GEOTECHNICAL ENGINEERING REPORT

NATIONAL CHEROKEE NATION PARK

SEQUOYAH COUNTY

SALLISAW, OKLAHOMA

Prepared for:

Cherokee Nation Entertainment, LLC
777 West Cherokee Street
Catoosa, Oklahoma 74015

Prepared by:

• Geotechnical Services
• Environmental Services
• Material Testing Services

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PROJECT NUMBER: 256748 Rev. 1

July 1, 2019

PALMERTON & PARRISH, INC.

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July 1, 2019

Cherokee Nation Entertainment, LLC
777 West Cherokee Street
Catoosa, Oklahoma 74015

Attn: Mr. James Thornton, Director of National Park
Email: James.Thornton@cn-bus.com

RE: Revised Geotechnical Engineering Report
National Cherokee Nation Park
Sequoyah County
Sallisaw, Oklahoma
PPI Project Number: 256748 Rev. 1
Project Service Agreement No.:15E0644.14

Dear Mr. Thornton:

Attached, please find the report summarizing the results of the geotechnical investigation conducted for the proposed National Cherokee Nation Park in Sallisaw, Oklahoma. We appreciate this opportunity to be of service. If you have any questions, please don't hesitate to contact this office.

PALMERTON & PARRISH, INC.
By:

R. Todd Hercules, P.E.
Geotechnical Engineer

PALMERTON & PARRISH, INC.
By:

LICENSED PROFESSIONAL ENGINEER
BRANDON ROSS PARRISH
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OKLAHOMA
July 1, 2019

Brandon R. Parrish, P.E.
Vice-President

Submitted: One (1) Electronic .pdf Copy

BRP/BRP/RTH

Cc: Mr. Benjamin Cowart (Benjamin.Cowart@cn-bus.com)

PALMERTON & PARRISH, INC.

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EXECUTIVE SUMMARY

A Geotechnical Investigation was performed for the National Cherokee Nation Park located in Sequoyah County near Sallisaw, Oklahoma. It is understood that a new park including camping sites for tents and RVs, cabins, general store, residences, pool, stables, arena, restaurant, marina, and meeting centers will be constructed at the approximate 160-acre subject site bordering the Robert S. Kerr Reservoir. Traffic loading was not provided but is assumed to be light. Cut and fill depths are anticipated to be highly variable due to the size of the site and topographic relief of the site.

Based upon the information obtained from the borings drilled and subsequent laboratory testing, the site is suitable for the proposed National Cherokee Nation Park. Important geotechnical considerations for the project are summarized below. However, users of the information contained in the report must review the entire report for specific details pertinent to geotechnical design considerations.

- Due to the size of the subject site, location specific geotechnical considerations have been provided in this report. These location specific considerations have been summarized in a table in Section 8.8;
- Portions of the subject site were heavily wooded with highly variable amounts of topsoil and organic materials. The existing access area and pavilion areas are partially grass covered. Surface material on the south side of the site was generally noted to have exposed bedrock and/or exposed boulder fields;
- Soils across the site are primarily residual from the weathering of shale and sandstone. Soil depths and depth to bedrock are highly variable due to varying degrees of weathering. Mixes of sands, lean clays, and fat clays should be anticipated in excavations;
- Shallow bedrock is anticipated within portions of the subject site. Varying depths of weathered bedrock over more competent bedrock were noted in the subsurface exploration. Generally, weathered bedrock should be excavatable with heavy duty

equipment. Pneumatic rock breaking equipment may be needed to excavate more competent bedrock areas;

- Moisture sensitive lean clays were noted near the surface of the subgrade exploration. This material is generally stable in moderately dry conditions but is sensitive to the addition of moisture and repeated traffic. Some over excavation and replacement or stabilization may be required of these soils;
- Some undocumented fill should be anticipated near existing structures;
- Medium volume change/expansive material was noted in the subsurface exploration. Areas noted with medium volume change material will require removal and replacement with a Low Volume Change (LVC) material as indicated within this report;
- Foundations for the proposed light structures are anticipated to bear on native soils, LVC fill material, or bedrock. Foundations bearing on native soils or controlled fill can be designed for allowable bearing capacities of 2,500 psf for column footings and 2,000 psf for continuous footings. Foundations bearing on competent bedrock can be designed for allowable bearing capacities of 5,000 psf for column footings and 4,500 psf for continuous footings;
- Foundations for the proposed moderate to heavily loaded structures, i.e. connector bridge structure, are anticipated to be supported upon drilled piers bearing on competent bedrock. Refer to Section 10.4 for additional details;
- Due to the number of different structure types and differing soil conditions encountered across the large site, we recommend foundation plans be reviewed by PPI once final site grading, structure loads, and foundation types are selected;
- The project site classifies as a Site Class C in accordance with Section 1613 of the 2012 International Building Code (IBC);

EXECUTIVE SUMMARY - CONTINUED

- Palmerton & Parrish, Inc. should be retained for construction observation and construction materials testing. Close monitoring of subgrade preparation work is considered critical to achieve adequate pavement and subgrade performance.

REVISED GEOTECHNICAL ENGINEERING REPORT
NATIONAL CHEROKEE NATION PARK
SEQUOYAH COUNTY
SALLISAW, OKLAHOMA

1.0 INTRODUCTION

This is the report of the Geotechnical Investigations performed for the proposed National Cherokee Nation Park located in Sequoyah County near Sallisaw, Oklahoma. This investigation was authorized by a Project Service Agreement number 15E0644.14 issued by Cherokee Nation Entertainment, LLC to Palmerton & Parrish, Inc. (PPI). In addition to the original geotechnical investigation performed between February 19 through March 1, 2019, a second investigation was performed between June 10 through June 12, 2019 for the newly proposed central premium cabins and for the additional cabins on the east bank of the subject site that were not originally explored in the February through May exploration. This revised report reflects the conditions of both explorations. The approximate site location is shown below:

The purpose of the Geotechnical Investigation was to provide information for foundation design, pavement design, construction planning, and to aid in site development. PPI's scope of services included field and laboratory investigation of the subsurface conditions in the vicinity of the proposed project site, engineering analysis of the collected data, development of recommendations for foundation design and construction planning, and preparation of this engineering report.

2.0 PROJECT DESCRIPTION

Item	Description
Site Layout	See Figure 1: Boring Location Plan
Buildings and Structures	Barn, Park Operations Buildings, Community Center, Welcome and Cultural Center, Amphitheater, Pavilions, Cabins, Stables, Arena, Residence, General Store, pool, splash pad, pool house, mini-golf, kiosk, helipad, Docks, Marina Building, Restaurant, Storm Shelter, Bridge, and Paved Areas for Parking and Drive Lanes.
Foundation Loadings	Loading information for the structures/buildings was not provided. All structures and buildings are anticipated to have light foundation loads, i.e. less than 250-kip column loads.
Existing Structure	Existing pavilions/sheds, parking and drive area pavements, and restrooms associated with the existing Sallisaw Public Use Area.
Grading	Grading at the subject site will be specific to the individual structures. It is anticipated that structures in steeply sloped areas will require large amounts of cut/fill. Flatter sections of the site are anticipated to have approximately equal cut and fill depths.

3.0 SITE DESCRIPTION

Item	Description
Physical Location	Sequoyah County in Sallisaw, Oklahoma. Bordering the Robert S. Kerr Reservoir.
Latitude: Longitude: (± Center of Project Site)	35.396552° -94.870230°
Available Historic Aerial Photography	The existing structures located on the northeast side of the site were constructed between the years 2003 and 2005, and the existing structures located near the center of the site were constructed between the years 2016 and 2017. The Public Use Area and roads pre-date photography from 1995.
Current Ground Cover	The subject site is generally densely wooded with some open areas.
Existing Topography	The subject site is generally a peninsula that extends into the existing Robert S. Kerr Reservoir. Accordingly, steeply sloped banks are present at the subject site.
Drainage Characteristics	Generally good with some areas of poor drainage within lower lying areas.

4.0 SITE PHOTOGRAPHS

Site photographs were obtained during the investigation of the landscapes at the site. Refer to the photographs presented below for typical land cover and topography present over the project site.

Heavily Wooded Areas

Heavily Wooded Areas

East Picnic Pavilion and Group Pavilion Areas

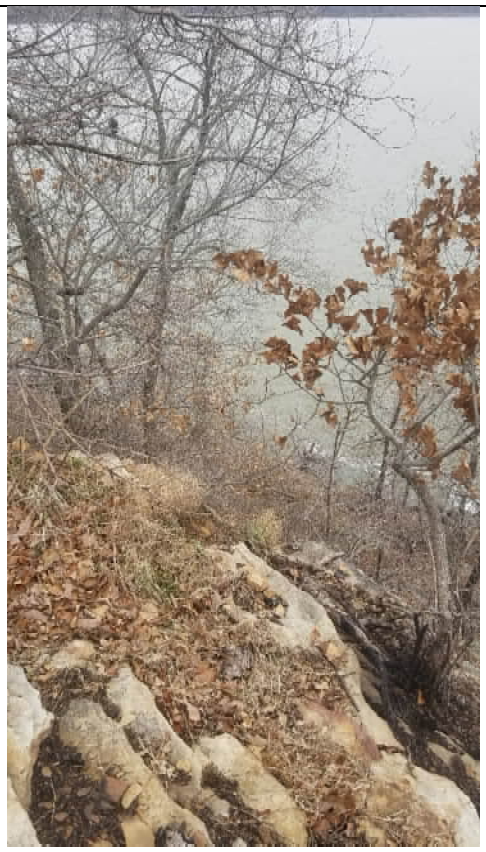
Community and Cultural Center Areas

Southeast Bank Premium Lake Cabin Areas/Top of Bluffs

Southeast Bank Premium Lake Cabin Areas/Top of Bluffs

Southeast Bank Premium Lake Cabin Areas/Bottom of Bluffs

Northeast Premium Lake Cabin Areas



5.0 SUBSURFACE INVESTIGATION

Two (2) subsurface investigations were performed at the subject site. The original investigation was performed between February and May, 2019 for the original site layout and an additional subsurface investigation was requested by the client and was performed in June, 2019 for the newly added central cabins and east bank cabins not previously explored. The subsurface exploration performed between February and May consisted of one-hundred, ten (110) subsurface borings and subsequent laboratory testing. The additional exploration performed in June contained an addition thirty-eight (38) borings.

5.1 Subsurface Borings

Boring locations were staked in the field by PPI using a site plan provided by the Client. Approximate boring locations are shown on Figure 1, Boring Location Plan. The Oklahoma One-Call System was notified prior to the investigation to assist in locating buried public utilities.

Logs of the borings showing descriptions of soil and rock units encountered, as well as results of field tests, laboratory tests and a “Key to Symbols” are presented in Appendix II.

Borings were drilled using 4.5-inch O.D. continuous flight augers powered by ATV-mounted drill-rigs. Soil samples were collected at 2.5 to 5-foot centers during drilling. Soil sample types included split spoon samples collected while performing the Standard Penetration Test (SPT) in general accordance with ASTM D1586 and thin walled Shelby tubes pushed hydraulically in advance of drilling in accordance with ASTM D1587. Please refer to Appendix III for general notes regarding boring logs and additional soil sampling information.

Due to the terrain, boulders, and rock bluffs at the project site, borings 76 and 77 were not accessible with drill rigs and were not explored. Additional areas not accessible with drill rigs were explored by hand sampling procedures and manual equipment as noted in the boring logs in Appendix II. Borings 143 through 145 contained bedrock

at the ground surface, as noted in the below images, and were not explored with soil borings.

Northeast Bank Surface Bedrock	
	
Boring 144	**Boring 145**

5.2 Laboratory Testing

Collected samples were sealed and transported to the laboratory for further evaluation and visual examination. Laboratory soil testing included the following:

- Moisture Content (ASTM D2216);
- Unconfined Compressive Strength (ASTM D2166);
- Atterberg Limits (ASTM D4318);
- Grain Size Analysis (ASTM D6913);
- Swell Tests (ASTM D4546); and
- Pocket Penetrometers.

Laboratory test results are shown on each boring log in Appendix II and are summarized in Appendix IV.

6.0 SITE GEOLOGY

The subject site is located over the McAlester and Hartshorne Formations. The primary bedrock types within this formation are shale and sandstone. Some coal is also known to be found within this formation. Based on the results of the subsurface exploration, sandstone, shale, and trace amounts of coal were noted in the subsurface borings. Some alluvial deposits of clay and sands were also encountered; however, the subsurface soils primarily consisted of residual clays and sands from the weathering of sandstone and shale.

7.0 GENERAL SITE SUBSURFACE CONDITIONS

Based upon subsurface conditions encountered within the borings drilled at the project site, generalized subsurface conditions are summarized in the table below. Soil stratification lines on the boring logs indicate approximate boundary lines between different types of soil units based upon observations made during drilling. In-situ transitions between soil and some rock types are typically gradual.

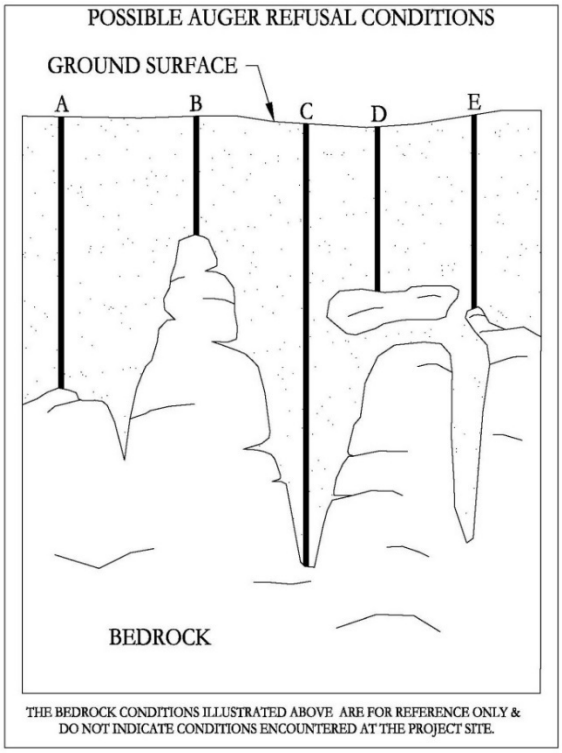
7.1 Soils

Generalized subsurface conditions are summarized in the list below:

- Surface soils generally consisted of a dark brown, lean clay, topsoil with varying amounts of sand and gravel. Portions of this material may not be suitable for reuse as topsoil due to the amount of sand and gravel present. Additionally, organic roots and compost from leaves are present within this material;
- Native soils at the subject site were highly variable. Native soils generally consisted of lean clay, fat clay, and clayey sand with highly varying amounts of clay, sand, and gravel. The native soils appear to be residual soils from the weathering of the shale and sandstone bedrock present at the subject site. Soils with liquid limits over 40 percent were noted to have medium volume change potential; and
- Bedrock was encountered as auger or split-spoon refusal across most of the site. Generally, the south side and higher elevation areas of the site contained shallow

bedrock conditions. Areas of weathered bedrock that were penetrable with auger drilling techniques were also encountered and are noted on the logs as weathered shale or weathered sandstone. Auger refusal and weathered bedrock depths are noted in the below table;

7.2 Auger Refusal



Auger refusal is defined as the depth below the ground surface at which a boring can no longer be advanced with the soil drilling technique being used. Auger refusal is subjective and is based upon the type of drilling equipment and types of augers being used, as well as the effort exerted by the driller. Several different auger refusal conditions are possible in the general site area. These conditions are represented graphically in the adjacent figure: (A) on the upper surface of continuous bedrock, (B) on rock “pinnacles”, (C) in widened joints that may extend well below the surrounding bedrock surface, (D) slabs of unweathered rock suspended in the residual soil matrix, or “floaters”, or (E) on the upper surface of discontinuous bedrock.

Due to possibility that some or all of these features exist at this project site, estimating the exact quantity of rock excavation is difficult. Linear interpolation of apparent bedrock elevations based upon the boring data is often used but can misrepresent actual rock removal quantities where such anomalies exist.

7.3 Bedrock

Bedrock in the location of the future bridge was explored with rock coring techniques utilizing a diamond impregnated core barrel of NQ size. Based on the samples of bedrock recovered, the bedrock in the location of the future bridge (southwest

abutment) is anticipated to be shale. Some minor amounts of sandstone may also be encountered. Rock Quality Designation (RQD) and percentage recovery of the rock core performed are included on the boring log located in Appendix II. Photographs of the rock core are included in Appendix VII.

Weathered bedrock units were encountered within the subsurface exploration at varying depths. These materials were generally able to be penetrated with augers and split-spoon samplers. Generally, the weathered bedrock units consisted of sandy shale or sandstone. Highly variable depths of weathering were noted across the subject site.

7.4 Groundwater

Shallow groundwater was observed within the borings at depths ranging from 0.5 to 13 feet below the existing ground surface on the date drilled. Groundwater levels should be expected to fluctuate with changes in site grading, precipitation, and regional groundwater levels. Groundwater may be encountered at shallower depths during wetter periods. Refer to Section 8.7 for additional details.

8.0 GEOTECHNICAL CONSIDERATIONS

Due to the size and scope of the proposed National Cherokee Nation Park, geotechnical considerations for the individual structures will vary based on the structure's location on the project site. Geotechnical considerations for the project site have been listed below:

8.1 Topsoil

Topsoil was noted in the subsurface exploration to depths between 0.1 to 1.5 feet below the ground surface. Due to the influence of vegetation and trees, this material should be stripped from construction areas and stockpiled for use in non-pavement or structure areas or removed from the site. Large root systems, such as root balls from trees or any root over 6 inches in diameter should be included in the removal of topsoil from beneath structures and pavements. Root systems may extend to depths deeper than those noted in the subsurface exploration. It should be noted that the use of the term topsoil within this report is for site construction and does not imply that the

material is suitable for sale as topsoil. Due to the increased gravel and sand contents and the plasticity of some of the topsoil, some of this material may not be suitable for re-use as a surficial landscaping material.

8.2 Surface Boulders

Boulders were noted on the ground surface at the project site. Boulders were especially noted on the south side of the project site below the exposed rock bluffs. Foundations and floor slabs for structures should not bear directly on large surface boulders. Additionally, boulders should be removed from areas to receive fill materials. Some boulder features may be too large to remove intact and may require special equipment, pneumatic breakers, or explosives to be reduced in size and removed.

8.3 Soft Surficial Soils

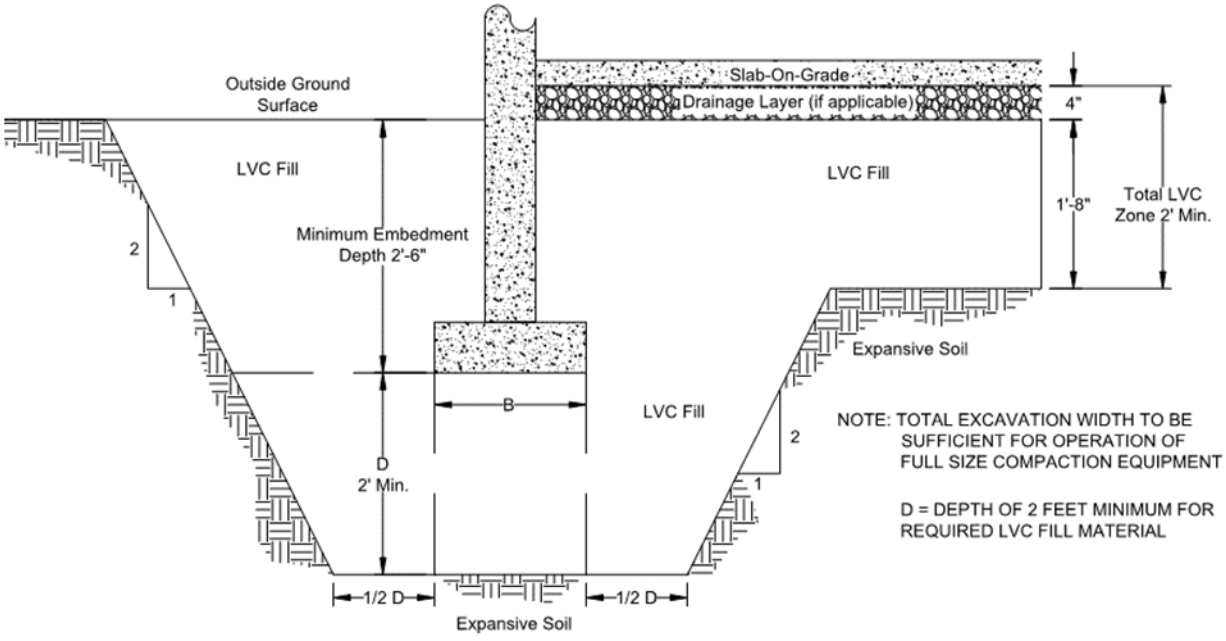
Areas of lean clay were noted near the surface in some of the borings. Generally, these materials may be stable during dry weather; however, these materials are anticipated to be sensitive to the addition of moisture. **During wet seasons or rain events or when exposed to repeated traffic, the near surface lean clay soils may become unstable and require over excavation and replacement or stabilization.** The amount of over excavation will be dependent upon conditions encountered during construction.

8.4 Undocumented Fill Near Existing Structures

Undocumented fill was not encountered in the subsurface exploration but is anticipated near existing structures. If undocumented fill is encountered during construction, foundations and slabs-on-grade should not bear over undocumented fill material. Foundations should either be extended through undocumented fill or be removed and replaced with controlled, engineered fill as described in Section 9. If undocumented fill is encountered in slab-on-grade areas, it should be removed and replaced as described in Section 9.

8.5 Moderate Volume Change Material

Based on laboratory testing of samples from the project site, soils with moderate swell potential were noted. These materials can excessively swell and sometimes shrink with the addition or evaporation of moisture. The excessive swelling can cause cracks in foundations, concrete slabs, and pavements to form. The material prone to swell at the project site includes materials noted as Lean to Fat Clay (CL-CH), Fat Clay (CH), and materials designated as shaley. Where these materials are present within 2 feet below the bottom of foundations or slabs-on-grade, a minimum of 2 feet of Low Volume Change (LVC) material should be established beneath foundations and slabs-on-grade. The LVC material should also extend a minimum of 12 inches beyond the footing width and be sloped up at a 1H:2V angle as shown in the below image. Material suitable as LVC material is described in Section 9.4 and includes treated soils as described in Section 9.2.



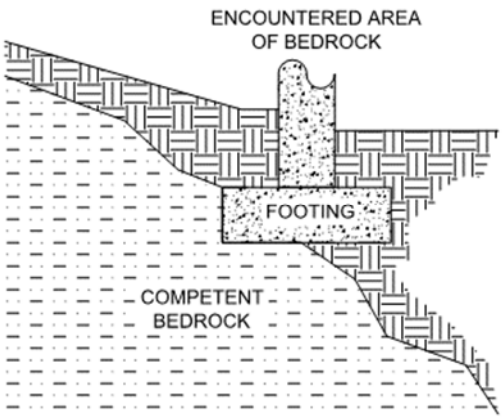
Moderate swell potential materials may also be encountered in pavement areas. Where moderate swell potential material is encountered in proposed road areas, moisture contents of the subgrade soils should be adjusted and **maintained** above

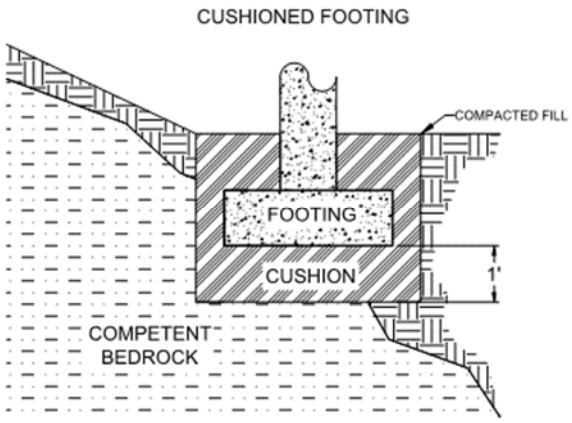
optimum to limit the potential for shrink/swell and a minimum of 1-foot of expansive material should be removed and replaced with LVC material.

8.6 Shallow Bedrock Considerations

The subsurface exploration program encountered areas of shallow bedrock and shallow auger refusal at the project site. Bedrock at the project site consists of variable units of shale and sandstone with highly variable degrees of weathering. Because of the variable degrees of weathering there is the potential for structures to encounter a condition where areas of intact, competent bedrock are mixed with relatively soft soils. In view of the increased potential for differential settlement between foundation units installed upon bearing strata with widely varying compressibility characteristics (incompressible bedrock versus firm clay), one of the following corrective measures should be implemented if bedrock is exposed in footing excavations or immediately below footing bottom elevation:

- The bedrock be over-excavated sufficient to allow placement of a minimum 12-inch “cushion” below footing bottoms as shown below. This “cushion” material may consist of a well-compacted low plasticity earth fill (if no groundwater is present), shot rock fill or compacted baserock. Bedrock heaved by blasting is not considered acceptable as cushion material. Caution should be exercised to limit over-shot of bedrock.





- Sufficient reinforcing steel added to the footing/foundation wall system in order to allow the footing/foundation wall to span at least 20 feet each side of the

edge of rock. Further, use of building components sensitive to differential settlement (plastic, masonry veneer, glass, etc.) should be prohibited at the edge of rock where there is an abrupt change in support characteristics.

8.7 Shallow Groundwater Considerations

Groundwater was encountered during the subsurface exploration at depths between 0.5 and 13 feet below the ground surface. As previously mentioned, water levels at the subject site should be anticipated to fluctuate with seasonal changes in moisture. Contractors should be prepared to encounter areas of shallow groundwater at the subject site. Generally, the shallow groundwater should be able to be removed with conventional pumping equipment; however, construction below the lake water table, if required, may require additional drainage systems to be implemented. PPI can provide these recommendations if needed.

8.8 Summary of Anticipated Geotechnical Considerations Per Structure

A table has been provided below based on the subsurface exploration and laboratory testing summarizing the geotechnical considerations noted within Section 8. Due to the relatively widely spaced borings at the subject site, some conditions may exist at the structures that were not present with the borings performed. If such conditions are encountered during construction, PPI should be contacted to provide additional recommendations.

Location	Surface Boulders	Moisture Sensitive Lean Clay	Moderate Swell Potential	Possible Area Undocumented Fill	Shallow Bedrock	Shallow Groundwater
Entry Areas	X	X	-	X	-	X
Community Center	X	X	X	-	X	-
Cultural Center	X	X	X	-	X	-
Amphitheater	X	X	X	-	-	-
Southeast Bank Premium Lake Cabins	X	X	X	-	X	X

Location	Surface Boulders	Moisture Sensitive Lean Clay	Moderate Swell Potential	Possible Area Undocumented Fill	Shallow Bedrock	Shallow Groundwater
Central Inland Premium Lake Cabins	X	X	X	-	X	-
Northeast Bank Premium Lake Cabins	X	X	-	X	X	-
Executive Cabins	X	X	-	-	X	-
Stables	X	X	-	-	-	-
Rodeo Area	X	X	X	-	X	X
Manager's Residence	X	X	-	-	-	-
General Store	X	X	X	-	X	-
Pool Area	X	X	-	Parking/Drive Area	X	-
Group Pavilions	X	X	X	X	X	-
Payment Kiosk	X	X	-	-	-	-
Flag Poles	X	X	X	-	-	-
Helipad	X	-	X	-	X	-
Marina Building and Restaurant	X	X	X	-	-	X
Storm Shelter West	X	-	X	-	X	X
Storm Shelter East	X	X	-	-	X	-
Picnic Pavilions	X	X	X	Nearby Loop Area	X	-

9.0 EARTHWORK

Earthwork for the proposed National Cherokee Nation Park will be dependent on the structure and location of the structure within the project site. A summary of anticipated geotechnical considerations per structure has been included in Section 8.8 to assist in identifying these conditions during construction.

