

# University of Central Arkansas - Chiller Plant – North Plant

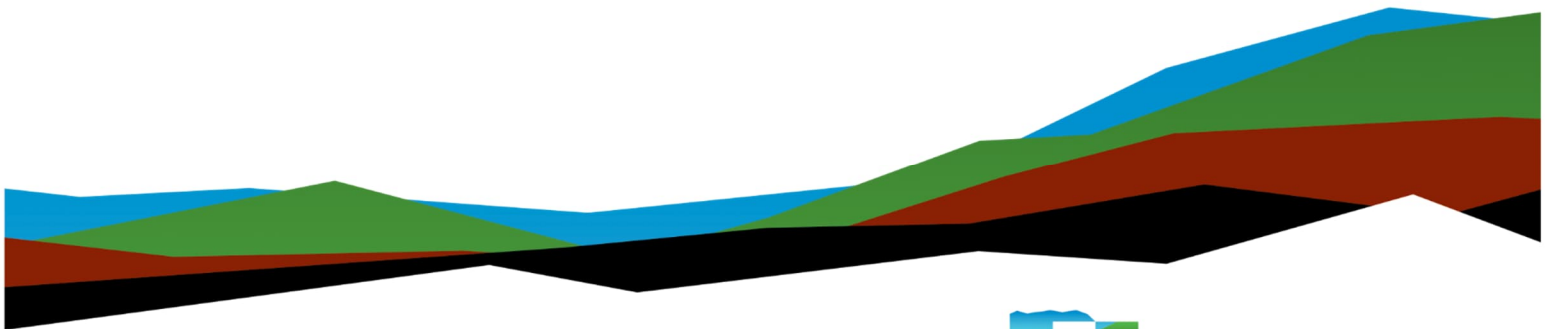
Geotechnical Engineering Addendum

Conway, Arkansas

March 27, 2026 | Terracon Project No. 35255142.A1

Prepared for:

AMR Architects  
1424 Main Street Suite 105  
Little Rock, AR 72202



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March 27, 2026

AMR Architects  
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Attn: Kate East, ASIS | LEED AP  
P: (501) 313-1921  
E: [kate@amr-architects.com](mailto:kate@amr-architects.com)

Re: Geotechnical Engineering Report  
University of Central Arkansas - Chiller Plant – North Plant  
411 Western Avenue  
Conway, Arkansas  
Terracon Project No. 35255142.A1

Dear Ms. East:

We have completed the scope of Geotechnical Engineering services for the referenced project in general accordance with Terracon Project Number 35255142 Change Order No. 01 dated February 17, 2026. This addendum presents the findings of the subsurface exploration and verifies or modifies the geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs for the new North Plant location with respect to Terracon report 35255142 dated January 19, 2026.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

**Terracon**

*Certificate of Authorization No 223, expires 12/31/2027*

Christopher F. Reid, E.I.  
Senior Staff Engineer

David A. Williams, P.E.  
Regional Technical Consultant  
Arkansas No. 22552



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Note: This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the  Terracon logo will bring you back to this page. For more interactive features, please view your project online at [client.terracon.com](http://client.terracon.com).

Refer to each individual Attachment for a listing of contents.

## Introduction

This addendum presents the results of our subsurface exploration and Geotechnical Engineering services performed for the updated chiller plant named “North Plant” to be located west of the existing parking lot with a real property address of 411 Western Avenue in Conway, Arkansas. The new North Plant is to be located south of the proposed alternative location as detailed within Terracon Report 35255142 dated January 19, 2026. The purpose of these services was to provide information and verify or modify geotechnical engineering recommendations relative to:

- Subsurface soil and rock conditions
- Groundwater conditions
- Seismic site classification
- Site preparation and earthwork
- Demolition considerations
- Foundation design and construction
- Floor slab design and construction
- Pavement design and construction

The geotechnical engineering Scope of Services for this project included the advancement of soil borings, laboratory testing, engineering analysis, and preparation of this addendum.

Drawings showing the new site and boring locations are shown on the [Site Location](#) and [Exploration Plans](#), respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the boring logs in the [Exploration Results](#) section.

