Exhibit 6

ECS MID-ATLANTIC, LLC

Geotechnical Engineering Report

Warrenton Data Center

Lee Highway and Blackwell Road
Warrenton, Virginia 20186

ECS Project No. 01:31153

Revised August 15, 2022

ECS MID-ATLANTIC, LLC *"Setting the Standard for Service"*
Geotechnical • Construction Materials • Environmental • Facilities

Revised August 15, 2022

Ms. Patricia Krinke
Bohler Engineering
28 Blackwell Park Lane, Suite 201
Warrenton, Virginia 20186

ECS Project No. 01:31153

Reference: Geotechnical Engineering Report
Warrenton Data Center
Lee Highway and Blackwell Road
Warrenton, Virginia 20186

Dear Ms. Krinke:

ECS Mid-Atlantic, LLC (ECS) has completed the subsurface exploration and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our Proposal No. 01:63686-GP1, dated May 4, 2021. This report presents our understanding of the geotechnical aspects of the project along with the results of the field exploration conducted and our design and construction recommendations.

It has been our pleasure to be of service to Bohler Engineering during the design phase of this project. We would welcome the opportunity to remain involved during the continuation of the design phase, and we would like to provide our services during construction phase operations as well to verify subsurface conditions assumed for this report. Should you have any questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

ECS MID-ATLANTIC, LLC

Commonwealth of Virginia
Dominic O. Agyepong
Lic. No. 0402047410
08-15-22
Professional Engineer

John A. Short, EIT
Project Manager
JAShort@ecslimited.com

Dominic O. Agyepong, PE
Principal Engineer
DAgyepong@ecslimited.com

9409 Innovation Drive, Manassas, VA 20110 • T: 703 396.6259 • www.ecslimited.com
ECS Florida, LLC • ECS Mid-Atlantic, LLC • ECS Midwest, LLC • ECS Southeast, LLP • ECS Southwest, LLP
ECS Capitol Services, PLLC - An Associate of the ECS Group of Companies

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EXECUTIVE SUMMARY

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

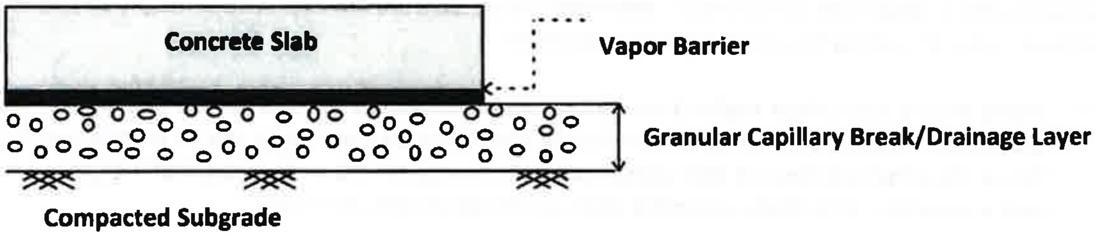
- Based on the subsurface exploration completed we anticipate the site will be suitable for the proposed development. We do not anticipate conditions on the project site to adversely affect future development beyond the typical difficulties encountered in this geographic region (i.e., rock excavation, potentially expansive soils, and moisture sensitive soils).
- For shallow foundation design we recommend the following design parameters:

Design Parameter	Column Footing	Wall Footing
Net Allowable Bearing Pressure (Stratum I Soil/Structural Fill)	3,000 psf	3,000 psf
Net Allowable Bearing Pressure (Stratum II- Weathered Rock Areas)	8,000 psf	8,000 psf
Minimum Width	24 inches	24 inches
Minimum Footing Embedment Depth (below slab or finished grade)	24 inches	24 inches

Deep foundation systems such as Drilled Shaft foundations or Auger Cast-In-Place (ACIP) Pile foundations can be utilized for heavily loaded structures. Deep foundations may be designed for an allowable bearing pressure on the order of 50 tons to 100 tons, if extended at least 3 drilled shaft diameters into the relatively unweathered rock. Actual designs will be provided in the final geotechnical report.

- Provided subgrades and structural fills are prepared as discussed herein, the proposed floor slabs can be constructed as **Ground Supported Slabs (or Slab-on-Grade).**

- The following graphic depicts our soil-supported slab recommendations:



1. Drainage Layer Thickness: 6 inches minimum.
2. Drainage Layer Material: 6 inches of VDOT #57 stone, VDOT 21-A/21-B

Soft or yielding soils may be encountered in some areas. Those soils should be removed and replaced with compacted Structural Fill in accordance with the recommendations included in this report. Floor slabs placed in areas where expansive soils (CH/MH) are encountered should be underlain by at least 2 feet of compacted suitable fill.

Subgrade Modulus: Provided the Structural Fill and Granular Drainage Layer are constructed in accordance with our recommendations, the slab may be designed assuming a modulus of subgrade reaction, k_1 of 150 pci (lbs./cu. inch).

Based on report, the anticipated geotechnical issues be considered during design included issues related to shallow bedrock, perched groundwater, potentially expansive and moisture sensitive soils, and deep foundations (drilled shafts) for the buildings.

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

STRUCTURAL FILL INDEX PROPERTIES	
Subject	**Property**
Building and Structural Areas	LL < 40, PI<15
Pavement Areas	LL < 45, PI<20
Max. Particle Size	4 inches
Fines Content (% passing #200 sieve)	Max. 25 %
Max. organic content	5% by dry weight

- Compaction Methodologies:

STRUCTURAL FILL COMPACTION REQUIREMENTS	
Subject	**Requirement**
Compaction Standard	Standard Proctor, ASTM D698/ Virginia Test Method (VTM-1)
Required Compaction	95% of Max. Dry Density for fill less than 10 feet
	98% of Max. Dry Density for fill greater than 10 feet
Moisture Content	-2 to +3 % points of the soil's optimum value
Loose Thickness	8 inches prior to compaction

- Building and site retaining walls and foundations (soil bearing, lateral earth pressures, subgrade modulus, coefficients of friction, etc.)

- Site Soil Design Parameters

Material	Unit Weight (pcf)	Angle of Internal Friction (phi)	At-Rest Pressure (psf per vertical foot of wall)	Active Pressure (psf per vertical foot of wall)	Passive Pressure (psf per vertical foot of wall)
CH	115	12	90	75	175
ML	120	25	70	50	300
SM	125	30	65	45	375
Weathered Rock	135	45	40	25	400

Material	Compacted or In-Situ Soil Moist Unit Weight (δ)	Angle of Internal Friction (ø)	Cohesion (C)	Coefficient of Earth Pressure at Rest (K_o)	Coefficient of Active Earth Pressure (Ka)	Coefficient of Passive Earth Pressure (K_p)
CH	115	12	0	0.79	0.66	1.52
ML	120	25	0	0.58	0.41	2.46
SM	125	30	0	0.50	0.33	3.0
Weathered Rock	135	45	0	0.29	0.17	5.82

- For sliding coefficient:

Sliding Friction Coefficient [Concrete on Soil] (μ)	0.30
Skin Friction [Concrete cast against Soil] (F_s) ¹	250 psf

- Potentially expansive soils (CH/MH) are common in the local geology characterized at this site. Expansive soils should not be reused as engineered fill in the building pad, nor as fill for roadway, curb, gutter, and sidewalk subgrade, within utility trenches, or within embankment slopes. Expansive soils (CH/MH) should be undercut to 4 feet below finished exterior grade or to 2 feet below the bottom of footing, whichever is deeper, and backfilled with controlled, compacted fill where encountered. In proposed pavement areas, we recommend undercutting and replacement of the expansive soils (CH/MH) to provide at least 2 feet of non-expansive soil fill below the pavement subgrade.

- Based on the soil conditions encountered (shallow rock and low permeability soils), stormwater management facilities that require infiltration are not feasible for this site.

- Considering the shallow weathered rock surface encountered at this site and our experience with other projects in the area, we recommend that the design for the building be based on a seismic site classification of **Site Class C**.

- Preliminary pavement section designs based on laboratory data and assumed design parameters are included within the report. We recommend pavement designs be developed in accordance with applicable VDOT requirements. Finalized designs should be based on anticipated traffic loading conditions and actual soil subgrade conditions. For design purposes, we recommend using a design California Bearing Ratio (CBR) value of 4 for the on-site clayey, silty, and sandy soil materials. Additionally, we recommend a Resiliency Factor (RF) of 1.5 be utilized for design of the proposed pavements.

- Groundwater on this site can be characterized as being broadly perched above less permeable materials and shallow rock. The depth at which perched water is present on the site varies with surface elevation. In low-lying areas, the presence of perched water is more pronounced. In higher areas and on ridge lines, perched water may be present, including above design cut elevations, but is less concentrated. Soils at contact with perched water levels were very moist to wet. In most cases, moisture then decreased with depth. The permanent groundwater able is significantly below the anticipated extents of excavation for this project.

1.0 INTRODUCTION

The purpose of this study was to provide geotechnical information for the design and construction of an industrial site which includes one data center building, a guard house facility, a stormwater management pond, a substation area, associated pavement infrastructure, and mass grading for the overall site. The recommendations developed for this report are based on project information supplied by Bohler Engineering.

Our services were provided in accordance with our Proposal No. No. 01:63686-GP1, dated May 4, 2021. This report contains the procedures and results of our subsurface exploration program, review of existing site conditions, engineering analyses, and recommendations for the design and construction of the project.

The report includes the following items.

- A brief review and description of our field and laboratory test procedures.
- A review of surface topographical features and site conditions.
- A review of area and site geologic conditions.
- A review of subsurface soil stratigraphy with pertinent available physical properties.
- Copies of our soil test boring logs.
- Recommendations for site preparation and construction of compacted fills, including an evaluation of on-site soils for use as compacted fills.
- Recommended foundation types.
- General recommendations for pavement design including a recommended design CBR value.
- Evaluation and recommendations relative to groundwater control.
- Recommendations for design and construction of drainage structures and stormwater management facilities.
- An evaluation of potential soil and rock excavation issues.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION & CURRENT SITE CONDITIONS

The proposed project site is located to the northeast of the intersection of Lee Highway and Blackwell Road in Warrenton, Fauquier County, Virginia. The subject property spans a single parcel (GPIN: 6984-69-2419) which, at the time of this exploration, is primarily occupied by active farmland with some wooded areas in the northwest and southeast portions, and site elevations range from approximate EL. 510± feet along the north edge of the site to approximate EL. 465± feet in the northeast corner. The southwest corner of the site is bordered by an existing car dealership. An aerial view of the site is pictured below.

Figure 2.1.1 Site Location

2.2 PROPOSED CONSTRUCTION

It is our understanding that the development will include the construction of one 214,388 sq. ft., 1-story data center building (FFE = EL. 486.0 feet), a guard house facility, a stormwater management pond, a 6-acre substation area, a retaining wall with a maximum exposed height of 6 feet, and associated pavement infrastructure. Based on current proposed grading information, it is our understanding that soils fill on the order of 21± feet and cuts on the order of 40± feet will be required in order to establish final site grades.

The description of the proposed project is based on the information provided to us by your office or other design team members at this time. If any of the information is inaccurate, either due to misunderstanding or due to design changes that may occur later, we recommend that we be contacted to provide additional or alternate recommendations that may be required.

2.2.1 Structural Information/Loads

A maximum structural column loading of 450 kips has been provided by the structural engineer at this time and it is our understanding that shallow foundations are considered feasible in design for support of the main building. If additional/revised maximum structural loading becomes available, ECS should be informed so that we may confirm or re-evaluate our recommendations.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

Our exploration procedures are explained in greater detail in Appendix B including the insert titled Subsurface Exploration Procedures. Our overall scope of work included drilling a total of 20 soil borings. Thirteen borings were performed in the vicinity of the data center building and guard house structural footprints, two borings were performed within the proposed stormwater pond, and five borings were performed within proposed pavement areas.

A track-mounted drill rig was utilized to drill the soil test borings. Borings were advanced to depths on the order of up to 80± feet below the existing ground surface. The subsurface exploration was completed under the general supervision of an ECS geotechnical engineer.

Boring locations were identified in the field by ECS personnel using GPS techniques prior to mobilization of our drilling equipment. The approximate as-drilled boring locations are shown on the Boring Location Diagram in Appendix A. Ground surface elevations noted on our boring logs were interpolated from the provided existing contour mapping.

Standard penetration tests (SPTs) were conducted in the borings at regular intervals in general accordance with ASTM D 1586. Representative samples were obtained during these tests and were used to classify the soils encountered. The standard penetration resistances obtained provide a general indication of soil shear strength and compressibility.

Rock sampling was performed at Borings B-3 and B-10 in accordance with ASTM D-2113 using a diamond-studded bit fastened to the end of a hollow double-tube core barrel. The core barrel was drilled into the rock up to five feet at a time, and the samples were removed for measurement of sample recovery. The recovery is determined as the ratio of sample length recovered to the distance drilled.

The core samples were stored in boxes and returned to our laboratory for identification and determination of the Rock Quality Designation (RQD). The RQD is determined as the ratio of intact rock in NX or NQ core sections 4 inches or longer to the distance drilled. Percentages of recovery and RQD are given on the boring logs included in the Appendix of this report and summarized within the table below.

Boring No.	Depth of Core Run (feet)	REC (%)	RQD (%)
B-3	39.0-44.0	32	13
	44.0-49.0	53	7
B-10	23.5-28.5	87	17
	28.5-33.5	100	22

3.1 SUBSURFACE CHARACTERIZATION

The project site is located within the Central Blue Ridge Anticlinorium. Based on the USGS Geological Map of Virginia (1993), the site is mapped within the Catoctin Formation – Metabasalt soils. This formation typically consists of grayish green to dark yellowish green, fine-grained, schistose chlorite and actinolite bearing metabasalt. The materials will initially weather into Silty and Clayey SAND and then into SILT and CLAY with extensive weathering.

The subsurface conditions encountered were generally consistent with published geological mapping. The following sections provide generalized characterizations of the soil and rock strata. Please refer to the boring logs in Appendix B.

Table 3.1.1 – Subsurface Soil Summary

Approximate Depth (ft)	Stratum	Description	Ranges of SPT[1] N-values (bpf)
0-0.5 (Surface cover)	n/a	Topsoil, Roots, and Organics	N/A
0.3-32.0	I	- Very Loose to Very Dense SAND (SM) and SILT (ML) with varying amounts of parent rock fragments - Firm to Very Stiff CLAY (CL, CH, MH)	4 to 50/4
3.0-80.0	II	- Very Dense Weathered Rock with varying amounts of parent rock fragments	60 to 50/0

Notes: (1) Standard Penetration Test

3.2 GROUNDWATER OBSERVATIONS

Groundwater was encountered in 4 of the 20 borings (B-1, B-2, B-3, and B-5) drilled as part of this geotechnical study ranging from depths of 23± to 53± feet below the existing ground surface. Perched water occurs as precipitation that enters the site, either directly or from overland flow from adjacent properties, begins to percolate through the near surface soils. Once the water percolation reaches the bedrock, which is virtually impermeable, it begins to flow at the intersection of the rock and the soil. This groundwater flow continues down gradient with the water table occasionally surfacing to form as springs and intermittent streams. Only in the lowest lying areas and adjacent to existing creeks is a shallow groundwater table in a continuous condition. Otherwise, it is related to precipitation, although springs may exist in the lower lying areas for extended periods of time without recharge from rainfall. Therefore, the groundwater conditions at this site are expected to be significantly influenced by surface water runoff and precipitation.

Because of the perched nature of the groundwater at this site, long term groundwater conditions can be deceptive. Although the true groundwater table can exist several hundred feet below the existing ground surface, groundwater located in streams and creeks, because of perched overland flow, creates the presence of an effective near surface groundwater table. Because the water is perched and flows at the interface between the soil and bedrock, water exiting fracture channels and cracks is common. Therefore, although all building excavations may appear dry at the time of completion, it is very common for fracture patterns in the rock, because of natural conditions or blasting to become natural pathways for ground water flow.

The highest groundwater observations are normally encountered in the late winter and early spring. Variations in the location of the long-term water table may occur because of changes in precipitation, evapo-transpiration, surface water runoff, and other factors not immediately apparent at the time of this exploration. The site may also be subject to severe desiccation during extended dry periods. Therefore, earthwork operations, especially in the winter and spring months are more likely to encounter difficulties with perched conditions than those operations undertaken in the summer or fall.

3.3 LABORATORY TESTING

Representative soil samples were selected tested in our laboratory to check field classification and to evaluate pertinent engineering properties. The laboratory testing program included visual classifications (ASTM D4318), moisture content tests (ASTM D2216), Atterberg Limits tests (ASTM D4318), washed sieve grain size analyses (ASTM D412), thermal resistivity testing (ASTM D5334), and California Bearing Ratio testing.

Each soil sample was visually classified on the basis of texture and plasticity in accordance with the Unified Soil Classification System. The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. A brief explanation of the Unified Soil Classification System is included in Appendix B of this report. The various soil types were grouped into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs and profiles are approximate; in situ, the transitions may be gradual, rather than distinct.

4.0 DESIGN RECOMMENDATIONS

The design recommendations outlined in this report are based on the 20 soil test borings performed within the proposed development limits. The following sections provide recommendations for foundation design, soil supported floor slabs, seismic design parameters, pavements, and stormwater management facilities.

4.1 BUILDING FOUNDATIONS

4.1.1 Shallow Foundations (Option)

Provided subgrades and structural fills are prepared as recommended in this report, the buildings, structures, and lightly-loaded substation features may be supported by shallow foundations including column footings and continuous wall footings. We recommend the foundation design use the following parameters:

Table 4.1.1.1 Shallow Foundation Design

Design Parameter	Column Footing	Wall Footing
Net Allowable Bearing Pressure (Stratum I Soil/Structural Fill) (1)	3,000 psf	3,000 psf
Net Allowable Bearing Pressure (Stratum II)^1	8,000 psf	8,000 psf
Minimum Width	24 inches	24 inches
Minimum Footing Embedment Depth (below slab or finished grade) (2)	24 inches	24 inches
Estimated Total Settlement (3)	Less than 1 inch	Less than 1 inch
Estimated Differential Settlement (4)	Less than 0.5 inches between columns	Less than 0.5 inches

Notes:

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

Potential Undercuts: Most of the natural soils at the foundation bearing elevation are anticipated to be suitable for support of the proposed structures. If soft or unsuitable soils are observed at the footing bearing elevations, the unsuitable soils should be undercut and removed. Any undercut should be backfilled with lean concrete ($f'_c \geq 1,000$ psi at 28 days) up to the original design bottom of footing elevation; the original footing shall be constructed on top of the hardened lean concrete. Additional undercutting of foundations may be required if highly plastic soils or undocumented fill soils are present below the foundation. Please see the High Plasticity Soils section of this report.

For building and site retaining walls and foundations (soil bearing, lateral earth pressures, subgrade modulus, coefficients of friction, etc.).

- Site Soil Design Parameters

Material	**Unit Weight (pcf)**	**Angle of Internal Friction (phi)**	**At-Rest Pressure (psf per vertical foot of wall)**	**Active Pressure (psf per vertical foot of wall)**	**Passive Pressure (psf per vertical foot of wall)**
CH	115	12	90	75	175
ML	120	25	70	50	300
SM	125	30	65	45	375
Weathered Rock	135	45	40	25	400

Material	**Compacted or In-Situ Soil Moist Unit Weight (δ)**	**Angle of Internal Friction (ø)**	**Cohesion (C)**	**Coefficient of Earth Pressure at Rest (K_o)**	**Coefficient of Active Earth Pressure (Ka)**	**Coefficient of Passive Earth Pressure (K_p)**
CH	115	12	0	0.79	0.66	1.52
ML	120	25	0	0.58	0.41	2.46
SM	125	30	0	0.50	0.33	3.0
Weathered Rock	135	45	0	0.29	0.17	5.82

- For sliding coefficient:

Sliding Friction Coefficient [Concrete on Soil] (μ)	0.30
Skin Friction [Concrete cast against Soil] (F_s) [1]	250 psf

4.1.2 Drilled Shafts (Option)

In the event maximum structural loads for the building are considered to be excessive for shallow foundation system design, the building as well as typical more heavily-loaded substation structures (e.g. transmission line towers, etc.) can be designed to bear on drilled shaft foundations. **For preliminary design purposes only,** we estimated that drilled shafts may be designed to bear in rock sockets having a depth of at least 1 shaft diameter with a design capacity of 60 ksf. An average rock unconfined strength of 4,000 psi may be utilized for preliminary design purposes. Rock suitable for end bearing can generally be identified in the field during drilling by observing drill cuttings which appear generally dry and to consist of rock fragments, a pronounced grinding of the auger teeth and visible dust noted during drilling. Based on the rock depths encountered, we estimate the shaft lengths will vary across the site between 15 feet to over 40 feet in some areas. **Additional borings and rock coring data will be required to determine final tip elevations for each drilled shaft location.** Project planning and estimates should account for potential variability of drilled shaft length throughout the project.

The actual structural designs of the drilled shaft foundation system (including final pier locations, pier lengths, pier dimensions, and spacing) shall be designed and submitted, separately, for review approval and appropriate permit to Prince William County Building Division prior to construction.

We recommend all drilled shaft excavations be observed and approved by the GER prior to concrete placement. We recommend a pre-production meeting be held prior to drilling operations to review the shaft termination criteria with the GER and drilling contractor. Termination criteria shall be determined by the GER based on the final structural design and type of rig.