9.1 Site Preparation

Grading plans for the National Cherokee Nation Park were not provided. Grading for the project site is anticipated to be highly variable across the project site and per structure. Large cuts or fills are anticipated on along the southeast bluff in the location

of the proposed cabins. Moderate cut and fills of 5 feet or less are anticipated for all other locations. The initial phase of site preparation should include the steps listed below;

- **It is recommended that a representative from PPI be present during site preparation to help identify the conditions described below**;
- Stripping and removal of all topsoil and vegetation as Describe in Section 8.1;
- Any loose boulders in building areas, fill areas, or pavement areas should be removed from the construction area as noted in Section 8.2;
- Areas of lean clay may be sensitive to moisture and require over excavation and replacement or stabilization if exposed to rain, excessive moisture, or repeated traffic as described in Section 8.3;
- Areas containing undocumented fill, if encountered, should be stripped and replaced, or measures taken as described in Section 8.4;
- Fat clay, moderate plasticity clay, and all shaley clay within 2 feet of at grade slabs and foundations should be removed and replaced or treated as described in Section 8.5;
- Structure areas that encounter a combination of partial rock and soil bearing should be treated as noted in Section 8.6;
- All areas scheduled to receive new fill should be proof-rolled as described below**.** Fill should not be placed on a frozen subgrade.

Proof-rolling consists essentially of rolling the ground surface with a loaded tandem axle dump truck or similar heavy rubber-tired construction equipment and noting any areas which rut or deflect during rolling. All soft subgrade areas identified during proof-rolling should be undercut and replaced with compacted fill as outlined below. Proof-rolling, undercutting, and replacement should be monitored by a qualified representative of the Geotechnical Engineer. The depth and areal extent of undercutting will be largely dependent upon the time of year and related soil moisture

conditions. If construction is initiated during wetter spring or winter months, the requirement for undercutting soft surficial soils below normal topsoil stripping should be anticipated and reflected in contract documents. However, even during summer months it is possible to encounter soft and saturated subgrade conditions. As previously mentioned, lean clays at the project site are moisture sensitive and may pose difficulties regarding subgrade stability and proper compaction.

9.2 Treated Soils

Chemical stabilization is an alternate for utilizing the on-site moderate to high plasticity clay and shaley clay generated from undercutting procedures. It is recommended that chemically stabilized clays be placed in 6 to 9-inch lifts and compacted to specified densities. Use of approximately 6 percent hydrated lime or 15 percent Type C Flyash, by weight, should be anticipated. With CH or CL clays chemically stabilized, it is considered applicable to place this material at all locations and elevations within the proposed pavement areas. Treated soils can be used in place of LVC material in all locations.

9.3 Scarifying and Recompacting

All subgrade areas approved after proof-rolling should be scarified to a depth of at least 8 inches and soil moisture adjusted and compacted to comply with project specifications.

9.4 Fill Material Types

Fill Type[1]	USCS Classification	Acceptable Location for Placement
Low Volume Change (LVC) Engineered Fill[2]	Non-shaley CL, GC, or SC (LL < 45) And treated soils as described in Section 9.2	All locations and elevations
On-Site Natural Soils	CL, SC, GC	All locations and elevations
	CL-CH[3], CH[3]	See Note 3
Rock Fill[4]	GW	All locations and elevations

1. Controlled, compacted fill should consist of approved materials that are free of organic matter and debris and contain maximum rock size of 4 to 6 in. Frozen material should not be used and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to its use.
2. Low plasticity cohesive soil or granular soil having at least 15% low plasticity fines.
3. CL-CH or CH clays with a Liquid Limit equal to or above 45 are considered suitable for use as controlled fill, only if the percentage of rock fragments exceeds 35% or if placed 2 feet below shallow foundations, pavements, or slab areas.
4. If rock is to be used as the primary filling medium, embankments should be constructed using rock having maximum dimensions in excess of 4 inches, but no greater than 8 inches. Rock material should be placed in horizontal layers having a thickness of approximately the maximum size of the larger rock comprising the lift, but not greater than 12 inches. Rocks or boulders too large to permit placing in a 12-inch thick lift should be reduced in size as necessary to permit placement or be bladed over the edge of the fill and not used in the compacted fill. Rock fill should not be dumped into place but should be distributed in horizontal lifts by blading and dozing in such a manner as to ensure proper placement into final position in the embankment. Finer material including rock fines and limited soil fines should be worked into the rock voids during this blading operation. Excessive soil and rock fine particles preventing interlock of cobble and boulder sized rock should be prohibited. Rock fill should be consolidated by a minimum of three (3) passes of a large diameter self-propelled vibratory compactor. Terminal fill slopes using rock may be constructed 1.5 horizontal to 1 vertical for fill height of 15 feet or less. The testing of rock fill quality should include the requirements that a representative of the Geotechnical Engineer be present daily, but not necessarily continuously during the placement of the fill to observe the placement of rock fill in order to determine fill quality and to observe that the contractors work sequence is in compliance with this specification. Progress reports indicative of the quality of the fill should be made at regular intervals to the Owner. If improper placement procedures are observed during the placement of the fill the Geotechnical Engineer should inform the Contractor, and no additional fill should be permitted on the affected area until the condition causing the low densities has been corrected and the fill has been reworked to obtain sufficient density.

9.5 Compaction Requirements

Item	Description
Subgrade Scarification Depth	At least 8 inches
Fill Lift Thickness	8-inch (loose)
Compaction Requirements[1]	• Coarse Grained Material with little or no fines: 70% Relative Density, or compacted by a minimum of three (3) passes of a self-propelled smooth drum vibratory compactor. • Fine Grained Material: 95% Standard Proctor Density (ASTM D-698)
Moisture Content	• ± 2% optimum moisture for CL, SC, or GC soil types; or • 0 to 4% above optimum for CL-CH or CH soil types
Recommended Testing Frequency	• One (1) Field Density (compaction) test for each 2,500 sq. ft. of fill within building areas; • One (1) Field Density (compaction) test for each 5,000 sq. ft. of fill within paving areas; and • A minimum of three (3) tests per lift.
1. We recommend that engineered fill (including scarified compacted subgrade) be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.	

9.6 Landscaping & Site Drainage

Discharge from roof downspouts should be collected and diverted well away from building perimeters and incorporated into the design plans. Rapid, efficient runoff away from buildings should also be provided. In addition, landscaping requiring frequent watering should be prohibited adjacent to building foundations.

In addition, provisions should be implemented to reduce the potential for large fluctuations in moisture within the subgrade soils adjacent to the structure. Ponding of surface water immediately adjacent to the structures and pavements can significantly increase subgrade moisture and may result in undesirable subgrade movement. As previously mentioned, careful consideration should be given to the landscaping and drainage elements to be installed at the project site adjacent to building and pavement areas. **Trees and some large bushes can draw significant**

moisture from the subgrade soils, resulting in shrinkage and subsequent foundation/pavement movement.

9.7 Earthwork Construction Considerations

Once grading and filling operations have been completed, the moisture within subgrades should be maintained and soils not be allowed to dry and desiccate prior to construction of floor slabs and footings. Grading of the site should be performed in such a manner so that ponding of surface water on prepared subgrade or in excavations is avoided. During construction, if the prepared subgrade should become frozen, desiccated, saturated, or disturbed, the affected material should be scarified or removed, moisture conditioned and recompacted prior to floor slab construction.

9.8 Excavations

Based upon the subsurface conditions encountered during this investigation, the on-site soils typically classify as Type C in accordance with OSHA regulations. Temporary excavations in soils classifying as Type C with a total height of less than 20 feet should be cut no steeper than 1.5H:1V in accordance with OSHA guidelines. If stable sandstone/shale bedrock is encountered in excavations, the bedrock may be cut to near vertical sidewalls. Confirmation of soil classification during construction, as well as construction safety (including shoring, if required), is the responsibility of the contractor.

9.9 Inclement Weather

If construction is initiated during wetter months, the requirement for undercutting soft surficial soils below normal site stripping should be anticipated and reflected in contract documents. **Undercut depths on the order of 2 or more feet are considered possible within structure footprints. Based upon past experience of this firm, the shallow lean clay subgrade at the site is known to significantly lose strength when saturated and disturbed by construction equipment. Further, material removed from undercuts may not be suitable for use as compacted fill due to high soil moisture if poor drying conditions (cool**

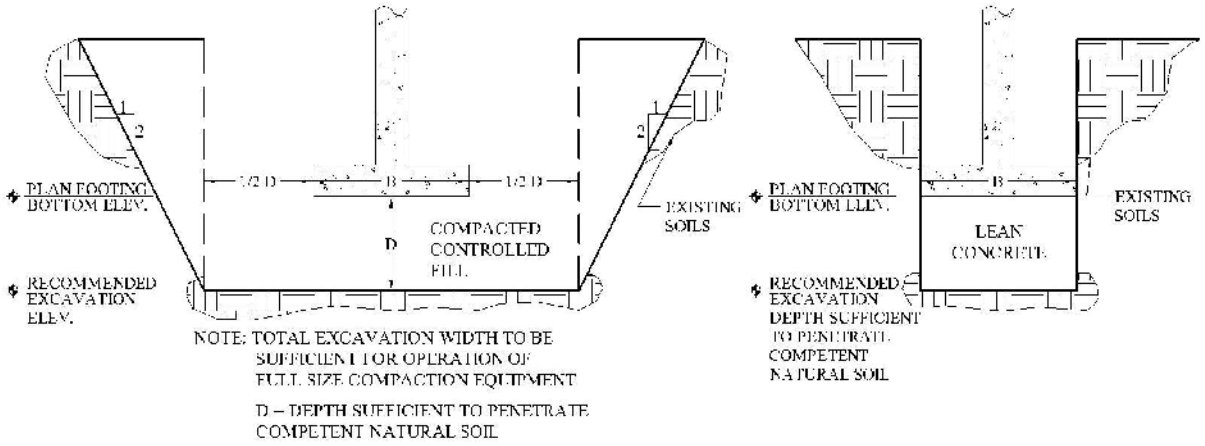
temperatures and/or frequent precipitation) occur during site grading. If the construction schedule will not permit delay for better drying conditions, the project budget should include an allowance for subgrade undercut and replacement with soil material containing appreciable quantities of rock fragments, treated soils as described in Section 9.2, or sand and gravel from an off-site borrow area that meet the requirements above. As an alternate to select fill, rock fill subbase (4 to 8-inch top size stone) may be placed to improve subgrade stability.

10.0 FOUNDATIONS

As previously noted, foundations for the proposed structures will be dependent on the structure's location on the project site. Refer to Section 8.8 for a summary of anticipated geotechnical conditions that may affect building foundations. Structures at the project site are anticipated to bear on native soils, controlled fill, bedrock, and combinations of those three materials. Foundations for the structures at the project site are anticipated to be primarily shallow, spread foundations or turned-down slabs with primarily light foundation loads. Drilled pier recommendations have been included for the proposed bridge located at the northeast corner of the project site. Drilled pier recommendations are meant only for the proposed bridge. Drilled pier recommendations can be provided for other structures, if necessary, upon request.

10.1 Shallow Building Foundations

As previously noted, footings for the proposed structures are anticipated to bear in stiff natural soils, controlled fill, bedrock, or a combination of those three materials. If isolated shallow rock is encountered, the shallow rock should be over excavated and replaced to provide a cushion as described in Section 8.6. Foundations for the proposed buildings should be extended through soft soils and through undocumented fill, if encountered, to bear on native soils. Alternatively, soft soils or undocumented fill should be removed and replaced with compacted, controlled fill or lean concrete as noted in the figure below. If expansive soils are encountered, they should be treated as noted in Section 8.5.



Please refer to the section below for recommendations regarding shallow foundations.

10.2 Shallow Foundation Design Recommendations

Description	Column (Spread Footing)	Wall (Continuous Footing)
Net allowable bearing pressure[1]	Soil: 2500 psf Bedrock: 5,000 psf	Soil: 2000 psf Bedrock: 5,000 psf
Minimum dimensions	2.5 feet	1.5 feet
Minimum embedment below finished grade for frost protection and variation in soil moisture[2] (footings on soil)	2.0 feet	2.0 feet
Estimated total settlement[3]	Soil: 1 inch or less Bedrock: Less than ½ inch	Soil: 1 inch or less Bedrock: Less than ½ inch
Allowable passive pressure[4]	600 psf	600 psf
Coefficient of sliding friction[5]	0.4 (natural soils/fill)	0.4 (natural soils/fill)

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. The recommended pressure considers all unsuitable and/or soft or loose soils, if encountered, are undercut and replaced with tested and approved new engineered fill. Footing excavations should be free of loose and disturbed material, debris, and water when concrete is placed. A factor of safety value of 3 has been applied to these values.
2. For perimeter footings and footings beneath unheated areas.
3. The foundation movement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations.
4. Allowable passive pressure value considers a factor of safety of about 2. Passive pressure value applies to undisturbed native clay or properly compacted fill. If formed footings are constructed, the space between the formed side of a footing and excavation sidewall should be cleaned of all loose material, debris, and water and backfilled with tested and approved fill compacted to at least 95% of the material's Standard Proctor dry density. Passive resistance should be neglected for the upper 2 feet of the soil below the final adjacent grade due to strength loss from freeze/thaw and shrink/swell.
5. Coefficient of friction value is an ultimate value and does not contain a factor of safety.

10.3 Uplift

Resistance of shallow spread footings to uplift (U_p) may be based upon the dead weight of the concrete footing structure (W_C) and the weight of soil backfill contained in an inverted cone or pyramid directly above the footings (W_S). The following parameters may be used in design:

Description	Weights
Weight of Concrete (W_c)	150 pcf
Weight of Soil Resistance (W_s)	100 pcf
Weight for on-site soils placed in accordance with Section 8	

The base of the cone or pyramid should be the top of the footing and the pyramid or cone sides should form an angle of 30 degrees with the vertical. Allowable uplift capacity (U_p) should be computed as the lesser of the two (2) equations listed below:

$$U_P = (W_S/2.0) + (W_C/1.25) \text{ or } U_P = (W_S + W_C)/1.5$$

10.4 Drilled Pier Recommendations for Bridge Foundations

The below drilled pier recommendations have been provided for the proposed bridge location only. Drilled shafts for the proposed bridge are anticipated to bear in shale bedrock. Drilled pier shafts should be installed straight with **no** underreaming due to the competent shale encountered within the subsurface exploration. Drilled shafts may be designed using an allowable bearing pressure of 20 ksf. This allowable bearing pressure may be utilized for the entire width of the bottom of the drilled shaft. It is recommended that drilled shafts have a minimum shaft diameter of 18-inches. A minimum embedment into the weathered shale unit of 5 feet is recommended. However, deeper embedment depths may be required to resist uplift and/or lateral loads.

Drilled shafts should be free of all loose and/or soft soils at the time of concrete placement. Concrete placement below more than 2 to 3 inches of water should be placed using a tremie. It is recommended that drilled shafts be examined by a representative of the Geotechnical Engineer to assure a relatively flat pier bottom, a plumb pier shaft and competent shale consistent with the recommended bearing

pressures, as well as removal of essentially all groundwater prior to concrete placement. In case shallow groundwater or caving soils are encountered, use of temporary casing should be anticipated and should be on-site prior to commencement of drilling.

10.4.1 Uplift Resistance for Drilled Shafts

For resistance to the total uplift, only the side friction of the sidewalls of the drilled shaft that penetrates into the shale bedrock a minimum depth may be applied. To calculate resistance to the total uplift, an allowable side friction of 1,300 psf may be used for shale.

10.4.2 Lateral Loadings

It is anticipated that resistance of the foundations to lateral loading and the associated lateral deflection will be evaluated using finite difference computer models based on the horizontal modulus of subgrade reaction (K_h). The following values may be used in the analysis for this site.

Pier Depth	Unit Weight (pcf)	Static K_h (pci)	Cyclic K_h (pci)	Fiction Angle (°)	Cohesion S_u (psf)	Uniaxial Compressive Strength (psi)	e_{50}
*0-1 Pier Diameter	Ignore	-	-	-	-	-	-
*1 Pier Diameter to 10 feet	125	680	280	-	2,000	-	0.006
10 feet to 30 feet	140	2000	800	30	-	150	0.002
*Lateral parameters for the upper 1 pier diameter, or 2.5 feet, whichever is shallower, should be ignored.							

The above values were measured or based upon published correlations with anticipated soil strength and classification tests.

11.0 BELOW GRADE POOL CONSIDERATIONS

Pool and aquatics features are greatly susceptible to settlement and movements due to the rigidity of the materials they are generally constructed of. Total allowable differential settlements of pool shell are often ½-inch for skimmer filtered systems and as little as ¼-inch for gutter skimmer systems. Additionally, because these features contain water often

chlorinated or salted, failures in the structures typically experience larger movements due to the introduction of water to the subgrade. Therefore, it is important that pool designs take into consideration site specific geotechnical considerations and that a proper pool design includes both the liner and the subgrade. Proper maintenance operations are also vital in the longevity of a pool/aquatics system and should not be overlooked.

It is anticipated that the proposed pool/aquatics area will be an outdoor feature with no controlled heating/cooling. Accordingly, it is anticipated that the pool will be closed and possibly drained during winter months. Due to the potential for frost induced movement, pool features not bearing on bedrock should be surrounded by a minimum of 2 feet of frost resistant material. Frost resistant material should consist of clean gravels having less than 10 percent fines. It is recommended that a filter fabric be utilized between soils and frost material to limit fine migration. A drainage system may also be required to limit water ponding within this material, especially when the base of the granular material is near bedrock elevation.

As noted in Section 8, the proposed pool and aquatics area at the project site was noted to contain shallow bedrock. Individual pool and aquatics features should bear on uniform bearing material and partial bearing on bedrock and partial on soil should be avoided due to the possibility of differential settlement and associated structure cracking. This may require over excavation of bedrock and replacement with a non-frost susceptible material with a proper drainage system as described above.

Below is a list of geotechnical items to be considered for pool and aquatic park systems:

- **Groundwater Concerns:** No indications of groundwater were noted in the soil exploration near the pool area; however, due to the presence of shallow shale and sandstone bedrock, ground water may perch temporarily over the bedrock. While the pool is filled this is not a concern; however, when the pool is drained this ponding of water may create enough buoyant force to lift the pool shell out of the ground. It is recommended that pools not placed directly on bedrock contain a proper under-pool drainage system to capture possible ground water and remove it from below the pool system;

- **Isolated Pool Shells:** Due to a pool's increased sensitivity to settlement, the pool shell should be isolated from any structure that may increase the possibility of settlement. Foundations from building and other structures should be kept a minimum of 2 foundation widths away from the edge of the pool shell. Additionally, it is not recommended that pool decks be tied into the pool shell;
- **Expansion Joints:** Expansion joints within a pool system should be avoided if possible. Due to the degradation of expansion joints with time, expansion joints are prone to leaking and are often the first areas of failure of pool systems. Leaking in these areas can cause increased swelling or erosion of subsurface soils. If expansion joints are utilized, they should be evaluated and maintained on a regular schedule.
- **Design for At-Rest Wall Conditions:** Pool side walls should be designed for At Rest wall conditions as backfill material will generally not be able to be placed properly behind pool walls. Design recommendations for at rest wall conditions are provided below;
- **Pool Construction:** Care should be taken during construction and once the pool system has been installed to not introduce surcharge loads on the pool shell with heavy machinery or by other means; and
- **Expansive Soils:** Due to the possibility of shrink and swell potential of the native shaley soils, it is considered essential that moisture content be adjusted and **maintained** above optimum for all exposed shaley clay and clays with a liquid limit of 45 percent or more to limit the potential for shrink/swell. Additionally, shaley clays and clays with liquid limits of 45 percent or more should be removed from beneath the pool and from the walls of the pool a minimum of 30 inches and replaced with an LVC material; however, this is anticipated to be accomplished with the installation of non-frost susceptible material.

11.1 Pool Lateral Earth Pressure Design

The below table should be used for pool wall design parameters only:

Soil Material	Level Backfill	
	Equivalent Fluid Pressure	K_o
Lean Clay	85 pcf	0.7
Fat Clay	75 pcf	0.6
Clean Crushed Stone*	50 pcf	0.4
*For pool walls of 3 feet or less		

12.0 LATERAL EARTH PRESSURE FOR BELOW GRADE WALLS

Retaining wall backfill should consist of free-draining crushed stone or alternatively, may consist of lean clay with appreciable chert fragments. Depending upon the type of backfill selected and degree of wall restraint, the following table of lateral earth pressures are considered appropriate for wall design.

For backfill sloped other than 2H:1V, interpolate between values given in the table below for level and sloped backfill.

NOTE: Structural design of unrestrained walls should permit wall rotation at top of wall equal to 1/240th of wall height.

Type of Backfill	Drained Level Backfill				Drained Sloped Backfill (2H:1V)*			
	Restrained Walls		Unrestrained Walls		Restrained Walls		Unrestrained Walls	
	Equivalent Fluid Pressure	K	Equivalent Fluid Pressure	K	Equivalent Fluid Pressure	K	Equivalent Fluid Pressure	K
Compacted Lean Clay (CL) or Cherty Clay >35% + No. 4 Sieve	70 pcf	0.6	45 pcf	0.4	80 pcf	0.7	55 pcf	0.5
Clean Crushed Stone	50 pcf	0.4	35 pcf	0.25	60 pcf	0.5	45 pcf	0.35
Rock Fill (Free Draining)	50 pcf	0.4	35 pcf	0.25	60 pcf	0.5	45 pcf	0.35

If crushed stone backfill is selected and wall design in accordance with the above equivalent fluid pressures, the crushed stone backfill should be placed within a boundary

projecting 30 degrees from the vertical commencing at a point 1 foot out from the base of wall. Regardless of the backfill type selected, an impervious moisture barrier should be applied to the basement wall. In addition, if lean clay backfill is selected, a geosynthetic drainage mat should be applied to the wall to assure removal of subsurface water. A perforated pipe should be laid at the base of wall to collect and remove subsurface water either from free-draining crushed stone or drainage mats. Flow line of the perforated pipe should be laid below basement finished floor.

13.0 SEISMIC CONSIDERATIONS

Code Used	Site Classification
2012 International Building Code (IBC)[1]	C
1. In general accordance with the *2012 International Building Code*, Section 1613	

14.0 FLOOR SLABS

Details of floor slab and slab-on-grade construction will be dependent on the structure's location at the project site as noted above. For geotechnical consideration affecting the proposed floor slabs and slabs-on-grade refer to Section 8. Slab-on-grade or slab-on-fill floor systems are considered appropriate at the site based upon subsurface conditions encountered and future site grading. Listed below are key considerations for design purposes of floor slabs.

- Subgrades containing fat clays (CH) or shaley clays in floor slab areas should be over excavated and replaced as described in Section 8.5;
- Subgrade materials containing undocumented fills, if encountered, in the areas of floor slabs should be proof-rolled prior to the construction of floor slabs. Areas not passing the proof rolled should be treated as noted in Section 8.4;
- Prior to placement of **controlled** fill, if any, natural soils should be scarified, moisture content adjusted and re-compacted in accordance with Section 9 of this report; and
- Prior to slab placement, soil moisture should be adjusted and maintained within the parameters specified in Section 9 of this report.

Placement of 4 or more inches of compacted free-draining granular base course below slabs that are not below grade is recommended to limit moisture rise through slabs and to improve slab support, particularly at joints. An impervious moisture barrier consisting of 6-mil plastic sheeting or equivalent should be provided in accordance with the 2012 IBC. Use of a 10-mil vapor barrier is recommended below all slab areas with an intended use sensitive to slab moisture.

15.0 PAVEMENT

Pavement subgrades should be prepared in accordance with Sections 8 and 9 of this report. If fat clays are exposed during road construction, a minimum of 12 inches of soil beneath the pavements should be removed and replaced with LVC material as described in Section 8.5. **It is considered essential that moisture content be adjusted and maintained above optimum for all exposed CH clays to limit the potential for shrink/swell.** It is anticipated that any new pavements associated with this project will be constructed of either an asphaltic concrete wearing surface placed over a base or a rigid Portland Cement Concrete pavement over a granular base.

15.1 Flexible Pavement

If asphaltic paving is selected, the aggregate base may be a granular compacted crushed limestone with a gradation and quality conforming to the requirements of the Oklahoma Department of Transportation (ODOT), Standard Specification 703.01 for Type A aggregate. The maximum lift thickness for the granular base is 4 in. Granular base thicknesses in excess of 4 in. should be placed in multiple lifts with each lift being of approximately equal thickness. The granular base should be compacted to at least 100% of Standard Proctor Compaction (ASTM D-698).

Asphaltic concrete, both base and surface, should conform to the applicable requirements of ODOT Standard Specification 708. Asphaltic concrete should be compacted to 92 to 96% of Maximum Theoretical Gravity (ASTM D-2041). Substitution of an appropriate Superpave Mix Design, SP 190C or SP 250C, can be used in place of the bituminous base. SP 190C or SP 125C may be used for the surface. All

bituminous mix designs should have been prepared or verified within 6 months of the date of placement on the project.

15.2 Rigid Pavement

If rigid concrete paving is selected, a minimum 4-in. thickness granular base compacted to 100% of Standard Proctor should be placed on the prepared subgrade. The Portland Cement Concrete (PCC) mix should have a minimum 28-day compressive strength of 4000 pounds per square inch (psi). Concrete should be placed at a low slump (1 to 3 inch) and have an entrained air content of 5 to 7%. If an increased slump is desired, use of Super Plasticizer is recommended.

15.3 Pavement Thickness

A pavement thickness would best be computed if traffic frequencies and wheel loadings were provided to us, but a typical pavement design for this type of facility would generally generate a Structural Number of 3.0 to 3.5 within heavy duty areas and 2.4 to 2.6 within light duty areas, depending on the subgrade conditions. The following table presents corresponding typical flexible and rigid pavement thicknesses using the general Structural Numbers. The pavement thicknesses provided below are conservative and can be re-evaluated if a final grading plan, traffic frequencies and wheel loadings are provided, if desired.

Pavement Type	Anticipated Traffic Frequency	Asphaltic Surface (in.)	Asphaltic Base (in.)	Concrete Thickness (in.)	Aggregate Base (in.)
Flexible Pavement	Heavy Duty	3.0	4.0	-	6.0
	Heavy Duty w/ Tensar TX5 Geogrid*	3.0	3.0	-	6.0
	Light Duty	2.0	2.0	-	6.0
	Light Duty w/ Tensar TX5 Geogrid*	3.0	-	-	6.0
Rigid Pavement	Heavy Duty	-	-	7.0	4.0
	Light Duty	-	-	5.0	4.0
*Geogrid to consist of Tensar TX5, installed below aggregate baserock section per manufacturer's recommendations.					

As mentioned above, a more accurate pavement thickness can be computed if anticipated traffic frequencies and wheel loadings are provided to PPI. The above thicknesses are considered approximate since actual pavement loading has not been provided.