## Project Description

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	On February 12, 2026, Ms. Kate East with AMR Architects requested that an updated exploration be performed for the new proposed location of the chiller plant. Following the request, Jacob Seither with AMR provided a document titled “UCA Campus District Loop & Chiller Plant - VE Site Plan” which provided two proposed exploration locations for the new site. In collaboration with AMR, Terracon proposed three exploration locations.
Project Description	The new north plant location includes a chiller facility building and an exterior cooling tower yard placed on a concrete pad.
Proposed Structure	Structures associated with the project include a ±3,600-square-foot one-story chiller building with separate cooling towers to its west.
Building Construction	The chiller building is anticipated to be a pre-engineered metal building. The chiller towers are anticipated to be steel construction with elevated cooling units.
Finished Floor Elevation	The finished floor elevation was not provided for the new North plant site, it is anticipated to be at or within 2 feet of the existing site grade.
Maximum Loads	Jacob Seither with AMR Architects confirmed via email on January 8, 2026, the following loads are appropriate for our engineering evaluations. <ul style="list-style-type: none"> <li>■ Columns: 100 kips</li> <li>■ Walls: 5 kips per linear foot (klf)</li> <li>■ Slabs: 150 pounds per square foot (psf)</li> </ul>
Grading	Updated grading information was not provided for the new North Plant site; we have assumed minimal cuts and fills will be required to achieve final grades, excluding remedial grading requirements.
Pavements	We have assumed that rigid pavements (concrete) remain the preferred pavement surfacing. The pavement design period is 20 years.

Terracon should be notified if any of the above information is inconsistent with the planned construction, especially the grading limits, as modifications to our recommendations may be necessary.

## Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration as well as our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	<p>The project is located south of an existing gravel parking lot with a real property address of 411 Western Avenue in Conway, Arkansas.</p> <p>The North Plant site is located within the southeast corner of parcel ID 710-04660-000 owned by the University of Central Arkansas.</p> <p>Latitude/Longitude (approximate) 35.0830° N, 92.4573° W                      See <a href="#">Site Location</a></p>
Existing Improvements	<p>The site is currently developed with a residential structure, which is anticipated to be demolished prior to the development of the North Plant site.</p>
Current Ground Cover	<p>The proposed North Plant site is currently a maintained grass lawn with a concrete driveway and a residential structure.</p>
Existing Topography	<p>The North Plant site is relatively level, generally sloping from west to east towards Western Ave, with an approximate elevation change of 1 foot across about 70 feet.</p>

We also collected photographs at the time of our field exploration program. Representative photos are provided in our [Photography Log](#).

## Geotechnical Characterization

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the [Exploration Results](#) and the GeoModel can be found in the [Figures](#) attachment of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	Silty Clay	Brown, very soft, silty clay
2	Lean Clay	Light gray and reddish brown, stiff to very stiff, lean clay soil with varying amounts of sand
3	Weathered Rock	Gray, highly weathered, very weak shale
4	Bedrock	Gray to dark gray, weak shale bedrock

The borings were advanced using solid stem continuous flight augers that allow short term groundwater observations to be made while drilling. Groundwater seepage was encountered at the maximum drilling depth during our field exploration in borings B-1 and B-3 at 5 feet and 4 feet, respectively. Groundwater conditions may be different at the time of construction. Groundwater conditions may change because of seasonal variations in rainfall, runoff, and other conditions not apparent at the time of drilling. Long-term groundwater monitoring was outside the scope of services for this project. Perched water can develop over low-permeability soil or rock strata. The possibility of groundwater level fluctuations should be considered when developing the project's design and construction plans.

## Seismic Site Class

The seismic design requirements for buildings and other structures are based on the Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC).

Based on the soil/bedrock properties observed at the site and as described on the exploration logs and results, our professional opinion is that a Seismic Site Classification of C be considered for the project. Subsurface explorations at this site were extended to a maximum depth of about 23.7 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

## Geotechnical Overview

The site appears suitable for the proposed construction based upon geotechnical conditions encountered in the soil borings, provided that the recommendations provided in this report are implemented in the design and construction phases of this project.

The native subsurface materials were generally consistent with findings from Terracon's initial Geotechnical Engineering Report 35255142, dated January 19, 2026, and consisted of a soft silty clay to a depth of approximately two feet atop lean clay with varying amounts of sand overlying weathered shale, transitioning to more competent shale with depth. Within the new proposed "North Plant" location, existing fill was not encountered within the North Plant footprint. Although existing fill was not encountered within the new boring locations, it may be encountered once the existing on-site residential structure is demolished.

