Final Geotechnical Engineering Report

Hamm Road Wet Weather Storage Facility

Chattanooga, Tennessee

October 3, 2018

Terracon Project No. E2175127F

Prepared for:

Hazen and Sawyer

Nashville, Tennessee

Prepared by:

Terracon Consultants, Inc.

Chattanooga, Tennessee

October 3, 2018

Hazen and Sawyer
545 Mainstream Drive, Suite 320
Nashville, Tennessee 37228

Attn: Mr. Michael Orr, P.E.
P: (615) 202-6219
E: morr@hazenandsawyer.com

Re: Final Geotechnical Engineering Report
Hamm Road Wet Weather Storage Facility
155 Hamm Road
Chattanooga, Tennessee
Terracon Project No. E2175127F

Dear Mr. Orr:

We have completed the Final Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. PE2175127 dated December 6, 2017. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs for the proposed project.

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

Sincerely,
Terracon Consultants, Inc.

JOHN D. CANNON
REGISTERED ENGINEER
No. 20106
STATE OF TENNESSEE

10-3-18

John D. Cannon, P.E.
Senior Engineer

for:
Frank Whitman, P.E.
Senior Engineer

REPORT TOPICS

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

ATTACHMENTS

Final Geotechnical Engineering Report

Hamm Road Wet Weather Storage Facility

155 Hamm Road

Chattanooga, Tennessee

Terracon Project No. E2175127F

October 3, 2018

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed wet weather storage project to be located at 155 Hamm Road in Chattanooga, Tennessee. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil (and rock) conditions
- Groundwater conditions
- Site preparation and earthwork
- Demolition considerations
- Excavation considerations
- Dewatering considerations
- Foundation design and construction
- Floor slab design and construction
- Seismic site classification per IBC
- Lateral earth pressures
- Pavement design and construction

The geotechnical engineering scope of services for this project included the advancement of 38 test borings to depths ranging from approximately 10 to 71.6 feet below existing site grades.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs in the **Exploration Results** section of this report.

SITE CONDITIONS

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

Item	Description
Parcel Information	The project is located at 155 Hamm Road in Chattanooga, Tennessee. Approximate Latitude/Longitude 35.054765° / -85.329771° (See Exhibit D)

Item	Description
Existing Improvements	According to Google Earth much of the property is covered with concrete slabs which are the remnants of a heavy equipment manufacturing facility operated by Koehring. All buildings were demolished but concrete slabs were left in place. Fire hydrants remain, but no other improvements are apparent.
Current Ground Cover	According to Google Earth current ground cover consists of concrete slabs, gravel, grass, shrubs, and some trees.
Existing Topography	According to Google Earth the site elevation ranges from 665 to 691.
Geology	Most of the site is underlain by the Mississippian age Fort Payne Formation, a formation characterized by bedded and disseminated chert, shale and siltstone beds, and zones of limestone and dolomite. The thickness of the Fort Payne is variable because of differential dissolution of the carbonate materials in the formation. The eastern edge of the site is underlain by the Mississippian / Devonian age Chattanooga Shale, a layer of brownish-black bituminous shale followed by the Silurian age Rockwood Formation, a reddish brown and yellow shale with thin beds of siltstone and sandstone. Geologic maps of the area indicate the beds strike between north and northeast, with dip of beds between about 5 and 10 degrees ranging from west to southeast due to crumpling.

PROJECT DESCRIPTION

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

Item	Description
Information Provided	Site plans and associated information supplied by Hazen and Sawyer.
Project Description	Wet weather storage project to include diversion structures, a pumping station, three 10 million gallon tanks, and associated buildings and structures.
Proposed Structures	Anticipated structures include up to three 10 MG tanks as part of Phase 1 of the Wet Weather Combined Sewer Storage project. Other components will include the Diversion Structure, Pump Station, Electrical Building, Generator Building, and Odor Control Building
Loading - Tanks	195 ft diameter, 45 ft high, prestressed concrete, bearing pressure 3,500 lbs/sq ft
Loading – Buildings	Slab supported structures are anticipated at the Electrical Building, Generator Building, and Odor Control Building. Allowable bearing pressure = 1,000 lbs/sq ft or less Tolerable settlement: < 1 inch total, < ½ inch differential Detect and remove zones of fill as noted in **Earthwork**

Item	Description
Loading - Diversion Structure	24 ft by 20 ft top of structure at grade, bearing 31 feet below ground at 2,000 lbs/sq ft
Loading - Pump Station	44 ft by 35 ft top of structure at grade, bearing 51 feet below ground at 3,500 lbs/sq ft
Loading - Valve Vault	14 ft by 11 ft top of structure at grade, bearing 8 feet below ground at 1,000 lbs/sq ft
Grading/Slopes	Finished floor elevation has not been established. Existing concrete slabs will be demolished. The underlying fill will be undercut to a depth of at least 4 feet below final grade. Removal of structurally or environmentally unacceptable materials beyond that depth may be required. We recommend slopes, whether cut or fill less than 15 feet in height should be no steeper than 3H:1V (Horizontal: Vertical). Slopes higher than 15 feet should be individually analyzed for stability, and may require additional sampling and laboratory testing of soils to determine the unconsolidated undrained shear strength of soil for analysis of long-term stability.
Free-Standing Retaining Walls	Retaining walls will likely be required between the excavated slope/bank along the western boundary of the site and the adjacent tank(s).
Pavements	Paved driveway and parking will be constructed in selected site areas yet to be determined. Traffic is understood to be limited to maintenance vehicles.
Estimated Start of Construction	2018

GEOTECHNICAL CHARACTERIZATION

Subsurface Profile

We have developed a general characterization of the subsurface soil and groundwater conditions based upon our review of the data and our understanding of the geologic setting and planned construction. The following table provides ground surface elevation and auger refusal depth at each boring location.

Boring Number	Ground Surface Elevation (feet) [1]	Auger refusal Depth (feet) [1]
T-1	676.43	29.2
T-2	676.77	40.4
T-3	675.85	70.0
T-4	676.18	41.4
T-5	675.58	40.6
T-6	675.72	10.0
T-7	676.39	36.5
T-8	674.97	55.6
T-9	675.95	67.6
T-10	676.50	71.6
T-11	676.12	51.0
T-12	676.54	44.3
T-13	674.82	46.0
T-14	676.58	59.0
T-15	676.53	41.8
T-16	676.41	70.0
T-17	674.51	70.0
T-18	669.44	50.1
T-19	673.69	56.0
T-20	674.76	60.4
T-21	669.44	49.3
T-22	673.74	53.0
T-23	674.03	59.9
T-24	669.50	49.0
DS-1	661.81	46.5
DS-2	661.39	44.2
DS-3	661.39	44.2
OC-1	675	51.2
OC-2	674	53.3
OC-3	676	53.0
OC-4	676	58.5
PS-1	670	54.7
PS-2	669	49.5
PS-3	669	48.5
PS-4	669	49.1

EB-1	669	51.2
EB-2	669	49.8
VB-1	676	48.6

The geotechnical characterization forms the basis of our geotechnical calculations and evaluation of site preparation, foundation options and pavement options. As noted in **General Comments**, the characterization is based upon widely spaced exploration points across the site, and variations are likely.

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/Density
Surface	6'-22'	Fill / Yellow and Red Silty Clay, Foundry Sand in some locations	N/A
1	28'-38'	Lean Clay / Light Brown	Medium Stiff to Stiff
2	48'-58'	Lean Clay / Clayey Gravel	Stiff to Very Stiff
2a	48'-58'	Gray Clay	Very Soft
3	48'-62'	Silty Clayey Sand	Dense
4	Undetermined	Limestone / Dolomite / Shale	Hard

Conditions encountered at each boring location are indicated on the individual boring logs shown in the **Exploration Results** section and are attached to this report. Stratification boundaries on the boring logs represent the approximate location of changes in native soil types; in situ, the transition between materials may be gradual.

The site is underlain by a geologic complex that includes rock which may be susceptible to dissolution along joints and bedding planes in the rock mass. This may result in voids and solution channels within the rock strata and a highly irregular bedrock surface. The weathering of the bedrock and subsequent collapse or erosion of the overburden into these openings results in what is referred to as karst topography, if there are an abundance of collapses within an area.

The owner should be aware of karst related risks associated with this site. Any construction in karst topography is accompanied by some degree of risk for future internal soil erosion and ground subsidence that could affect the stability of the proposed structures. However, our borings did not disclose any obvious signs of sinkhole activity within the depths explored and a review of topographic drawings did not disclose closed depressions within relative proximity of the project site.

Groundwater Conditions

The boreholes were observed while drilling and after completion for the presence and level of groundwater. In addition, delayed water levels were also obtained in some borings. The water levels observed in the boreholes can be found on the boring logs in **Exploration Results**, and are summarized below.

Boring Number	Approximate Depth to Groundwater while Drilling (feet) [1]	Approximate Depth to Groundwater after Drilling (feet) [1]
T-3	32	Borehole caved
T-4	33	Borehole caved
T-5	33	Borehole caved
T-8	33	Borehole caved
T-9	30	Borehole caved
T-11	33	Borehole caved
T-17	35	Borehole caved
T-18	34.6	Borehole caved
T-19	20	Borehole caved
T-20	50[2]	Borehole caved
T-21	13	Borehole caved
T-22	53	Borehole caved
T-23	50[3]	Borehole caved
T-24	33	Borehole caved
PS-1	48.5	Borehole caved
PS-2	48.5	Borehole caved
PS-3	18.5	44
DS-2	38	Borehole caved
DS-3	18.5	44.2

1. Below ground surface
2. Wet soils observed at 38.5 feet
3. Wet soils observed at 48.5 feet

Groundwater was not observed in the remaining borings while drilling, or for the short duration the borings could remain open. However, this does not necessarily mean the borings terminated above groundwater, or the water levels summarized above are stable groundwater levels. Due to the low permeability of the soils encountered in the borings, a relatively long period may be necessary for a groundwater level to develop and stabilize in a borehole. Long term observations in piezometers or

observation wells sealed from the influence of surface water are often required to define groundwater levels in materials of this type.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project. Installation of a dewatering system for construction of below ground structures, especially the diversion structure and the pump station, should be expected to influence ground water levels in adjacent areas, and may have effects not directly related to ground water.

Geophysical Data Interpretation

In viewing the shear-wave velocity profiles, the depicted color scale represents estimated shear-wave velocities. According to the 2012 International Building Code Table 1613.5.2, shear-wave velocities are correlated to specific soil profile characteristics as described in the table below.

CONSISTENCY	SHEAR-WAVE VELOCITY (FT/SEC)
Rock	>2500
Weathered Bedrock	1250>2500
Stiff Soil	600>1250
Soft Soil	<600

Because soft soil is often found in and around incipient sinkholes, shear-wave velocities below 600 feet per second (ft/sec) are of interest. Also, shear-waves are not able to pass through voids. Consequently, voids in the soil horizon will also result in lower shear-wave velocity zones. Not all zones of soft soil indicate potential subsidence activity, but zones of soft soil found in areas with other anomalies are potential areas of concern. On the shear-wave velocity profiles, soft soils are represented by the color magenta while green, yellow, orange and red represent velocities in the range considered to be weathered rock and rock. Blue and green are within the range considered to be stiff to very dense soil. Sinkholes have been noted to occur at topographic lows and above topographic highs in the bedrock surface. However, sinkholes tend to favor zones where the bedrock surface has sharp changes over a relatively short distance.

It should be noted the terminology in the IBC table regarding the relative consistency of the soil profile does not directly match soil classification consistency ranges based on the Standard Penetration Test (SPT) N-values or undrained shear strength. Generally, a ‘Soft Soil’ by the IBC chart correlates to soils that in normal geotechnical terms are considered to have consistencies varying between very soft to stiff, whereas ‘Stiff Soil’ based on velocity correlates to a consistency of very stiff.

Geology

The project site is located within the Valley and Ridge Physiographic Province, which is comprised of geologic formations that were deposited during the Paleozoic Era. According to the *Geologic Map of Hamilton County, Tennessee,* compiled by Milici, Maher, and Moore III, dated 1978, the majority of the project site is underlain by the Mississippian-aged Fort Payne Formation. The Fort Payne Chert Formation is characterized by bedded and disseminated chert, shale, and siltstone beds, and zones of limestone and dolomite. The eastern portion of the project site is underlain by the Mississippian/Devonian-aged Chattanooga Shale, which consists of brownish-black bituminous shale. Geologic maps of the area indicate the beds strike between north and northeast, with a dip between about 5 and 10 degrees ranging from west to southeast.

It should be noted that the site is underlain by geologic complexes that are susceptible to dissolution along joints and bedding planes in the rock mass. This may result in voids and solution channels within the rock strata and a highly irregular bedrock surface. The weathering of the bedrock and subsequent collapse or erosion of the overburden into these openings results in what is referred to as karst topography, if there are an abundance of collapses within an area. Any construction within terrain susceptible to dissolution is typically accompanied by some degree of risk for future internal soil erosion and ground subsidence that could affect the stability of the proposed construction.

Geophysical Profile Summary

As mentioned in the previous section, four (4) seismic arrays were conducted within the project site. A seismic array location plan along with the shear-wave velocity profiles are provided on Exhibits A-2 through A-6 in the attachments. A summary of the seismic array cross-sections is provided below.

Based on our observations of Array A, weathered rock (represented by the colors green and yellow) appears to be located approximately 25 to 50 feet below the current ground surface. Competent bedrock (represented by the color red) appears to be located below the weathered rock strata across the majority of the profile for Array A. The soil profile (represented by the color blue) appears to have variable thicknesses across the profile indicating an irregular bedrock topography underlying the site.

The cross-sectional profile of Array B also indicates weathered rock at a depth of approximately 25 feet below the current ground surface. There are two areas of relatively softer material underlying the denser stratum on either side of the profile. The first area of relatively softer material underlying denser strata is located underneath geophone location 6 to about 10 – this area depicts weathered rock (represented by the color green) underlying the more competent rock (represented by the color red). The second area is located on the other side of the profile underlying geophones locations 15 to 18. This area indicates very soft soil (represented by the color blue) or a void. This feature is also depicted in the profile for Array C, described below.

Array C indicates variable densities of material in the upper subsurface, possibly fill, as well as a two areas of relatively softer material underlying denser stratum. As depicted in Array B in the previous paragraph, there appears to be an area of very soft soil or a void underlying geophone locations 6 through 9 in Array C. The second feature is located in the center of the profile and is located underlying geophone locations 10 to 13. This area is represented by blue, and is underlying denser strata represented by green. The profile for Array C also depicts variable bedrock topography with varying degrees of density in the upper subsurface profile.

The cross-sectional profile of Array D represents a typical subsurface profile where soil (represented by blue) grades into weathered rock (represented by green and yellow) which grades into competent bedrock (represented by red. Weathered rock appears to be located at a depth of about 25 feet to 40 feet below the current surface. The shallow subsurface indicates varying degrees of density, represented by interbedded blue and green. This pattern of interbedded soil is typically representative of fill materials.

Please note that the depth of the cross-sectional profiles is dependent on the spacing of the geophones. In general, the depth of a cross-section is 1/3 the horizontal length of the seismic array. Arrays A, C, and D were extended to horizontal distances of 300 feet which yielded a depth profile of 100 feet below the current ground surface. Due to site restrictions (i.e. dense vegetation and roadways), Array B was limited to a horizontal distance of 264 feet which yielded a depth profile of 88 feet.

Summary of Geophysical Findings

Observations in the shear-wave velocity profiles indicate variable strength of fill in the upper portions of the subsurface. As represented by interbedded layers of soil and weathered rock, fill in the upper portions of the site appears to be inconsistent. In addition, multiple areas of very soft soil, or voids, were observed underlying relatively denser strata in Array A, Array B, and Array C.

This limited geophysical investigation also revealed a variable bedrock topography underlying weathered-rock zones of varying thickness. The geologic stratification and topography of the site is typical of this formation and should be expected to provide challenges during future construction, especially given the indications of voids or vertically-aligned zones of extreme contrast in soil/rock competence.

GEOTECHNICAL OVERVIEW

Concrete slabs cover much of the site in the vicinity of the proposed storage tanks. These slabs contain steel rails common to industrial facilities that pre-date forklifts. We understand the slabs will be demolished. Fill underlying the slabs extends to depths of about 6 to 22 feet, and consists

of lean to fat clays which range in consistency from very soft to stiff, with medium stiff to soft materials most common near the surface but some zones in which attempts to perform Standard Penetration Testing (SPT) resulted in an SPT N-value of zero, due to the sampler advancing through the 18-inch sample interval under the weight of the hammer and sampling tools. Similar zones were encountered in the native soils underlying the fill.

Auger refusal occurred at depths in the range of about 29 to 72 feet, except for T-6, where auger refusal occurred at 10 feet. In three locations, T-3, T-16 and T-17, drilling was terminated at a depth of 70 feet in hard material. Though augers could still be advanced, drilling was terminated because the risk of mechanical damage of equipment was high.

Rock coring indicated bedrock beneath most of the tank area to be residual chert, the in-place weathering product of the parent limestone formation subjected to dissolution by ground water. Portions of the site are underlain by dolomite bedrock which is a suitable bearing stratum for deep foundations.

The heavy loading of the water tanks and some ancillary structures will require deep foundations. Because of the variable bedrock conditions, we recommend utilizing micropiles, in which steel casing is set into bedrock, a rock socket is advanced, and reinforcement is grouted in place. Driven piles are also possible provided a means of proof-testing can be performed to verify that piles are not bearing on a thin rock stratum, and that the poor lateral support characteristics of the soils above bedrock are acceptable where lateral loading is anticipated, or can be compensated for by the use of battered (angled) piles or other structural means.

Where lightly loaded structures will bear near final grade, loading is light enough that remedial undercutting and fill placement could produce an allowable bearing capacity suitable for shallow foundation support. However, the presence of very soft soils in the 10 to 20 feet above auger refusal could result in excessive settlement if groundwater levels change due to construction dewatering, or the deep foundation installation process. If possible, the grading should be performed during the warmer and drier time of the year. If grading is performed during the winter months, an increased risk for possible undercutting and replacement of unstable subgrade will persist. Additional site preparation recommendations including subgrade improvement and fill placement are provided in the **Earthwork** section.

The **Pavements** section addresses general guidelines for the design of pavement systems, but will require specific loadings and traffic frequencies to provide final pavement design recommendations. However, if a light duty pavement will be adequate, given the likely use for maintenance vehicles only, a minimum recommended pavement section would consist of 6 inches of dense graded base stone topped with 2 inches of base course asphalt and 1 ½ inches of surface course asphalt. Where a rigid pavement is required, a minimum section of light duty pavement would consist of 4 inches of dense graded base topped with 5 inches of Portland

cement concrete. Details are provided in the **Pavements** section of this report.

Support of floor slabs and pavements on or above existing fill materials is discussed in this report. However, even with the recommended construction procedures, there is an inherent risk for the owner that compressible fill or unsuitable material within or buried by the fill will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill, but can be reduced by following the recommendations contained in this report. To take advantage of the cost benefit of not removing the entire amount of undocumented fill, the owner must be willing to accept the risk associated with building over the undocumented fills following the recommended reworking of the material. Should this be the case, certain ancillary buildings and structures may be supported on a shallow foundation system.

The **General Comments** section provides an understanding of the report limitations.

EARTHWORK

Prior to earthwork, extensive demolition will be required, including removal of concrete slabs covering much of the proposed tank locations. Concrete floor slabs included rail systems. Other below grade structures may be encountered during demolition, requiring complete or partial removal and possible remedial fill placement.

Following demolition, earthwork will include clearing and grubbing, excavations and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria as necessary to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Site Preparation

Prior to placing fill, existing vegetation and root mat should be removed. Complete stripping of the topsoil should be performed in the proposed tank pads, as well as ancillary structures, buildings and parking/driveway areas.

The subgrade should be proof-rolled with an adequately loaded vehicle such as a fully loaded tandem axle dump truck. The proof-rolling should be performed under the direction of the Geotechnical Engineer. Areas excessively deflecting under the proof-roll should be delineated and subsequently addressed by the Geotechnical Engineer. Such areas should either be removed or modified by stabilizing with some combination crushed concrete, limestone riprap, geogrid reinforcement, and soil amendments, such as cement stabilization. Excessively wet or dry material should either be removed or moisture conditioned and recompacted.

Existing Fill

As noted in **Geotechnical Characterization**, existing fill was encountered throughout the site to depths ranging from about 6 to 22 feet. The fill contains industrial byproducts including what appears to be foundry sand and may have been placed in a controlled manner, but we have no records to indicate the degree of control. Support of footings, floor slabs, and pavements on or above existing fill soils is discussed in this report. However, even with the recommended construction procedures, there is an inherent risk for the owner that compressible fill or unsuitable material within or buried by the fill will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill, but can be reduced by following the recommendations contained in this report.

If the owner elects to construct the footings and floor slabs on the existing fill, the following protocol should be followed. Once the planned grading has been completed, the area should be undercut 6 feet within the building areas as well as 10 feet beyond the lateral limits of the building areas. Once materials have been removed, the entire area should be proof-rolled with heavy, rubber tire construction equipment such as a fully loaded tandem axle dump truck, to aid in delineating areas of soft, or otherwise unsuitable soil. Once unsuitable materials have been remediated, and the subgrade has passed the proof-roll test, the existing, and undocumented fill that was removed can be evaluated for reuse as structural fill.

