within three to five years after construction, cracks and depressions may appear in heavily traveled areas, such as drive aisles and entry drives. Such areas should be cut out and repaired expeditiously to extend the pavement life. Periodically during the pavement life, the pavement should be assessed for application of a seal coat of hot bituminous and rock chips.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Groundwater

Based on our experience in this area and groundwater measurements on the date of drilling, it is possible that perched groundwater could be encountered. Since the clayey soils at this site have very low permeability characteristics, it is possible that groundwater seepage could take hours or days to enter excavations.

If surface runoff or groundwater enters the excavations, it should be promptly pumped out before compacted fill or concrete are placed. The contractor should not be allowed to place fill or concrete into standing water, or over softened soils in an attempt to displace these materials. This technique can result in trapping softened soils under footings or utilities, resulting in excessive post-construction settlement, even if the softened zone is only a few inches thick.

7.2 Disturbance of Soils

The soils on this site can be easily disturbed under construction traffic, especially if the soils are wet. If soils become disturbed, they should be subcut to the underlying undisturbed soils. The subcut soils can then be dried and re-compacted back in place, or they should be removed and replaced with drier imported fill.

7.3 Excavation Backsloping

If the excavation slopes on this project are not retained, the excavations should have allowable slopes in accordance with *OSHA Regulations (Standards 29 CFR), Part 1926, Subpart P, "Excavations"* (can be found on www.osha.gov). Even with the required OSHA sloping, water seepage or surface runoff can potentially induce sideslope erosion or running which could require slope maintenance.

7.4 Observation and Testing

The recommendations in this report are based on the subsurface conditions found at our test boring locations. Since the soil conditions can be expected to vary between the boring locations, we recommend on-site observation by a geotechnical engineer/technician during construction to evaluate these potential changes. Soil density testing should also be performed on new fill in order to document that project specifications for compaction have been met.

8.0 GENERAL QUALIFICATIONS

This report has been prepared based on the soil and groundwater conditions found in our borings, and on the project design as described in the Introduction of this report. If there are any changes in size, location, finished floor elevation, structural loads, use or nature of the proposed buildings from those outlined in the Introduction of this report, or if our understanding of the project is incomplete or incorrect, it is necessary that you contact us so we can review our

recommendations to determine if they remain applicable. If we are not given the opportunity to review any changes in the building design, then the recommendations in this report will not be valid.

We determined the soil and groundwater conditions at six locations for the proposed buildings and two locations for proposed pavement. The subsurface conditions we describe and discuss in this report are pertinent only at the borings and under the environment of our field exploration. Variations in the subsurface soils were found, and it is likely that additional variations exist that cannot be determined from our borings or our site observations. These variations would not become apparent until excavation is started. No warranty, express or implied, is presented in this report with respect to the soil and groundwater conditions on this site.

9.0 ASTM STANDARDS

When we refer to an ASTM Standard in this report, we mean that our services were performed in general accordance with that standard. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

10.0 STANDARD OF CARE

Within the limitations of the work scope, budget, and schedule, we have endeavored to provide our services in accordance with generally accepted geotechnical engineering practices at this time and location. Other than this, no warranty, express or implied, is intended.

Appendix A

AET Project No. 07-06007

Geotechnical Field Exploration and Testing
Boring Log Notes
Unified Soil Classification System
Figure 1 – Boring Locations
Subsurface Boring Logs

Appendix A
Geotechnical Field Exploration and Testing
AET Project No. 07-06007

A.1 FIELD EXPLORATION

The subsurface conditions at the site were explored by drilling and sampling eight standard penetration test borings. The locations of the borings appear on Figure 1, preceding the Subsurface Boring Logs in Appendix A.

A.2 SAMPLING METHODS

A.2.1 Split-Spoon Samples (SS)

Standard penetration (split-spoon) samples were collected in general accordance with ASTM: D1586. The ASTM test method consists of driving a 2-inch O.D. split-barrel sampler into the in-situ soil with a 140-pound hammer dropped from a height of 30 inches. The sampler is driven a total of 18 or 24 inches into the soil. After an initial set of 6 inches, the number of hammer blows to drive the sampler the next 12 inches is known as the standard penetration resistance or N-value.