16.0 CONSTRUCTION OBSERVATION & TESTING

The construction process is an integral design component with respect to the geotechnical aspects of a project. Since geotechnical engineering is influenced by variable depositional and weathering processes and because we sample only a small portion of the soils affecting the performance of the proposed structures, unanticipated or changed conditions can be disclosed during grading. Proper geotechnical observation and testing during construction is imperative to allow the Geotechnical Engineer the opportunity to evaluate assumptions made during the design process. Therefore, we recommend that PPI be kept apprised of design modifications and construction schedule of the proposed project to observe compliance with the design concepts and geotechnical recommendations, and to allow design changes in the event that subsurface conditions or methods of construction differ from those assumed while completing this study. We recommend that during construction all earthwork be monitored by a representative of PPI, including site preparation, placement of all engineered fill and trench backfill, and all foundation excavations as outlined below.

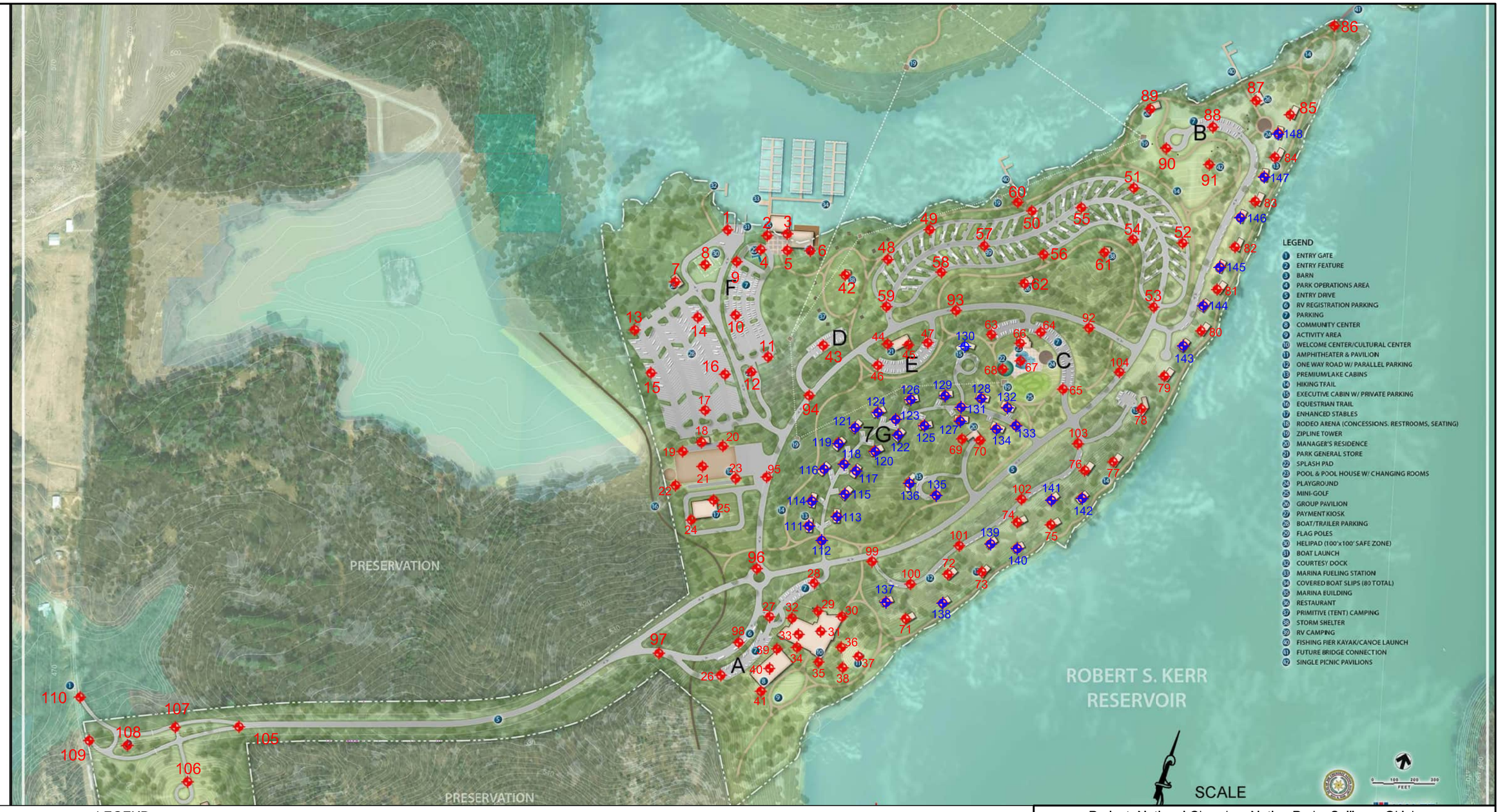
- An experienced Geotechnical Engineer or Engineering Technician of PPI should observe the subgrade throughout the proposed project site immediately following stripping to evaluate the native clay, identify areas requiring undercutting, and evaluate the suitability of the exposed surface for fill placement;
- An experienced Engineering Technician of PPI should monitor and test all fill placed within building and pavement areas to determine whether the type of material, moisture content, and degree of compaction are within recommended limits;

- An experienced Technician or Engineer of PPI should observe and test all footing excavations. Where unsuitable bearing conditions are observed, remedial procedures can be established in the field to avoid construction delays; and
- The condition of the subgrade should be evaluated immediately prior to construction of building floor slabs to determine whether the moisture content and relative density of the subgrade soils are as recommended.

17.0 REPORT LIMITATIONS

This report has been prepared in accordance with generally accepted practices of other consultants undertaking similar studies at the same time and in the same geographical area. Palmerton & Parrish, Inc. observed that degree of care and skill generally exercised by other consultants under similar circumstances and conditions. Palmerton & Parrish's findings and conclusions must be considered not as scientific certainties, but as opinions based on our professional judgment concerning the significance of the data gathered during the course of this investigation. Other than this, no warranty is implied or intended.

APPENDIX I - FIGURES



LEGEND

Phase I Boring Locations

Phase II Boring Locations

SCALE: 1"=450'

Project: National Cherokee Nation Park - Sallisaw, Oklahoma
Client: Cherokee Nation Entertainment, LLC

Boring Location Plan

DATE: June 19, 2019 Project Number: 256748

PALMERTON & PARRISH, INC.
GEOTECHNICAL AND MATERIALS ENGINEERS/MATERIALS TESTING LABORATORIES/ENVIRONMENTAL SERVICES

FIGURE 1

S:_MASTER PROJECT FILE\2019\OK\C\Cherokee Nation Park-Sub\Figures\Cherokee Nation Ent-256748-Nat'l Cherokee Nation

APPENDIX II - BORING LOGS & KEY TO SYMBOLS

4168 W. Kearney
Springfield, Missouri 65803
Telephone: (417) 864-6000
Fax: (417) 864-6004

GEOTECHNICAL BORING LOG

BORING NUMBER 1

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 1 ft
LOGGED BY CJ **CHECKED BY** BP
AT END OF DRILLING 1 ft
NOTES Offset 25' W Due to Standing Water/Soft Conditions

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist 0.8 ft FAT CLAY, w/ Coarse Sand, Tan, Soft to Stiff, Moist (CH)	SPT 1		0-1-1 (2)	0.5		
				SPT 2		4-4-8 (12)	2		
5			5.0 ft SHALE, Highly Weathered, Tan to Brown, Soft to Medium Hard	SPT 3		65/3"	2.5		
			Gray Below 8.5'	SPT 4		62-65/3"	3.75		
10			11.2 ft						

Refusal at 11.2 feet.
Bottom of borehole at 11.2 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 2

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 0.5 ft
LOGGED BY CJ **CHECKED BY** BP
AT END OF DRILLING 0.5 ft
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Soft, Moist — 0.3 ft	SPT 1		0-1-1 (2)	0.5
			SANDY LEAN CLAY, w/ Gravel, Trace Roots, Tan, Soft, Moist (CL) — 3.0 ft				
			SANDY FAT CLAY, Tan, Stiff to Very Stiff, Moist (CH)	SPT 2		5-5-7 (12)	1.75
5			*Increasing Intermittent Layers of Weathered Shale With Depth Below 4.5'* — 6.5 ft	SPT 3		10-9-16 (25)	2.25
			SHALE, Highly Weathered, Gray to Tan, Soft to Medium Hard	SPT 4		27-56-65/2"	2.75
10			— 13.0 ft				
			SHALE, Gray, Medium Hard — 13.7 ft	SPT 5		65/2"	4.5

Refusal at 13.7 feet.
Bottom of borehole at 13.7 feet.

DRY UNIT WT (pcf) 20 40 60 80 100
N VALUE 20 40 60 80
PL MC LL 20 40 60 80
SHEAR STRENGTH (ksf) 1 2 3 4

ELEVATION (ft)

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GEOTECHNICAL BORING LOG

BORING NUMBER 3

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 0.5 ft
LOGGED BY CJ **CHECKED BY** BP
AT END OF DRILLING 2 ft
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Soft, Wet — 0.3 ft SANDY LEAN CLAY, Brown, Soft to Stiff, Moist (CL)	SPT 1		1-1-3 (4)	0.75		
			3.7 ft SANDY FAT CLAY, Tan Gray, Stiff, Moist (CH)	SPT 2		4-4-5 (9)			
5				SPT 3		7-4-5 (9)	0.75		
			Increasing Intermittent Layers of Weathered Shale With Depth Below 8' - Very Stiff Below 8.5'	SPT 4		5-8-12 (20)	2.25		
10			11.0 ft SHALE, Highly Weathered, Tan Gray, Soft 13.0 ft						
			SANDY SHALE, Gray, Soft	SPT 5		65/1"			
15			17.2 ft						

Refusal at 17.2 feet.
Bottom of borehole at 17.2 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 4

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** BP
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Soft, Wet — 0.8 ft SANDY LEAN CLAY, Brown, Soft to Stiff, Moist (CL)	SPT 1		0-1-1 (2)	1		
			3.0 ft SANDY FAT CLAY, Brown, Stiff to Very Hard, Moist (CH)	SPT 2		4-5-5 (10)	2		
5			-Brownish Gray Below 7'	SPT 3		8-5-7 (12)	3.75		
				ST 4	79		4.5		
10			11.5 ft SHALE, Highly Weathered, Gray, Soft to Medium Hard						
				SPT 5		56-65/3"	3.5		
15			15.0 ft Refusal at 14.3 feet. Bottom of borehole at 15.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 5

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/21/19 **COMPLETED** 2/21/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** BP
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Soft, Wet — 0.5 ft SANDY FAT CLAY, Brown Tan, Soft, Very Moist (CH)	SPT 1		0-1-3 (4)	0.75		
			3.0 ft LEAN TO FAT CLAY, w/ Sand, Tan Gray, Stiff to Very Hard, Moist (CL-CH)	SPT 2		7-7-5 (12)	2		
5			7.0 ft FAT CLAY, Shaley, Tan Gray, Very Hard to Stiff, Moist (CH)	ST 3	67		3.75		
				SPT 4		5-5-5 (10)	1.25		
10			11.0 ft SHALE, Slightly Weathered, Tan Gray, Soft to Medium Hard	SPT 5		65/1"			
15				SPT 6		65/1"			
			20.0 ft						
20			Refusal at 18.6 feet. Bottom of borehole at 20.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 6

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/21/19 **COMPLETED** 2/21/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 3 ft
LOGGED BY CJ **CHECKED BY** BP
AT END OF DRILLING 6 ft
NOTES Offset 40' S Due to Standing Water/Soft

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Soft, Wet — 0.8 ft	SPT 1		1-1-3 (4)	0.5
			LEAN CLAY, Trace Sand, Tanish Gray, Stiff to Very Stiff, Moist (CL)				
			4.0 ft	ST 2	71		4.5
5			FAT CLAY, Trace Sand, Brownish Tan, Soft to Very Stiff, Moist (CH)	SPT 3		4-5-8 (13)	2.75
				SPT 4		5-8-9 (17)	2.75
10			11.0 ft				
			SANDY SHALE, Highly Weathered, Gray, Soft to Medium Hard				
			13.5 ft	SPT 5		65/0"	

Auger Refusal on Shale Bedrock
Refusal at 13.5 feet.
Bottom of borehole at 13.5 feet.

DRY UNIT WT (pcf) 20 40 60 80 100
N VALUE 20 40 60 80
PL MC LL 20 40 60 80
SHEAR STRENGTH (ksf) 1 2 3 4

ELEVATION (ft)

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GEOTECHNICAL BORING LOG

BORING NUMBER 7

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 8.5 ft
LOGGED BY CJ **CHECKED BY** BP
AT END OF DRILLING 8.5 ft
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Stiff, Wet — 0.3 ft SANDY FAT CLAY, Brown, Stiff, Moist (CH) — 1.0 ft SANDY SHALE, Highly Weathered, Red Tan, Soft	SPT 1		3-4-7 (11)	1.75		
			— 5.0 ft	SPT 2		16-40-59 (99)	4.5		
5			SANDY SHALE, Brown & Gray, Soft to Medium Hard	SPT 3		65/5"	4.5		
			— 8.8 ft	SPT 4		65/3"			

Refusal at 8.8 feet.
Bottom of borehole at 8.8 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 8

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** BP
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Very Stiff, Wet	SPT 1		3-3-13 (16)	1		
			0.5 ft SANDY FAT CLAY, Tan Gray, Very Stiff, Moist (CH) 1.3 ft						
			SANDY SHALE, Highly Weathered, Tan Gray, Soft						
			4.5 ft SANDY SHALE, Tan, Soft to Medium Hard	SPT 2		27-62-65/2"	3.75		
5				SPT 3		5/4"			
			8.7 ft	SPT 4		3/2"	4.5		

Refusal at 8.7 feet.
Bottom of borehole at 8.7 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 9

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** BP
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Stiff, Wet — 0.7 ft SANDY LEAN TO FAT CLAY, Tannish Brown, Stiff, Moist (CL) — 1.2 ft SANDY SHALE, Highly Weathered, Tan Gray, Soft	SPT 1		3-3-8 (11)	1	▲ ○	
			4.2 ft SANDY SHALE, Highly Weathered, Gray Tan, Soft — 5.0 ft	SPT 2		23-47-65 (112)	4.5	○ ▲	
5			Refusal at 4.8 feet. Bottom of borehole at 5.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 10

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** BP
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Soft, Moist 0.8 ft SANDY LEAN CLAY, w/ Gravel, Tannish Gray, Soft to Very Stiff, Moist (CL)	SPT 1		1-1-1 (2)	0.5		
			5.0 ft	SPT 2		5-7-9 (16)	1.25		
5			Bottom of borehole at 5.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 11

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 0.5 ft
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING 0.5 ft
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, With Sand, Dark Brown, Soft, Wet (0.3 ft) SANDY LEAN CLAY, Tan & Gray, Soft to Stiff, Moist (CL)	SPT 1		1-1-1 (2)	0.5	▲ ○	
			(5.0 ft)	SPT 2		3-4-7 (11)	0.75	▲ ○	
5			Bottom of borehole at 5.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 12

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/19/19 **COMPLETED** 2/19/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 1 ft
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING 1 ft
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Very Soft, Wet (0.3 ft) FAT CLAY, w/ Sand, Tan, Very Soft, Moist (CH) *Increasing Sand with Depth*	SPT 1		0-0-0 (0)			
			3.0 ft SANDY LEAN CLAY, Gray & Tan, Medium Stiff, Moist (CL)	SPT 2		3-3-3 (6)	0.5		
5			6.0 ft SANDY SHALE, Highly Weathered, Tan to Brown, Very Soft	SPT 3		13-14-10 (24)			
			8.5 ft SANDY SHALE, Gray, Soft to Medium Hard	SPT 4		31-40-65/2"	3.25		
10			10.0 ft Bottom of borehole at 10.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 13

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 1 ft
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING 0.5 ft
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		0.2 ft TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist						
			SANDY LEAN CLAY, Gray Tan, Stiff to Very Stiff, Moist (CL)	SPT 1		0-5-10 (15)	1		
			4.5 ft	SPT 2		5-8-13 (21)	2.5		
5			5.0 ft SANDY SHALE, Highly Weathered, Gray Brown, Soft						
			Bottom of borehole at 5.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 14

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Medium Stiff, Moist 0.5 ft SANDY FAT CLAY, Shaley, Tan, Medium Stiff, Moist (CH) 3.0 ft SANDY SHALE, Highly Weathered, Trace Roots, Tan to Brown, Soft 5.0 ft	SPT 1		1-3-3 (6)	1.75		
				SPT 2		40-52-60 (112)	4.5		
5			Bottom of borehole at 5.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 15

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/19/19 **COMPLETED** 2/19/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist (0.3 ft) LEAN CLAY, w/ Sand, Tan Brown, Soft to Medium Stiff, Moist (CL)	SPT 1		0-1-1 (2)	1.25		
5			(5.0 ft)	SPT 2		3-3-3 (6)	2.25		
			Bottom of borehole at 5.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 16

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/19/19 **COMPLETED** 2/19/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 3 ft
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING 3 ft
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist (0.5 ft) LEAN CLAY, Tan Brown, Soft, Wet (CL)	SPT 1		1-1-3 (4)	0.5		
			With Sand, Moist, Very Stiff, Below 3.5'	SPT 2		9-9-9 (18)	3.25		
5			Bottom of borehole at 5.0 feet. (5.0 ft)						

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GEOTECHNICAL BORING LOG

BORING NUMBER 17

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/19/19 **COMPLETED** 2/19/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist 0.5 ft SANDY LEAN CLAY, Red Tan, Medium Stiff, Moist (CL) 2.0 ft FAT CLAY, Shaley, Reddish Brown, Stiff, Moist (CH)	SPT 1		3-3-3 (6)	2.25		
			4.8 ft 5.0 ft	SPT 2		4-4-7 (11)	3.75		
5			SHALE, Highly Weathered, Gray, Soft Bottom of borehole at 5.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 18

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/19/19 **COMPLETED** 2/19/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Very Stiff, Moist — 0.3 ft CLAYEY SAND, Reddish Brown, Medium Dense, Moist (SC)	SPT 1		8-9-9 (18)	1.25		
			3.0 ft SANDY SHALE, Highly Weathered, Tan to Brown, Soft to medium Hard	SPT 2		62-51-65/2"	4.5		
5			5.0 ft Refusal at 5.0 feet. Bottom of borehole at 5.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 19

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/19/19 **COMPLETED** 2/19/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 10 ft
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING 8 ft
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist 1.0 ft						
			SANDY FAT CLAY, Red, Hard, Moist (CH) 2.0 ft	SPT 1		5-13-20 (33)	3.5		
			SANDY SHALE, Highly Weathered, Tan to Brown, Soft to Medium Hard	SPT 2		27-53/3"			
5				SPT 3		50/4"	4.5		
				SPT 4		50/4"	4.5		
10			13.0 ft						
			SANDY SHALE, Gray, Soft to Medium Hard 14.8 ft	SPT 5		50/5"	4.5		

Refusal at 14.8 feet.
Bottom of borehole at 14.8 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 20

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/18/19 **COMPLETED** 2/18/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 2 ft
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING 2 ft
NOTES Offset 10' S Due to Overhead Trees

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Stiff, Moist (0.5 ft) SANDY LEAN CLAY, Brown, Stiff, Moist (CL) (1.3 ft) SANDY SHALE, Highly Weathered, Tan to Brown, Soft to Medium Hard	SPT 1		4-4-5 (9)	1.25		
				SPT 2		65/2"			
5			Refusal at 5.0 feet. Bottom of borehole at 5.0 feet. (5.0 ft)						

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GEOTECHNICAL BORING LOG

BORING NUMBER 21

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/19/19 **COMPLETED** 2/19/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist — 0.5 ft SANDY FAT CLAY, Reddish Brown, Stiff, Moist (CH) — 2.0 ft	SPT 1		7-4-8 (12)	1.25
			SANDY SHALE, Highly Weathered, Reddish Brown to Brown, Soft to Medium Hard	SPT 2		10-20-30 (50)	4.5
5				SPT 3		19-43-50/5"	4.5
			- Soft Below 8'	SPT 4		13-23-37 (60)	4.5
10			Bottom of borehole at 10.0 feet. — 10.0 ft				

DRY UNIT WT (pcf) 20 40 60 80 100
N VALUE 20 40 60 80
PL MC LL 20 40 60 80
SHEAR STRENGTH (ksf) 1 2 3 4

ELEVATION (ft)

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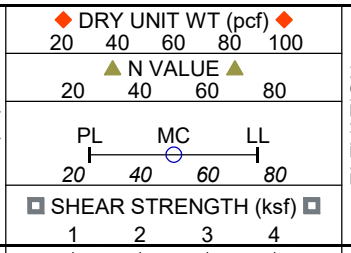
GEOTECHNICAL BORING LOG

BORING NUMBER 22

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/19/19 **COMPLETED** 2/19/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist — 1.0 ft					
			SANDY LEAN CLAY, Tan & Gray, Stiff, Moist (CL)	SPT 1		4-5-8 (13)		
				SPT 2		6-12-15 (27)	3.75	
5			— 6.0 ft					
			SHALE, Highly Weathered, Tan to Brown, Soft	SPT 3		30-42-27 (69)	1.75	
			— 9.0 ft	SPT 4		25-26-50/1"	4.5	
			SHALE, Brown & Gray, Soft to Medium Hard — 10.0 ft					
10			Bottom of borehole at 10.0 feet.					



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GEOTECHNICAL BORING LOG

BORING NUMBER 23

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/18/19 **COMPLETED** 2/18/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Medium Stiff, Moist 0.5 ft GRAVELLY FAT CLAY, w/ Sand, Gray and Brown, Medium Stiff, Moist (CH) 3.7 ft SANDY SHALE, Highly Weathered, Tan to Brown, Very Soft 5.2 ft 5 5.5 ft SHALE, Brownish Gray, Soft to Medium Hard	SPT 1 SPT 2		3-3-4 (7) 4-10-14 (24)	2 4.5	▲ ○ ○ ▲	

Refusal at 5.5 feet.
Bottom of borehole at 5.5 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 24

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/18/19 **COMPLETED** 2/18/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist 1.0 ft				
			LEAN CLAY, Gray & Tan, Very Stiff to Hard, Moist (CL)	SPT 1		3-7-10 (17)	
				SPT 2		6-13-20 (33)	2.75
5			6.0 ft				
			SANDY SHALE, Highly Weathered, Brown, Very Soft	SPT 3		7-11-10 (21)	4.5
			8.5 ft	SPT 4		8-50/5"	4
10			SANDY SHALE, Gray, Soft to Medium Hard *Increasing Sand With Depth*				
			13.8 ft	SPT 5		50/3"	

Refusal at 13.8 feet.
Bottom of borehole at 13.8 feet.

DRY UNIT WT (pcf) 20 40 60 80 100
N VALUE 20 40 60 80
PL MC LL 20 40 60 80
SHEAR STRENGTH (ksf) 1 2 3 4

ELEVATION (ft)

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GEOTECHNICAL BORING LOG

BORING NUMBER 25

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/18/19 **COMPLETED** 2/18/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Medium Stiff, Moist — 1.0 ft	SPT 1		1-3-3 (6)	0.75	
			SANDY LEAN CLAY, Red Tan, Medium Stiff, Moist (CL) — 3.0 ft					
			LEAN CLAY, Shaley, Tan, Very Stiff, Moist (CL)	SPT 2		10-8-13 (21)	4.5	
5			— 6.0 ft					
			SANDY SHALE, Highly Weathered, Tan to Brown, Soft	SPT 3		9-26-42 (68)	4.5	
			— 9.0 ft	SPT 4		21-65/5"	4.5	
10			SANDY SHALE, Gray, Soft to Medium Hard					
			— 12.5 ft					

DRY UNIT WT (pcf) ◆ 20 40 60 80 100
▲ N VALUE ▲ 20 40 60 80
PL MC LL 20 40 60 80
SHEAR STRENGTH (ksf) ■ 1 2 3 4

Refusal at 12.5 feet.
Bottom of borehole at 12.5 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 26

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Dark Brown, Medium Stiff, Moist (0.3 ft) LEAN CLAY, Shaley, Red Tan, Medium Stiff to Very Stiff, Moist (CL)	SPT 1		1-2-3 (5)	2.25		
			(5.0 ft)	SPT 2		3-6-11 (17)	4.5		
5			Bottom of borehole at 5.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 27

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Stiff, Moist	SPT 1		2-1-8 (9)			
1.5 ft			SANDY LEAN CLAY, Reddish Brown, Medium Stiff to Hard, Moist (CL)						
3.4 ft 3.5 ft			SANDSTONE, Fine Grained, Well Cemented, Brown, Medium Hard	SPT 2		8-50/0"			
			Refusal at 3.5 feet. Bottom of borehole at 3.5 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 28

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist — 0.3 ft LEAN CLAY, With Very Fine Sand, Brown Gray, Very Stiff to Hard, Moist (CL) — 2.0 ft SHALE, Highly Weathered, Tan to Brown, Soft to Medium Hard	SPT 1		13-34-48 (82)	3.25		
				SPT 2		50/1"			
5			Bottom of borehole at 5.0 feet. — 5.0 ft						

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GEOTECHNICAL BORING LOG

BORING NUMBER 29

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft to Hard, Moist — 0.3 ft / 0.7 ft	SPT 1		3-23-50/0"			
			CLAYEY SAND, w/ Gravel, Brown, Very Dense, Moist (SC) — 1.7 ft						
			SANDSTONE, Fine Grained, Poorly to Well Cemented, Brown, Soft to Medium Hard	SPT 2		50/0"			

Refusal at 1.7 feet.
Bottom of borehole at 1.7 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 30

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Hard, Moist — 0.3 ft BOULDER/COBBLES, Sandstone, Brown — 1.0 ft LEAN TO FAT CLAY, Shaley, w/ Sand, Reddish Brown, Hard, Moist to Slightly Moist (CL-CH)	SPT 1		30-23-13 (36)			
				SPT 2		10-8-14 (22)	4.5		
5			- Very Stiff Below 6'	SPT 3		17-21-22 (43)	4.5		
				SPT 4		10-16-27 (43)	4.5		
10			13.0 ft SANDY SHALE, Highly Weathered, Gray & Brown, Soft	SPT 5		23-38-44 (82)	4.5		
15				SPT 6		36-40-48 (88)	4.5		
			20.0 ft						
20			Bottom of borehole at 20.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 31

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		0.3 ft 0.7 ft TOPSOIL - SANDY LEAN CLAY, Dark Brown, Very Stiff, Moist BOULDER/COBBLES, Sandstone, Brown LEAN CLAY, w/ Sand, Shaley, Reddish Brown to Brown w/ Gray, Very Stiff, Slightly Moist (CL)	SPT 1		3-5-14 (19)			
				SPT 2		5-5-17 (22)	4.5		
5				SPT 3		5-5-22 (27)	4.5		
			8.0 ft SANDY SHALE, Highly Weathered, Gray & Brown, Soft	SPT 4		23-25-27 (52)	4.5		
10									
				SPT 5		40-49-60 (109)	4.5		
15			16.3 ft						

Refusal at 16.3 feet.
Bottom of borehole at 16.3 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 32

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft to Hard, Moist 0.4 ft	SPT 1		7-50/2"	2		
			SANDSTONE, Fine Grained, Poorly to Well Cemented, Tan, Soft to Medium Hard 1.2 ft	SPT 2		50/0"			
			Refusal at 1.2 feet. Bottom of borehole at 1.2 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 33

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Stiff to Hard, Moist — 0.3 ft SANDSTONE, Fine Grained, Weakly to Well Cemented, Tan, Soft to Medium Hard — 1.9 ft	SPT 1		7-40-50/0"	2.25		
			Refusal at 1.9 feet. Bottom of borehole at 1.9 feet.	SPT 2		50/0"			

