

## **ENGINEERING & TESTING CONSULTANTS INC.**

November 9, 2023

Express Oil Change & Tire Engineers  
Attn: Ms. Ashley Bernatski  
1880 Southpark Drive  
Birmingham, AL 35244

**SUBJECT: GEOTECHNICAL EXPLORATION FOR BRAKES PLUS – SOUTH OF  
FRY’S MARKETPLACE IN PRESCOTT VALLEY, AZ**

Dear Ms. Bernatski:

Engineering & Testing Consultants, Inc., (ETC) has completed our geotechnical exploration for the undeveloped, triangular pad, located just south of Fry’s Food & Drug.

The purpose of this exploration is to determine the general subsurface soil conditions on the property and to present geotechnical engineering recommendations regarding foundation support, slabs-on-grade, site grading, pavement structural section, and lateral soil pressures.

### **PROJECT AND SITE CONDITIONS**

The undeveloped land is somewhat elevated above the adjacent drives. The north and northwest sides of the lot appear to have been cut into the lot to a similar elevation to the adjacent drives. The majority of the southeast side of the lot is elevated above the adjacent drive.

Utility markings indicate a water line crosses through the southern portion of the lot, aligned west to east.

**GEOTECHNICAL ENGINEERING • SOILS & MATERIALS TESTING • SPECIAL INSPECTION**

**417 NORTH ARIZONA AVENUE • PRESCOTT, ARIZONA 86301  
928-778-9001**



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We understand the project will include a new building in the northern portion of the lot. The project also includes paved parking lots and paved access, trash enclosure, and other ancillary site features.

We anticipate the proposed new structures will utilize conventional foundations (continuous and/or spread footing) for support with slab-on-grade construction.

### **SUBSURFACE SOIL CONDITIONS**

ETC completed three (3) exploratory test borings at the site. The boring locations were estimated using limited existing site features. The borings were performed to determine general subsurface soil conditions and to collect soil samples for laboratory analysis. If soil conditions encountered during construction differ from those described herein, this firm should be contacted for review.

A more detailed description of the subsurface soils encountered by each of the borings is provided on the boring logs included in Appendix A. A Boring Location Map is attached as Figure 1.

The borings performed at the site encountered dark brown, stiff, high plasticity, highly expansive Clay (Clay with Sand & Sandy Clay, CH/CL) to depths of approximately 4.5 to 6 feet below existing grade.

Below the high plasticity, highly expansive clays, dense to very dense, light brown gravelly material was encountered at depths ranging from approximately 4.5 to 6 feet, with varying amounts of cobble and boulders.

Auger refusal on boulder or very dense cobbles was encountered at depths ranging from approximately 6.5 to 10 feet.

The clay soils have high expansive characteristics, or sensitivity to changes in moisture. The expansive clay will expand or heave with increasing moisture. Conversely, the clay will also tend to shrink with a decrease in moisture. Therefore, ETC is providing modified foundation recommendations and additional earthwork for site development and building support, as further discussed herein.



laboratory test results is presented below in Table 1. Laboratory testing was performed in accordance with applicable ASTM standards.

As shown in Table 1, the clay site soils have high plasticity indices, with similar expansive characteristics.

**TABLE 1**  
**SUMMARY OF LABORATORY TEST RESULTS**

Boring	Depth (feet)	Liquid Limit (%)	Plasticity Index	Fines <sup>1</sup> Content (%)	Gravel Content (%)	Moisture Content (%)	Unified Soil Classification
B-1	0 – 3	53	33	77	10	19.3	CH
	3 – 4.5	47	28	50	6	11.8	CL
B-2	0 – 3.5	57	36	79	2	21.9	CH

<sup>1</sup>Note: Total silt and clay fraction of the soil (% passing #200 sieve).

An expansion index test (ASTM D4829) was performed for a combined sample of the upper 3 to 3.5 feet of high plasticity clay collected from the borings. The clay soil sample was compacted to approximately 52% saturation and inundated. With an applied surcharge load of 144psf, the sample *swelled over 10 percent*, with a ***High Expansion Index of 107***.

## **FOUNDATIONS**

The highly expansive clay throughout the site is very moisture sensitive. The clay soil particles have a great capacity to hold water. Consequently, an increase in moisture content will cause the clay soil to heave, or to increase in volume. The pressures developed by the expanding clay soil can easily lift foundations and slabs, causing damage to the building and other structures.

The purpose of the recommendations herein, is to help reduce, but will not eliminate, the potential for excessive moisture fluctuations and subsequent volume changes of expansive clay soil beneath the building. Therefore, efficient drainage away from site structures is very important for the long-term stability of foundation soils.