A.2.2 Disturbed Samples (DS)/Spin-up Samples (SU)

Sample types described as "DS" or "SU" on the boring logs are disturbed samples, which are taken from the flights of the auger. Because the auger disturbs the samples, possible soil layering and contact depths should be considered approximate.

A.2.3 Sampling Limitations

Unless actually observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders, and other large objects generally cannot be recovered from test borings, and they may be present in the ground even if they are not noted on the boring logs.

Determining the thickness of "topsoil" layers is usually limited, due to variations in topsoil definition, sample recovery, and other factors. Visual-manual description often relies on color for determination, and transitioning changes can account for significant variation in thickness judgment. Accordingly, the topsoil thickness presented on the logs should not be the sole basis for calculating topsoil stripping depths and volumes. If more accurate information is needed relating to thickness and topsoil quality definition, alternate methods of sample retrieval and testing should be employed.

A.3 CLASSIFICATION METHODS

Soil descriptions shown on the boring logs are based on the Unified Soil Classification System (USCS). The USCS is described in ASTM: D2487 and D2488. Where laboratory classification tests (sieve analysis or Atterberg Limits) have been performed, accurate classifications per ASTM: D2487 are possible. Otherwise, soil descriptions shown on the boring logs are visual-manual judgments. Charts are attached which provide information on the USCS, the descriptive terminology, and the symbols used on the boring logs.

The boring logs include descriptions of apparent geology. The geologic depositional origin of each soil layer is interpreted primarily by observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation, and development can sometimes aid this judgment.

A.4 WATER LEVEL MEASUREMENTS

The ground water level measurements are shown at the bottom of the boring logs. The following information appears under "Water Level Measurements" on the logs:

- Date and Time of measurement
- Sampled Depth: lowest depth of soil sampling at the time of measurement
- Casing Depth: depth to bottom of casing or hollow-stem auger at time of measurement
- Cave-in Depth: depth at which measuring tape stops in the borehole
- Water Level: depth in the borehole where free water is encountered
- Drilling Fluid Level: same as Water Level, except that the liquid in the borehole is drilling fluid

The true location of the water table at the boring locations may be different than the water levels measured in the boreholes. This is possible because there are several factors that can affect the water level measurements in the borehole. Some of these factors include: permeability of each soil layer in profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions, and use of borehole casing.

A.5 TEST STANDARD LIMITATIONS

Field and laboratory testing is done in general conformance with the described procedures. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

A.6 SAMPLE STORAGE

Unless notified to do otherwise, we routinely retain representative samples of the soils recovered from the borings for a period of 30 days.

BORING LOG NOTES

DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
B,H,N:	Size of flush-joint casing
CA:	Crew Assistant (initials)
CAS:	Pipe casing, number indicates nominal diameter in inches
CC:	Crew Chief (initials)
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DR:	Driller (initials)
DS:	Disturbed sample from auger flights
FA:	Flight auger; number indicates outside diameter in inches
HA:	Hand auger; number indicates outside diameter
HSA:	Hollow stem auger; number indicates inside diameter in inches
LG:	Field logger (initials)
MC:	Column used to describe moisture condition of samples and for the ground water level symbols
N (BPF):	Standard penetration resistance (N-value) in blows per foot (see notes)
NQ:	NQ wireline core barrel
PQ:	PQ wireline core barrel
RD:	Rotary drilling with fluid and roller or drag bit
REC:	In split-spoon (see notes) and thin-walled tube sampling, the recovered length (in inches) of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered.
REV:	Revert drilling fluid
SS:	Standard split-spoon sampler (steel; 1d" is inside diameter; 2" outside diameter); unless indicated otherwise
SU	Spin-up sample from hollow stem auger
TW:	Thin-walled tube; number indicates inside diameter in inches
WASH:	Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after "falling" through drilling fluid
WH:	Sampler advanced by static weight of drill rod and 140-pound hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
▼:	Water level measured in borehole prior to abandonment
▽:	Interim water level measurement or estimated water level based on sample appearance

