



# ECS Southeast, LLC

## Geotechnical Engineering Report Express Oil Change Maumelle

Maumelle Blvd  
Maumelle, Pulaski County, Arkansas

ECS Project No. 62:1321

January 25, 2024





**ECS SOUTHEAST, LLC**

Geotechnical • Construction Materials • Environmental • Facilities

January 25, 2024

Ms. Ashley Bernatski  
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ECS Project No. 62:1321

Reference: Geotechnical Engineering Report  
**Express Oil Change Maumelle**  
Maumelle Blvd  
Maumelle, Pulaski County, Arkansas

Dear Ms. Bernatski:

ECS Southeast, 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 Express Oil Change 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,

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"ONE FIRM. ONE MISSION."

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## **APPENDICES**

### **Appendix A – Drawings & Reports**

- Site Location Diagram
- Boring Location Diagram

### **Appendix B – Field Operations**

- Reference Notes for Boring Logs
- Subsurface Exploration Procedure: Standard Penetration Testing (SPT)
- Boring Logs B-01 through B-05

### **Appendix C – Laboratory Testing**

- Laboratory Testing Summary
- Plasticity Chart

### **Appendix C – Supplemental Report Documents and Calculations**

- Important Information

## EXECUTIVE SUMMARY

ECS Southeast, LLC (ECS) has completed the subsurface exploration for the proposed construction of a new Express Oil Change facility on Maumelle Blvd in Maumelle, Arkansas. The project information summarized below is based exclusively on the information made available to us by the client at the time of this report and the results of our subsurface exploration. Our findings, conclusions, and recommendations are summarized below.

### PROJECT INFORMATION:

- Site Location: Maumelle Blvd, Maumelle, Arkansas
- Building Scope: Single-story steel framed building with structural masonry walls
- Assumed Loads: Max. column loads = 25 kips, Max. wall loads = 2.5 klf
- Earthwork: Less than 5 feet of cut and fill anticipated
- Sitework: Parking lot and drive lanes

### SUBSURFACE CONDITIONS:

- Field Exploration: 7 SPT borings in the proposed construction area
- Surface Material: Not Encountered
- Native Material: Sandy Lean CLAY (CL) with Sandstone Pieces
- Groundwater: Borings B-01 and B-03 at approx. 18 and 5 feet, respectively.

### GEOTECHNICAL CONCERNS:

- Hard to Excavate Material
- Moisture Sensitive Soils

### DESIGN & CONSTRUCTION RECOMMENDATIONS:

- Foundations: Shallow foundations: 3,000 psf
- Slabs-on-Grade: Modulus of Subgrade Reaction,  $k = 110$  pci
- Seismic Design: Seismic Site Class "C"

*This Executive Summary is intended as a very brief overview of the primary geotechnical conditions that are expected to affect design and construction. Information gleaned from this Executive Summary should not be utilized in lieu of reading the entire geotechnical report.*

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## 1.0 INTRODUCTION

The purpose of this study was to provide geotechnical information for the design of foundations and pavements for the Express Oil Change in Maumelle, Arkansas. The project will include two single-story steel framed buildings with masonry bearing walls and associate drive lanes. The recommendations developed for this report are based on project information supplied by you.

Our services were provided in accordance with our Proposal No. 62-1716P, dated December 20, 2023, which included the agreed to Terms and Conditions of Service.

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

The report includes the following items.

- A brief review and description of our field and laboratory test procedures and the results of testing conducted.
- A review of surface topographical features and site conditions.
- A review of area and site geologic conditions.
- A review of subsurface soil stratigraphy with pertinent physical properties.
- Final soil test boring logs.
- Recommendations for site preparation and construction of compacted fills, including an evaluation of on-site soils for use as compacted fills.
- Recommended foundation type and design parameters.
- Recommendations for slab-on-grade design and construction.
- Recommendations for below grade wall design and construction.
- Recommended cut and fill slope design criteria.
- General recommendations for pavement design, including a recommended design CBR value.
- Evaluation and recommendations relative to groundwater control.
- An evaluation of soil excavation issues.



## 2.0 PROJECT INFORMATION

### 2.1 PROJECT LOCATION AND USE

The site is located north of Maumelle Blvd in Maumelle, Arkansas. The site is currently a vacant lot. Based on elevations obtained from Google Earth, the site appears to undergo approximately 20 feet of topographic relief. The elevations and topographic variations were estimated from Google Earth. The location is depicted on the Figure shown below:



**Figure 2.1.1 Approximate Site Location Shown Outlined in Red**

## 2.2 PROPOSED CONSTRUCTION

The following information explains our understanding of the planned development including proposed buildings and related infrastructure.

**Table 2.2.1 Design Information**

SUBJECT	DESIGN INFORMATION / ASSUMPTIONS
Building Footprint	Approximately 3,200 (North Building) and 2,160 (South Building) square feet in plan view
# of Stories	1 story
Usage	Oil Change Facility
Framing	Light-duty steel framing with masonry walls
Column Loads	25 kips (Full Dead and Factored Live)
Wall Loads	2.5 kips per linear foot (klf) maximum

## 2.3 REGIONAL/SITE GEOLOGY

The subject site lies in the Arkansas Valley and Ouachita Mountains Regions of Arkansas. The formation includes the Jackfork Sandstone within the Morrowan series of Pennsylvanian age. The Jackfork Sandstone is thin- to massive-bedded, fine- to coarse-grained, brown, tan, or bluish-gray quartzitic sandstones with subordinate brown, silty sandstones and gray-black shales. The Jackfork Sandstone rests conformably on the Stanley Shale and varies between 3,500 to 6,000 feet in thickness.

## 3.0 FIELD EXPLORATION AND LABORATORY TESTING

Our exploration procedures are explained in greater detail in Appendix B including the insert titled Subsurface Exploration Procedures. Our scope of work included drilling seven (7) borings and laboratory tests. Our borings were located with a handheld GPS unit and their approximate locations are shown on the Boring Location Diagram in Appendix A. The laboratory tests, including Natural Moisture Contents, Atterberg limits, and Percent Passing #200 Sieve Analysis, are shown in Appendix C.

### 3.1 SUBSURFACE CHARACTERIZATION

The subsurface conditions encountered were generally consistent with published geological mapping. The following table provides a generalized characterization of the soil encountered. No surface material was encountered at the boring locations, and it appeared that the site had been previously graded. Please refer to the boring logs in Appendix B.



**Table 3.1.1 Generalized Subsurface Conditions**

Approximate Depth (ft)	Stratum	Description	Ranges of SPT <sup>(1)</sup> N-values (bpf) <sup>(1)</sup>
0 to 21.5	I	Very Hard Sandy Lean CLAY (CL) with Sandstone and Shale Pieces, dry to wet	41 – 50+

Notes:

1. Standard Penetration Testing; blows per foot
2. Soil descriptions show generalized strata to 20'. Strata in the borings vary with depth, please see attached Boring Logs in Appendix B.

### 3.2 GROUNDWATER OBSERVATIONS

During drilling operations, groundwater was encountered in Borings B-01 and B-03 at approximate depths of 5 and 18 feet, respectively, during and after drilling. It should be noted that it is possible for perched water to exist within the depths explored at the other borings during other times of the year depending upon climatic and rainfall conditions. Additionally, discontinuous zones of perched water may exist within the native materials.

Variations in the location of the long-term water table may occur as a result of change in precipitation, evaporation, surface water runoff, and other factors not immediately apparent at the time of this exploration.

### 3.3 LABORATORY TESTING

The laboratory testing consisted of selected tests performed on samples obtained during our field exploration operations. Classification and index property tests were performed on representative soil samples. The results are provided in Appendix C.

Each sample was visually classified on the basis of texture and plasticity in accordance with ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedures) and including USCS classification symbols, and ASTM D2487 Standard Practice for Classification for Engineering Purposes (Unified Soil Classification System, USCS). After classification, the samples were grouped in the major zones noted on the boring logs in Appendix B. The group symbols for each soil type are indicated in parentheses along with the soil descriptions. The stratification lines between strata on the logs are approximate; in situ, the transitions may be gradual.

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## **4.0 DESIGN RECOMMENDATIONS**

The following recommendations have been developed on the basis of the previously described project characteristics and subsurface conditions identified during this study. If there are changes to the project characteristics or if different subsurface conditions are encountered during construction, ECS should be consulted so that the recommendations of this report can be reviewed. Site grading information was not provided during this report; however, we have assumed fill heights will be 2 feet or less across the site. If the finished floor elevation deviates from this assumed site grades, the recommendations provided below should be evaluated by our office.

### **4.1 GEOTECHNICAL CONSIDERATIONS**

The primary purpose of this geotechnical exploration was to help identify and evaluate the general subsurface conditions relative to the proposed construction. Based on the subsurface conditions encountered in the borings, the anticipated column and loading conditions and the lowest level bearing elevation, the site appears suited for the proposed development provided the recommendations herein are strictly adhered to. The following sections detail our geotechnical concerns and recommendations for the proposed development regarding foundation and below grade work.