*Due to the high expansive potential of the clay soils, ETC recommends all foundations (continuous or spread footings) be seated at a minimum embedment depth of 3.5 feet below*



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*lowest, adjacent, finished grade, or shallower wherever the lower, lighter brown, dense to very dense gravelly material is encountered.*

*If applicable, any perimeter turn-down edge footings for metal buildings shall be seated at a minimum embedment depth of 3 feet. Footings for site walls, monuments, and other exterior structures not part of the building, may also be seated at a minimum embedment depth of 3 feet.*

***All foundations for the building and other structures that are excavated through the upper clay and seated into the lower, lighter brown, dense to very dense gravelly material may be seated at a shallower embedment depth of 24 inches.***

In determining foundation embedment depths, lowest, adjacent finished grade shall be measured from the exterior ground surface (bottom of contiguous slabs/pavement) within 5 feet of the foundations for exterior footings and may be measured from finished floor elevation for interior footings. Uncontrolled landscaping/gravel shall not be considered as finished grade.

Over-excavated footing trenches shall not be backfilled with slurry or compacted fill, due to moisture migration and ponding within and through these porous materials. *Deepened foundations shall be achieved with increased footing height or stem wall height.* Alternatively, low strength concrete (2,000psi or greater) may be used to backfill over-excavated footings to bottom of footing elevation. Steel reinforcement is not our expertise. Therefore, reinforcement specifications within deepened foundations, if required, shall be provided by others.

For foundations constructed as recommended herein, ETC recommends a maximum allowable foundation pressure of **2,500 psf** be used for design. The allowable foundation pressure may be increased by one-third when considering total loads including wind and seismic forces.

Due to the expansive clay on the site, special attention shall be given to final grades to ensure efficient drainage away from the buildings, slabs, and other soil-supported features of the project.

ETC shall be contacted to observe foundation excavations to verify adequate footing dimensions and foundation bearing soils are in conformance with our recommendations presented herein.

Footing excavations on sloping ground shall be properly stepped with relatively level bottoms and shall be free of all loose or otherwise unstable soil.

Continuous footings and stem walls should be reinforced to distribute stresses arising from small differential movements and long exposed walls should be provided with control joints to accommodate these movements. Reinforcement and control joints are suggested to allow slight movement and minimize cracking.





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Providing that foundation construction is carried out as set forth herein, differential movements under design loads have been estimated to be less than  $\frac{3}{4}$  inches. Increased foundation movements may occur if adequate drainage is not maintained around the building areas, or foundation soils experience significant increases in moisture.

ETC recommends a Site Class of “C” be used for seismic considerations, per 2018 IBC and ASCE 7.

### **SLABS-ON-GRADE**

Condensation from upward rising water vapor beneath floor slabs, and horizontal water vapor movement from outside, can cause wet soil conditions beneath concrete slabs. Due to the light surcharge load, concrete slabs will be particularly susceptible to movements if the underlying clay soils experience significant changes in moisture.

Due to the moisture sensitivity of the clay soils, ETC is recommending additional imported, granular material be placed between the expansive clay and concrete slabs.

ETC recommends a minimum thickness of **20 inches** of granular material be placed between the prepared clay subgrade soil and slab-on-grade floors. The granular material shall consist of at least 4 inches processed aggregate base course (ABC) in accordance with MAG Specifications, Section 702, placed on 16 inches of non-expansive, granular, engineered fill material.

In any areas where the clay soils are removed, if applicable, a minimum of 6 inches ABC may be used below interior and exterior slabs and the lower exposed lighter brown very gravelly material.

*Engineered fill used below slabs should not extend beyond building walls, due to the porosity of the granular fill, if practicable. Engineered fill that does extend beyond building walls shall be capped with at least 12 inches of compacted, on-site clay soils, outside of slab areas, to promote surface drainage away from the building.*

For exterior concrete slabs, ETC recommends a minimum of 10 inches of granular material, which includes 4 inches of ABC, be placed between the prepared clayey subgrade soils and exterior slabs. ETC also recommends minimum 12-inch turn-down edges also be used for exterior slabs, to help reduce the potential for exterior moisture migration into the expansive clay subgrade.

Due to the expansive clay soil and exposure to inclement weather, some movement of exterior slabs may be difficult to prevent. Due to some potential movements of concrete slabs, special



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attention shall be given to adequate spacing, location, and construction of control joints during concrete placement.

### **Additional Considerations**

*The clay soils can hold a significant amount of water. Therefore, although not required for slab support, consideration should be given to installation of a vapor retarder below concrete floor slabs to help mitigate the amount of water vapor migration into interior spaces, especially if moisture sensitive floor coverings will be used. Concrete slabs-on-grade should be allowed to cure sufficiently before installing moisture sensitive floor coverings. If a vapor retarder will be used, an appropriate concrete mix design will be required for placement on polyethylene.*

ETC recommends the American Concrete Institute (ACI) be used as a reference for placement, curing, and finishing of Portland cement concrete (PCC). Concrete should be placed at the appropriate slump determined by mix design, required strength, and application. After placement, concrete should be properly cured, and special attention shall be given to ensure adequate moisture is present during the initial curing process to prevent/reduce shrinkage and stress cracks.