TEST SYMBOLS

Symbol	Definition
CONS:	One-dimensional consolidation test
DEN:	Dry density, pcf
DST:	Direct shear test
E:	Pressuremeter Modulus, tsf
HYD:	Hydrometer analysis
LL:	Liquid Limit, %
LP:	Pressuremeter Limit Pressure, tsf
OC:	Organic Content, %
PERM:	Coefficient of permeability (K) test; F - Field; L - Laboratory
PL:	Plastic Limit, %
q_p:	Pocket Penetrometer strength, tsf (approximate)
q_c:	Static cone bearing pressure, tsf
q_u:	Unconfined compressive strength, psf
R:	Electrical Resistivity, ohm-cms
RQD:	Rock Quality Designation of Rock Core, in percent (aggregate length of core pieces 4" or more in length as a percent of total core run)
SA:	Sieve analysis
TRX:	Triaxial compression test
VSR:	Vane shear strength, remoulded (field), psf
VSU:	Vane shear strength, undisturbed (field), psf
WC:	Water content, as percent of dry weight
%-200:	Percent of material finer than #200 sieve

STANDARD PENETRATION TEST NOTES

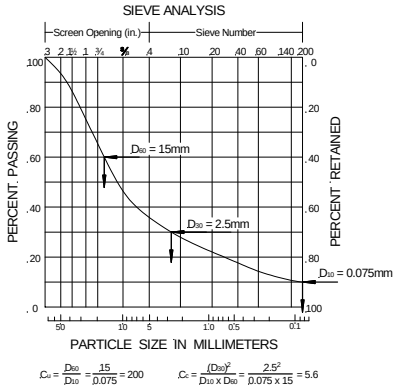
The standard penetration test consists of driving the sampler with a 140 pound hammer and counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM:D1586, the blows for each complete 6" increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash.

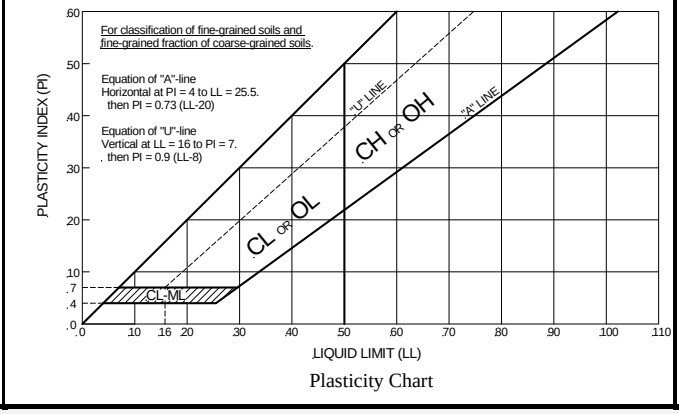
The length of sample recovered, as shown on the "REC" column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6" set (unless partial penetration defined in ASTM:D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18").

UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM Designations: D 2487, D2488

AMERICAN ENGINEERING TESTING, INC.

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification: Group Symbol	Soil Classification: Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	Cu≥4 and 1≤Cc≤3[E]	GW	Well graded gravel[F]
			Cu<4 and/or 1>Cc>3[E]	GP	Poorly graded gravel[F]
		Gravels with Fines more than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	Cu≥6 and 1≤Cc≤3[E]	SW	Well-graded sand[I]
			Cu<6 and 1>Cc>3[E]	SP	Poorly-graded sand[I]
		Sands with Fines more than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve (see Plasticity Chart below)	Silts and Clays Liquid limit less than 50	inorganic	PI>7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI<4 or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried <0.75	OL	Organic clay[K,L,M,N] Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI plots below "A" line	MH	Elastic silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried <0.75	OH	Organic clay[K,L,M,P] Organic silt[K,L,M,Q]
Highly organic soil			Primarily organic matter, dark in color, and organic in odor	PT	Peat[R]





Plasticity Chart

Notes

[A]Based on the material passing the 3-in (75-mm) sieve.