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GEOTECHNICAL BORING LOG

BORING NUMBER 34

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Stiff, Moist (0.3 ft)	SPT 1		13-6-3 (9)	2.75		
			CLAYEY SAND, Trace Gravel, Tan & Brown, Loose to Medium Dense, Wet to Slightly Moist (SC)	SPT 2		3-5-8 (13)	4.5		
5			5.0 ft SANDY SHALE, Highly Weathered, Tan & Gray, Soft	SPT 3		12-23-25 (48)	4.5		
				SPT 4		15-24-30 (54)	4.5		
10				SPT 5		15-27-38 (65)	4.5		
15			18.0 ft SANDY SHALE, Gray, Soft to Medium Hard						
			19.0 ft	SPT 6		43-50/0"	4.5		

Refusal at 19.0 feet.
Bottom of borehole at 19.0 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 35

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Stiff, Moist — 0.3 ft	SPT 1		4-4-5 (9)	2.75		
			SANDY FAT CLAY, Reddish Tan, Stiff to Very Stiff, Moist (CH)						
			- Shaley Below 4'	SPT 2		8-9-13 (22)	4.25		
5			6.0 ft						
			SANDY SHALE, Highly Weathered, Brown to Brown & Gray, Soft to Medium Hard	SPT 3		20-33-52 (85)	4.5		
				SPT 4		40-65/4"	4.5		
10									
			14.8 ft	SPT 5		33-65-65/4"	4.5		

Refusal at 14.8 feet.
Bottom of borehole at 14.8 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 36

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		0.3 ft TOPSOIL - SANDY LEAN CLAY, Dark Brown, Medium Stiff, Moist SANDY FAT CLAY, Trace Gravel, Reddish Brown, Medium Stiff, Moist (CH) - Shaley & Stiff Below 3'	SPT 1		3-3-5 (8)	2		
				SPT 2		4-5-8 (13)	2.75		
5			6.5 ft SANDY SHALE, Highly Weathered, Tan to Gray, Soft	SPT 3		17-25-27 (52)	4.5		
				SPT 4		27-36-40 (76)	4.5		
10				SPT 5		17-49-52 (101)	4.5		
			15.0 ft						
15			Bottom of borehole at 15.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 37

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Stiff, Moist (0.3 ft) SANDY FAT CLAY, Trace Gravel, Reddish Brown, Stiff to Hard, Moist (CH) - Shaley Below 3'	SPT 1		5-5-5 (10)	2		
			(5.0 ft)	SPT 2		8-16-16 (32)	3.5		
5			SANDY SHALE, Highly Weathered, Brown, Soft	SPT 3		21-27-31 (58)	4.5		
				SPT 4		23-31-39 (70)	4.5		
10									
			(15.0 ft)	SPT 5		40-44-46 (90)	4.5		
15			Bottom of borehole at 15.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 38

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Medium Stiff, Moist — 0.7 ft SANDY LEAN CLAY, Shaley, Reddish Brown, Medium Stiff to Stiff, Moist (CL)	SPT 1		3-3-5 (8)			
				SPT 2		5-7-10 (17)	4.25		
5			5.5 ft SANDY SHALE, Highly Weathered, Brown, Soft	SPT 3		23-34-22 (56)	4.5		
				SPT 4		27-31-33 (64)	4.5		
10									
			15.0 ft	SPT 5		40-39-49 (88)	4.5		
15			Bottom of borehole at 15.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 39

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/28/19 **COMPLETED** 2/28/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		CLAYEY SAND, w/ Gravel, Brown, Medium Dense, Slightly Moist (SC) — 0.7 ft SANDSTONE, Fine Grained, Poorly to Well Cemented, Tan, Soft to Medium Hard	SPT 1		10-10-12 (22)			
			3.9 ft	SPT 2		65/2"			

Bottom of borehole at 3.9 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 40

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/28/19 **COMPLETED** 2/28/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		CLAYEY SAND, w/ Gravel, Dark Brown to Brown, Medium Dense, Moist (SC)	SPT 1		4-8-9 (17)			
			2.0 ft SANDY LEAN CLAY, Shaley, Reddish Brown to Brown, Very Stiff, Moist (CL)	SPT 2		10-9-9 (18)	4.5		
5			5.5 ft SANDY SHALE, Highly Weathered, Brown, Very Soft to Soft	SPT 3		10-14-13 (27)	4.5		
				SPT 4		13-16-23 (39)	4		
10			12.0 ft SANDY SHALE, Gray, Soft	SPT 5		49-52-53 (105)	4.5		
			15.0 ft						
15			Bottom of borehole at 15.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 41

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/28/19 **COMPLETED** 2/28/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 11 ft
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING 11 ft
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		CLAYEY SAND, w/ Gravel, Dark Brown to Brown, Loose, Moist (SC)	SPT 1		14-3-3 (6)			
			2.0 ft SANDY FAT CLAY, Shaley, Tan & Gray, Medium Stiff, Moist (CH)						
				SPT 2		3-3-5 (8)	2.75		
5			5.0 ft SANDY SHALE, Highly Weathered, Brown, Soft to Medium Hard						
				SPT 3		7-14-30 (44)	4.5		
				SPT 4		10-15-33 (48)	4.5		
10									
				SPT 5		50/0"	4.5		
			15.0 ft						
15			Refusal at 15.0 feet. Bottom of borehole at 15.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 42

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/21/19 **COMPLETED** 2/21/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 2 ft
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING 2 ft
NOTES

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist — 0.7 ft FAT CLAY, With Coarse Sand, Tan, Soft, Moist (CH)	SPT 1		1-1-3 (4)	0		
			3.0 ft SANDY SHALE, Highly Weathered, Brown, Soft	SPT 2		65/5"	4.5		
			4.5 ft						

Refusal at 4.5 feet.
Bottom of borehole at 4.5 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 43

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 3.5 ft
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING 3.5 ft
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, w/ Sand, Dark Brown, Soft, Moist 0.3 ft SANDY LEAN CLAY, Shaley, Trace Gravel, Reddish Brown, Soft, Moist (CL)	SPT 1		1-1-1 (2)	1.25		
			4.0 ft SANDSTONE, Fine Grained, Poorly to Well Cemented, Tan, Soft to Medium Hard 4.6 ft	SPT 2		1-43-50/1"	3		

Refusal at 4.6 feet.
Bottom of borehole at 4.6 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 44

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		GRAVELLY LEAN CLAY, Dark Brown, Very Stiff, Very Moist (CL)	SPT 1		17-10-7 (17)	1.75		
			0.3 ft SANDY FAT CLAY, Trace Gravel, Reddish Tan, Very Stiff, Moist (CH)						
			4.0 ft SANDY SHALE, Highly Weathered, Brown and Dark Brown, Soft	SPT 2		23-27-46 (73)	4.5		
5			6.0 ft SANDY SHALE, Brown to Gray, Soft to Medium Hard	SPT 3		65/4"	4.5		
			8.8 ft	SPT 4		65/3"	4.5		

Refusal at 8.8 feet.
Bottom of borehole at 8.8 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 45

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Medium Stiff, Moist 0.5 ft SANDY FAT CLAY, Reddish Brown, Medium Stiff, Moist (CH) 3.5 ft SANDY SHALE, Highly Weathered, Gray & Brown, Soft to Medium Hard	SPT 1		1-3-3 (6)	2.5		
				SPT 2		65/2"	3		
5				SPT 3		27-48-65/5"	4.5		
				SPT 4		40-56-65/4"	4.5		
			9.8 ft						

Refusal at 9.8 feet.
Bottom of borehole at 9.8 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 46

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft to Hard, Moist — 0.3 ft SANDY LEAN CLAY, Tan, Hard, Very Moist (CL) — 1.0 ft SANDY FAT CLAY, Shaley, Red & Gray, Hard, Moist (CH) — 3.0 ft SANDY SHALE, Highly Weathered, Gray to Black, Soft - Coaly Below 4.5' — 5.0 ft	SPT 1		4-10-22 (32)	1		
				SPT 2		27-33-43 (76)	4.5		
5			Bottom of borehole at 5.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 47

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/26/19 **COMPLETED** 2/26/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Medium Stiff, Moist — 0.7 ft CLAYEY SAND, Reddish Tan, Loose, Very Moist (SC) — 2.0 ft SANDY LEAN CLAY, Reddish Brown & Gray, Very Hard, Slightly Moist (CL)	SPT 1		4-3-4 (7)	0.5		
				SPT 2		16-20-21 (41)	1.75		
5			Bottom of borehole at 5.0 feet. — 5.0 ft						

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GEOTECHNICAL BORING LOG

BORING NUMBER 48

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/21/19 **COMPLETED** 2/21/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist 0.3 ft SANDY SILTY LEAN CLAY, Brown, Medium Stiff, Moist (CL-ML) 3.0 ft SANDY SHALE, Slightly Weathered, Brown to Dark Brown, Soft to Medium Hard 5.0 ft	SPT 1		3-4-4 (8)	1		
				SPT 2		65/5"	4.5		
5			Bottom of borehole at 5.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 49

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/21/19 **COMPLETED** 2/21/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist 0.5 ft SANDY LEAN CLAY, w/ Gravel, Brown, Medium Stiff to Stiff, Wet (CL)	SPT 1		3-3-3 (6)	1.25		
			3.8 ft SANDY SHALE, Highly Weathered, Brown, Soft 5.0 ft	SPT 2		14-17-40 (57)	4.5		
5			Bottom of borehole at 5.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 50

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/26/19 **COMPLETED** 2/26/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Very Soft, Moist — 0.5 ft SANDY FAT CLAY, Reddish Brown, Very Soft to Very Stiff, Moist (CH)	SPT 1		0-0-0 (0)		▲	
				ST 2	100		2.75	○	
			4.2 ft SANDY SHALE, Highly Weathered, Gray & Brown, Soft — 5.2 ft	SPT 3		12-12-18-19 (30)	4.5	○ ▲	
5			Bottom of borehole at 5.2 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 51

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/26/19 **COMPLETED** 2/26/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Stiff, Moist — 0.7 ft	SPT 1		3-4-5 (9)	3.75		
			SANDY FAT CLAY, Shaley, Gray & Tan, Stiff, Moist (CH) — 2.0 ft						
			CLAYEY SAND, Trace Gravel, Reddish Brown, Medium Dense to Dense, Slightly Moist (SC)	ST 2	100		3.5		
			— 4.2 ft	SPT 3		11-12-14 (26)	4.5		
5			SANDSTONE, Fine Grained, Poorly to Well Cemented, Brown, Soft to Medium Hard						
			— 6.5 ft	SPT 4		50-50/0"	4.5		

Refusal at 6.5 feet.
Bottom of borehole at 6.5 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 52

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/21/19 **COMPLETED** 2/21/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist — 0.3 ft						
			CLAYEY SAND, Red Brown & Tan, Dense, Slightly Moist (SC)	SPT 1		7-12-22 (34)	4.5		
			3.0 ft SANDY SHALE, Highly Weathered, Gray Brown, Soft *Sandstone Lenses*						
			4.2 ft 4.4 ft SHALE, Gray, Soft to Medium Hard	SPT 2		25-50/5"	4.5		

Refusal at 4.4 feet.
Bottom of borehole at 4.4 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 53

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/21/19 **COMPLETED** 2/21/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist 0.3 ft SANDSTONE, Fine Grained, Poorly to Well Cemented, Tan, Soft to Medium Hard	SPT 1		50/3"			
			2.6 ft Refusal at 2.6 feet. Bottom of borehole at 2.6 feet.	SPT 2		50/1"			

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GEOTECHNICAL BORING LOG

BORING NUMBER 54

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES Offset 20' SW Due to Steep Grade

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Soft, Wet 0.4 ft SANDSTONE, Fine Grained, Well Cemented, Tan, Medium Hard 0.5 ft Refusal at 0.5 feet. Bottom of borehole at 0.5 feet.	SPT 1		2-50/0"	0		

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GEOTECHNICAL BORING LOG

BORING NUMBER 55

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/26/19 **COMPLETED** 2/26/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Soft, Wet — 0.3 ft SANDY FAT CLAY, Shaley, Red, Soft to Very Stiff, Very Moist (CH)	SPT 1		1-1-2 (3)	2		
			— 3.1 ft SANDY SHALE, Highly Weathered, Dark Brown w/ Brown, Soft	SPT 2		3-4-15 (19)	4.5		
			— 5.0 ft	SPT 3		5-21-22 (43)	4.5		
5			Bottom of borehole at 5.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 56

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/26/19 **COMPLETED** 2/26/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Stiff, Moist	0.3 ft	SPT 1		3-5-7 (12)	3.25		
			LEAN CLAY, Tan, Stiff, Moist (CL)	1.0 ft						
			SANDSTONE BOULDER, Tan, Highly Weathered, Soft	1.5 ft						
			FAT CLAY, Shaley, Tan, Stiff, Moist (CH)	3.1 ft						
			SANDSTONE, Fine Grained, Poorly to Well Cemented, Tan, Soft to Medium Hard	3.5 ft	SPT 2		50/0"			

Refusal at 3.5 feet.
Bottom of borehole at 3.5 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 57

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/21/19 **COMPLETED** 2/21/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Medium Stiff, Moist 0.5 ft SANDY FAT CLAY, Tan, Medium Stiff, Moist (CH)	SPT 1		3-1-4 (5)	0.25		
			- Shaley Below 3'						
			4.5 ft SHALE, Highly Weathered, Tan to Brown, Soft 5.0 ft	SPT 2		5-9-16 (25)	3.25		
5			Bottom of borehole at 5.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 58

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/21/19 **COMPLETED** 2/21/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Very Stiff, Moist — 0.5 ft CLAYEY SAND, Trace Gravel, Brown & Dark Brown, Medium Dense, Slightly Moist (SC) — 2.0 ft SANDY SHALE, Highly Weathered, Gray w/ Reddish Brown, Soft	SPT 1		7-7-9 (16)			
				SPT 2		10-16-20 (36)	4.5		
5			Bottom of borehole at 5.0 feet. — 5.0 ft						

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GEOTECHNICAL BORING LOG

BORING NUMBER 59

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Medium Stiff, Moist 0.5 ft	SPT 1		3-3-4 (7)	1		
			SANDY FAT CLAY, Tan to Reddish Brown w/ Gray, Medium Stiff to Very Hard, Moist (CH)						
			4.0 ft 3.8 ft	SPT 2		14-17-65 (82)	3.25		
5			SANDSTONE, Fine Grained, Well Cemented, Reddish Tan, Medium Hard Bottom of borehole at 5.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 60

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/26/19 **COMPLETED** 2/26/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Medium Stiff, Moist	SPT 1		1-2-3 (5)	1.25		
			0.5 ft SANDY FAT CLAY, Shaley, Brown, Medium Stiff to Stiff, Moist (CH)	SPT 2		3-6-8 (14)	3.5		
			4.0 ft SANDY SHALE, Highly Weathered, Brown, Soft						
5			6.0 ft SANDY SHALE, Dark Brown, Soft to Medium Hard	SPT 3		10-30-40 (70)	4.5		
				SPT 4		7-50/5"	4.5		
				SPT 5		50/3"			
10			11.3 ft Refusal at 11.3 feet. Bottom of borehole at 11.3 feet.	SPT 6		50/0"			

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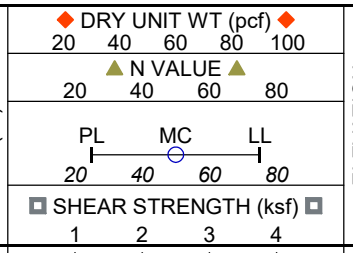
GEOTECHNICAL BORING LOG

BORING NUMBER 61

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/28/19 **COMPLETED** 2/28/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES Offset 20' SW Due to Steep Grade

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist — 0.7 ft	SPT 1		2-1-3 (4)	1.25
			SANDY LEAN CLAY, Red Tan, Very Loose, Slightly Moist (CL) — 3.0 ft				
			SANDY SHALE, w/ Sandstone Lenses, Highly Weathered, Brown, Medium Hard to Soft	SPT 2		50/5"	
5				SPT 3		10-25-46 (71)	2.25
			9.0 ft				
			COALY SHALE, Moderately Weathered, Black & Dark Gray, Soft	SPT 4		6-25-33 (58)	3.5
10			12.5 ft				
			SHALE, Black & Dark Gray, Soft to Medium Hard — 13.8 ft				
			14.0 ft	SPT 5		50/4"	4.5
			SANDSTONE, Gray, Medium Hard	SPT 6		50/0"	

Refusal at 14.0 feet.
Bottom of borehole at 14.0 feet.



ELEVATION (ft)

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GEOTECHNICAL BORING LOG

BORING NUMBER 62

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Stiff, Moist 0.3 ft CLAYEY SAND, w/ Gravel, Red Tan, Medium Dense, Wet (SC)	SPT 1		3-3-8 (11)			
			3.0 ft 3.1 ft SANDSTONE, Fine Grained, Well Cemented, Tan, Medium Hard	SPT 2		50/0"			
			Refusal at 3.1 feet. Bottom of borehole at 3.1 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 63

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/26/19 **COMPLETED** 2/26/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Very Soft, Moist (0.3 ft) SANDY LEAN CLAY, Reddish Brown, Very Soft to Very Stiff, Very Moist to Moist (CL)	SPT 1		0-0-0 (0)	0.25		
				SPT 2		8-7-12 (19)	0		
5			Bottom of borehole at 5.0 feet. (5.0 ft)						

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GEOTECHNICAL BORING LOG

BORING NUMBER 64

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/26/19 **COMPLETED** 2/26/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Hard, Moist 0.5 ft SANDSTONE, Weakly Cemented, Highly Weathered, Tan, Soft 3.0 ft SANDY SHALE, w/ Sandstone Lenses, Highly Weathered, Tan & Gray, Soft 5.0 ft	SPT 1		7-17-27 (44)			
				SPT 2		30-40-44 (84)	4.5		
5			Bottom of borehole at 5.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 65

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/26/19 **COMPLETED** 2/26/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Stiff, Moist 0.5 ft CLAYEY SAND, Trace Gravel, Red Tan, Medium Dense, Moist (SC) 2.5 ft SANDY SHALE, Highly Weathered, Tan & Gray, Soft	SPT 1		7-7-7 (14)	1.75		
				SPT 2		17-39-49 (88)	3.75		
5			Bottom of borehole at 5.0 feet. 5.0 ft						

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GEOTECHNICAL BORING LOG

BORING NUMBER 66

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/26/19 **COMPLETED** 2/26/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist 0.3 ft SANDY LEAN CLAY, Reddish Brown, Soft, Moist (CL)	SPT 1		1-1-1 (2)	2.75		
			3.8 ft SANDY SHALE, w/ Sandstone Lenses, Highly Weathered, Reddish Tan, Soft to Medium Hard 4.7 ft 4.8 ft	SPT 2		17-13-65/1"	2.25		
			SANDSTONE, Fine Grained, Poorly to Well Cemented, Tan, Soft to Medium Hard Refusal at 4.8 feet. Bottom of borehole at 4.8 feet.	SPT 3		65/2"			

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GEOTECHNICAL BORING LOG

BORING NUMBER 67

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/26/19 **COMPLETED** 2/26/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist 0.3 ft LEAN CLAY, w/ Sand, Reddish Brown, Soft, Moist (CL) 3.5 ft SANDSTONE, w/ Clay Lenses, Fine Grained, Poorly to Well Cemented, Tan, Soft to Medium Hard 4.5 ft	SPT 1 SPT 2		1-1-1 (2) 30-65/5"	1.5		

Refusal at 4.5 feet.
Bottom of borehole at 4.5 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 68

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/26/19 **COMPLETED** 2/26/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Soft, Moist — 0.3 ft SANDY LEAN CLAY, Reddish Brown, Soft, Moist (CL)	SPT 1		1-3-1 (4)	0.25		
			3.3 ft SANDSTONE, Fine Grained, Poorly to Well Cemented, Brown, Soft to Medium Hard — 4.3 ft	SPT 2		40-65/3"			

Refusal at 4.3 feet.
Bottom of borehole at 4.3 feet.

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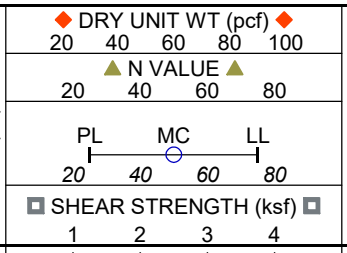
GEOTECHNICAL BORING LOG

BORING NUMBER 69

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist (0.2 ft)				
			SANDY LEAN CLAY, Tan, Stiff, Very Moist (CL)	SPT 1		3-3-7 (10)	1
			3.0 ft				
			CLAYEY SAND, Reddish Brown, Dense, Moist (SC) *Increasing Shale Lenses With Depth*	SPT 2		8-12-13 (25)	4.25
			5.0 ft				
5			SANDY SHALE, Highly Weathered, Tan to Brown, Soft to Medium Hard	SPT 3		20-43-50/5"	4.5
				SPT 4		23-14-18 (32)	4.5
10			12.0 ft				
			COAL, Black, Soft				
			14.0 ft				
			SHALE, Gray, Soft	SPT 5		8-16-22 (38)	4.5
			15.0 ft				
15			Bottom of borehole at 15.0 feet.				



ELEVATION (ft)

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GEOTECHNICAL BORING LOG

BORING NUMBER 70

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist (0.3 ft)				
			CLAYEY SAND, Trace Gravel, Reddish Tan, Very Dense to Medium Dense, Moist to Slightly Moist (SC) *Increasing Shale Seams and Sandstone w/ Depth*	SPT 1		8-50/4"	3.75
				SPT 2		33-11-11 (22)	
			(5.0 ft)				
5			SANDY SHALE, Highly Weathered, Reddish Tan to Dark Gray w/ Brown, Soft	SPT 3		18-21-30 (51)	4.5
				SPT 4		11-18-22 (40)	4.5
10							
			(15.0 ft)	SPT 5		8-11-25 (36)	4.5
15			Bottom of borehole at 15.0 feet.				

DRY UNIT WT (pcf) 20 40 60 80 100
N VALUE 20 40 60 80
PL MC LL 20 40 60 80
SHEAR STRENGTH (ksf) 1 2 3 4

ELEVATION (ft)

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GEOTECHNICAL BORING LOG

BORING NUMBER 71

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/28/19 **COMPLETED** 2/28/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 11 ft
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING 11 ft
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Very Stiff, Moist (0.2 ft)	SPT 1		4-6-10 (16)	3
			CLAYEY SAND, w/ Gravel, Reddish Brown, Medium Dense, Slightly Moist (SC)				
			(3.0 ft) FAT CLAY, Trace Sand, Shaley, Reddish Brown, Very Stiff to Stiff, Slightly Moist (CH)	SPT 2		3-8-12 (20)	4.5
5			(7.0 ft) SANDY SHALE, Highly Weathered, Brown to Dark Brown, Very Soft to Soft	SPT 3		5-5-10 (15)	4.5
				SPT 4		5-12-18 (30)	4.5
10			- Dark Brown & Wet Below 12.5'				
			(15.0 ft)	SPT 5		3-30-20-20 (50)	2.75
15			Bottom of borehole at 15.0 feet.				

DRY UNIT WT (pcf) 20 40 60 80 100
N VALUE 20 40 60 80
PL MC LL 20 40 60 80
SHEAR STRENGTH (ksf) 1 2 3 4

ELEVATION (ft)

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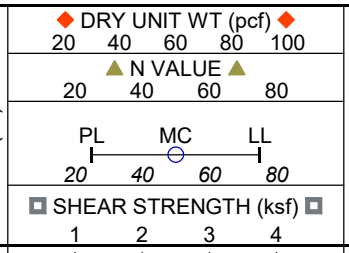
GEOTECHNICAL BORING LOG

BORING NUMBER 72

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/28/19 **COMPLETED** 2/28/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES Offset 35' SE Due to Steep Grade

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Stiff, Moist — 0.7 ft	SPT 1		3-5-7 (12)	1.25
			SANDY FAT CLAY, Trace Gravel, Tan, Stiff, Moist (CH) — 3.0 ft				
			FAT CLAY, w/ Gravel, Shaley, Reddish Brown, Very Stiff, Moist (CH)	SPT 2		8-7-10 (17)	3
5			— 5.5 ft				
			SANDY SHALE, Highly Weathered, Brown w/ Dark Brown, Soft	SPT 3		8-16-18 (34)	4.25
				SPT 4		9-23-34 (57)	4.5
10							
			— 15.0 ft	SPT 5		27-34-46 (80)	4.5
15			Bottom of borehole at 15.0 feet.				



ELEVATION (ft)

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GEOTECHNICAL BORING LOG

BORING NUMBER 73.1

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/28/19 **COMPLETED** 2/28/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES Offset 40' SW Due to Steep Grade, Augers Kicked Off at 12' and Boring was terminated and Offset an additional 2 feet

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, w/ Sand, Dark Brown, Very Stiff, Moist — 0.3 ft SANDY LEAN CLAY, w Gravel, Dark Brown, Very Soft to Very Hard, Moist (CL) — 1.0 ft Refusal at 1.0 feet. Bottom of borehole at 1.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 73.2

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/28/19 **COMPLETED** 2/28/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 6 ft
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING 6 ft
NOTES Offset 42' SW Due to Steep Grade

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, w/ Sand, Dark Brown, Very Stiff, Moist (0.3 ft)	SPT 1		0-0-0 (0)	1.5
			SANDY LEAN CLAY, w Gravel, Dark Brown, Very Soft to Very Hard, Moist (CL)				
			(4.5 ft)	SPT 2		12-3/5"	3.25
5			SANDSTONE BOULDER, Fine Grained, Poorly Cemented, Highly Weathered, Brown, Soft (5.5 ft)				
			CLAYEY SAND, w/ Gravel, Brown, Medium Dense, Moist (SC)				
			(7.3 ft)	SPT 3		4-8-15 (23)	2
			SANDSTONE BOULDER, Fine Grained, Weakly Cemented, Highly Weathered, Brown, Soft (7.8 ft)				
			(8.5 ft)				
			SANDY LEAN CLAY, Red Tan, Very Hard, Wet (CL) (9.0 ft)	SPT 4		50/5"	
10			SANDSTONE BOULDER, Fine Grained, Weakly Cemented, Highly Weathered, Brown, Soft				
			SANDY SHALE, Highly Weathered, Brown, Soft				
			(15.0 ft)	SPT 5		6-12-12 (24)	2.5
15			Bottom of borehole at 15.0 feet.				