#### **4.1.1 Construction Monitoring**

ECS should be on-site full-time during earthwork and foundation construction activities to document that our recommendations are followed and to provide recommendations for remedial activities, where necessary.

#### **4.1.2 Moisture Sensitive Soils**

Based on the laboratory test results, fine grained soils were disclosed directly beneath the ground surface across the site. These soils are moisture sensitive, subject to volume changes and will become weak when wet of their optimum moisture content as evaluated by a standard Proctor test. Effective site drainage should be implemented at the onset of construction and maintained throughout the construction process. Care should be taken to keep construction traffic to a minimum across the site during wet periods. Water should not be allowed to pond on construction areas (building pads or pavement subgrade).

#### **4.1.3 Perimeter Conditions**

Positive drainage away from the structure should be provided during construction and maintained throughout the life of the proposed project. Water should not be allowed to infiltrate into the excavations during construction. Foundation soils should not be allowed to become wet. Grades must be sloped to provide effective drainage away from the building during and after construction. Adjacent concrete sidewalks and pavements should be sloped to provide drainage away from the building, and joints should be sealed; close attention should be paid to those directly abutting the building.

Roof runoff and surface drainage should be collected and discharged away from the structure to reduce the likelihood of the wetting of the foundation soils. Roof gutters should be installed and connected to downspouts and pipes directing roof runoff into stormwater collection systems or discharged onto positively sloped pavements.

## 4.2 FOUNDATIONS

Provided subgrades and structural fills are strictly prepared as recommended in this report, the proposed structure can be supported by shallow foundations including column footings and continuous wall footings. We recommend the foundation design use the following parameters:

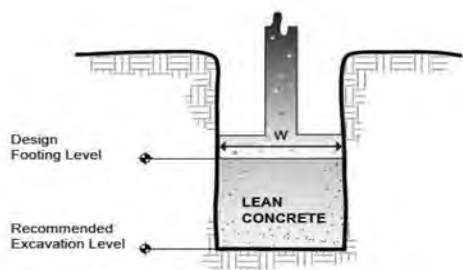
**Table 4.2.1 Foundation Design**

Design Parameter	Column Footing	Wall Footing
Net Allowable Bearing Pressure <sup>(1)</sup>	3,000 psf	3,000 psf
Acceptable Bearing Soil Material	Stiff or Better Native Soil or Compacted Structural Fill	Stiff or Better Native Soil or Compacted Structural Fill
Minimum Width	24 inches	16 inches
Minimum Footing Embedment Depth (below slab or finished grade) <sup>(2)</sup>	18 inches	18 inches
Minimum Exterior Frost Depth (below final exterior grade)	18 inches	18 inches
Estimated Total Settlement <sup>(3)</sup>	Less than 1-inch	Less than 1-inch
Estimated Differential Settlement <sup>(4)</sup>	Less than ½ inch between columns	Less than ½ inch along 40 feet

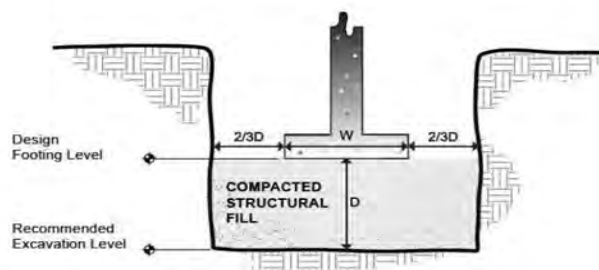
Notes:

- (1) Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.
- (2) For bearing considerations, frost penetration requirements
- (3) Based on assumed structural loads. If final loads are different, ECS must be contacted to update foundation recommendations and settlement calculations.
- (4) Based on maximum column/wall loads and variability in borings. Differential settlement can be re-evaluated once the foundation plans are more complete.

**Potential Undercuts:** If soft or low consistency soils are observed during footing inspections, as noted in Section 4.1.2, the footings should be extended to adequate bearing soils. Undercut areas should be backfilled with compacted engineered fill or lean concrete ( $f'_c \geq 1,000$  psi at 28 days) to the original design bottom of footing elevation; the original footing should be constructed on top of the hardened lean concrete or engineered fill. If engineered fill is used to backfill the undercut footing, the over-excavated footings should be widened accordingly on each side for each one (1) foot of over excavation as detailed in the figure below. If lean concrete is used for backfill, the over-excavation does not require widening.



**Lean Concrete Backfill**



**Structural Fill Backfill**

The net allowable soil bearing pressure refers to that pressure which may be transmitted to the foundation bearing soils in excess of the final minimum surrounding overburden pressure. The final footing elevation should be evaluated by ECS's geotechnical engineering personnel to evaluate that the bearing soils are capable of supporting the recommended net allowable bearing pressure and adequate for foundation construction. These evaluations should include visual observations using a T-probe or static cone penetrometer, or with the use of a Dynamic Cone Penetrometer (DCP), if necessary. Evaluations should be performed within each column footing excavation (minimum of 2 tests per column footing) and at intervals not greater than 25 feet in continuous footings. The DCP testing should extend at least 2 feet below the final foundation subgrade. A minimum DCP value of 10 blows should be used for the evaluation of the foundations.

Exposure to the environment may weaken the soils at the foundation bearing level if the foundation excavations remain exposed during periods of inclement weather. Therefore, foundation concrete should be placed the same day that final excavation is achieved, and the design bearing pressure verified. If the bearing soils are softened by surface water absorption or exposure to the environment, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the foundation excavation must remain open overnight, or if rainfall is apparent while the bearing soils are exposed, we recommend that a 1 to 3-inch thick "mud mat" of "lean" concrete be placed over the exposed bearing soils before the placement of reinforcing steel.

#### 4.3 SLABS ON GRADE

Provided subgrades and structural fills are prepared as discussed herein, the proposed floor slabs can be constructed as Ground Supported Slabs (or Slab-On-Grade). It appears that the slabs will bear on newly compacted fill or Stratum I – stiff or greater native soils. The following graphic depicts our soil-supported slab recommendations:

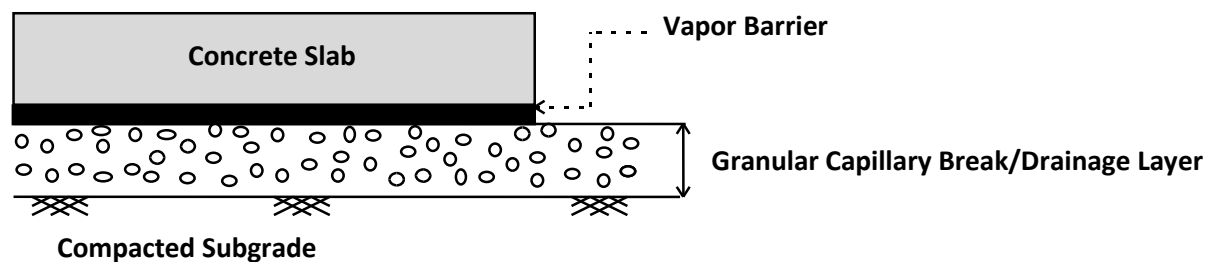


Figure 4.3.1

1. Drainage Layer Thickness: 6 inches
2. Drainage Layer Material: 6 inches of GRAVEL (GP, GW) or SAND (SP, SW)

**Subgrade Modulus:** Provided the structural fill and granular drainage layer are constructed in accordance with our recommendations, the slab may be designed assuming a modulus of subgrade reaction,  $k_1$  of 110 pci (lbs./cu. inch). The modulus of subgrade reaction value is based on a 1 ft by 1 ft plate load test basis.

**Vapor Barrier:** Before the placement of concrete, a vapor barrier may be placed on top of the granular drainage layer to provide additional protection against moisture penetration through the floor slab. When

a vapor barrier is used, special attention should be given to surface curing of the slab to reduce the potential for uneven drying, curling and/or cracking of the slab. Depending on proposed flooring material types, the structural engineer and/or the architect may choose to eliminate the vapor barrier.

**Slab Isolation:** Soil-supported slabs should be isolated from the foundations and foundation-supported elements of the structure so that differential movement between the foundations and slab will not induce excessive shear and bending stresses in the floor slab. Where the structural configuration does not allow the use of a free-floating slab such as in a drop down footing/monolithic slab configuration, the slab should be designed with adequate reinforcement and load transfer devices to avoid overstressing of the slab.

#### 4.4 BELOW GRADE WALLS

We recommend that below grade walls be designed to withstand at-rest lateral earth pressures and surcharge loads from adjacent building foundations, and/or streets. These recommendations apply to a “drained” condition which is where there is drainage material behind below grade walls that reduces the likelihood of hydrostatic water pressures on the back of the below grade wall. To accomplish a drained condition, drainage materials such as a free draining gravel, geocomposite drainage panels, and an underslab drainage system, and potential sump area, should be used. Where a drained condition cannot be incorporated into the wall design, the walls should be designed with hydrostatic water pressures.