[B]If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C]Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

[D]Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E]$Cu = D_{60} / D_{10}$, $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F]If soil contains ≥15% sand, add "with sand" to group name.

[G]If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H]If fines are organic, add "with organic fines" to group name.

[I]If soil contains ≥15% gravel, add "with gravel" to group name.

[J]If Atterberg limits plot is hatched area, soils is a CL-ML silty clay.

[K]If soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.

[L]If soil contains ≥30% plus No. 200, predominantly sand, add "sandy" to group name.

[M]If soil contains ≥30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N]PI≥4 and plots on or above "A" line.

[O]PI<4 or plots below "A" line.

[P]PI plots on or above "A" line.

[Q]PI plots below "A" line.

[R]Fiber Content description shown below.

ADDITIONAL TERMINOLOGY NOTES USED BY AET FOR SOIL IDENTIFICATION AND DESCRIPTION

Grain Size

Term	Particle Size
Boulders	Over 12"
Cobbles	3" to 12"
Gravel	#4 sieve to 3"
Sand	#200 to #4 sieve
Fines (silt & clay)	Pass #200 sieve

Gravel Percentages

Term	Percent
A Little Gravel	3% - 14%
With Gravel	15% - 29%
Gravelly	30% - 50%

Consistency of Plastic Soils

Term	N-Value, BPF
Very Soft	less than 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very Stiff	16 - 30
Hard	Greater than 30

Relative Density of Non-Plastic Soils

Term	N-Value, BPF
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	Greater than 50

Moisture/Frost Condition

(MC Column)

D (Dry): Absense of moisture, dusty, dry to touch.

M (Moist): Damp, although free water not visible. Soil may still have a high water content (over "optimum").

W (Wet/ Waterbearing): Free water visible intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt.

F (Frozen): Soil frozen

Layering Notes

Laminations: Layers less than ½" thick of differing material or color.

Lenses: Pockets or layers greater than ½" thick of differing material or color.

Fiber Content of Peat

Term	Fiber Content (Visual Estimate)
Fibric Peat:	Greater than 67%
Hemic Peat:	33 – 67%
Sapric Peat:	Less than 33%