The concrete slab should be properly jointed, with maximum joint spacing of 24 to 36 times the slab thickness, unless noted otherwise. Any required saw cutting should be performed to an appropriate depth and in a timely manner, typically within 12 hours of concrete finishing.

It should be noted that for exterior concrete, that the use of deicing salt within the first year of concrete placement can cause damage to the concrete surface. This can be avoided by using 4,500psi concrete with a water/cement ratio of 0.45, or as recommended by the supplier.

### **DRAINAGE**

Positive drainage is critical to the successful performance of any foundation, slab system, and for pavement areas. Excess moisture infiltration into foundation soils is often the primary cause of soil-related problems below structures. Efficient surface and subsurface drainage should be established prior to and maintained during and after construction to prevent water from ponding and/or saturating the soils within or adjacent to the buildings, pavement areas, slabs, foundations, and other soil-supported structures.

*Special attention shall be given to providing for efficient surface drainage away from site structures.*



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The design should divert water away from where it could penetrate the ground, particularly if granular fills are used. Care should be taken in design and construction to assure that water is contained to prevent seepage into the underlying soils. ETC recommends roof water down pipes not discharge storm water adjacent to building foundations, utilizing piping and/or the use of splash blocks and swales.

ETC recommends any irrigated vegetation within 5 feet of the building be limited to low water-use vegetation. Trees should not be planted within 15 feet of the building, or the mature foliage radius, whichever is greater. Backfill against footings, exterior walls, and in utility trenches should be compacted to reduce the possibility of moisture infiltration through loose soil.

*Planters shall also utilize low water-use vegetation and be provided with adequate drainage to prevent water from ponding.*

Backfill against footings, exterior walls, and in utility trenches shall be compacted to reduce the possibility of moisture infiltration through loose soil. The cavity above the footings or between the stem walls and trench side walls shall be adequately backfilled and compacted.

Special attention should be given to final grades and landscaping improvements to ensure efficient drainage away from foundations, slabs, and pavements. Minimizing irrigation water near the building, positive drainage of surface water away from the site structures, and adequate compaction of soils around the building and in utility trenches is very important for the long-term stability of foundation soils.

## **EARTHWORK**

The areas where fill is required must be stripped of all vegetation, debris, loose, wet, or otherwise unstable soils, and such material shall be removed. Depressions and sloped ground should be widened or benched as necessary to accommodate compaction equipment and provide a level base for placing fill.

The exposed ground surface shall be scarified, moisture conditioned, and compacted to a minimum depth of 8 inches prior to fill placement, to the specifications herein. Special attention shall be given to ensure adequate moisture is present throughout the entire 8-inch depth.

All subbase fill required to bring the structured areas up to subgrade elevation shall be placed in horizontal lifts not exceeding 8 inches compacted thickness. Soils should be compacted to meet the criteria listed in Table 2.



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*It is ETC's intention that the on-site soils be used for general site grading, as needed. However, engineered fill material shall be used for fill inside of stem walls, to the depths required under slabs, and for backfill behind any retaining walls.*

Engineered fill, where required, shall be clean, granular soil free of vegetation, debris, organic soil, and shall conform to the following requirements, as approved by the engineer:

- 100 percent passing 4" sieve;
- 3 to 36 percent passing No. 200 sieve;
- 30 to 97 percent passing No. 4 sieve;
- Maximum Plasticity Index (PI) of 15; and
- Maximum expansion index of 20.

ETC recommends the observation of the site grading operation with sufficient tests to verify proper compaction.

**TABLE 2**  
**SOIL COMPACTION CRITERIA**  
**ASTM D698**

Operation		Moisture Content	Degree of Compaction
<b>I</b>	<b>Slabs-on-Grade</b>		
	Finish Clay Surface Below Engineered Fill (where present)	Optimum to +4%	<b>89% to 95%</b> of Maximum Dry Density
	Granular Soils	±2 % of Optimum	Minimum of <b>95%</b> of Maximum Dry Density
<b>II</b>	<b>Site Grading, Utility Trench Backfill and Backfill Adjacent to Footings or Stem Walls</b>		
	Clay Soils	-1% to +3% of Optimum	Minimum of <b>95%</b> of Maximum Dry Density
	Granular Soils	±2 % of Optimum	Minimum of <b>95%</b> of Maximum Dry Density
<b>III</b>	<b>Pavement Areas</b>		
	Clay Soils	-4% to +1% of Optimum	Minimum of <b>95%</b> of Maximum Dry Density
	Granular Soils	±2 % of Optimum	Minimum of <b>95%</b> of Maximum Dry Density



### **Constructed Slopes**

All fill slopes and soil cut slopes shall be constructed at a maximum slope angle of 2:1 (horizontal: vertical). Soil in the top of cut slopes should be rounded back from the slope face to create a gradual transition to natural grade.