DRY UNIT WT (pcf) 20 40 60 80 100
N VALUE 20 40 60 80
PL MC LL 20 40 60 80
SHEAR STRENGTH (ksf) 1 2 3 4

ELEVATION (ft)

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GEOTECHNICAL BORING LOG

BORING NUMBER 74

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 3/1/19 **COMPLETED** 3/1/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 2 ft
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING 1.17 ft
NOTES

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	HAND SAMPLE		GRAVELLY LEAN CLAY, w/ sand, Dark Brown, Medium Stiff, Moist (CL) 0.3 ft CLAYEY SAND, w/ gravel and cobbles, Tan, Dense, Moist (SC) 2.2 ft	GB 1 GB 2					

Refusal at 2.2 feet.
Bottom of borehole at 2.2 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 75

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/28/19 **COMPLETED** 2/28/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 6.5 ft
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING 6.5 ft
NOTES

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Medium Stiff, Moist	SPT 1		1-3-3 (6)	0.5		
			0.5 ft LEAN CLAY, w/ Sand, Tan Brown, Medium Stiff to Soft, Moist (CL)	SPT 2		1-1-3 (4)	1		
5			6.0 ft SANDY LEAN CLAY, Trace Gravel, Light Gray & Tan, Very Hard, Very Moist (CL)	SPT 3		27-23-39 (62)	0		
			9.0 ft SANDSTONE, Fine Grained, Poorly to Well Cemented, Tan, Soft to Medium Hard 9.9 ft	SPT 4		40-52-65/2"	3.5		

Refusal at 9.9 feet.
Bottom of borehole at 9.9 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 78

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 3/1/19 **COMPLETED** 3/1/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE _____
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	HAND SAMPLE		TOPSOIL - LEAN CLAY, w/ Boulders, Gravel, & Sand, Dark Brown, Soft, Moist	GB 1					
1.4 ft 1.5 ft			SANDSTONE, Fine Grained, Well Cemented, Brown, Medium Hard Refusal at 1.5 feet. Bottom of borehole at 1.5 feet.	GB 2					

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GEOTECHNICAL BORING LOG

BORING NUMBER 79

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/28/19 **COMPLETED** 2/28/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, w/ Sand, Dark Brown, Very Stiff, Moist — 0.5 ft	SPT 1		3-6-12 (18)	0.75		
			CLAYEY SAND, w/ Gravel, Tan, Medium Dense, Moist (SC) — 1.5 ft						
			SANDSTONE, Fine Grained, Poorly to Well Cemented, Brown, Soft to Medium Hard — 2.3 ft	SPT 2		50/0"			
			Refusal at 2.3 feet. Bottom of borehole at 2.3 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 80

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 3/1/19 **COMPLETED** 3/1/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE _____
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	HAND SAMPLE		TOPSOIL - LEAN CLAY, w/ Sand and Gravel, Dark Brown, Soft, Moist 0.3 ft SANDY LEAN CLAY, w/ Gravel, Brown, Medium Stiff, Slightly Moist (CL) 2.1 ft SANDSTONE, Fine Grained, Poorly Cemented, Brown to Light Gray, Soft 2.2 ft Refusal at 2.2 feet. Bottom of borehole at 2.2 feet.	GB 1 GB 2 GB 3					

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GEOTECHNICAL BORING LOG

BORING NUMBER 81

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/25/19 **COMPLETED** 2/25/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	4.5" O.D. CFA		TOPSOIL - LEAN CLAY, w/ Sand, Dark Brown, Stiff to Hard, Moist	0.3 ft	SPT 1		10-50/5"			
			CLAYEY SAND, w/ Gravel, Tan, Very Dense, Slightly Moist (SC)	0.9 ft						
			SANDSTONE, Fine Grained, Poorly to Well Cemented, Brown, Soft to Medium Hard	1.6 ft	SPT 2		50/0"			

Refusal at 1.6 feet.
Bottom of borehole at 1.6 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 82

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/25/19 **COMPLETED** 2/25/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Stiff to Hard, Moist 0.3 ft SANDSTONE, Fine Grained, Poorly to Well Cemented, Tan, Soft to Medium Hard 1.7 ft Refusal at 1.7 feet. Bottom of borehole at 1.7 feet.	SPT 1 SPT 2		11-24-50/2" 50/0"			

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GEOTECHNICAL BORING LOG

BORING NUMBER 83

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/25/19 **COMPLETED** 2/25/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, w/ Sand, Dark Brown, Stiff, Moist — 0.5 ft CLAYEY SAND, w/ Gravel, Red Tan, Medium Dense, Slightly Moist (SC)	SPT 1		3-6-8 (14)			
			4.1 ft SANDY SHALE, Highly Weathered, Red Tan & Gray, Soft to Medium Hard — 5.3 ft	SPT 2		6-9-20 (29)	2.75		
5			Refusal at 5.3 feet. Bottom of borehole at 5.3 feet.	SPT 3		50/0"			

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GEOTECHNICAL BORING LOG

BORING NUMBER 84

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/25/19 **COMPLETED** 2/25/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Stiff to Hard, Moist 0.2 ft	SPT 1		4-10-50/1"	1.5		
			CLAYEY SAND, w/ Gravel, Brown, Very Dense, Moist (SC) 1.1 ft						
			SANDSTONE, Fine Grained, Well Cemented, Reddish Tan, Medium Hard 1.4 ft	SPT 2		50/0"			
			Refusal at 1.4 feet. Bottom of borehole at 1.4 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 85

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/21/19 **COMPLETED** 2/21/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, w/ Boulders & Gravel & Sand, Dark Brown, Soft, Moist — 0.3 ft					
			SANDY LEAN CLAY, w/ Gravel, Red Tan, Medium Stiff to Stiff, Moist (CL)	SPT 1		0-4-4 (8)	2.25	
				SPT 2		3-4-6 (10)	1.25	
			5.0 ft					
5			SANDY SHALE, Highly Weathered, Reddish Tan, Soft					
			7.0 ft	SPT 3		40-45-48 (93)	3.25	
			SANDSTONE, Fine Grained, Poorly to Well Cemented, Brown, Soft to Medium Hard	SPT 4		50/2"		
			9.4 ft					
			Refusal at 9.4 feet. Bottom of borehole at 9.4 feet.	SPT 5		50/0"		

DRY UNIT WT (pcf) 20 40 60 80 100
N VALUE 20 40 60 80
PL MC LL 20 40 60 80
SHEAR STRENGTH (ksf) 1 2 3 4

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GEOTECHNICAL BORING LOG

BORING NUMBER 86

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/26/19 **COMPLETED** 2/26/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 6 ft
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, w/ Sand & Gravel, Brown, Medium Stiff, Moist (0.3 ft) SANDSTONE, Weakly Cemented, Highly Weathered, Fine Grained, Red & Tan, Very Soft (3.3 ft)	SPT 1		4-4-3 (7)			
5			SANDY SHALE, w/ Sandstone Lenses, Highly Weathered, Gray & Brown, Soft to Hard	SPT 2		10-10-13 (23)	4.5		
			▽	SPT 3		17-39-65/2"	4.5		
10	CORE BARREL - NQ		SHALE, Light Gray to Gray w/ Very Thin Dark Gray Bands, Very Thin Bedding, Medium Hard to Moderately Hard (8.4 ft)	NQ 1	89 (70)				
15				NQ 2	97 (87)				
20				NQ 3	100 (85)				

(Continued Next Page)

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GEOTECHNICAL BORING LOG

BORING NUMBER 86

CLIENT Cherokee Nation Entertainment **PROJECT NAME** National Cherokee Nation Park

PROJECT NO. 256748 Rev. 1 **PROJECT LOCATION** Sallisaw, OK

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
25	CORE BARREL - NQ		SHALE, Light Gray to Gray w/ Very Thin Dark Gray Bands, Very Thin Bedding, Medium Hard to Moderately Hard *(continued)*	NQ 4	100 (58)				
			- Very Dark Gray to Black & Soft Below 27'4"	NQ 5	100 (0)				
			28.4 ft						

Refusal at 28.4 feet.
Bottom of borehole at 28.4 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 87

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/21/19 **COMPLETED** 2/21/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist — 0.5 ft						
			CLAYEY SAND, Reddish Brown, Very Dense, Slightly Moist (SC) — 1.5 ft	SPT 1		10-50/4"	4.25		
			SANDSTONE, Fine Grained, Poorly to Well Cemented, Reddish Brown to Tan, Soft to Medium Hard — 2.1 ft	SPT 2		50/1"			

Refusal at 2.0 feet.
Bottom of borehole at 2.1 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 88

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/21/19 **COMPLETED** 2/21/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist — 0.3 ft SANDY LEAN CLAY, Brown, Soft to Hard, Slighlty Moist (CL) — 2.0 ft SANDSTONE, Fine Grained, Poorly to Well Cemented, Reddish Tan to Light Tan, Soft to Medium Hard — 3.6 ft	SPT 1		0-7-50/3"	1.75		
				SPT 2		50/1"			

Refusal at 3.6 feet.
Bottom of borehole at 3.6 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 89

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/21/19 **COMPLETED** 2/21/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 13 ft
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING 13 ft
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist — 0.3 ft					
			SANDY LEAN CLAY, Trace Gravel, Red Brown, Very Stiff, Slightly Moist (CL) - Trace Coal From 1.75' to 3' — 2.0 ft	SPT 1		2-11-11 (22)	3.25	
			SANDY SHALE, Highly Weathered, Brown, Soft	ST 2	75		3	7.77
5				SPT 3		10-25-39 (64)	4.5	
				SPT 4		20-33-45 (78)	4.5	
10			13.0 ft — SANDY SHALE, Gray, Soft to Medium Hard — 13.8 ft	SPT 5		50/3"	4.5	

Refusal at 13.8 feet.
Bottom of borehole at 13.8 feet.

DRY UNIT WT (pcf) 20 40 60 80 100
N VALUE 20 40 60 80
PL MC LL 20 40 60 80
SHEAR STRENGTH (ksf) 1 2 3 4

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GEOTECHNICAL BORING LOG

BORING NUMBER 90

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/21/19 **COMPLETED** 2/21/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 3 ft
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING 4 ft
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist 0.3 ft SANDY LEAN CLAY, Brown, Soft to Stiff, Wet (CL)	SPT 1		0-0-4 (4)	1.25		
			▽ - Very Moist & Shaley Below 3.5'	SPT 2		5-6-9 (15)	1		
5			Bottom of borehole at 5.0 feet. 5.0 ft						

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GEOTECHNICAL BORING LOG

BORING NUMBER 91

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/21/19 **COMPLETED** 2/21/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist (0.3 ft) SANDY LEAN CLAY, Trace Gravel, Tan, Stiff to Hard, Moist (CL) (1.8 ft) SANDSTONE, Fine Grained, Poorly to Well Cemented, Reddish Tan, Soft to Medium Hard	SPT 1		20-50/3"	1.25		
			(3.5 ft)	SPT 2		50/2"			

Refusal at 3.5 feet.
Bottom of borehole at 3.5 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 92

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/26/19 **COMPLETED** 2/26/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		CLAYEY SAND, w/ Gravel, Dark Brown & Red, Very Dense, Moist (SC) 0.7 ft SANDSTONE, Fine Grained, Poorly to Well Cemented, Tan, Soft to Medium Hard	SPT 1		7-39-65/2"	1.75		
			4.2 ft	SPT 2		65/2"			

Refusal at 4.2 feet.
Bottom of borehole at 4.2 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 93

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Stiff, Moist 0.5 ft SANDY FAT CLAY, Tan & Red, Stiff, Moist (CH) 3.0 ft SANDY SHALE, Highly Weathered, Brown & Dark Brown, Very Soft 5.0 ft	SPT 1		3-3-7 (10)	1.25	▲ ○	
				SPT 2		13-9-17 (26)	3.25	▲ ●	
5			Bottom of borehole at 5.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 94

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Very Stiff, Moist — 0.2 ft CLAYEY SAND, Trace Gravel, Brown, Medium Dense, Moist (SC) 3.0 ft SANDY SHALE, Highly Weathered, Brown, Soft to Medium Hard 4.5 ft	SPT 1 SPT 2		3-7-11 (18) 10-35-50/0"	4.5		

Refusal at 4.5 feet.
Bottom of borehole at 4.5 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 95

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/18/19 **COMPLETED** 2/18/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist (0.5 ft) CLAYEY SAND, Trace Roots, Dark Brown, Very Loose to Loose, Wet (SC) - Trace Gravel Below 3'	SPT 1		1-1-3 (4)	0.75		
				SPT 2		3-3-4 (7)			
5			Bottom of borehole at 5.0 feet. (5.0 ft)						

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GEOTECHNICAL BORING LOG

BORING NUMBER 96

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/18/19 **COMPLETED** 2/18/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 2.67 ft
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING 2.17 ft
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist 0.5 ft LEAN CLAY, w/ Sand, Brown & Red, Very Soft to Stiff, Moist (CL) 3.0 ft SANDY LEAN CLAY, Shaley, Brown & Tan, Very Stiff, Wet to Moist (CLS)	SPT 1		0-0-11 (11)			
				SPT 2		10-12-12 (24)	1.75		
5			Bottom of borehole at 5.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 97

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES Offset 10' NW

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist (0.3 ft) CLAYEY SAND, Brown, Medium Dense, Slightly Moist (SC)	SPT 1		3-5-8 (13)			
			- Shaley Seams Below 3'	SPT 2		11-19-33 (52)	4.5		
5			Bottom of borehole at 5.0 feet. (5.0 ft)						

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GEOTECHNICAL BORING LOG

BORING NUMBER 98

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/27/19 **COMPLETED** 2/27/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Stiff, Moist (0.1 ft) SANDY FAT CLAY, Red Tan, Stiff, Moist (CH)	SPT 1		2-1-8 (9)	1.5		
			- Shaley, w/ Gravel Below 3'	SPT 2		3-3-6 (9)	3.25		
5			Bottom of borehole at 5.0 feet. (5.0 ft)						

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GEOTECHNICAL BORING LOG

BORING NUMBER 99

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist — 0.3 ft POORLY-GRADED SAND, w/ Gravel, Tan, Dense to Very Dense, Slightly Moist (SP) — 1.5 ft SANDSTONE, Fine Grained, Poorly to Well Cemented, Tan, Soft to Medium Hard	SPT 1		20-50/5"			
				SPT 2		50/3"			
5			Bottom of borehole at 5.0 feet. — 5.0 ft						

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GEOTECHNICAL BORING LOG

BORING NUMBER 100

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/28/19 **COMPLETED** 2/28/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		CLAYEY SAND, w/ Gravel, Dark Brown, Loose, Moist (SC) 0.5 ft SANDY FAT CLAY, w/ Gravel, Tan & Brown, Medium Stiff to Very Stiff, Moist (CH)	SPT 1		1-3-3 (6)			
				SPT 2		8-10-10 (20)	1.5		
5			Bottom of borehole at 5.0 feet. 5.0 ft						

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GEOTECHNICAL BORING LOG

BORING NUMBER 101

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/28/19 **COMPLETED** 2/28/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Brown, Very Hard, Moist (0.3 ft) SANDSTONE, Fine Grained, Poorly to Well Cemented, Tan, Soft to Medium Hard	SPT 1		16-23-65/2"			
			Refusal at 3.5 feet. (3.5 ft) Bottom of borehole at 3.5 feet.	SPT 2		65/0"			

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GEOTECHNICAL BORING LOG

BORING NUMBER 102

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/28/19 **COMPLETED** 2/28/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME 55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - SANDY LEAN CLAY, Dark Brown, Very Hard, Moist 0.9 ft SANDSTONE, Fine Grained, Poorly to Well Cemented, Tan, Soft to Medium Hard 1.4 ft Refusal at 1.4 feet. Bottom of borehole at 1.4 feet.	SPT 1		5-10-65/3"	1.25		

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GEOTECHNICAL BORING LOG

BORING NUMBER 103

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/28/19 **COMPLETED** 2/28/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER RD **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JG **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - CLAYEY GRAVEL, Dark Brown, Very Loose, Moist (0.2 ft) SANDY FAT CLAY, Red, Soft, Moist (CH)	SPT 1		9-2-2 (4)	1.75		
			SANDSTONE, Fine Grained, Poorly to Well Cemented, Tan, Soft to Medium Hard (3.5 ft – 4.5 ft)	SPT 2		15-50	4.5		
			Refusal at 4.5 feet. Bottom of borehole at 4.5 feet.	SPT 3		50/0"	1.75		

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GEOTECHNICAL BORING LOG

BORING NUMBER 104.1

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist 0.3 ft CLAYEY SAND, Reddish Brown, Very Dense, Slightly Moist (SC) 1.3 ft SANDSTONE/SANDY SHALE, Highly Weathered, Tan to Brown, Medium Hard 2.3 ft	SPT 1		50/4"	1.75		

Refusal at 2.3 feet.
Bottom of borehole at 2.3 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 104.2

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES Offset 5' NE Due to Auger Refusal

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist — 0.3 ft CLAYEY SAND, Reddish Brown, Very Dense, Slightly Moist (SC) — 1.3 ft SANDSTONE, Fine Grained, Poorly to Well Cemented, Tan to Brown, Soft to Medium Hard — 2.0 ft Refusal at 2.0 feet. Bottom of borehole at 2.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 105

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist (0.5 ft) CLAYEY SAND, w/ Sandy Shale Seams, Trace Gravel, Brown, Dense to Medium Dense, Moist to Dry (SC)	SPT 1		5-14-34 (48)	4.5		
				SPT 2		12-9-11 (20)	2.75		
5			Bottom of borehole at 5.0 feet. (5.0 ft)						

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GEOTECHNICAL BORING LOG

BORING NUMBER 106

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist (0.5 ft) CLAYEY SAND, w/ Sandy Shale Seams, Trace Gravel, Reddish Brown to Brown, Medium Dense to Dense, Slightly Moist (SC)	SPT 1		4-6-8 (14)	2.25		
				SPT 2		9-12-15 (27)	4.5		
5			Bottom of borehole at 5.0 feet. (5.0 ft)						

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GEOTECHNICAL BORING LOG

BORING NUMBER 107

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES Offset 5' S Due to Overhead Obstacles

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist — 0.3 ft						
			CLAYEY SAND, Trace Gravel, Brown, Very Dense, Dry (SC)	SPT 1		10-25-30 (55)	4.5		
			3.9 ft	SPT 2		50/5"			
			SANDSTONE, Fine Grained, Poorly to Well Cemented, Brown, Soft to Medium Hard — 5.0 ft						
5			Bottom of borehole at 5.0 feet.						

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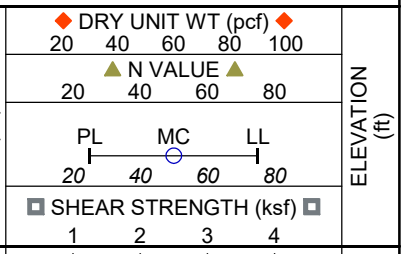
GEOTECHNICAL BORING LOG

BORING NUMBER 108

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist 0.5 ft CLAYEY GRAVEL, w/ Sand, Reddish Brown, Medium Dense, Moist (GC)	SPT 1		4-4-12 (16)	
			3.5 ft SANDY LEAN CLAY, w/ Gravel, Reddish Brown, Very Stiff, Moist (CL) 5.0 ft	SPT 2		9-12-12 (24)	4.5
5			SANDY SHALE, w/ Intermittent Sandstone Seams, Weathered, Brown, Medium Hard	SPT 3		50/5"	4.5
				SPT 4		50/5"	
			10.0 ft				
10			Bottom of borehole at 10.0 feet.				



ELEVATION (ft)

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GEOTECHNICAL BORING LOG

BORING NUMBER 109

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 4 ft
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING 4 ft
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Soft, Moist (0.3 ft) SANDY LEAN CLAY, Brown to Reddish Brown, Stiff to Very Stiff, Wet to Very Moist (CL)	SPT 1		0-6-6 (12)	0		
				SPT 2		5-8-12 (20)	2.5		
5			Bottom of borehole at 5.0 feet. (5.0 ft)						

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GEOTECHNICAL BORING LOG

BORING NUMBER 110

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 2/20/19 **COMPLETED** 2/20/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER LB **DRILL RIG** D50
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING 2 ft
LOGGED BY JH **CHECKED BY** RTH
AT END OF DRILLING 4 ft
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Very Soft, Moist — 0.3 ft						
			SANDY LEAN CLAY, Trace Gravel, Brown, Very Soft to Soft, Wet (CL)	SPT 1		0-0-0 (0)	0		
				SPT 2		3-1-2 (3)	1.5		
5			5.0 ft Bottom of borehole at 5.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 111

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/11/19 **COMPLETED** 6/11/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (2") 0.2 ft SANDY LEAN CLAY, Brown w/ Red, Moist, Soft (CL)	SPT 1		3-1-3 (4)	1		
			3.0 ft SHALE, Trace Coal, Highly Weathered, Grayish Brown w/ Black, Dry, Very Soft to Soft	SPT 2		10-9-17 (26)	4.75		
5				SPT 3		23-40-65/1"	4.75		
			8.2 ft SANDSTONE, Fine Grained, Highly Weathered, Tan, Dry, Medium Hard 8.8 ft	SPT 4		65/2"			
			Auger Refusal on Sandstone Refusal at 8.8 feet. Bottom of borehole at 8.8 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 112

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/11/19 **COMPLETED** 6/11/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (3") — 0.3 ft SANDY LEAN CLAY, Brown w/ Gray, Moist, Soft (CL)	ST 1	79		2		
			3.0 ft SANDSTONE, Fine Grained, Highly Weathered, Tan, Dry, Medium Hard — 3.8 ft	SPT 2		65/1"	0		
			Auger Refusal on Sandstone Refusal at 3.8 feet. Bottom of borehole at 3.8 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 113

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/11/19 **COMPLETED** 6/11/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (4") 0.3 ft SANDY LEAN CLAY, Brown, Moist, Soft (CL)	SPT 1		1-1-1 (2)	0.25		
			3.0 ft SHALEY LEAN CLAY, w/ Sand, Brown, Moist, Very Stiff (CL)	ST 2	83		4		
5			5.8 ft SANDSTONE, Fine Grained, Highly Weathered, Tan, Dry, Soft 6.9 ft	SPT 3		17-65/3"	4.5		

Auger Refusal on Sandstone
Refusal at 6.9 feet.
Bottom of borehole at 6.9 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 114

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/11/19 **COMPLETED** 6/11/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (3") 0.3 ft SANDY LEAN CLAY, Brown, Moist, Soft (CL)	SPT 1		1-1-3 (4)	1.75		
			3.7 ft SHALE, w/ Sand, Trace Coal, Highly Weathered, Dry, Grayish Brown w/ Black, Very Soft to Soft	SPT 2		8-12-14 (26)	4.5		
5			6.8 ft SANDSTONE, w/ Interbedded Shale, Fine Grained, Highly Weathered, Gray & Brown, Dry, Medium Hard	SPT 3		22-65/5"	4.5		
			8.6 ft Auger Refusal on Sandstone Refusal at 8.6 feet. Bottom of borehole at 8.6 feet.	SPT 4		65/1"	4.5		

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GEOTECHNICAL BORING LOG

BORING NUMBER 115

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/11/19 **COMPLETED** 6/11/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		0.2 ft TOPSOIL (2")	SPT 1		3-3-3 (6)	0.25		
			SANDY LEAN CLAY, Brown, Moist, Medium Stiff (CL)						
			3.8 ft SHALEY LEAN TO FAT CLAY, Trace Sand, Brown, Slightly Moist, Very Stiff (CL-CH)	SPT 2		4-8-13 (21)	4.5		
5			5.5 ft SHALE, Trace Coal, Highly Weathered, Dry, Brown & Gray & Black, Soft	SPT 3		22-65/5"	4.5		
			8.2 ft SANDSTONE, Fine Grained, Highly Weathered, Tan, Dry, Medium Hard 8.8 ft	SPT 4		65/4"	4.5		
			Auger Refusal on Sandstone Refusal at 8.8 feet. Bottom of borehole at 8.8 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 116

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/11/19 **COMPLETED** 6/11/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (1") — 0.1 ft LEAN CLAY, Trace Sand, Tan to Brown, Moist, Soft (CL)	SPT 1		1-1-3 (4)	1.25		
			3.7 ft SANDY SHALE, Highly Weathered, Brown to Light Gray, Dry, Soft	SPT 2		65/5"	1		
5			6.0 ft 6.3 ft SANDSTONE, Fine Grained, Highly Weathered, Tan, Dry, Medium Hard	SPT 3		65/1"			

Auger Refusal on Sandstone
Refusal at 6.3 feet.
Bottom of borehole at 6.3 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 117

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/11/19 **COMPLETED** 6/11/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (4") 0.3 ft SANDY LEAN CLAY, Trace Chert, Brown w/ Gray & Red, Moist, Very Soft (CL)	SPT 1		1-1-0 (1)	1.5	
			4.0 ft SHALEY LEAN CLAY, w/ Sand, Reddish Brown, Moist, Very Stiff (CL)	ST 2	83		4.5	5.80
5			6.1 ft SHALE, Trace Coal, Highly Weathered, Gray & Tan w/ Black & Red, Dry, Soft	SPT 3		20-65/5"	4.5	128
			8.3 ft SANDSTONE, Fine Grained, Highly Weathered, 8.8 ft Gray to Black & Brown, Dry, Medium Hard	SPT 4		65/4"	4.5	

Auger Refusal on Sandstone
Refusal at 8.8 feet.
Bottom of borehole at 8.8 feet.

DRY UNIT WT (pcf) ◆ 20 40 60 80 100
▲ N VALUE ▲ 20 40 60 80
PL MC LL 20 40 60 80
SHEAR STRENGTH (ksf) ■ 1 2 3 4

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GEOTECHNICAL BORING LOG

BORING NUMBER 118

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/11/19 **COMPLETED** 6/11/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (2") 0.2 ft SANDY LEAN CLAY, Tan to Gray w/ Red, Moist, Soft (CL)	ST 1	100		0.75		
			4.1 ft SHALE, Trace Coal, Highly Weathered, Tan to Light Gray w/ Red & Black, Dry, Very Soft 4.9 ft	SPT 2		7-13-21 (34)	4.75		
5			SANDSTONE, Fine Grained, Highly Weathered, Tan to Light Gray, Dry, Very Soft to Medium Hard 6.7 ft	SPT 3		65/2"			

Auger Refusal on Sandstone
Refusal at 6.7 feet.
Bottom of borehole at 6.7 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 119

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/11/19 **COMPLETED** 6/11/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (3") 0.3 ft SANDY LEAN CLAY, Brown, Moist, Soft (CL)	ST 1	96		1.25		
			2.0 ft SANDSTONE, Fine Grained, Highly Weathered, Brown to Tan, Dry, Medium Hard						
			4.2 ft	SPT 2		65/4"			

Auger Refusal on Sandstone
Refusal at 4.2 feet.
Bottom of borehole at 4.2 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 120

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/11/19 **COMPLETED** 6/11/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (2") 0.2 ft SANDY LEAN CLAY, w/ Chert Gravel, Brown, Wet, Hard (CL) 0.6 ft SANDSTONE, Fine Grained, Highly Weathered, Brown to Gray, Dry, Soft 1.2 ft Auger Refusal on Sandstone Refusal at 1.2 feet. Bottom of borehole at 1.2 feet.	SPT 1		16-65/2"	2		

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GEOTECHNICAL BORING LOG

BORING NUMBER 121

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/11/19 **COMPLETED** 6/11/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (2") 0.2 ft SANDY LEAN CLAY, Brown, Moist, Stiff (CL)	ST 1	100		0.75	
			3.0 ft SHALEY LEAN TO FAT CLAY, w/ Sand, Brown, Moist, Stiff (CL-CH)	SPT 2		5-7-8 (15)	4.5	
5			7.0 ft SHALE, w/ Sand, Highly Weathered, Dry, Gray w/ Tan, Very Soft to Soft	ST 3	100		3.75	
				SPT 4		17-65/2"	4	
10			13.6 ft	SPT 5		65/1"	4.5	

Split-Spoon Refusal on Shale
Refusal at 13.6 feet.
Bottom of borehole at 13.6 feet.