Groundwater was encountered within boring B-1 and B-3 at depths ranging from four to five feet below the ground surface. No groundwater was observed within boring B-2. Perched water can develop over low-permeability soil or rock strata. The possibility of groundwater level fluctuations should be considered when developing the project's design and construction plans.

It is our opinion that based on the conditions encountered and estimated load-settlement relationships, the proposed structures can be supported on conventional continuous or spread footings.

The near-surface, stiff-to-very stiff, medium-plasticity, lean clay could become unstable under typical earthwork and construction traffic, especially after precipitation events. Effective drainage should be completed early in the construction sequence and maintained after construction to avoid potential issues. If possible, grading should be performed during the warmer, drier times of the year. If grading is performed during the winter months, an increased risk for possible undercutting and replacement of unstable subgrade will persist. Additional site preparation recommendations, including subgrade improvement and fill placement, are provided in the [Earthwork](#) section.

The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the [Exploration Results](#)), engineering analyses, and our current understanding of the proposed project. The [General Comments](#) section provides an understanding of the report limitations.

## Earthwork

Earthwork is anticipated to include demolition, clearing and grubbing, excavation, and placement of structural fill. The following section provides demolition recommendations for the North Plant site. All other recommendations presented within the [Earthwork](#) section of 35255142 titled "*35255142.University of Central Arkansas - Chiller Plant.1.19.26 – signed*" dated January 19, 2026, remain appropriate for the design and construction of foundations, floor slabs, and pavements.

## Demolition

The proposed North Plant will be constructed within the footprint of an existing residential structure, which will need to be demolished, along with exterior sidewalks, pavement, and utilities. We recommend that existing foundations, slabs, and utilities be removed from within the proposed building footprint and at least 5 feet beyond the outer edge of the foundations.

For areas outside the proposed building footprints and foundation-bearing zones, existing foundations, floor slabs, and utilities should be removed where they conflict with the proposed utilities, retaining walls, and pavements. In such cases, existing foundations, floor slabs, and utilities should be removed to a depth of at least 2 feet below the affected utility or design pavement subgrade elevation.

## Shallow Foundations

If the site has been prepared in accordance with the requirements noted in [Earthwork](#), the recommendations presented within the [Design Parameters – Compressive Loads](#) section of Terracon report 35255142 titled "*35255142.University of Central Arkansas - Chiller Plant.1.19.26 – signed*" dated January 19, 2026 are appropriate for design and construction of shallow foundations for the North Plant site.

## Floor Slabs

If the site has been prepared in accordance with the requirements noted in [Earthwork](#), the recommendations presented within the [Floor Slabs](#) section of Terracon report 35255142 titled "*35255142.University of Central Arkansas - Chiller Plant.1.19.26 – signed*" dated January 19, 2026, remain appropriate for the design and construction of floor slabs for the North Plant site.

## Pavements

If the site has been prepared in accordance with the requirements noted in [Earthwork](#), the recommendations presented within the [Pavements](#) section of Terracon report 35255142 titled "*35255142.University of Central Arkansas - Chiller Plant.1.19.26 – signed*" dated January 19, 2026, remain appropriate for the design and construction of pavements for the North Plant site.

## General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly affect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the