ETC recommends a minimum building setback distance of 5 feet from the top of slope. Water shall be intercepted and prevented from flowing down the face of any significant constructed slopes with the use of brow ditches and swales.

### **PAVEMENT DESIGN**

Site grading for pavement areas should be as outlined herein to provide subgrade support for the pavement structure.

The clay subgrade soils encountered provide reduced structural support. Therefore, increased pavement sections are recommended.

The recommended pavement sections are expected to function with periodic maintenance or overlays when the subgrade, base, and pavement are constructed in accordance with MAG Construction Standards with Town of Prescott Valley modifications. Efficient surface water drainage must be provided and maintained to help prevent moisture infiltration into the subgrade.

**TABLE 3  
PAVEMENT STRUCTURAL SECTION**

<b>Description</b>	<b>Asphaltic Concrete Thickness (inches)</b>	<b>Aggregate Base Thickness (inches)</b>	<b>Prepared Subgrade Thickness (inches)</b>
Low traffic Areas	3	10	8
High Traffic Areas / Heavy Truck Access	4	10	8
	5	7	8



High Traffic Areas / Heavy Truck Access	4	10	8
	5	7	8

Prior to placement of aggregate base material, the exposed subgrade shall be proof-rolled to confirm stable subgrade soils.

### **Pavements on Expansive Soils**

We do want to note that highly expansive clay soils, as encountered throughout this project, are very moisture sensitive and will expand (swell) when wetted. Conversely, the clay will shrink when dry. The pavement structural sections provided herein in Table 3 are designed to be structurally adequate for the poor-quality clay soils. However, an asphaltic concrete pavement system is not designed to accommodate shrink and swell movements of highly expansive clay soils when they become wetted. Consequently, properly constructed and designed asphaltic concrete pavement can still experience some amount of cracking and other distress movements due to swelling and shrinking clay subgrade soil.

The detrimental effects of expansive clay soils can be limited by controlling moisture changes in the clay subgrade soil with providing and maintaining efficient site drainage. This includes pavement maintenance, such as crack sealing operations to prevent water migration down into the underlying base and moisture sensitive subgrade. Also providing efficient drainage within any adjacent planters or landscaped areas, including limiting irrigation water. Some movement and related cracking should be expected when constructing pavements on the expansive clay soils which will require periodic maintenance.

### **LATERAL DESIGN PARAMETERS**

ETC recommends the following parameters be used for design of any retaining walls. Wall foundations shall be constructed in accordance with the recommendations herein for conventional foundations.

Retaining wall backfill shall consist of granular, non-expansive, engineered fill, as specified herein. Retaining walls shall be waterproofed prior to being backfilled against, and drains shall be installed to help prevent saturation of wall backfill.



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<sup>1</sup> Foundation Toe Pressure	1.33 x allowable bearing pressure
<sup>2</sup> Lateral Backfill Pressure:	
unrestrained walls	36 psf/foot
restrained walls	58 psf/foot
Lateral Passive Pressures	
firm native/compacted fill:	350 psf/foot
Coefficient of Base Friction	
firm native/compacted fill:	0.35

<sup>1</sup> Increase in allowable foundation bearing pressure (provided herein) for foundation toe pressure due to eccentric or lateral loading. The entire footing-bearing surface should remain in compression.

<sup>2</sup> Equivalent fluid pressures for vertical walls and horizontal backfill surfaces (maximum 12-foot height). Pressures do not include temporary forces imposed during compaction of the backfill, swelling pressures developed by overcompacted clayey backfill, hydrostatic pressures from inundation or saturation of backfill, or surcharge loads. Walls should be suitably braced during backfilling to prevent damage and deflection.

When calculating the stability of the wall against sliding, independent of passive resistance, ETC recommends the factor of safety be at least 1.5, and when calculating stability against sliding in conjunction with the passive pressure, ETC recommends the factor of safety be at least 2.0.

### **LIMITATIONS**

The figures and recommendations in this report were prepared in accordance with accepted professional engineering principles and soil mechanics practices. We make no other guarantee or warranty, either implied or expressed. If during subsequent planning and construction, conditions are different than as indicated, this firm should be notified for evaluation.

We like to inform our clients that Portland cement concrete is not a perfect construction material. Due to the characteristics of Portland cement, cracking of the concrete may occur. Cracking will



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be minimized, but not eliminated, by providing appropriate control, isolation, construction joints, and quality control testing. Drying and thermal shrinkage of the slabs with resultant hairline cracking or curling may occur even if the slabs are cured under optimum curing conditions. In short, there is no practical method of insuring that all floor cracking is eliminated utilizing slab-on-grade construction at the site.