DRY UNIT WT (pcf) 20 40 60 80 100
N VALUE 20 40 60 80
PL MC LL 20 40 60 80
SHEAR STRENGTH (ksf) 1 2 3 4

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GEOTECHNICAL BORING LOG

BORING NUMBER 122

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/10/19 **COMPLETED** 6/10/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (3") 0.3 ft SANDY LEAN CLAY, Brown, Moist, Very Stiff (CL)	SPT 1		5-10-14 (24)	0		
			3.0 ft SHALEY FAT CLAY, w/ Sand, Brown & Gray w/ Red, Moist, Hard (CH)	SPT 2		17-13-22 (35)			
5			5.5 ft SHALE, Highly Weathered, Gray to Tan, Dry, Very Soft - Gray to Black w/ Trace Coal Below 8'1"	SPT 3		22-39-53 (92)			
10				SPT 4		65/3"			
			15.0 ft						
15			Bottom of borehole at 15.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 123

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/10/19 **COMPLETED** 6/10/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		0.2 ft TOPSOIL (2") SANDY LEAN CLAY, Brown, Moist, Very Stiff (CL) 1.7 ft SHALE, Trace Coal, Highly Weathered, Brown & Gray w/ Black, Dry, Very Soft to Soft	SPT 1		4-4-12 (16)	1.25		
				SPT 2		16-14-20 (34)	4.5		
5				SPT 3		22-65/5"			
10			13.8 ft	SPT 4		65/4"	3		

Split-Spoon Refusal on Shale
Refusal at 13.8 feet.
Bottom of borehole at 13.8 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 124

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/11/19 **COMPLETED** 6/11/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (2") — 0.2 ft SANDY FAT CLAY, Brown w/ Gray & Red, Moist, Medium Stiff (CH)	SPT 1		3-3-5 (8)	1.25		
			3.2 ft SHALE, Highly Weathered, Gray, Dry, Soft	SPT 2		65/5"	2		
5			8.8 ft Auger Refusal on Shale Refusal at 8.8 feet. Bottom of borehole at 8.8 feet.	SPT 3		65/3"			

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GEOTECHNICAL BORING LOG

BORING NUMBER 125

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/10/19 **COMPLETED** 6/10/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (3") 0.3 ft SANDY LEAN CLAY, Brown, Wet, Very Soft to Hard (CL) 1.3 ft SANDSTONE, Fine Grained, Highly Weathered, Tan, Dry, Medium Hard 2.5 ft	SPT 1		1-1-65/4"	0.5		

Auger Refusal on Sandstone
Refusal at 2.5 feet.
Bottom of borehole at 2.5 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 126

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/11/19 **COMPLETED** 6/11/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		0.2 ft TOPSOIL (2") SANDY LEAN CLAY, Brown w/ Red & Gray, Moist, Soft (CL)	ST 1	100		0.25		
			3.0 ft SHALEY SANDY LEAN CLAY, Reddish Brown, Moist, Stiff (CL)	ST 2	67		4.5		
5			6.3 ft SHALE, Trace Coal, Highly Weathered, Tan w/ Black, Dry, Soft	SPT 3		12-27-65/5"	2.75		
			9.4 ft	SPT 4		33-65/5"	4.5		

Auger Refusal on Shale
Refusal at 9.4 feet.
Bottom of borehole at 9.4 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 127

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/12/19 **COMPLETED** 6/12/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (6") 0.5 ft SANDY LEAN CLAY, Trace Organics, Brown, Moist, Medium Stiff (CL)	SPT 1		3-3-5 (8)	0.5		
			3.3 ft SHALEY SANDY LEAN CLAY, Brown, Moist, Very Stiff (CL)	SPT 2		5-9-12 (21)	2.5		
5			5.4 ft 5.5 ft SANDSTONE, w/ Shale Seams, Fine Grained, Highly Weathered, Tan to Brown w/ Gray & Red, Dry, Medium Hard	SPT 3		65/1"			

Auger Refusal on Sandstone
Refusal at 5.5 feet.
Bottom of borehole at 5.5 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 128

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/12/19 **COMPLETED** 6/12/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (5") — 0.4 ft LEAN TO FAT CLAY, w/ Sand and Gravel, Brown to Tan, Moist, Medium Stiff (CL-CH)	SPT 1		7-1-4 (5)	2.5		
			3.7 ft SANDY SHALE, Highly Weathered, Tan & Brown w/ Light Gray & Red, Dry, Very Soft to Soft	SPT 2		4-25-23 (48)	1		
5				SPT 3		65/5"	4.5		
			8.9 ft Auger Refusal on Shale Refusal at 8.9 feet. Bottom of borehole at 8.9 feet.	SPT 4		65/5"	4.5		

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GEOTECHNICAL BORING LOG

BORING NUMBER 129

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/10/19 **COMPLETED** 6/10/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (2") 0.2 ft SANDY LEAN CLAY, Trace Chert, Brown w/ Gray, Moist, Soft (CL)	SPT 1		1-1-1 (2)	0.5		
			3.0 ft SHALEY SANDY LEAN TO FAT CLAY, Brown w/ Red, Moist, Very Stiff to Hard (CH)	SPT 2		8-13-13 (26)	4.5		
5			9.0 ft SHALE, Trace Coal, Highly Weathered, Gray to Brown & Black, Dry, Very Soft to Soft	SPT 3		5-14-26 (40)	4.5		
10			14.4 ft	SPT 4		18-65/5"	4.5		

Split-Spoon Refusal on Shale
Refusal at 14.4 feet.
Bottom of borehole at 14.4 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 130

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/12/19 **COMPLETED** 6/12/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (4") 0.3 ft SANDY LEAN CLAY, Brown, Moist, Stiff to Very Stiff (CL)	SPT 1		3-5-4 (9)	2		
			4.5 ft SANDSTONE, Fine Grained, Highly Weathered, Tan w/ Gray & Red, Dry, Very Soft to Medium Hard	SPT 2		8-7-17 (24)			
5			5.9 ft Auger Refusal on Sandstone Refusal at 5.9 feet. Bottom of borehole at 5.9 feet.	SPT 3		65/1"			

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GEOTECHNICAL BORING LOG

BORING NUMBER 131

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/12/19 **COMPLETED** 6/12/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (6") 0.5 ft SANDY LEAN CLAY, w/ Gravel, Tan to Brown w/ Gray & Red, Moist, Stiff (CL)	SPT 1		4-7-7 (14)	3		
			4.1 ft SHALE, Highly Weathered, Light Gray to Tan w/ Red, Dry, Soft 4.9 ft	SPT 2		10-26-65/5"	4.25		
5			5.3 ft SANDSTONE, Fine Grained, Highly Weathered, Light Gray to Tan, Dry, Medium Hard						

Auger Refusal on Sandstone
Refusal at 5.3 feet.
Bottom of borehole at 5.3 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 132

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/12/19 **COMPLETED** 6/12/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (9") 0.8 ft SANDY LEAN CLAY, w/ Gravel, Brown to Red, Moist, Medium Stiff (CL) 1.7 ft SANDSTONE, Fine Grained, Highly Weathered, Tan, Dry, Medium Hard 2.0 ft Auger Refusal on Sandstone Refusal at 2.0 feet. Bottom of borehole at 2.0 feet.	SPT 1		3-4-3 (7)	2.5		

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GEOTECHNICAL BORING LOG

BORING NUMBER 133

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/12/19 **COMPLETED** 6/12/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (1") 0.1 ft SANDY LEAN CLAY, Trace Organics, Brown w/ Gray & Red, Moist, Medium Stiff (CL)	SPT 1		3-3-3 (6)	2.25		
			3.0 ft SHALEY SANDY LEAN TO FAT CLAY, Brown, Moist, Very Stiff to Hard (CL-CH)	SPT 2		7-13-13 (26)	4.5		
5									
			9.2 ft SHALE, Trace Coal, Highly Weathered, Black & Brown, Dry, Very Soft	SPT 3		10-16-21 (37)	4.5		
10			11.7 ft SANDSTONE, Fine Grained, Highly Weathered, Tan, Dry, Medium Hard 12.3 ft						
			Auger Refusal on Sandstone Refusal at 12.3 feet. Bottom of borehole at 12.3 feet.	SPT 4		65/0"			

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GEOTECHNICAL BORING LOG

BORING NUMBER 134

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/12/19 **COMPLETED** 6/12/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (6") 0.5 ft CLAYEY SAND, w/ Gravel, Fine Grained, Brown to Tan, Moist, Medium Dense (SC) 1.4 ft SANDSTONE, w/ Shale, Fine Grained, Highly Weathered, Light Gray to Tan w/ Black, Dry, Soft	SPT 1		1-7-20 (27)			
			4.5 ft SHALE, Trace Coal, Highly Weathered, Black & Brown, Dry, Very Soft	SPT 2		12-16-20 (36)	3.5		
5				SPT 3		17-65/5"	4.5		
			9.9 ft	SPT 4		10-13-65/5"	4.5		

Auger Refusal on Shale
Refusal at 9.9 feet.
Bottom of borehole at 9.9 feet.

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GEOTECHNICAL BORING LOG

BORING NUMBER 135

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/12/19 **COMPLETED** 6/12/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (2")	SPT 1		3-3-4 (7)	1.75	▲ ○	
			1.2 ft SANDY LEAN CLAY, w/ Gravel, Brown w/ Red, Moist, Medium Stiff (CL)						
			3.4 ft SANDSTONE, Fine Grained, Highly Weathered, Tan to Brown, Dry, Medium Hard	SPT 2		65/3"	0.75	○ ▲	
			4.1 ft Auger Refusal on Sandstone Refusal at 4.1 feet. Bottom of borehole at 4.1 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 136

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/12/19 **COMPLETED** 6/12/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (2") 0.2 ft SANDY LEAN CLAY, w/ Gravel, Brown w/ Red, Moist, Medium Stiff (CL)	SPT 1		3-3-3 (6)	0.75		
				SPT 2		65/1"			
			4.4 ft 4.4 ft SANDSTONE, Fine Grained, Highly Weathered, Tan, Dry, Medium Hard Auger Refusal on Sandstone Refusal at 4.4 feet. Bottom of borehole at 4.4 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 137

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/11/19 **COMPLETED** 6/11/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (4") 0.3 ft LEAN CLAY, Trace Sand & Gravel, Brown, Moist, Hard (CL)	SPT 1		65/4"			
			3.2 ft SHALEY LEAN TO FAT CLAY, w/ Sand, Trace Gravel, Tan to Gray w/ Red, Moist, Very Stiff (CL-CH)	SPT 2		8-9-9 (18)	4		
5			7.6 ft SHALE, Trace Coal, Highly Weathered, Gray to Brown w/ Black & Red, Dry, Very Soft to Soft	SPT 3		9-17-20 (37)	4.5		
10				SPT 4		65/3"	4.5		
			15.0 ft						
15			Bottom of borehole at 15.0 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 138

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/11/19 **COMPLETED** 6/11/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** Hand Sample
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	HAND SAMPLE		TOPSOIL (2") 0.2 ft SANDY LEAN CLAY, Trace Gravel & Boulders, Brown to Tan, Moist (CL)	GB 1					
			1.8 ft Refusal on Sandstone Refusal at 1.8 feet. Bottom of borehole at 1.8 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 139

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/11/19 **COMPLETED** 6/11/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** Hand Sample
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	HAND SAMPLE		TOPSOIL (1") 0.1 ft SANDY LEAN CLAY, Trace Gravel & Boulders, Brown w/ Gray & Red, Moist (CL)	GB 1					
			2.2 ft Refusal on Sandstone Refusal at 2.2 feet. Bottom of borehole at 2.2 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 140

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/11/19 **COMPLETED** 6/11/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** Hand Sample
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	HAND SAMPLE		TOPSOIL (4") 0.3 ft SANDY LEAN CLAY, Brown, Dry (CL)	GB 1					
			1.2 ft Refusal on Sandstone Refusal at 1.2 feet. Bottom of borehole at 1.2 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 141

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/11/19 **COMPLETED** 6/11/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** Hand Sample
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	HAND SAMPLE		TOPSOIL (3") 0.3 ft SANDY LEAN CLAY, Trace Gravel, Brown to Tan, Moist (CL) 0.7 ft Refusal on Sandstone Refusal at 0.7 feet. Bottom of borehole at 0.7 feet.	GB 1					

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GEOTECHNICAL BORING LOG

BORING NUMBER 142

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/11/19 **COMPLETED** 6/11/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** Hand Sample
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	HAND SAMPLE		TOPSOIL (2") 0.2 ft SANDY LEAN CLAY, Brown, Dry (CL) 0.8 ft	GB 1					
			Refusal on Sandstone Refusal at 0.8 feet. Bottom of borehole at 0.8 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 146

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/12/19 **COMPLETED** 6/12/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (3") 0.3 ft SANDSTONE, Fine Grained, Highly Weathered, Tan to Light Gray, Dry, Soft 0.8 ft Auger Refusal on Sandstone Refusal at 0.8 feet. Bottom of borehole at 0.8 feet.	SPT 1		3-65/2"			

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GEOTECHNICAL BORING LOG

BORING NUMBER 147

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/12/19 **COMPLETED** 6/12/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (6") 0.5 ft SANDSTONE, Fine Grained, Highly Weathered, Tan to Light Gray, Dry, Soft 1.4 ft	SPT 1		10-44-65/1"	2.5		
			Auger Refusal on Sandstone Refusal at 1.4 feet. Bottom of borehole at 1.4 feet.						

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GEOTECHNICAL BORING LOG

BORING NUMBER 148

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK
DATE STARTED 6/12/19 **COMPLETED** 6/12/19
SURFACE ELEVATION _____ **BENCHMARK EL.** _____
DRILLER CW **DRILL RIG** 2015 CME-55
GROUND WATER LEVELS
HAMMER TYPE Auto
AT TIME OF DRILLING None
LOGGED BY CJ **CHECKED BY** RTH
AT END OF DRILLING _____
NOTES _____

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION (Unified Soil Classification System)	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 / N VALUE 20 40 60 80 / PL MC LL 20 40 60 80 / SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (4") 0.3 ft SANDY LEAN CLAY, w/ Gravel, Brown w/ Red, Moist (CL) 1.1 ft SANDSTONE, Fine Grained, Highly Weathered, Tan to Light Gray, Dry, Soft 1.7 ft Auger Refusal on Sandstone Refusal at 1.7 feet. Bottom of borehole at 1.7 feet.	GB 1					

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KEY TO SYMBOLS

CLIENT Cherokee Nation Entertainment
PROJECT NAME National Cherokee Nation Park
PROJECT NO. 256748 Rev. 1
PROJECT LOCATION Sallisaw, OK

LITHOLOGIC SYMBOLS
(Unified Soil Classification System)


BLDRCBBL: Boulders and cobbles


CH: USCS High Plasticity Clay


CHG: USCS High Plasticity Gravelly Clay


CHS: USCS High Plasticity Sandy Clay


CL: USCS Low Plasticity Clay


CL-CH: USCS Low to High Plasticity Clay


CLG: USCS Low Plasticity Gravelly Clay


CL-ML: USCS Low Plasticity Silty Clay


CLS: USCS Low Plasticity Sandy Clay


COAL: Coal


GC: USCS Clayey Gravel


SANDSTONE: Sandstone


SC: USCS Clayey Sand


SHALE: Shale


SP: USCS Poorly-graded Sand


TOPSOIL: Topsoil

SAMPLER SYMBOLS


Grab Sample


NQ


Standard Penetration Test


Shelby Tube

WELL CONSTRUCTION SYMBOLS

ABBREVIATIONS

LL - LIQUID LIMIT (%)
PI - PLASTIC INDEX (%)
W - MOISTURE CONTENT (%)
DD - DRY DENSITY (PCF)
NP - NON PLASTIC
-200 - PERCENT PASSING NO. 200 SIEVE
PP - POCKET PENETROMETER (TSF)

TV - TORVANE
PID - PHOTOIONIZATION DETECTOR
UC - UNCONFINED COMPRESSION
ppm - PARTS PER MILLION


Water Level at Time Drilling, or as Shown


Water Level at End of Drilling, or as Shown


Water Level After 24 Hours, or as Shown

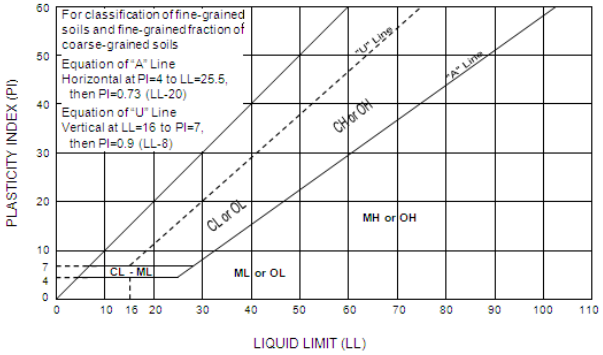
APPENDIX III - GENERAL NOTES

GENERAL NOTES

SOIL PROPERTIES & DESCRIPTIONS

COHESIVE SOILS

Consistency	Unconfined Compressive Strength (Qu)	Pocket Penetrometer Strength	N-Value
	(psf)	(tsf)	(blows/ft)
Very Soft	<500	<0.25	0-1
Soft	500-1000	0.25-0.50	2-4
Medium Stiff	1001-2000	0.50-1.00	5-8
Stiff	2001-4000	1.00-2.00	9-15
Very Stiff	4001-8000	2.00-4.00	16-30
Hard	>8000	>4.00	31-60
Very Hard			>60



Group Symbol	Group Name
CL –	Lean Clay
ML –	Silt
OL –	Organic Clay or Silt
CH –	Fat Clay
MH –	Elastic Silt
OH –	Organic Clay or Silt
PT –	Peat
CL-CH –	Lean to Fat Clay

Plasticity		Moisture	
Description	Liquid Limit (LL)	Descriptive Term	Guide
Lean	<45%	Dry	No indication of water
Lean to Fat	45-49%	Moist	Indication of water
Fat	≥50%	Wet	Visible water

Fine Grained Soil Sub Classification	Percent (by weight) of Total Sample
Terms: SILT, LEAN CLAY, FAT CLAY, ELASTIC SILT	PRIMARY CONSTITUENT
Sandy, gravelly, abundant cobbles, abundant boulders	>30-50]
with sand, with gravel, with cobbles, with boulders	>15-30] – secondary coarse grained constituents
scattered sand, scattered gravel, scattered cobbles, scattered boulders	5-15]
a trace sand, a trace gravel, a few cobbles, a few boulders	<5]
The relationship of clay and silt constituents is based on plasticity and normally determined by performing index tests. Refined classifications are based on Atterberg Limits tests and the Plasticity Chart.	

NON-COHESIVE (GRANULAR) SOILS

RELATIVE DENSITY	N-VALUE
Very Loose	0-4
Loose	5-10
Medium Dense	11-24
Dense	25-50
Very Dense	≥51

MOISTURE CONDITION	
Descriptive Term	Guide
Dry	No indication of water
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table.

**GRAIN SIZE IDENTIFICATION		
Name	Size Limits	Familiar Example
Boulder	12 in. or more	Larger than basketball
Cobbles	3 in. to 12 in.	Grapefruit
Coarse Gravel	¾-in. to 3 in.	Orange or lemon
Fine Gravel	No. 4 sieve to ¾-in.	Grape or pea
Coarse Sand	No. 10 sieve to No. 4 sieve	Rock salt
Medium Sand	No. 40 sieve to No. 10 sieve	Sugar, table salt
Fine Sand*	No. 200 sieve to No. 40 sieve	Powdered sugar
Fines	Less than No. 200 sieve	
*Particles finer than fine sand cannot be discerned with the naked eye at a distance of 8 inches.		

Coarse Grained Soil Sub Classification	Percent (by weight) of Total Sample
Terms: GRAVEL, SAND, COBBLES, BOULDERS	PRIMARY CONSTITUENT
Sandy, gravelly, abundant cobbles, abundant boulders	>30-50]
with gravel, with sand, with cobbles, with boulders	>15-30] – secondary coarse grained constituents
scattered gravel, scattered sand, scattered cobbles, scattered boulders	5-15]
a trace gravel, a trace sand, a few cobbles, a few boulders	<5]
Silty (MH & ML)*, clayey (CL & CH)*	<15]
(with silt, with clay)*	5-15] – secondary fine grained constituents
(trace silt, trace clay)*	<5]
*Index tests and/or plasticity tests are performed to determine whether the term "silt" or "clay" is used.	

*Modified after Ref. ASTM D2487-93 & D2488-93
**Modified after Ref. Oregon DOT 1987 & FHWA 1997
***Modified after Ref. AASHTO 1988, DM 7.1 1982, and Oregon DOT 1987

GENERAL NOTES

BEDROCK PROPERTIES & DESCRIPTIONS

ROCK QUALITY DESIGNATION (RQD)	
Description of Rock Quality	*RQD (%)
Very Poor	< 25
Poor	25-50
Fair	50-75
Good	75-90
Excellent	90-100

*RQD is defined as the total length of sound core pieces 4 in. or greater in length, expressed as a percentage of the total length cored. RQD provides an indication of the integrity of the rock mass and relative extent of seams and bedding planes.

SCALE OF RELATIVE ROCK HARDNESS		
Term	Field Identification	Approx. Unconfined Compressive Strength (tsf)
Extremely Soft	Can be indented by thumbnail	2.6-10
Very Soft	Can be peeled by pocket knife	10-50
Soft	Can be peeled with difficulty by pocket knife	50-260
Medium Hard	Can be grooved 2 mm deep by firm pressure of knife	260-520
Moderately Hard	Requires one hammer blow to fracture	520-1040
Hard	Can be scratched with knife or pick only with difficulty	1040-2610
Very Hard	Cannot be scratched by knife or sharp pick	>2610

DEGREE OF WEATHERING	
Slightly Weathered	Rock generally fresh, joints stained and discoloration extends into rock up to 25mm (1 in), open joints may contain clay, core rings under hammer impact.
Weathered	Rock mass is decomposed 50% or less, significant portions of rock show discoloration and weathering effects, cores cannot be broken by hand or scraped by knife.
Highly Weathered	Rock mass is more than 50% decomposed, complete discoloration of rock fabric, core may be extremely broken and gives clunk sound when struck by hammer, may be shaved with a knife.

GRAIN SIZE (TYPICALLY FOR SEDIMENTARY ROCKS)		
Description	Diameter (mm)	Field Identification
Very Coarse Grained	>4.76	
Coarse Grained	2.0-4.76	Individual grains can easily be distinguished by eye.
Medium Grained	0.42-2.0	Individual grains can be distinguished by eye.
Fine Grained	0.074-0.42	Individual grains can be distinguished by eye with difficulty.
Very Fine Grained	<0.074	Individual grains cannot be distinguished by unaided eye.

VOIDS	
Pit	Voids barely seen with the naked eye to 6mm *1/4-inch)
Vug	Voids 6 to 50mm (1/4 to 2 inches) in diameter
Cavity	50 to 6000mm (2 to 24 inches) in diameter
Cave	> 600mm

BEDDING THCKNESS	
Very Thick Bedded	> 3' Thick
Thick Bedded	1' to 3' Thick
Medium Bedded	4" to 1' Thick
Thin Bedded	1-1/4" to 4" Thick
Very Thin Bedded	½" to 1-1/4" Thick
Thickly Laminated	1/8" to ½" Thick
Thinly Laminated	1/8" or less (paper thin)

DRILLING NOTES

Drilling & Sampling Symbols		
NQ – Rock Core (2-inch diameter)	CFA- Continuous Flight (Solid Stem) Auger	WB – Wash Bore or Mud Rotary
HQ – Rock Core (3-inch diameter)	SS – Split Spoon Sampler	TP – Test Pit
HSA – Hollow Stem Auger	ST – Shelby Tube	HA – Hand Auger

Soil Sample Types

Shelby Tube Samples: Relatively undisturbed soil samples were obtained from the borings using thin wall (Shelby) tube samplers pushed hydraulically into the soil in advance of drilling. This sampling, which is considered to be undisturbed, was performed in accordance with the requirements of ASTM D 1587. This type of sample is considered best for the testing of "in-situ" soil properties such as natural density and strength characteristics. The use of this sampling method is basically restricted to soil containing little to no chert fragments and to softer shale deposits.

Split Spoon Samples: The Standard Penetration Test is conducted in conjunction with the split-barrel sampling procedure. The "N" value corresponds to the number of blows required to drive the last 1 foot of an 18-inch long, 2-inch O.D. split-barrel sampler with a 140 lb. hammer falling a distance of 30 inches. The Standard Penetration Test is carried out according to ASTM D-1586.

Water Level Measurements

Water levels indicated on the boring logs are levels measured in the borings at the times indicated. In permeable materials, the indicated levels may reflect the location of groundwater. In low permeability soils, shallow groundwater may indicate a perched condition. Caution is merited when interpreting short-term water level readings from open bore holes. Accurate water levels are best determined from piezometers.

Automatic Hammer

Palmerton and Parrish, Inc.'s CME's are equipped with automatic hammers. The conventional method used to obtain disturbed soil samples used a safety hammer operated by company personnel with a cat head and rope. However, use of an automatic hammer allows a greater mechanical efficiency to be achieved in the field while performing a Standard Penetration resistance test based upon automatic hammer efficiencies calibrated using dynamic testing techniques.