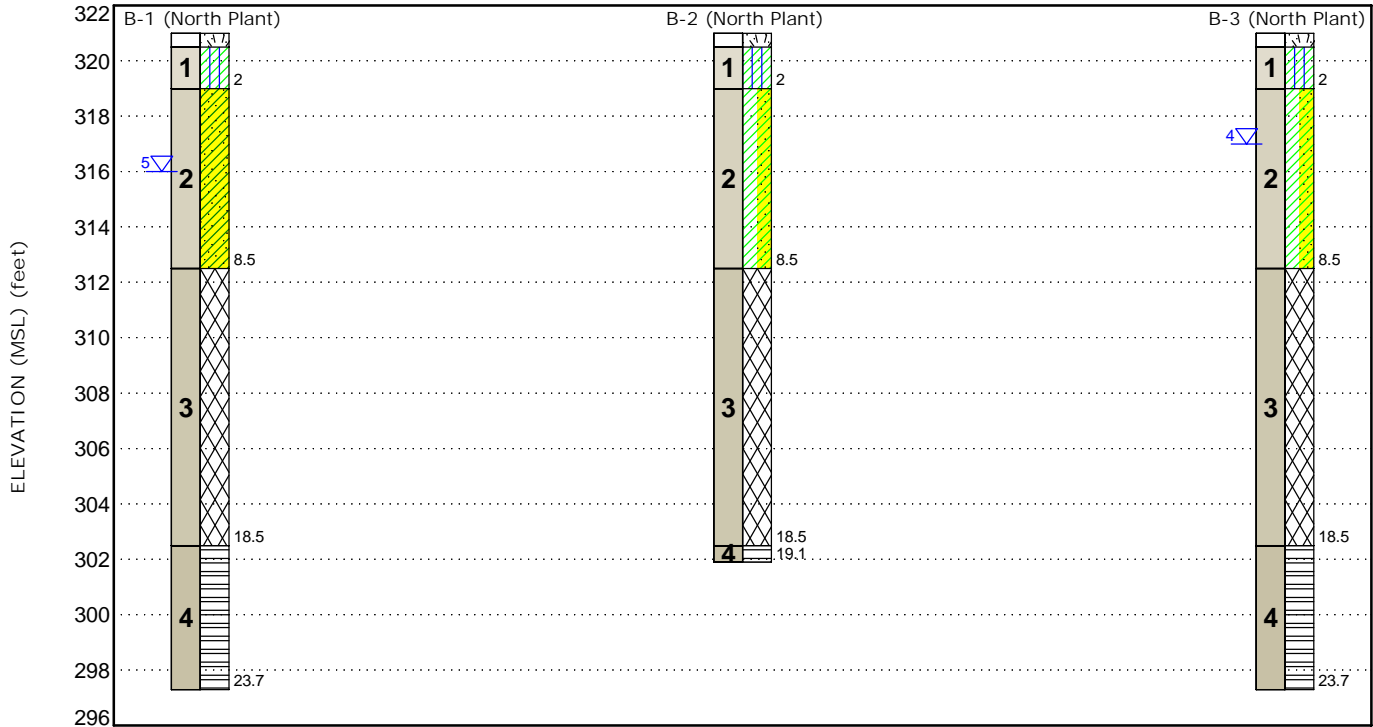
specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

## Figures

Contents:

GeoModel

## GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description	Legend	
1	Silty Clay	Brown, very soft, silty clay	Topsoil	Silty Clay
2	Lean Clay	Light gray and reddish brown, stiff to very stiff, lean clay soil with varying amounts of sand	Sandy Lean Clay	Highly Weathered Shale
3	Weathered Rock	Gray, highly weathered, very weak shale	Shale	Lean Clay with Sand
4	Bedrock	Gray to dark gray, weak shale bedrock		

First Water Observation

**NOTES:**

Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time. Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

## Attachments

# Exploration and Testing Procedures

## Field Exploration

Number of Borings	Approximate Boring Depth (feet)	Location
3	19.1 to 23.7	North Plant Chiller Area

Boring Layout and Elevations: Terracon personnel provided the boring layout using handheld GPS equipment (estimated horizontal accuracy of about  $\pm 10$  feet) and referencing existing site features. Approximate ground surface elevations were obtained in the field utilizing an Emlid Reach RS3 unit. If more precise elevations and boring layout are desired, we recommend borings be surveyed.

Subsurface Exploration Procedures: We advanced the borings with a track-mounted drill rig using continuous flight solid stem augers. Five samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. Soil sampling was performed using split-barrel sampling procedures. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. For safety purposes, all borings were backfilled with auger cuttings after their completion.

We also observed the boreholes while drilling and at the completion of drilling for the presence of groundwater. Groundwater was not observed at these times in the boreholes.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials observed during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

## Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests. The laboratory testing program included the following types of tests:

- Moisture Content
- Sieve Analysis
- Atterberg Limits

The laboratory testing program often included examination of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

Rock classification was conducted using locally accepted practices for engineering purposes; petrographic analysis may reveal other rock types. Rock core samples typically provide an improved specimen for this classification. Boring log rock classification was determined using the Description of Rock Properties.