We recommend that walls that are restrained from movement at the top be designed for a linearly increasing lateral earth pressure. The following Figure depicts our recommended at-rest lateral earth pressure condition for a “drained below-grade wall” with restrained wall top:

This diagram is not adequate for the design of Support of Excavation or temporary shoring systems.

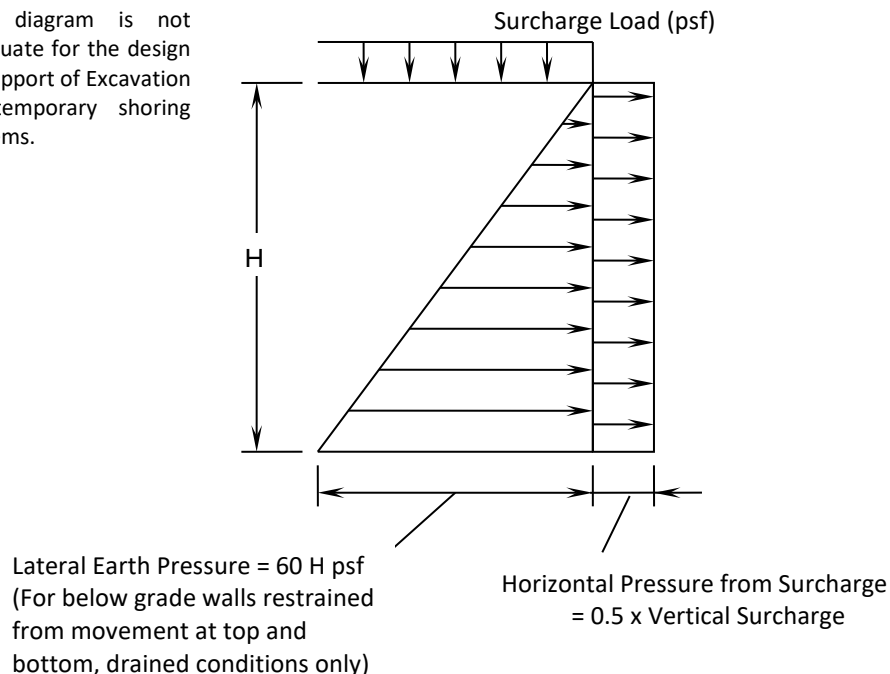


Figure 4.4.1

Surcharge loads imposed within a 45-degree slope from the base of the restrained wall should be considered in the below grade wall design. These surcharge loads should be based on an at-rest pressure coefficient,  $k_0$ , of 0.5. Care should be used to avoid the operation of heavy equipment to compact the wall backfill since it may overload and damage the wall; in addition, such loads are not typically considered in the design of below grade walls.

#### 4.5 SEISMIC DESIGN CONSIDERATIONS

**Seismic Site Classification:** The International Building Code (IBC) 2021 requires site classification for seismic design based on the upper 100 feet of a soil profile. At least two methods are utilized in classifying sites, namely the shear wave velocity ( $v_s$ ) method and the Standard Penetration Resistance (N-value) method. The second method was used in classifying this site.

Table 4.5.1 Seismic Site Classification			
Site Class	Soil Profile Name	Shear Wave Velocity, $V_s$ , (ft./s)	N value (bpf)
A	Hard Rock	$V_s > 5,000$ fps	N/A
B	Rock	$2,500 < V_s \leq 5,000$ fps	N/A
C	Very dense soil and soft rock	$1,200 < V_s \leq 2,500$ fps	$> 50$
D	Stiff Soil Profile	$600 \leq V_s \leq 1,200$ fps	15 to 60
E	Soft Soil Profile	$V_s < 600$ fps	$< 15$

Based upon our interpretation of the subsurface conditions, the appropriate Seismic Site Classification is "C" as shown in the preceding table.

**Ground Motion Parameters:** In addition to the seismic site classification, ECS has evaluated the design spectral response acceleration parameters following the IBC methodology. The Mapped Responses were estimated from the OSHPD website <https://seismicmaps.org>. The design responses for the short (0.2 sec,  $S_{D5}$ ) and 1-second period ( $S_{D1}$ ) are noted in bold at the far right end of the following table.

Table 4.5.2 Ground Motion Parameters [Ibc 2021 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)	
Reference	Figures 1613.3.1 (1) & (2)		Tables 1613.3.3 (1) & (2)		Eqs. 16-37 & 16-38		Eqs. 16-39 & 16-40	
0.2	$S_5$	0.397	$F_a$	1.3	$S_{MS}=F_a S_5$	0.516	$S_{D5}=2/3 S_{MS}$	<b>0.344</b>
1.0	$S_1$	0.149	$F_v$	1.5	$S_{M1}=F_v S_1$	0.223	$S_{D1}=2/3 S_{M1}$	<b>0.149</b>

The Site Class definition should not be confused with the Seismic Design Category designation which the Structural Engineer typically assesses. If a higher site classification is beneficial to the project, we can provide additional testing methods that may yield more favorable results.



## 4.6 PAVEMENTS

Based on the results of our borings, it appears that the pavement subgrades in cuts will consist mainly of Sandy Lean Clay (CL) and Shale. California Bearing Ratio (CBR) testing was not performed as part of this study. Therefore, we have assumed a CBR value of 4 for preliminary design purposes.

We were not provided traffic loading information, so we have assumed loadings typical of this type of project. We have assumed traffic loading conditions of 5,000 ESALs for light duty pavement and 25,000 ESALs for heavy duty pavement.

The preliminary pavement sections below are guidelines that may or may not comply with local jurisdictional minimums.

Table 4.6.2 Proposed Pavement Sections				
MATERIAL	FLEXIBLE PAVEMENT		RIGID PAVEMENT	
	Light Duty	Heavy Duty	Light Duty	Heavy Duty
Portland Cement Concrete ( $f'_c = 4000$ psi)	-	-	5 in.	6 in.
Asphaltic Concrete Surface Course	1.5 in.	2 in.	-	-
Asphaltic Concrete Binder Course	2 in.	2 in.	-	-
Graded Aggregate Base Course	6 in.	6 in.	6 in.	6 in.

In general, heavy-duty sections are areas that will be subjected to trucks, buses, or other similar vehicles including main drive lanes of the development. Light duty sections are appropriate for vehicular traffic and parking areas.

Large, front loading trash dumpsters frequently impose concentrated front wheel loads on pavements during loading. This type of loading typically results in rutting of asphalt pavement and ultimately pavement failures. For preliminary design purposes, we recommend that the pavement in trash pickup areas consist of a 6-inch thick, 4,000 psi, reinforced concrete slab over 6-inches of dense graded aggregate. Concrete for the dumpster pad should extend a minimum of five feet past the anticipated location of the wheel loads. When traffic loading becomes available, ECS or the Civil Engineer can design the pavements.

Prior to subbase placement and paving, CBR testing of the subgrade soils (both natural and fill soils) should be performed to evaluate the soil engineering properties for final pavement design.

## 5.0 SITE CONSTRUCTION RECOMMENDATIONS

### 5.1 SUBGRADE PREPARATION

#### 5.1.1 Stripping and Grubbing

The subgrade preparation should consist of stripping vegetation, rootmat, topsoil, existing fill, and soft or inadequate materials from the 10-foot expanded building and 5-foot expanded pavement limits, and 5 feet beyond the toe of structural fills. The borings encountered a surficial material consisting of approximately 10 inches of topsoil. Topsoil or organic laden soils may be present in wet, low-lying, and poorly drained areas. ECS should be retained to verify that topsoil and inadequate surficial materials have been removed prior to the placement of structural fill or construction of structures.

#### 5.1.2 Excavation Considerations

Based on boring data obtained during the exploration, we anticipate that materials requiring difficult or rock excavation techniques will be encountered during site grading and excavation to planned subgrades.

The excavation of weathered rock and rock can have a substantial impact on the cost and schedule of the proposed construction. This discussion considers two general classes of materials for purposes of describing excavatability. Residuum and weathered rock will be used as the terms for the materials to be excavated.

In mass excavations for general site work, overburden soils with standard penetration test N-values of 30 bpf or less can usually be removed with conventional earth excavation equipment. Residual soils or soft weathered (Saprolitic) rock with N-values of 30 to 50 bpf can generally be removed with conventional earth moving equipment after first being loosened with a large single-tooth ripper attached to a large crawler tractor. Harder, less weathered rock will generally require the use of a large single-tooth ripper, dozers, and/or track-mounted backhoes for excavation. However, materials exhibiting N-values of 50 blows for 6 inch of penetration, typically defined as refusal material, will be more difficult to excavate and generally require blasting and other rock excavation techniques. The actual excavatability of the bedrock material will be greatly controlled by in-situ jointing and bedding and may vary from location to location.

In confined excavations, such as utility trenches, excavation of dense residual soils typically requires the use of large track-mounted backhoes. Excavation of harder phases of weathered rock typically requires the use of large track-mounted backhoes, pneumatic spades, or light blasting. Refusal materials (apparent rock) normally require blasting in trench excavations. Blasting in utility trenches should be done carefully to avoid damage to the surrounding materials. If the material to be excavated requires blasting, the contractor should comply with the requirements of the City of Maumelle.