*Modified after Ref. ASTM D2487-93 & D2488-93
**Modified after Ref. Oregon DOT 1987 & FHWA 1997
***Modified after Ref. AASHTO 1988, DM 7.1 1982, and Oregon DOT 1987

APPENDIX IV – SUMMARY OF LABORATORY RESULTS

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SUMMARY OF LABORATORY RESULTS

CLIENT Cherokee Nation Entertainment **PROJECT NAME** National Cherokee Nation Park

PROJECT NO. 256748 Rev. 1 **PROJECT LOCATION** Sallisaw, OK

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Cohe-sion (psf)	Void Ratio
1	0.0							26.2			
1	3.5							21.4			
1	6.0							17.4			
1	8.5							16.6			
2	0.0	28	17	11				27.9			
2	3.5							24.8			
2	6.0							22.1			
2	8.5							21.9			
2	13.5							11.1			
3	0.0							31.1			
3	3.5							28.1			
3	6.0							26.8			
3	8.5							32.1			
3	13.5							3.9			
4	0.0							25.8			
4	3.5							19.8			
4	6.0							17.7			
4	8.0	54	17	37				24.5	100.7	4,570	
4	13.5							12.1			
5	0.0							26.6			
5	3.5							23.4			
5	6.0	49	16	33				21.3	107.0	4,516	
5	8.5							26.1			
5	13.5							5.1			
5	18.5							3.6			
6	0.0							29.7			
6	3.0							15.8	115.2	3,016	
6	6.0				4.75	96		25.3			
6	8.5							25.3			
7	0.0							29.1			
7	3.5							10.8			
7	6.0							8.0			
7	8.5							6.0			
8	0.0							30.6			
8	3.5							8.8			
8	6.0							7.7			
8	8.5							7.7			
9	0.0							26.0			
9	3.5							10.4			
10	0.0							24.7			
10	3.5							18.1			
11	0.0							24.1			
11	3.5							20.1			

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Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Cohe-sion (psf)	Void Ratio
12	0.0							24.4			
12	3.5				19	69		20.2			
12	6.0							28.1			
12	8.5							16.4			
13	1.0	40	16	24				22.9			
13	3.5							22.5			
14	0.0							33.2			
14	3.5							15.3			
15	0.0							22.5			
15	3.5	44	15	29				23.4			
16	0.0							23.7			
16	3.5							16.2			
17	0.0							23.0			
17	3.5							19.9			
18	0.0							13.1			
18	3.5							6.7			
19	1.0				19	59		17.1			
19	3.0							4.3			
19	6.0							5.8			
19	8.5							7.8			
19	13.5							8.9			
20	0.0							23.4			
20	3.5							7.6			
21	1.0							18.1			
21	3.0							12.4			
21	6.0							13.7			
21	9.5							13.5			
22	1.0	42	16	26				21.0			
22	3.0							18.5			
22	6.0							16.7			
22	8.5							13.9			
23	0.0							24.0			
23	3.5							15.6			
24	1.0				19	86		22.8			
24	3.0	31	19	12				18.0			
24	6.0							12.3			
24	8.0							15.9			
24	13.5							6.7			
25	0.0							22.9			
25	3.5	44	16	28				18.3			
25	6.0							14.9			
25	8.5							14.1			
26	0.0							20.8			

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Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Cohe-sion (psf)	Void Ratio
26	3.5							19.8			
27	0.0							19.9			
27	3.5							7.0			
28	1.0							10.6			
28	3.5							6.6			
29	0.0							8.1			
30	0.0							6.0			
30	3.5	46	21	25				17.0			
30	5.0							14.9			
30	8.5							13.4			
30	13.5							12.0			
30	18.5							12.5			
31	0.0							13.1			
31	3.5				19	77		17.9			
31	6.0							15.0			
31	8.5							14.5			
31	13.5							9.8			
32	0.0							15.7			
33	0.0							16.2			
34	0.0							17.6			
34	3.0							15.4			
34	6.0							12.1			
34	8.0							9.4			
34	13.0							9.5			
34	18.5							8.1			
35	0.0							27.9			
35	3.5							18.9			
35	6.0							11.8			
35	8.5							10.9			
35	13.5							10.2			
36	0.0							25.1			
36	3.5							25.0			
36	6.0							13.3			
36	8.5							12.0			
36	13.5							10.8			
37	0.0							14.9			
37	3.5							30.6			
37	6.0							13.0			
37	8.5							13.4			
37	13.5							13.5			
38	0.0							21.4			
38	3.5							18.1			
38	6.0							12.3			

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Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Cohe-sion (psf)	Void Ratio
38	8.5							12.3			
38	13.5							13.1			
39	0.0							6.0			
39	3.5							8.7			
40	0.0				19	29		13.1			
40	3.5							21.6			
40	6.0							17.7			
40	8.5							22.2			
40	13.5							14.6			
41	0.0							11.9			
41	3.5	55	19	36				27.0			
41	6.0							12.9			
41	8.5							12.7			
41	13.5							10.9			
42	0.0							24.2			
42	3.5							7.7			
43	0.0							20.4			
43	3.5							12.7			
44	0.0							25.9			
44	3.5							22.8			
44	6.0							16.0			
44	8.5							4.8			
45	0.0							27.6			
45	3.5							26.4			
45	6.0							16.4			
45	8.5							15.9			
46	0.0							25.1			
46	3.5							11.0			
47	0.0							22.7			
47	3.5	37	18	19				21.6			
48	0.0							22.2			
48	3.5							9.5			
49	0.0	24	17	7				18.4			
49	3.5							9.3			
50	0.0							27.0			
50	2.0							10.9			
50	3.2							13.5			
51	0.0							16.9			
51	2.2							18.1			
51	2.8							15.9			
52	1.0				25	27		9.2			
52	3.5							6.6			
53	1.0							4.7			

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PROJECT NO. 256748 Rev. 1 **PROJECT LOCATION** Sallisaw, OK

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Cohe-sion (psf)	Void Ratio
53	2.4							4.4			
54	0.0							30.1			
55	0.0							33.4			
55	2.0							30.4			
55	3.5							15.4			
56	0.0							12.9			
57	0.0							24.2			
57	3.5							20.8			
58	0.0							11.1			
58	3.5							23.0			
59	0.0							19.9			
59	3.5							20.2			
60	0.0							31.0			
60	2.5	50	16	34				19.5			
60	5.5							10.7			
60	7.5							12.1			
61	0.0							23.3			
61	3.5							6.0			
61	6.0							14.1			
61	8.5							20.3			
61	13.5							12.2			
62	0.0				37.5	33		13.7			
63	0.0							22.1			
63	3.5							22.1			
64	0.0							11.2			
64	3.5							11.9			
65	0.0							17.2			
65	3.5							10.4			
66	0.0							17.8			
66	3.5							10.3			
66	4.7							3.6			
67	0.0				19	72		19.7			
67	3.5							3.9			
68	0.0	30	17	13				26.0			
68	3.5							4.9			
69	1.0	30	15	15				18.4			
69	3.0							12.9			
69	5.0							11.8			
69	6.0							10.9			
69	8.0							11.2			
69	12.5							22.6			
69	13.5							16.2			
70	1.0							12.7			

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Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Cohe-sion (psf)	Void Ratio
70	3.0				25	38		9.5			
70	6.0							12.0			
70	8.0							13.3			
70	13.5							15.1			
71	0.0							11.4			
71	3.0	57	18	39	19	87	CH	25.5			
71	6.0							15.8			
71	8.0							13.9			
71	13.0							15.0			
72	0.0							24.5			
72	3.5	60	20	40				22.9			
72	6.0							18.0			
72	8.5							16.0			
72	13.5							13.2			
73.2	0.0	27	18	9	9.5	55	CL	19.9			
73.2	3.5							14.6			
73.2	6.0							12.3			
73.2	8.5							6.4			
73.2	13.5							21.7			
74	0.0							38.3			
74	3.5							21.4			
75	0.0							21.5			
75	3.5	29	18	11	9.5	72	CL	22.9			
75	6.0							20.9			
75	8.5							10.3			
78	0.0							34.1			
79	0.0							19.8			
80	0.0							66.2			
80	0.3							11.6			
81	0.0							11.0			
82	0.0							5.9			
83	0.0				25	25		11.2			
83	3.5							17.1			
84	0.0							14.3			
85	1.0				19	67		17.2			
85	3.0							15.8			
85	6.0							14.1			
85	8.0							10.7			
85	9.5							6.0			
86	0.0							17.1			
86	3.5							11.4			
86	6.0							10.3			
87	1.0							8.6			

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CLIENT Cherokee Nation Entertainment **PROJECT NAME** National Cherokee Nation Park

PROJECT NO. 256748 Rev. 1 **PROJECT LOCATION** Sallisaw, OK

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Cohe-sion (psf)	Void Ratio
87	1.9							0.6			
88	1.0							14.9			
88	3.5							1.6			
89	1.0				19	62		19.5			
89	3.0							16.6	114.9	7,768	
89	6.0							12.2			
89	8.0							10.6			
89	13.5							7.5			
90	1.0							21.2			
90	3.5	35	17	18				21.0			
91	1.0							14.4			
91	3.0							5.7			
92	0.0							26.8			
92	3.5							5.7			
93	0.0							26.2			
93	3.5							25.5			
94	0.0							8.3			
94	3.5							4.6			
95	0.0							19.8			
95	3.5				25	46		14.2			
96	1.0	28	19	9				14.9			
96	3.5							17.9			
97	1.0							8.5			
97	3.5							10.8			
98	0.0							15.2			
98	3.5							27.1			
99	1.0							5.4			
99	3.5							3.5			
100	0.0							13.9			
100	3.5							24.4			
101	0.0							8.0			
101	3.5							3.0			
102	0.0							14.7			
103	0.0							24.9			
103	3.5							7.4			
104.1	1.0							16.2			
104.1	2.3							3.6			
105	1.0							10.1			
105	3.5							12.9			
106	1.0							9.5			
106	3.5							15.0			
107	1.0				37.5	22		5.8			
107	3.5							5.7			

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CLIENT Cherokee Nation Entertainment **PROJECT NAME** National Cherokee Nation Park

PROJECT NO. 256748 Rev. 1 **PROJECT LOCATION** Sallisaw, OK

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Cohe-sion (psf)	Void Ratio
108	1.0	30	13	17	25	42	GC	12.5			
108	3.0							16.6			
108	6.0							7.1			
108	8.5							3.7			
109	1.0							21.3			
109	3.5							21.6			
110	1.0							21.9			
110	3.5							14.6			
111	0.0							16.8			
111	3.5							18.5			
111	6.0							12.8			
111	8.5							2.4			
112	1.0							18.0			
112	3.0							17.6			
113	0.0							18.7			
113	3.5	35	15	20				18.6	110.8	3,853	
113	6.0							13.8			
114	0.0							16.3			
114	3.5							20.5			
114	6.0							12.4			
114	8.5							15.5			
115	0.0							29.6			
115	3.5							20.8			
115	6.0							20.5			
115	8.5							13.8			
116	0.0							20.5			
116	3.5							12.6			
116	6.0							1.9			
117	0.0							20.0			
117	3.5	42	19	23				11.5	128.0	5,800	
117	6.0							12.3			
117	8.5							21.9			
118	0.0							19.1			
118	3.5							15.3			
119	0.0							21.7			
119	3.5							3.6			
120	0.0							21.7			
121	0.0							18.2	112.0	1,560	
121	3.5	46	20	26				21.4			
121	6.0							18.9			
121	8.5							11.4			
121	13.5							6.1			
122	0.0							21.9			

4168 W. Kearney
Springfield, Missouri 65803
Telephone: (417) 864-6000
Fax: (417) 864-6004

SUMMARY OF LABORATORY RESULTS

CLIENT Cherokee Nation Entertainment **PROJECT NAME** National Cherokee Nation Park

PROJECT NO. 256748 Rev. 1 **PROJECT LOCATION** Sallisaw, OK

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Cohe-sion (psf)	Void Ratio
123	0.0							19.6			
123	3.5							9.5			
123	8.5							11.3			
123	13.5							10.9			
124	0.0							17.7			
124	3.5							9.9			
124	8.5							4.3			
125	0.0							21.6			
126	0.0	32	16	16				21.3			
126	3.5							18.5	109.9	3,049	
126	6.0							11.5			
126	8.5							10.8			
127	0.0							23.0			
127	3.5							14.6			
127	5.4							4.5			
128	0.0							17.3			
128	3.5							10.1			
128	6.0							8.0			
128	8.5							7.0			
129	0.0							29.4			
129	3.5							18.8			
129	8.5							14.7			
129	13.5							15.5			
130	0.0							26.0			
131	0.0							14.2			
131	3.5							15.6			
132	0.0							17.3			
133	0.0							20.3			
133	3.5							18.3			
133	8.5							18.3			
134	0.0							6.4			
134	3.5							16.2			
134	6.0							15.7			
134	8.5							13.8			
135	0.0							14.8			
135	3.5							13.5			
136	0.0							17.6			
136	3.5							7.3			
137	0.0							15.7			
137	3.5							24.4			
137	8.5							17.8			
137	13.5							11.8			
138	0.0							11.9			

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SUMMARY OF LABORATORY RESULTS

CLIENT Cherokee Nation Entertainment **PROJECT NAME** National Cherokee Nation Park

PROJECT NO. 256748 Rev. 1 **PROJECT LOCATION** Sallisaw, OK

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Cohe-sion (psf)	Void Ratio
139	0.0							17.9			
140	0.0							18.5			
141	0.0							20.5			
142	0.0							29.4			
146	0.0							4.4			
147	0.0							10.8			
148	0.0							15.6			

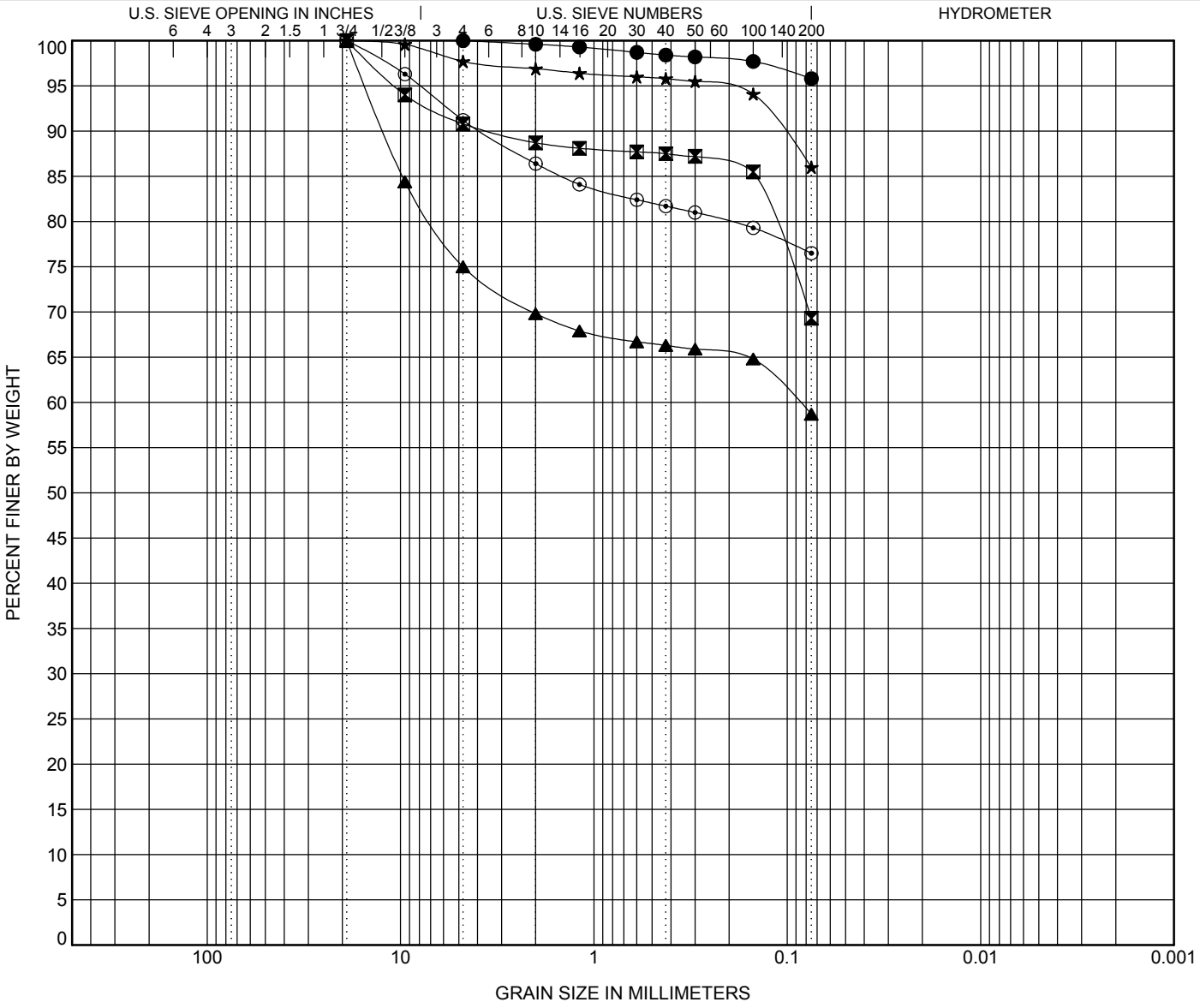
APPENDIX V - GRAIN SIZE ANALYSIS

4168 W. Kearney St.
Springfield, MO 65803
Telephone: (417) 864-6000
Fax: (417) 864-6004

GRAIN SIZE DISTRIBUTION

CLIENT Cherokee Nation Entertainment **PROJECT NAME** National Cherokee Nation Park

PROJECT NO. 256748 **PROJECT LOCATION** Sallisaw, OK



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	6	6.0	FAT CLAY(CH)					
⊠	12	3.5	SANDY FAT CLAY(CH)					
▲	19	1.0	GRAVELLY FAT CLAY with SAND(CH)					
★	24	1.0	LEAN CLAY(CL)					
⊙	31	3.5	FAT CLAY with SAND(CH)					

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	6	6.0	4.75				0.0	4.2	95.8	
⊠	12	3.5	19				9.2	21.5	69.3	
▲	19	1.0	19	0.087			25.0	16.3	58.7	
★	24	1.0	19				2.3	11.7	86.0	
⊙	31	3.5	19				8.8	14.7	76.5	

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GRAIN SIZE DISTRIBUTION

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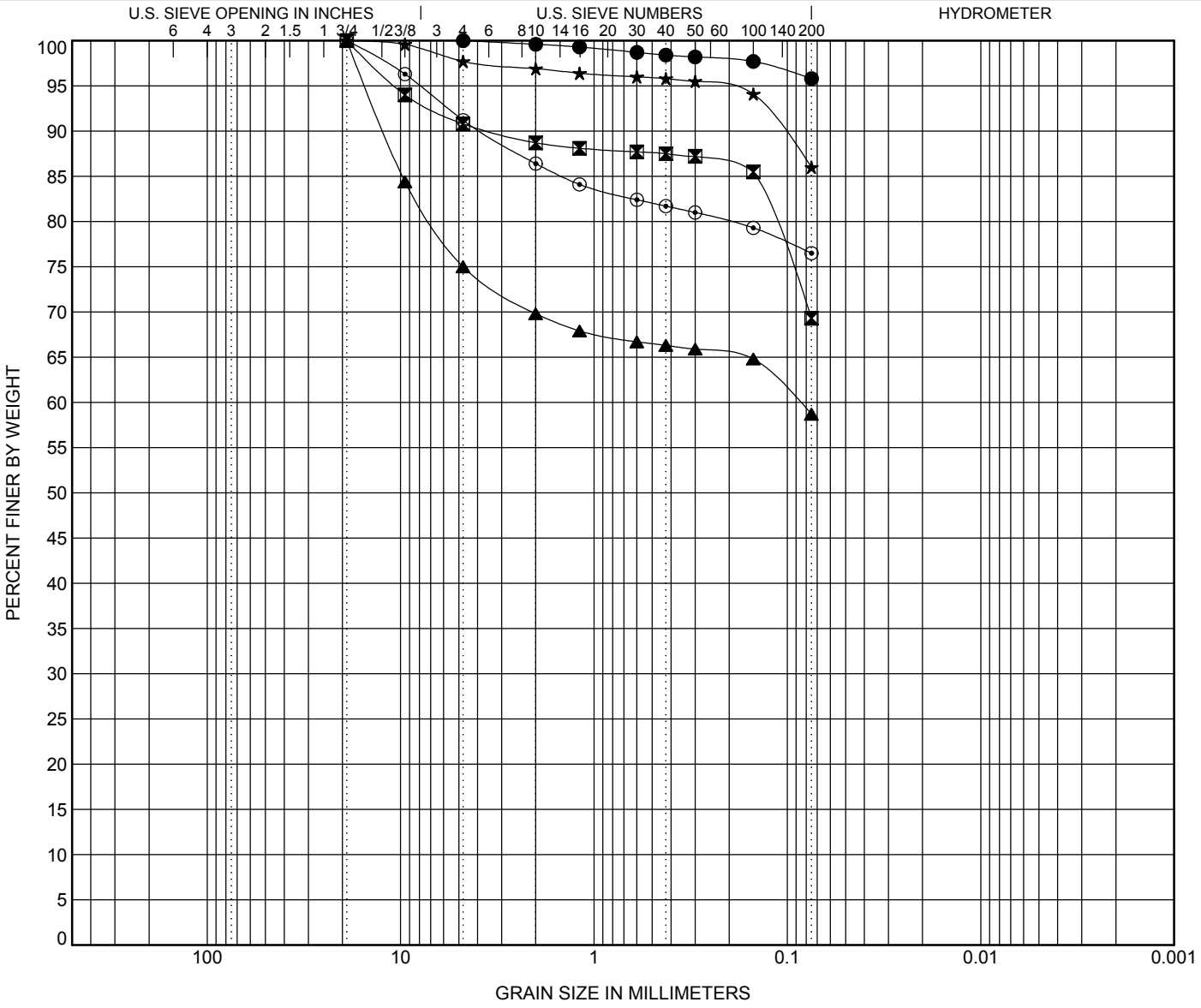
PROJECT NO. 256748 **PROJECT LOCATION** Sallisaw, OK



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	6	6.0	**FAT CLAY(CH)**					
⊠	12	3.5	**SANDY FAT CLAY(CH)**					
▲	19	1.0	**GRAVELLY FAT CLAY with SAND(CH)**					
★	24	1.0	**LEAN CLAY(CL)**					
⊙	31	3.5	**FAT CLAY with SAND(CH)**					

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	6	6.0	4.75				0.0	4.2	95.8	
⊠	12	3.5	19				9.2	21.5	69.3	
▲	19	1.0	19	0.087			25.0	16.3	58.7	
★	24	1.0	19				2.3	11.7	86.0	
⊙	31	3.5	19				8.8	14.7	76.5	

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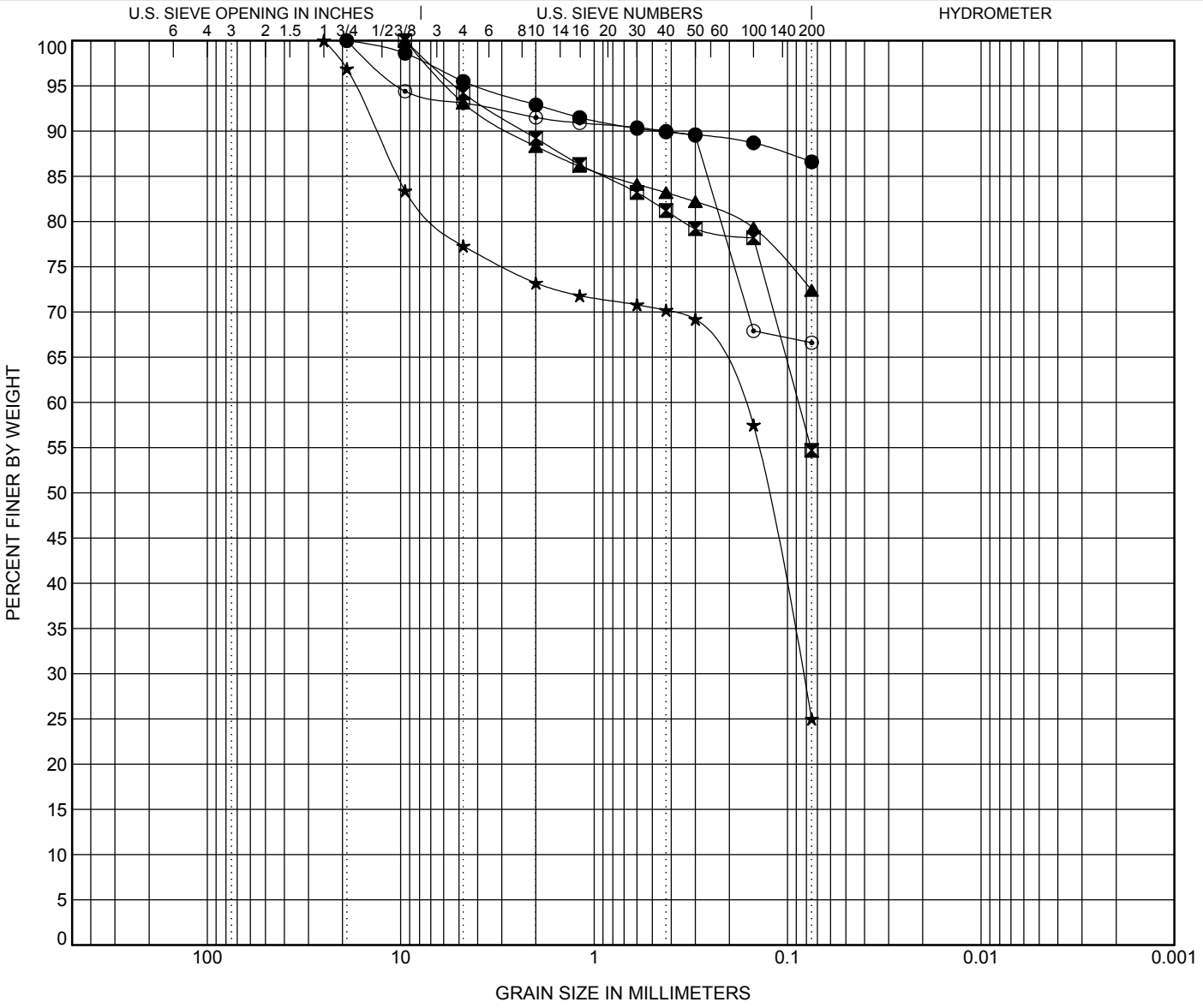
GRAIN SIZE DISTRIBUTION

CLIENT Cherokee Nation Entertainment **PROJECT NAME** National Cherokee Nation Park

PROJECT NO. 256748 **PROJECT LOCATION** Sallisaw, OK



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	71	3.0	FAT CLAY(CH)	57	18	39		
⊠	73.2	0.0	SANDY LEAN CLAY(CL)	27	18	9		
▲	75	3.5	LEAN CLAY with SAND(CL)	29	18	11		
★	83	0.0	CLAYEY SAND with GRAVEL(SC)					
⊙	85	1.0	SANDY FAT CLAY(CH)					

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	71	3.0	19				4.5	8.9	86.6	
⊠	73.2	0.0	9.5	0.088			5.8	39.5	54.7	
▲	75	3.5	9.5				6.9	20.7	72.4	
★	83	0.0	25	0.174	0.083		22.7	52.3	25.0	
⊙	85	1.0	19				6.9	26.5	66.6	

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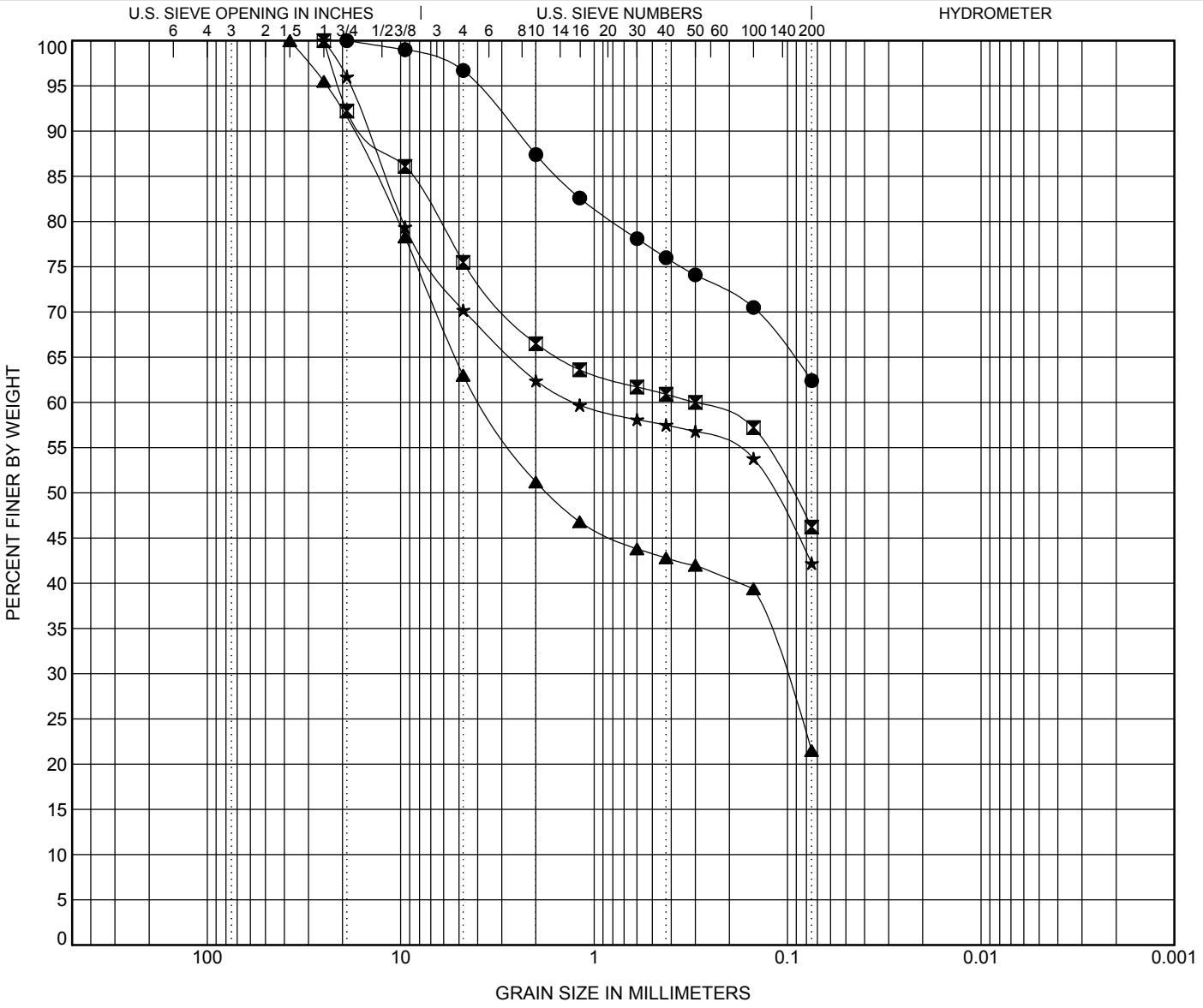
GRAIN SIZE DISTRIBUTION