## Photography Log



North Pan Building Location – NW Corner Facing SE (Near Boring B-2)



North Pan Building Location – NE Corner Facing SW (Near Boring B-1)

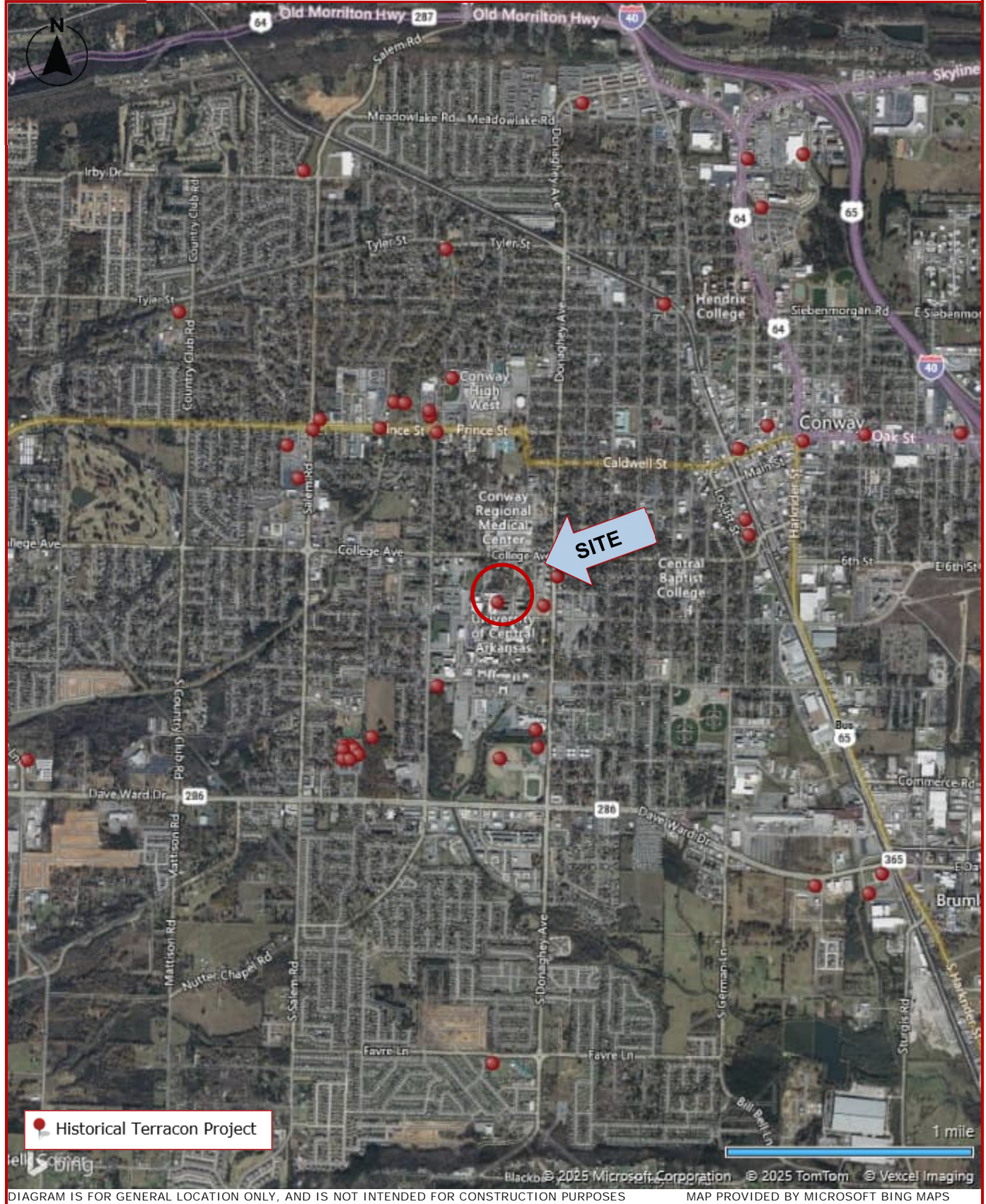
## Site Location and Exploration Plans

### Contents:

- Site Location
- Exploration Plan with Site Layout
- Exploration Plan without Site Layout

Note: All attachments are one page unless noted above.

## Site Location



## Exploration Plan with Site Layout



## Exploration Plan without Site Layout



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

# Exploration and Laboratory Results

Contents:

Boring Logs (B-1 through B-3)

Note: All attachments are one page unless noted above.