If the owner elects to construct pavements on the existing fill, the following protocol should be followed. Once the planned subgrade elevation has been reached the entire pavement area should be proof-rolled. Areas of soft, or otherwise unsuitable material should be undercut and replaced with either new structural fill or suitable, existing on site materials.

Fill Material Types

Fill required to achieve design grade should be classified as structural fill and general fill. Structural fill is material used below, or within 10 feet of structures, pavements or constructed slopes. General fill is material used to achieve grade outside of these areas. Earthen materials used for structural and general fill should meet the following material property requirements:

Fill Type [1]	USCS Classification	Acceptable Parameters (for Structural Fill)
Low Plasticity Cohesive	CL, CL-ML ML, SM, SC	Liquid Limit less than 49 Plasticity index less than 36 12 % or more retained on #200 sieve
High Plasticity Cohesive [2]	CH, MH	Liquid Limit less than 60, Plasticity index less than 40
Granular	GW, GP, GM, GC, SW, SP, SM, SC	0 to 12% Passing #200 sieve

Fill Type [1]	USCS Classification	Acceptable Parameters (for Structural Fill)
On-Site Soils	CL, CH, GC, SC	Liquid Limit less than 55 Plasticity Index less than 36
Controlled Low Strength Material (CLSM)	--	Also known as "flowable fill," CLSM is a cement-sand product commonly recommended as an alternative to structural fill, especially in deep excavations, or where natural water content or heavy precipitation make moisture-conditioning of fill untenable from a scheduling standpoint. Another alternative is to amend soils with lime kiln dust (LKD) or cement as a moisture-conditioning agent. Soils may be amended in place, or may be excavated, amended, and replaced in the excavation.

1. Structural and general fill should consist of approved materials free of organic matter and debris. 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 use on this site.
2. CH or MH soils should not be used within 3 feet of finished grade in building area and 1 foot below finished grade in other structural fill areas.

Fill Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Structural Fill	General Fill
Maximum Lift Thickness	8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used	Same as Structural fill
Minimum Compaction Requirements [1, 2, 3]	98% of max. below foundations and within 1 foot of finished pavement subgrade 95% of max. above foundations, below floor slabs, and more than 1 foot below finished pavement subgrade	92% of max.
Water Content Range [1]	Low plasticity cohesive: -1% to +3% of optimum High plasticity cohesive: 0 to +4% of optimum Granular: -3% to +3% of optimum	As required to achieve min. compaction requirements

1. Maximum density and optimum water content as determined by the standard Proctor test (ASTM D 698).
2. High plasticity cohesive fill should not be compacted to more than 100 percent of standard Proctor maximum dry density.
3. If the granular material is a coarse sand or gravel, or of a uniform size, or has a low fines content, compaction comparison to relative density may be more appropriate. In this case, granular materials should be compacted to at least 70% relative density (ASTM D 4253 and D 4254).

Utility Trench Backfill

For low permeability subgrades, utility trenches are a common source of water infiltration and migration. Utility trenches penetrating beneath structures and buildings should be effectively sealed to restrict water intrusion and flow through the trenches, which could migrate below the structure or building. The trench should provide an effective trench plug that extends at least 5 feet from the face of the building exterior. The plug material should consist of cementitious flowable fill or low permeability clay. The trench plug material should be placed to surround the utility line. If used, the clay trench plug material should be placed and compacted to comply with the water content and compaction recommendations for structural fill stated previously in this report.

Grading and Drainage

All grades must provide effective drainage away from the tank and building areas during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. Building roofs should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

Exposed ground should be sloped and maintained at a minimum 5 percent away from building pads for at least 10 feet beyond the perimeter of any structures. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted as necessary as part of the structure's maintenance program. Where paving or flatwork abuts the structure a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

If possible, the bottom of deep excavations, such as the Pump Station, should be maintained with a grade that will direct water into a sump for ready dewatering of the excavation.

Earthwork Construction Considerations

Shallow excavations, for ancillary structures, are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of floor slabs. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over, or adjacent to, construction areas should be removed. If the subgrade freezes, desiccates,

saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted, prior to floor slab construction.

The groundwater table could affect over-excavation efforts for deep structures and will require a dewatering system consisting of sumps with pumps could be necessary to achieve the recommended depth of over-excavation.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, “Excavations” and its appendices, and in accordance with any applicable local, and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

Construction Observation and Testing

The earthwork efforts should be monitored under the direction of the Geotechnical Engineer. Monitoring should include documentation of adequate removal of vegetation and top soil, proof-rolling and mitigation of areas delineated by the proof-roll to require mitigation.

Each lift of compacted fill should be tested, evaluated, and reworked as necessary until approved by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. One density and water content test for every 50 linear feet of compacted utility trench backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Geotechnical Engineer. In the event that unanticipated conditions are encountered, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer’s evaluation of subsurface conditions, including assessing variations and associated design changes.

SHALLOW FOUNDATIONS

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

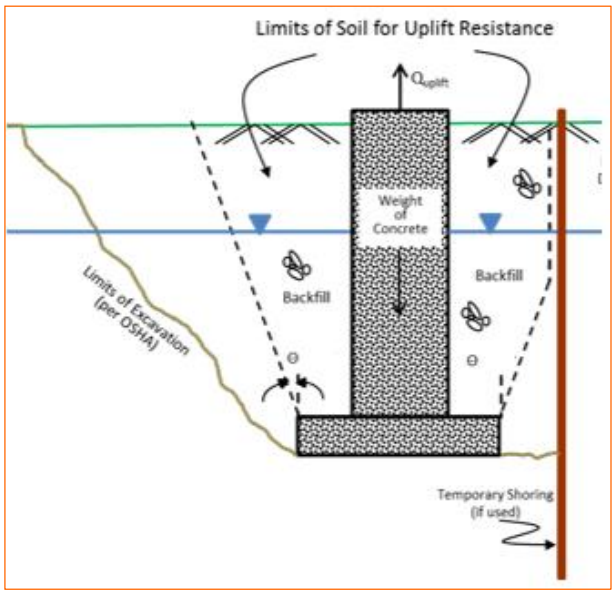
Design Parameters – Compressive Loads

Item	Description
Maximum Net Allowable Bearing pressure [1, 2]	2,000 psf (foundations bearing within structural fill)
Required Bearing Stratum [3]	Structural fill
Minimum Foundation Dimensions	Columns: 30 inches Continuous: 18 inches
Ultimate Passive Resistance [4] **(equivalent fluid pressures)**	390 pcf (cohesive backfill) 295 pcf (granular backfill)
Ultimate Coefficient of Sliding Friction [5]	0.3 (native clay) 0.35 (granular material)
Minimum Embedment below Finished Grade [6]	Exterior footings in unheated areas: 24 inches Exterior footings in heated areas: 24 inches Interior footings in heated areas: 24 inches
Estimated Total Settlement from Structural Loads [2]	Less than about 1 inch
Estimated Differential Settlement [2, 7]	About 2/3 of total settlement

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied. These bearing pressures can be increased by 1/3 for transient loads unless those loads have been factored to account for transient conditions. Values assume that exterior grades are no steeper than 20% within 10 feet of structure.
2. Values provided are for maximum loads noted in **Project Description**.
3. Unsuitable or soft soils should be over-excavated and replaced per the recommendations presented in the **Earthwork**.
4. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face.
5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions.
6. Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
7. Differential settlements are as measured over a span of 50 feet.

Design Parameters - Uplift Loads

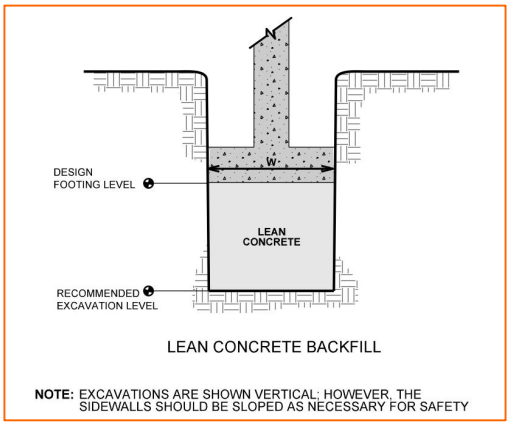
Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils. As illustrated on the subsequent figure, the effective weight of the soil prism defined by diagonal planes extending up from the top of the perimeter of the foundation to the ground surface at an angle, q, of 20 degrees from the vertical can be included in uplift resistance. The maximum allowable uplift capacity should be taken as a sum of the effective weight of soil plus the dead weight of the foundation, divided by an appropriate factor of safety. A maximum total unit weight of 100 pcf should be used for the backfill. This unit weight should be reduced to 40 pcf for portions of the backfill or natural soils below the groundwater elevation.



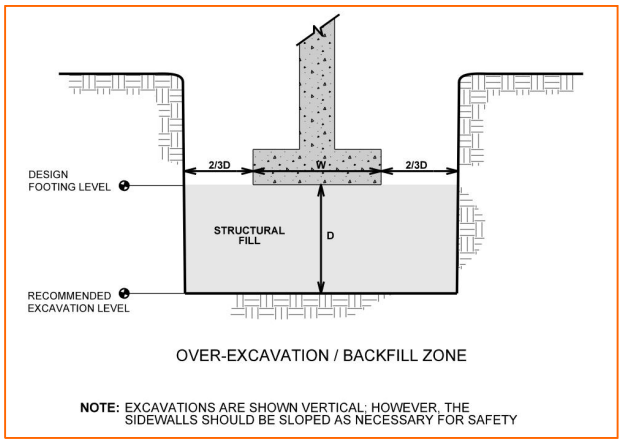
Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

If unsuitable bearing soils are encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils. The footings may bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. This is illustrated on the sketch below.



Over-excavation for structural fill placement below footings should be conducted as shown below. The over-excavation should be backfilled up to the footing base elevation, with structural fill placed as recommended in the **Earthwork** section.



GROUND IMPROVEMENT

As an alternative to supporting the ancillary structures on deep foundations, and replacing the fill, the structure and potentially floor slabs could be supported on lower strength/lower density native soils if ground improvement methods are utilized. Ground improvement methods are proprietary systems designed by licensed contractors who could provide further information regarding support options. Vibrated aggregate piers are commonly used in the local area to transfer foundations loads to a deeper, stratum.

SPECIALTY FOUNDATIONS

The proposed tanks and ancillary structures will be supported by a deep foundation system bearing on the underlying bedrock, primarily limestone and some shale. Depths to auger refusal were in the range of about 29 to 72 feet, but based on the results of coring, sound rock may be 100 feet or more in depth.

It is our understanding that driven piles may not be acceptable due to the absence of lateral support in very soft zones.

Micropiles are the preferred deep foundation option. The micropile design/build contractor will recommend the actual construction materials and procedures, installation depths and allowable loads. Allowable loads are often in the range of 100 to 300 kips per micropile (factor of safety, FS=2). Based on the hard, unweathered dolomite encountered during rock coring, we recommend a grout/rock bond of 200 psi be used for design.

Estimated Settlement

Based on an 8-inch O.D. pipe with 0.75-inch wall thickness, a pipe pile (29 ksi steel) 66 feet long with a 10 foot rock socket would be expected to compress about ¾ inch if loaded to 250 kips and about ½ inch if loaded to 175 kips. For the same rock socket, assuming sound rock, the estimated settlement is expected to be on the order of 0.1 inch, based on a rock compressive strength of 2,500 psi at a strain of 0.05 percent. To keep the total of estimated compression and settlement less than 1 inch, we recommend micropile loading of 250 kips to determine lateral spacing of micropiles. All estimated and recommended loading in this report is based on the assumption the foundation designer has applied appropriate factors of safety to achieve the design loading.

Driven Pile Design Parameters

Though micropiles are the preferred option, value engineering using driven piles could be an option. The following table can be used to estimate capacities for individual driven steel H-piles. The values are considered to be adequate for estimation of allowable (safety factor applied) load carrying capacity for driven piles ranging in depth from about 30 to 90 feet. Driven piles should be spaced at least three pile widths apart (center-to-center) if side friction is used for compressive loads.

Driven Pile Design Summary [1, 2]				
Approximate Elevation (feet)	Stratigraphy [3]		Allowable Skin Friction (psf) [4]	Allowable End Bearing Pressure (psf) [5]
	No.	Material		
680 – 660	1	Lean Clay	500	NA
680-660	1a	Lean Clay – Fill	250	NA
660 – 630	2	Lean Clay	650	NA
630-610	3	Weathered shale & siltstone	780	18,000
630 - 610	3a	Very soft clay	0	0
610 – 580	4	Weathered Limestone / Dolomite	2,000	50,000

1. Design capacities are dependent upon the method of installation, and quality control parameters. The values provided are estimates and should be verified when installation protocol have been finalized.
2. Design capacities can be increased by 33% for highly transient loads
3. See **Subsurface Profile** in **Geotechnical Characterization** for more details on Stratigraphy
4. Applicable for compressive loading only. Reduce to 2/3 of values shown for uplift loading. Effective weight of pile can be added to uplift load capacity.
5. Piles should be driven to meet refusal criteria established during test pile installation and dynamic pile analysis. Piles terminated in shale should extend 2 feet into the bearing stratum for end bearing to be considered.

Driven Pile Lateral Loading

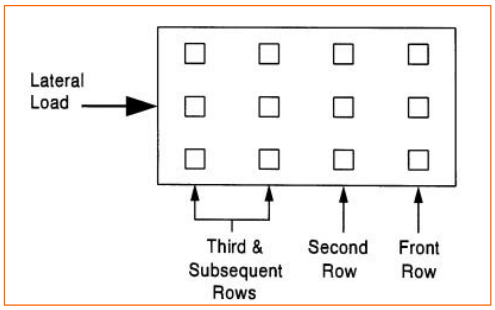
The following table lists input values for use in LPILE analyses. LPILE will estimate values of k_h and E_{50} based on strength; however, non-default values of k_h should be used where provided, in particular for the sand strata. Since deflection or a service limit criterion will likely control lateral capacity design, no safety/resistance factor is included with the parameters.

Stratigraphy [1]		L-Pile Soil Model	S_u (psf) [2]	f [2]	g (pcf) [2,3]	ε_{50} [2]	K (pci) [2]		q_u (psi) [2]
No.	Material						Static	Cyclic	
1	Lean Clay	Soft clay	1,200	NA	110	0.007	500	200	250
2	Lean Clay	Stiff clay without g'water	2,000	NA	125	0.005	1,000	400	600
3	Weathered shale & siltstone	Weak rock	6,300	NA	135	0.001	2,000	800	1,200

Stratigraphy [1]		L-Pile Soil Model	S_u (psf) [2]	f [2]	g (pcf) [2,3]	ε_{50} [2]	K (pci) [2]		q_u (psi) [2]
No.	Material						Static	Cyclic	
3a	Very soft clay	Soft clay	0	NA	100	0	0	0	0
4	Weathered Limestone / Dolomite	Strong rock	500,000	NA	200	0.0004	2,400	2,000	1,5 million

1. See **Subsurface Profile** in **Geotechnical Characterization** for more details on Stratigraphy.
2. Definition of Terms:
   - S_u: Undrained shear strength
   - f : Internal friction angle
   - g: Moist unit weight
   - ε_{50}: Non-default E50 strain
   - K: Horizontal modulus of subgrade reaction
   - q_u: Non-default soil modulus – static. Refer to software guidelines for cyclic loading.
3. Buoyant unit weight values should be used below water table.

When piles are used in groups, the lateral capacities of the piles in the second, third, and subsequent rows of the group should be reduced as compared to the capacity of a single, independent pile. Guidance for applying p-multiplier factors to the p values in the p-y curves for each row of pile foundations within a pile group are as follows:



- Front row: $P_m = 0.8$;
- Second row: $P_m = 0.4$
- Third and subsequent row: $P_m = 0.3$.

The load capacities provided herein are based on the stresses induced in the supporting soil strata. The structural capacity of the piles should be checked to assure they can safely accommodate the combined stresses induced by axial and lateral forces. Lateral deflections of piles should be evaluated using an appropriate analysis method, and will depend upon the pile's diameter, length,

configuration, stiffness and “fixed head” or “free head” condition. We can provide additional analyses and estimates of lateral deflections for specific loading conditions upon request. The load-carrying capacity of piles may be increased by increasing the section (for H-piles), diameter (for pipe piles) and/or length.

Driven Pile Construction Considerations

The contractor should select a driving hammer and cushion combination which can install the selected piling without overstressing the pile material. The hammer should have a rated energy in foot-pounds at least equal to 15 percent of the design compressive load capacity in pounds. The contractor should submit the pile driving plan and the pile hammer-cushion combination to the engineer for evaluation of the driving stresses in advance of pile installation. During driving a maximum of 10 blows per inch is recommended to reduce the potential of damage to the piles.

If practical refusal is experienced above the anticipated rock surface elevation, the pile may be on a boulder or other obstruction and a replacement pile should be driven. If this occurs, the situation should be evaluated by Terracon during the pile driving operations.

Difficult driving could also be encountered in the weathered rock, especially the areas underlain by the Fort Payne Chert. Consideration should be given to using protective points and/or flange stiffening if H-piles are used. The contractor should be prepared to cut or splice piles, as necessary. Splicing of piles should be in accordance with specifications provided by the project Structural Engineer.

Pile driving conditions, hammer efficiency, and stress on the pile during driving could be better evaluated during installation using a Pile Driving Analyzer (PDA). A Terracon representative should observe pile driving operations. Each pile should be observed and checked for buckling, crimping and alignment in addition to recording penetration resistance, depth of embedment, and general pile driving operations.

Nearby existing facilities (structures and subsurface utilities) should be observed prior to pile installation to document their condition. Structures should also be observed during pile installation for indications of movement. Pile driving should be stopped and Terracon contacted if movement or cracking of the existing structures is observed. Monitoring vibration levels during pile driving should be considered. Although vibrations from pile driving may be below levels that will cause structural damage, they may be felt by occupants of the adjacent buildings. The potential impact of driving piles at this site should be considered when evaluating this alternative.

The pile driving process should be performed under the direction of the Geotechnical Engineer. The Geotechnical Engineer should document the pile installation process including soil/rock and groundwater conditions encountered, consistency with expected conditions, and details of the installed pile.

SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of standard penetration resistance values (N-values) according to the 2012 International Building Code (which references the ASCE-7 Chapter 20; Table 20.3-1). In addition, field measurement of shear wave velocity using refraction techniques was performed to explore the possibility of a more favorable site classification than that determined using N-values.

As previously mentioned, Seismic Array A and Array C were evaluated for the average weighted shear wave velocity in the upper 100 feet. During this limited geophysical study, the average weighted shear-wave velocity profiles for Array A and Array C were determined to be 2,188 ft/sec and 2,019 ft/sec, respectively. Profiles for the average weighted shear-wave velocities of Array A and Array C are provided as Exhibits A-7 and A-8 in the attachments. The results follow:

Description	Value
2012 International Building Code Site Classification	C [2]
Site Latitude	35.054765°
Site Longitude	-85.329771°
S_{DS} Spectral Acceleration for a Short Period [3]	0.522g
S_{D1} Spectral Acceleration for a 1-Second Period [3]	0.284g

1. Seismic site classification in general accordance with the *2012 International Building Code*, which refers to ASCE 7-10.
2. The 2012 International Building Code (IBC) uses a site profile extending to a depth of 100 feet for seismic site classification. Borings at this site were extended to a maximum depth of 104 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.
3. These values were obtained using online seismic design maps and tools provided by the USGS (http://earthquake.usgs.gov/hazards/designmaps/).

FLOOR SLABS

Depending upon the finished floor elevation, unsuitable weak, soft to medium stiff soils may be encountered at the floor slab subgrade level. These soils should be replaced with structural fill so the floor slab is supported on at least 2 feet of compacted structural fill.

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and. positive drainage of the aggregate base beneath the floor slab.

Floor Slab Design Parameters

Item	Description
Floor Slab Support [1]	Minimum 6 inches of free-draining (less than 6% passing the U.S. No. 200 sieve) crushed aggregate compacted to at least 95% of ASTM D 698 [2, 3] At least 18 inches of low plasticity cohesive or granular soils with at least 18% passing the U.S. No. 200 sieve material should be present below floor slabs where fat clay soils are present
Estimated Modulus of Subgrade Reaction [2]	100 pounds per square inch per inch (psi/in) for point loads

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.
3. Free-draining granular material should have less than 5 percent fines (material passing the #200 sieve). Other design considerations such as cold temperatures and condensation development could warrant more extensive design provisions.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or cracks should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Settlement of floor slabs supported on existing fill materials cannot be accurately predicted, but could be larger than normal and result in some cracking. Mitigation measures as noted in **Existing Fill** within **Earthwork** are critical to the performance of floor slabs. In addition to the mitigation measures, the floor slab can be stiffened by adding steel reinforcement, grade beams and/or post-tensioned elements.

Floor Slab Construction Considerations

Finished subgrade within and for at least 10 feet beyond the floor slab should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should approve the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

BELOW-GRADE STRUCTURES

Where below grade structures are anticipated, shoring and dewatering will be necessary. Design of shoring and dewatering systems is typically done by a specialty contractor.