This report is not a bidding document. Any contractor reviewing this report must draw his own conclusions regarding site conditions and specific construction techniques to be used on this project.

For your use. If you have any questions, please contact us at (928) 778-9001.

Sincerely,

**ENGINEERING & TESTING CONSULTANTS, INC.**



Michael P. Wilson, P.E.  
Project Engineer

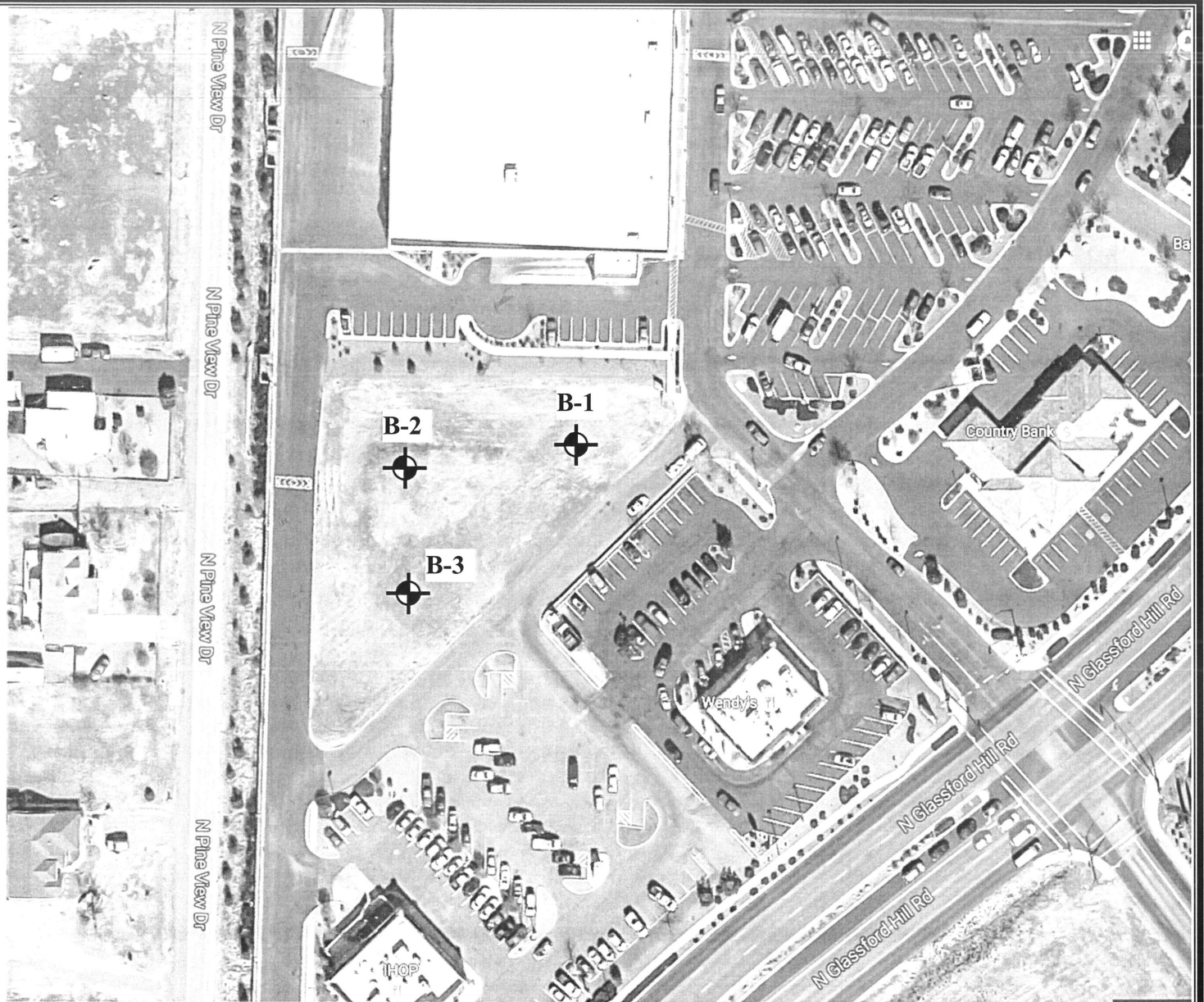


Reviewed by: Richard G. Kelley, P.E.  
Project Manager

Attachment: Figure 1 and Appendix A

cc: ETC File No. 12388





# Legend

 Approximate Boring Location



Engineering & Testing Consultants, Inc.  
 •Subsurface Drilling •Geotechnical •Environmental Support

Drawn by: others      Date: 10/16/23  
 Project No: ETC 12388      Page No:

## FIGURE 1 BORING LOCATION MAP

Brakes Plus  
 Prescott Valley, AZ



**APPENDIX A**

**FIELD EXPLORATION**

## GENERAL NOTES

### DESCRIPTIVE SOIL CLASSIFICATION:

Soil Classification is based on the Unified Soil Classification System and ASTM Designations D-2487 and D-2488. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine grained soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: Clays, if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse grained soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their consistency. Example: Lean clay with sand, trace gravel, stiff (CL); silty sand, trace gravel, medium dense (SM).