## Boring Log No. B-1 (North Plant)

Graphic Log	Location: See <a href="#">Exploration Plan</a>		Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits	
	Latitude: 35.0830° Longitude: -92.4571°							LL-PL-PI	Percent Fines
Depth (Ft.)		Elevation: 321 (Ft.)							
0.5	<b>TOPSOIL (6 INCHES)</b>		320.5						
2.0	<b>SILTY CLAY (CL-ML)</b> , brown with light gray, soft		319			1-1-1 N=2	20.6		
8.5	<b>SANDY LEAN CLAY (CL)</b> , light gray and reddish brown, medium stiff to very stiff		312.5	5	▽	2-3-5 N=8	22.8		
						4-6-8 N=14	22.4		
						5-14-16 N=30	24.6	37-19-18	74.7
18.5	<b>WEATHERED SHALE</b> , gray, highly weathered, very weak		302.5	10		14-22-18 N=40	18.9		
						17-38-40 N=78	20.4		
23.7	<b>SHALE</b> , gray to dark gray, highly weathered, weak rock		297.3	20		43-50/1"	13.1		
						50/2"	10.2		
<i>Boring Terminated approximately at 23.7 Feet</i>									

<p>See <a href="#">Exploration and Testing Procedures</a> for a description of field and laboratory procedures used and additional data (if any).</p> <p>See <a href="#">Supporting Information</a> for explanation of symbols and abbreviations.</p> <p>Elevation Reference: Elevations measured in the field utilizing a Reach RS3 unit.</p> <p>Samples obtained using a 2" O.D. split spoon sampler</p>	<p>Water Level Observations   5 feet while sampling</p>	<p>Drill Rig 1153 Geoprobe</p> <p>Hammer Type Automatic</p> <p>Driller BM</p>
<p>Notes</p>	<p>Advancement Method 3 1/4" Solid Stem Continuous Flight Auger</p> <p>Abandonment Method Boring backfilled with auger cuttings upon completion.</p>	<p>Logged by TR</p> <p>Boring Started 03-13-2026</p> <p>Boring Completed 03-13-2026</p>

## Boring Log No. B-2 (North Plant)

Graphic Log	Location: See <a href="#">Exploration Plan</a>		Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits	
	Latitude: 35.0828° Longitude: -92.4572°							LL-PL-PI	Percent Fines
Depth (Ft.)		Elevation: 321 (Ft.)							
0.5	<u>TOPSOIL (6 INCHES)</u>		320.5						
2.0	<u>SILTY CLAY (CL-ML)</u> , brown, soft		319	X		0-1-1 N=2	23.7		
8.5	<u>LEAN CLAY WITH SAND (CL)</u> , light gray and reddish brown, stiff to very stiff		312.5	X		2-4-5 N=9	22.4	37-19-18	86.9
			5	X		6-7-11 N=18	24.2		
			10	X		11-16-14 N=30	22.0		
			15	X		11-20-25 N=45	14.4		
			18.5	X		19-38-50/5"	11.4		
			19.1	X		16-50/1"	4.9		
	<u>WEATHERED SHALE</u> , gray, highly weathered, very weak								
	<u>SHALE</u> , gray to dark gray, highly weathered, weak rock								
	<i>Boring Terminated approximately at 19.1 Feet</i>								

<p>See <a href="#">Exploration and Testing Procedures</a> for a description of field and laboratory procedures used and additional data (if any).</p> <p>See <a href="#">Supporting Information</a> for explanation of symbols and abbreviations.</p> <p>Elevation Reference: Elevations measured in the field utilizing a Reach RS3 unit.</p> <p>Samples obtained using a 2" O.D. split spoon sampler</p>	<p>Water Level Observations No free water observed during augering</p>	<p>Drill Rig 1153 Geoprobe</p> <p>Hammer Type Automatic</p> <p>Driller BM</p>
<p>Notes</p>	<p>Advancement Method 3 1/4" Solid Stem Continuous Flight Auger</p> <p>Abandonment Method Boring backfilled with auger cuttings upon completion.</p>	<p>Logged by TR</p> <p>Boring Started 03-13-2026</p> <p>Boring Completed 03-13-2026</p>

## Boring Log No. B-3 (North Plant)

Graphic Log	Location: See <a href="#">Exploration Plan</a>		Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits	
	Latitude: 35.0829° Longitude: -92.4573°							LL-PL-PI	Percent Fines
Depth (Ft.)		Elevation: 321 (Ft.)							
0.5	<b>TOPSOIL (6 INCHES)</b>		320.5						
2.0	SILTY CLAY (CL-ML), brown, very soft		319			0-0-0 N=0	26.9		
8.5	LEAN CLAY WITH SAND (CL), light gray and reddish brown, stiff to very stiff		312.5	5	▽	4-4-6 N=10	20.3		
						7-9-11 N=20	19.9	47-18-29	86.1
						7-11-14 N=25	21.3		
18.5	WEATHERED SHALE, gray, highly weathered, very weak		302.5	10		11-24-33 N=57	15.8		
						13-16-18 N=34	15.8		
23.7	SHALE, gray to dark gray, highly weathered, weak rock		297.3	15		50/5"	13.1		
	Boring Terminated approximately at 23.7 Feet			20					
						50/2"	9.9		