4.1.3 Auger Cast-In-Place (ACIP) Pile Foundations (Option)

Auger Cast-In-Place (ACIP) piles are installed by drilling a hollow stem auger with a closed tip. Upon reaching the bearing stratum, the plug is removed, and a sand-cement grout is placed under pressure through the hollow stem as the augers are withdrawn (tremie placement). The upper portion of the pile is terminated approximately 6 inches above the bottom of the proposed pile cap. ACIP foundations may be preliminarily designed for an allowable bearing pressure on the order of 50 tons to 100 tons. We estimate the shaft lengths will vary across the site between 25 feet to over 60 feet in some areas. **Additional borings and rock coring data will be required to determine final tip elevations for each ACIP location.** Project planning and estimates should account for potential variability of drilled shaft length throughout the project.

Auger cast-in-place piles greater than 18 inches in diameter will require special equipment to be installed and generally cannot be drilled more than 60 feet in the ground. Please note top of pile elevations were used in calculations and were estimated to be two feet below the finished floor elevations.

The actual structural designs of the ACIP foundation system (including final pier locations, pier lengths, pier dimensions, and spacing) shall be designed and submitted, separately, for review approval and appropriate permit to Prince William County Building Division prior to construction.

We recommend a series of three widely spaced auger probe/test piles be installed under the observation of the geotechnical engineer. Based on these observations, at least one pile should be selected for load testing, by the geotechnical engineer. The purpose of the test piles is to confirm our assumption of pile capacity (which is related to our design safety factor) and to allow observation of the subsurface conditions encountered by the augers.

The single test pile should be load tested in axial compression. The primary objective of the load test program is to observe the load-settlement response of an individual pile in order to verify that the contractor's construction procedures and installation equipment can produce an acceptable pile foundation. The geotechnical engineer should be retained to select the location of the test, observe and document the installation of the test pile and reaction piles, perform the load test and interpret the results, and develop recommendations concerning installation procedure and design tip elevations of production piles. Significant differences from accepted procedures or expected results should be brought to the attention of the Structural Consultant.

The axial compressive pile load test should be performed in general accordance with procedures outlined in ASTM D1143, Paragraphs 5.1 and 5.3. The test pile should eventually be loaded to plunging failure, which can be described as a total pile butt displacement on the order of 15% of the pile diameter, or about

2 inches. Accurate systems referenced to a stationary reference beam supported well away from the zone of influence of the test pile and reaction piles (if applicable). We recommend the load test be performed no sooner than five days after the installation of the test pile, unless the contractor can establish sufficient grout strength only after three days.

Auger cast piles may also be utilized to anchor the reaction frame system for the pile load test. However, these anchor piles may be pulled upward during loading. Upward movement of the piles beyond that of elastic elongation would reduce the downward axial capacity of these piles. Therefore, these anchor piles should not be used as production piles.

4.2 SLABS ON GRADE

Provided subgrades and structural fills are prepared as discussed herein, the proposed floor slabs can be constructed as Ground Supported Slabs (or Slab-on-Grade). The following graphic depicts our soil-supported slab recommendations:

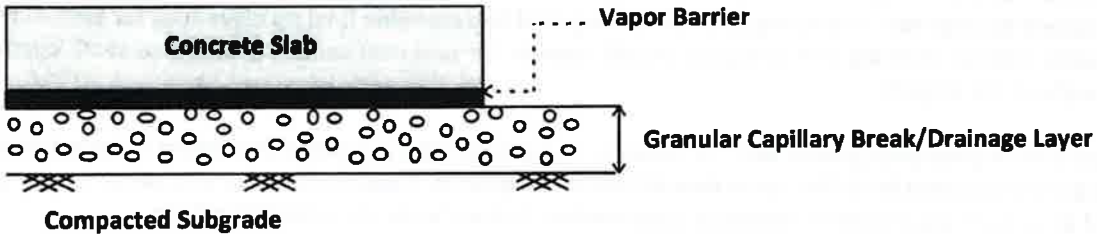


Figure 4.2.1

1. Drainage Layer Thickness: 6 inches minimum.
2. Drainage Layer Material: 6 inches of VDOT #57 stone, VDOT 21-A/21-B

Soft or yielding soils may be encountered in some areas. Those soils should be removed and replaced with compacted structural fill in accordance with the recommendations included in this report. Floor slabs placed in areas where expansive soils (CH/MH) are encountered should be underlain by at least 2 feet of compacted suitable fill.

Subgrade Modulus: Provided the Structural Fill and Granular Drainage Layer are constructed in accordance with our recommendations, the slab may be designed assuming a modulus of subgrade reaction, k_1 of 150 pci (lbs./cu. inch).

Vapor Barrier: Before the placement of concrete, a vapor barrier may be placed on top of the granular drainage layer to provide additional protection against moisture penetration through the floor slab. When a vapor barrier is used, special attention should be given to surface curing of the slab to reduce the potential for uneven drying, curling and/or cracking of the slab. Depending on proposed flooring material types, the structural engineer and/or the architect may choose to eliminate the vapor barrier.
Slab Isolation: Soil-supported slabs should be isolated from the foundations and foundation-supported elements of the structure so that differential movement between the foundations and slab will not induce excessive shear and bending stresses in the floor slab. Where the structural configuration prevents the

use of a free-floating slab such as in a drop down footing/monolithic slab configuration, the slab should be designed with suitable reinforcement and load transfer devices to preclude overstressing of the slab.

4.3 BELOW GRADE WALLS

Any below grade walls that will be backfilled with soil or aggregate should be designed to withstand lateral earth pressures and surcharge loads. For below grade walls that are properly drained, the walls may be designed for an equivalent fluid pressure of 60 pounds per square foot (psf) per foot of wall height. The 60 psf horizontal pressure reflects the moderate strength low plasticity silty and clayey soils present with the wall influence zones. A Lateral Earth Pressure Diagram illustrating our general recommendations regarding the application of lateral earth pressure are included in the Appendix D of this report and in Figure 4.3.1.

The following Figure depicts the suggested lateral earth pressure condition for a "drained condition" with restrained wall top:

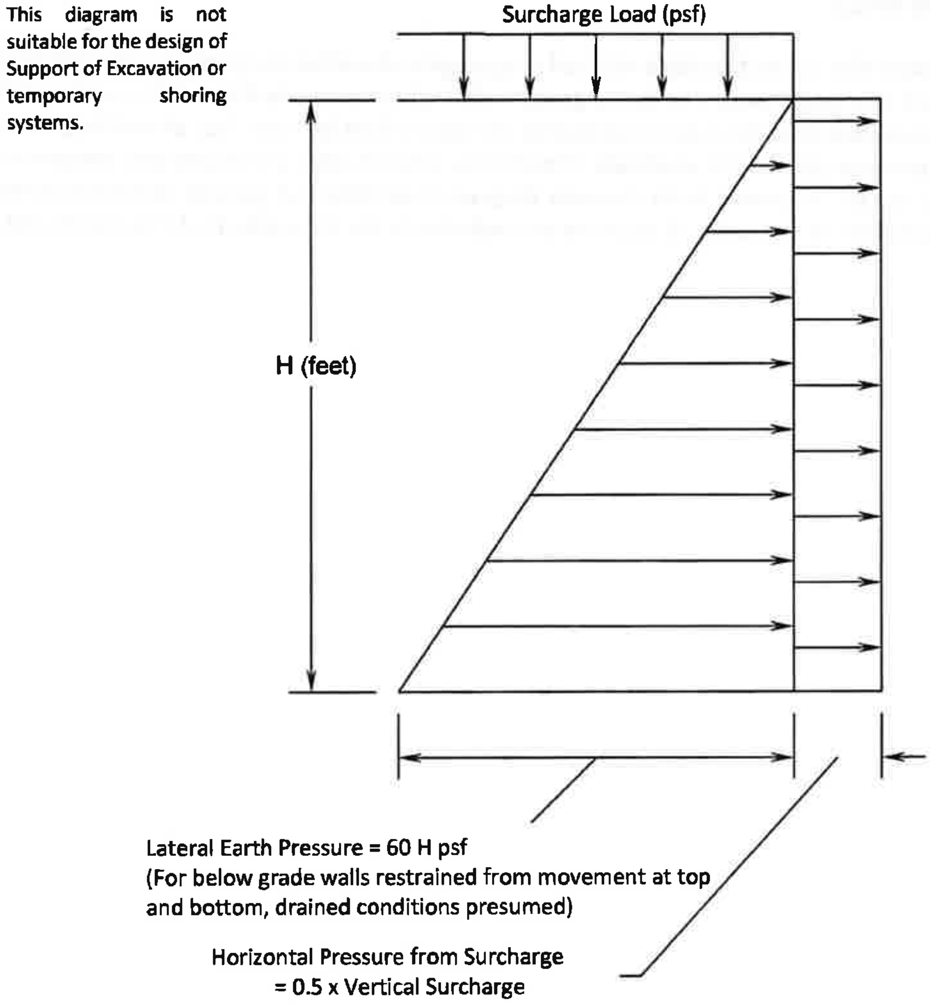


Figure 4.3.1

Any surcharge loads imposed within a 45 degree slope of the base of the wall should be considered in the below grade wall design. The influence of these surcharge loads on the below grade walls should be based on an at-rest pressure coefficient, k_0, of 0.5 in the case of restrained walls.

Backfill materials should consist of inorganic materials, free of debris and be free draining. The fill placed adjacent to the below grade walls should not be over-compacted. Heavy earthwork equipment should maintain a minimum horizontal distance away from the below grade walls of 1 foot per foot of vertical wall height. Lighter compaction equipment should be used close to the below grade walls and the thickness of the lifts should be no more than 6 inches where light weight compaction equipment is used.

To reduce excessive pressures against the below grade walls, and to reduce the settlement of the wall backfill, it is recommended that the wall backfill be compacted to between 92% and 95% of the maximum dry density determined in accordance with ASTM D 698 or VTM-1. Where the fill will be supporting pavement or other structures, the fill should be compacted to near 95% of this specification. Backfill materials which are placed behind below-grade walls should be free of organic materials and debris, free-draining, non-frost susceptible, and should not include any high plasticity Elastic SILT (MH) or Fat CLAY (CH) materials.

Depending upon the excavation methods employed at the time of installation, it may be advantageous to discontinue use of soil as structural backfill and substitute using open graded stone such as VDOT No. 57 stone. The use of No. 57 stone should help with any problems that should be encountered when attempting to backfill and compact soils. The top 2 feet of backfill should be suitable soils placed and compacted in accordance with the section titled Fill Placement. We recommend filter fabric be placed between the VDOT No. 57 stone and the compacted soil to reduce the risk of the soil fines migrating into the voids in the VDOT No. 57 stone. The GER should be contacted prior to employing the use of open graded stone to backfill around these structures.

Suitable manmade drainage materials may be used in lieu of the free draining granular backfill, adjacent to the below grade walls. These materials should be covered with a filter fabric having an Apparent Opening Size (AOS) consistent with the size of the soils to be retained. The material should be placed in accordance with the manufacturer's recommendations and connected to either the perimeter drainage system or the underslab granular mat, which in turn should be properly drained. The ground surface adjacent to the below grade walls should be kept properly graded to prevent ponding of water adjacent to below grade walls.

4.4 SEISMIC DESIGN CONSIDERATIONS

The International Building Code (IBC) 2012 and Chapter 20 of ASCE 7 require site classification for seismic design based on the upper 100 feet of a soil profile. Three methods are utilized in classifying sites, namely the shear wave velocity (v_s) method; the undrained shear strength (s_u) method; and the Standard Penetration Test Resistance (N-value) method. Where site specific data are not available to a depth of 100 feet, appropriate soil properties are permitted to be estimated by the registered design professional preparing the soils report based on known geologic conditions. The seismic site class definitions for the weighted average of either the SPT N-values or the shear wave velocities in the upper 100 feet of the soil profile are presented in Chapter 20 of ASCE 7 and in the table below.

Table 4.4.1: Seismic Site Classification

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

In the absence of actual shear wave (V_s) data, we utilized the Standard Penetration Test (SPT) N-values recorded from the borings. Considering the shallow rock surface encountered at this site and our experience with other projects in the area, we recommend that the design for the building be based on a seismic site classification of **Site Class C**.

Considering that the foundation will bear in or close to bedrock, a Site Class B may be possible; however, site specific seismic testing to determine the shear wave velocity of the rock would be required to evaluate this site classification. If it is determined by the structural engineer that an increase in the site class for the project site will result in significant economic savings in the final design, we would be pleased to provide additional site-specific seismic testing services.

4.5 PAVEMENTS

The pavement design recommendations shall conform to the latest VDOT Road and Bridge Standards and Specifications. For the design and construction of exterior pavements, we recommend that all the procedures outlined in the Subgrade Preparation and Earthwork Operations and Fill Placement and Compaction sections be followed through the establishment of roadway section subgrade elevations.

We recommend that topsoil, existing fill material, construction debris, and any other soft or unsuitable materials be removed from the pavement area. The stripped surface should be proofrolled and carefully observed at the time of construction in order to aid in identifying the localized soft or unsuitable materials which should be removed. If high plasticity soils are exposed during the final grading of the paved areas, we recommend that these areas be over-excavated of the high plasticity soil to a depth of 2 feet and replaced with engineered fill.

An important consideration with the design and construction of pavements is surface and subsurface drainage. Where standing water develops, either on the pavement surface or within the base course layer, softening of the subgrade and other problems related to the deterioration of the pavement can be expected. Furthermore, good drainage should reduce the possibility of the subgrade materials becoming saturated over a long period of time. We would be pleased to be of further assistance to you in the design of the project pavements by providing additional recommendations during construction of the project.

It is common practice to install only the base aggregate and the base course asphalt during initial construction, and then the final topping surface asphalt much later in the construction process. Often, depending upon the sequence and timing of construction, the final pavement surface may not be placed until several months to even years after the initial base asphalt is placed. Studies have shown that the most critical load conditions for most development occur during the construction phase. In particular, the pavement system is subjected to loading that includes construction equipment, low-boys, concrete trucks, pre-fabricated joist and dry wall deliveries, and other heavy, high concentrated truck loading which does not occur once the development is finished. Not only does this represent the highest traffic loading condition, but it occurs at a time when the pavement section is not at its full strength, simply because the surface asphalt has not been placed.

Although it is usually not economically feasible to increase the pavement section to satisfy this potential design issue, it should be recognized that prudent steps can be taken to help reduce failures of the pavement system during the construction. For example, we recommend using intermediate type asphalt for the base layer of asphalt to reduce the amount of surface water infiltration into the pavement subbase.

Furthermore, any areas that are low and will have a tendency to pond water should be drained to the extent feasible. This should normally be undertaken in areas that are relatively low and wet, or in areas where there is known to be a concentration of construction traffic. These concentrations should be considered to be the initial entryways to the site, the travelways and any other high-construction traffic areas.

Depending upon the time in which the temporary construction is used as a service road, some failures should be expected. If the construction pavement system fails, it will be necessary to remove this failed section and replace it with the initial design section or an equivalent repaired section.

If pavements will be constructed early during site development to accommodate construction traffic, consideration must be given to the construction of heavier pavement sections, capable of accommodating the much heavier loads normally associated with these activities. The design of actual pavement sections is beyond the scope of this report. We recommend final pavement designs be developed in accordance with applicable VDOT and Prince William County requirements, as appropriate. Such a design should be developed considering anticipated traffic loading conditions, soil subgrade conditions, and CBR value.

Rutting of pavement and ultimately pavement failure are typically experienced due to front loading garbage trucks imposing concentrated wheel loads on pavements. Therefore, we recommend that the pavement in any trash pick-up areas consist of a reinforced concrete pavement underlain by VDOT 21A subbase. Design of concrete pavements is beyond the scope of this report. We recommend concrete pavement designs be developed in accordance with applicable VDOT and Prince William County requirements. Such a design should be based on anticipated traffic loading conditions and soil subgrade conditions.

A design CBR value of 4 is recommended based on laboratory testing performed on samples obtained from Borings B-14 and B-15 during our subsurface exploration. Additionally, we recommend that a Resiliency Factor (RF) of 1.5 be utilized for design purposes of the pavements. If the results of the CBR tests taken during construction differ from that mentioned above, the pavement design should be modified as necessary.

New Asphalt Pavement Section: We have assumed that asphalt (light-duty and heavy-duty) and concrete (heavy-duty) pavement section designs for the parking lot and access roadway pavement areas will be based upon 20-year and 30-year design lives with assumed ESALs of 19,300/610,000 for light/heavy-duty Flexible Pavements and 1,400,000 for Rigid Pavement. If these assumptions are found to be inaccurate for the finalized project average daily traffic values, ECS shall be informed in order to revise pavement section design accordingly.

We have also assumed other design parameters in table below.

Table 4.5.1 Pavement Design Parameters

Reliability	90%
Overall Standard Deviation	0.49
Effective Subgrade Resilient Modulus	6,000 psi
Initial Serviceability	4.2
Terminal Serviceability	2.8

The following sections are expected to provide adequate support for standard-duty pavement and heavy-duty pavements for the newly constructed pavement areas that will be part of the development of the project site.

Table 4.5.2 Design Pavement Sections

Pavement Material	**Pavement Thickness (inches)**		
	Standard-Duty - Asphalt	**Heavy-Duty - Asphalt**	**Heavy-Duty - Concrete**
Surface Course	1.5	1.5	---
Intermediate Course		2.0	---
Base Course	3.0	3.0	---
Portland Cement Concrete	---	---	8.0
Aggregate Base Material	6.0	8.0	8.0
Total Pavement Section Thickness	**10.5**	**14.5**	**16.0**

It should be recognized that construction loading conditions may be more severe than in-service conditions and the Geotechnical Engineer should be advised of any traffic loading conditions that become available in order to confirm and/or modify the pavement section recommendations.

New Concrete Pavement Section: The heavy-duty concrete pavement section should consist of a minimum of 8 inches of air-entrained Portland cement concrete having a minimum 28-day compressive strength of 4,000 pounds per square inch (psi). The concrete pavement shall be underlain by a minimum of 8 inches of compacted dense-graded aggregate base course stone (VDOT 21-A). The rigid concrete pavement section should be provided with construction joints at appropriate intervals per typical concrete pavement construction requirements.

Exterior Concrete Slabs on Grade (Sidewalks, Curbs, Gutters, and Dumpster Pads): The exterior concrete slabs recommendations should conform to the latest VDOT Road and Bridge Standards and Specifications. For the construction of exterior concrete, we recommend that topsoil and any other soft or unsuitable materials be removed from the paved area. The stripped surface should be proofrolled and carefully observed at the time of construction in order to aid in identifying the localized soft or unsuitable materials which should be removed.

We recommend that exterior concrete slabs such as sidewalks, curbs and gutter be underlain by a minimum of 4 inches of granular material having a maximum aggregate size of 1.5 inches and no more than 2% passing the #200 sieve. This granular layer will reduce the potential for frost heaving of the exterior slabs. Exterior concrete exposed to the weather should be air-entrained.

4.6 SITE RETAINING WALL

One retaining wall with a maximum exposed wall height of 6 feet is proposed along the northeast edge of the site. While design details for the wall are not available at this time, general recommendations have been provided below.

Since retaining walls are free to rotate at the top, they effectively mobilize more of the shear strength of the retained soil than conventional basement or loading dock walls. For the design of permanent site retaining walls with level backfill, we recommend an equivalent fluid pressure of 45 psf per vertical foot of wall. At the areas of the walls such as corners where rotation will be limited, we recommend an equivalent fluid pressure of 60 psf per vertical foot of wall since rotation is restricted in these areas. This lateral earth pressure assumes that low-plasticity materials with a LL equal to or less than 40 and a PI less than 15, unless the material can be shown to have a very low expansion potential, are used for the wall backfill and that drainage of the backfill is provided as discussed below. A Lateral Earth Pressure Diagram has been included in the Appendix to further detail the anticipated earth pressure distribution behind the wall. The design should also account for any surcharge loads that are within a 45° slope from the base of the wall, and any slope of the backfill. The retaining wall should be designed so that the resultant of the overturning forces remains in the central one-third of the footing.

The foundations for proposed retaining wall should be designed for a maximum allowable soil bearing pressure of 3,000 psf, provided that the footings are founded within firm natural soils or engineered fill placed over firm natural soils. Special care should be taken to confirm soft existing soils are removed prior to the placement of structural fill on the established foundation subgrades.

Sliding resistance of the retaining wall can be achieved either through the use of a shear key (for concrete retaining walls only) or through the frictional forces developed at the base of the retaining wall. A shear key, if installed, can be designed for a passive pressure of 300 psf per foot of depth. This assumes that the soils at the base of the retaining wall are approved, firm natural soils or compacted structural fill. A frictional resistance coefficient of 0.3 can be utilized for sliding resistance design for the retaining wall. The structural design of proposed retaining walls should be approved prior to site implementation.

The recommendations presented herein assume that the backfill behind the retaining wall is properly drained. Suitable man-made drainage materials may be used in lieu of the free draining granular backfill, adjacent to the wall. These materials should be covered with a filter fabric having an Apparent Opening Size (AOS) consistent with the size of the soils to be retained and should be placed in accordance with the manufacturer's requirements. Drainage of the backfill may be accomplished through the use of 4-inch diameter weep holes at 8 feet spacing, through the wall, immediately above proposed grade at the front of the wall. Alternatively, a longitudinal drain line could be used behind the retaining wall. The drain should consist of a 6-inch perforated pipe surrounded by a minimum of 6 inches of VDOT No. 57 stone.