### CONSISTENCY OF FINE-GRAINED SOILS:

N-Blows/ft.	Consistency
0-2	Very Soft
3-4	Soft
5-8	Medium
9-16	Stiff
17-32	Very Stiff
33+	Hard

### RELATIVE DENSITY OF COARSE-GRAINED SOILS:

N-Blows/ft.	Relative Density
0-3	Very Loose
4-9	Loose
10-29	Medium Dense
30-49	Dense
50+	Very Dense

### RELATIVE PROPORTIONS OF SAND AND GRAVEL:

Description Term(s) (of Components Also Present in Sampling)	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

### GRAIN SIZE TERMINOLOGY:

Major Component of Sampling	Size Range
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 sieve (0.075mm)

### RELATIVE PROPORTIONS OF FINES:

Description Term(s) (of Components Also Present in Sampling)	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

# UNIFIED SOIL CLASSIFICATION SYSTEM\*

				Soil Classification	
				Group Symbol	Group Name <sup>a</sup>
COARSE-GRAINED SOILS More than 50 % retained on No. 200 sieve	Gravels More than 50 % of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5 % fines <sup>c</sup>	$Cu \geq 4$ and $1 \leq Cc \leq 3^E$	GW	Well-graded gravel <sup>F</sup>
			$Cu < 4$ and/or $1 > Cc > 3^E$	GP	Poorly graded gravel <sup>F</sup>
		Gravels with Fines More than 12 % fines <sup>c</sup>	Fines classify as ML or MH	GM	Silty gravel <sup>F,G,H</sup>
			Fines classify as CL or CH	GC	Clayey gravel <sup>F,G,H</sup>
	Sands 50 % or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5 % fines <sup>D</sup>	$Cu \geq 6$ and $1 \leq Cc \leq 3^E$	SW	Well-graded sand <sup>I</sup>
			$Cu < 6$ and/or $1 > Cc > 3^E$	SP	Poorly graded sand <sup>I</sup>
		Sands with Fines More than 12 % fines <sup>D</sup>	Fines classify as ML or MH	SM	Silty sand <sup>G,H,I</sup>
			Fines classify as CL or CH	SC	Clayey sand <sup>G,H,I</sup>
FINE-GRAINED SOILS 50 % or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	$PI > 7$ and plots on or above "A" line <sup>J</sup>	CL	Lean clay <sup>K,L,M</sup>
			$PI < 4$ or plots below "A" line <sup>J</sup>	ML	Silt <sup>K,L,M</sup>
		organic	Liquid limit – oven dried Liquid limit – not dried $< 0.75$	OL	Organic clay <sup>K,L,M,N</sup> Organic silt <sup>K,L,M,O</sup>
	Silts and Clays Liquid limit 50 or more	inorganic	$PI$ plots on or above "A" line	CH	Fat clay <sup>K,L,M</sup>
			$PI$ plots below "A" line	MH	Elastic silt <sup>K,L,M</sup>
		organic	Liquid limit – oven dried Liquid limit – not dried $< 0.75$	OH	Organic clay <sup>K,L,M,P</sup> Organic silt <sup>K,L,M,Q</sup>
HIGHLY ORGANIC SOILS		Primarily organic matter, dark in color, and organic odor		PT	Peat

<sup>a</sup> Based on the material passing the 3-in. (75-mm) sieve.

<sup>b</sup> If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

<sup>c</sup> 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

<sup>d</sup> 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

$$^e Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

<sup>f</sup> If soil contains  $\geq 15$  % sand, add "with sand" to group name.

<sup>g</sup> If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

<sup>h</sup> If fines are organic, add "with organic fines" to group name.

<sup>i</sup> If soil contains  $\geq 15$  % gravel, add "with gravel" to group name.

<sup>j</sup> If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.

<sup>k</sup> If soil contains 15 to 29 % plus No. 200, add "with sand" or "with gravel," whichever is predominant.

<sup>l</sup> If soil contains  $\geq 30$  % plus No. 200, predominantly sand, add "sandy" to group name.