RETAINING WALLS

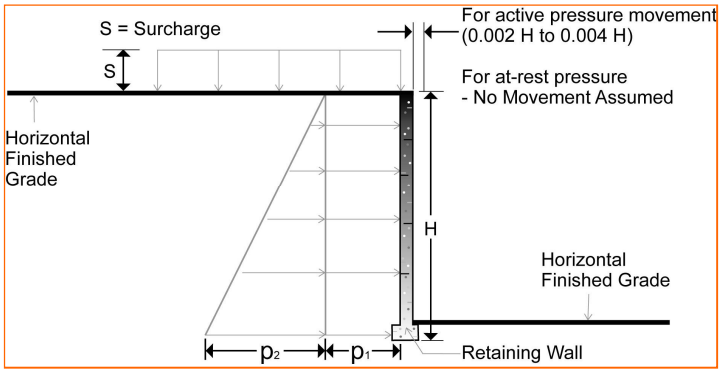
Retaining walls are anticipated between tanks and the existing slopes near the western property boundary, and may be up to 20 feet high. Retaining walls should be designed using lateral earth pressure parameters similar to those used for design of below grade structures, some of which function as retaining walls. Active earth pressure is appropriate where walls are free to deflect, at-rest earth pressure where walls are restrained, and passive earth pressure where the structure is moving toward the soil, such as the resisting face of a tie-back or deadman.

Retaining wall foundations bearing on structural fill should be designed for an allowable bearing capacity of 2,000 psf. Ordinarily, a higher allowable bearing capacity would be appropriate for structural fill, but because of the elevated potential for shallow foundations to be underlain by soils of highly variable consistency, we recommend basing preliminary foundation design for retaining walls on a lower value. Another factor to be considered is the type of wall. Cast walls are more susceptible to the effects of differential settlement than MSE walls. On the other hand, the distance between the wall and the existing slope must be wide enough to accommodate the design length of geo-grid reinforcement, possibly requiring excavation. Alternatively, a system of tie-backs may be required to stabilize the existing slope as part of retaining wall design and construction.

LATERAL EARTH PRESSURES

Design Parameters

Structures with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to values indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement and is commonly used for basement walls, loading dock walls, or other walls restrained at the top. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls (unless stated).



Lateral Earth Pressure Design Parameters				
Earth Pressure Condition [1]	**Coefficient for Backfill Type** [2]	**Surcharge Pressure p_1 (psf)** [3, 4, 5]	**Effective Fluid Pressures (psf)** [2, 4, 5]	
			Unsaturated [6]	**Submerged** [6]
Active (Ka)	Granular - 0.31 Fine Grained - 0.41	(0.31)S (0.41)S	(40)H (50)H	(80)H (85)H
At-Rest (Ko)	Granular - 0.47 Fine Grained - 0.58	0.47)S (0.58)S	(55)H (70)H	(90)H (95)H
Passive (Kp)	Granular - 3.25 Fine Grained - 2.46	--- ---	(390)H (295)H	(250)H (205)H

1. For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height. For passive earth pressure, wall must move horizontally to mobilize resistance.
2. Uniform, horizontal backfill, compacted to at least 95 percent of the ASTM D 698 maximum dry density, rendering a maximum unit weight of 120 pcf.
3. Uniform surcharge, where S is surcharge pressure.
4. Loading from heavy compaction equipment is not included.
5. No safety factor is included in these values.

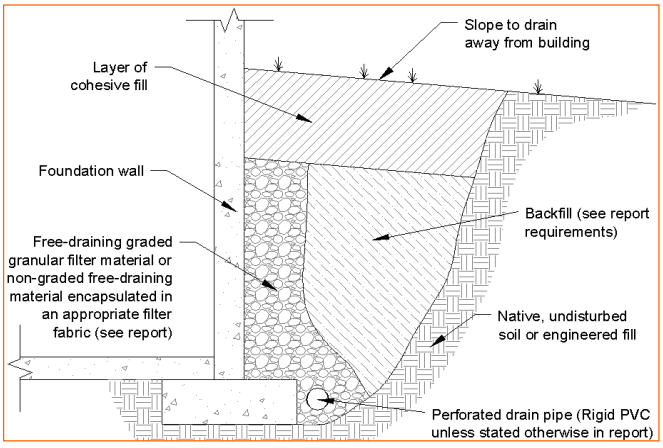
Lateral Earth Pressure Design Parameters				
Earth Pressure Condition [1]	Coefficient for Backfill Type [2]	Surcharge Pressure [3, 4, 5] p_1 (psf)	Effective Fluid Pressures (psf) [2, 4, 5]	
			Unsaturated [6]	Submerged [6]

6. In order to achieve "Unsaturated" conditions, follow guidelines in **Subsurface Drainage for Below Grade Walls** below. "Submerged" conditions are recommended when drainage behind walls is not incorporated into the design.

Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out and up from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively.

Subsurface Drainage for Below Grade Walls

A perforated rigid plastic drain line installed behind the base of walls and extends below adjacent grade is recommended to prevent hydrostatic loading on the walls. The invert of a drain line around a below-grade building area or exterior retaining wall should be placed near foundation bearing level. The drain line should be sloped to provide positive gravity drainage to daylight or to a sump pit and pump. The drain line should be surrounded by clean, free-draining granular material having less than 5 percent passing the No. 200 sieve, such as No. 57 aggregate. The free-draining aggregate should be encapsulated in a filter fabric. The granular fill should extend to within 2 feet of final grade, where it should be capped with compacted cohesive fill to reduce infiltration of surface water into the drain system.



As an alternative to free-draining granular fill, a pre-fabricated drainage structure may be used. A pre-fabricated drainage structure is a plastic drainage core or mesh which is covered with filter fabric to prevent soil intrusion, and is fastened to the wall prior to placing backfill.

PAVEMENTS

General Pavement Comments

Traffic loads and frequencies have not yet been determined. Therefore, our recommendations are general and will required re-evaluation once traffic information is known. A critical aspect of pavement performance is site preparation. Pavement designs, noted in this section, must be applied to the site, which has been prepared as recommended in the **Earthwork** section.

Support characteristics of subgrade for pavement design do not account for shrink/swell movements of an expansive clay subgrade, such as soils encountered on this project. Thus, the pavement may be adequate from a structural standpoint, yet still experience cracking and deformation due to shrink/swell related movement of the subgrade.

Pavement Section Thicknesses

As a minimum, we suggest the following pavement sections be considered:

Asphaltic Concrete Design	
Layer	**Thickness (inches)**
	Light Duty
Surface course A**C** [1]	1.5
Base Course AC[1]	2
Aggregate Base[2]	6

1. All materials should meet the current State of Tennessee Department of Transportation (TDOT) Standard Specifications for Highway and Bridge Construction.
   - Surface - TDOT Type A Asphaltic Cement Concrete: Section 411
   - Asphaltic Base - TDOT Type B Asphaltic Cement Concrete, Class I: Section 307
2. Mineral Aggregate Base stone per TDOT Section 303

Portland Cement Concrete Design	
Layer	**Thickness (inches)**
	Light Duty
PCC [1]	5
Mineral Aggregate Base	4

1. All materials should meet the current Tennessee Department of Transportation (TDOT) Standard Specifications for Highway and Bridge Construction.

Portland Cement Concrete Design	
Layer	Thickness (inches)
	Light Duty
■ Concrete Pavement - TDOT Portland Cement Concrete Type C: Section 501	

The pavement sections provided in this report are estimates and should be re-evaluated when design specifics are available. Areas for parking of heavy vehicles, concentrated turn areas, and start/stop maneuvers could require thicker pavement sections. Edge restraints (i.e. concrete curbs or aggregate shoulders) should be planned along curves and areas of maneuvering vehicles. A maintenance program including surface sealing, joint cleaning and sealing, and timely repair of cracks and deteriorated areas will increase the pavement's service life. As an option, thicker sections could be constructed to decrease future maintenance.

Concrete for rigid pavements should have a minimum 28-day compressive strength of 4,000 psi, and be placed with a maximum slump of 4 inches. Although not required for structural support, a minimum 4-inch thick base course layer is recommended to help reduce potential for slab curl, shrinkage cracking, and subgrade pumping through joints. Proper joint spacing will also be required to prevent excessive slab curling and shrinkage cracking. Joints should be sealed to prevent entry of foreign material and dowelled where necessary for load transfer.

Where practical, we recommend early-entry cutting of crack-control joints in PCC pavements+-. Cutting of the concrete in its "green" state typically reduces the potential for micro-cracking of the pavements prior to the crack control joints being formed, compared to cutting the joints after the concrete has fully set. Micro-cracking of pavements may lead to crack formation in locations other than the sawed joints, and/or reduction of fatigue life of the pavement.

Pavement design methods are intended to provide structural sections with adequate thickness over a subgrade such that wheel loads are reduced to a level the subgrade can support. The support characteristics of the subgrade for pavement design do not account for shrink/swell movements of a potentially expansive clay subgrade such as the CH soils encountered in some exploration locations. Thus, the pavement may be adequate from a structural standpoint, yet still experience cracking and deformation due to shrink/swell related movement of the subgrade. It is, therefore, important to minimize moisture changes in the subgrade to reduce shrink/swell movements.

Openings in pavements, such as decorative landscaped areas, are sources for water infiltration into surrounding pavement systems. Water can collect in the islands and migrate into the surrounding subgrade soils thereby degrading support of the pavement. This is especially applicable for islands with raised concrete curbs, irrigated foliage, and low permeability near-

surface soils. The civil design for the pavements with these conditions should include features to restrict or to collect and discharge excess water from the islands. Examples of features are edge drains connected to the storm water collection system, longitudinal subdrains, or other suitable outlet and impermeable barriers preventing lateral migration of water such as a cutoff wall installed to a depth below the pavement structure.

Dishing in parking lots surfaced with ACC is usually observed in frequently-used parking stalls (such as near the front of buildings), and occurs under the wheel footprint in these stalls. The use of higher-grade asphaltic cement, or surfacing these areas with PCC, should be considered. The dishing is exacerbated by factors such as irrigated islands or planter areas, sheet surface drainage to the front of structures, and placing the ACC directly on a compacted clay subgrade.

Rigid PCC pavements will perform better than ACC in areas where short-radii turning and braking are expected (i.e. entrance/exit aprons) due to better resistance to rutting and shoving. In addition, PCC pavement will perform better in areas subject to large or sustained loads. An adequate number of longitudinal and transverse control joints should be placed in the rigid pavement in accordance with ACI and/or AASHTO requirements. Expansion (isolation) joints must be full depth and should only be used to isolate fixed objects abutting or within the paved area.

Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

The pavement surfacing and adjacent sidewalks should be sloped to provide rapid drainage of surface water. Water should not be allowed to pond on or adjacent to these grade-supported slabs, since this could saturate the subgrade and contribute to premature pavement or slab deterioration.

The pavement surfacing and adjacent sidewalks should be sloped to provide rapid drainage of surface water. Water should not be allowed to pond on or adjacent to t slabs, since it could saturate the subgrade and contribute to premature pavement or slab deterioration.

Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore, preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment.

Maintenance consists of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance (e.g. surface sealing). Preventive maintenance is usually the priority when implementing a pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.
- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install below pavement drainage systems surrounding areas anticipated for frequent wetting.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.
- Place curb, gutter and/or sidewalk directly on clay subgrade soils rather than on unbound granular base course materials.

GENERAL COMMENTS

As the project progresses, we address assumptions by incorporating information provided by the design team, if any. Revised project information that reflects actual conditions important to our services is reflected in the final report. The design team should collaborate with Terracon to confirm these assumptions and to prepare the final design plans and specifications. This facilitates the incorporation of our opinions related to implementation of our geotechnical recommendations. Any information conveyed prior to the final report is for informational purposes only and should not be considered or used for decision-making purposes.

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

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

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

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Boring Depth (feet)	Planned Location
24 (T-1 through T-24)	29.2 to 71.6 (auger refusal)[1]	Water tanks
14 (DS-1 through DS-3; PS-1 through PS-4; OC-1 through OC-4; EB-1 and EB-2; VB-1)	44.2 to 58.5 (auger refusal)	Diversion structure, odor control building, electrical building, pump station, valve bank

1. One boring encountered auger refusal at 10 feet, and two borings were terminated at a depth of 70 feet without encountering auger refusal.

Boring Layout and Elevations: Unless otherwise noted, Terracon personnel provide the boring layout. Coordinate data and elevations were provided by Earthworx, LLC.

Subsurface Exploration Procedures: We advance the borings with a combination of truck-mounted, track-mounted, and ATV-mounted rotary drill rig using continuous flight augers (solid stem and/or hollow stem as necessary depending on soil conditions). Four samples are obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon is driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. We observe and record groundwater levels during drilling and sampling. Boreholes were initially open for observation of groundwater, but for safety purposes, were subsequently backfilled with auger cuttings.

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

At 14 selected locations, rock was sampled using diamond coring techniques.

Laboratory Testing

The project engineer reviews the field data and assigns various laboratory tests to better understand the engineering properties of the various soil and rock strata as necessary for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods are applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D422 Standard Test Method for Particle-Size Analysis of Soils

The laboratory testing program often includes examination of soil samples by an engineer. Based on the material's texture and plasticity, we describe and classify the soil samples in accordance with the Unified Soil Classification System.

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

Geophysical Testing

The purpose of this study was to non-intrusively explore the subsurface conditions underlying the site to aid in the identification of potential karstic features and provide a shear-wave velocity profile of the upper 100 feet for the seismic site classification.

Field Program

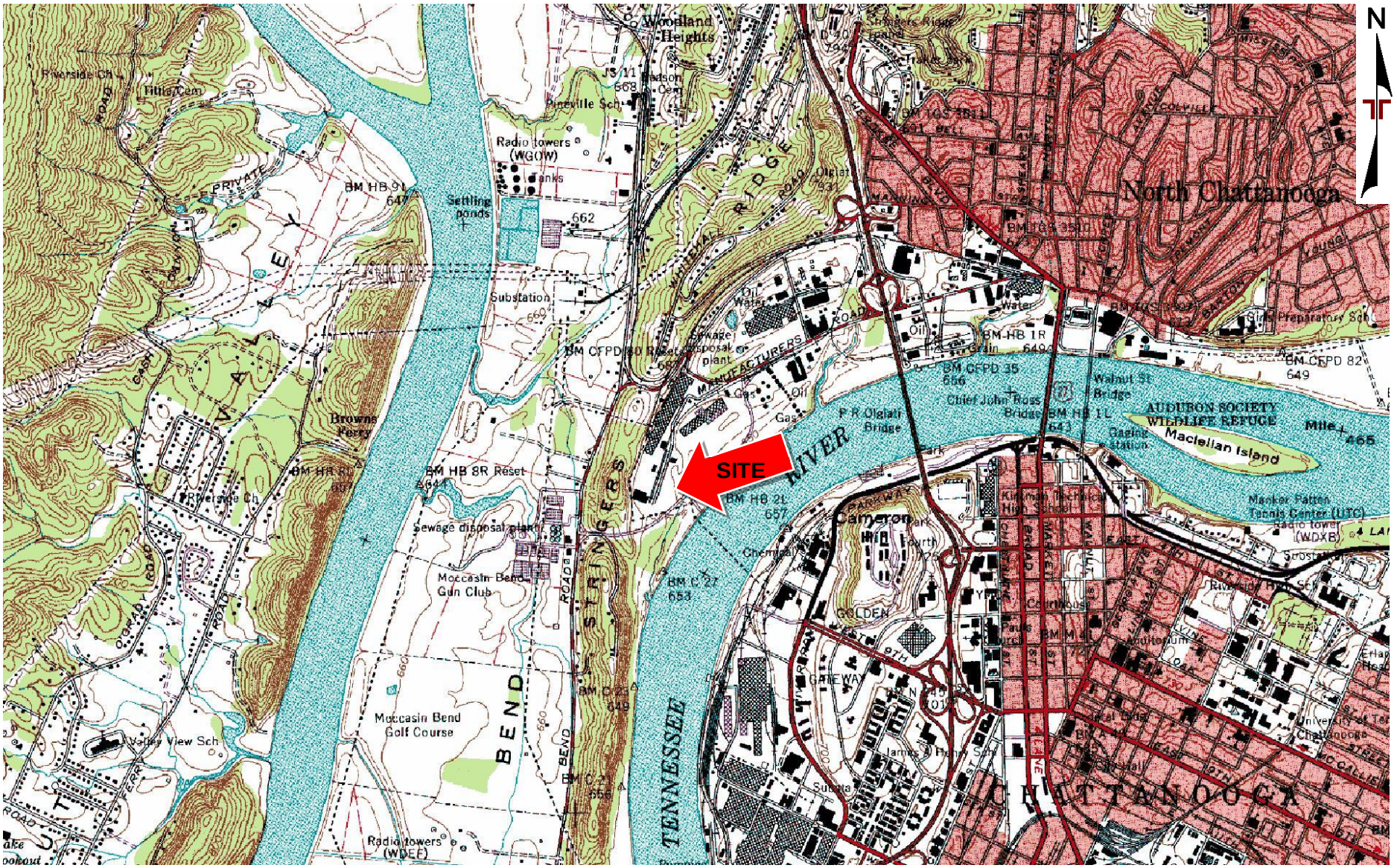
The field program for this investigation consisted of a limited geophysical survey which included four (4) seismic arrays designated Array A, Array B, Array C, and Array D. Profiles associated with the seismic arrays are attached as Exhibits A-3, A-4, A-5, and A-6 of this document, respectively.

Terracon used the SeisOpt® Refraction Microtremor™ (ReMi) method to develop shear-wave velocity profiles at the site. These developed profiles show relatively higher and lower shear-wave velocity subsurface characteristics. Settlement-prone areas (i.e., voids and areas of soft soil) are generally depicted as zones of lower shear-wave velocity.

A total of four (4) seismic arrays, each using an arrangement of 24 geophones, were analyzed to depths ranging from 88 feet to 100 feet below current surface elevation. The collected shear-wave data was processed using computer software (SeisOpt® ReMi™ by Optim, LLC), the shear-wave dispersion curve, and the picked point plot of the data. The shear-wave velocity profiles for each of the four (4) seismic arrays were generated from the SeisOpt® ReMi™ method of data reduction and can be seen on the attached Exhibits A-3, A-4, A-5, and A-6.

In addition to the cross-sectional profiles generated for the four (4) seismic arrays, two of the arrays (Array A and Array C) were evaluated for their average, weighted shear-wave velocity profiles. These additional profiles help to characterize the upper 100 feet for use in the determination of the site's seismic site classification per the 2012 IBC. The average weighted shear-wave velocity profiles for seismic Array A and Array C are provided as Exhibits A-7 and A-8, respectively.

SITE LOCATION AND EXPLORATION PLANS



TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY QUADRANGLES INCLUDE: CHATTANOOGA, TN (1/1/1969) and CHATTANOOGA, TN (1/1/1976).

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

Project Manager:	JR
Drawn by:	MM
Checked by:	JC
Approved by:	JC

Project No.	E2175127
Scale:	1"=2,000'
File Name:	E2175127
Date:	6/21/2018

Terracon
51 LOST MOUND DRIVE; SUITE 135
CHATTANOOGA, TN 37406

CROSS-SECTIONAL PROFILE LAYOUT

Limited Geophysical Study

HAMM ROAD
CHATTANOOGA, TN

Exhibit

A-1

EXPLORATION PLAN

Hamm Road ■ Chattanooga, TN

January 24, 2018 ■ Terracon Project No. E2175127

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

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

BORING LOG NO. T-1

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.05522° Longitude: -85.330076°

Surface Elev.: 676.43 (Ft.)