The No. 57 stone should be completely wrapped in a filtration geotextile such as Mirafi 140N. The geotextile used should be reviewed and approved by the geotechnical engineer. The ground surface adjacent to the retaining wall should be kept properly graded to prevent ponding of water adjacent to the wall or drainage of water over the front of the wall.

The land above the recommended geogrid reinforcement layers must be designated as a "soil reinforcement zone easement" and any future landscaping or planting should be coordinated such that it does not disturb the soil reinforcement system and/or will not affect the retaining wall stability. The geogrid layers will be installed in conjunction with the wall construction and thus will precede the excavations for plant material and landscaping. Trees and other plant material that might impact the geogrid reinforcing shall be kept outside the soil reinforcement zone easement.

The construction sequence will be important in areas where construction of the wall will either be in conflict or be too close to any existing storm pipes and structures. We recommend that in such cases, the storm pipes and the structures be installed first or simultaneously with the construction of the wall, since excavation for the storm pipes and structures after construction of the wall may jeopardize the stability of the wall. The wall designer should consider the presence of the storm structures in his or her design and should include standard or specific details for placement of wall backfill around these structures in design. In cases where storm sewer pipes penetrate and/or are located underneath the proposed wall, we recommend the provision of an encasement/liner or a grade beam in order to allow the pipes to be removed for maintenance without affecting the wall stability. If the storm line extends through the face of the wall, then block units should be saw cut within 1/2-inch of the pipe. Details for the pipe outlet and casing as well as wall sections with the pipe in the reinforcing zone should be included in the retaining wall design.

4.7 STORM WATER MANAGEMENT PONDS

One storm water management pond is currently proposed for the site. At the time of this report, specific details regarding water surface elevations and locations and elevations of pond structures were not available. As such, it is the intent of this section to provide general recommendations for design and construction of the pond. Once detailed pond designs and grading is available, ECS should be contacted to provide updated recommendations and, if necessary, global stability analyses for the pond.

4.7.1 Earthwork Operations

Subgrade preparation operations should consist of stripping all vegetation, rootmat, and topsoil and any other soft or unsuitable material from the dam embankment. Where possible, stripping limits for the proposed grading of the dam should be extended at least 10 feet beyond the toe.

After stripping to the desired grade and prior to new fill placement, the exposed soils should be carefully examined to identify any localized loose, yielding or otherwise unsuitable materials by an experienced geotechnical engineer or his authorized representative. After examining the exposed soils, loose and yielding areas can be identified by proofrolling with an approved piece of equipment, such as a loaded dump truck having an axle weight of at least 10 tons. Any soft or unsuitable materials encountered during this proofrolling should be removed and replaced with an approved backfill.

4.7.2 Embankment Fill Placement

The on-site materials may be reused as engineered fill if they do not contain organics or foreign debris, are not highly plastic, are not environmentally impacted, and conform to the criteria outlined below for acceptable soil types for construction. Based on observations made during the subsurface exploration program and following visual observation of the recovered soil samples, some of the natural soils may be suitable for reuse as engineered fill materials; however additional laboratory testing will be required for confirmation of soils to be used as engineered fill. Under no circumstances should CH soils be used as fill material in proposed structural areas.

The preparation of fill subgrades should be observed on a full-time basis. These observations should be performed by the Geotechnical Engineer of Record, or their representative, to ensure all unsuitable materials have been removed, and the subgrade is suitable for support of the proposed construction and/or fills. In some areas, excessively soft and/or wet soils may be encountered for fill subgrades, especially in the winter or early spring months. All soft areas should be excavated and removed.

Upon achieving competent subgrade materials, the excavated area should be filled, where appropriate, to planned grades with an approved controlled, compacted fill. All fill and backfill placed within the embankments and around the structures should be placed in lifts not exceeding 8-inches in loose thickness and moisture conditioned to within 2 percentage points on the wet side of the optimum moisture content. We recommend that the lifts be compacted to at least 95 % of their maximum dry density, as determined by ASTM D-698, Standard Proctor, for the full depth of the fill. Acceptable soil types for construction of the embankment on the upstream and downstream side (excluding the clay liner) include soils having a USCS designation of ML and CL; and SM and SC having a minimum of 25% passing No. 200 sieve. The on-site SM and SC soils tested do generally meet these requirements and should be suitable for use as fill.

The timing for placement of backfill for the embankment should be planned to minimize the risk of piping of soil based on laboratory tests performed on the material proposed for use prior to construction (additional observations and analyses may be required for the clay liner placement).

It is recommended that new fill soils be **benched** into the existing soils to verify adequate soil bonding of these materials. If the top of an exposed layer is too smooth, it should be rerolled with a sheepsfoot roller, or scarified prior to the placement of the next lift of fill. Although it is desirable to seal off fill surfaces on a daily basis using a steel drum or rubber tired roller, these surfaces should be scarified the following day prior to fill activities to minimize the creation of planes of seepage within the embankment structure.

Fill materials should not be placed on frozen soils or frost-heaved soils and/or soils which have been recently subjected to precipitation. All frozen soils should be removed prior to continuation of fill operations. Borrow fill materials, if required, should not contain frozen materials at the time of placement. All frost-heaved soils should be removed prior to placement of controlled, compacted fill, granular subbase materials, foundation or slab concrete, and asphalt pavement materials. Soil bridging lifts within the proposed embankment should not be used since excessive settlement of the structure can occur. Also, trees should not be planted on the existing dam embankment.

4.7.3 Facility Outlets

The principal outlet pipes penetrating the embankment dams should be provided with seepage control measures consisting of a concrete cradle and downstream collection drain. Primary outlet conduits, which penetrate the facility embankments, should be constructed on a concrete cradle along the upstream two-thirds of the conduit length. The downstream one-third of the principal spillway pipe should be surrounded with a 12-inch thick layer of open graded coarse aggregate (VDOT No. 78) wrapped with a suitable nonwoven geotextile with an Apparent Opening Size (AOS) of 70. (The coarse aggregate should conform to the current VDOT Road and Bridge Specifications Section 203 and the geotextile with Section 245.) The gravel layer below and around the conduit at the downstream end will serve to collect any seepage along the conduit. This drainage blanket should be daylighted at the slope face or tied into the stormwater discharge structure.

4.7.4 Foundations for Drainage Control Structures

Based on the results of our subsurface exploration and our engineering analysis, we recommend that any proposed stormwater discharge control structures be supported on spread footing foundations bearing either on suitable firm natural soils or on new engineered fill constructed over suitable natural soils. Assuming subgrades are prepared according to the recommendations above, the foundations may be designed for a net allowable soil bearing pressure of 2,000 pounds per square foot (psf).

If unsuitable soil types or bearing conditions are found to exist at the foundation level, then the base of the excavation should be lowered to suitable materials. As an alternative, the original bottom-of-footing level can be restored by the placement of "lean" (1,000 psi) concrete after removal of the unsuitable soils.

Fill materials should be placed in accordance with the Compaction section of this report. The soil will be moisture and disturbance sensitive; therefore, excavation for the outlet structures should proceed in an expeditious manner in order to reduce exposure of the bedding soils. The foundation excavation should be observed and the bearing pressure of the footing subgrade tested by an authorized representative of the GER.

Granular bedding should not be used to support foundations or pipes penetrating the facility embankments. Granular soils should only be used where specifically designed for drainage. Conduits penetrating the embankments should be supported by properly placed soil or natural soils trimmed to fit the pipe diameter, or concrete fill, such as lean concrete or "flowable" fill, to control seepage along such conduits which could otherwise result in a soil piping failure. The upstream two thirds of the primary discharge pipe should be placed over a concrete cradle as described in the previous section.

4.7.5 Pond Liner (Wet Ponds Only)

In order to maintain the permanent pool elevations, we recommend the use of a clay or synthetic liner to minimize the potential for seepage through the silty and clayey sand materials and weathered rock.

The liner should be present along the entire pond bottom, including embankment slopes up to the 10-yr storm elevation on the impounded side only. The liner should consist of an 18-inch thick layer of material meeting the specification of the most recent edition of the BMP Clearinghouse (Table 14.4). The liner should consist of soil with a minimum of 30% clay particles, by weight. The material should also have a minimum Plasticity Index of 15 and a minimum Liquid Limit of 30. We recommend the liner have a maximum permeability of $1x10^{-7}$ ft/sec and should be compacted to 90% to 95% of the maximum dry density as determined by the Standard Proctor Method (ASTM D698). Generally, a soil material classified as Lean CLAY (CL) and having less than 10% retained on the #4 sieve should meet this requirement. Fat CLAY (CH) is not recommended for use as a liner due to concerns over shrinkage cracks. We also recommend the soils for the liner be installed at 2 to 3 percentage points wet of the optimum moisture content. Clay liner materials should be kept moist during and after installation to reduce the potential for desiccation and cracking. It is recommended that new clay liner soils be benched into the existing soils to verify adequate soil bonding of these materials.

4.8 SOIL THERMAL RESISTIVITY

Soil thermal resistivity testing was performed on remolded samples obtained from depths ranging from 1± feet to 6± feet below site grades. The samples were compacted to approximately 95% of the maximum dry density as determined by the Standard Proctor Method (ASTM D698). Tests were performed in general accordance with ASTM D5334. Tests were performed at various moisture contents to develop a dry-out curve. Based on the test results, we recommend the following maximum resistivity values at each location be used for design:

Sample No.	Recommended Max. Rho (°C*cm/W)
B-2	220
B-7	190
B-11	205

Based on the test results, we recommend a **single maximum resistivity value of 220** be used for design of general site duct banks. Laboratory test results for each sample are included in the Appendix of this report.

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 SUBGRADE PREPARATION

5.1.1 Stripping and Grubbing

The subgrade preparation should consist of stripping all vegetation, rootmat, topsoil, existing fill, and any soft or unsuitable materials from the 10-foot expanded building and 5-foot expanded pavement limits, and 5 feet beyond the toe of structural fills. Deeper topsoil or organic laden soils may be present in wet, low-lying, and poorly drained areas. Root balls may extend as deep as about 2 feet and will require additional localized stripping depth to completely remove the organics. ECS should be retained to verify that topsoil and unsuitable surficial materials have been removed prior to the placement of structural fill or construction of structures.

5.1.2 Proofrolling

Prior to fill placement or other construction on subgrades, the subgrades should be evaluated by an ECS field technician. The exposed subgrade should be thoroughly proofrolled with construction equipment having a minimum axle load of 10 tons [e.g. fully loaded tandem-axle dump truck]. Proofrolling should be traversed in two perpendicular directions with overlapping passes of the vehicle under the observation of an ECS technician. This procedure is intended to assist in identifying any localized yielding materials.

Where proofrolling identifies areas that are unstable or "pumping" subgrade those areas should be repaired prior to the placement of any subsequent Structural Fill or other construction materials. Methods of stabilization include undercutting, moisture conditioning, or chemical stabilization. The situation should be discussed with ECS to determine the appropriate procedure. Test pits may be excavated to explore the shallow subsurface materials to help in determining the cause of the observed unstable materials, and to assist in the evaluation of appropriate remedial actions to stabilize the subgrade.

5.1.3 Site Temporary Dewatering

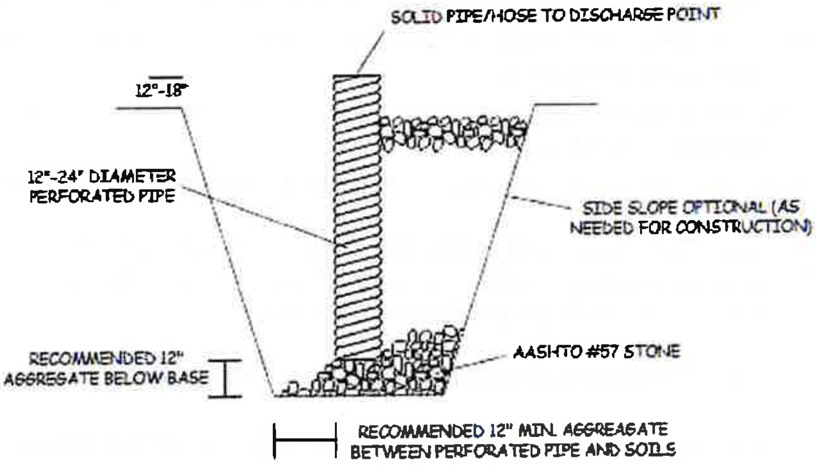
Groundwater on this site can be characterized as being broadly perched above less permeable materials and shallow rock. The depth at which perched water is present on the site varies with surface elevation. In low-lying areas the presence of perched water is more pronounced. In higher areas and on ridge lines, perched water may be present, including above design cut elevations, but is less concentrated. Soils at contact with perched water levels were very moist to wet. In most cases, moisture then decreased with depth.

The contractor shall make their own assessment of temporary dewatering needs based upon the limited subsurface groundwater information presented in this report. Soil sampling is not continuous, and thus soil and groundwater conditions may vary between sampling intervals (typically 5 feet). If the contractor believes additional subsurface information is needed to assess dewatering needs, they should obtain such information at their own expense. ECS makes no warranties or guarantees regarding the adequacy of the provided information to determine dewatering requirements; such recommendations are beyond our scope of services.

Dewatering systems are a critical component of many construction projects. Dewatering systems must be selected, designed, and maintained by a qualified and experienced (specialty or other) contractor familiar with the succinct geotechnical and other aspects of the project. The failure to properly design and maintain a dewatering system for a given project can result in delayed construction, unnecessary foundation subgrade undercuts, detrimental phenomena such as 'running sand' conditions, internal erosion (i.e., 'piping'), the migration of 'fines' down-gradient towards the dewatering system, localized settlement of nearby infrastructure, foundations, slabs-on-grade and pavements, etc. Water discharged from any site dewatering system shall be discharged in accordance with all local, state and federal requirements.

Strategies for Addressing Perched Groundwater:

The typical primary strategy for addressing perched groundwater seeping into excavations is pumping from trench (or French) and sump pits with sump pumps. A typical sump pump drain (found in a sump pit or along a French drain) is depicted below. The inlet of the sump pump is placed at the bottom of the corrugated pipe and the discharge end of the sump is directed to an appropriate stormwater drain.



Sump Pit/Pump Diagram

Details of a typical French drainage installation are included in Appendix D. A typical French drain consists of an 18 to 24-inch wide by 18 to 24-inch deep bed of AASHTO #57 (or similar open graded aggregate) aggregate wrapped in a medium duty, non-woven geotextile and (sometimes) containing a 6-inch diameter, Schedule 40 PVC perforated or slotted pipe. Actual dimensions should be as determined necessary by ECS during construction. After the installation has been completed, the geotextile should be wrapped over the top of the aggregate and pipe followed by placement of backfill. The top of the drain should be positioned at least 18 inches below the design subgrade elevations. Drains should not be routed within the expanded building limits.

Pumping wells or a vacuum system could also be used to address perched groundwater. These techniques often are only effective during the initial depletion of the perched water quantity and may quickly be ineffective at addressing accumulation of water from rain, snow, etc.

5.2 EARTHWORK OPERATIONS

5.2.1 High Plasticity Soils

Within the proposed project limits, potentially expansive soils (CH/MH) were encountered during this exploration; these types of soils are common in this area, and, based on the regional geology as well as results from past ECS subsurface explorations performed on nearby sites, these and other high plasticity soils are believed to present at the site at locations which may not have been evaluated during this subsurface exploration. Care should be taken to limit moisture variations in order to reduce potential volume changes. If the field work is conducted during the winter or early spring months, it is expected that even the low-plasticity clay/silt soils at the surface may need to be removed or dried prior to fill placement. If expansive clays and clay-silt mixtures are encountered, they should not be used as fill for roadway, curb, gutter, and sidewalk subgrade, within utility trenches, or within embankment slopes. For suitability of natural soils to be used in structural areas (i.e. foundations and floor slabs), soils meeting all four of the following provisions shall be considered expansive per IBC 2012, except that tests to show compliance with items 1, 2, and 3 shall not be required if the test prescribed in Item 4 is conducted:

1. *Plasticity Index (PI) of 15 or greater, determined in accordance with ASTM D 4318.*
2. *More than 10 percent of the soil particles pass a No. 200 sieve (0.75 μm), determined in accordance with ASTM D 422.*
3. *More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D 422.*
4. *Expansion Index greater than 20, determined in accordance with ASTM D4829.*

If the Plasticity Index (PI) of the soil is 20 or less and the Liquid Limit (LL) is 45 or less, the Plasticity Index Corrected (PI cor) or the Expansion Index Corrected (E1 cor) may be substituted in the definition of Expansive Soil. Where PI cor and E1 cor are determined as follows:

PI cor = PI x (% Passing No.40 sieve)/100 and EI cor = EI x (% Passing No. 4 Sieve)/100

These soils should not be reused as engineered fill. When these soils are encountered in cut areas, they should be undercut to 4 feet below finished exterior grade or to 2 feet below the bottom of footing, whichever is deeper, and backfilled with controlled, compacted fill. If the bottom of the plastic soils extends to depths less than 4 feet below the finished exterior grade, the undercutting and replacement may be limited to the depth of the high plasticity soils.

Alternatively, the footings can be "stepped down" to bear either at 4 feet below exterior grade or at 2 feet below normal footing subgrade, whichever is deeper, bearing on the plastic soils. If the plastic soils are found to be less than 4 feet in thickness, the footing needs bear only below the plastic soils and the frost line.

Floor slabs placed in areas where highly plastic soils are encountered should be underlain by at least 2 feet of compacted suitable fill. In proposed pavement areas, we recommend undercutting and replacement of the expansive soils in order to provide at least 2 feet of non-expansive soil fill below the pavement subgrade.

5.2.2 Existing Man-Placed Fill

Existing man-placed fill was not encountered below the existing ground surface within any of the borings evaluated for this exploration. However, it should be noted that the general site is bordered by some developed areas and fill may be present in areas of the site not explored during our current study or adjacent to utilities or structures at the site. Existing fill material should be considered undocumented fill and will have to be removed and reworked or replaced within structural areas. Any encountered trash or unsuitable fill materials should be completely removed within structural areas and should not be used in structural fill areas.

If areas of existing fill are encountered at a subsequent time during site development, it may be feasible to remove and re-compact the existing fill materials; however, further laboratory testing should be performed at that time to confirm if the fill materials satisfy the requirements for an engineered fill. Some moisture conditioning of the soils may be necessary prior to placement in order to achieve proper compaction. Additionally, the amount of debris present in existing fill materials can frequently be difficult to evaluate with soil borings. Therefore, test pits may be warranted to confirm the fill does not contain unacceptable debris prior to reuse in engineered fill. Some screening may be required to remove any debris prior to placement of these soils, so the planning of earthwork operations should recognize and account for these efforts and increased costs.

5.2.3 Weathered Rock and Rock Excavation Operations

Weathered rock was encountered as shallow as 3.0± feet below the existing ground surface. Rock excavation will be required for mass grading and installation of any deep utilities. Typically, for excavations in relatively unweathered rock material, ripping is practical for excavations extending down to about 2 feet below the depth of auger refusal. However, blasting or hoe-ramming for removal of weathered rock or intact rock will likely be required below auger refusal depths.

For the construction planning and final pay quantities, we recommend that the following definition be utilized in the project specification to define rock:

> "For footings, trenches and pits, rock shall be defined as those materials that cannot be excavated with a Caterpillar Model No. 320L track-type hydraulic excavator, equipped with a 42-inch wide short-tip radius rock bucket, rated at not less than 120 hp flywheel power with a maximum drawbar pull force of not less than 39,700 lbs. Boulders or masses of rock exceeding one-half cubic yard in volume shall also be considered rock excavation. This classification does not include materials such as loose rock, concrete, or other materials that can be removed by means other than drilling and blasting, hoe-ramming, or rock trenching, but which for reasons of economy in excavating, the contractor chooses to remove by drilling and blasting, hoe-ramming, or rock trenching techniques."

Refusal materials (intact rock) normally require blasting in deep excavations. Blasting in utility trenches should be done carefully to avoid damage to the surrounding materials. When the material to be excavated requires blasting, the contractor should comply with the requirements of the county.

5.2.4 Structural Fill

Product Submittals: Prior to placement of structural fill, representative bulk samples (about 50 pounds) of on-site and off-site borrow should be submitted to ECS for laboratory testing, which will include Atterberg limits, natural moisture content, grain-size distribution, and moisture-density relationships for compaction. Import materials should be tested prior to being hauled to the site to determine if they meet project specifications.

Satisfactory Structural Fill Materials: Fill material underneath the proposed structures and pavements should consist of an approved material (CL, ML, SC, SM or more granular), free of debris, organics, and cobbles greater than 4 inches. The structural fill in the "active zone" under the building pad should have Liquid Limit (LL) no greater than 40 and Plasticity Index (PI) less than 15, and shall be non-expansive in addition to meeting all the other requirements for a suitable structural fill material. The "active zone" is defined by PWC as a buffer of at least four feet below the final exterior grades or two feet below the bottom of the foundation, whichever is greater. Fill below the "active zone" for structures, and below subgrade for slopes and pavement (curb and gutter, sidewalk, etc.) should have LL and PI no greater than 45 and 20, respectively, unless it can be shown to have very low expansion potential. If no structural fill is required, the upper two feet of existing soil shall meet these criteria. Under no circumstances should high plasticity (CH, MH) soil be used as fill material in proposed structural areas.