#### 5.1.3 Proofrolling

Prior to fill placement or other construction on subgrades, the subgrades should be evaluated by an ECS field technician. The exposed subgrade should be thoroughly proofrolled with construction equipment having a minimum axle load of 15 tons [e.g. fully loaded tandem-axle dump truck]. Proofrolling should be

traversed in two perpendicular directions with overlapping passes of the vehicle under the observation of an ECS technician. This procedure is intended to assist in identifying localized yielding materials.

Where proofrolling identifies areas that are soft or “pumping” subgrade those areas should be repaired prior to the placement of subsequent structural fill or other construction materials. Methods of stabilization include undercutting, moisture conditioning, or chemical stabilization. The situation should be discussed with ECS to evaluate the appropriate procedure. Test pits may be excavated to explore the shallow subsurface materials to help in evaluating the cause of the observed inadequate materials, and to assist in the evaluation of appropriate remedial actions to improve the subgrade.

#### **5.1.4 Site Temporary Dewatering**

Based upon our subsurface exploration at this site, as well as significant experience on sites in nearby areas of similar geologic setting, we believe construction dewatering at this site will be mainly limited to removing accumulated rainwater and some minor seepage from the support of excavation (SOE). However, as oil change pits are part of this facility construction, groundwater control may be required if perched water conditions exist.

Deep wells should not be required for the temporary dewatering system. However, the dewatering operations for near grade excavations can be handled by the use of conventional submersible pumps directly in the excavation, temporary trenches, or French drains.

### **5.2 EARTHWORK OPERATIONS**

#### **5.2.1 Moisture-Sensitive Soil**

Near surface, moisture sensitive fine-grained soils were disclosed in the borings across the site. These soils will become difficult to work with and inadequate when wet of their optimum moisture content as evaluated by the standard Proctor test (ASTM D-698). Care should be taken during construction to reduce construction activities during and immediately following inclement weather.

#### **5.2.2 Structural Fill**

Prior to placement of structural fill, representative bulk samples (about 50 pounds) of on-site and/or off-site borrow should be submitted to ECS for laboratory testing, which will typically include Atterberg limits, natural moisture content, grain-size distribution, and moisture-density relationships (i.e., Proctors) for compaction. Import materials should be tested prior to being hauled to the site to evaluate if they meet project specifications. Alternatively, Proctor data from other accredited laboratories can be submitted if the test results are within the last 90 days.

**Structural Fill Materials:** Materials for use as structural fill should consist of inorganic soils with the following engineering properties and compaction requirements.

**Table 5.2.2.1 Structural Fill Index Properties**

Subject	Property
Building and Pavement Areas	LL < 45, PI<25
Max. Particle Size	4 inches
Fines Content	Max. 25 % > #200 sieve
Max. organic content	5% by dry weight

**Table 5.2.2.2 Structural Fill Compaction Requirements**

Subject	Requirement
Compaction Standard	Standard Proctor, ASTM D698
Required Compaction	95% of Max. Dry Density
Moisture Content	-1 to +3 % points of the soil's optimum value
Loose Thickness	8 inches prior to compaction

**On-Site Borrow:** On site soils meeting the parameters outlined in this report may be used as structural fill if they meet the structural fill properties outlined in this report.

**Fill Compaction Control:** The expanded limits of the proposed construction areas should be well defined, including the limits of the fill zones for buildings, pavements, and slopes, etc., at the time of fill placement. Grade controls should be maintained throughout the filling operations. Filling operations should be observed on a full-time basis by ECS to document that the minimum compaction requirements are being achieved. Field density testing of fills should be performed at the frequencies shown in Table 5.2.2.3, but not less than 2 tests per lift.

**Table 5.2.2.3 Frequency of Compaction Tests in Fill Areas**

Location	Frequency of Tests
Expanded Building Limits	1 test per 2,500 sq. ft. per lift
Pavement Areas	1 test per 10,000 sq. ft. per lift
Utility Trenches	1 test per 200 linear ft. per lift

**Fill Placement:** Fill materials should not be placed on frozen soils, on frost-heaved soils, and/or on excessively wet soils. Borrow fill materials should not contain frozen materials at the time of placement, and frozen or frost-heaved soils should be removed prior to placement of structural fill or other fill soils and aggregates. Excessively wet soils or aggregates should be scarified, aerated, and moisture conditioned.

At the end of each workday, fill areas should be graded to facilitate drainage of precipitation and the surface should be sealed by use of a smooth-drum roller to limit infiltration of surface water. During placement and compaction of new fill at the beginning of each workday, the Contractor may need to scarify existing subgrades to a depth on the order of 4 inches so that a weak plane will not be formed between the new fill and the existing subgrade soils.

Drying and compaction of wet soils is typically difficult during the cold, winter months. Accordingly, earthwork should be performed during the warmer, drier times of the year, if practical. Proper drainage should be maintained during the earthwork phases of construction to reduce ponding of water which has a tendency to degrade subgrade soils.

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 or keyed into the existing material. Fill material should be placed in horizontal lifts. In confined areas such as utility trenches, portable compaction equipment and thin lifts of 3 inches to 4 inches may be required to achieve specified degrees of compaction.

We recommend that the grading contractor have equipment on site during earthwork for both drying and wetting fill soils. We do not anticipate significant problems in controlling moisture within the fill during dry weather, but moisture control may be difficult during winter months or extended periods of rain. The control of moisture content of higher plasticity soils is difficult when these soils become wet. Further, such soils are easily degraded by construction traffic when the moisture content is elevated.

### 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. Therefore, 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 1 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 soils at the foundation bearing elevation are anticipated to be adequate for support of the proposed structure. It is important to have ECS observe the foundation subgrade prior to placing foundation concrete, to confirm the bearing soils are what was anticipated.

**Slab Subgrade Verification:** Prior to placement of a drainage layer, the subgrade should be prepared in accordance with the recommendations found in **Section 5.1.3 Proofrolling**.

### 5.4 UTILITY INSTALLATIONS

**Utility Subgrades:** The soils encountered in our exploration are expected to be generally adequate for support of utility pipes. The pipe subgrades should be observed and probed for stability by ECS. Loose or inadequate materials encountered should be removed and replaced with adequate compacted structural fill, or pipe stone bedding material. Excavation will be difficult for a small rubber-tired backhoe. Excavation for deep utilities will require a large excavator or a trencher machine capable of trenching through very hard soils or weathered rock.

**Utility Backfilling:** The granular bedding material (often AASHTO #57 stone) should be at least 4 inches thick, but not less than that specified by the civil engineer's project drawings and specifications. We

recommend that the bedding materials be placed up to the springline of the pipe. Fill placed for support of the utilities, as well as backfill over the utilities, should satisfy the requirements for structural fill and fill placement.

**Excavation Safety:** Excavations and slopes should be constructed and maintained in accordance with OSHA excavation safety standards. The contractor is solely responsible for designing, constructing, and maintaining adequate temporary excavations and slopes. 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. 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.



## 6.0 CLOSING

ECS has prepared this report to guide the 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 by Express Oil Change, LLC. If any of this information is inaccurate or changes, either because of our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted so we can review our recommendations and provide additional or alternate recommendations that reflect the proposed construction.

We recommend that ECS review the project plans and specifications so we can confirm that those plans/specifications are in accordance with the recommendations of this geotechnical report.