CLIENT Cherokee Nation Entertainment **PROJECT NAME** National Cherokee Nation Park

PROJECT NO. 256748 **PROJECT LOCATION** Sallisaw, OK



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	89	1.0	SANDY FAT CLAY(CH)					
⊠	95	3.5	CLAYEY SAND with GRAVEL(SC)					
▲	107	1.0	CLAYEY SAND with GRAVEL(SC)					
★	108	1.0	CLAYEY GRAVEL with SAND(GC)	30	13	17		

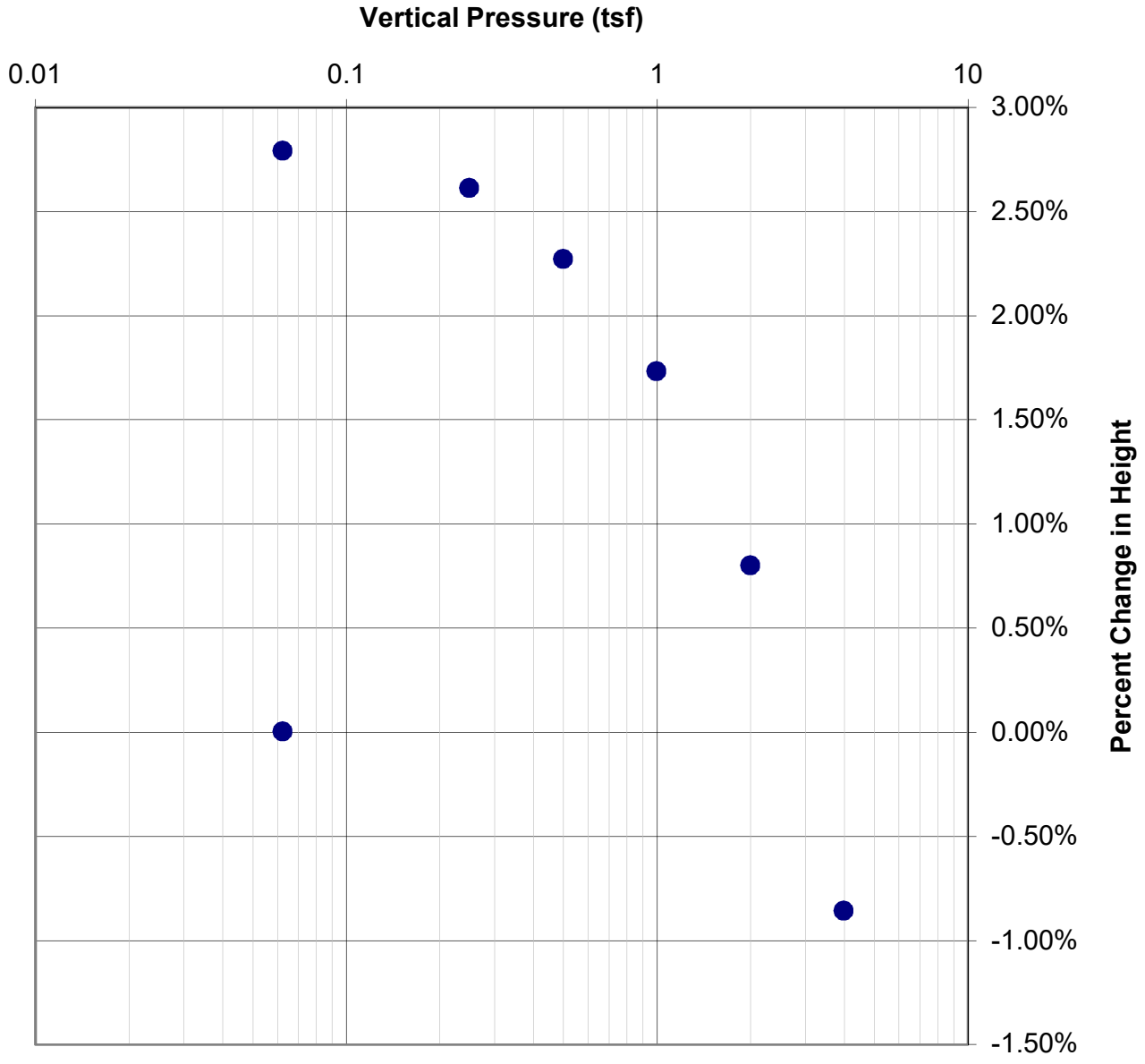
	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	89	1.0	19				3.3	34.3	62.4	
⊠	95	3.5	25	0.3			24.5	29.3	46.2	
▲	107	1.0	37.5	3.812	0.104		37.0	41.5	21.5	
★	108	1.0	25	1.259			29.8	28.0	42.2	

APPENDIX VI – SWELL TEST RESULTS

Palmerton & Parrish, Inc.
4168 W. Kearney St. - Springfield, MO 65803
Phone: (417) 864-6000 Fax: (417) 864-6004

Client:	**Cherokee Nation Entertainment**	Dry Unit Wt lbs/cf	99.6	% Swell
Project:	**National Cherokee Nation Park**	Trimmings M%	24.5%	**2.79%**
Boring	**B-4**	Specimen M%	27.0%	
Depth	**8'-10'**	Liquid Limit	54	Swell Pressure (TSF)
Description:		Plastic Limit	17	**3.00 TSF**
		Plastic Index	37	

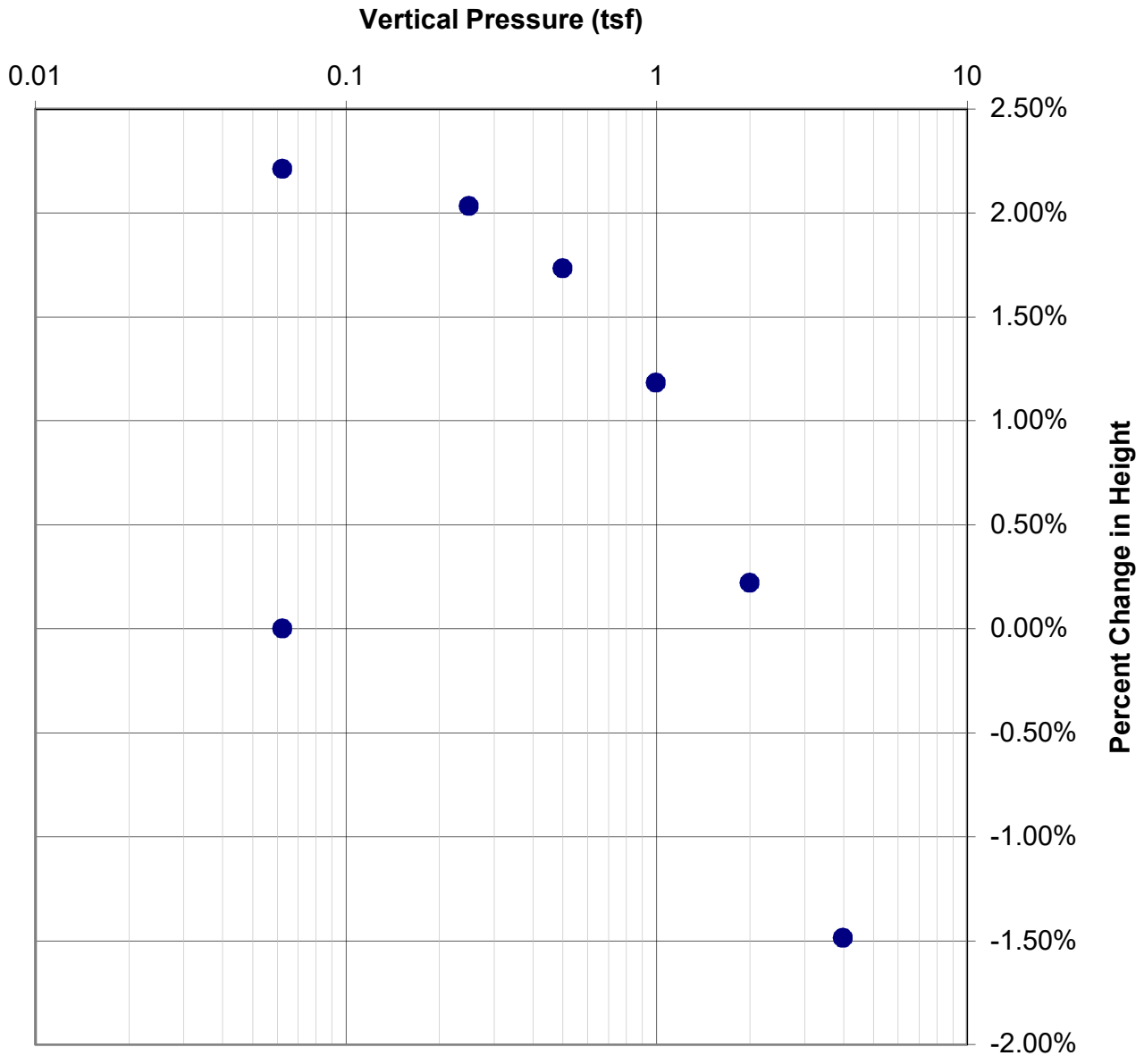
Swell Test Results



Palmerton & Parrish, Inc.
4168 W. Kearney St. - Springfield, MO 65803
Phone: (417) 864-6000 Fax: (417) 864-6004

Client:	**Cherokee Nation Entertainment**	Dry Unit Wt lbs/cf	105.8	% Swell
Project:	**National Cherokee Nation Park**	Trimmings M%	21.3%	**2.21%**
Boring	**B-5**	Specimen M%	22.3%	
Depth	**6'-8'**	Liquid Limit	49	Swell Pressure (TSF)
Description:		Plastic Limit	16	**2.30 TSF**
		Plastic Index	33	

Swell Test Results



APPENDIX VII – ROCK CORE PHOTOGRAPHS

4168 W. Kearney St.
Springfield, MO 65803
Ph: (417) 864-6000
www.ppimo.com

Boring 86
8.4 feet to 18.4 feet

Boring 86
18.4 feet to 28.4 feet

APPENDIX VIII - IMPORTANT INFORMATION REGARDING YOUR GEOTECHNICAL REPORT

Important Information about This

Geotechnical-Engineering Report

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

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

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems 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 below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a 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. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

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

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *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.*

This Report May Not Be Reliable

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

- for a different client;
- for a different project;
- 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, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been 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 your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide 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 judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed 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 full-time 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 on hand quickly 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 observation.

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 informational 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, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. 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. 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 relate any 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 yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

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, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled 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

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

APPENDIX B

ADDENDA

Addendum No. 1

NATIONAL CHEROKEE NATION PARK
PHASE I SITE INFRASTRUCTURE IMPROVEMENTS

Bids Received Until: **5:00 pm Thursday, July 14, 2022**
Cherokee Nation Businesses, LLC
777 W. Cherokee St.
Catoosa, Oklahoma 74015

This addendum modifies the plans and bid documents for the subject project and shall become a part of the contract documents. Bidders shall acknowledge receipt of this addendum in the bid schedule form and on the outside of your bid envelope. Failure to do so may subject bidder to disqualification.

Please note the following corrections, revisions and clarifications to the subject project bidding documents:

1. Final Plans

   The Final Plans should be removed and replaced with "National Cherokee Nation Park – Final Plans – Addendum No. 1"

Final Plans have been revised, major changes are as follows:

- Added "Boat Launch Improvements" Final Plans as Added Alternate No. 1.
- Revisions to Planning and Landscape Architecture Plans.
- Added Dumpster Pads and Restroom Facilities Locations.
- Added utility services to center open space on western RV area.
- Added RV parking/pad space numbering for clarity.

2. Bid Proposal Schedule and Technical Specifications Booklet

   The Bid Proposal Schedule and Technical Specifications Booklet should be removed and replaced with "National Cherokee Nation Park – Bid Proposal Schedule and Technical Specifications Booklet – Addendum No. 1"

Bid Proposal Schedule has been revised as noted below:

- Added "Section VI - Added Alternate No. 1 – Boat Ramp Improvements"
- Minor quantity updates in Sections I, II and III to reflect plan changes discussed in Item 1 of this addendum.

Technical Specifications have been revised as noted below:

- Added Boat Ramp Specifications
- Added Architectural Specifications

3. Bid Schedule - Total Contract Time

Total Contract Time has been updated to <u>600 calendar days</u> for final completion, including <u>50 inclement weather days.</u>

Please acknowledge the receipt of Addendum No. 1 on the outside of your Bid Envelope and in the Bid Schedule form.

Prepared By:
Halff and Associates, Inc.

6/24/2022

Project Engineer Date

Receipt of This Addendum is Hereby Acknowledged:

Company

Printed Name

Signature Date

Addendum No. 2

NATIONAL CHEROKEE NATION PARK
PHASE I SITE INFRASTRUCTURE IMPROVEMENTS

Bids Received Until: **5:00 pm Thursday, July 14, 2022**
Cherokee Nation Businesses, LLC
777 W. Cherokee St.
Catoosa, Oklahoma 74015

This addendum modifies the plans and bid documents for the subject project and shall become a part of the contract documents. Bidders shall acknowledge receipt of this addendum in the bid schedule form and on the outside of your bid envelope. Failure to do so may subject bidder to disqualification.

Please note the following corrections, revisions and clarifications to the subject project bidding documents:

1. Final Plans – Remove the following sheets and replace with attached sheets revisions:
    A. Demolition Plans – Sheets C9 thru C11 and C13 thru C21
    B. Paving Plans – Sheet C24
    C. Utility Plans – Sheets C74, C78, C79, C82, and C85 thru C88
    D. Erosion Control Plans – Sheet C127
    E. W/WW Treatment Plants and Pump Station Plans – Sheets W1 thru W3, W7 thru W9, and W21 thru W30
    F. Landscape Plans – Sheets L01, L04, L08 thru L13, L15, and L16

These revisions address the following:
- Clearing limits and area for proposed water and sanitary sewer line installations.
- Tree protection and selective clearing in relation to proposed paving and utilities.
- PLA plan references in relation to entry/exit and roundabout paving.
- Notes to address discharge permit for WWTP.
- Miscellaneous WTP and WWTP notes and specification references.
- Minor Landscape updates

2. Bid Proposal Schedule and Technical Specifications Booklet

    The "Bid Proposal Schedule – Addendum No. 1" should be removed and replaced with "National Cherokee Nation Park – Bid Proposal Schedule – Addendum No. 2"

Bid Proposal Schedule has been revised as noted below:
- Bid Item No. I-13 – Quantity revised to 23,593 SF
- Bid Item No. I-15 – Quantity revised to 492 SY

- Bid Item No. I-16 – Quantity revised to 63 SY
- Bid Item No. I-17 – Quantity revised to 52 SY
- Bid Item No. II-11 – Quantity revised to 4,480 LF
- Bid Item No. I-47 – Quantity revised to 5,000 SF
- Bid Item No. I-51 – Added Bid Item for Restroom Facility Allowance

Add the attached Wastewater Treatment Plant Specifications to the Booklet

Add the following bid item specifications:

BID ITEM NO. I-47: 7-INCH THICK, 4,000 PSI STAINED AND STAMPED DECORATIVE REINFORCED PORTLAND CEMENT CONCRETE PAVEMENT

The work for "7-inch Thick, 4,000 psi Stained and Stamped Decorative Reinforced Portland Cement Concrete Pavement" pay item shall conform to the provisions of ODOT Specification Sections 414 and 701.

The bid quantity was established for bidding purposes only. Quantities for payment will be based on the amount of decorative pavement actually installed, complete in place.

Stained and stamped decorative concrete pavement shall be constructed in accordance with the lengths and widths as shown on the plans and shall be poured 7-inches thick with #3 bars on 24" centers.

Integral coloring shall be "Platinum" or "Natural Gray" or approved equal and shall be submitted and approved by the Owner prior to installation.

Patterning shall be "Ashlar" or "Cobble Stone" or approved equal and shall be submitted and approved by the Owner prior to installation.

In addition to the requirements of the standard specifications, decorative pavement shall be in accordance with the manufacturer specifications. This includes their requirements for expansion joints, joint filler board, and concrete mix.

All work performed must be of the same manufacturer and all materials used, including concrete mix, must be the same for the entire project. Color hardeners and release agents as recommended by the tooling manufacturer shall be used.

Measurement and Payment for 7-inch Thick, 4,000 psi Stained and Stamped Decorative Reinforced Portland Cement Concrete Pavement shall be by the square foot (SF) and shall include thickened edge, integral colored concrete, patterning, reinforcing steel, jointing, curing compound, sealing materials, labor, equipment, and incidentals necessary to complete the work.

BID ITEM NO. I-51: RESTROOM FACILITY ALLOWANCE

This bid item shall be used at the discretion of the Nation for payment for all materials, labor, and other incidentals necessary for the installation of a prefabricated restroom facility that will include men's, women's and family restrooms, laundry facility, at minimum three (3) shower rooms, one of which being ADA accessible, and maintenance area. Contractor shall provide submittal for proposed restroom facility for Nation and Engineer approval prior to commencing

installation. This item will only pay for work performed at the direction of the Nation and Engineer. Any work performed without authorization of the Nation shall not be paid under this bid item. At the completion of the project, funds not utilized in this item shall be removed from the contract agreement via a construction change order. The amount for this item shall be included with their bid and is set for all bidders at $600,000 and is not to be altered.

3. The following are RFI's that came up during the "Questions and Answers" period and the responses given:

    A. **Q:** Since this project is being governed by ODOT specs, will the asphalt be indexed? Will the price be firm or an escalation be allowed per the ODOT spec 411.06(B)?
    A: For bidding purposes, these items will be bid as a firm unit price. This is a special provision allowed by ODOT when the contract pay units of measure are by ton. Since the modified provisions for measurement and payment provided with each Asphalt bid item are to measure and pay by square yard, ODOT 411.06(B)(2) Paragraph 2 states "when the units of measure in this contract for the items of work listed in the table do not correspond with the units shown in the table (i.e. Asphalt Concrete paid by the square yard, etc.), those items will not be subject to the terms of this special provision or any asphalt binder price adjustment." However, the Nation is open to considering indexed pricing and this can be discussed further at the preconstruction meeting.

    B. **Q:** Please provide Silt Fence Quantity for the Phase 1 portion, it is provided for the Addendum 1 Boat Launch Improvements.
    A: Phase 1 silt fencing is bid differently than the Boat Launch Improvements. Silt fence quantities are provided on the Phase 1 plan sheets for reference, but silt fence quantity and cost is subsidiary to Bid Item No. I-4. Total Phase 1 plan quantity for silt fencing is approximately 8,950 linear feet.

    C. **Q:** Please provide Geo-Tech Borehole Layout with current Site Plan.
    A: This will be considered for request through the Geotech consultant but will not be available during the bidding phase.

    D. **Q:** Please provide Circles shown on the Demolition Plans on all sheets.
    A: This has been addressed in the revised demolition sheets provided with this addendum.

    E. **Q:** Please provide specifications and plans for the demolition areas of the proposed SS and Water to be constructed outside of current Demolition Plan Sheets.
    A: This has been addressed in the revised demolition sheets provided with this addendum.

    F. **Q:** Please provide CADD files.

A: CADD files will be made available after the bid opening to the awarded bidder. Files will not be provided during the bidding phase.

G. **Q:** Addendum 1 Plans show to remove concrete for an old set of bathrooms. Has the septic system for them been removed? And if not Please provide Specifications on how you would like them removed.
A: The septic system holding tank has been confirmed to have been removed previously by the Nation. If any part of the system or piping remains upon removal/excavation activities, existing lines shall be cut, plugged and abandoned in place at a cost subsidiary to the project.

H. **Q:** Who is the regulation authority (ODEQ, EPA, etc..) on the Phase 1 and Addendum 1 areas inside the boundaries of the Cherokee Nation owned land and who is for the area on the C of E owned part in Addendum 1?
A: The Cherokee Nation Environmental Protection Commission (EPC) for land inside the boundary line. United States Army Corps of Engineers (USACE) for land outside the boundary line. Nation EPC is actively engaged in coordination with the USACE on this project.

I. **Q:** The Specification for Pay Item No. I-5 states it is to be paid out monthly. Will CN consider 100% payment up front? Can this be changed to match ODOT Specifications payment of two installments?
A: The Nation is open to paying this bid-item 100% up-front. This can be discussed further at the preconstruction meeting.

J. **Q:** Please update Quantities and Plans to show removal of gravel under pavement in areas to be graded.
A: Please refer to the specifications for Bid Items I-6, I-7, and I-20 thru I-22 for clarifications on subgrade removal under existing pavement to establish proposed grades.

K. **Q:** Granite is stated on the Plans and Specifications may we substitute limestone?
A: Yes, approved equals will be considered by the Nation and/or Engineer per Bid Items I-28 and I-29 specifications.

L. **Q:** Please provide Striping Plans and Specifications for Phase 1.
A: Any and all proposed striping or signage is shown on the Pavement Plans, see Bid Item I-40 in specifications booklet for further details.

M. **Q:** Is Owner Providing all Quality Control Testing for Fill, Asphalt and Concrete?
A: Yes, Nation will be handling testing.

N. **Q:** Will the custom lettering be required as shown on the ODOT Storm Drain Detail located on sheet C134?
A: No.

O. **Q:** What grade of oil (on asphalt) is required? PG 64-22 or other?
A: 64-22 minimum is required; RAP shall not be greater than 25%.

P. **Q:** Where is the staging area indicated?
A: Staging Area location(s) will be discussed and decided at the preconstruction meeting. Park land will be allowed for use.

Q. **Q:** Gasket & Bell restraint at all joints or bends only?
A: Jointing shall be per manufacturer recommendations and per requirements of AWWA as stated in the ODOT specifications.

R. **Q:** Is the Nation considering Cost Plus on materials only?
A: The Nation will evaluate this at the preconstruction meeting. The Nation is open to paying partial payment for materials on hand and then full payment once materials are installed complete in place.

S. **Q:** If Contractor brings any significant VE savings to the CN, will the contractor receive any percentage of the savings back?
A: The Nation will consider this as an option. Percentage to Contractor is currently TBD.

T. **Q:** General Note 6 on Sheet W1 states to place 12" of topsoil. The other Notes and Specifications throughout the Plans state 4", please clarify.
A: Topsoil shall be 4” throughout, not shall be revised.

U. **Q:** Please confirm discharge permit values. S&L can’t provide a plant to meet an unknown discharge permit. Phase 1 and Phase 2 show Effluent Limits of 10 TSS mg/L and 15 BOD mg/L. Previously, we were told Effluent Limits of 30 TSS mg/L and 30 BOD mg/L; the plant shown W25 / W 26 / W 27 was designed 30/30. If the Effluent Limits are lower, it would require a larger and more expensive plant. Please confirm discharge permit values.
A: Target permit values will be 30 BOD / 30 TSS for bidding purposes.

V. **Q:** No specifications were provided that relate to the wastewater treatment plant. Please provide relevant sections.
A: WWTP specifications are provided with this addendum

W. **Q:** 12” or 16” overflow line [at Water Treatment Plant]?
A: 12”

X. **Q:** Model/Detail for Eyewash Station.
A: This will be provided with the specifications in this addendum.

Y. **Q:** Cookson Electric has not completed the design at this time for Main Line extension. Item B under General Site Plan Notes on sheet E001 cannot be performed, please advise.
A: Halff and the Nation are coordinating with Cookson Hills on this. This will be discussed further at the preconstruction meeting.

Z. **Q:** On Sheet E001, Electrical Legend the symbol for the RV Pedestals calls out for a NEMA 5-30R receptacle but most RV Pedestals have a type TT30R configuration. Please confirm that the desired receptacle type is a NEMA 5-30R.
A: The 30A receptacle is type TT as indicated in the Pedestal cut sheet and it's integrated in the Pedestal. See cutsheet for RV Pedestal:

MILBANK
ENERGY AT WORK

U5200-XL-75

Catalog Number	U5200-XL-75
Marketing Product Description	Unmetered Small Closing Plate TT30 1450 520GR Single Pedestal Direct Bury
UPC	784572258198
Length (IN)	5.188
Width (IN)	8.688
Height (IN)	64.5
Brand Name	Milbank
Type	Unmetered Power Supply
Special Features	Single Pole 20 Ampere Breaker and Single Pole 30 Ampere Breaker and Double Pole 50 Ampere Breaker
Application	RV Power
Standard	UL Listed;Type 3R
Voltage Rating	Up to 240 Volts Alternating Current
Amperage Rating	125 Continuous Ampere
Phase	1 Phase
Frequency Rating	60 Hertz
Size	5.188L x 8.688W x 64.5H
Number Of Cutouts	3

Cutout Size	One Single Pole 20 Ampere Breaker and One Single Pole 30 Ampere Breaker and One Double Pole 50 Ampere Breaker
Cable Entry	Underground
Terminal	Double Mechanical
Insulation	Glass Polyester
Mounting	Pedestal
Enclosure	G90 Galvanized Steel with Powder Coat Finish
Jaw Quantity	0 Terminals
Bypass Type	No Bypass
Number of Meter Positions	Single Power Head
Equipment Ground	2 Barrel Ground Lug and Ground Bar
Hub Opening	Small Closing Plate
Line Side Wire Range	6 AWG - 350 kcmil
Number Branch Circuits	2
Number Of Receptacles	3
Receptacle Configuration	One NEMA 14-50 and One NEMA TT30 and One NEMA 5-20 Ground Fault

Please consult serving utility for their requirements prior to ordering or installing, as specifications and approvals vary by utility and may require local electrical inspector approval. All installations must be installed by a licensed electrician and must comply with all national and local codes, laws and regulations. Milbank reserves the right to make changes in specifications and features shown without notice or obligation.

AA. **Q:** The Unit Price Bid Schedule on Pay Item No. IV-16 gives a description of a MARINA PANELBOARD that is 100A MLO. There are no MLO panelboards scheduled for the project. Is this intended to be Panel LP3A?
A: Yes, this is LP3A and per plans MCB.

BB. **Q:** There is no electric metering shown for any of the electrical services. Will this facility be primary metered or should each service be metered in accordance with Cookson Hills Electric Standards?
A: This will be primary metered.

CC. **Q:** May we grind all trees and shrubs under 6" in diameter?
A: Yes.

DD. **Q:** May we burn to dispose of removed trees, shrubs and brush?
A: Yes.

EE. **Q:** Can we substitute 6' T-Posts for the Lodgepole tree supports?
A: No. Lodgepoles shall be used per plan details.

FF. **Q:** Can we substitute industry standard straps for the Hemp ties?
A: Yes.

Please acknowledge the receipt of Addendum No. 2 on the outside of your Bid Envelope and in the Bid Schedule form.

Prepared By:
Halff and Associates, Inc.

7/8/2022

Project Engineer Date

Receipt of This Addendum is Hereby Acknowledged:

Company

Printed Name

Signature Date