The low plasticity natural soils at this site are expected to be suitable for use as controlled fill; however, they may require moisture content adjustments, via discing or other drying techniques or spraying of water to the soil prior to their use as controlled fill material. Additionally, any debris or other unsuitable materials must be removed, as necessary, from the on-site materials prior to their reuse as engineered fill. The planning of earthwork operations should recognize and account for these efforts and increased costs. Suitable structural fill soils should have the index properties shown in the tables below.

STRUCTURAL FILL INDEX PROPERTIES	
Subject	Property
Building and Structural Areas	LL < 40, PI<15
Pavement Areas	LL < 45, PI<20
Max. Particle Size	4 inches
Fines Content (% passing #200 sieve)	Max. 25 %
Max. organic content	5% by dry weight

STRUCTURAL FILL COMPACTION REQUIREMENTS	
Subject	**Requirement**
Compaction Standard	Standard Proctor, ASTM D698/ Virginia Test Method (VTM-1)
Required Compaction	95% of Max. Dry Density for fill less than 10 feet
	98% of Max. Dry Density for fill greater than 10 feet
Moisture Content	-2 to +3 % points of the soil's optimum value
Loose Thickness	8 inches prior to compaction

Flowable Fill/Lean Concrete Fill Recommendations: Low strength flowable fill/lean concrete materials are also considered suitable for use as fill to restore site grades to final slab-on-grade elevations for conduit installation. Prior to the placement of these materials, subgrades shall be observed and approved in accordance with the requirements presented in this report. Fill areas shall be limited to locations where compaction of approved structural fill soils will not result in adequate parameters/values, and fill depths shall be limited to depths to which consolidation will not be permissible. The flowable fill shall be approved by the design team to ensure placement, curing, and resistivity values are achieved. Other approved structural fill materials shall not be layered between multiple lifts of flowable fill.

On-Site Borrow Suitability: Significant natural deposits of soils classified in our boring logs as Silty SAND/Sandy SILT (SM/ML) have been identified as being present on the site. These occur mostly at relatively shallow depth below the surface where residual soils are mostly weathered.

Non-Durable Rock: Nondurable rock materials removed in ripping excavations may be used as fill if suitably broken down by mechanical compaction effort. Durability is the term used to describe the ability of a rock or rock-like material to withstand long term chemical or mechanical weathering without size degradation. Any weathered rock excavated from the site and used as engineered fill should have a well-graded grain size distribution with rock and soil particles ranging from clay or silt size particles to a maximum size of 4 inches in diameter. Particles larger than this should be broken by mechanical compaction equipment to achieve the desired grain size distribution, and the samples should have a minimum of 20% passing the #200 sieve and 50% passing the #40 sieve. Variations from these recommendations should be approved by the GER, at the time the samples are prepared.

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

Fill Equilibrium Monitoring: Up to approximately 21± feet of new fill will be required to reach planned grades in some areas. With this extensive fill and predominately fine-grained soils anticipated for its construction, settlement monitoring prior to commencing foundation construction is recommended in order to confirm the fill has reached equilibrium. Likewise, it would be prudent to place the extensive new fill for the building as early as possible in the site development phase so that any residual, fill-induced settlement can occur without major impacts to the building construction schedule.

We believe that the majority of the fill-induced settlement will occur within the fill itself, rather than over a deep soft soil layer. Therefore, a monitoring program utilizing near-surface settlement plates or monuments should be implemented near or immediately upon the conclusion of the fill placement. The frequency of monitoring should be on a weekly basis, but this should be adjusted as necessary by the GER based upon settlement rates. The GER will also determine the duration of the settlement monitoring based on settlement rates and trends. Typically, the fill-induced settlement rates are highest during the fill placement and begin to taper off shortly after ceasing any fill placement. Fill-induced settlements will practically stop within two or so months after the completion of any fill placement. Construction can begin when subsequent readings indicate settlement of the fill under its own weight has virtually ceased.

5.2.5 Temporary and Permanent Slopes

Because of the erodibility of the natural soil at the site, special care should be taken to prevent erosion. We recommend that temporary slopes established during construction be constructed no steeper than 1H:1V and maintained for no more than 30 days.

Landscape berms can be constructed as steep as 2H:1V; however, it should be noted that the site soil is highly erodible and that adequate measures must be taken to prevent erosion of slopes steeper than 3H:1V. All slopes must be protected from erosion by a ground cover of adequate vegetation and erosion control measures. All excavations should be performed in accordance with the current OSHA and VOSHA regulations.

5.3 FOUNDATION AND SLAB OBSERVATIONS

Protection of Foundation Excavations: Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for too long a time. Therefore, foundation concrete should be placed the same day that excavations are made. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, a 1 to 3-inch thick "mud mat" of "lean" concrete should be placed on the bearing soils before the placement of reinforcing steel.

Footing Subgrade Observations: Most of the soils at the foundation bearing elevation are anticipated to be suitable for support of the proposed structure. It is important to have ECS observe the foundation subgrade prior to placing foundation concrete, to confirm the bearing soils are what was anticipated.

Slab Subgrade Verification: Prior to placement of a drainage layer, the subgrade should be prepared in accordance with the recommendations found in **Section 5.1.2 Proofrolling**.

5.4 UTILITY INSTALLATIONS

Utility Subgrades: The soils encountered in our exploration are expected to be generally suitable for support of utility pipes. The pipe subgrades should be observed and probed for stability by ECS. Any loose or unsuitable materials encountered should be removed and replaced with suitable compacted structural fill or pipe stone bedding material.

Utility Backfilling: The granular bedding material (often VDOT #57 stone) should be at least 4 inches thick, but not less than that specified by the civil engineer's project drawings and specifications. We recommend that the bedding materials be placed up to the springline of the pipe. Fill placed for support of the utilities, as well as backfill over the utilities, should satisfy the requirements for Structural Fill and Fill Placement.

Excavation Safety: All excavations and slopes should be constructed and maintained in accordance with OSHA excavation safety standards. The contractor is solely responsible for designing, constructing, and maintaining stable temporary excavations and slopes. The contractor's responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. ECS is providing this information solely as a service to our client. ECS is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

6.0 CLOSING

ECS has prepared this report to guide the geotechnical-related design and construction aspects of the project. We performed these services in accordance with the standard of care expected of professionals in the industry performing similar services on projects of like size and complexity at this time in the region. No other representation, expressed or implied, and no warranty or guarantee is included or intended in this report.

The description of the proposed project is based on information provided to ECS by Bohler. If any of this information is inaccurate or changes, either because of our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted so we can review our recommendations and provide additional or alternate recommendations that reflect the proposed construction.

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

Field observations, and quality assurance testing during earthwork and foundation installation are an extension of, and integral to, the geotechnical design. We recommend that ECS be retained to apply our expertise throughout the geotechnical phases of construction, and to provide consultation and recommendation should issues arise. ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

APPENDIX A – Diagrams & Reports

Site Location Diagram
Boring Location Diagram

ECS

SITE LOCATION DIAGRAM
WARRENTON DATA CENTER

LEE HIGHWAY AND BLACKWELL ROAD, WARRENTON, VIRGINIA
BOHLER ENGINEERING

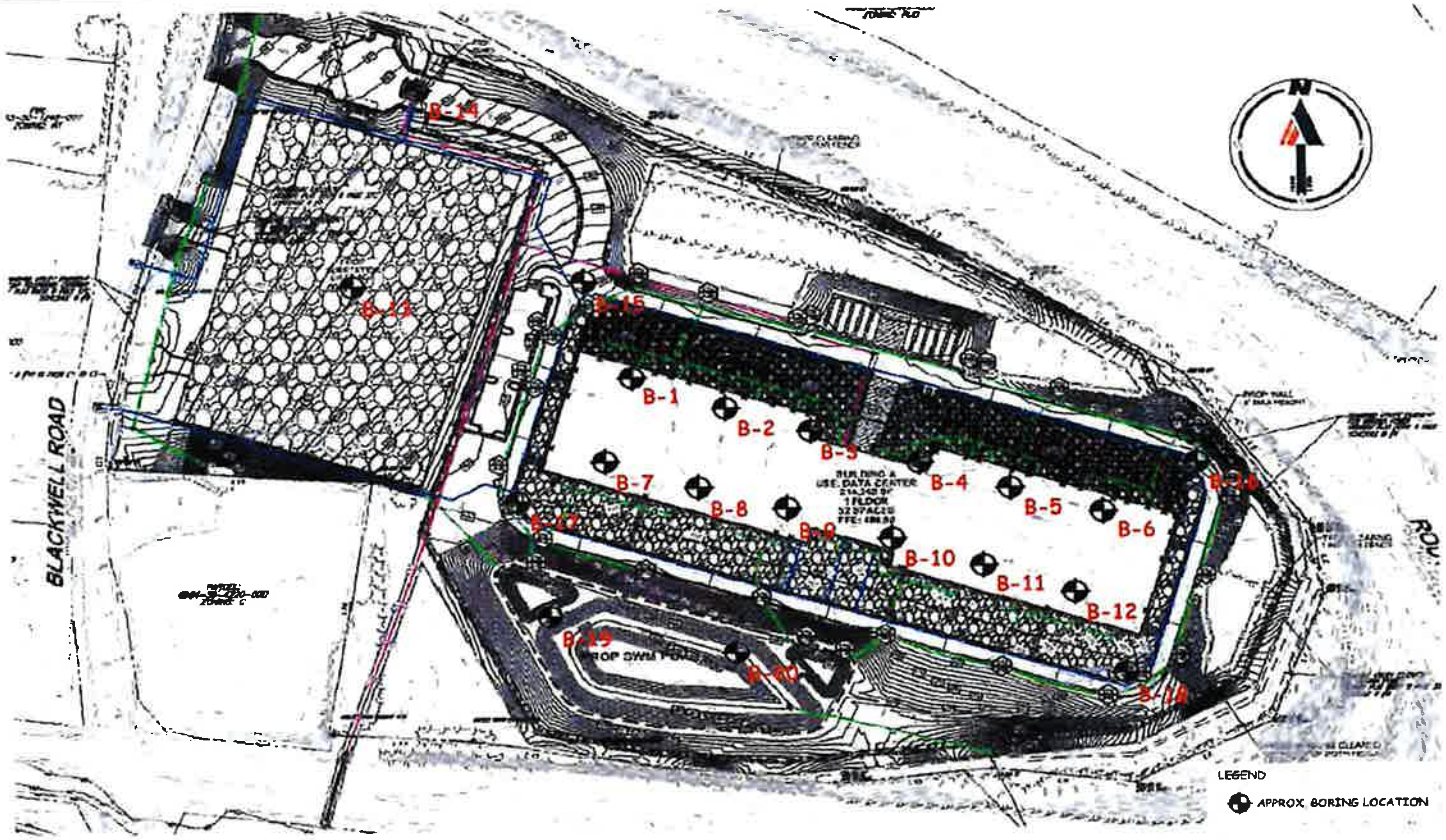
ENGINEER
DOA

SCALE
AS NOTED

PROJECT NO.
01:31153

SHEET
1 OF 1

DATE
11/10/2021



Proposed Boring Location Diagram

Bohler Engineering

ECS

Warrenton Data Center

Warrenton, Virginia

ENGINEER	JAS6
SCALE	NTS
PROJ NO.	01:31153
SHEET	1
DATE	3/18/2022

APPENDIX B – Field Operations

Reference Notes for Boring Logs
Subsurface Exploration Procedure Notes
Boring Logs B-1 through B-20

REFERENCE NOTES FOR BORING LOGS

MATERIAL[1,2]		
■		ASPHALT
░		CONCRETE
○		GRAVEL
▨		TOPSOIL
□		VOID
▦		BRICK
○		AGGREGATE BASE COURSE
🟥	FILL[3]	MAN-PLACED SOILS
▓	GW	WELL-GRADED GRAVEL gravel-sand mixtures, little or no fines
▓	GP	POORLY-GRADED GRAVEL gravel-sand mixtures, little or no fines
▓	GM	SILTY GRAVEL gravel-sand-silt mixtures
▓	GC	CLAYEY GRAVEL gravel-sand-clay mixtures
░	SW	WELL-GRADED SAND gravelly sand, little or no fines
░	SP	POORLY-GRADED SAND gravelly sand, little or no fines
▥	SM	SM SILTY SAND sand-silt mixtures
▨	SC	CLAYEY SAND sand-clay mixtures
▥	ML	SILT non-plastic to medium plasticity
▥	MH	ELASTIC SILT high plasticity
▨	CL	LEAN CLAY low to medium plasticity
▨	CH	FAT CLAY high plasticity
▨	OL	ORGANIC SILT or CLAY non-plastic to low plasticity
■	OH	ORGANIC SILT or CLAY high plasticity
▒	PT	PEAT highly organic soils

DRILLING SAMPLING SYMBOLS & ABBREVIATIONS

SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation %
HSA	Hollow Stem Auger		

PARTICLE SIZE IDENTIFICATION

DESIGNATION		PARTICLE SIZES
Boulders		12 inches (300 mm) or larger
Cobbles		3 inches to 12 inches (75 mm to 300 mm)
Gravel:	Coarse	¾ inch to 3 inches (19 mm to 75 mm)
	Fine	4.75 mm to 19 mm (No. 4 sieve to ¾ inch)
Sand:	Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
	Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
	Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")		<0.074 mm (smaller than a No. 200 sieve)

COHESIVE SILTS & CLAYS

UNCONFINED COMPRESSIVE STRENGTH, QP[4]	SPT[5] (BPF)	CONSISTENCY[7] (COHESIVE)
<0.25	<3	Very Soft
0.25 - <0.50	3 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

RELATIVE AMOUNT[7]	COARSE GRAINED (%)[8]	FINE GRAINED (%)[8]
Trace	<5	≤5
Dual Symbol (ex: SW-SM)	10	10
With	15 - 25	15 - 25
Adjective (ex: "Silty")	>30	>30

GRAVELS, SANDS & NON-COHESIVE SILTS

SPT[6]	DENSITY
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

WATER LEVELS[6]

▽	WL (First Encountered)
▼	WL (Completion)
▼	WL (Seasonal High Water)
▽	WL (Stabilized)

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[1] Classifications and symbols per ASTM D 2488-17 (Visual-Manual Procedure) unless noted otherwise.

[2] To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.

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

[4] Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).

[5] Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf). SPT correlations per 7.4.2 Method B and need to be corrected if using an auto hammer.

[6] The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.

[7] Minor deviation from ASTM D 2488-17 Note 16.

[8] Percentages are estimated to the nearest 5% per ASTM D 2488-17.

SUBSURFACE EXPLORATION PROCEDURE:
STANDARD PENETRATION TESTING (SPT)
ASTM D 1586
Split-Barrel Sampling

Standard Penetration Testing, or **SPT**, is the most frequently used subsurface exploration test performed worldwide. This test provides samples for identification purposes, as well as a measure of penetration resistance, or N-value. The N-Value, or blow counts, when corrected and correlated, can approximate engineering properties of soils used for geotechnical design and engineering purposes.

SPT Procedure:

- Involves driving a hollow tube (split-spoon) into the ground by dropping a 140-lb hammer a height of 30-inches at desired depth
- Recording the number of hammer blows required to drive split-spoon a distance of 12 inches (in 3 or 4 Increments of 6 inches each)

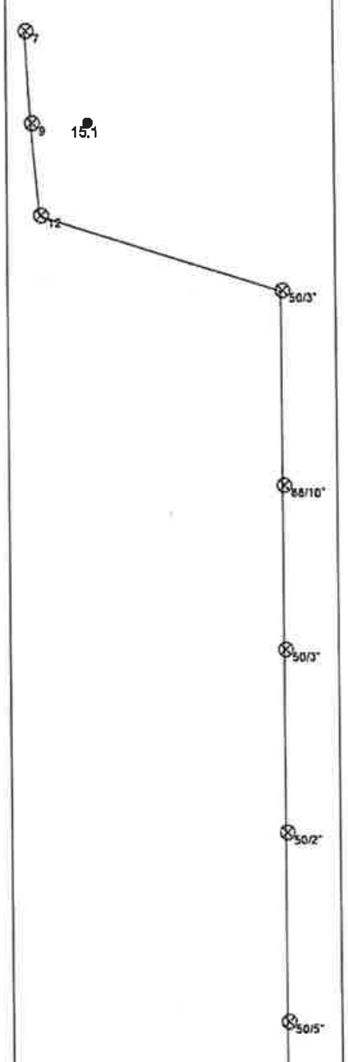
- Auger is advanced* and an additional SPT is performed
- One SPT test is typically performed for every two to five feet
- Obtain two-inch diameter soil sample

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

CLIENT: **Bohler Engineering**	PROJECT NO.: **01:31153**	BORING NO.: **B-01**	SHEET: **1 of 2**	ECS
PROJECT NAME: **Warrenton Data Center**	DRILLER/CONTRACTOR: **All American Geotech, Inc.**			
SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**			LOSS OF CIRCULATION	
NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **492**	BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit
X——●——△
⊗ STANDARD PENETRATION BLOWS/FT
ROCK QUALITY DESIGNATION & RECOVERY
🟥 RQD
— REC
○ CALIBRATED PENETROMETER TON/SF
[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness [4"]			
	S-1	SS	18	12	(SM) SILTY SAND, brown, moist, loose			3-3-4 (7)
	S-2	SS	18	16	(CH) SANDY FAT CLAY, brown and gray, moist, firm			4-4-5 (9)
5					(SM) SILTY SAND, brown, moist, medium dense		487	
	S-3	SS	18	10				5-5-7 (12)
	S-4	SS	9	0	WEATHERED ROCK, light brown, moist, very dense			32-50/3" (50/3")
10							482	
	S-5	SS	16	13				29-38-50/4" (88/10")
15							477	
	S-6	SS	3	3				50/3" (50/3")
20							472	
						▽		
	S-7	SS	2	2				50/2" (50/2")
25							467	
	S-8	SS	5	5				50/5" (50/5")
30							462	



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**23.0**	BORING STARTED:	**Sep 21 2021**	CAVE IN DEPTH:	**47.0**
▼ WL (Completion)	**34.0**	BORING COMPLETED:	**Sep 21 2021**	HAMMER TYPE:	**Auto**
▼ WL (Seasonal High Water)		EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD:	**3.25 HSA**
▽ WL (Stabilized)					

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**	PROJECT NO.: **01:31153**	BORING NO.: **B-01**	SHEET: **2 of 2**	ECS
PROJECT NAME: **Warrenton Data Center**	DRILLER/CONTRACTOR: **All American Geotech, Inc.**			
SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**			LOSS OF CIRCULATION	
NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **492**	BOTTOM OF CASING

Plastic Limit X—— Water Content ●—— Liquid Limit △

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

🟥 RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	
					WEATHERED ROCK, light brown, moist, very dense				
	~~S-9~~	~~SS~~	~~5~~	~~5~~		▼		50/5" (50/5")	⊗50/5"
35							457		
	S-10	SS	15	15				24-43-50/3" (93/9")	16.5 ⊗[illegible]
40							452		
	S-11	SS	10	10				32-50/4" (50/4")	⊗50/4"
45							447		
	~~S-12~~	~~SS~~	~~4~~	~~4~~				50/4" (50/4")	⊗50/4"
50							442		
	~~S-13~~	~~SS~~	~~4~~	~~4~~				50/4" (50/4")	⊗50/4"
55							437		
	~~S-14~~	~~SS~~	~~3~~	~~3~~	END OF BORING AT 58.8 FT			50/3" (50/3")	⊗50/3"
60							432		

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**23.0**	BORING STARTED:	**Sep 21 2021**	CAVE IN DEPTH:	**47.0**
▼ WL (Completion)	**34.0**	BORING COMPLETED:	**Sep 21 2021**	HAMMER TYPE:	**Auto**
▽ WL (Seasonal High Water)		EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD:	**3.25 HSA**
▽ WL (Stabilized)					

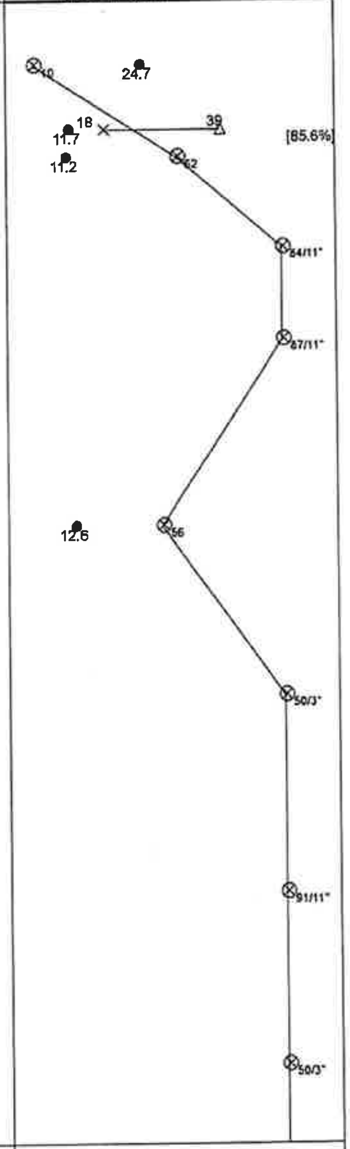
GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**	PROJECT NO.: **01:31153**	BORING NO.: **B-02**	SHEET: **1 of 2**	ECS
PROJECT NAME: **Warrenton Data Center**	DRILLER/CONTRACTOR: **All American Geotech, Inc.**			
SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**				LOSS OF CIRCULATION
NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **480**	BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit
X———●———△

⊗ STANDARD PENETRATION BLOWS/FT
ROCK QUALITY DESIGNATION & RECOVERY
🟥 RQD
— REC
○ CALIBRATED PENETROMETER TON/SF
[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	SS	18	12	Topsoil Thickness [3"] (SM) SILTY SAND, brown, moist, loose			2-3-7 (10)
	D3S-191 S-2	BG1 SS	60 18	18	WEATHERED ROCK, light brown, greenish gray, and black, moist, very dense			17-24-38 (62)
5							475	
	S-3	SS	17	17				19-34-50/5" (84/11")
	S-4	SS	17	17				20-37-50/5" (87/11")
10							470	
	S-5	SS	18	18				17-24-32 (56)
15							465	
	S-6	SS	9	9				24-50/3" (50/3")
20							460	
	S-7	SS	17	15				30-41-50/5" (91/11")
25							455	
	S-8	SS	9	9				45-50/3" (50/3")
30							450	



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**45.0**	BORING STARTED:	**Sep 27 2021**	CAVE IN DEPTH:	**52.0**
▼ WL (Completion)	**53.0**	BORING COMPLETED:	**Sep 27 2021**	HAMMER TYPE:	**Auto**
▽ WL (Seasonal High Water)		EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD:	**3.25 HSA**
▽ WL (Stabilized)					

GEOTECHNICAL BOREHOLE LOG

CLIENT:
Bohler Engineering

PROJECT NO.:
01:31153

BORING NO.:
B-02

SHEET:
2 of 2

PROJECT NAME:
Warrenton Data Center

DRILLER/CONTRACTOR:
All American Geotech, Inc.