DEPTH	ELEVATION (Ft.)
0.3	676
6.0	670.5

TOPSOIL

FILL - GRAVELLY LEAN CLAY, angular, light brown and brown, black mineral staining

GRAVELLY LEAN CLAY WITH SAND (CL), light brown and light gray, stiff, black mineral staining

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	X	8-10-10 N=20			NA	9		
	X	7-8-11 N=19			3.0 (HP)	17		
5								
	X	6-5-5 N=10			NA	16	34-20-14	55
	X	4-6-7 N=13			2.5 (HP)	20		
10								
	X	4-6-8 N=14			2.5 (HP)	26		
15								
	X	3-4-5 N=9			1.5 (HP)	28		
20								
	X	4-4-5 N=9			1.75 (HP)	26		
25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-05-2018 | Boring Completed: 01-05-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-1

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.05522° Longitude: -85.330076°

Surface Elev.: 676.43 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		GRAVELLY LEAN CLAY WITH SAND (CL), light brown and light gray, stiff, black mineral staining *(continued)*										
	29.2	647				50/4"			NA	9		
		Auger Refusal at 29.2 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-05-2018 | Boring Completed: 01-05-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-2

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.05518° Longitude: -85.32985°

Surface Elev.: 676.77 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.2	676.5	**TOPSOIL**
		FILL - LEAN CLAY, with gravel, brown
12.0	665	**FILL - GRAVELLY LEAN CLAY**, brown, black mineral staining
22.0	655	**LEAN CLAY (CL)**, trace gravel, angular, light brown and light gray, very stiff, black mineral staining

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
0			
	X	5-6-7 N=13	NA
	X	2-2-2 N=4	NA
5			
	X	3-2-2 N=4	NA
	X	4-4-5 N=9	1.5 (HP)
10			
	X	2-6-8 N=14	2.0 (HP)
15			
	X	4-7-8 N=15	2.0 (HP)
20			
	X	6-8-9 N=17	2.0 (HP)
25			

RECOVERY (%) | RQD (%) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-04-2017 | Boring Completed: 01-04-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-2

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.05518° Longitude: -85.32985°

Surface Elev.: 676.77 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		LEAN CLAY (CL), trace gravel, angular, light brown and light gray, very stiff, black mineral staining *(continued)*										
					X	6-7-9 N=16			2.5 (HP)			
	32.0	645	30									
		LEAN CLAY (CL), grayish brown to reddish brown, very soft to soft										
					X	1-1-1 N=2			0.5 (HP)			
			35									
					X	0-0-0 N=0			NA			
	40.4	636.5	40									
		Auger Refusal at 40.4 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-04-2017 | Boring Completed: 01-04-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-3

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.055187° Longitude: -85.329613°

Surface Elev.: 675.85 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
0.3	675.5	**TOPSOIL**				
		FILL - LEAN CLAY WITH GRAVEL, angular, reddish brown, light brown and brown				
				X	3-4-3 N=7	
				X	2-1-2 N=3	
		-no recovery	5	X	1-1-1 N=2	
				X	1-2-3 N=5	
			10			
				X	2-2-2 N=4	
			15			
17.0	659	**LEAN CLAY (CL)**, light brown, medium stiff				
				X	2-2-3 N=5	
			20			
22.0	654	**LEAN CLAY (CL)**, light brown and light gray, stiff to very stiff				
				X	4-8-8 N=16	1.25 (HP)
			25			

WATER LEVEL OBSERVATIONS

ATTERBERG LIMITS: LL-PL-PI

RECOVERY (%) | RQD (%) | WATER CONTENT (%) | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-03-2018 | Boring Completed: 01-03-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-3

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.055187° Longitude: -85.329613°

Surface Elev.: 675.85 (Ft.)

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			30									
						4-6-8 N=14			3.0 (HP)			
			35			4-5-6 N=11			3.0 (HP)			
37.0	639											
			40			50/4"			2.0 (HP)			
						50/5"						
			45									
						50/3"						
			50									

LEAN CLAY (CL), light brown and light gray, stiff to very stiff *(continued)*

CLAYEY GRAVEL (GC), angular, light brown and light gray, very dense

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-03-2018 | Boring Completed: 01-03-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-3

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.055187° Longitude: -85.329613°

Surface Elev.: 675.85 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		CLAYEY GRAVEL (GC), angular, light brown and light gray, very dense *(continued)*				50/1"						
	57.0	619	55									
		POORLY GRADED GRAVEL WITH SAND (GP), light gray, very dense				14-50/2"						
			60									
						22-50/2"						
			65									
		-no recovery				50/3"						
	70.0	606	70									
		Boring Terminated at 70 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-03-2018 | Boring Completed: 01-03-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-4

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.055012° Longitude: -85.330035°

Surface Elev.: 676.18 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
0.4	676	**TOPSOIL**				
		FILL - GRAVELLY LEAN CLAY, reddish brown and brown, black mineral staining		X	3-6-6 N=12	NA
				X	3-4-8 N=12	NA
			5	X	7-7-6 N=13	2.0 (HP)
				X	5-7-8 N=15	NA
			10			
				X	3-2-2 N=4	NA
			15			
17.0	659					
		LEAN CLAY (CL), trace gravel, light brown and yellowish brown, stiff		X	3-5-5 N=10	2.0 (HP)
			20			
22.0	654					
		LEAN CLAY WITH SAND (CH), light brown and light gray, medium stiff to soft		X	2-2-2 N=4	1.0 (HP)
			25			

RECOVERY (%)	RQD (%)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-05-2018 | Boring Completed: 01-05-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-4

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.055012° Longitude: -85.330035°

Surface Elev.: 676.18 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			30			3-2-3 N=5						
				▽								
			35			1-1-1 N=2						
			40			1-2-1 N=3						
	41.4	635										

LEAN CLAY WITH SAND (CH), light brown and light gray, medium stiff to soft *(continued)*

Auger Refusal at 41.4 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-05-2018 | Boring Completed: 01-05-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-5

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.055018° Longitude: -85.329689°

Surface Elev.: 675.58 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	675.5									
TOPSOIL										
FILL - GRAVELLY LEAN CLAY WITH SAND, angular, reddish brown and brown, black mineral staining			X	3-3-4 N=7				14		
			X	3-1-2 N=3				16		
		5	X	3-3-3 N=6				17		
			X	3-2-3 N=5				17	33-19-14	43
brown		10	X	2-2-2 N=4				20		
17.0	658.5	15								
LEAN CLAY (CL), light brown, medium stiff			X	1-1-3 N=4			1.0 (HP)	26		
22.0	653.5	20								
LEAN CLAY (CL), light brown and light gray, very stiff			X	5-9-9 N=18			3.0 (HP)	24		
		25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-03-2018 | Boring Completed: 01-03-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-5

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.055018° Longitude: -85.329689°

Surface Elev.: 675.58 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		LEAN CLAY (CL), light brown and light gray, very stiff *(continued)*										
						6-8-10 N=18			2.5 (HP)	22		
	32.0	643.5	30									
		LEAN CLAY (CL), trace gravel, angular, reddish brown, light gray and black, very stiff, black mineral staining		▽								
						10-11-11 N=22			3.5 (HP)	24		
	37.0	638.5	35									
		GRAVELLY LEAN CLAY (CL), trace sand, angular, light brown and brown, very stiff, black mineral staining										
						7-9-10 N=19				17		
	40.6	***Auger Refusal at 40.6'*** 635	40									
		ADVANCED CASING										
	45.2	630.5	45									
		Begin NQ2 Wireline Rock Core **COARSE SAND** -exploration team member described material as a coarse sand				**RUN 1:** Depth: 45.2' - 50.2' Run Length: 5'	0	0				
	50.2	625.5	50									
		Coring Terminated at 50.2 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-03-2018 | Boring Completed: 01-03-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-6

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054879° Longitude: -85.329871°

Surface Elev.: 675.72 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	0.3	675.5										
	TOPSOIL											
	GRAVELLY LEAN CLAY, reddish brown to brown, black mineral staining					3-4-5 N=9			NA			
						3-5-5 N=10			NA			
			5			8-50/1"			1.5 (HP)			
						50/1"			NA			
	10.0	665.5	10									
	Auger Refusal at 10 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-05-2018 | Boring Completed: 01-05-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-7

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054812° Longitude: -85.330054°

Surface Elev.: 676.39 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.5	676	**TOPSOIL**
		FILL - GRAVELLY LEAN CLAY, reddish brown
6.0	670.5	
		FILL - CLAYEY GRAVEL, brown
8.0	668.5	
		FILL - POORLY GRADED GRAVEL WITH SAND, light brown
		-no recovery
17.0	659.5	
		SANDY LEAN CLAY WITH GRAVEL (CL), angular, light brown and reddish brown, stiff to very stiff, black mineral staining

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	X	5-7-7 N=14				12		
5	X	5-5-10 N=15				17		
	X	5-27-29 N=56				13		
	X	18-24-30 N=54				3		
10								
	X	6-8-9 N=17				31		
15								
	X	5-6-7 N=13			2.5 (HP)	27		
20								
	X	9-9-9 N=18			2.0 (HP)	22	32-17-15	54
25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-22-2017 | Boring Completed: 12-22-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-7

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054812° Longitude: -85.330054°

Surface Elev.: 676.39 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
27.0	649.5	**SANDY LEAN CLAY (CL)**, trace gravel, angular, light brown and reddish brown, medium stiff									
					4-3-3 N=6			0.75 (HP)	29		
32.0	644.5	**FAT CLAY (CH)**, light gray and reddish brown, medium stiff	30								
					4-3-5 N=8						
36.5	640	***Auger Refusal at 36.5'***	35								
		ADVANCED CASING									
44.0	632.5	***Begin NQ2 Wireline Rock Core*** **DOLOMITIC LIMESTONE**, light brown, slightly weathered, minor shale bedding, medium strong	40								
47.0	629.5	**CLAY AND CHERT FRAGMENTS**	45		**RUN 1:** Depth: 44' - 54' Run Length: 10'	33	18				
			50								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-22-2017 | Boring Completed: 12-22-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-7

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054812° Longitude: -85.330054°

Surface Elev.: 676.39 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		CLAY AND CHERT FRAGMENTS *(continued)*										
			55									
						RUN 2: Depth: 54' - 64' Run Length: 10'	0	0				
	64.0	612.5	60									
		Coring Terminated at 64 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-22-2017 | Boring Completed: 12-22-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-8

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054818° Longitude: -85.329665°

Surface Elev.: 674.97 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
0.3	674.5				
TOPSOIL					
FILL - GRAVELLY LEAN CLAY, reddish brown			X	5-5-5 N=10	
			X	4-5-6 N=11	
-no recovery		5	X	1-1-2 N=3	
			X	2-3-3 N=6	
		10			
			X	1-3-1 N=4	
17.0	658	15			
LEAN CLAY (CL), light brown and light gray, stiff to very stiff			X	5-6-6 N=12	2.0 (HP)
		20			
			X	4-8-11 N=19	2.5 (HP)
		25			

RECOVERY (%) | RQD (%) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-02-2018 | Boring Completed: 01-02-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-8

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054818° Longitude: -85.329665°

Surface Elev.: 674.97 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		LEAN CLAY (CL), light brown and light gray, stiff to very stiff *(continued)*										
			30			6-8-10 N=18			3.0 (HP)			
32.0	643											
		LEAN CLAY (CL), gray, soft to medium stiff		▽								
			35			2-2-3 N=5			1.0 (HP)			
						2-2-1 N=3						
42.0	633		40									
		CLAYEY GRAVEL (GC), light brown, very dense				34-50/2"						
47.0	628		45									
		POORLY GRADED GRAVEL (GP), black, very dense				39-50/2"						
			50									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-02-2018 | Boring Completed: 01-02-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-8

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054818° Longitude: -85.329665°

Surface Elev.: 674.97 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		POORLY GRADED GRAVEL (GP), black, very dense *(continued)*										
						50/1"						
	55.6	***Auger Refusal at 55.6'***	55									
		ADVANCED CASING										
	57.3											
		Begin NQ2 Wireline Rock Core										
		SAND AND CHERT FRAGMENTS	60			**RUN 1:** Depth: 57.3' - 62.3' Run Length: 5'	0	0				
	62.3											
		ADVANCED CASING										
			65									
			70									
			75									
	76.9											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-02-2018 | Boring Completed: 01-02-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-8

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054818° Longitude: -85.329665°

Surface Elev.: 674.97 (Ft.)

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
79.7	595.5											
		DOLOMITE, light brown and light gray, slightly weathered, white mineral staining on faces, strong rock *(continued)*										
		DOLOMITE, gray, minor shale bedding, strong rock	80			**RUN 2:** Depth: 76.9' - 86.9' Run Length: 10'	86	71				
			85									
86.9	588											
		Coring Terminated at 86.9 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-02-2018 | Boring Completed: 01-02-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-9

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054686° Longitude: -85.329887°

Surface Elev.: 675.95 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.0	676									
				2-2-2 N=4						
				2-3-3 N=6						
		5								
				2-2-2 N=4						
8.0	668									
				2-2-2 N=4						
		10								
12.0	664									
				4-4-6 N=10			2.0 (HP)			
		15								
				4-6-7 N=13			2.5 (HP)			
		20								
				6-6-7 N=13			2.25 (HP)			
		25								

FILL - GRAVELLY LEAN CLAY, reddish brown

FILL - LEAN CLAY WITH GRAVEL, brown

LEAN CLAY (CL), trace gravel, angular, light brown, stiff

black mineral staining

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-22-2017 | Boring Completed: 12-22-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-9

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054686° Longitude: -85.329887°

Surface Elev.: 675.95 (Ft.)

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			30	▽		5-8-8 N=16			2.0 (HP)			
			35			3-4-10 N=14			1.25 (HP)			
			40			29-18-22 N=40						
			45			14-23-25 N=48						
			50			7-46-40 N=86						

LEAN CLAY (CL), trace gravel, angular, light brown, stiff *(continued)*

37.0 639

CLAYEY GRAVEL (GC), angular, light gray, dense to very dense

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-22-2017 | Boring Completed: 12-22-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-9

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054686° Longitude: -85.329887°

Surface Elev.: 675.95 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			55			8-23-36 N=59						
			60			18-45-50/1"						
			65			26-50-50/1"						
			70									
			75									

CLAYEY GRAVEL (GC), angular, light gray, dense to very dense *(continued)*

light brown, black mineral staining

reddish brown

67.6 ***Auger Refusal at 67.6'*** 608.5

ADVANCE CASING

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-22-2017 | Boring Completed: 12-22-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-9

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054686° Longitude: -85.329887°

Surface Elev.: 675.95 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		ADVANCE CASING *(continued)*	80									
	86.5	589.5	85									
		Begin NQ2 Wireline Rock Core **COARSE SAND**				**RUN 1:** Depth: 86.5' - 93' Run Length: 6.5'	0	0				
	93.0	583	90									
		Coring Terminated at 93 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-22-2017 | Boring Completed: 12-22-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-10

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.05453° Longitude: -85.33°

Surface Elev.: 676.50 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.6	676	**CONCRETE**
		FILL - LEAN CLAY, trace gravel, angular, brown
6.0	670.5	**FILL - LEAN CLAY WITH GRAVEL**, angular, reddish brown, black mineral staining
17.0	659.5	**FILL - POORLY GRADED GRAVEL WITH CLAY**
22.0	654.5	**LEAN CLAY (CL)**, trace gravel, angular, light brown, stiff, black mineral staining

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
5		1-1-2 N=3	1.25 (HP)
		2-2-2 N=4	1.25 (HP)
		4-5-4 N=9	2.5 (HP)
10		5-7-9 N=16	3.25 (HP)
15		9-13-12 N=25	3.25 (HP)
20		30-40-21 N=61	
25		4-6-8 N=14	2.0 (HP)

WATER LEVEL OBSERVATIONS; RECOVERY (%); RQD (%); WATER CONTENT (%); ATTERBERG LIMITS LL-PL-PI; PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-21-2017 | Boring Completed: 12-22-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-10

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.05453° Longitude: -85.33°

Surface Elev.: 676.50 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
27.0	649.5	**SANDY LEAN CLAY (CL)**, light brown, medium stiff
32.0	644.5	**LEAN CLAY (CL)**, trace gravel, angular, reddish brown, gray and light brown, medium stiff to very stiff, black mineral staining
42.0	634.5	**GRAVELLY LEAN CLAY (CL)**, angular, brown and light brown, very stiff to hard, black mineral staining
52.0	624.5	

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
30		3-2-3 N=5	1.25 (HP)
35		4-4-4 N=8	1.5 (HP)
40		10-19-4 N=23	2.0 (HP)
45		7-13-17 N=30	2.75 (HP)
50		30-38-50/5"	3.0 (HP)

WATER LEVEL OBSERVATIONS: ▽ While drilling

RECOVERY (%) | RQD (%) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-21-2017 | Boring Completed: 12-22-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-10

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.05453° Longitude: -85.33°

Surface Elev.: 676.50 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			55									
	SANDY LEAN CLAY WITH GRAVEL (CL), angular, reddish brown to brown					23-40-50/5"			2.75 (HP)			
			60			28-50/4"			2.5 (HP)			
	low recovery					50/4"						
			65									
	low recovery					46-13-50/3"						
			70									
	71.6	605										
	Auger Refusal at 71.6 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-21-2017 | Boring Completed: 12-22-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-11

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054532° Longitude: -85.329766°

Surface Elev.: 676.12 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3 **ASPHALT**	676									
FILL - POORLY GRADED GRAVEL, light gray				50			NA	0		
3.0	673									
FILL - GRAVELLY LEAN CLAY, reddish brown, black mineral staining		5		1-1-2 N=3			NA	16		
				1-2-1 N=3			NA	16		
		10		1-1-1 N=2			NA	19		
		15		4-7-10 N=17			NA	11		
17.0	659									
LEAN CLAY (CL), trace gravel, angular, light brown and light gray, medium stiff to stiff		20		3-4-5 N=9			2.5 (HP)	26		
		25		3-3-4 N=7			2.25 (HP)	23		

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-09-2018 | Boring Completed: 01-09-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-11

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054532° Longitude: -85.329766°

Surface Elev.: 676.12 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		LEAN CLAY (CL), trace gravel, angular, light brown and light gray, medium stiff to stiff *(continued)*										
			30			5-6-7 N=13			2.5 (HP)	23		
				▽								
			35			6-6-8 N=14			2.5 (HP)	22		
	37.0	639										
		LEAN CLAY WITH SAND (CL), light brown, soft to medium stiff	40			1-2-1 N=3			NA	23	28-20-8	78
			45			1-2-3 N=5			NA	27		
			50			50/3"			NA	22		
	51.0	625										
		Auger Refusal at 51 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-09-2018 | Boring Completed: 01-09-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-12

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054394° Longitude: -85.330194°

Surface Elev.: 676.54 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
				4-4-6 N=10				14		
				3-4-6 N=10				16		
		5								
				3-5-5 N=10				17		
				3-5-7 N=12			2.5 (HP)	18		
		10								
				4-4-4 N=8			1.5 (HP)	22		
		15								
				2-3-3 N=6			1.5 (HP)	30	59-23-36	87
		20								
				5-7-6 N=13				26		
		25								

FILL - LEAN CLAY, trace gravel, angular, reddish brown and dark brown, black mineral staining

8.0 668.5

LEAN CLAY (CL), trace gravel, angular, light brown and grayish brown, medium stiff to stiff, black mineral staining

17.0 659.5

FAT CLAY (CH), trace gravel, angular, reddish brown, light brown and grayish brown, medium stiff, black mineral staining

22.0 654.5

SILTY CLAY (CL-ML), light gray, stiff to very stiff

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-15-2017 Boring Completed: 12-18-2017

Drill Rig: Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-12

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054394° Longitude: -85.330194°

Surface Elev.: 676.54 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY CLAY (CL-ML), light gray, stiff to very stiff *(continued)*										
					X	6-8-9 N=17				21		
			30									
		trace gravel, angular										
					X	4-5-4 N=9			1.0 (HP)	44		
	37.0	639.5	35									
		LEAN CLAY WITH GRAVEL (CL), angular, light gray and light brown, hard										
					X	9-42-9 N=51				27		
			40									
	44.3	632			X	10-50/3"				21		
		Auger Refusal at 44.3 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-15-2017 | Boring Completed: 12-18-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-13

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054428° Longitude: -85.329564°

Surface Elev.: 674.82 (Ft.)

DEPTH | ELEVATION (Ft.)

GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
FILL - LEAN CLAY WITH GRAVEL, angular, reddish brown, brown and light brown										
			X	3-3-5 N=8			1.25 (HP)			
			X	3-4-5 N=9						
-low recovery	5		X	2-2-3 N=5						
-low recovery			X	2-3-2 N=5						
-low recovery	10		X	5-5-3 N=8						
	15		X	3-4-4 N=8						
22.0 653 **LEAN CLAY (CL)**, trace sand, angular, light brown and light gray, stiff to very stiff	20		X	6-10-10 N=20			4.0 (HP)			
	25									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-19-2017 | Boring Completed: 12-19-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-13

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054428° Longitude: -85.329564°

Surface Elev.: 674.82 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	FIELD TEST RESULTS	LABORATORY HP (tsf)
		LEAN CLAY (CL), trace sand, angular, light brown and light gray, stiff to very stiff *(continued)*		
			7-9-11 N=20	3.25 (HP)
			4-6-6 N=12	2.0 (HP)
			4-7-9 N=16	
42.0	633	**LEAN CLAY (CL)**, trace sand, angular, gray, very soft		
			0-0-0 N=0	
46.0	629	***Auger Refusal at 46.0'***		
		ADVANCED CASING		
49.1	625.5	***Begin NQ2 Wireline Rock Core*** **BEDDED SILICIOUS ZONES OF CHERT AND DOLOMITE**, light brown and light gray, slightly weathered, medium strong		

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-19-2017 | Boring Completed: 12-19-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-13

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054428° Longitude: -85.329564°

Surface Elev.: 674.82 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		BEDDED SILICIOUS ZONES OF CHERT AND DOLOMITE, light brown and light gray, slightly weathered, medium strong *(continued)*	55									
			60			**RUN 1:** Depth: 49.1' - 70' Run Length: 20.9'	22	0				
	70.0	605	65									
		DOLOMITE, light gray, slightly weathered, medium strong	70			**RUN 2:** Depth: 70' - 75' Run Length: 5'	63	41				
	75.0	600	75									
		Coring Terminated at 75 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-19-2017 | Boring Completed: 12-19-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-14

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.05433° Longitude: -85.329995°

Surface Elev.: 676.58 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
0.6	676	**CONCRETE**				
		FILL - LEAN CLAY WITH GRAVEL, angular, brown and reddish brown		X	4-4-4 N=8	
				X	3-4-5 N=9	1.75 (HP)
			5	X	3-6-6 N=12	1.75 (HP)
8.0	668.5			X	3-5-7 N=12	
		FILL - GRAVELLY LEAN CLAY, angular, reddish brown, black mineral staining	10			
				X	7-7-7 N=14	2.5 (HP)
17.0	659.5		15			
		FILL - SANDY LEAN CLAY, reddish brown		X	4-5-7 N=12	
22.0	654.5		20			
		FAT CLAY (CH), trace gravel, angular, light gray, light brown and reddish brown, stiff		X	6-6-10 N=16	
			25			

RECOVERY (%)	RQD (%)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-15-2017 | Boring Completed: 12-15-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL E2175127 HAMM ROAD.GPJ TERRACON_DATATEMPLATE.GDT 3/30/18

BORING LOG NO. T-14

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.05433° Longitude: -85.329995°

Surface Elev.: 676.58 (Ft.)