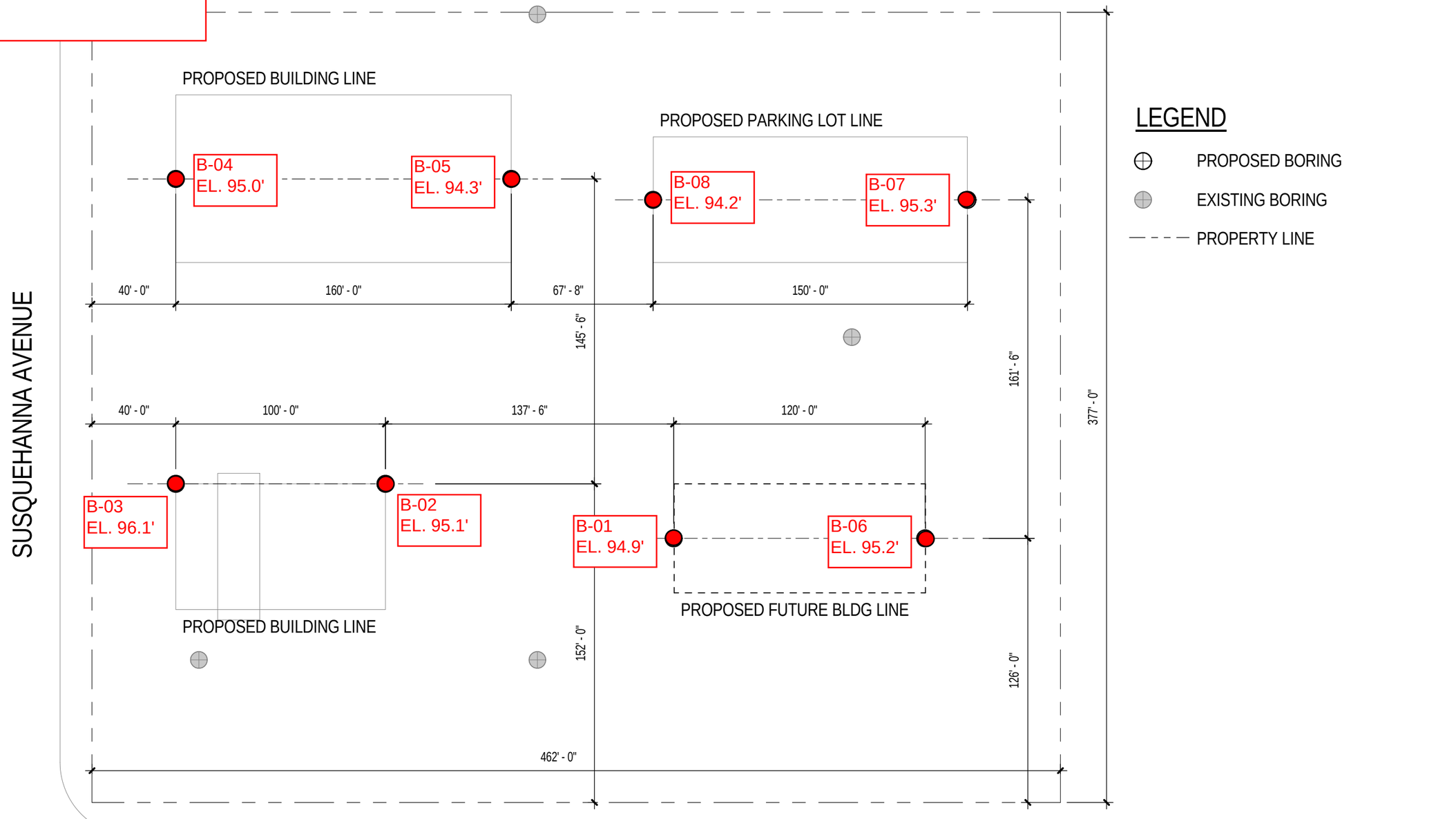
Organic/Roots Description (if no lab tests)

Soils are described as *organic*, if soil is not peat and is judged to have sufficient organic fines content to influence the soil properties. *Slightly organic* used for borderline cases.

With roots: Judged to have sufficient quantity of roots to influence the soil properties.

Trace roots: Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.

FIGURE 1 - APPROXIMATE BORING LOCATIONS
PROPOSED GUARDIAN PEST SOLUTIONS BUILDINGS
HALVOR LANE AND US HIGHWAY 2
SUPERIOR, WISCONSIN
AET PROJECT NO. 07-06007
JUNE 6, 2014



LEGEND

- PROPOSED BORING
- EXISTING BORING
- PROPERTY LINE

TBM: Top nut of fire hydrant
Assigned El. 100.0'

CALZO architects
1901 South Street
Duluth, MN 55812
Tele: 218.722.4319
Fax: 218.727.1338

GUARDIAN PEST SOLUTIONS
WINTER BUSINESS PARK - PARCEL 'I' PROPOSED SOIL BORING LOCATIONS
4.15.2014

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **07-06007** LOG OF BORING NO. **B-01 (p. 1 of 1)**

PROJECT: **Proposed Guardian Pest Solutions Buildings; Halvor Lane and US Hwy 2; Superior, WI**