SITE LOCATION:
Lee Highway and Blackwell Road, Warrenton, Virginia 20186

NORTHING:

EASTING:

STATION:

SURFACE ELEVATION:
480

LOSS OF CIRCULATION 100%

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit
X——●——△

⊗ STANDARD PENETRATION BLOWS/FT
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC
○ CALIBRATED PENETROMETER TON/SF
[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	
					WEATHERED ROCK, light brown, greenish gray, and black, moist, very dense				
	S-9	SS	11	10				38-50/5" (50/5")	⊗50/5"
35							445		
	S-10	SS	4	4				50/4" (50/4")	⊗50/4"
40							440		
	S-11	SS	5	5				50/5" (50/5")	⊗50/5"
45						▽	435		
	S-12	SS	3	3				50/3" (50/3")	⊗50/3"
50							430		
						▼			
	S-13	SS	4	4				50/4" (50/4")	⊗50/4"
55							425		
	S-14	SS	3	3	**END OF BORING AT 58.8 FT**			50/3" (50/3")	⊗50/3"
60							420		

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	45.0
▼ WL (Completion)	53.0
▼ WL (Seasonal High Water)	
▽ WL (Stabilized)	

BORING STARTED: **Sep 27 2021**

BORING COMPLETED: **Sep 27 2021**

EQUIPMENT: **ATV**

LOGGED BY:

CAVE IN DEPTH: **52.0**

HAMMER TYPE: **Auto**

DRILLING METHOD: **3.25 HSA**

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**	PROJECT NO.: **01:31153**	BORING NO.: **B-03**	SHEET: **1 of 2**	ECS
PROJECT NAME: **Warrenton Data Center**	DRILLER/CONTRACTOR: **All American Geotech, Inc.**			
SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**			LOSS OF CIRCULATION	
NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **475**	BOTTOM OF CASING

Plastic Limit X Water Content ● Liquid Limit △

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

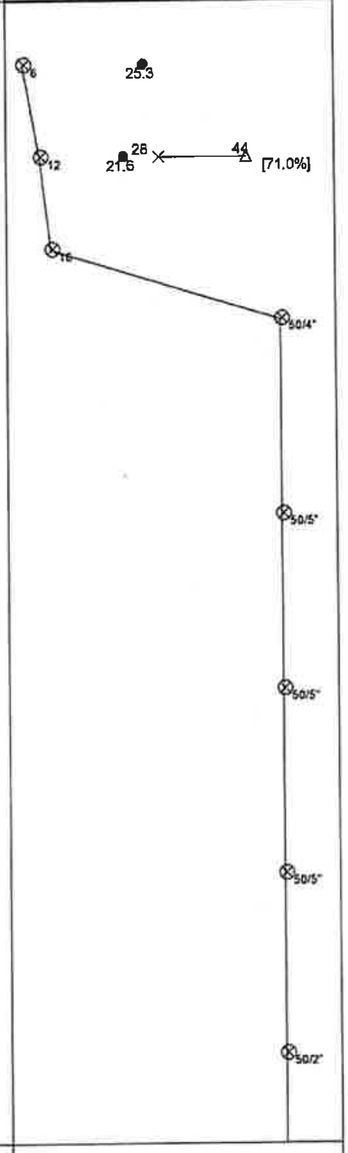
🟥 RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness [6"]			
	S-1	SS	18	12	(ML) SANDY SILT, light brown, moist, loose to medium dense			3-3-3 (6)
	S-2	SS	18	18				4-5-7 (12)
5							470	
	S-3	SS	18	12				6-7-9 (16)
	S-4	SS	4	4	WEATHERED ROCK, light brown to gray, moist, very dense			50/4" (50/4")
10							465	
	S-5	SS	11	11				39-50/5" (50/5")
15							460	
	S-6	SS	5	5				50/5" (50/5")
20							455	
	S-7	SS	5	5				50/5" (50/5")
25							450	
	S-8	SS	2	2		▽		50/2" (50/2")
30							445	



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**29.0**	BORING STARTED: **Oct 04 2021**		CAVE IN DEPTH: **36.0**
▼ WL (Completion)	**35.0**	BORING COMPLETED: **Oct 04 2021**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)		EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD: **3.25 HSA**
▽ WL (Stabilized)				

GEOTECHNICAL BOREHOLE LOG

CLIENT:
Bohler Engineering

PROJECT NO.:
01:31153

BORING NO.:
B-03

SHEET:
2 of 2

PROJECT NAME:
Warrenton Data Center

DRILLER/CONTRACTOR:
All American Geotech, Inc.

SITE LOCATION:
Lee Highway and Blackwell Road, Warrenton, Virginia 20186

NORTHING:

EASTING:

STATION:

SURFACE ELEVATION:
475

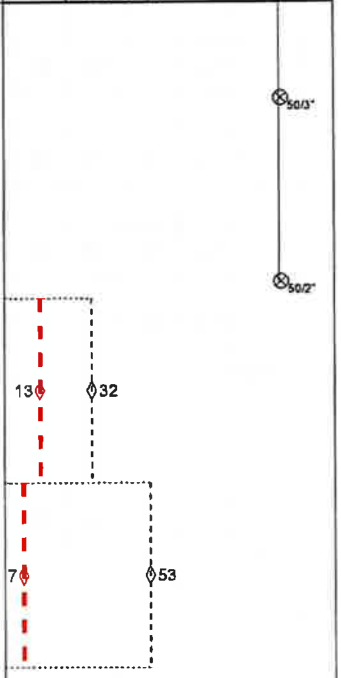
LOSS OF CIRCULATION

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit
X———●———△

⊗ STANDARD PENETRATION BLOWS/FT
ROCK QUALITY DESIGNATION & RECOVERY
— RQD
— REC
○ CALIBRATED PENETROMETER TON/SF
[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					WEATHERED ROCK, light brown to gray, moist, very dense			
	S-9	SS	3	3				50/3" (50/3")
35						▼	440	
	S-10	SS	2	2				50/2" (50/2")
40	S-11	RC	60	19	SCHIST, [REC=32%,RQD=13%], Highly Weathered, Very Hard, Light Gray		435	
45	S-12	RC	60	32	SCHIST, [REC=53%,RQD=7%], Highly Weathered, Very Hard, Brownish Gray		430	
50					**AUGER REFUSAL AT 49.0 FT**		425	
55							420	
60							415	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	29.0	BORING STARTED:	Oct 04 2021	CAVE IN DEPTH:	36.0
▼ WL (Completion)	35.0	BORING COMPLETED:	Oct 04 2021	HAMMER TYPE:	Auto
▽ WL (Seasonal High Water)		EQUIPMENT: ATV	LOGGED BY:	DRILLING METHOD:	3.25 HSA
▽ WL (Stabilized)					

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**

PROJECT NO.: **01:31153**

BORING NO.: **B-04**

SHEET: **1 of 2**

PROJECT NAME: **Warrenton Data Center**

DRILLER/CONTRACTOR: **All American Geotech, Inc.**

SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**

NORTHING:

EASTING:

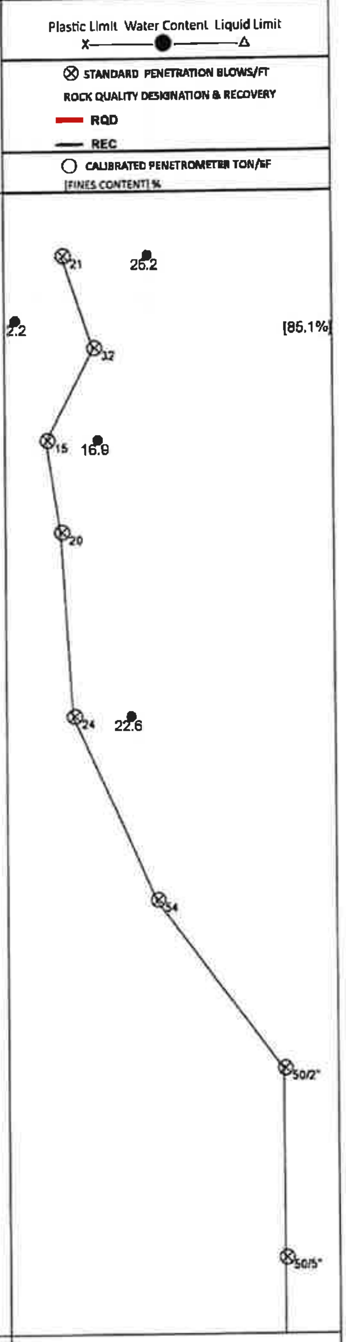
STATION:

SURFACE ELEVATION: **483**

LOSS OF CIRCULATION ⟩100%⟩

BOTTOM OF CASING ➡

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness [6"]			
	S-1	SS	18	18	(ML) SILT, brown to light brown, moist, medium dense to very dense			5-5-16 (21)
	D3S-188	BG1	60					
5	S-2	SS	18	18			478	11-13-19 (32)
	S-3	SS	18	18				5-7-8 (15)
10	S-4	SS	18	18			473	7-10-10 (20)
15	S-5	SS	18	18			468	11-11-13 (24)
20	S-6	SS	18	18			463	21-23-31 (54)
					WEATHERED ROCK, brownish gray, moist, very dense			
25	S-7	SS	8	8			458	47-50/2" (50/2")
30	S-8	SS	11	11			453	36-50/5" (50/5")



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **Dry**

▼ WL (Completion) **Dry**

▼ WL (Seasonal High Water)

▽ WL (Stabilized)

BORING STARTED: **Sep 28 2021**

BORING COMPLETED: **Sep 28 2021**

EQUIPMENT: **ATV**

LOGGED BY:

CAVE IN DEPTH: **17.0**

HAMMER TYPE: **Auto**

DRILLING METHOD: **3.25 HSA**

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**	PROJECT NO.: **01:31153**	BORING NO.: **B-04**	SHEET: **2 of 2**	
PROJECT NAME: **Warrenton Data Center**	DRILLER/CONTRACTOR: **All American Geotech, Inc.**			
SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**			LOSS OF CIRCULATION	)100%)
NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **483**	BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit
X———●———△

⊗ STANDARD PENETRATION BLOWS/FT
ROCK QUALITY DESIGNATION & RECOVERY
▬ RQD
— REC
○ CALIBRATED PENETROMETER TON/SF
(FINES CONTENT) %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL		WATER LEVELS	ELEVATION (FT)	BLOWS/6"	
					WEATHERED ROCK, brownish gray, moist, very dense	▨				
	S-9	SS	1	1	**AUGER REFUSAL AT 33.6 FT**				50/1" (50/1")	⊗50/1"
35								448		
40								443		
45								438		
50								433		
55								428		
60								423		

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	Dry	BORING STARTED:	Sep 28 2021	CAVE IN DEPTH:	17.0
▼ WL (Completion)	Dry	BORING COMPLETED:	Sep 28 2021	HAMMER TYPE:	Auto
▼ WL (Seasonal High Water)		EQUIPMENT: ATV	LOGGED BY:	DRILLING METHOD:	3.25 HSA
▽ WL (Stabilized)					

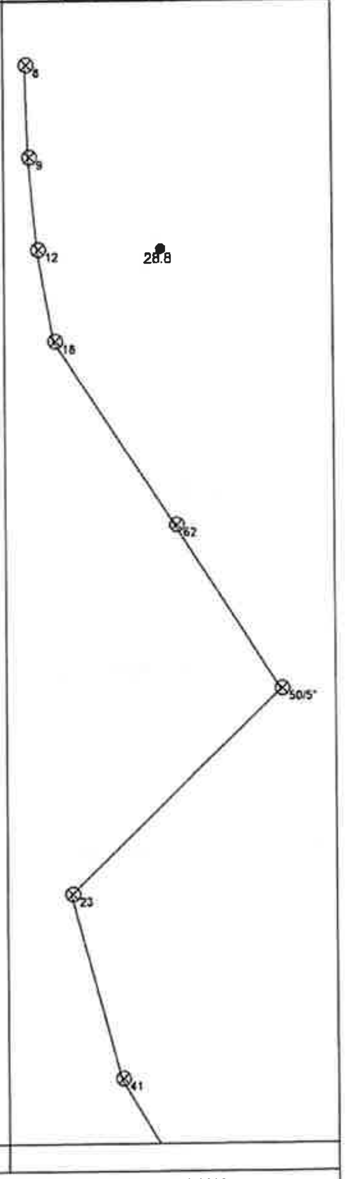
GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**
PROJECT NO.: **01:31153**
BORING NO.: **B-05**
SHEET: **1 of 3**
PROJECT NAME: **Warrenton Data Center**
DRILLER/CONTRACTOR: **All American Geotech, Inc.**
SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**
NORTHING:
EASTING:
STATION:
SURFACE ELEVATION: **482**

LOSS OF CIRCULATION ⟩100%⟩
BOTTOM OF CASING ➧

Plastic Limit X——— Water Content ●——— Liquid Limit △
⊗ STANDARD PENETRATION BLOWS/FT
ROCK QUALITY DESIGNATION & RECOVERY
🟥 RQD
— REC
○ CALIBRATED PENETROMETER TON/SF
[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness [6"]			
	S-1	SS	18	10	(ML) SANDY SILT, reddish brown, moist, loose			3-3-5 (8)
	S-2	SS	18	18				4-5-4 (9)
5					(ML) SILT, brown and black, moist, medium dense to very dense		477	
	S-3	SS	18	18				3-5-7 (12)
	S-4	SS	18	18				6-9-9 (18)
10							472	
	S-5	SS	18	18				21-27-35 (62)
15							467	
					(ML) SANDY SILT WITH GRAVEL, contains quartz fragments, light brownish gray, moist, very dense			
	S-6	SS	5	5				50/5" (50/5")
20							462	
					(ML) SILT, light brown, moist, medium dense to dense			
	S-7	SS	18	18				9-10-13 (23)
25							457	
	S-8	SS	18	18				16-19-22 (41)
30							452	



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **53.0**
▼ WL (Completion) **48.0**
▼ WL (Seasonal High Water)
▽ WL (Stabilized)

BORING STARTED: **Sep 28 2021**
BORING COMPLETED: **Sep 28 2021**
EQUIPMENT: **ATV**
LOGGED BY:
CAVE IN DEPTH: **49.0**
HAMMER TYPE: **Auto**
DRILLING METHOD: **3.25 HSA**

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**	PROJECT NO.: **01:31153**	BORING NO.: **B-05**	SHEET: **2 of 3**	ECS
PROJECT NAME: **Warrenton Data Center**	DRILLER/CONTRACTOR: **All American Geotech, Inc.**			
SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**			LOSS OF CIRCULATION	⟩100%⟩
NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **482**	BOTTOM OF CASING ▶

Plastic Limit X Water Content ● Liquid Limit △

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

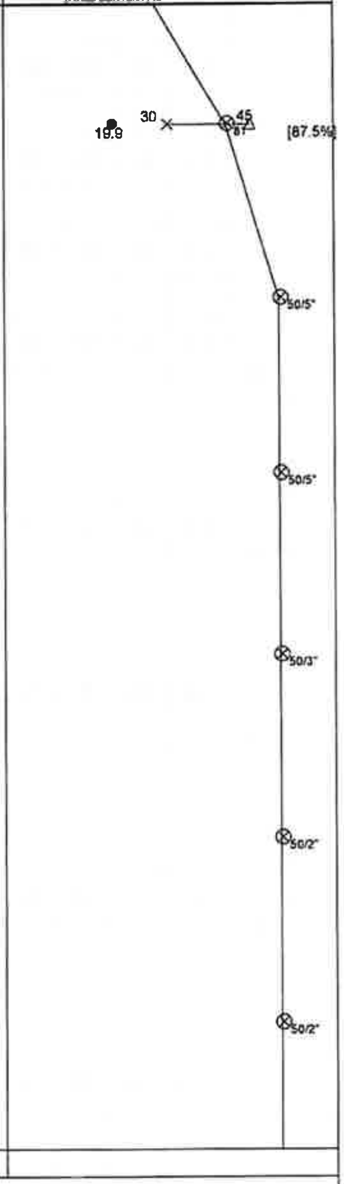
🟥 RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					(ML) SILT, light brown, moist, medium dense to dense			
					WEATHERED ROCK, brownish gray, moist, very dense			
35	S-9	SS	18	18			447	21-38-43 (81)
40	S-10	SS	11	11			442	46-50/5" (50/5")
45	S-11	SS	5	5			437	50/5" (50/5")
50	S-12	SS	3	3		▼	432	50/3" (50/3")
55	S-13	SS	2	2		▽	427	50/2" (50/2")
60	S-14	SS	2	2			422	50/2" (50/2")



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **53.0**	BORING STARTED: **Sep 28 2021**		CAVE IN DEPTH: **49.0**
▼ WL (Completion) **48.0**	BORING COMPLETED: **Sep 28 2021**		HAMMER TYPE: **Auto**
▽ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD: **3.25 HSA**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**	PROJECT NO.: **01:31153**	BORING NO.: **B-05**	SHEET: **3 of 3**
PROJECT NAME: **Warrenton Data Center**	DRILLER/CONTRACTOR: **All American Geotech, Inc.**		
SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**			
NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **482**

LOSS OF CIRCULATION 100%

BOTTOM OF CASING

Plastic Limit X Water Content ● Liquid Limit △

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
					WEATHERED ROCK, brownish gray, moist, very dense				
	S-15	SS	5	5				50/5" (50/5")	50/5"
65							417		
	S-16	SS	1	1				50/1" (50/1")	50/1"
70							412		
	S-17	SS	3	3				50/3" (50/3")	50/3"
75							407		
	S-18	SS	1	1	END OF BORING AT 78.6 FT			50/1" (50/1")	50/1"
80							402		
85							397		
90							392		

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	53.0	BORING STARTED:	Sep 28 2021	CAVE IN DEPTH:	49.0
▼ WL (Completion)	48.0	BORING COMPLETED:	Sep 28 2021	HAMMER TYPE:	Auto
▽ WL (Seasonal High Water)		EQUIPMENT: ATV	LOGGED BY:	DRILLING METHOD:	3.25 HSA
▽ WL (Stabilized)					

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**

PROJECT NO.: **01:31153**

BORING NO.: **B-06**

SHEET: **1 of 2**

PROJECT NAME: **Warrenton Data Center**

DRILLER/CONTRACTOR: **All American Geotech, Inc.**

SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**

NORTHING:

EASTING:

STATION:

SURFACE ELEVATION: **482**

LOSS OF CIRCULATION 100%

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit
X——●——△

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

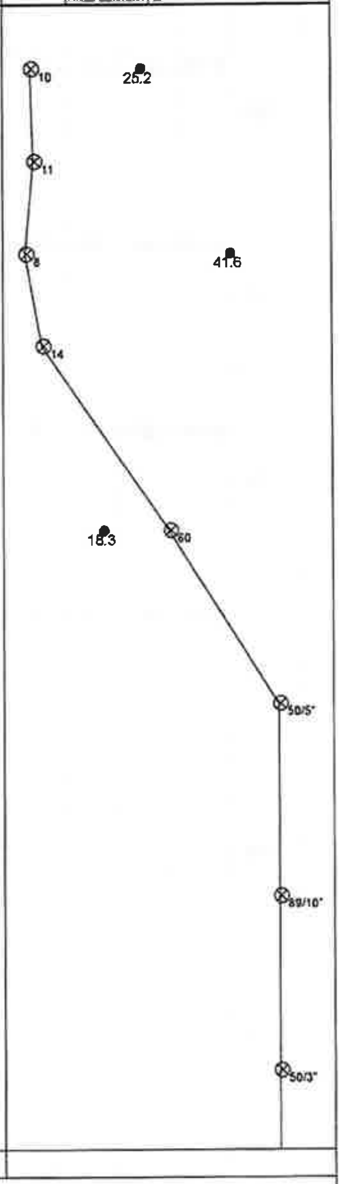
🟥 RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness [6"]			
	S-1	SS	18	12	(ML) SANDY SILT, reddish brown, moist, loose			4-5-5 (10)
	S-2	SS	18	10	(ML) SILT, light brown, moist, loose to medium dense			3-5-6 (11)
5							477	
	S-3	SS	18	18				3-4-4 (8)
	S-4	SS	18	18				7-7-7 (14)
10							472	
					WEATHERED ROCK, light brown and gray, moist, very dense			
	S-5	SS	18	18				22-27-33 (60)
15							467	
	S-6	SS	11	11				33-50/5" (50/5")
20							462	
	S-7	SS	16	16				27-39-50/4" (89/10")
25							457	
	S-8	SS	9	9				20-50/3" (50/3")
30							452	