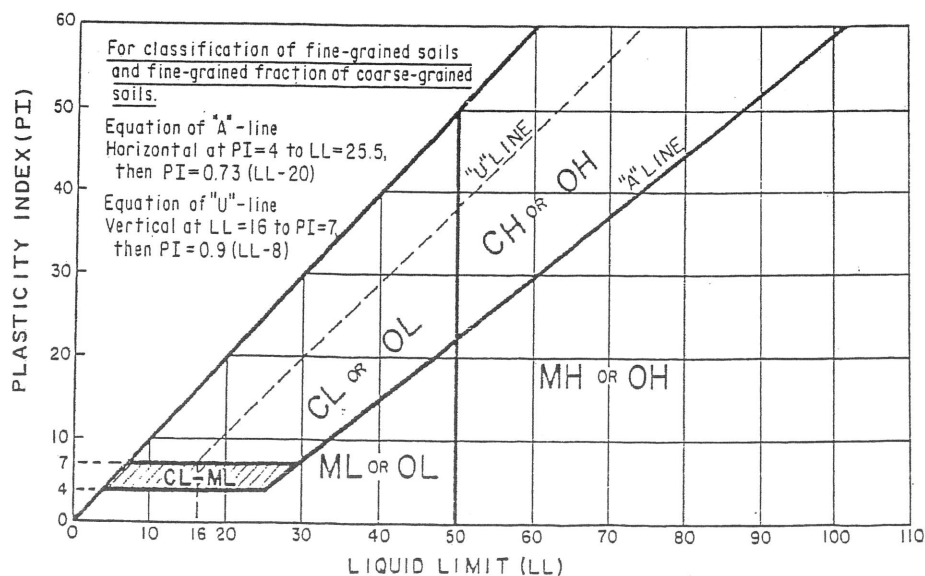
<sup>m</sup> If soil contains  $\geq 30$  % plus No. 200, predominantly gravel, add "gravelly" to group name.

<sup>n</sup>  $PI \geq 4$  and plots on or above "A" line.

<sup>o</sup>  $PI < 4$  or plots below "A" line.

<sup>p</sup>  $PI$  plots on or above "A" line.

<sup>q</sup>  $PI$  plots below "A" line.



# LOG OF BORING NO. B-1



ENGINEERING & TESTING CONSULTANTS, INC.