DEPTH IN FEET	SURFACE ELEVATION: 94.9 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS PID	DD	LL	PL	q_p
1	TOPSOIL, fat clay with roots, brown	FILL									
1	FAT CLAY, reddish brown, firm to very stiff, laminations of gray silt (CH)	LACUSTRINE DEPOSITS	3	M	SS	10	0				
3			8	M	SS	17	0				>4.5
5			16	M	SS	22	0				>4.5
8			12	M	SS	19	0				3.75
10			10	M	SS	22	0				3.75
13			20	M	SS	24	0				
14	SILTY SAND, fine grained, brown, moist, medium dense, laminations of silt and lean clay (SM)										
15			23	M	SS	20	0				
16	**END OF BORING AT 16.5 FEET** *Boring backfilled with bentonite chips*										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-14½' 3.25" HSA	**5/13/14**	**1:33**	**16.5**	**14.5**	**16.3**	**--**	**None**
BORING COMPLETED: **5/13/14**							
DR: **GM** LG: **MH** Rig: **67**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **07-06007** LOG OF BORING NO. **B-02 (p. 1 of 1)**

PROJECT: **Proposed Guardian Pest Solutions Buildings; Halvor Lane and US Hwy 2; Superior, WI**

DEPTH IN FEET	SURFACE ELEVATION: 95.1 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS PID	DD	LL	PL	q_p
1	FILL, organic to slightly organic fat clay with roots, a little gravel, dark brown	FILL	4	M	SS	10	0				
2											
3			5	M	SS	3	0				
4	FAT CLAY, reddish brown, stiff (CH)	LACUSTRINE DEPOSITS									
5											
6			9	M	SS	20	0				3
7											
8			9	M	SS	24	0				3
9											
10											
11			11	M	SS	24	0				3.25
12											
13	SILTY SAND, fine grained, brown, moist, medium dense, laminations of reddish brown fat clay and clayey sand (SM)		15	M	SS	22	0				
14											
15	SAND, fine to medium grained, brown, moist, medium dense (SP)		14	M	SS	20	0				
16											
	END OF BORING AT 16.5 FEET *Boring backfilled with bentonite chips*										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-14½' 3.25" HSA	**5/13/14**	**2:25**	**16.5**	**14.5**	**16.4**	**--**	**None**
BORING COMPLETED: **5/13/14**							
DR: **GM** LG: **MH** Rig: **67**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **07-06007** LOG OF BORING NO. **B-03 (p. 1 of 1)**

PROJECT: **Proposed Guardian Pest Solutions Buildings; Halvor Lane and US Hwy 2; Superior, WI**

SURFACE ELEVATION: **96.1**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS PID	DD	LL	PL	q_p
1	FILL, organic to slightly organic fat clay with sand and roots, dark brown and reddish brown	FILL	5	M	SS	8	0				
3	FILL, a mixture of fat clay, silt, and organic lean clay with roots, reddish brown, gray, and dark brown		6	M	SS	10	0				
5	FAT CLAY, reddish brown, stiff (CH)	LACUSTRINE DEPOSITS	9	M	SS	18	0				3
8			10	M	SS	24	0				3.25
10			10	M	SS	24	0				3.25
12	SANDY LEAN CLAY, brown (CL)										
13	SILTY SAND, fine grained, reddish brown, moist, medium dense, laminations and lenses of sand, lean clay, and silt (SM)		14	M	SS	24	0				
15			18	M	SS	24	0				
16	SILTY SAND, fine grained, brown, moist (SM)										
	END OF BORING AT 16.5 FEET *Boring backfilled with bentonite chips*										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-14½' 3.25" HSA	**5/13/14**	**3:15**	**16.5**	**14.5**	**16.3**	**--**	**None**
BORING COMPLETED: **5/13/14**							
DR: **GM** LG: **MH** Rig: **67**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **07-06007** LOG OF BORING NO. **B-04 (p. 1 of 1)**

PROJECT: **Proposed Guardian Pest Solutions Buildings; Halvor Lane and US Hwy 2; Superior, WI**