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**Dry**	BORING STARTED:	**Sep 28 2021**	CAVE IN DEPTH:	**20.0**
▼ WL (Completion)	**Dry**	BORING COMPLETED:	**Sep 28 2021**	HAMMER TYPE:	**Auto**
▽ WL (Seasonal High Water)		EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD:	**3.25 HSA**
▽ WL (Stabilized)					

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**	PROJECT NO.: **01:31153**	BORING NO.: **B-06**	SHEET: **2 of 2**
PROJECT NAME: **Warrenton Data Center**	DRILLER/CONTRACTOR: **All American Geotech, Inc.**		
SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**			LOSS OF CIRCULATION
NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **482**
			BOTTOM OF CASING

Plastic Limit X — Water Content ● — Liquid Limit △

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

— RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL		WATER LEVELS	ELEVATION (FT)	BLOWS/6"	
					WEATHERED ROCK, light brown and gray, moist, very dense	▨				
	S-9	SS	1	1					50/1" (50/1")	⊗ 50/1"
					AUGER REFUSAL AT 33.6 FT					
35								447		
40								442		
45								437		
50								432		
55								427		
60								422		

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**Dry**	BORING STARTED: **Sep 28 2021**		CAVE IN DEPTH: **20.0**
▼ WL (Completion)	**Dry**	BORING COMPLETED: **Sep 28 2021**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)		EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD: **3.25 HSA**
▽ WL (Stabilized)				

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**	PROJECT NO.: **01:31153**	BORING NO.: **B-07**	SHEET: **1 of 1**	ECS
PROJECT NAME: **Warrenton Data Center**	DRILLER/CONTRACTOR: **All American Geotech, Inc.**			
SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**			LOSS OF CIRCULATION	
NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **492**	BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit
X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

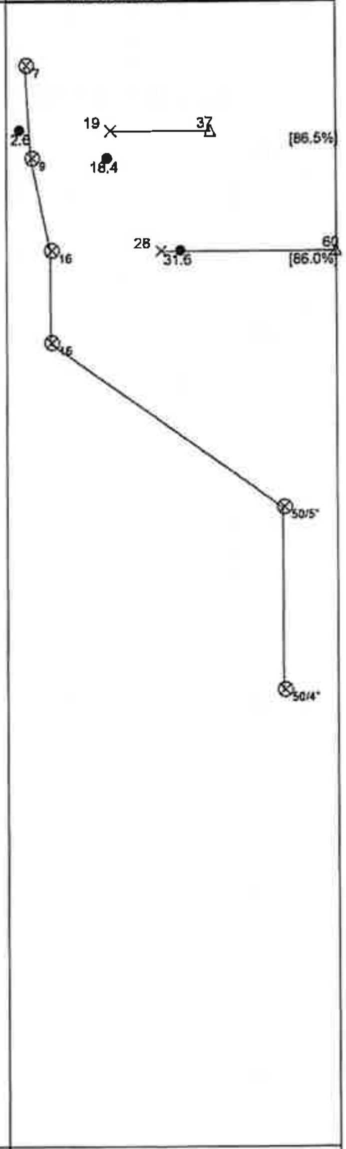
🟥 RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness [6"]			
	S-1	SS	18	9	(ML) SANDY SILT, reddish brown, moist, loose			3-3-4 (7)
5	D3S- 193 S-2	BG1 SS	60 18	12			487	3-4-5 (9)
	S-3	SS	18	18	(CH) FAT CLAY, light brown and gray, moist, very stiff			7-7-9 (16)
10	S-4	SS	18	16	(ML) SANDY SILT, brown and gray, moist, medium dense		482	4-7-9 (16)
	S-5	SS	5	5	WEATHERED ROCK, light brown to gray, moist, very dense			50/5" (50/5")
15							477	
	S-6	SS	4	4				50/4" (50/4")
20					**AUGER REFUSAL AT 20.0 FT**		472	
25							467	
30							462	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	Dry	BORING STARTED: **Sep 29 2021**		CAVE IN DEPTH: **13.5**
▼ WL (Completion)	Dry	BORING COMPLETED: **Sep 29 2021**		HAMMER TYPE: **Auto**
▽ WL (Seasonal High Water)		EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD: **3.25 HSA**
▽ WL (Stabilized)				

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**	PROJECT NO.: **01:31153**	BORING NO.: **B-08**	SHEET: **1 of 3**	ECS
PROJECT NAME: **Warrenton Data Center**	DRILLER/CONTRACTOR: **All American Geotech, Inc.**			
SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**			LOSS OF CIRCULATION	⟩100%⟩
NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **487**	BOTTOM OF CASING ➡

Plastic Limit X——●——△ Liquid Limit, Water Content

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

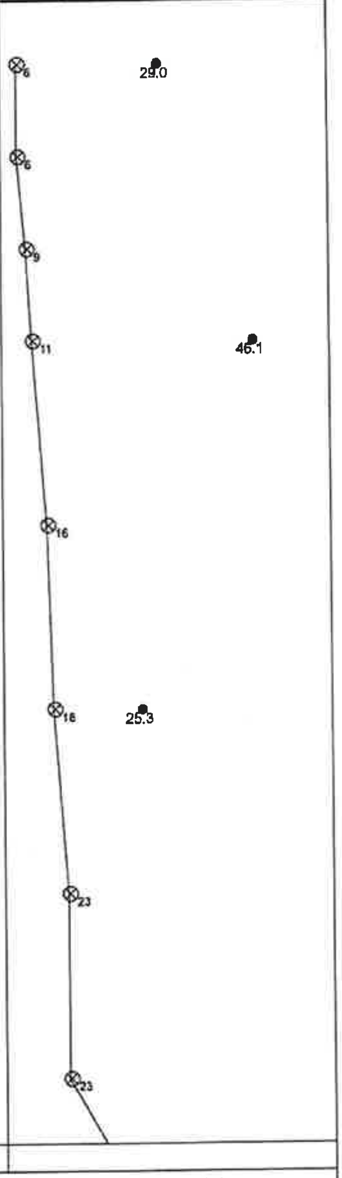
🟥 RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness [6"]			
	S-1	SS	18	18	(ML) SANDY SILT, reddish brown, moist, loose			3-3-3 (6)
5	S-2	SS	18	18			482	2-3-3 (6)
	S-3	SS	18	18	(ML) SILT, light brown and gray, moist, loose to medium dense			3-4-5 (9)
10	S-4	SS	18	18			477	4-5-6 (11)
15	S-5	SS	18	18			472	6-7-9 (16)
20	S-6	SS	18	18			467	7-8-10 (18)
25	S-7	SS	18	18			462	8-11-12 (23)
30	S-8	SS	18	18			457	9-10-13 (23)



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**Dry**	BORING STARTED:	**Oct 02 2021**	CAVE IN DEPTH:	**53.0**
▼ WL (Completion)	**Dry**	BORING COMPLETED:	**Oct 02 2021**	HAMMER TYPE:	**Auto**
▼ WL (Seasonal High Water)		EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD:	**3.25 HSA**
▽ WL (Stabilized)					

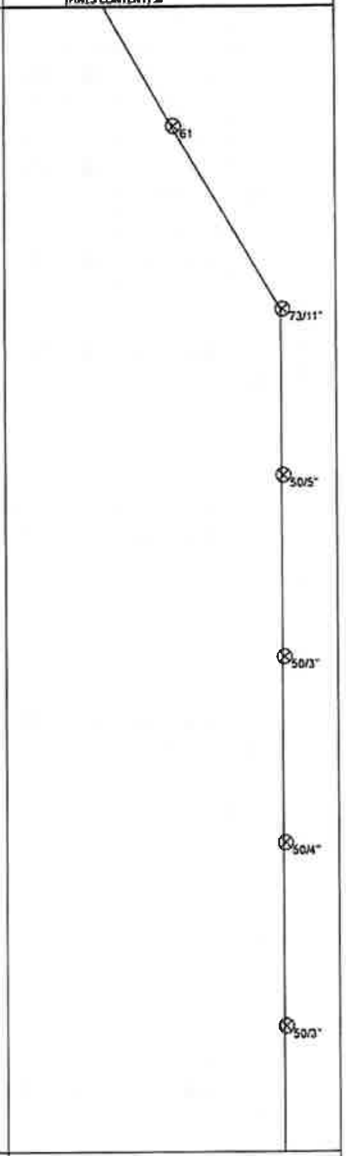
GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**	PROJECT NO.: **01:31153**	BORING NO.: **B-08**	SHEET: **2 of 3**	ECS
PROJECT NAME: **Warrenton Data Center**	DRILLER/CONTRACTOR: **All American Geotech, Inc.**			
SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**				LOSS OF CIRCULATION
NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **487**	BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit
X———●———△

⊗ STANDARD PENETRATION BLOWS/FT
ROCK QUALITY DESIGNATION & RECOVERY
🟥 RQD
— REC
○ CALIBRATED PENETROMETER TON/SF
[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					(ML) SILT, light brown and gray, moist, loose to medium dense			
					WEATHERED ROCK, brownish gray, moist, very dense			
	S-9	SS	18	18				11-24-37 (61)
35							452	
	S-10	SS	17	17				14-23-50/5" (73/11")
40							447	
	S-11	SS	5	5				50/5" (50/5")
45							442	
	S-12	SS	3	3				50/3" (50/3")
50							437	
	S-13	SS	4	4				50/4" (50/4")
55							432	
	S-14	SS	3	3				50/3" (50/3")
60							427	



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**Dry**	BORING STARTED:	**Oct 02 2021**	CAVE IN DEPTH:	**53.0**
▼ WL (Completion)	**Dry**	BORING COMPLETED:	**Oct 02 2021**	HAMMER TYPE:	**Auto**
▽ WL (Seasonal High Water)		EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD:	**3.25 HSA**
▽ WL (Stabilized)					

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**	PROJECT NO.: **01:31153**	BORING NO.: **B-08**	SHEET: **3 of 3**
PROJECT NAME: **Warrenton Data Center**	DRILLER/CONTRACTOR: **All American Geotech, Inc.**		
SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**			
NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **487**

LOSS OF CIRCULATION 100%

BOTTOM OF CASING

Plastic Limit X Water Content ● Liquid Limit △

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

🟥 RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
					WEATHERED ROCK, brownish gray, moist, very dense				
	S-15	SS	5	5				50/5" (50/5")	50/5"
65							422		
	~~S-16~~	~~SS~~	~~2~~	~~2~~				50/2" (50/2")	50/2"
70							417		
	S-17	SS	4	4				50/4" (50/4")	50/4"
75							412		
	S-18	SS	5	5				50/5" (50/5")	50/5"
80					END OF BORING AT 80.0 FT		407		
85							402		
90							397		

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**Dry**	BORING STARTED:	**Oct 02 2021**	CAVE IN DEPTH:	**53.0**
▼ WL (Completion)	**Dry**	BORING COMPLETED:	**Oct 02 2021**	HAMMER TYPE:	**Auto**
▽ WL (Seasonal High Water)		EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD:	**3.25 HSA**
▽ WL (Stabilized)					

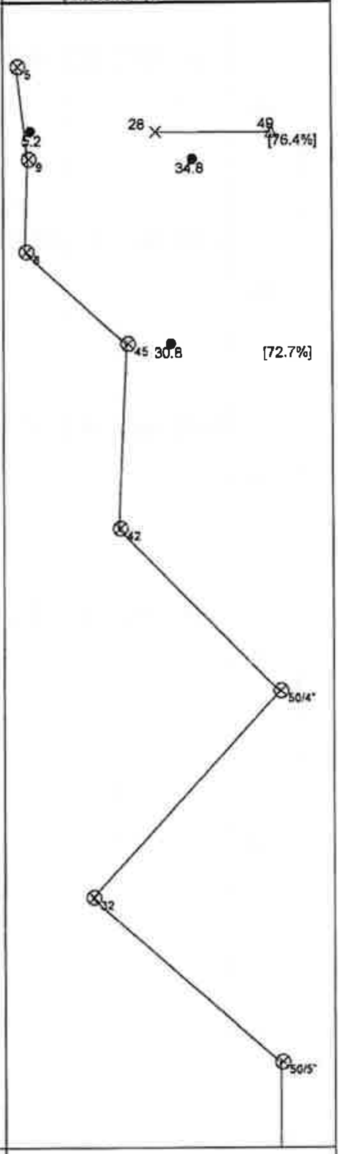
GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**		PROJECT NO.: **01:31153**	BORING NO.: **B-09**	SHEET: **1 of 2**
PROJECT NAME: **Warrenton Data Center**		DRILLER/CONTRACTOR: **All American Geotech, Inc.**		
SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**				LOSS OF CIRCULATION
NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **478**	BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit
X———●———△

⊗ STANDARD PENETRATION BLOWS/FT
ROCK QUALITY DESIGNATION & RECOVERY
▬ RQD
▬ REC
○ CALIBRATED PENETROMETER TON/SF
[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness [6"]			
	S-1	SS	18	9	(ML) SANDY SILT, reddish brown, moist, loose			2-2-3 (5)
	D3S-189 S-2	BG1 SS	60 18	13	(CL) LEAN CLAY, reddish brown, moist, firm			3-4-5 (9)
5					(ML) SANDY SILT, reddish brown, moist, loose		473	
	S-3	SS	18	14				4-4-4 (8)
	S-4	SS	18	18	(ML) SILT, light brown, moist, dense to very dense			13-19-26 (45)
10							468	
	S-5	SS	18	17				11-15-27 (42)
15							463	
	S-6	SS	4	4				50/4" (50/4")
20							458	
	S-7	SS	18	18				14-15-17 (32)
25							453	
					WEATHERED ROCK, light gray, brown, and black, moist, very dense			
	S-8	SS	5	5				50/5" (50/5")
30							448	



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**Dry**	BORING STARTED:	**Sep 29 2021**	CAVE IN DEPTH:	**27.0**
▼ WL (Completion)	**Dry**	BORING COMPLETED:	**Sep 29 2021**	HAMMER TYPE:	**Auto**
▽ WL (Seasonal High Water)		EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD:	**3.25 HSA**
▽ WL (Stabilized)					

GEOTECHNICAL BOREHOLE LOG

CLIENT:
Bohler Engineering

PROJECT NO.: **01:31153**

BORING NO.: **B-09**

SHEET: **2 of 2**

ECS

PROJECT NAME:
Warrenton Data Center

DRILLER/CONTRACTOR: **All American Geotech, Inc.**

SITE LOCATION:
Lee Highway and Blackwell Road, Warrenton, Virginia 20186

NORTHING:

EASTING:

STATION:

SURFACE ELEVATION: **478**

LOSS OF CIRCULATION

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

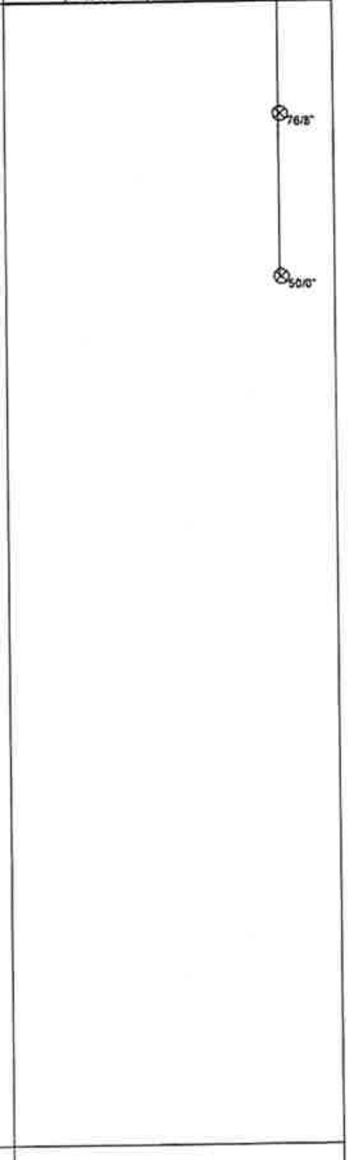
RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL		WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-9	SS	14	14	WEATHERED ROCK, light gray, brown, and black, moist, very dense	▨			17-26-50/2" (76/8")
35					**AUGER REFUSAL AT 34.8 FT**			443	
	~~S-10~~	~~SS~~	~~0~~	~~0~~					50/0" (50/0")
40								438	
45								433	
50								428	
55								423	
60								418	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	Dry	BORING STARTED:	Sep 29 2021	CAVE IN DEPTH:	27.0
▼ WL (Completion)	Dry	BORING COMPLETED:	Sep 29 2021	HAMMER TYPE:	Auto
▼ WL (Seasonal High Water)		EQUIPMENT: ATV	LOGGED BY:	DRILLING METHOD:	3.25 HSA
▽ WL (Stabilized)					

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**

PROJECT NO.: **01:31153**

BORING NO.: **B-10**

SHEET: **1 of 2**

PROJECT NAME: **Warrenton Data Center**

DRILLER/CONTRACTOR: **All American Geotech, Inc.**

SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**

NORTHING:

EASTING:

STATION:

SURFACE ELEVATION: **469**

LOSS OF CIRCULATION 100%

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit
X——●——△

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

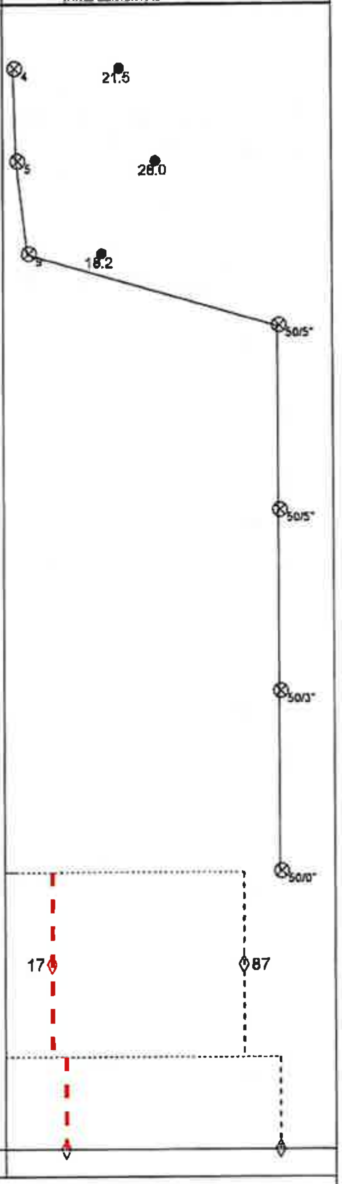
🟥 RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness [6"]			
	S-1	SS	18	12	(SM) SILTY SAND, reddish brown, moist, very loose to loose			1-2-2 (4)
	S-2	SS	18	18				2-2-3 (5)
5							464	
					(ML) SANDY SILT WITH GRAVEL, contains quartz fragments, light brown, moist, loose			
	S-3	SS	18	18				5-4-5 (9)
					WEATHERED ROCK, light brown to grayish brown, moist, very dense			
	S-4	SS	5	5				50/5" (50/5")
10							459	
	S-5	SS	5	5				50/5" (50/5")
15							454	
	S-6	SS	3	3				50/3" (50/3")
20							449	
	S-7	SS	0	0				50/0" (50/0")
					SCHIST, [REC=87%,RQD=17%], Highly Weathered, Very Hard, Grayish Brown			
25							444	
	S-8	RC	60	52				
					SCHIST, [REC=100%,RQD=22%], Highly Weathered, Very Hard, Grayish Brown			
30							439	
	S-9	RC	60	60				



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **Dry**

▼ WL (Completion) **Dry**

▼ WL (Seasonal High Water)

▽ WL (Stabilized)

BORING STARTED: **Oct 05 2021**

BORING COMPLETED: **Oct 05 2021**

EQUIPMENT: **ATV**

LOGGED BY:

CAVE IN DEPTH: **19.0**

HAMMER TYPE: **Auto**

DRILLING METHOD: **3.25 HSA**

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**

PROJECT NO.: **01:31153**

BORING NO.: **B-10**

SHEET: **2 of 2**

PROJECT NAME: **Warrenton Data Center**

DRILLER/CONTRACTOR: **All American Geotech, Inc.**

SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**

NORTHING:

EASTING:

STATION:

SURFACE ELEVATION: **469**

LOSS OF CIRCULATION (100%)

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit
X———●———△

⊗ STANDARD PENETRATION BLOWS/FT
ROCK QUALITY DESIGNATION & RECOVERY
🟥 RQD
— REC
○ CALIBRATED PENETROMETER TON/SF
(FINES CONTENT) %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL		WATER LEVELS	ELEVATION (FT)	BLOWS/6"	
					SCHIST, [REC=100%,RQD=22%], Highly Weathered, Very Hard, Grayish Brown	🟩				22 100
					AUGER REFUSAL AT 33.5 FT					
35								434		
40								429		
45								424		
50								419		
55								414		
60								409		

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **Dry**

▼ WL (Completion) **Dry**

▼ WL (Seasonal High Water)

▽ WL (Stabilized)