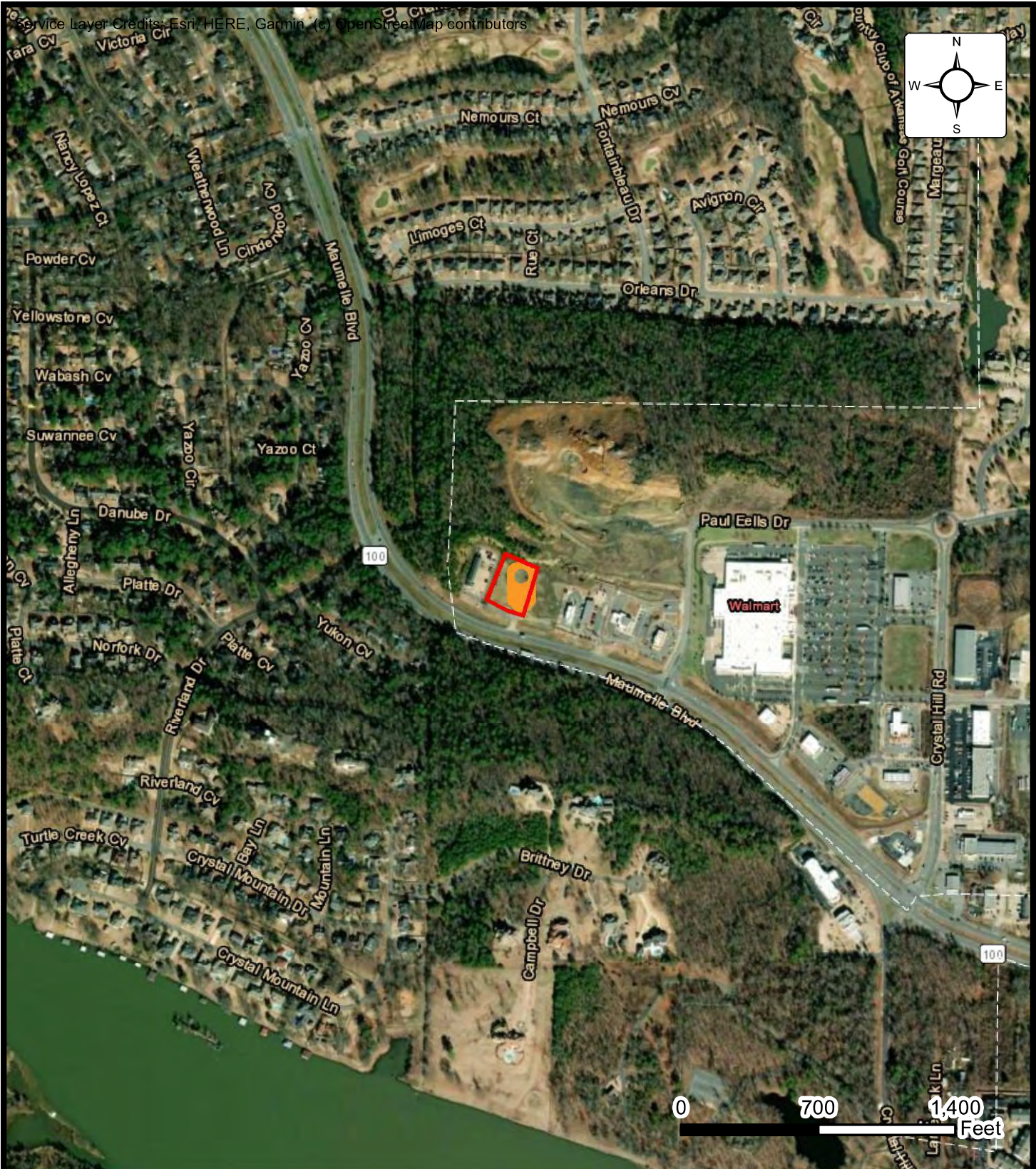
Field observations, and quality assurance testing during earthwork and foundation installation are an extension of, and integral to, the geotechnical design. We recommend that ECS be retained to apply our expertise throughout the geotechnical phases of construction, and to provide consultation and recommendation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

Site Location Diagram

Boring Location Diagram(s)



## SITE LOCATION DIAGRAM EXPRESS OIL CHANGE - MAUMELLE

MAUMELLE BLVD, MAUMELLE, ARKANSAS

EXPRESS OIL CHANGE, LLC

ENGINEER  
JDG2

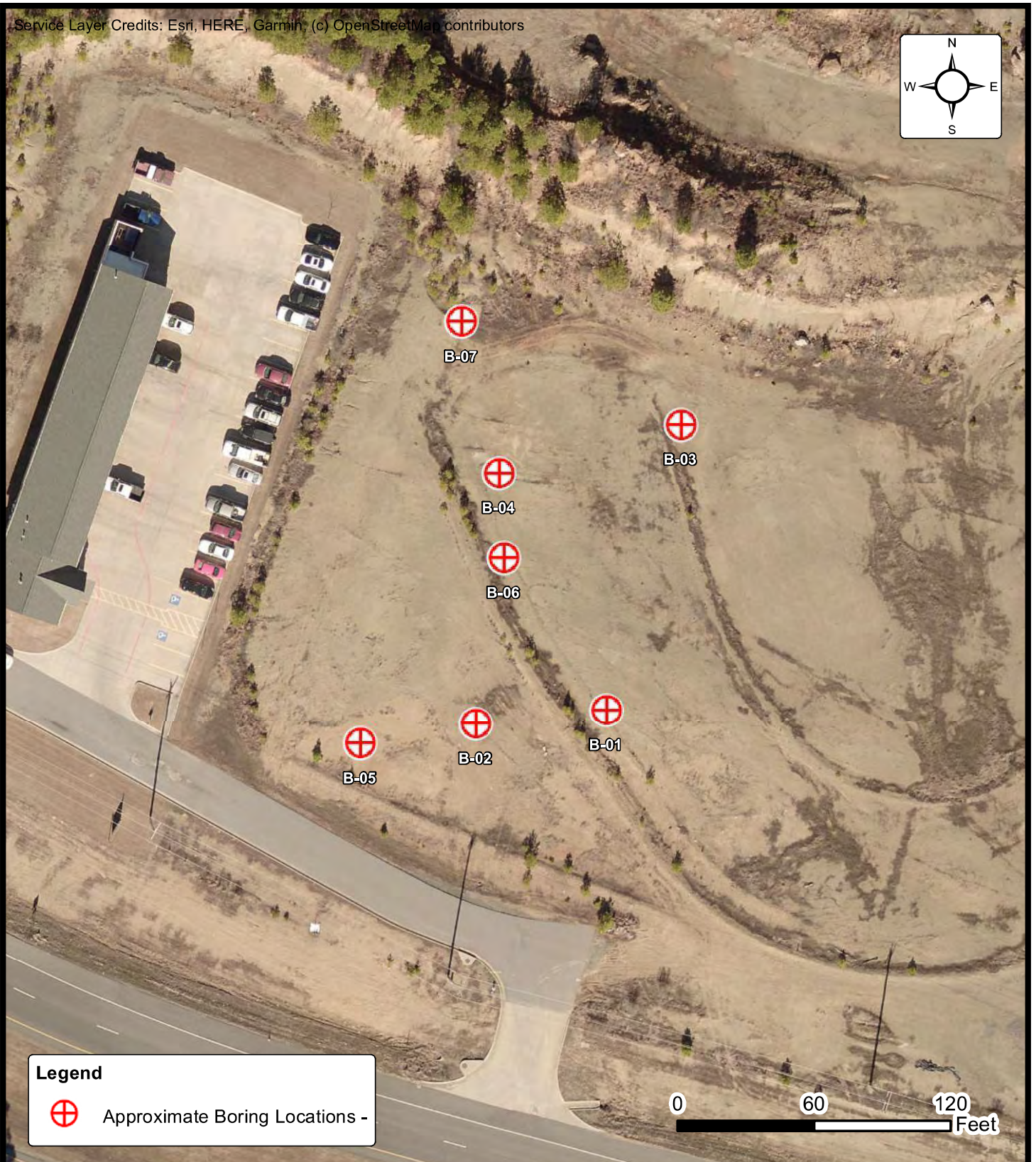
SCALE  
AS NOTED

PROJECT NO.  
62:1321

FIGURE  
1 OF 1

DATE  
1/24/2024





**Legend**



Approximate Boring Locations -



**BORING LOCATION DIAGRAM  
EXPRESS OIL CHANGE - MAUMELLE**

**MAUMELLE BLVD, MAUMELLE, ARKANSAS**

**EXPRESS OIL CHANGE, LLC**

ENGINEER  
JDG2

SCALE  
AS NOTED

PROJECT NO.  
62:1321

FIGURE  
1 OF 1

DATE  
1/24/2024

## **Appendix B – Field Operations**

Reference Notes

Exploration Procedures

Boring Logs



# REFERENCE NOTES FOR BORING LOGS

MATERIAL <sup>1,2</sup>	
	<b>ASPHALT</b>
	<b>CONCRETE</b>
	<b>GRAVEL</b>
	<b>TOPSOIL</b>
	<b>VOID</b>
	<b>BRICK</b>
	<b>AGGREGATE BASE COURSE</b>
	<b>GW WELL-GRADED GRAVEL</b> gravel-sand mixtures, little or no fines
	<b>GP POORLY-GRADED GRAVEL</b> gravel-sand mixtures, little or no fines
	<b>GM SILTY GRAVEL</b> gravel-sand-silt mixtures
	<b>GC CLAYEY GRAVEL</b> gravel-sand-clay mixtures
	<b>SW WELL-GRADED SAND</b> gravely sand, little or no fines
	<b>SP POORLY-GRADED SAND</b> gravely sand, little or no fines
	<b>SM SILTY SAND</b> sand-silt mixtures
	<b>SC CLAYEY SAND</b> sand-clay mixtures
	<b>ML SILT</b> non-plastic to medium plasticity
	<b>MH ELASTIC SILT</b> high plasticity
	<b>CL LEAN CLAY</b> low to medium plasticity
	<b>CH FAT CLAY</b> high plasticity
	<b>OL ORGANIC SILT or CLAY</b> non-plastic to low plasticity
	<b>OH ORGANIC SILT or CLAY</b> high plasticity
	<b>PT PEAT</b> 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 <sup>4</sup>	SPT <sup>5</sup> (BPF)	CONSISTENCY <sup>7</sup> (COHESIVE)
<0.25	<2	Very Soft
0.25 - <0.50	2 - 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 <sup>7</sup>	COARSE GRAINED (%) <sup>8</sup>	FINE GRAINED (%) <sup>8</sup>
Trace	≤5	≤5
With	10 - 20	10 - 25
Adjective (ex: "Silty")	25 - 45	30 - 45

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

WATER LEVELS <sup>6</sup>	
	WL (First Encountered)
	WL (Completion)
	WL (Seasonal High Water)
	WL (Stabilized)

FILL AND ROCK			
FILL	POSSIBLE FILL	PROBABLE FILL	ROCK

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

<sup>2</sup>To 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.