DEPTH IN FEET	SURFACE ELEVATION: 95.0 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS PID	DD	LL	PL	q_p
1	FILL, a mixture of fat clay, organic clay with roots, a little gravel, dark brown, brown, and reddish brown	FILL	4	M	SS	10	0				
2											
3	SLIGHLTY ORGANIC LEAN CLAY, trace roots, grayish brown, may be fill (CL)	FINE ALLUVIUM OR FILL	5	M	SS	14	0				
4	FAT CLAY, reddish brown, firm to stiff (CH)	LACUSTRINE DEPOSITS									
5											
6			8	M	SS	18	0				2.25
7											
8			9	M	SS	10	0				3
9											
10											
11			9	M	SS	24	0				3
12											
13			9	M	SS	24	0				2.75
14	SANDY SILT, brown, moist (ML)										
15											
16	SAND, fine to medium grained, brown, moist, medium dense (SP)		25	M	SS	20	0				
	END OF BORING AT 16.5 FEET *Boring backfilled with bentonite chips*										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-14½' 3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
	5/13/14	**4:20**	**16.5**	**14.5**	**16.4**	**--**	**None**	
BORING COMPLETED: **5/13/14**								
DR: **GM** LG: **MH** Rig: **67**								

06/06

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **07-06007** LOG OF BORING NO. **B-05 (p. 1 of 1)**

PROJECT: **Proposed Guardian Pest Solutions Buildings; Halvor Lane and US Hwy 2; Superior, WI**

DEPTH IN FEET	SURFACE ELEVATION: 94.3 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS PID	DD	LL	PL	q_p
1	TOPSOIL, organic fat clay with sand and roots, dark brown	FILL	3	M	SS	6	0				
2											
3	FAT CLAY, reddish brown, firm to stiff, laminations of gray silt above about 10 feet (CH)	LACUSTRINE DEPOSITS	8	M	SS	13	0				2.75
4											
5			9	M	SS	18	0				3.25
6											
7											
8			8	M	SS	24	0				3
9											
10			10	M	SS	24	0				3.5
11											
12											
13	SAND, fine to medium grained, brown, moist to wet, medium dense (SP)		16	M	SS	20	15				
14											
15			17	M	SS	18	187				
16											
17											
18			13	W	SS	19	441				
19	**END OF BORING AT 19.0 FEET** *Boring backfilled with bentonite chips*										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-17' 3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
	5/14/14	**8:15**	**19.0**	**17.0**	**17.3**	**--**	**None**	
	5/14/14	**8:32**	**19.0**	**17.0**	**17.3**	**--**	**None**	
BORING COMPLETED: **5/14/14**								
DR: **GM** LG: **MH** Rig: **67**								

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **07-06007** LOG OF BORING NO. **B-06 (p. 1 of 1)**

PROJECT: **Proposed Guardian Pest Solutions Buildings; Halvor Lane and US Hwy 2; Superior, WI**

DEPTH IN FEET	SURFACE ELEVATION: 95.2 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS PID	DD	LL	PL	q_p
1	TOPSOIL, organic to slightly organic lean clay with roots, dark grayish brown	FILL	6	M	SS	8	0				
2	FAT CLAY, reddish brown, firm to stiff (CH)	LACUSTRINE DEPOSITS									
3			6	M	SS	14	0				2.25
4											
5											
6			7	M	SS	24	0				2.5
7											
8			10	M	SS	0					
9											
10											
11			8	M	SS	24	0				2.25
12											
13			9	M	SS	24	0				2.5
14											
15	SILTY SAND, fine grained, brown, moist, medium dense, laminations of fat clay (SM)		27	M	SS	24	0				
16											
	END OF BORING AT 16.5 FEET *Boring backfilled with bentonite chips*										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-14½' 3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
	5/14/14	**9:58**	**16.5**	**14.5**	**16.5**	**--**	**None**	
BORING COMPLETED: **5/14/14**								
DR: **GM** LG: **MH** Rig: **67**								

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **07-06007** LOG OF BORING NO. **B-07 (p. 1 of 1)**

PROJECT: **Proposed Guardian Pest Solutions Buildings; Halvor Lane and US Hwy 2; Superior, WI**