BORING STARTED: **Oct 05 2021**

BORING COMPLETED: **Oct 05 2021**

EQUIPMENT: **ATV**

LOGGED BY:

CAVE IN DEPTH: **19.0**

HAMMER TYPE: **Auto**

DRILLING METHOD: **3.25 HSA**

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**

PROJECT NO.: **01:31153**

BORING NO.: **B-11**

SHEET: **1 of 1**

PROJECT NAME: **Warrenton Data Center**

DRILLER/CONTRACTOR: **All American Geotech, Inc.**

SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**

NORTHING:

EASTING:

STATION:

SURFACE ELEVATION: **468**

LOSS OF CIRCULATION ⟩100%⟩

BOTTOM OF CASING ➡

Plastic Limit Water Content Liquid Limit
X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

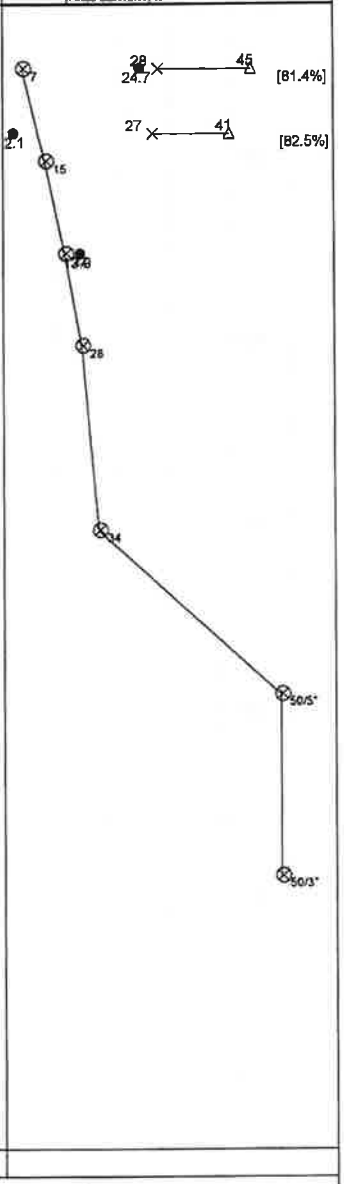
🟥 RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness [6"]			
	S-1	SS	18	8	(ML) SILT, brownish gray, moist, loose to dense			3-3-4 (7)
	D3S-194 S-2	BG1 SS	60 18	12				5-6-9 (15)
5							463	
	S-3	SS	18	16				7-10-12 (22)
	S-4	SS	18	18				11-12-16 (28)
10							458	
	S-5	SS	18	18				10-15-19 (34)
15							453	
					WEATHERED ROCK, gray, moist, very dense			
	S-6	SS	5	5				50/5" (50/5")
20							448	
	S-7	SS	3	3				50/3" (50/3")
25					**END OF BORING AT 25.0 FT**		443	
30							438	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

∇ WL (First Encountered)	Dry	BORING STARTED: **Sep 29 2021**		CAVE IN DEPTH: **12.7**
▼ WL (Completion)	Dry	BORING COMPLETED: **Sep 29 2021**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)		EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD: **3.25 HSA**
∇ WL (Stabilized)				

GEOTECHNICAL BOREHOLE LOG

CLIENT:
Bohler Engineering

PROJECT NO.:
01:31153

BORING NO.:
B-12

SHEET:
1 of 1

PROJECT NAME:
Warrenton Data Center

DRILLER/CONTRACTOR:
All American Geotech, Inc.

SITE LOCATION:
Lee Highway and Blackwell Road, Warrenton, Virginia 20186

LOSS OF CIRCULATION	⟩100⟩
BOTTOM OF CASING	➨

NORTHING:

EASTING:

STATION:

SURFACE ELEVATION:
474

Plastic Limit Water Content Liquid Limit
X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

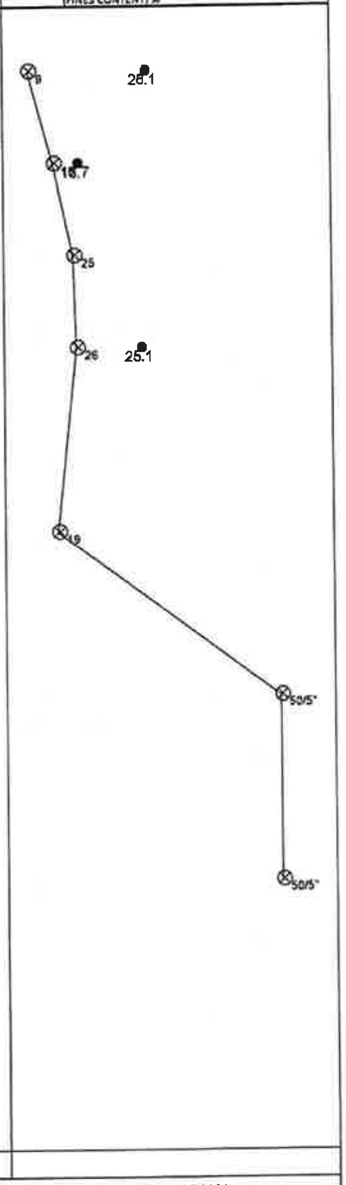
🟥 RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness [6"]			
	S-1	SS	18	18	(SM) SILTY SAND, reddish brown, moist, loose			3-4-5 (9)
	S-2	SS	18	18	(ML) SANDY SILT, reddish brown, moist, medium dense			6-7-11 (18)
5					(ML) SILT, light brown, moist, medium dense		469	
	S-3	SS	18	18				10-13-12 (25)
	S-4	SS	18	18				10-11-15 (26)
10							464	
	S-5	SS	18	18				11-8-11 (19)
15							459	
					WEATHERED ROCK, light brown and gray, moist, very dense			
	S-6	SS	5	5				50/5" (50/5")
20							454	
	S-7	SS	5	5				50/5" (50/5")
					END OF BORING AT 23.9 FT			
25							449	
30							444	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**Dry**	BORING STARTED:	**Oct 02 2021**	CAVE IN DEPTH:	**14.0**
▼ WL (Completion)	**Dry**	BORING COMPLETED:	**Oct 02 2021**	HAMMER TYPE:	**Auto**
▽ WL (Seasonal High Water)		EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD:	**3.25 HSA**
▽ WL (Stabilized)					

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**

PROJECT NO.: **01:31153**

BORING NO.: **B-13**

SHEET: **1 of 1**

ECS

PROJECT NAME: **Warrenton Data Center**

DRILLER/CONTRACTOR: **All American Geotech, Inc.**

SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**

LOSS OF CIRCULATION

NORTHING:

EASTING:

STATION:

SURFACE ELEVATION: **490**

BOTTOM OF CASING

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	BLOWS/6"
S-1	SS	18	10	3-3-5 (8)
S-2	SS	18	12	2-3-6 (9)
S-3	SS	18	18	7-8-11 (19)
S-4	SS	4	4	50/4" (50/4")
S-5	SS	18	18	12-13-15 (28)
S-6	SS	18	18	10-12-17 (29)
S-7	SS	2	2	50/2" (50/2")
S-8	SS	0	0	50/0" (50/0")

DEPTH (FT)	ELEVATION (FT)	DESCRIPTION OF MATERIAL
0	490	Topsoil Thickness [4"]
		(ML) SILT WITH SAND, reddish brown, moist, loose to medium dense
5	485	
		(SM) SILTY SAND WITH GRAVEL, gray and dark brown, moist, medium dense to very dense
10	480	
15	475	
20	470	
		WEATHERED ROCK, dark brownish gray, moist, very dense
25	465	
		AUGER REFUSAL AT 27.0 FT
30	460	

WATER LEVELS

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

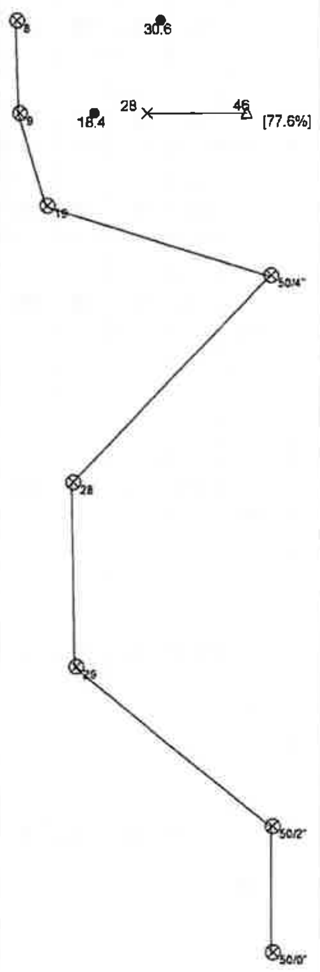
ROCK QUALITY DESIGNATION & RECOVERY

🟥 RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **Dry**

▼ WL (Completion) **Dry**

▽ WL (Seasonal High Water)

▽ WL (Stabilized)

BORING STARTED: **Sep 30 2021**

BORING COMPLETED: **Sep 30 2021**

EQUIPMENT: **ATV**

LOGGED BY:

CAVE IN DEPTH: **18.5**

HAMMER TYPE: **Auto**

DRILLING METHOD: **3.25 HSA**

GEOTECHNICAL BOREHOLE LOG

CLIENT:
Bohler Engineering

PROJECT NAME:
Warrenton Data Center

PROJECT NO.:
01:31153

BORING NO.:
B-14

SHEET:
1 of 1

DRILLER/CONTRACTOR:
All American Geotech, Inc.

SITE LOCATION:
Lee Highway and Blackwell Road, Warrenton, Virginia 20186

NORTHING:

EASTING:

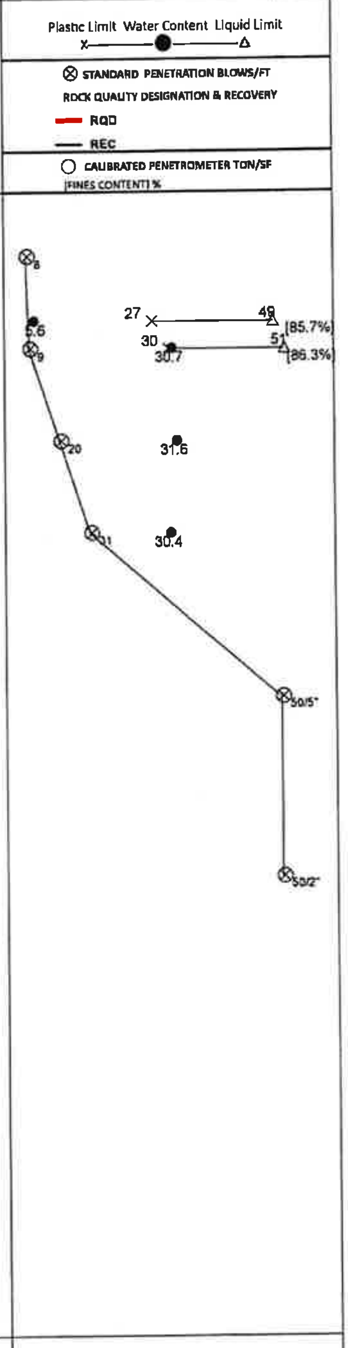
STATION:

SURFACE ELEVATION:
500

LOSS OF CIRCULATION

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness [3"]			
	S-1	SS	18	18	(MH) ELASTIC SILT, light brown, moist, firm to stiff			3-4-4 (8)
	D35 186	BG1 SS	60 18	18				2-4-5 (9)
5	S-2						495	
	S-3	SS	18	18	(SM) SILTY SAND, brown, moist, medium dense to dense			5-9-11 (20)
	S-4	SS	18	18				10-12-19 (31)
10							490	
					WEATHERED ROCK, reddish brown and black, moist, very dense			
	S-5	SS	5	5				50/5" (50/5")
15							485	
	S-6	SS	2	2				50/2" (50/2")
					END OF BORING AT 18.7 FT			
20							480	
25							475	
30							470	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**Dry**	BORING STARTED:	**Sep 30 2021**	CAVE IN DEPTH:	**11.5**
▼ WL (Completion)	**Dry**	BORING COMPLETED:	**Sep 30 2021**	HAMMER TYPE:	**Auto**
▽ WL (Seasonal High Water)		EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD:	**3.25 HSA**
▽ WL (Stabilized)					

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**	PROJECT NO.: **01:31153**	BORING NO.: **B-15**	SHEET: **1 of 1**
PROJECT NAME: **Warrenton Data Center**	DRILLER/CONTRACTOR: **All American Geotech, Inc.**		
SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**			LOSS OF CIRCULATION ⟩100%⟩
NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **497**
			BOTTOM OF CASING ■

Plastic Limit X——— Water Content ● ——— Liquid Limit △

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

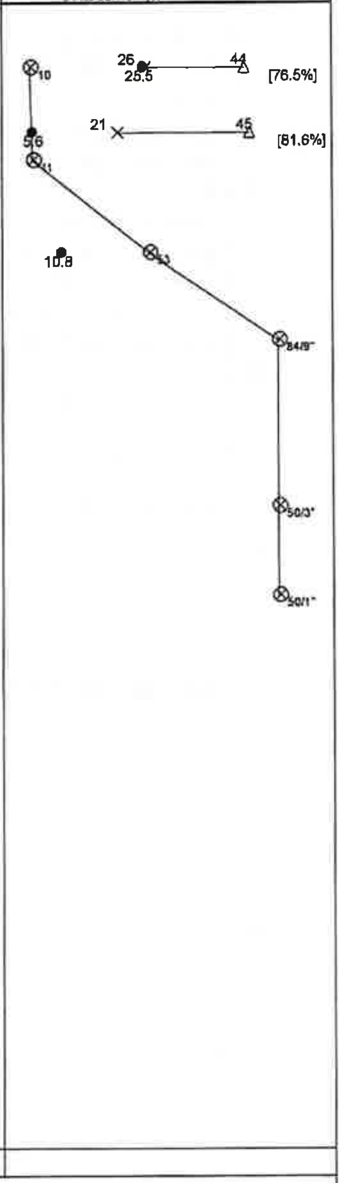
🟥 RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness [4"]			
	S-1	SS	18	12	(CL) LEAN CLAY WITH SAND, grayish brown, moist, stiff			3-4-6 (10)
	~~D35-~~ 187 ~~S-2~~	~~BG1~~ SS	~~60~~ 18	17				4-4-7 (11)
5							492	
	S-3	SS	18	18	(ML) SANDY SILT WITH GRAVEL, light brown and gray, moist, very dense			23-24-29 (53)
	S-4	SS	15	14	WEATHERED ROCK, grayish brown to gray, moist, very dense			15-34-50/3" (84/9")
10							487	
	~~S-5~~	~~SS~~	~~3~~	~~3~~				50/3" (50/3")
15							482	
	~~S-6~~	~~SS~~	~~1~~	~~1~~	**AUGER REFUSAL AT 16.1 FT**			50/1" (50/1")
20							477	
25							472	
30							467	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **Dry**	BORING STARTED: **Sep 30 2021**		CAVE IN DEPTH: **10.3**
▼ WL (Completion) **Dry**	BORING COMPLETED: **Sep 30 2021**		HAMMER TYPE: **Auto**
▽ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD: **3.25 HSA**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**	PROJECT NO.: **01:31153**	BORING NO.: **B-16**	SHEET: **1 of 1**
PROJECT NAME: **Warrenton Data Center**	DRILLER/CONTRACTOR: **All American Geotech, Inc.**		
SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**			
NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **475**

LOSS OF CIRCULATION

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness [6"]			
	S-1	SS	18	18	(SM) SILTY SAND, brown, moist, loose			3-5-5 (10)
	S-2	SS	18	18	(ML) SANDY SILT, light brown and gray, moist, medium dense			5-4-7 (11)
5							470	
	S-3	SS	18	18				6-6-8 (14)
	S-4	SS	18	18				5-7-11 (18)
10							465	
	S-5	SS	18	14				10-13-17 (30)
15							460	
					WEATHERED ROCK, light brown, moist, very dense			
	S-6	SS	4	4				50/4" (50/4")
20							455	
	S-7	SS	5	5				50/5" (50/5")
					END OF BORING AT 24.0 FT			
25							450	
30							445	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

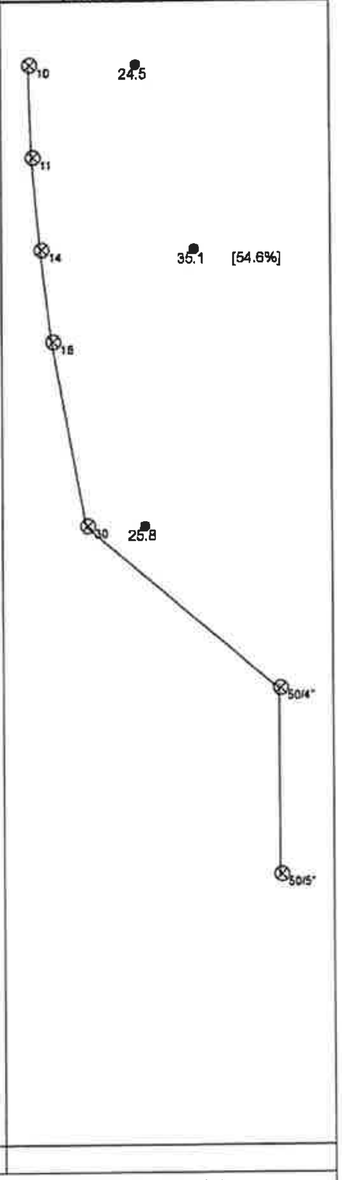
ROCK QUALITY DESIGNATION & RECOVERY

🟥 RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**Dry**	BORING STARTED:	**Oct 02 2021**	CAVE IN DEPTH:	**14.7**
▼ WL (Completion)	**Dry**	BORING COMPLETED:	**Oct 02 2021**	HAMMER TYPE:	**Auto**
▽ WL (Seasonal High Water)		EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD:	**3.25 HSA**
▽ WL (Stabilized)					

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**	PROJECT NO.: **01:31153**	BORING NO.: **B-17**	SHEET: **1 of 1**
PROJECT NAME: **Warrenton Data Center**	DRILLER/CONTRACTOR: **All American Geotech, Inc.**		
SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**			LOSS OF CIRCULATION
NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **492**

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit
X———●———Δ

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

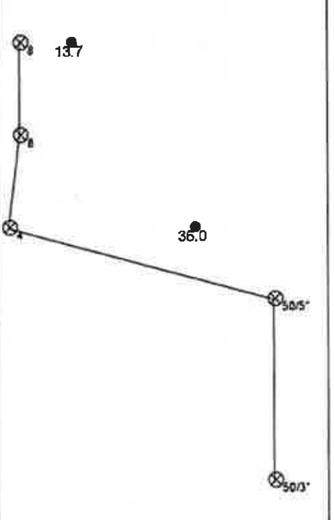
🟥 RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness [3"]			
	S-1	SS	18	20	(SM) SILTY SAND, reddish brown, moist, loose			4-4-4 (8)
	S-2	SS	18	18				3-4-4 (8)
5					(ML) SANDY SILT, brown and gray, moist, very loose		487	
	S-3	SS	18	18				1-2-2 (4)
	S-4	SS	5	5	WEATHERED ROCK, dark gray, moist, very dense			50/5" (50/5")
10							482	
	S-5	SS	3	3				50/3" (50/3")
					END OF BORING AT 13.8 FT			
15							477	
20							472	
25							467	
30							462	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **Dry**	BORING STARTED: **Oct 02 2021**		CAVE IN DEPTH: **7.0**
▼ WL (Completion) **Dry**	BORING COMPLETED: **Oct 02 2021**		HAMMER TYPE: **Auto**
▽ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD: **3.25 HSA**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Bohler Engineering**	PROJECT NO.: **01:31153**	BORING NO.: **B-18**	SHEET: **1 of 1**	ECS
PROJECT NAME: **Warrenton Data Center**	DRILLER/CONTRACTOR: **All American Geotech, Inc.**			
SITE LOCATION: **Lee Highway and Blackwell Road, Warrenton, Virginia 20186**				LOSS OF CIRCULATION 〉100〉
NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **482**	BOTTOM OF CASING ▶

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness [6"]			
	S-1	SS	18	18	(SM) SILTY SAND, reddish brown, moist, loose to medium dense			3-3-4 (7)
5	S-2	SS	18	18			477	4-5-7 (12)
	S-3	SS	18	18				7-9-13 (22)
10	S-4	SS	18	18	(ML) SILT, light brown, moist, dense		472	15-15-22 (37)
15	S-5	SS	5	5	WEATHERED ROCK, light brown to grayish brown, moist, very dense		467	50/5" (50/5")
	S-6	SS	4	4				50/4" (50/4")
20					**END OF BORING AT 18.9 FT**		462	
25							457	
30							452	

Plastic Limit X——●——Δ Liquid Limit Water Content

⊗ STANDARD PENETRATION BLOWS/FT

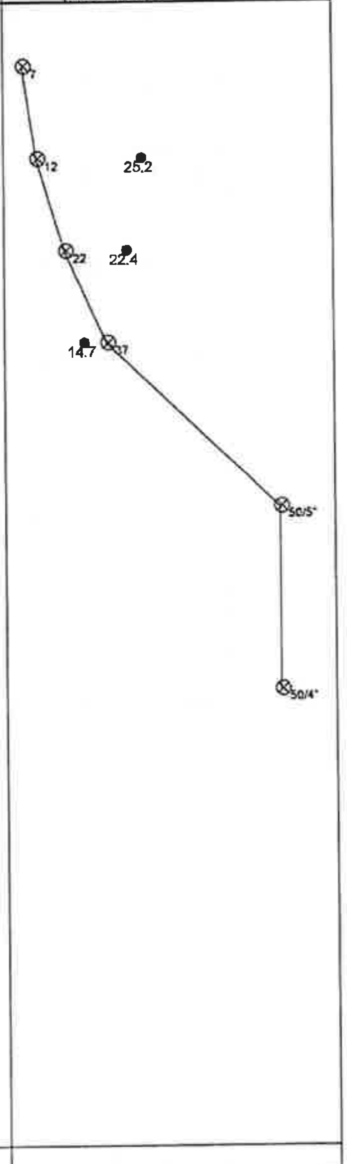
ROCK QUALITY DESIGNATION & RECOVERY

▬ RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **Dry**	BORING STARTED: **Oct 01 2021**		CAVE IN DEPTH: **14.5**
▼ WL (Completion) **Dry**	BORING COMPLETED: **Oct 01 2021**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD: **3.25 HSA**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:
Bohler Engineering

PROJECT NO.:
01:31153

BORING NO.:
B-19

SHEET:
1 of 1

PROJECT NAME:
Warrenton Data Center

DRILLER/CONTRACTOR:
All American Geotech, Inc.