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

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

<sup>5</sup>Standard 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.

<sup>6</sup>The 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.

<sup>7</sup>Minor deviation from ASTM D 2488-17 Note 14.

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

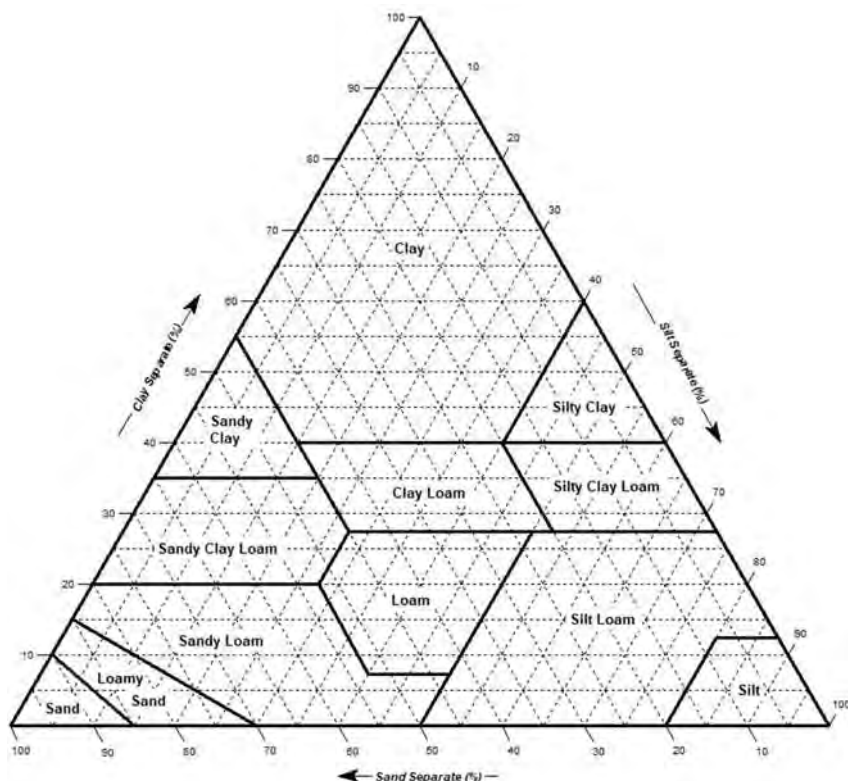




## U.S. Department of Agriculture (USDA) Soil Classification System

### Texture Triangle

Fine Earth Texture Classes (—)



### Texture Class

Texture Class or Subclass	Code	
	Conv.	NASIS
Coarse Sand	cos	COS
Sand	s	S
Fine Sand	fs	FS
Very Fine Sand	vfs	VFS
Loamy Coarse Sand	lcos	LCOS
Loamy Sand	ls	LS
Loamy Fine Sand	lfs	LFS
Loamy Very Fine Sand	lvfs	LVFS
Coarse Sandy Loam	cosl	COSL
Sandy Loam	sl	SL
Fine Sandy Loam	fsl	FSL
Very Fine Sandy Loam	vfsl	VFSL
Loam	l	L
Silt Loam	sil	SIL
Silt	si	SI
Sandy Clay Loam	scl	SCL
Clay Loam	cl	CL
Silty Clay Loam	sicl	SICL
Sandy Clay	sc	SC
Silty Clay	sic	SIC
Clay	c	C

**Texture Modifiers** – Conventions for using “Rock Fragment Texture Modifiers” and for using textural adjectives that convey the “% volume” ranges for **Rock Fragments – Size and Quantity**.

Fragment Content % By Volume	Rock Fragment Modifier Usage
< 15	No texture adjective is used (noun only; e.g., <i>loam</i> ).
15 to < 35	Use adjective for appropriate size; e.g., <i>gravelly</i> .
35 to < 60	Use “very” with the appropriate size adjective; e.g., <i>very gravelly</i> .
60 to < 90	Use “extremely” with the appropriate size adjective; e.g., <i>extremely gravelly</i> .
≥ 90	No adjective modifier. If ≤ 10% fine earth, use the appropriate noun for the dominant size class; e.g., <i>gravel</i> . <b>Use terms in lieu of texture.</b>

### Texture Modifiers – (Adjectives)

Rock Fragments: Size and Quantity	Code		Criteria: Percent (by volume) of total rock fragments and dominated by ( <i>name size</i> ):
	Conv.	PDP/ NASIS	
<b><i>Rock Fragments (&gt; 2mm; ≥ Strongly Cemented)</i></b>			
Gravelly	GR	GR	≥ 15% but < 35% gravel
Fine Gravelly	FGR	GRF	≥ 15% but < 35% fine gravel
Medium Gravelly	MGR	GRM	≥ 15% but < 35% med. gravel
Coarse Gravelly	CGR	GRC	≥ 15% but < 35% coarse gravel
Very Gravelly	VGR	GRV	≥ 35% but < 60% gravel
Extremely Gravelly	XGR	GRX	≥ 60% but < 90% gravel
Cobbly	CB	CB	≥ 15% but < 35% cobbles
Very Cobbly	VCB	CBV	≥ 35% but < 60% cobbles
Extremely Cobbly	XCB	CBX	≥ 60% but < 90% cobbles
Stony	ST	ST	≥ 15% but < 35% stones
Very Stony	VST	STV	≥ 35% but < 60% stones
Extremely Stony	XST	STX	≥ 60% but < 90% stones
Bouldery	BY	BY	≥ 15% but < 35% boulders
Very Bouldery	VBY	BYV	≥ 35% but < 60% boulders
Extremely Bouldery	XBY	BYX	≥ 60% but < 90% boulders
Channery	CN	CN	≥ 15% but < 35% channers
Very Channery	VCN	CNV	≥ 35% but < 60% channers
Extremely Channery	XCN	CNX	≥ 60% but < 90% channers
Flaggy	FL	FL	≥ 15% but < 35% flagstones
Very Flaggy	VFL	FLV	≥ 35% but < 60% flagstones
Extremely Flaggy	XFL	FLX	≥ 60% but < 90% flagstones



## SUBSURFACE EXPLORATION PROCEDURE: STANDARD PENETRATION TESTING (SPT) ASTM D 1586 Split-Barrel 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 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 split-spoon a distance of 18-24 inches (in 3 or 4 Increments of 6 inches each)
- Auger is advanced\* and an additional SPT is performed
- One SPT typically performed for every two to five feet. An approximate 1.5 inch diameter soil sample is recovered.














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








CLIENT: Express Oil Change, LLC				PROJECT NO.: 62:1321		BORING NO.: B-01		SHEET: 1 of 1						
PROJECT NAME: Express Oil Change - Maumelle				DRILLER/CONTRACTOR: Anderson Engineering Consultants, Inc										
SITE LOCATION: Maumelle Blvd, Maumelle, Arkansas, 72113								LOSS OF CIRCULATION 						
LATITUDE: 34.832326		LONGITUDE: -92.398883		STATION:		SURFACE ELEVATION:		BOTTOM OF CASING 						
DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (N - Value)	STANDARD PENETRATION BLOWS/FT		ROCK QUALITY DESIGNATION & RECOVERY		WATER CONTENT % [FINES CONTENT] %	
									20 40 60 80 100		RQD REC		10 20 30 40 50	
	S-1	SS	18	18	(CL) SANDY LEAN CLAY, contains rock fragments, brown, dry, very hard			15-25-50 (75)		75		21	39	
	S-2	SS	4	4					50/4" (50/4")		50		11.2	
5	S-3	SS	3	3				-5	50/3" (50/3")		50		6.9	
	S-4	SS	3	3					50/3" (50/3")		50		6.8	
10	S-5	SS	3	3				-10	50/3" (50/3")		50		7.0	
15	S-6	SS	0	0				-15	50/0" (50/0")		50		4.9	
20	S-7	SS	0	0				-20	50/0" (50/0")		50		7.5	
					END OF BORING AT 21.5 FT									
25							-25							
30							-30							
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL														
 WL (First Encountered) 18.00				BORING STARTED: Jan 08 2024				CAVE IN DEPTH:						
 WL (Completion)				BORING COMPLETED: Jan 08 2024				HAMMER TYPE: Auto						
 WL (Seasonal High Water)				EQUIPMENT: Truck		LOGGED BY: ABJ		DRILLING METHOD: HSA 3.25"						
GEOTECHNICAL BOREHOLE LOG														