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
27.0	649.5											
FAT CLAY (CH), with black sand, reddish brown and black, stiff						6-7-7 N=14						
33.0	643.5		30	▽								
LEAN CLAY WITH GRAVEL (CL), angular, reddish brown and light brown, very soft to hard -no recovery						0-0-0 N=0						
			35									
						2-2-4 N=6						
			40									
						50/1"						
-no recovery			45			50/2"						
			50									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-15-2017 | Boring Completed: 12-15-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-14

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.05433° Longitude: -85.329995°

Surface Elev.: 676.58 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		LEAN CLAY WITH GRAVEL (CL), angular, reddish brown and light brown, very soft to hard *(continued)*										
		-no recovery				50/1"						
			55									
	59.0	-no recovery				50/1"						
		617.5										
		Auger Refusal at 59 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-15-2017 | Boring Completed: 12-15-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-15

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054334° Longitude: -85.329764°

Surface Elev.: 676.53 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
0.5	676	**CONCRETE**				
		FILL - BLACK SANDY CLAY			5-9-5 N=14	
					4-2-2 N=4	
		with concrete, low recovery	5		4-50/0"	
			10		2-3-4 N=7	
12.0	664.5					
		FILL - LEAN CLAY WITH GRAVEL, angular, reddish brown				
		-low recovery	15		3-2-2 N=4	
17.0	659.5					
		LEAN CLAY (CL), light brown, reddish brown and light gray, medium stiff to stiff, black mineral staining	20		3-3-4 N=7	2.0 (HP)
			25		3-3-4 N=7	1.5 (HP)

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-21-2017 | Boring Completed: 12-21-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-15

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054334° Longitude: -85.329764°

Surface Elev.: 676.53 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	FIELD TEST RESULTS	LABORATORY HP (tsf)
		LEAN CLAY (CL), light brown, reddish brown and light gray, medium stiff to stiff, black mineral staining *(continued)*		
			3-4-5 N=9	2.25 (HP)
32.0	644.5			
		LEAN CLAY (CL), gray, very soft		
			0-0-0 N=0	
		stiff	18-7-4 N=11	
41.8	634.5	***Auger Refusal at 41.8'***		
		ADVANCED CASING		

GRAPHIC LOG | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | RECOVERY (%) | RQD (%) | LABORATORY HP (tsf) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-21-2017 | Boring Completed: 12-21-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-15

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054334° Longitude: -85.329764°

Surface Elev.: 676.53 (Ft.)

DEPTH ELEVATION (Ft.)

GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES

ADVANCED CASING *(continued)*

55

60

65

70

75

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-21-2017 Boring Completed: 12-21-2017

Drill Rig: Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-15

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054334° Longitude: -85.329764°

Surface Elev.: 676.53 (Ft.)

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
ADVANCED CASING *(continued)*												
80.7	596		80									
SAND AND CHERT FRAGMENTS			85									
92.0	584.5		90									
Begin NQ2 Wireline Rock Core **DOLOMITE**, light brown and light gray, slightly weathered, vugs, minor shale partings, strong rock			95			**RUN 1:** Depth: 92.3' - 102.3' Run Length: 10'	91	74				
102.3	574		100									
Coring Terminated at 102.3 Feet												

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-21-2017 | Boring Completed: 12-21-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-16

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054178° Longitude: -85.329894°

Surface Elev.: 676.41 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.6	676									
CONCRETE										
BLACK SAND AND GRAVEL										
				8-3-3 N=6				3		
				4-4-4 N=8				7		
		5		3-3-2 N=5				8		
				3-2-1 N=3				7		
		10		8-7-3 N=10				9		
-no recovery		15		4-3-3 N=6						
22.0	654.5	20								
LEAN CLAY (CL), trace sand, angular, light brown and grayish brown, medium stiff to stiff				4-3-4 N=7			3.0 (HP)	23		
		25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-15-2017 | Boring Completed: 12-15-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-16

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054178° Longitude: -85.329894°

Surface Elev.: 676.41 (Ft.)

DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		LEAN CLAY (CL), trace sand, angular, light brown and grayish brown, medium stiff to stiff *(continued)*								
			30	4-4-6 N=10			2.75 (HP)	23		
32.0	644.5									
		CLAYEY SAND WITH GRAVEL (SC), angular, reddish brown and light brown, medium dense, black mineral staining	35	6-5-5 N=10			2.0 (HP)	16	43-22-21	44
37.0	639.5									
		CLAYEY GRAVEL WITH SAND (GC), angular, reddish brown, very dense, black mineral staining	40	13-30-33 N=63				7		
			45	38-32-29 N=61				17		
			50	20-38-41 N=79				14		

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-15-2017 | Boring Completed: 12-15-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-16

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054178° Longitude: -85.329894°

Surface Elev.: 676.41 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	CLAYEY GRAVEL WITH SAND (GC), angular, reddish brown, very dense, black mineral staining *(continued)*											
						15-31-30 N=61				22		
	57.0	619.5	55									
	POORLY GRADED GRAVEL WITH SAND (GP), angular, dark gray, very dense					50/1"				16		
			60									
						50/2"				9		
			65									
						50/2"				13		
	70.0	606.5	70									
	Boring Terminated at 70 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-15-2017 | Boring Completed: 12-15-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-17

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054953° Longitude: -85.329426°

Surface Elev.: 674.51 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
				X	2-2-4 N=6						
				X	1-1-2 N=3						
		5									
				X	1-1-1 N=2						
				X	1-1-1 N=2						
		10									
				X	3-4-4 N=8						
		15									
17.0	657.5										
				X	3-3-5 N=8			1.75 (HP)			
		20									
				X	3-4-6 N=10			1.75 (HP)			
		25									

FILL - GRAVELLY LEAN CLAY, angular, reddish brown, light brown and black
-no recovery

LEAN CLAY (CL), light brown and light gray, medium stiff to stiff

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-05-2018 | Boring Completed: 01-05-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-17

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054953° Longitude: -85.329426°

Surface Elev.: 674.51 (Ft.)

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			30									
						4-6-7 N=13			2.0 (HP)			
			35			2-2-3 N=5			1.0 (HP)			
			40			2-2-4 N=6			1.25 (HP)			
			45			1-3-3 N=6			1.25 (HP)			
			50			50/4"						

LEAN CLAY (CL), light brown and light gray, medium stiff to stiff *(continued)*

47.0 627.5

CLAYEY GRAVEL (GC), light brown, very dense

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-05-2018 Boring Completed: 01-05-2018

Drill Rig: Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-17

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054953° Longitude: -85.329426°

Surface Elev.: 674.51 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	CLAYEY GRAVEL (GC), light brown, very dense *(continued)*											
	-no recovery					50/2"						
	57.0	617.5	55									
	POORLY GRADED GRAVEL (GP), light brown, very dense					7-50/4"						
			60									
						50/3"						
			65									
	69.1	605.5				5-50/1"						
	Auger Refusal at 69.1 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-05-2018 | Boring Completed: 01-05-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-18

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054934° Longitude: -85.328981°

Surface Elev.: 669.44 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.3	669	**ASPHALT**
		FILL - LEAN CLAY WITH GRAVEL (CL), angular, reddish brown, light gray and brown
12.0	657.5	
		FAT CLAY (CH), light brown, medium stiff
17.0	652.5	
		LEAN CLAY (CL), trace sand, angular, light brown, medium stiff to stiff

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		4-3-5 N=8				10		
5		3-2-2 N=4				14		
		3-2-2 N=4				14		
		3-4-5 N=9			1.5 (HP)	17		
10								
		2-2-3 N=5			1.0 (HP)	27	50-22-28	86
15								
		3-3-4 N=7			2.0 (HP)	23		
20								
		7-5-8 N=13			3.0 (HP)	23		
25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-18-2017 | Boring Completed: 12-18-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-18

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054934° Longitude: -85.328981°

Surface Elev.: 669.44 (Ft.)

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			30			3-5-5 N=10			2.0 (HP)	25		
			35	▽		2-3-2 N=5			0.75 (HP)	24		
			40			0-0-0 N=0				28		
			45			0-0-0 N=0				29		
			50			25-25-25 N=50				4		

LEAN CLAY (CL), trace sand, angular, light brown, medium stiff to stiff *(continued)*

37.0 — 632.5

LEAN CLAY (CL), trace sand, angular, gray, very soft

47.0 — 622.5

GRAVELLY LEAN CLAY WITH SAND (CL), angular, light gray and dark gray, hard

50.1 — ***Auger Refusal at 41.8'*** — 619.5

ADVANCED CASING

51.8 — 617.5

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-18-2017 | Boring Completed: 12-18-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-18

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054934° Longitude: -85.328981°

Surface Elev.: 669.44 (Ft.)

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
						Begin NQ2 Wireline Rock Core						
						DOLOMITE, light brown, light gray and light green, slightly weathered, minor shale bedding, strong rock *(continued)*						
			55			**RUN 1:** Depth: 51.8' - 61.8' Run Length: 10'	64	26				
			60									
			65			**RUN 2:** Depth: 61.8' - 66.8' Run Length: 5'	65	30				
66.8	602.5											
						Coring Terminated at 66.8 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-18-2017 | Boring Completed: 12-18-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-19

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054898° Longitude: -85.329197°

Surface Elev.: 673.69 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.7	673	**CONCRETE**
		FILL - BLACK SAND
3.0	670.5	**FILL - GRAVELLY LEAN CLAY**, angular, brown and reddish brown
17.0	656.5	**FILL - CLAYEY GRAVEL**, angular, light gray
22.0	651.5	**LEAN CLAY (CL)**, light gray and light brown, medium stiff to stiff

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
	X	3-2-2 N=4	
5	X	3-2-2 N=4	
	X	2-2-3 N=5	
	X	2-2-3 N=5	1.0 (HP)
10			
	X	2-2-4 N=6	
15			
	X	3-15-2 N=17	
20			
	X	1-2-2 N=4	1.0 (HP)
25			

RECOVERY (%) | RQD (%) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

WATER LEVEL OBSERVATIONS: ▽ at 20

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-05-2018 | Boring Completed: 01-05-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-19

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054898° Longitude: -85.329197°

Surface Elev.: 673.69 (Ft.)

DEPTH | ELEVATION (Ft.)

GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
LEAN CLAY (CL), light gray and light brown, medium stiff to stiff *(continued)*										
	30		X	4-5-7 N=12			2.5 (HP)			
	35		X	3-5-5 N=10			2.25 (HP)			
	40		X	2-4-4 N=8			1.5 (HP)			
light gray	45		X	2-3-4 N=7			1.25 (HP)			
	50		X	2-4-5 N=9			1.5 (HP)			
52.0 621.5										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-05-2018 | Boring Completed: 01-05-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-19

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054898° Longitude: -85.329197°

Surface Elev.: 673.69 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	POORLY GRADED GRAVEL (GP), angular, light brown					50/2"						
	56.0	617.5	55									
	Auger Refusal at 56 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-05-2018 | Boring Completed: 01-05-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-20

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054789° Longitude: -85.329379°

Surface Elev.: 674.76 (Ft.)

DEPTH | ELEVATION (Ft.)

GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
FILL - CLAYEY GRAVEL WITH SAND, angular, brown and light brown										
			X	3-3-5 N=8				16		
			X	3-2-3 N=5				16		
	5		X	1-2-2 N=4				14		
			X	1-1-2 N=3				20		
reddish brown	10		X	1-1-1 N=2			0.5 (HP)	13	37-22-15	40
17.0 658	15									
LEAN CLAY (CL), light brown and light gray, stiff, black mineral staining			X	3-4-5 N=9			2.75 (HP)	25		
	20									
			X	3-4-6 N=10			2.5 (HP)	27		
	25									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-04-2018 | Boring Completed: 01-04-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-20

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054789° Longitude: -85.329379°

Surface Elev.: 674.76 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			30			3-4-5 N=9			2.5 (HP)	23		
			35			4-3-5 N=8			2.5 (HP)	25		
			40			2-2-3 N=5			0.75 (HP)	25		
			45			0-1-2 N=3			0.5 (HP)	24	31-22-9	79
			50	▽		6-10-15 N=25			4.5 (HP)	19		

LEAN CLAY (CL), light brown and light gray, stiff, black mineral staining *(continued)*

37.0 — 638

LEAN CLAY WITH SAND (CL), gray, soft to medium stiff

47.0 — 628

CLAYEY GRAVEL (GC), light brown and brown, medium dense

52.0 — 623

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-04-2018 | Boring Completed: 01-04-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-20

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054789° Longitude: -85.329379°

Surface Elev.: 674.76 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		POORLY GRADED GRAVEL WITH SAND (GP), reddish brown, dense to very dense										
						16-21-20 N=41						
			55									
						6-50/3"						
	59.9	***Auger Refusal at 59.9'*** 615										
		ADVANCED CASING	60									
	61.9	613										
		VOID	65									
			70									
			75									
	77.1	597.5										
		Begin NQ2 Wireline Rock Core										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-04-2018 | Boring Completed: 01-04-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-20

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054789° Longitude: -85.329379°

Surface Elev.: 674.76 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			80			**RUN 1:** Depth: 77.1' - 82.1' Run Length: 5'	32	13				
			85			**RUN 2:** Depth: 82.1' - 87.1' Run Length: 5'	40	35				
	87.1	587.5										

INTERBEDDED DOLOMITE AND SHALE, light gray and white, slightly weathered, medium strong *(continued)*

Coring Terminated at 87.1 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-04-2018 | Boring Completed: 01-04-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-21

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054761° Longitude: -85.329042°

Surface Elev.: 669.44 (Ft.)

DEPTH	ELEVATION (Ft.)	FIELD TEST RESULTS	LABORATORY HP (tsf)
		FILL - LEAN CLAY, with gravel, reddish brown and brown	
		3-4-4 N=8	
		4-4-3 N=7	
		3-4-10 N=14	
		-low recovery	
		3-4-6 N=10	
		-low recovery	
		3-2-3 N=5	
		-low recovery	
17.0	652.5		
		LEAN CLAY (CL), trace sand, angular, light brown and light gray, medium stiff to stiff	
		2-3-3 N=6	1.0 (HP)
		3-3-3 N=6	1.0 (HP)

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-19-2017 | Boring Completed: 12-19-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-21

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054761° Longitude: -85.329042°

Surface Elev.: 669.44 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
	LEAN CLAY (CL), trace sand, angular, light brown and light gray, medium stiff to stiff *(continued)*				
		30		3-4-6 N=10	1.5 (HP)
		35		3-4-6 N=10	1.5 (HP)
		40		2-2-2 N=4	
42.0	627.5				
	LEAN CLAY (CL), trace sand, angular, gray, very soft	45		0-0-0 N=0	
49.3	620			0-0-0 N=0	
	Auger Refusal at 49.3 Feet				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-19-2017 | Boring Completed: 12-19-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-22

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054627° Longitude: -85.329222°

Surface Elev.: 673.74 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS
0.8	673	**CONCRETE**			
		FILL - GRAVELLY LEAN CLAY, reddish brown and brown		X	1-1-2 N=3
				X	1-1-2 N=3
			5	X	2-2-2 N=4
				X	1-2-2 N=4
			10		
				X	2-2-2 N=4
			15		
17.0	656.5				
		LEAN CLAY (CL), light brown, stiff to very stiff, black mineral staining		X	3-4-6 N=10
			20		
				X	3-5-6 N=11
			25		

RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		3.0 (HP)			
		3.0 (HP)			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *No free water observed while drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-05-2018 | Boring Completed: 01-05-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-22

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054627° Longitude: -85.329222°

Surface Elev.: 673.74 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
	LEAN CLAY (CL), light brown, stiff to very stiff, black mineral staining *(continued)*	30			
				4-7-10 N=17	3.0 (HP)
		35		4-5-7 N=12	1.5 (HP)
37.0	636.5				
	LEAN CLAY (CL), gray, medium stiff	40		2-2-2 N=4	0.75 (HP)
		45		2-2-3 N=5	0.75 (HP)
		50		1-3-4 N=7	1.0 (HP)

GRAPHIC LOG | WATER LEVEL OBSERVATIONS | RECOVERY (%) | RQD (%) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *No free water observed while drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-05-2018 | Boring Completed: 01-05-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-22

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054627° Longitude: -85.329222°

Surface Elev.: 673.74 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		LEAN CLAY (CL), gray, medium stiff *(continued)*										
	53.5	620										
		Auger Refusal at 53.5 Feet				50/0"						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-05-2018 | Boring Completed: 01-05-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-23

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054586° Longitude: -85.329427°

Surface Elev.: 674.03 (Ft.)

DEPTH	Description	ELEVATION (Ft.)
0.5	**CONCRETE**	673.5
	FILL - GRAVELLY LEAN CLAY, angular, brown	
	-low recovery	
17.0		657
	LEAN CLAY (CL), light brown and light gray, stiff to very stiff, black mineral staining	

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1 - 2.5		X	3-2-2 N=4						
3.5 - 5		X	2-2-2 N=4						
6 - 7.5		X	1-1-2 N=3						
8.5 - 10		X	1-2-3 N=5						
13.5 - 15		X	9-3-4 N=7						
18.5 - 20		X	3-5-9 N=14			3.5 (HP)			
23.5 - 25		X	5-9-13 N=22			4.0 (HP)			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-04-2018	Boring Completed: 01-04-2018
Drill Rig:	Driller: J. Freeman
Project No.: E2175127	

BORING LOG NO. T-23

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054586° Longitude: -85.329427°

Surface Elev.: 674.03 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	LEAN CLAY (CL), light brown and light gray, stiff to very stiff, black mineral staining *(continued)*										
		30			3-6-9 N=15			3.5 (HP)			
		35			3-4-5 N=9			2.0 (HP)			
		40			4-4-5 N=9			1.25 (HP)			
42.0	632										
	LEAN CLAY (CL), gray, very soft	45			0-0-1 N=1						
47.0	627										
	SANDY LEAN CLAY (CL), trace gravel, angular, gray, stiff	50	▽		4-7-7 N=14						
52.0	622										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-04-2018 | Boring Completed: 01-04-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-23

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054586° Longitude: -85.329427°

Surface Elev.: 674.03 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		POORLY GRADED GRAVEL (GP), angular, reddish brown to light gray, very dense				50/3"						
			55									
						2-50/4"						
	60.4	613.5	60									
		Auger Refusal at 60.4 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 01-04-2018 | Boring Completed: 01-04-2018

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-24

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054581° Longitude: -85.328985°

Surface Elev.: 669.50 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	669.5									
ASPHALT										
FILL - LEAN CLAY WITH GRAVEL, angular, reddish brown and light brown			X	6-3-3 N=6				15		
			X	3-2-2 N=4				13		
		5	X	3-2-3 N=5			1.0 (HP)	19		
			X	3-2-2 N=4				17		
12.0	657.5	10								
LEAN CLAY (CL), trace sand, angular, light brown and light gray, stiff, black mineral staining			X	3-6-7 N=13			2.5 (HP)	24		
		15								
			X	3-5-6 N=11			2.5 (HP)	22		
		20								
			X	6-7-8 N=15			3.0 (HP)	23		
		25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-19-2017 | Boring Completed: 12-19-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-24

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054581° Longitude: -85.328985°

Surface Elev.: 669.50 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	LEAN CLAY (CL), trace sand, angular, light brown and light gray, stiff, black mineral staining *(continued)*										
		30			3-5-7 N=12			1.5 (HP)	22	34-23-11	87
32.0	637.5										
	LEAN CLAY (CL), trace sand, angular, gray, very soft		▽		0-0-0 N=0				26		
		35									
					0-0-0 N=0				29		
		40									
					0-0-0 N=0				31		
		45									
49.0	***Auger Refusal at 49'*** 620.5										
	ADVANCED CASING				0-0-0 N=0				18		
50.7	619	50									
	Begin NQ2 Wireline Rock Core										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-19-2017 | Boring Completed: 12-19-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. T-24

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054581° Longitude: -85.328985°

Surface Elev.: 669.50 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	INTERBEDDED DOLOMITE, CHERT, AND SHALE, light gray, light brown and light greenish gray, slightly weathered, medium strong *(continued)*					**RUN 1:** Depth: 50.7' - 55.7' Run Length: 5'	65	0				
	55.7	614	55									
	DOLOMITE, light gray, slightly weathered, minor shale bedding, strong rock					**RUN 1:** Depth: 55.7' - 60.7' Run Length: 5'	87	74				
	60.7	609	60									
	Coring Terminated at 60.7 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 12-19-2017 | Boring Completed: 12-19-2017