PROJECT: Brakes Plus

PROJECT NO.: 12388

CLIENT: Express Oil Change & Tire Engineers

DATE: 10-16-2023

LOCATION: See Boring Location Map

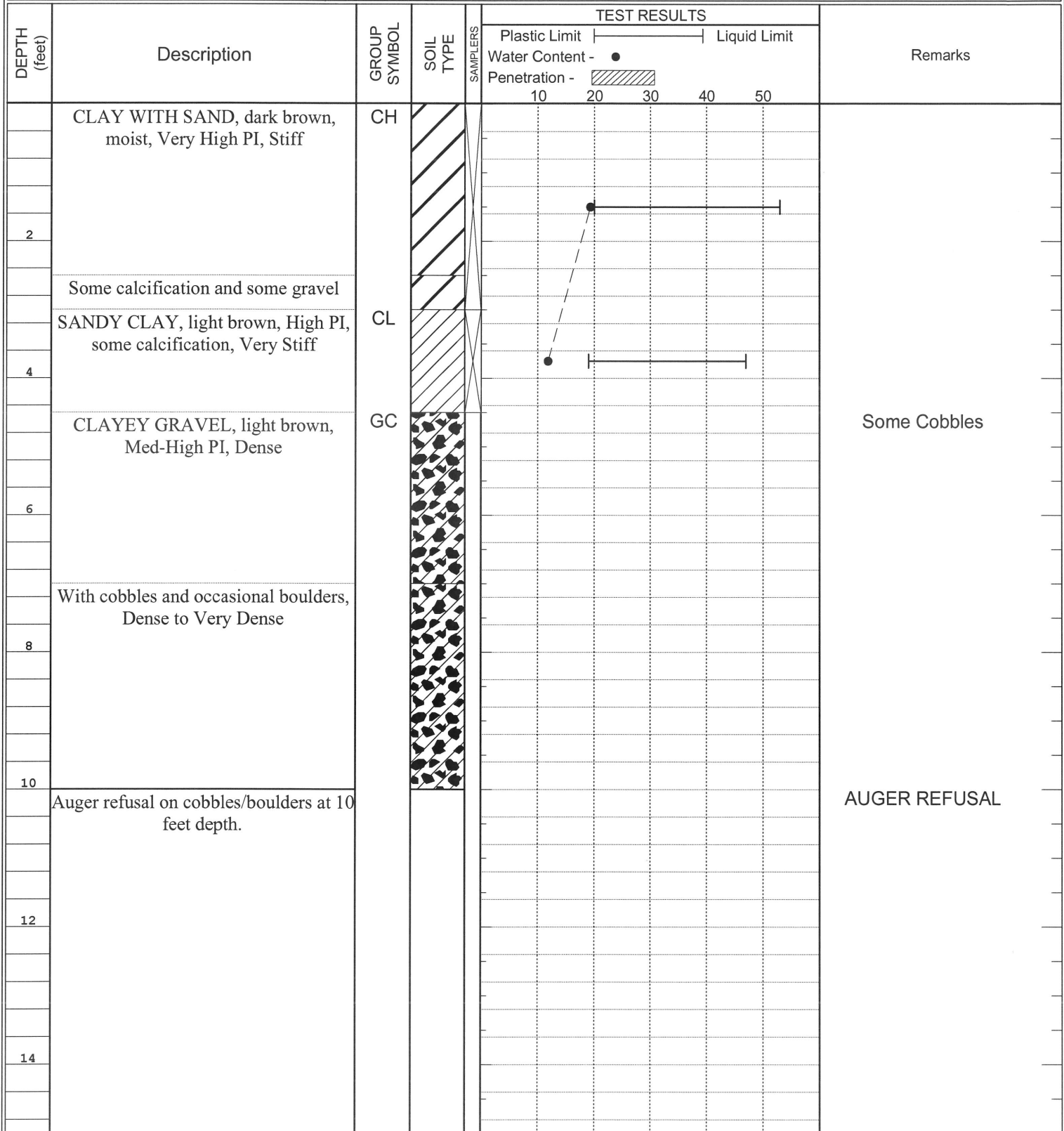
ELEVATION: ---

DRILLER: ETC

LOGGED BY: M. Wilson

DRILLING METHOD: Continuous flight auger

This information pertains only to this boring and should not be interpreted as being indicative of the site.



# LOG OF BORING NO. B-2



ENGINEERING & TESTING CONSULTANTS, INC.

PROJECT: Brakes Plus

PROJECT NO.: 12388

CLIENT: Express Oil Change & Tire Engineers

DATE: 10-16-2023

LOCATION: See Boring Location Map

ELEVATION: ---

DRILLER: ETC

LOGGED BY: M. Wilson

DRILLING METHOD: Continuous flight auger

This information pertains only to this boring and should not be interpreted as being indicative of the site.

DEPTH (feet)	Description	GROUP SYMBOL	SOIL TYPE	TEST RESULTS		Remarks
				Plastic Limit Water Content - Penetration -	Liquid Limit	
2	CLAY WITH SAND, dark brown, moist, Very High PI, Stiff	CH				
4	Some gravel & increased Sand					
6	SANDY CLAY, brown to reddish, High PI, moist, some gravel, Stiff	CH				
6	SANDY CLAY, brown, Med-High PI, moist, Very Stiff	CL GC				
8	CLAYEY GRAVEL, light brown, Med-High PI, Dense to Very Dense Auger refusal on cobbles/boulders at 6.5 feet depth.					With Cobbles & Boulders AUGER REFUSAL
10						
12						
14						

# LOG OF BORING NO. B-3



ENGINEERING & TESTING CONSULTANTS, INC.

PROJECT: Brakes Plus

PROJECT NO.: 12388

CLIENT: Express Oil Change & Tire Engineers

DATE: 10-16-2023

LOCATION: See Boring Location Map

ELEVATION: ---

DRILLER: ETC

LOGGED BY: M. Wilson

DRILLING METHOD: Continuous flight auger

This information pertains only to this boring and should not be interpreted as being indicative of the site.

DEPTH (feet)	Description	GROUP SYMBOL	SOIL TYPE	SAMPLERS	TEST RESULTS					Remarks
					Plastic Limit	Water Content -	Liquid Limit	Penetration -		
	CLAY WITH SAND, dark brown, moist, Very High PI, Stiff	CH				●				
2										
4	SANDY CLAY, brown, Med-High PI, some gravel, some calcification, moist, Very Stiff	CL								
6	CLAYEY GRAVEL, light brown, Med-High PI, Dense to Very Dense Drilled through 12-in boulder	GC								With Cobbles & some Boulders
8	Auger refusal on cobbles/boulders at 6-3/4 feet depth.									AUGER REFUSAL
10										
12										
14										



# KEY TO SYMBOLS

Symbol    Description

## Strata symbols



High plasticity  
clay



Low plasticity  
clay



Clayey gravel

## Soil Samplers



Bulk sample taken  
from 4 in. auger

## Notes:

1. Exploratory borings were drilled on 10-16-2023 using a 4-inch diameter continuous flight power auger.
2. No free water was observed at the time of drilling.
3. Boring locations were estimated from existing site features.
4. These logs are subject to the limitations, conclusions, and recommendations in this report.
5. Results of tests conducted on samples recovered are reported on the logs.