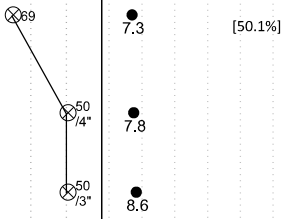
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PROJECT NAME: Express Oil Change - Maumelle				DRILLER/CONTRACTOR: Anderson Engineering Consultants, Inc											
SITE LOCATION: Maumelle Blvd, Maumelle, Arkansas, 72113								LOSS OF CIRCULATION 							
LATITUDE: 34.832295		LONGITUDE: -92.399112		STATION:		SURFACE ELEVATION:		BOTTOM OF CASING 							
DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (N - Value)	STANDARD PENETRATION BLOWS/FT 20 40 60 80 100		ROCK QUALITY DESIGNATION & RECOVERY		WATER CONTENT % [FINES CONTENT] %		
									X RQD — REC		10 20 30 40 50				
	S-1	SS	18	18	(CL) SANDY LEAN CLAY, contains rock fragments, brown, dry, very hard			21-22-40 (62)			62				
	S-2	SS	4	4				50/4" (50/4")			50/4"				
5	S-3	SS	4	4				-5 50/4" (50/4")			50/4"				
	S-4	SS	5	5				50/5" (50/5")			50/5"				
10	S-5	SS	6	6				-10 50							
15	S-6	SS	2	2			-15 50/2" (50/2")			50/2"					
					END OF BORING AT 16.5 FT										
20								-20							
25								-25							
30								-30							
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL															
<input type="checkbox"/> WL (First Encountered) Not Encountered				BORING STARTED: Jan 09 2024				CAVE IN DEPTH:							
<input checked="" type="checkbox"/> WL (Completion)				BORING COMPLETED: Jan 09 2024				HAMMER TYPE: Auto							
<input checked="" type="checkbox"/> WL (Seasonal High Water)				EQUIPMENT: Truck				LOGGED BY: ABJ				DRILLING METHOD: HSA 3.25"			
<input checked="" type="checkbox"/> WL (Stabilized)															
GEOTECHNICAL BOREHOLE LOG															







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PROJECT NAME: Express Oil Change - Maumelle				DRILLER/CONTRACTOR: Anderson Engineering Consultants, Inc										
SITE LOCATION: Maumelle Blvd, Maumelle, Arkansas, 72113								LOSS OF CIRCULATION 						
LATITUDE: 34.832650		LONGITUDE: -92.398776		STATION:		SURFACE ELEVATION:		BOTTOM OF CASING 						
DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (N - Value)	STANDARD PENETRATION BLOWS/FT		ROCK QUALITY DESIGNATION & RECOVERY		WATER CONTENT % [FINES CONTENT] %	
									20 40 60 80 100		RQD REC		10 20 30 40 50	
5	S-1	SS	12	12	(CL) SANDY LEAN CLAY, contains rock fragments, brown, dry, very hard		-5	15-50		50/1"	5.2	5.1	7.7	[62.0%]
	S-2	SS	1	1				50/1"						
	S-3	SS	10	10	(CL) SANDY LEAN CLAY, contains rock fragments, brown, wet, very hard		-10	30-50/4"		50/4"	18	17.2	37	
	S-4	SS	18	18	25-21-35 (56)									
	S-5	SS	18	18	17-22-33 (55)		50/0"	19.7						
	S-6	SS	0	0	50/0"									
END OF BORING AT 16.5 FT														
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL														
 WL (First Encountered) 10.00					BORING STARTED: Jan 08 2024					CAVE IN DEPTH:				
 WL (Completion) 5.00					BORING COMPLETED: Jan 08 2024					HAMMER TYPE: Auto				
 WL (Seasonal High Water)					EQUIPMENT: Truck					LOGGED BY: ABJ				
 WL (Stabilized)										DRILLING METHOD: HSA 3.25"				
GEOTECHNICAL BOREHOLE LOG														



CLIENT: Express Oil Change, LLC				PROJECT NO.: 62:1321		BORING NO.: B-04		SHEET: 1 of 1						
PROJECT NAME: Express Oil Change - Maumelle				DRILLER/CONTRACTOR: Anderson Engineering Consultants, Inc										
SITE LOCATION: Maumelle Blvd, Maumelle, Arkansas, 72113								LOSS OF CIRCULATION						
LATITUDE: 34.832599		LONGITUDE: -92.399040		STATION:		SURFACE ELEVATION:		BOTTOM OF CASING						
DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (N - Value)	STANDARD PENETRATION BLOWS/FT		ROCK QUALITY DESIGNATION & RECOVERY		WATER CONTENT % [FINES CONTENT] %	
									20 40 60 80 100		RQD REC		10 20 30 40 50	
5	S-1	SS	18	18	(CL) SANDY LEAN CLAY, contains rock fragments, brown, dry, very hard			13-17-37 (54)						
	S-2	SS	6	6				50						
	S-3	SS	6	6				50						
10	S-4	SS	6	6			50							
	S-5	SS	5	5			-10	50/5" (50/5")			50/5"			
15														
	S-6	SS	4	4			50							
							-15	50/4" (50/4")			50/4"			
20					END OF BORING AT 16.5 FT									
25														
30														
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL														
 WL (First Encountered)				Not Encountered		BORING STARTED: Jan 08 2024				CAVE IN DEPTH:				
 WL (Completion)						BORING COMPLETED: Jan 08 2024				HAMMER TYPE: Auto				
 WL (Seasonal High Water)						EQUIPMENT: Truck		LOGGED BY: ABJ		DRILLING METHOD: HSA 3.25"				
 WL (Stabilized)														
GEOTECHNICAL BOREHOLE LOG														

CLIENT: Express Oil Change, LLC				PROJECT NO.: 62:1321		BORING NO.: B-05		SHEET: 1 of 1							
PROJECT NAME: Express Oil Change - Maumelle				DRILLER/CONTRACTOR: Anderson Engineering Consultants, Inc											
SITE LOCATION: Maumelle Blvd, Maumelle, Arkansas, 72113								LOSS OF CIRCULATION							
LATITUDE: 34.832268		LONGITUDE: -92.399248		STATION:		SURFACE ELEVATION:		BOTTOM OF CASING							
DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (N - Value)	STANDARD PENETRATION BLOWS/FT		ROCK QUALITY DESIGNATION & RECOVERY		WATER CONTENT % [FINES CONTENT] %		
									20 40 60 80 100		RQD REC		10 20 30 40 50		
	S-1	SS	18	18	(CL) SANDY LEAN CLAY, contains rock fragments, brown, dry, hard to very hard			15-18-23 (41)	 41						
	S-2	SS	3	3					50/3" (50/3")	 50/3"					
5	S-3	SS	3	3				-5	50/3" (50/3")	 50/3"					
					END OF BORING AT 6.5 FT										
10								-10							
15								-15							
20								-20							
25								-25							
30								-30							
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) Not Encountered				BORING STARTED: Jan 09 2024				CAVE IN DEPTH:							
<input checked="" type="checkbox"/> WL (Completion)				BORING COMPLETED: Jan 09 2024				HAMMER TYPE: Auto							
<input checked="" type="checkbox"/> WL (Seasonal High Water)				EQUIPMENT: Truck				LOGGED BY: ABJ							
<input checked="" type="checkbox"/> WL (Stabilized)								DRILLING METHOD: HSA 3.25"							
GEOTECHNICAL BOREHOLE LOG															

CLIENT: Express Oil Change, LLC				PROJECT NO.: 62:1321		BORING NO.: B-06		SHEET: 1 of 1				
PROJECT NAME: Express Oil Change - Maumelle				DRILLER/CONTRACTOR: Anderson Engineering Consultants, Inc								
SITE LOCATION: Maumelle Blvd, Maumelle, Arkansas, 72113								LOSS OF CIRCULATION 				
LATITUDE: 34.832487		LONGITUDE: -92.399032		STATION:		SURFACE ELEVATION:		BOTTOM OF CASING 				
DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (N - Value)	STANDARD PENETRATION BLOWS/FT 20 40 60 80 100 ROCK QUALITY DESIGNATION & RECOVERY RQD REC		LIQUID LIMIT X PLASTIC LIMIT CALIBRATED PENETROMETER TSF 1 2 3 4 5 WATER CONTENT % [FINES CONTENT] % 10 20 30 40 50	
	S-1	SS	18	18	(CL) SANDY LEAN CLAY, contains rock fragments, brown, dry, very hard			16-29-40 (69)				
	S-2	SS	4	4				50/4" (50/4")				
5	S-3	SS	3	3				50/3" (50/3")				
	END OF BORING AT 6.5 FT											
10												
15												
20												
25												
30												
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) Not Encountered					BORING STARTED: Jan 09 2024				CAVE IN DEPTH:			
<input checked="" type="checkbox"/> WL (Completion)					BORING COMPLETED: Jan 09 2024				HAMMER TYPE: Auto			
<input checked="" type="checkbox"/> WL (Seasonal High Water)					EQUIPMENT: Truck		LOGGED BY: ABJ		DRILLING METHOD: HSA 3.25"			
<input checked="" type="checkbox"/> WL (Stabilized)												
GEOTECHNICAL BOREHOLE LOG												