Drill Rig: | Driller: J. Freeman

Project No.: E2175127

BORING LOG NO. OC-1

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0544° Longitude: -85.3293°

Approximate Surface Elev: 676 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	LITHOLOGY	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
0.5	675.5+/-	**CONCRETE**				
		FILL - SANDY LEAN CLAY WITH GRAVEL, brown, yellow and gray		X	4-2-3 N=5	2.0 (HP)
			5	X	2-2-2 N=4	2.5 (HP)
				X	2-3-3 N=6	1.75 (HP)
			10	X	2-2-3 N=5	1.5 (HP)
12.0	664+/-	**LEAN CLAY (CL)**, brown, yellow and gray, medium stiff		X	1-2-2 N=4	1.5 (HP)
			15			
			20	X	2-3-4 N=7	2.0 (HP)
22.0	654+/-	**LEAN CLAY (CL)**, brown and gray, very stiff				
			25	X	4-7-11 N=18	3.25 (HP)

WATER LEVEL OBSERVATIONS	RECOVERY (%)	RQD (%)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-06-2018 | Boring Completed: 02-06-2018

Drill Rig: DR0009 | Driller: C. Penton

Project No.: E2175127

BORING LOG NO. OC-1

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0544° Longitude: -85.3293°

Approximate Surface Elev: 676 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
	LEAN CLAY (CL), brown and gray, very stiff *(continued)*				
		30		4-8-11 N=19	
32.0	644+/-				
	LEAN CLAY (CL), brown, stiff	35		3-4-5 N=9	1.25 (HP)
37.0	639+/-				
	SANDY LEAN CLAY (CL), olive and brown, medium stiff	40		2-3-3 N=6	1.0 (HP)
		45		0-2-2 N=4	0.75 (HP)
47.0	629+/-				
	SANDY LEAN CLAY (CL), olive and gray, stiff	50		4-4-7 N=11	1.5 (HP)
51.2	625+/-				
	Auger Refusal at 51.2 Feet				

RECOVERY (%) | RQD (%) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-06-2018 | Boring Completed: 02-06-2018

Drill Rig: DR0009 | Driller: C. Penton

Project No.: E2175127

BORING LOG NO. OC-2

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0544° Longitude: -85.3293°

Approximate Surface Elev: 676 (Ft.) +/-

DEPTH	ELEVATION (Ft.)
0.3	675.5+/-
12.0	664+/-

ASPHALT

FILL - SANDY LEAN CLAY WITH GRAVEL, reddish brown

LEAN CLAY (CL), brown, stiff

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
	X	3-4-5 N=9	0 (HP)
	X	3-4-4 N=8	0 (HP)
5	X	1-3-3 N=6	
	X	2-3-4 N=7	1.25 (HP)
10			
	X	3-4-5 N=9	3.5 (HP)
15			
	X	2-5-6 N=11	3.25 (HP)
20			
	X	3-6-9 N=15	4.0 (HP)
25			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-06-2018 | Boring Completed: 02-06-2018

Drill Rig: DR0009 | Driller: C. Penton

Project No.: E2175127

BORING LOG NO. OC-2

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0544° Longitude: -85.3293°

Approximate Surface Elev: 676 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	FIELD TEST RESULTS	LABORATORY HP (tsf)
		LEAN CLAY (CL), brown, stiff *(continued)*	
		3-7-9 N=16	3.5 (HP)
32.0	644+/-		
		LEAN CLAY (CL), olive to brown, very soft	
		0-0-1 N=1	0.75 (HP)
		1-1-1 N=2	0.75 (HP)
		0-0-0 N=0	1.0 (HP)
		0-0-1 N=1	0.75 (HP)

GRAPHIC LOG | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (%) | RQD (%) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-06-2018 | Boring Completed: 02-06-2018

Drill Rig: DR0009 | Driller: C. Penton

Project No.: E2175127

BORING LOG NO. OC-2

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0544° Longitude: -85.3293° Approximate Surface Elev: 676 (Ft.) +/- DEPTH / ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	LEAN CLAY (CL), olive to brown, very soft *(continued)* 53.3 622.5+/-										
	Auger Refusal at 53.3 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-06-2018 | Boring Completed: 02-06-2018

Drill Rig: DR0009 | Driller: C. Penton

Project No.: E2175127

BORING LOG NO. OC-3

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0544° Longitude: -85.3294°

Approximate Surface Elev: 675 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.5	674.5+/-	**CONCRETE**
		FILL - POORLY GRADED SAND AND GRAVEL, brown and red
3.0	672+/-	
		FILL - GRAVELLY FAT CLAY WITH SAND, orange and brown
8.0	667+/-	
		FILL - GRAVELLY FAT CLAY WITH SAND, orange and brown
17.0	658+/-	
		LEAN CLAY (CL), gray and brown, stiff
22.0	653+/-	
		LEAN CLAY (CL), gray and brown, very stiff

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
5		3-6-6 N=12	0 (HP)
		2-1-1 N=2	1.75 (HP)
		1-1-1 N=2	0.75 (HP)
10		2-2-3 N=5	1.75 (HP)
		2-2-6 N=8	1.0 (HP)
15			
20		2-4-6 N=10	2.75 (HP)
25		4-8-14 N=22	4.0 (HP)

GRAPHIC LOG | WATER LEVEL OBSERVATIONS | RECOVERY (%) | RQD (%) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-06-2018 | Boring Completed: 02-06-2018

Drill Rig: DR0009 | Driller: C. Penton

Project No.: E2175127

BORING LOG NO. OC-3

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0544° Longitude: -85.3294°

Approximate Surface Elev: 675 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			30			5-7-13 N=20						
32.0	643+/-											
LEAN CLAY (CL), trace silt, brown and gray, medium stiff			35			3-4-4 N=8			1.5 (HP)			
			40			3-4-6 N=10			1.5 (HP)			
42.0	633+/-											
SILTY LEAN CLAY (CL-ML), gray, very soft			45			0-0-0 N=0			0.75 (HP)			
			50			0-0-1 N=1			1.0 (HP)			

LEAN CLAY (CL), gray and brown, very stiff *(continued)*

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-06-2018 | Boring Completed: 02-06-2018

Drill Rig: DR0009 | Driller: C. Penton

Project No.: E2175127

BORING LOG NO. OC-3

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0544° Longitude: -85.3294° Approximate Surface Elev: 675 (Ft.) +/- DEPTH / ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY LEAN CLAY (CL-ML), gray, very soft 53.0 *(continued)* 622+/-										
	Auger Refusal at 53 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-06-2018 | Boring Completed: 02-06-2018

Drill Rig: DR0009 | Driller: C. Penton

Project No.: E2175127

BORING LOG NO. OC-4

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0543° Longitude: -85.3294°

Approximate Surface Elev: 675 (Ft.) +/-

DEPTH ELEVATION (Ft.)

GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
FILL - LEAN CLAY WITH GRAVEL, orange to brown										
			X	2-2-3 N=5			1.5 (HP)			
			X	2-2-3 N=5			1.5 (HP)			
	5		X	2-2-2 N=4			1.0 (HP)			
			X	1-2-2 N=4			0.75 (HP)			
	10									
			X	1-1-1 N=2			1.0 (HP)			
17.0 658+/-	15									
LEAN CLAY (CL), brown, stiff			X	3-5-7 N=12			2.25 (HP)			
	20									
			X	4-5-9 N=14			3.0 (HP)			
	25									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-06-2018 Boring Completed: 02-06-2018

Drill Rig: DR0009 Driller: C. Penton

Project No.: E2175127

BORING LOG NO. OC-4

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0543° Longitude: -85.3294°

Approximate Surface Elev: 675 (Ft.) +/-

DEPTH ELEVATION (Ft.)

GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
LEAN CLAY (CL), brown, stiff *(continued)*										
	30			3-5-7 N=12			2.25 (HP)			
	35			5-5-9 N=14			2.5 (HP)			
37.0 638+/-										
SILTY LEAN CLAY (CL-ML)	40			1-2-3 N=5			0.75 (HP)			
	45			1-2-2 N=4			1.0 (HP)			
47.0 628+/-										
SILTY CLAYEY SAND (SC-SM), gray, dense	50			9-22-24 N=46			1.25 (HP)			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-06-2018 Boring Completed: 02-06-2018

Drill Rig: DR0009 Driller: C. Penton

Project No.: E2175127

BORING LOG NO. OC-4

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0543° Longitude: -85.3294°

Approximate Surface Elev: 675 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY CLAYEY SAND (SC-SM), gray, dense *(continued)*										
						50/1"						
58.5	616.5+/-	***Auger Refusal at 58.5'***	55									
		Begin NQ2 Wireline Rock Core **INTERBEDDED DOLOMITE, SHALE, AND SILTSTONE**, light gray, light brown and light green, medium strong				**RUN 1:** Depth: 58.5' - 68.5' Run Length: 10'	35	8				
68.5	606.5+/-	***Coring Terminated at 68.5 Feet***	60 65									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-06-2018 | Boring Completed: 02-06-2018

Drill Rig: DR0009 | Driller: C. Penton

Project No.: E2175127

BORING LOG NO. VB-1

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0552° Longitude: -85.3294°

Approximate Surface Elev: 678 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
		FILL - CLAYEY GRAVEL, orange and brown				
				X	3-5-5 N=10	
3.0	675+/-					
		FILL - LEAN CLAY WITH GRAVEL, orange and brown		X	1-2-2 N=4	
			5	X	0-0-1 N=1	1.0 (HP)
				X	1-1-2 N=3	0.5 (HP)
12.0	666+/-		10			
		SANDY LEAN CLAY WITH GRAVEL (CL), brown, very soft		X	0-2-3 N=5	1.0 (HP)
			15			
				X	0-0-0 N=0	0.5 (HP)
			20			
				X	0-0-0 N=0	3.25 (HP)
			25			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-12-2018 | Boring Completed: 02-12-2018

Drill Rig: DR754 | Driller: R. Preston

Project No.: E2175127

BORING LOG NO. VB-1

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0552° Longitude: -85.3294°

Approximate Surface Elev: 678 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	FIELD TEST RESULTS	LABORATORY HP (tsf)
		SANDY LEAN CLAY WITH GRAVEL (CL), brown, very soft *(continued)*	
28.0	650+/-		
		LEAN CLAY WITH SAND (CL), brown and gray, stiff	
		3-5-6 N=11	4.25 (HP)
		4-6-6 N=12	4.0 (HP)
34.5	643.5+/-		
		SANDY LEAN CLAY WITH GRAVEL (CL), gray, soft	
		0-0-0 N=0	0.5 (HP)
42.0	636+/-		
		SANDY LEAN CLAY WITH GRAVEL (CL), yellow to orange, medium dense	
		15-50/3"	0.5 (HP)
48.6	629.5+/-		
		Auger Refusal at 48.6 Feet	

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-12-2018 | Boring Completed: 02-12-2018

Drill Rig: DR754 | Driller: R. Preston

Project No.: E2175127

BORING LOG NO. EB-1

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0551° Longitude: -85.3288°

Approximate Surface Elev: 669 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	LITHOLOGY
0.5	668.5+/-	**ASPHALT**
		FILL - LEAN CLAY WITH GRAVEL, orange and brown
5.5	663.5+/-	**FILL - CLAYEY GRAVEL**, brown
12.0	657+/-	**LEAN CLAY WITH SAND (CL)**, brown, stiff

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
	X	1-4-6 N=10	1.0 (HP)
5	X	3-3-2 N=5	1.0 (HP)
	X	3-6-7 N=13	
	X	1-3-2 N=5	
10			
	X	4-5-5 N=10	1.5/3.0
15			
	X	4-3-5 N=8	2.0 (HP)
20			
	X	3-4-6 N=10	2.25 (HP)
25			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-12-2018 | Boring Completed: 02-12-2018

Drill Rig: DR754 | Driller: R. Preston

Project No.: E2175127

BORING LOG NO. EB-1

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0551° Longitude: -85.3288°

Approximate Surface Elev: 669 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION	FIELD TEST RESULTS	LABORATORY HP (tsf)
27.0	642+/-	**LEAN CLAY WITH SAND (CL)**, brown, stiff *(continued)*		
		SILTY LEAN CLAY (CL-ML), dark gray, medium stiff	2-3-5 N=8	0.5 (HP)
32.0	637+/-	**LEAN CLAY (CL)**, dark gray, very stiff	0-0-0 N=0	0.5 (HP)
			0-0-0 N=0	0.75 (HP)
			0-0-0 N=0	1.0 (HP)
47.0	622+/-	**GRAVELLY LEAN CLAY WITH SAND (CL)**, dark gray, hard	10-35-50/5"	
51.2	618+/-	***Auger Refusal at 51.2'***		
		Begin NQ2 Wireline Rock Core		

DEPTH (Ft.): 30, 35, 40, 45, 50

WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (%) | RQD (%) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-12-2018 | Boring Completed: 02-12-2018

Drill Rig: DR754 | Driller: R. Preston

Project No.: E2175127

BORING LOG NO. EB-1

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0551° Longitude: -85.3288°

Approximate Surface Elev: 669 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		DOLOMITE, light gray, minor shale bedding, strong rock *(continued)*	55			**RUN 1:** Depth: 51.2' - 61.2' Run Length: 10'	10	3				
	61.2	608+/-	60									
		Coring Terminated at 61.2 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-12-2018 | Boring Completed: 02-12-2018

Drill Rig: DR754 | Driller: R. Preston

Project No.: E2175127

BORING LOG NO. EB-2

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0551° Longitude: -85.3287°

Approximate Surface Elev: 669 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	
0.5	668.5+/-	**ASPHALT**
		FILL - CLAYEY SAND, dark brown and black
5.5	663.5+/-	
		FILL - GRAVELLY CLAY, dark brown
8.0	661+/-	
		GRAVELLY LEAN CLAY WITH SAND, brown
12.0	657+/-	
		SANDY LEAN CLAY (CL), brown, stiff

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
	X	3-5-7 N=12	0.5 (HP)
	X	0-0-0 N=0	
5	X	2-2-1 N=3	1.25 (HP)
	X	9-5-5 N=10	1.25/0.5
10			
	X	3-5-5 N=10	3.0 (HP)
15			
	X	3-4-5 N=9	3.0 (HP)
20			
	X	3-4-5 N=9	2.5 (HP)
25			

RECOVERY (%) | RQD (%) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-12-2018 | Boring Completed: 02-12-2018

Drill Rig: DR754 | Driller: R. Preston

Project No.: E2175127

BORING LOG NO. EB-2

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0551° Longitude: -85.3287°

Approximate Surface Elev: 669 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
27.0	642+/-										
SANDY LEAN CLAY (CL), brown, stiff *(continued)*											
SILTY LEAN CLAY (CL), gray and dark gray, very soft											
				X	0-0-0 N=0			0.75 (HP)			
		30									
				X	0-0-0 N=0			0.5 (HP)			
		35									
				X	0-0-0 N=0			0.75 (HP)			
		40									
				X	0-0-0 N=0			0.75 (HP)			
		45									
47.0	622+/-										
SILTY LEAN CLAY (CL-ML), gray, hard											
49.8	619+/-			X	25-31-42/4"			1.25 (HP)			
Auger Refusal at 49.8 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-12-2018 | Boring Completed: 02-12-2018

Drill Rig: DR754 | Driller: R. Preston

Project No.: E2175127

BORING LOG NO. PS-1

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0553° Longitude: -85.3288°

Approximate Surface Elev: 669 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3 **ASPHALT**	668.5+/-										
0.5 **AGGREGATE**	668.5+/-										
FILL - POORLY GRADED SAND AND GRAVEL, black				X	8-15-18 N=33						
				X	10-5-5 N=10						
		5									
				X	13-50/6"						
hard at 10'				X	15-35-31 N=66						
		10									
12.0	657+/-										
SILTY LEAN CLAY WITH SAND (CL), brown, stiff, chemical and fuel aroma				X	2-4-7 N=11			3.75 (HP)			
		15									
				X	3-6-8 N=14			3.0 (HP)			
		20									
				X	3-4-6 N=10			2.5 (HP)			
		25									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-08-2018 | Boring Completed: 02-08-2018

Drill Rig: DR754 | Driller: R. Preston

Project No.: E2175127

BORING LOG NO. PS-1

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0553° Longitude: -85.3288°

Approximate Surface Elev: 669 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY LEAN CLAY WITH SAND (CL), brown, stiff, chemical and fuel aroma *(continued)*											
					X	3-3-4 N=7			1.25 (HP)			
			30									
					X	0-0-0 N=0			0.75 (HP)			
			35									
					X	0-0-0 N=0			0.75 (HP)			
			40									
					X	0-0-0 N=0			1.25 (HP)			
			45									
				▽	X	17-50/2"			0.75 (HP)			
			50									
32.0	637+/-											
	LEAN CLAY WITH SILT (CL), dark gray, very soft											
47.0	622+/-											
	CLAYEY SAND WITH GRAVEL (SC), brown, very dense											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-08-2018 | Boring Completed: 02-08-2018

Drill Rig: DR754 | Driller: R. Preston

Project No.: E2175127

BORING LOG NO. PS-1

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0553° Longitude: -85.3288° Approximate Surface Elev: 669 (Ft.) +/- DEPTH / ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	CLAYEY SAND WITH GRAVEL (SC), brown, very dense *(continued)*										
				X	5-50						
	54.7 / 614.5+/-										
	Auger Refusal at 54.7 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-08-2018 | Boring Completed: 02-08-2018

Drill Rig: DR754 | Driller: R. Preston

Project No.: E2175127

BORING LOG NO. PS-2

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0553° Longitude: -85.3287°

Approximate Surface Elev: 669 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.5	668.5+/-											
ASPHALT												
0.8	668+/-											
CONCRETE												
FILL - POORLY GRADED SAND, dark brown and black					X	14-16-11 N=27						
					X	6-7-4 N=11						
			5		X	15-28-14 N=42						
					X	8-9-6 N=15						
12.0	657+/-		10									
SANDY LEAN CLAY (CL), brown and gray, stiff					X	1-4-5 N=9			4.0 (HP)			
			15									
					X	3-6-9 N=15			4.0 (HP)			
			20									
					X	3-6-4 N=10			3.0 (HP)			
			25									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-08-2018 | Boring Completed: 02-08-2018

Drill Rig: DR754 | Driller: R. Preston

Project No.: E2175127

BORING LOG NO. PS-2

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0553° Longitude: -85.3287°

Approximate Surface Elev: 669 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
27.0	642+/-	**SANDY LEAN CLAY (CL)**, brown and gray, stiff *(continued)*										
		SILTY LEAN CLAY WITH SAND (CL-ML), dark gray, very soft	30			0-0-0 N=0			0.75 (HP)			
			35			0-0-0 N=0			0.75 (HP)			
			40			0-0-0 N=0			0.75 (HP)			
			45			0-0-0 N=0			0.75 (HP)			
47.0	622+/-	**SAND WITH GRAVEL (SP)**, gray and black, very dense		▽								
49.5	619.5+/-	***Auger Refusal at 49.5'***				11-50						
		Begin NQ2 Wireline Rock Core **SHALE**, dark gray, unweathered, medium stiff	50									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-08-2018 | Boring Completed: 02-08-2018

Drill Rig: DR754 | Driller: R. Preston

Project No.: E2175127

BORING LOG NO. PS-2

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0553° Longitude: -85.3287°

Approximate Surface Elev: 669 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SHALE, dark gray, unweathered, medium stiff *(continued)*	55			**RUN 1:** Depth: 49.5' - 59.5' Run Length: 10'	40	21				
	59.5	609.5+/-										
		Coring Terminated at 59.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-08-2018 | Boring Completed: 02-08-2018

Drill Rig: DR754 | Driller: R. Preston

Project No.: E2175127

BORING LOG NO. PS-3

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0552° Longitude: -85.3288°

Approximate Surface Elev: 669 (Ft.) +/-

DEPTH	ELEVATION (Ft.)
0.5	668.5+/-
12.0	657+/-

ASPHALT

FILL - POORLY GRADED SAND, black, with organics (wood)

LEAN CLAY WITH SAND (CL), brown and gray, stiff

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
		12-24-21 N=45	
5		27-22-16 N=38	
		19-10-21 N=31	
		3-2-1 N=3	
10			
		3-3-6 N=9	3.0 (HP)
15			
		8-6-6 N=12	4.0/2.0
20			
		3-4-6 N=10	2.25 (HP)
25			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started:

Boring Completed:

Drill Rig: DR754

Driller: R. Preston

Project No.: E2175127

BORING LOG NO. PS-3

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0552° Longitude: -85.3288°

Approximate Surface Elev: 669 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
27.0	642+/-	**LEAN CLAY WITH SILT (CL)**, gray and dark gray, soft to very soft				
			30	X	3-2-1 N=3	0.5 (HP)
			35	X	0-0-0 N=0	0.5 (HP)
			40	X	0-0-0 N=0	0.75 (HP)
			45	X	0-0-0 N=0	0.75 (HP)
47.0	622+/-	**CLAYEY GRAVEL (GC)**, brown, very dense				
48.5	620.5+/-	***Auger Refusal at 48.5'***				
		Begin NQ2 Wireline Rock Core **DOLOMITE**, light gray to light brown and light green, slightly weathered, minor shale bedding, strong rock	50		50/0"	

RECOVERY (%)	RQD (%)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started:

Boring Completed:

Drill Rig: DR754

Driller: R. Preston

Project No.: E2175127

BORING LOG NO. PS-3

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0552° Longitude: -85.3288°

Approximate Surface Elev: 669 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		DOLOMITE, light gray to light brown and light green, slightly weathered, minor shale bedding, strong rock *(continued)*	55			**RUN 1:** Depth: 48.5' - 58.5' Run Length: 10'	56	16				
	58.5	610.5+/-										
		Coring Terminated at 58.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started:

Boring Completed:

Drill Rig: DR754

Driller: R. Preston

Project No.: E2175127

BORING LOG NO. PS-4

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0552° Longitude: -85.3287°

Approximate Surface Elev: 669 (Ft.) +/-

DEPTH	ELEVATION (Ft.)
0.5	668.5+/-
12.0	657+/-

ASPHALT

FILL - POORLY GRADED SAND AND GRAVEL, dark brown and black

SANDY LEAN CLAY (SC), brown and gray, medium stiff to stiff

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
	X	10-1-3 N=4	
	X	1-2-18 N=20	
5			
	X	1-1-2 N=3	
	X	1-3-2 N=5	
10			
	X	3-3-2 N=5	2.0 (HP)
15			
	X	3-3-6 N=9	3.0 (HP)
20			
	X	3-4-5 N=9	1.75 (HP)
25			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-08-2018 | Boring Completed: 02-08-2018

Drill Rig: DR754 | Driller: R. Preston

Project No.: E2175127

BORING LOG NO. PS-4

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.0552° Longitude: -85.3287°

Approximate Surface Elev: 669 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
27.0	642+/-										
LEAN CLAY WITH SILT (CL), gray and dark gray, very soft											
					0-0-0 N=0			0.5 (HP)			
		30									
					0-0-0 N=0			0.75 (HP)			
		35									
					0-0-0 N=0			0.5 (HP)			
		40									
					0-0-0 N=0			1.0 (HP)			
		45									
47.0	622+/-										
CLAYEY SAND WITH GRAVEL (SC), dark gray, very dense											
49.1	620+/-				15-50/1"						
Auger Refusal at 49.1 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-08-2018 | Boring Completed: 02-08-2018

Drill Rig: DR754 | Driller: R. Preston

Project No.: E2175127

BORING LOG NO. DS-1

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.055013° Longitude: -85.327216°

Surface Elev.: 661.81 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.5	661.5	**ASPHALT**
		FILL - LEAN CLAY WITH GRAVEL, greenish gray and brown
		brown and black
8.0	654	
		FILL - LEAN CLAY WITH GRAVEL, brown, yellow and gray
12.5	649.5	-low recovery
		FILL - LEAN CLAY, brown
17.0	645	
		LEAN CLAY (CL), brown and gray, medium stiff to stiff

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
	X	3-6-8 N=14	2.5 (HP)
5	X	2-3-3 N=6	3.0 (HP)
	X	3-2-2 N=4	1.75 (HP)
	X	3-5-5 N=10	1.75 (HP)
10			
	X	2-1-1 N=2	2.5 (HP)
15			
	X	2-3-4 N=7	2.0 (HP)
20			
	X	2-6-7 N=13	4.0 (HP)
25			

RECOVERY (%) | RQD (%) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started:

Boring Completed:

Drill Rig: DR754

Driller: R. Preston

Project No.: E2175127

BORING LOG NO. DS-1

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.055013° Longitude: -85.327216°

Surface Elev.: 661.81 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	27.0	635										
	SANDY LEAN CLAY (CL), brown and gray, medium stiff				X	2-3-4 N=7			1.5 (HP)			
			30									
					X	0-0-6 N=6			.5 (HP)			
			35									
	37.0	625										
	CLAYEY GRAVELLY SAND (SP-SC), blue-gray and greenish brown, medium stiff				X	3-3-4 N=7						
			40									
	-no recovery below 42'				X	3-16-29 N=45						
			45									
	46.5	615.5										
	Auger Refusal at 46.5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed while drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started:

Boring Completed:

Drill Rig: DR754

Driller: R. Preston

Project No.: E2175127

BORING LOG NO. DS-2

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054966° Longitude: -85.32715°

Surface Elev.: 661.39 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	FILL - LEAN CLAY, trace gravel, brown and gray, trace wood fragments					3-4-4 N=8			4.0 (HP)			
						7-6-4 N=10			2.0 (HP)			
	-no recovery		5			2-2-2 N=4	0					
	-no recovery					0-2-2 N=4	0					
			10									
						1-1-1 N=2			1.0 (HP)			
			15									
						0-3-3 N=6			2.25 (HP)			
			20									
						3-6-9 N=15			2.5 (HP)			
			25									

17.0 644.5

LEAN CLAY (CL), dark brown and black, medium stiff

22.0 639.5

SANDY LEAN CLAY (CL), gray and rust orange, stiff

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-05-2018 | Boring Completed: 02-05-2018

Drill Rig: DR754 | Driller: C. Penton

Project No.: E2175127

BORING LOG NO. DS-2

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054966° Longitude: -85.32715°

Surface Elev.: 661.39 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SANDY LEAN CLAY (CL), gray and rust orange, stiff *(continued)*										
						3-4-6 N=10			1.5 (HP)			
	32.0	629.5	30									
		SANDY LEAN CLAY (CL), gray and orange, medium stiff										
						4-3-4 N=7			1.0/2.0			
	37.0	624.5	35									
		SILTY SANDY CLAY (CL-ML), dark gray, medium stiff		▽								
						0-0-5 N=5			.75 (HP)			
	42.0	619.5	40									
		CLAYEY SAND WITH GRAVEL (SC), red, dense										
	44.2	***Auger Refusal at 44.2'*** 617				45-50/2"			1.0 (HP)			
		Begin NQ2 Wireline Rock Core **SLIGHTLY WEATHERED SHALE**, calcareous, light gray and gray, medium strong	45									
			50			**RUN 1:** Depth: 44.2' - 54.2' Run Length: 10'	44	14				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-05-2018 | Boring Completed: 02-05-2018

Drill Rig: DR754 | Driller: C. Penton

Project No.: E2175127

BORING LOG NO. DS-2

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054966° Longitude: -85.32715°

Surface Elev.: 661.39 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
SLIGHTLY WEATHERED SHALE, calcareous, light gray and gray, medium strong *(continued)*											
54.2	607										
SHALE, calcareous, light gray, gray, and maroon, unweathered, medium strong		55			**RUN 2:** Depth: 54.2' - 59.2' Run Length: 5'	100	74				
59.2	602										
Coring Terminated at 59.2 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA
NQ2 Wireline Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-05-2018 | Boring Completed: 02-05-2018

Drill Rig: DR754 | Driller: C. Penton

Project No.: E2175127

BORING LOG NO. DS-3

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054948° Longitude: -85.327227°

Surface Elev.: 661.39 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.5	661	**TOPSOIL**
		FILL - LEAN CLAY, brown and orange
5.5	656	
		FILL - LEAN CLAY, with rock, brown
7.5	654	
		LEAN CLAY (CL), with chert, yellow to brown, medium stiff
12.0	649.5	
		CLAYEY SAND (SC), black, very loose
17.0	644.5	
		LEAN CLAY (CL), olive to brown, very soft
22.0	639.5	
		SANDY LEAN CLAY (CL), tan and gray, stiff

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	LABORATORY HP (tsf)
		3-4-4 N=8	1.75/2.75
5		2-2-7 N=9	1.5 (HP)
		3-50/3"	1.25 (HP)
		1-3-3 N=6	1.25 (HP)
10			
		0-0-2 N=2	1.0 (HP)
15			
		0-0-1 N=1	1.25 (HP)
20			
		4-6-9 N=15	3.5/1.75
25			

WATER LEVEL OBSERVATIONS, RECOVERY (%), RQD (%), WATER CONTENT (%), ATTERBERG LIMITS (LL-PL-PI), PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

At completion of drilling

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-08-2018 | Boring Completed: 02-08-2018

Drill Rig: DR754 | Driller: R. Preston

Project No.: E2175127

BORING LOG NO. DS-3

PROJECT: Hamm Road

CLIENT: Hazen & Sawyer
Nashville, TN

SITE: 155 Hamm Road
Chattanooga, Tennessee

LOCATION See Exploration Plan

Latitude: 35.054948° Longitude: -85.327227°

Surface Elev.: 661.39 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
SANDY LEAN CLAY (CL), tan and gray, stiff *(continued)*											
		30			0-3-4 N=7			1.5 (HP)			
medium stiff											
		35			2-2-2 N=4			2.0 (HP)			
37.0	624.5										
CLAYEY SAND (SC), dark gray, medium dense											
		40			0-2-10 N=12			.75 (HP)			
42.0	619.5										
EXTREMELY WEATHERED SHALE											
44.2	617		▽		35-50/2"			2.5 (HP)			
Auger Refusal at 44.2 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

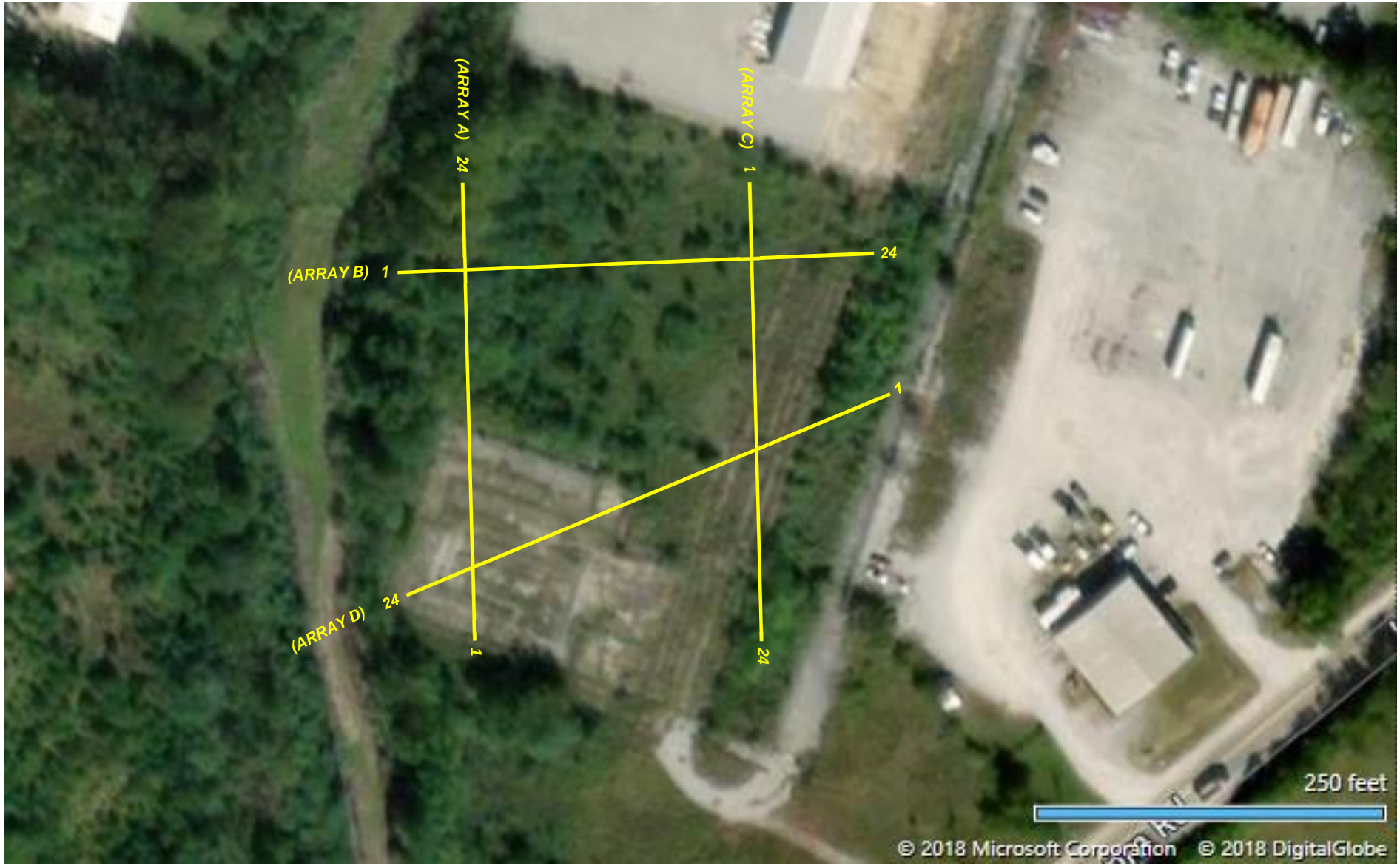
▽ *At completion of drilling*

Terracon
51 Lost Mound Dr Ste 135
Chattanooga, TN

Boring Started: 02-08-2018 | Boring Completed: 02-08-2018

Drill Rig: DR754 | Driller: R. Preston

Project No.: E2175127



CROSS-SECTIONAL PROFILES CREATED WITH REFRACTION MICROTREMOR (REMI) EQUIPMENT. DATA REDUCTION PERFORMED WITH ReMiVSPECT V4.0 SOFTWARE. DATA MODEL CREATED WITH ReMiDISPERSV4.0.
24 12-Hz GEOPHONES USED DURING FIELD DATA ACQUISITION.

Project Manager:	JR
Drawn by:	MM
Checked by:	JC
Approved by:	JC

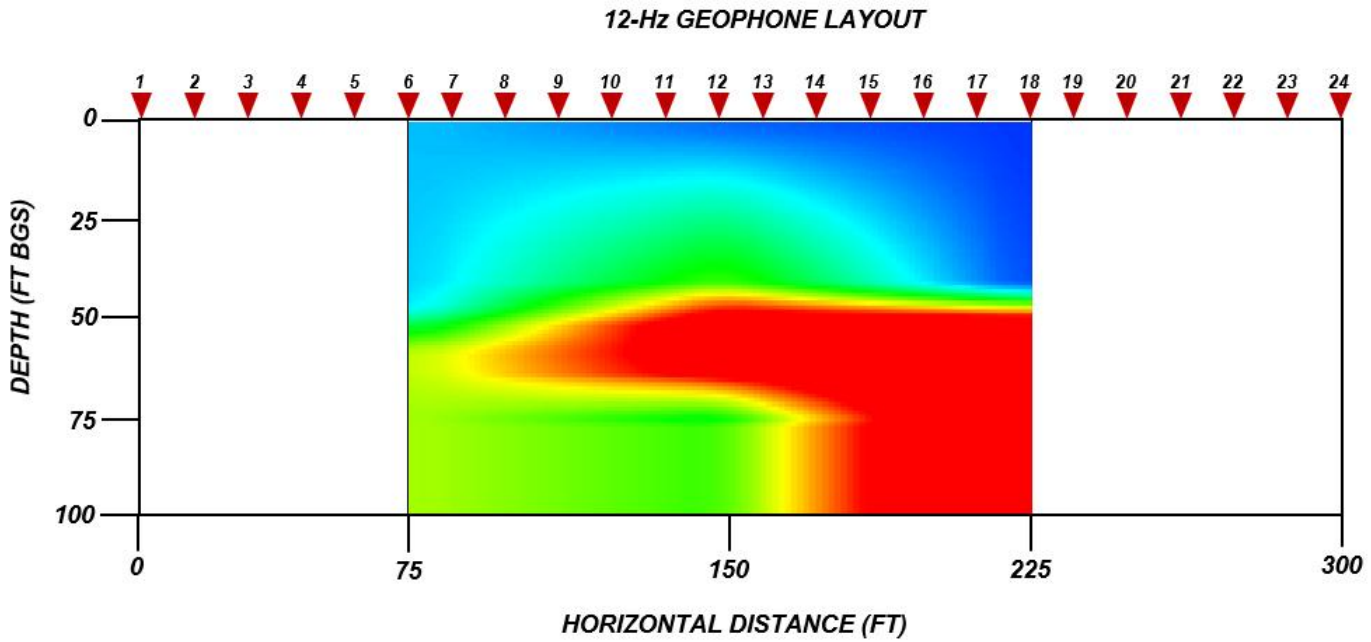
Project No.	E2175127
Scale:	NOTED
File Name:	E2175127
Date:	6/21/2018

Terracon
51 LOST MOUND DRIVE; SUITE 135
CHATTANOOGA, TN 37406

CROSS-SECTIONAL PROFILE LAYOUT

Limited Geophysical Study
HAMM ROAD
CHATTANOOGA, TN

Exhibit
A-2



SOIL | ***VERY STILL SOIL / WEATHERED ROCK*** | ***ROCK***

CROSS-SECTIONAL PROFILES CREATED WITH REFRACTION MICROTREMOR (REMI) EQUIPMENT. DATA REDUCTION PERFORMED WITH ReMiVSPECT V4.0 SOFTWARE. DATA MODEL CREATED WITH ReMiDISPERSV4.0.
24 12-Hz GEOPHONES USED DURING FIELD DATA ACQUISITION.

Project Manager:	JR
Drawn by:	MM
Checked by:	JC
Approved by:	JC

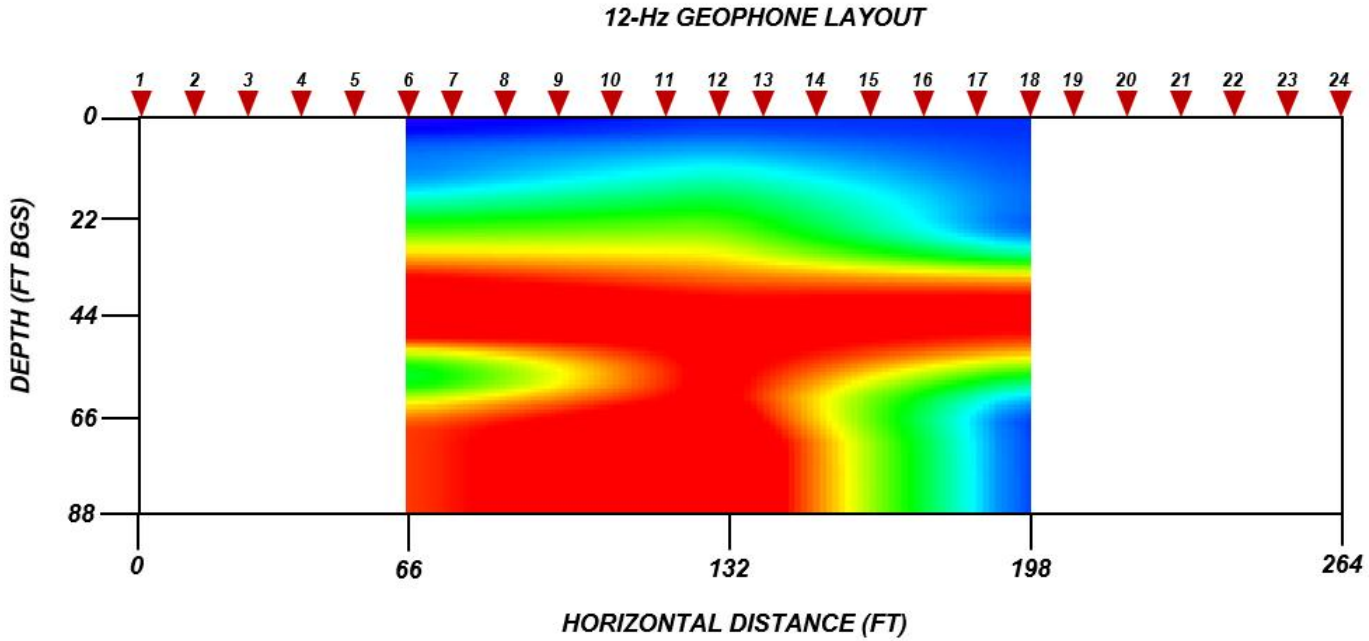
Project No.	E2175127
Scale:	NOTED
File Name:	E2175127
Date:	6/21/2018

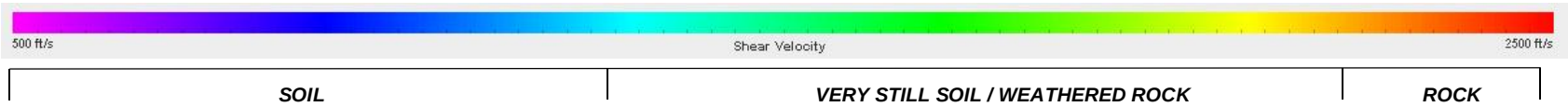
Terracon
51 LOST MOUND DRIVE; SUITE 135
CHATTANOOGA, TN 37406

ARRAY A CROSS-SECTIONAL PROFILE

Limited Geophysical Study
HAMM ROAD
CHATTANOOGA, TENNESSEE

Exhibit
A-3





CROSS-SECTIONAL PROFILES CREATED WITH REFRACTION MICROTREMOR (REMI) EQUIPMENT. DATA REDUCTION PERFORMED WITH ReMiVSPECT V4.0 SOFTWARE. DATA MODEL CREATED WITH ReMiDISPERSV4.0.
24 12-Hz GEOPHONES USED DURING FIELD DATA ACQUISITION.