<p>See <a href="#">Exploration and Testing Procedures</a> for a description of field and laboratory procedures used and additional data (if any).</p> <p>See <a href="#">Supporting Information</a> for explanation of symbols and abbreviations.</p> <p>Elevation Reference: Elevations measured in the field utilizing a Reach RS3 unit.</p> <p>Samples obtained using a 2" O.D. split spoon sampler</p>	<p>Water Level Observations   4 feet while sampling</p>	<p>Drill Rig 1153 Geoprobe</p> <p>Hammer Type Automatic</p> <p>Driller BM</p>
<p>Notes</p>	<p>Advancement Method 3 1/4" Solid Stem Continuous Flight Auger</p> <p>Abandonment Method Boring backfilled with auger cuttings upon completion.</p>	<p>Logged by TR</p> <p>Boring Started 03-13-2026</p> <p>Boring Completed 03-13-2026</p>






## Supporting Information

### Contents:

General Notes  
Unified Soil Classification System  
Description of Rock Properties

Note: All attachments are one page unless noted above.

## General Notes

Sampling	Water Level	Field Tests
 Standard Penetration Test	 Water Initially Encountered  Water Level After a Specified Period of Time  Water Level After a Specified Period of Time  Cave In Encountered  Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	N Standard Penetration Test Resistance (Blows/Ft.) (HP) Hand Penetrometer (T) Torvane (DCP) Dynamic Cone Penetrometer UC Unconfined Compressive Strength (PID) Photo-Ionization Detector (OVA) Organic Vapor Analyzer

### Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

### Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

### Strength Terms

Relative Density of Coarse-Grained Soils (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		Consistency of Fine-Grained Soils (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Relative Density	Standard Penetration or N-Value (Blows/Ft.)	Consistency	Unconfined Compressive Strength Qu (tsf)	Standard Penetration or N-Value (Blows/Ft.)
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	5 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	9 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	16 - 30
		Hard	> 4.00	> 30

### Relevance of Exploration and Laboratory Test Results

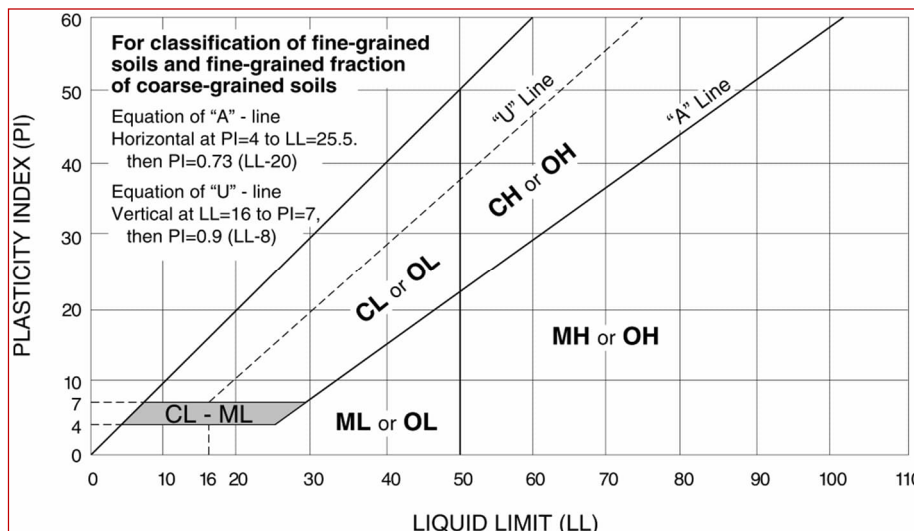
Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

## Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests <sup>A</sup>				Soil Classification	
				Group Symbol	Group Name <sup>B</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 $1 \leq Cc \leq 3$ <sup>E</sup>	GW	Well-graded gravel <sup>F</sup>
		Gravels with Fines: More than 12% fines <sup>C</sup>	$Cu < 4$ and/or $[Cc < 1$ or $Cc > 3.0]$ <sup>E</sup>	GP	Poorly graded gravel <sup>F</sup>
			Fines classify as ML or MH	GM	Silty 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>	Fines classify as CL or CH	GC
	$Cu \geq 6$ and $1 \leq Cc \leq 3$ <sup>E</sup>			SW	Well-graded sand <sup>I</sup>
	Sands with Fines: More than 12% fines <sup>D</sup>		$Cu < 6$ and/or $[Cc < 1$ or $Cc > 3.0]$ <sup>E</sup>	SP	Poorly graded sand <sup>I</sup>
			Fines classify as ML or MH	SM	Silty 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 above "A" line <sup>J</sup>	CL
$PI < 4$ or plots below "A" line <sup>J</sup>				ML	Silt <sup>K, L, M</sup>
Organic:			$\frac{LL \text{ oven dried}}{LL \text{ not dried}} < 0.75$	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
PI plots below "A" line		MH			Elastic silt <sup>K, L, M</sup>
Organic:		$\frac{LL \text{ oven dried}}{LL \text{ not dried}} < 0.75$		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	

- <sup>A</sup> Based on the material passing the 3-inch (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.
- <sup>E</sup>  $Cu = D_{60}/D_{10}$      $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
- <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 shaded 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.



## Rock Classification Notes

WEATHERING			
Term	Description		
Fresh	Mineral crystals appear bright; show no discoloration. Features show little or now staining on surfaces. Discoloration does not extend into intact rock.		
Slightly weathered	Rock generally fresh except along fractures. Some fractures stained and discoloration may extend <0.5 inches into rock.		
Moderately weathered	Significant portions of rock are dull and discolored. Rock may be significantly weaker than in fresh state near fractures. Soil zones of limited extent may occur along some fractures.		
Highly weathered	Rock dull and discolored throughout. Majority of rock mass is significantly weaker and has decomposed and/or disintegrated; isolated zones of stronger rock and/or soil may occur throughout.		
Completely weathered	All rock material is decomposed and/or disintegrated to soil. The rock mass or fabric is still evident and largely intact. Isolated zones of stronger rock may occur locally.		
STRENGTH OR HARDNESS			
Description	Field Identification		Uniaxial Compressive Strength, psi
Extremely strong	Can only be chipped with geological hammer. Rock rings on hammer blows. Cannot be scratched with a sharp pick. Hand specimens require several hard hammer blows to break.		>36,000
Very strong	Several blows of a geological hammer to fracture. Cannot be scratched with a 20d common steel nail. Can be scratched with a geologist's pick only with difficulty.		15,000-36,000
Strong	More than one blow of a geological hammer needed to fracture. Can be scratched with a 20d nail or geologist's pick. Gouges or grooves to ¼ inch deep can be excavated by a hard blow of a geologist's pick. Hand specimens can be detached by a moderate blow.		7,500-15,000
Medium strong	One blow of geological hammer needed to fracture. Can be distinctly scratched with 20d nail. Can be grooved or gouged 1/16 in. deep by firm pressure with a geologist's pick point. Can be fractured with single firm blow of geological hammer. Can be excavated in small chips (about 1-in. maximum size) by hard blows of the point of a geologist's pick;		3,500-7,500
Weak	Shallow indent by firm blow with geological hammer point. Can be gouged or grooved readily with geologist's pick point. Can be excavated in pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.		700-3,500
Very weak	Crumbles under firm blow with geological hammer point. Can be excavated readily with the point of a geologist's pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.		150-700
DISCONTINUITY DESCRIPTION			
Fracture Spacing (Joints, Faults, Other Fractures)		Bedding Spacing (May Include Foliation or Banding)	
Description	Spacing	Description	Spacing
Intensely fractured	< 2.5 inches	Laminated	< ½-inch
Highly fractured	2.5 – 8 inches	Very thin	½ – 2 inches
Moderately fractured	8 inches to 2 feet	Thin	2 inches – 1 foot
Slightly fractured	2 to 6.5 feet	Medium	1 – 3 feet
Very slightly fractured	> 6.5 feet	Thick	3 – 10 feet
		Massive	> 10 feet
ROCK QUALITY DESIGNATION (RQD) <sup>1</sup>			
Description	RQD Value (%)		
Very Poor	0 - 25		
Poor	25 – 50		
Fair	50 – 75		
Good	75 – 90		
Excellent	90 - 100		

1. The combined length of all sound and intact core segments equal to or greater than 4 inches in length, expressed as a percentage of the total core run length.