CLIENT: Express Oil Change, LLC				PROJECT NO.: 62:1321		BORING NO.: B-07		SHEET: 1 of 1							
PROJECT NAME: Express Oil Change - Maumelle				DRILLER/CONTRACTOR: Anderson Engineering Consultants, Inc											
SITE LOCATION: Maumelle Blvd, Maumelle, Arkansas, 72113								LOSS OF CIRCULATION							
LATITUDE: 34.832769		LONGITUDE: -92.399092		STATION:		SURFACE ELEVATION:		BOTTOM OF CASING							
DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (N - Value)	STANDARD PENETRATION BLOWS/FT		ROCK QUALITY DESIGNATION & RECOVERY		WATER CONTENT % [FINES CONTENT] %		
									20 40 60 80 100		RQD REC		10 20 30 40 50		
	S-1	SS	8	8	(CL) SANDY LEAN CLAY, contains rock fragments, brown, dry, very hard			30-50/2" (50/2")			50/2"				
	S-2	SS	6	6					50						
5	S-3	SS	2	2					-5	50/2" (50/2")			50/2"		
					END OF BORING AT 6.5 FT										
10															
15															
20															
25															
30															
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) Not Encountered				BORING STARTED: Jan 08 2024				CAVE IN DEPTH:							
<input checked="" type="checkbox"/> WL (Completion)				BORING COMPLETED: Jan 08 2024				HAMMER TYPE: Auto							
<input checked="" type="checkbox"/> WL (Seasonal High Water)				EQUIPMENT: Truck		LOGGED BY: ABJ		DRILLING METHOD: HSA 3.25"							
<input checked="" type="checkbox"/> WL (Stabilized)															
GEOTECHNICAL BOREHOLE LOG															

## **Appendix C – Laboratory Testing**

Laboratory Testing Summary

Plasticity Chart(s)



## Laboratory Testing Summary

Sample Location	Sample Number	Depth (ft)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-01	S-1	0.0-1.5	10.2	CL	39	21	18						
B-01	S-2	3.0-3.3	11.2										
B-01	S-3	5.0-5.3	6.9										
B-01	S-4	8.0-8.3	6.8										
B-01	S-5	10.0-10.3	7.0										
B-01	S-6	15.0-15.0	4.9										
B-01	S-7	20.0-20.0	7.5										
B-03	S-1	0.0-1.0	5.2										
B-03	S-2	3.0-3.1	5.1										
B-03	S-3	5.0-5.8	7.7					62.0					

**Notes:** See test reports for test method, ^ASTM D2216-19, \*ASTM D2488, \*\*ASTM D1140-17, #ASTM D2974-20e1 < See test report for D4718 corrected values

**Definitions:** MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content

Project: Express Oil Change - Maumelle  
Client: Express Oil Change, LLC

Project No.: 62:1321  
Date Reported: 1/23/2024



Office / Lab

ECS Southeast LLC - Memphis

Address

4145 Willow Lake Blvd.  
Memphis, TN 38118

Office Number / Fax

(901)250-4087  
(901)457-0016

Tested by	Checked by	Approved by	Date Received
ABJackson		ABJackson	

## Laboratory Testing Summary

Sample Location	Sample Number	Depth (ft)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-03	S-4	8.0-9.5	17.2	CL	37	18	19						
B-03	S-5	10.0-11.5	10.8										
B-03	S-6	15.0-15.0	19.7										
B-06	S-1	0.0-1.5	7.3					50.1					
B-06	S-2	3.0-3.3	7.8										
B-06	S-3	5.0-5.3	8.6										

**Notes:** See test reports for test method, ^ASTM D2216-19, \*ASTM D2488, \*\*ASTM D1140-17, #ASTM D2974-20e1 < See test report for D4718 corrected values

**Definitions:** MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content

Project: Express Oil Change - Maumelle  
Client: Express Oil Change, LLC

Project No.: 62:1321  
Date Reported: 1/23/2024



Office / Lab

ECS Southeast LLC - Memphis

Address

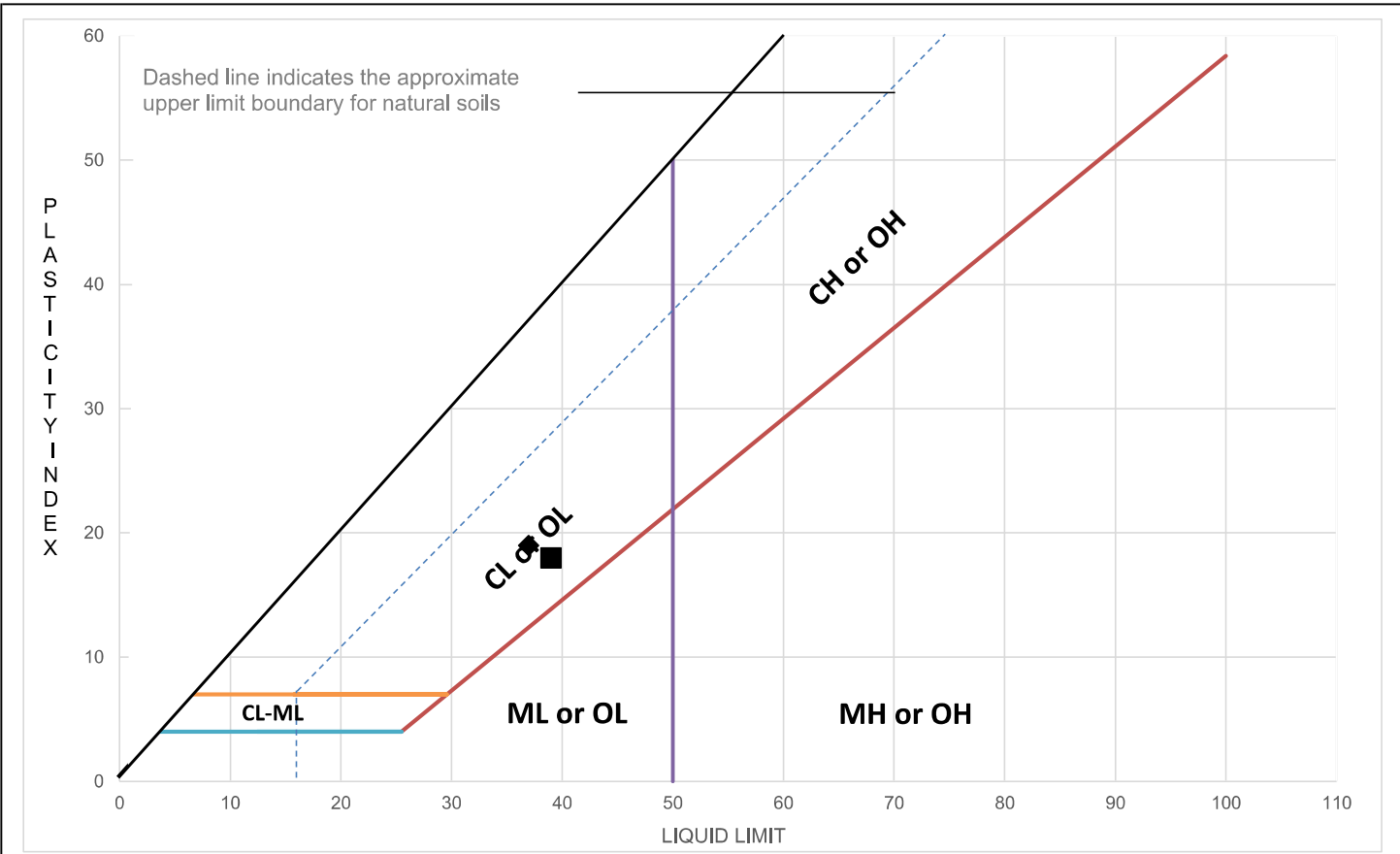
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(901)457-0016

Tested by	Checked by	Approved by	Date Received
ABJackson		ABJackson	

LIQUID AND PLASTIC LIMITS TEST REPORT



TEST RESULTS (ASTM D4318-10 (MULTIPOINT TEST))

	Sample Location	Sample Number	Sample Depth (ft)	LL	PL	PI	%<#40	%<#200	AASHTO	USCS	Material Description
■	B-01	S-1	0.00-1.50	39	21	18				CL	
◆	B-03	S-4	8.00-9.50	37	18	19				CL	

Project: Express Oil Change - Maumelle  
Client: Express Oil Change, LLC

Project No.: 62:1321  
Date Reported: 1/23/2024



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Tested by ABJackson	Checked by	Approved by ABJackson	Date Received
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## **Appendix D – Other Information**

GBA - Geotechnical Engineering Report Information Sheet

# 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 site-wide 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.*



**GEOPROFESSIONAL  
BUSINESS  
ASSOCIATION**

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