DEPTH IN FEET	SURFACE ELEVATION: 95.3 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS PID	DD	LL	PL	q_p
1	FILL, a mixture of fat clay, silty sand, organic clay with roots, a little gravel, reddish brown, brown, and black	FILL	6	M	SS	6	0				
2											
3	FAT CLAY, reddish brown, firm to stiff, laminations of gray silt above about 7 feet (CH)	LACUSTRINE DEPOSITS	7	M	SS	14	0				2.5
4											
5			12	M	SS	20	2				4
6											
7											
8			10	M	SS	24	8				3.25
9											
10			8	M	SS	24	0				2.5
11											
	END OF BORING AT 11.5 FEET *Boring backfilled with bentonite chips*										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-9½' 3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
	5/14/14	**10:50**	**11.5**	**9.5**	**11.3**	**--**	**None**	
BORING COMPLETED: **5/14/14**								
DR: **GM** LG: **MH** Rig: **67**								

06/06

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **07-06007** LOG OF BORING NO. **B-08 (p. 1 of 1)**

PROJECT: **Proposed Guardian Pest Solutions Buildings; Halvor Lane and US Hwy 2; Superior, WI**

DEPTH IN FEET	SURFACE ELEVATION: 94.2 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS PID	DD	LL	PL	q_p
0	TOPSOIL, organic clay with roots, dark brown	FILL									
1	FAT CLAY, trace roots, brown, may be fill (CH)	LACUSTRINE DEPOSITS OR FILL	5	M	SS	10	0				
2											
3	FAT CLAY, reddish brown, stiff, laminations of gray silt (CH)	LACUSTRINE DEPOSITS	6	M	SS	12	0				
4											
5											
6			11	M	SS	18	0				3.25
7											
8	FAT CLAY, reddish brown, very stiff to stiff, laminations and lenses of brown sandy silt (CH)		18	M	SS	14	0				3.75
9											
10											
11			10	M	SS	24	0				3
	END OF BORING AT 11.5 FEET *Boring backfilled with bentonite chips*										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-9½' 3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
	5/14/14	**11:32**	**11.5**	**9.5**	**11.3**	**--**	**None**	
BORING COMPLETED: **5/14/14**								
DR: **GM** LG: **MH** Rig: **67**								

Appendix B

AET Project No. 07-06007

Geotechnical Report Limitations and Guidelines for Use

Appendix B
Geotechnical Report Limitations and Guidelines for Use
AET Project No. 07-06007

B.1 REFERENCE

This appendix provides information to help you manage your risks relating to subsurface problems which are caused by construction delays, cost overruns, claims, and disputes. This information was developed and provided by ASFE[1], of which, we are a member firm.

B.2 RISK MANAGEMENT INFORMATION

B.2.1 Geotechnical Services are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. And no one, not even you, should apply the report for any purpose or project except the one originally contemplated.

B.2.2 Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

B.2.3 A Geotechnical Engineering Report is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typically factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, always inform your geotechnical engineer of project changes, even minor ones, and request an assessment of their impact. Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.

B.2.4 Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. Do not rely on a geotechnical engineering report whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. Always contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

1 ASFE, 8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733: www.asfe.org

B.2.5 Most Geotechnical Findings Are Professional Opinions
Site exploration identified subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

B.2.6 A Report's Recommendations Are Not Final
Do not overrely on the construction recommendations included in your report. Those recommendations are not final, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.

B.2.7 A Geotechnical Engineering Report Is Subject to Misinterpretation
Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

B.2.8 Do Not Redraw the Engineer's Logs
Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognizes that separating logs from the report can elevate risk.

B.2.9 Give Contractors a Complete Report and Guidance
Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, but preface it with a clearly written letter of transmittal. In the letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

B.2.10 Read Responsibility Provisions Closely
Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their report. 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.

B.2.11 Geoenvironmental Concerns Are Not Covered
The equipment, techniques, and personnel used to perform a geoenvironmental study differ significantly from those used to perform a geotechnical study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Unanticipated environmental problems have led to numerous project failures. If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. Do not rely on an environmental report prepared for someone else.