Project Manager:	JR
Drawn by:	MM
Checked by:	JC
Approved by:	JC

Project No.	E2175127
Scale:	NOTED
File Name:	E2175127
Date:	6/21/2018

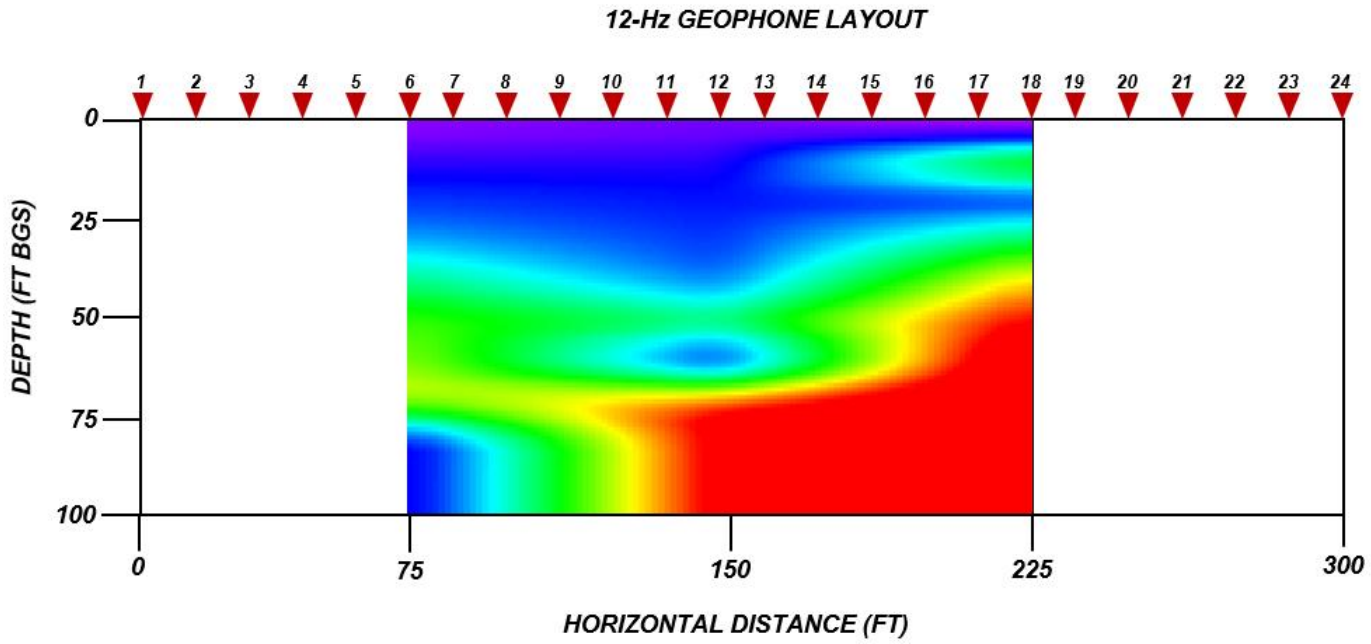
Terracon
51 LOST MOUND DRIVE; SUITE 135
CHATTANOOGA, TN 37406

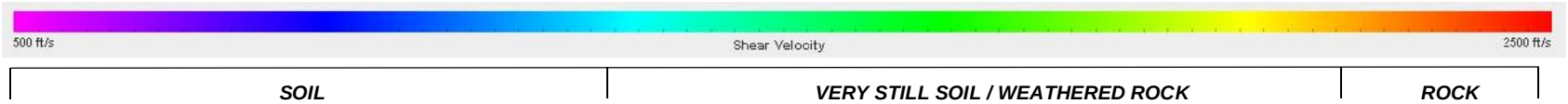
ARRAY B CROSS-SECTIONAL PROFILE

Limited Geophysical Study
HAMM ROAD
CHATTANOOGA, TENNESSEE

Exhibit

A-4





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24 12-Hz GEOPHONES USED DURING FIELD DATA ACQUISITION.

Project Manager:	JR
Drawn by:	MM
Checked by:	JC
Approved by:	JC

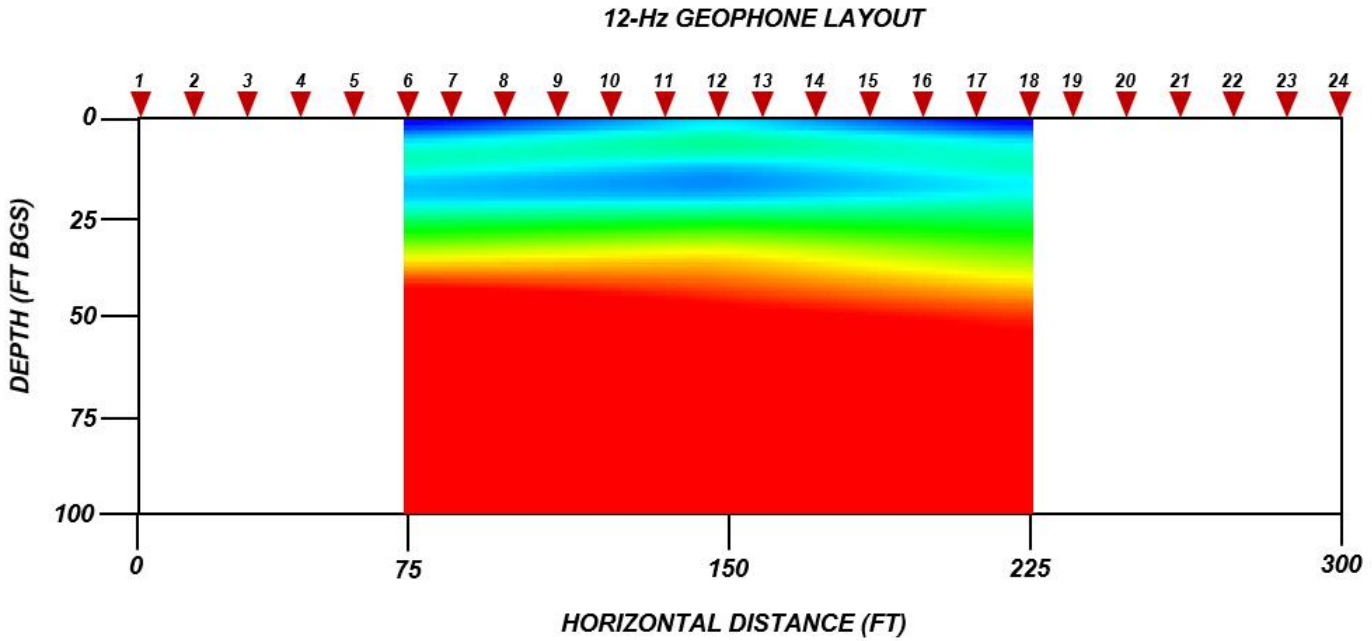
Project No.	E2175127
Scale:	NOTED
File Name:	E2175127
Date:	6/21/2018

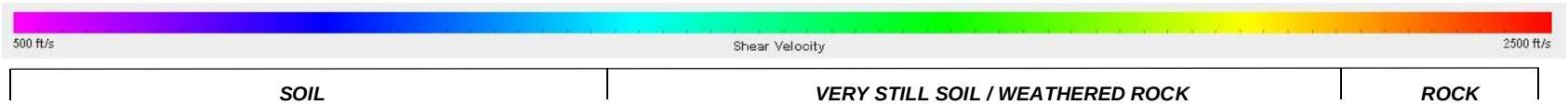
Terracon
51 LOST MOUND DRIVE; SUITE 135
CHATTANOOGA, TN 37406

ARRAY C CROSS-SECTIONAL PROFILE

Limited Geophysical Study
HAMM ROAD
CHATTANOOGA, TENNESSEE

Exhibit
A-5





CROSS-SECTIONAL PROFILES CREATED WITH REFRACTION MICROTREMOR (REMI) EQUIPMENT. DATA REDUCTION PERFORMED WITH ReMiVSPECT V4.0 SOFTWARE. DATA MODEL CREATED WITH ReMiDISPERSV4.0.
24 12-Hz GEOPHONES USED DURING FIELD DATA ACQUISITION.

Project Manager:	JR
Drawn by:	MM
Checked by:	JC
Approved by:	JC

Project No.	E2175127
Scale:	NOTED
File Name:	E2175127
Date:	6/21/2018

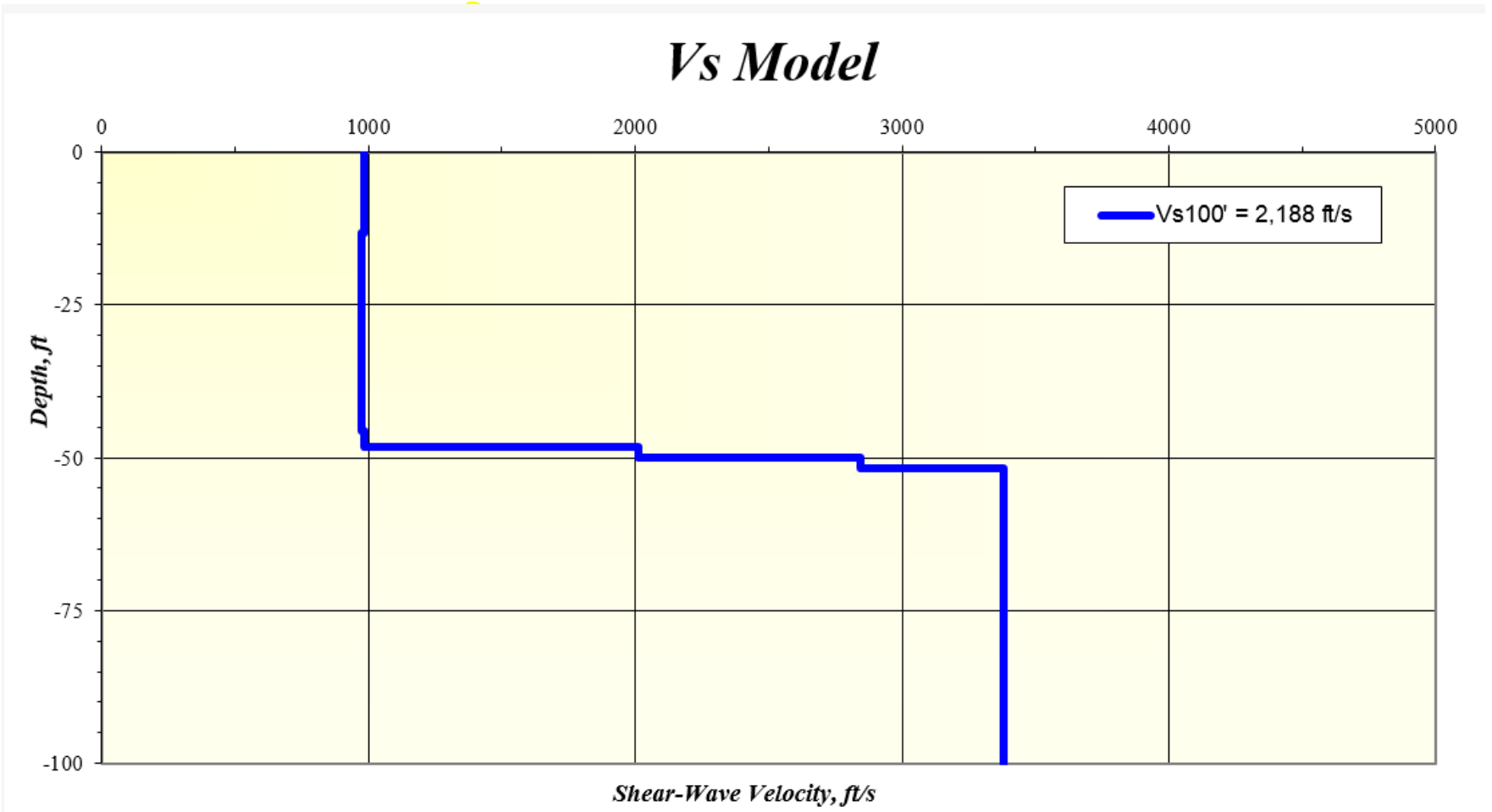
Terracon
51 LOST MOUND DRIVE; SUITE 135
CHATTANOOGA, TN 37406

ARRAY D CROSS-SECTIONAL PROFILE

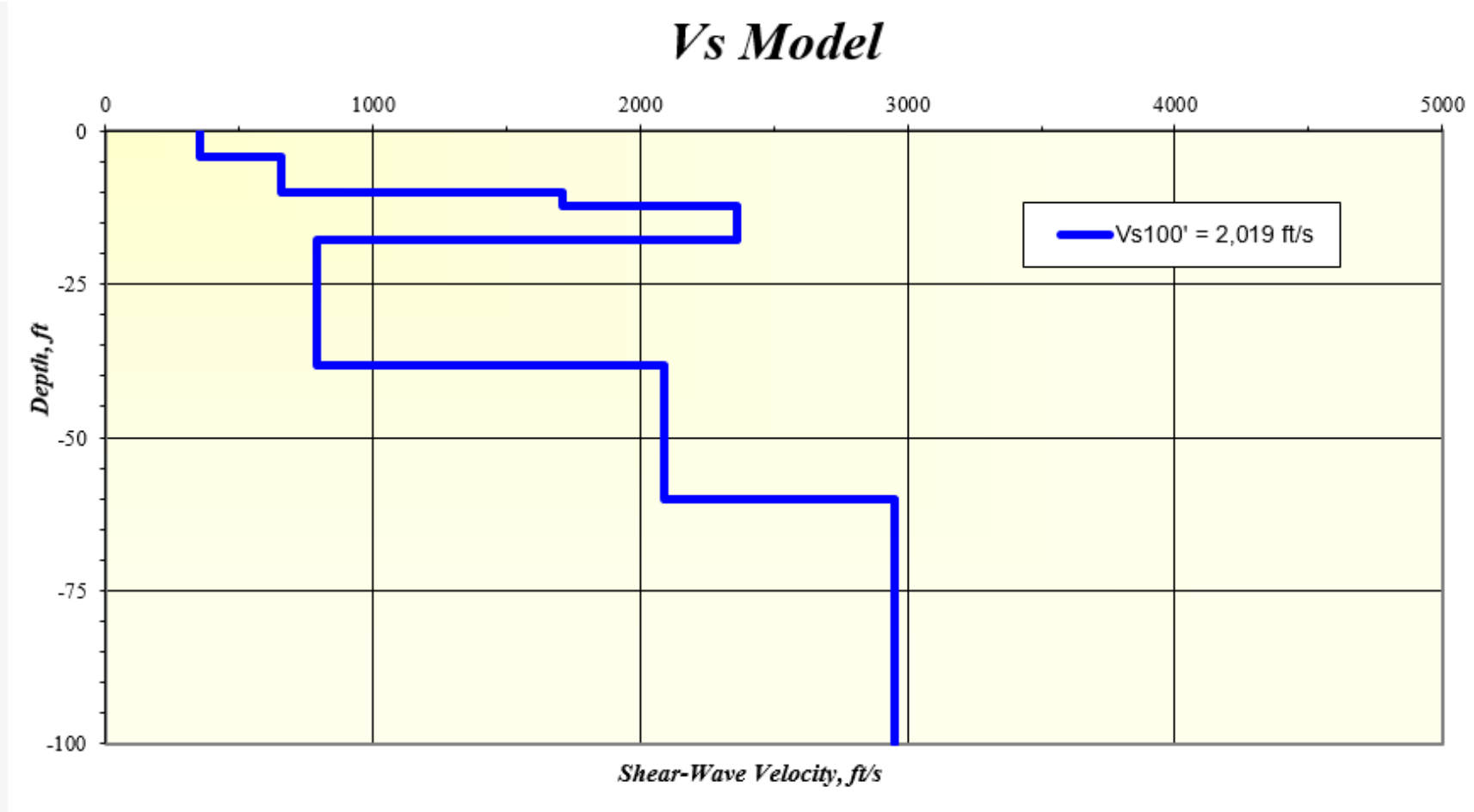
Limited Geophysical Study
HAMM ROAD
CHATTANOOGA, TENNESSEE

Exhibit

A-6



Project Manager: JR Drawn by: MM Checked by: JC Approved by: JC	Project No. E2175127 Scale: NOTED File Name: E2175127 Date: 6/21/2018	Terracon 51 LOST MOUND DRIVE; SUITE 135 CHATTANOOGA, TN 37406	SHEAR-WAVE VELOCITY PROFILE ARRAY A Limited Geophysical Study HAMM ROAD CHATTANOOGA, TN	Exhibit A-7



Project Manager: JR	Project No. E2175127	Terracon	SHEAR-WAVE VELOCITY PROFILE ARRAY C	Exhibit
Drawn by: MM	Scale: NOTED	51 LOST MOUND DRIVE; SUITE 135 CHATTANOOGA, TN 37406	Limited Geophysical Study **HAMM ROAD** **CHATTANOOGA, TN**	A-8
Checked by: JC	File Name: E2175127			
Approved by: JC	Date: 6/21/2018			

SUPPORTING INFORMATION

UNIFIED SOIL CLASSIFICATION SYSTEM

Hamm Road Wet Weather Storage Facility ■ Chattanooga, Tennessee

October 3, 2018 ■ Terracon Project No. E2175127F

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

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

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

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

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

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

[F] If soil contains ³ 15% sand, add “with sand” to group name.

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

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

[I] If soil contains ³ 15% gravel, add “with gravel” to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

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

[L] If soil contains ³ 30% plus No. 200 predominantly sand, add “sandy” to group name.

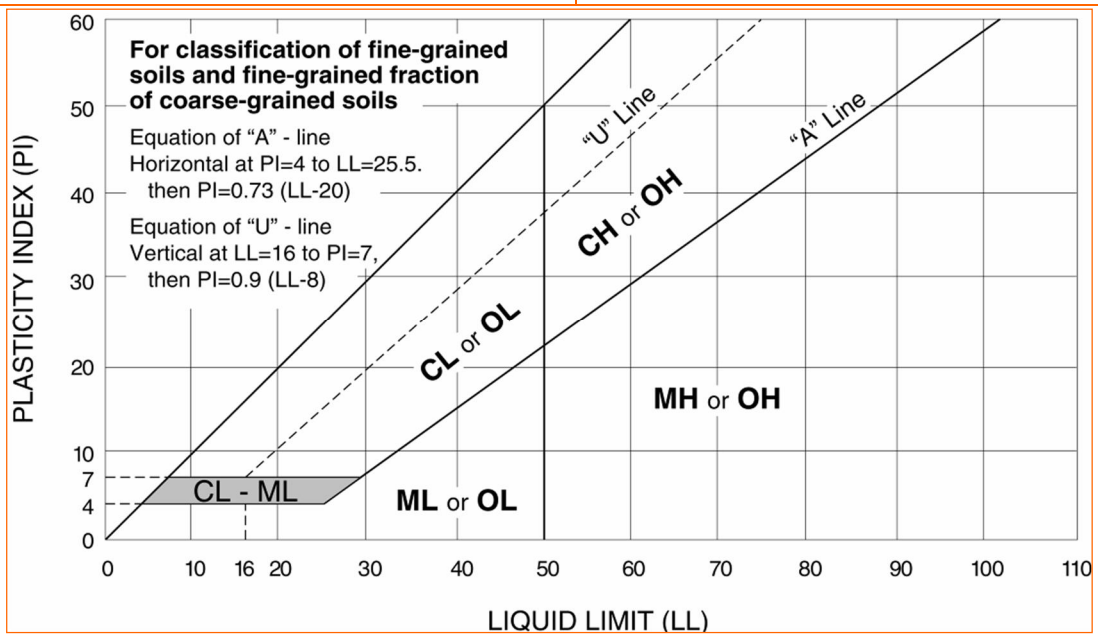
[M] If soil contains ³ 30% plus No. 200, predominantly gravel, add “gravelly” to group name.

[N] PI ³ 4 and plots on or above “A” line.

[O] PI < 4 or plots below “A” line.

[P] PI plots on or above “A” line.

[Q] PI plots below “A” line.



DESCRIPTION OF ROCK PROPERTIES

Hamm Road Wet Weather Storage Facility ■ Chattanooga, Tennessee

October 3, 2018 ■ Terracon Project No. E2175127F

WEATHERING	
Fresh	Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Very slight	Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.
Slight	Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate	Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Moderately severe	All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick.
Severe	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Very severe	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.
Complete	Rock reduced to "soil". Rock "fabric" no discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers.

HARDNESS (for engineering description of rock – not to be confused with Moh's scale for minerals)	
Very hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick.
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Moderately hard	Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow.
Medium	Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick.
Soft	Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

Joint, Bedding, and Foliation Spacing in Rock [1]		
Spacing	**Joints**	**Bedding/Foliation**
Less than 2 in.	Very close	Very thin
2 in. – 1 ft.	Close	Thin
1 ft. – 3 ft.	Moderately close	Medium
3 ft. – 10 ft.	Wide	Thick
More than 10 ft.	Very wide	Very thick

1. Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.

Rock Quality Designator (RQD) [1]	
RQD, as a percentage	**Diagnostic description**
Exceeding 90	Excellent
90 – 75	Good
75 – 50	Fair
50 – 25	Poor
Less than 25	Very poor

1. RQD (given as a percentage) = length of core in pieces 4 inches and longer / length of run

Joint Openness Descriptors	
Openness	**Descriptor**
No Visible Separation	Tight
Less than 1/32 in.	Slightly Open
1/32 to 1/8 in.	Moderately Open
1/8 to 3/8 in.	Open
3/8 in. to 0.1 ft.	Moderately Wide
Greater than 0.1 ft.	Wide

References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. Subsurface Investigation for Design and Construction of Foundations of Buildings. New York: American Society of Civil Engineers, 1976. U.S. Department of the Interior, Bureau of Reclamation, Engineering Geology Field Manual.