SITE LOCATION:
Lee Highway and Blackwell Road, Warrenton, Virginia 20186

LOSS OF CIRCULATION 100%

BOTTOM OF CASING

NORTHING:

EASTING:

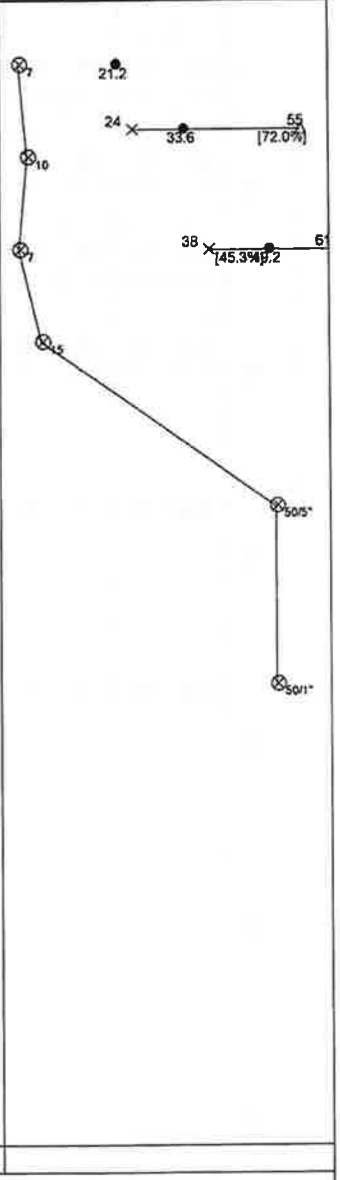
STATION:

SURFACE ELEVATION:
490

Plastic Limit Water Content Liquid Limit
X———●———△

⊗ STANDARD PENETRATION BLOWS/FT
ROCK QUALITY DESIGNATION & RECOVERY
🟥 RQD
— REC
○ CALIBRATED PENETROMETER TON/SF
[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness [4"]			
	S-1	SS	18	18	(CL) SANDY LEAN CLAY, reddish brown, moist, firm			4-4-3 (7)
	D35	BG1	60		(GM) SILTY GRAVEL WITH SAND, reddish brown and brown, moist, loose to medium dense			
	190	SS	18	18				3-4-6 (10)
5	S-2						485	
	S-3	SS	18	18				3-3-4 (7)
	S-4	SS	18	18				9-7-8 (15)
10							480	
					WEATHERED ROCK, light brown and dark gray, moist, very dense			
	S-5	SS	5	5				50/5" (50/5")
15							475	
	S-6	SS	1	1	**END OF BORING AT 18.6 FT**			50/1" (50/1")
20							470	
25							465	
30							460	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) Dry	BORING STARTED: Oct 01 2021		CAVE IN DEPTH: 14.5
▼ WL (Completion) Dry	BORING COMPLETED: Oct 01 2021		HAMMER TYPE: Auto
▽ WL (Seasonal High Water)	EQUIPMENT: ATV	LOGGED BY:	DRILLING METHOD: 3.25 HSA
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:
Bohler Engineering

PROJECT NO.:
01:31153

BORING NO.:
B-20

SHEET:
1 of 1

PROJECT NAME:
Warrenton Data Center

DRILLER/CONTRACTOR:
All American Geotech, Inc.

SITE LOCATION:
Lee Highway and Blackwell Road, Warrenton, Virginia 20186

LOSS OF CIRCULATION

BOTTOM OF CASING

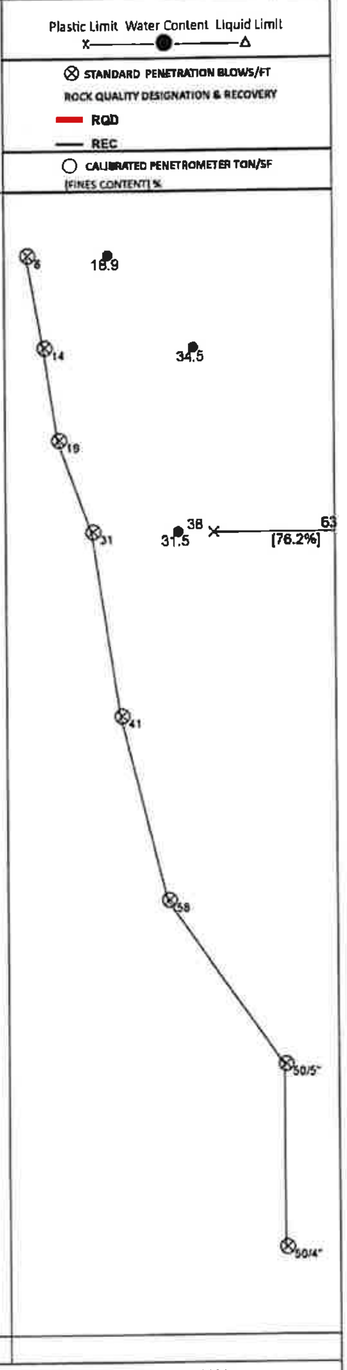
NORTHING:

EASTING:

STATION:

SURFACE ELEVATION:
490

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness [4"]			
	S-1	SS	18	10	(SM) SILTY SAND, brown, moist, loose			4-4-4 (8)
	S-2	SS	18	18	(ML) SILT, reddish brown to grayish brown, moist, medium dense to very dense			5-7-7 (14)
5							485	
	S-3	SS	18	18				7-9-10 (19)
	S-4	SS	18	18	(MH) ELASTIC SILT WITH SAND, yellowish brown, moist, hard to very hard			14-15-16 (31)
10							480	
	S-5	SS	18	18				8-15-26 (41)
15							475	
	S-6	SS	18	18				17-23-35 (58)
20							470	
					WEATHERED ROCK, light brown and gray, moist, very dense			
	S-7	SS	5	5				50/5" (50/5")
25							465	
	S-8	SS	4	4				50/4" (50/4")
					END OF BORING AT 28.9 FT			
30							460	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

∇ WL (First Encountered)	**Dry**	BORING STARTED:	**Oct 01 2021**	CAVE IN DEPTH:	**23.0**
▼ WL (Completion)	**Dry**	BORING COMPLETED:	**Oct 01 2021**	HAMMER TYPE:	**Auto**
▼ WL (Seasonal High Water)		EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD:	**3.25 HSA**
∇ WL (Stabilized)					

GEOTECHNICAL BOREHOLE LOG

APPENDIX C – Laboratory Testing

Laboratory Testing Summary

Sample Location	Sample Number	Depth (feet)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-01	S-10	38.5-39.7	16.5	ML	NP	NP	NP	75.6					
B-01	S-2	3.5-5	15.1										
B-02	S-1	1-2.5	24.7										
B-02	S-2	3.5-5	11.2										
B-02	S-5	13.5-15	12.6										
B-03	S-1	1-2.5	25.3										
B-03	S-2	3.5-5	21.6	ML	44	28	16	71.0					
B-04	S-1	1-2.5	26.2										
B-04	S-3	6-7.5	16.9										
B-04	S-5	13.5-15	22.6										

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

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

Project: Warrenton Data Center
Client:

Project No.: 01:31153
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by	
jvong	Htran	Dtran	

Laboratory Testing Summary

Sample Location	Sample Number	Depth (feet)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-05	S-3	6-7.5	28.8										
B-05	S-9	33.5-35	19.9	ML	45	30	15	87.5					
B-06	S-1	1-2.5	25.2										
B-06	S-3	6-7.5	41.6										
B-06	S-5	13.5-15	18.3										
B-07	S-2	3.5-5	18.4										
B-07	S-3	6-7.5	31.6	CH	60	28	32	86.0					
B-08	S-1	1-2.5	29.0										
B-08	S-4	8.5-10	46.1										
B-08	S-6	18.5-20	25.3										

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

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

Project: Warrenton Data Center
Client:

Project No.: 01:31153
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by	
jvong	Htran	Dtran	

Laboratory Testing Summary

Sample Location	Sample Number	Depth (feet)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-09	S-2	3.5-5	34.8										
B-09	S-4	8.5-10	30.8	ML	NP	NP	NP	72.7					
B-10	S-1	1-2.5	21.5										
B-10	S-2	3.5-5	28.0										
B-10	S-3	6-7.5	18.2										
B-11	S-1	1-2.5	24.7	ML	45	28	17	81.4					
B-11	S-3	6-7.5	13.9										
B-12	S-1	1-2.5	26.1										
B-12	S-2	3.5-5	13.7										
B-12	S-4	8.5-10	25.1										

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

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

Project: **Warrenton Data Center**
Client:

Project No.: 01:31153
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by	
jvong	Htran	Dtran	

Laboratory Testing Summary

Sample Location	Sample Number	Depth (feet)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-13	S-1	1-2.5	30.6										
B-13	S-2	3.5-5	18.4	ML	46	28	18	77.6					
B-14	S-2	3.5-5	30.7	MH	51	30	21	86.3					
B-14	S-3	6-7.5	31.6										
B-14	S-4	8.5-10	30.4										
B-15	S-1	1-2.5	25.5	CL	44	26	18	76.5					
B-15	S-3	6-7.5	10.8										
B-16	S-1	1-2.5	24.5										
B-16	S-3	6-7.5	35.1	ML	NP	NP	NP	54.6					
B-16	S-5	13.5-15	25.8										

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

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

Project: Warrenton Data Center

Client:

Project No.: 01:31153

Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by	
jvong	Htran	Dtran	

Laboratory Testing Summary

Sample Location	Sample Number	Depth (feet)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-17	S-1	1-2.5	13.7										
B-17	S-3	6-7.5	36.0										
B-18	S-2	3.5-5	25.2										
B-18	S-3	6-7.5	22.4										
B-18	S-4	8.5-10	14.7										
B-19	S-1	1-2.5	21.2										
B-19	S-3	6-7.5	49.2	GM	61	38	23	45.3					
B-20	S-1	1-2.5	18.9										
B-20	S-2	3.5-5	34.5										
B-20	S-4	8.5-10	31.5	MH	63	38	25	76.2					

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

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

Project: Warrenton Data Center
Client:

Project No.: 01:31153
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by	
jvong	Htran	Dtran	

Laboratory Testing Summary

Sample Location	Sample Number	Depth (feet)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-02	D3S-191	1-6	11.7	CL	39	18	21	85.6	122.1	15.2			
B-04	D3S-188	1-6	2.2	ML	NP	NP	NP	85.1	112.3	15.8			
B-07	D3S-193	1-6	2.6	CL	37	19	18	86.5	112.2	17.7			
B-09	D3S-189	1-6	5.2	ML	49	28	21	76.4	99.5	21.6			
B-11	D3S-194	1-6	2.1	ML	41	27	14	82.5	119.2	13.8			
B-14	D3S-186	1-6	5.6	CL	49	27	22	85.7	102.3	22.4	5	4.7	
B-15	D3S-187	1-6	5.6	CL	45	21	24	81.6	111.0	17.7	7.6	6.6	
B-19	D3S-190	1-6	33.6	CH	55	24	31	72.0	101.9	24.2			

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

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

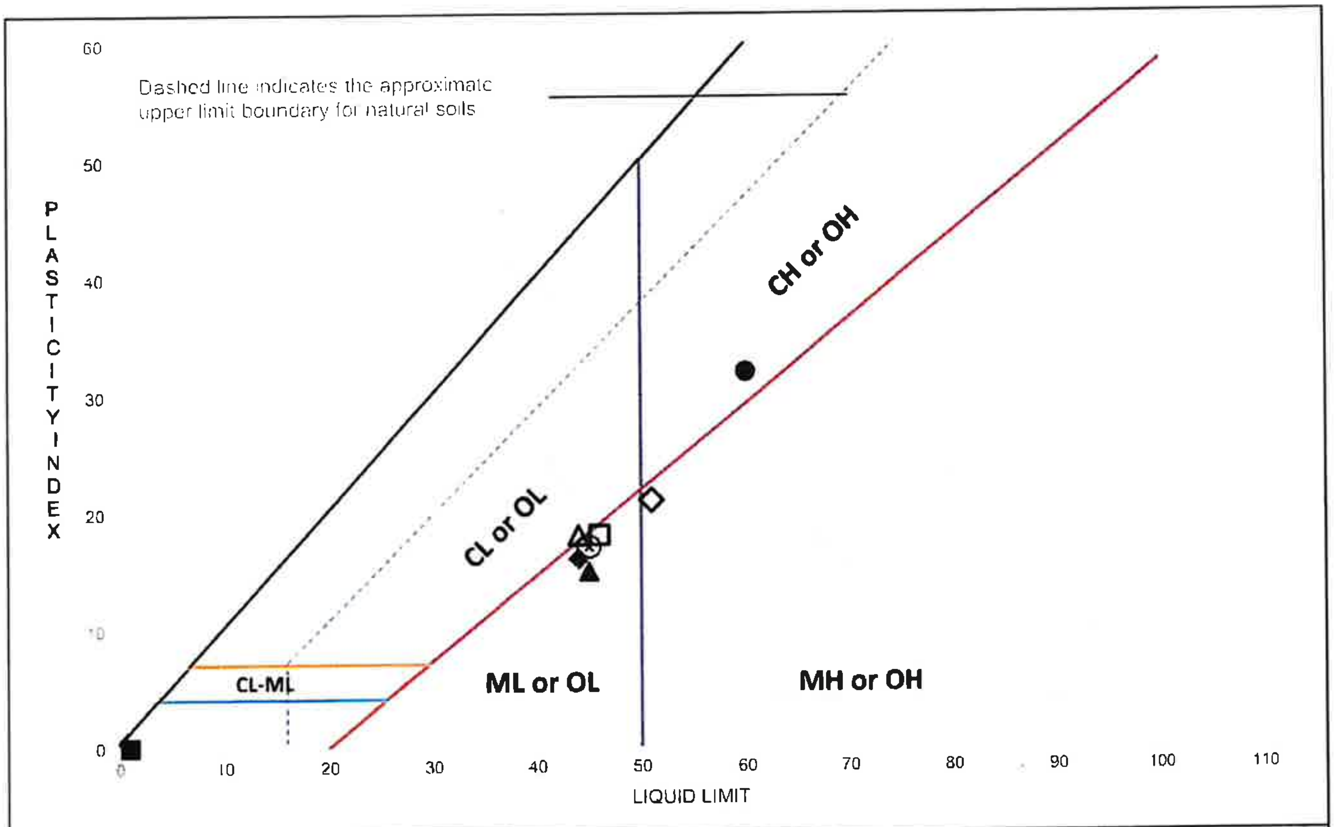
Project: Warrenton Data Center
Client:

Project No.: 01:31153
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by	
jvong	Htran	Dtran	

LIQUID AND PLASTIC LIMITS TEST REPORT



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

	Sample Location	Sample Number	Sample Depth (ft)	LL	PL	PI	%<#40	%<#200	AASHTO	USCS	Material Description
■	B-01	S-10	38.5-39.75	NP	NP	NP	95.3	75.6	A-4	ML	Silt with Sand Trace Mica Yellow Light Brown
◆	B-03	S-2	3.5-5	44	28	16	91.7	71.0	A-7-6	ML	Silt with Sand Trace Mica Yellow Light Brown
▲	B-05	S-9	33.5-35	45	30	15	99.5	87.5	A-7-5	ML	Silt Trace Mica Yellow Light Brown
●	B-07	S-3	6-7.5	60	28	32	93.9	86.0	A-7-6	CH	Fat Clay Light Brown
✱	B-09	S-4	8.5-10	NP	NP	NP	95.9	72.7	A-4	ML	Silt with Sand Trace Mica Yellow Light Brown
⊗	B-11	S-1	1-2.5	45	28	17	95.3	81.4	A-7-6	ML	Silt with Sand Trace Mica Brown
□	B-13	S-2	3.5-5	46	28	18	89.9	77.6	A-7-6	ML	Silt with Sand Trace Mica Yellowish Light Brown
◇	B-14	S-2	3.5-5	51	30	21	94.7	86.3	A-7-5	MH	Elastic Silt Trace Mica Light Brown
△	B-15	S-1	1-2.5	44	26	18	85.8	76.5	A-7-6	CL	Lean Clay with Sand Light Brown
×	B-16	S-3	6-7.5	NP	NP	NP	85.3	54.6	A-4	ML	Sandy Silt Trace Mica Yellowish Light Brown

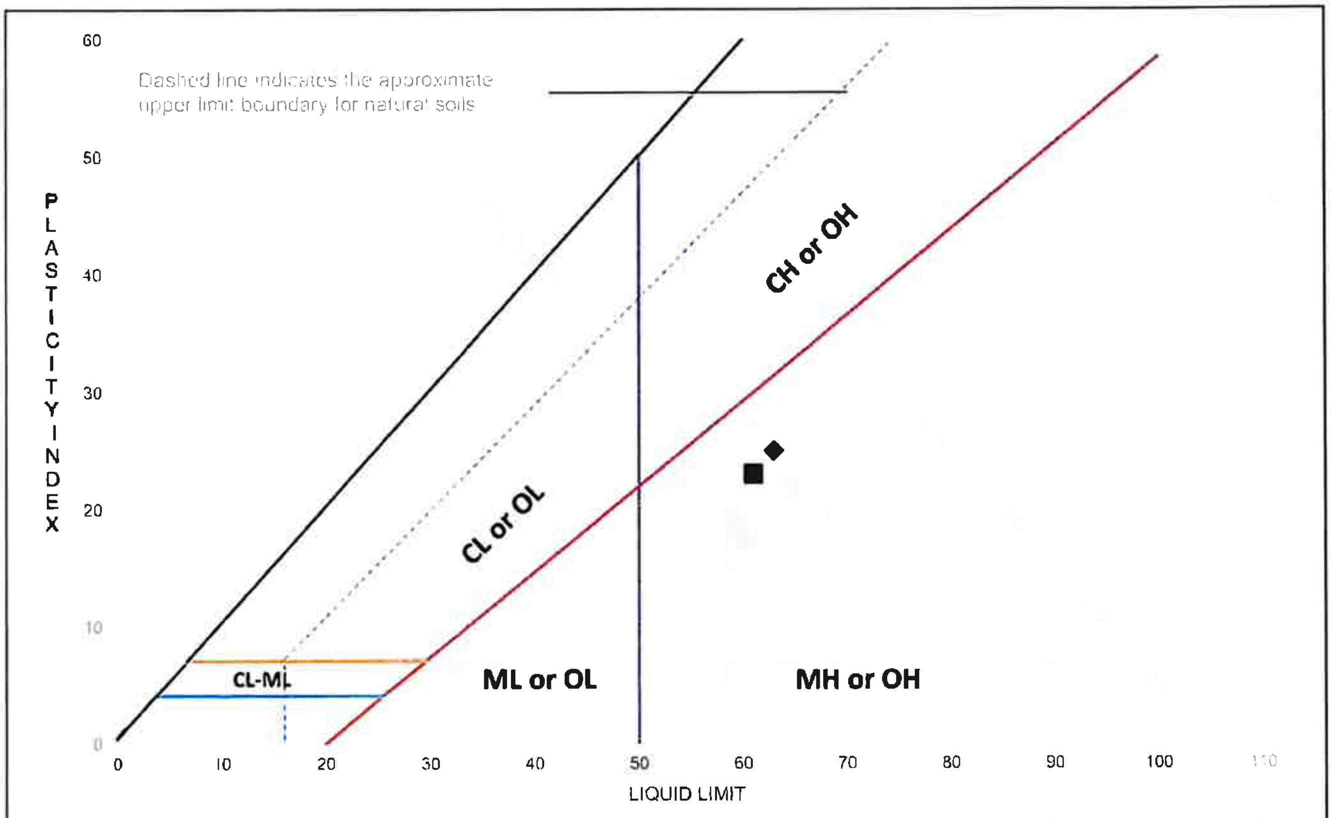
Project: Warrenton Data Center
Client:

Project No.: 01:31153
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by	
jvong	Htran	Dtran	

LIQUID AND PLASTIC LIMITS TEST REPORT



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

	Sample Location	**Sample Number**	**Sample Depth (ft)**	**LL**	**PL**	**PI**	**%<#40**	**%<#200**	**AASHTO**	**USCS**	**Material Description**
■	B-19	S-3	6-7.5	61	38	23	53.5	45.3	A-7-5	GM	Silty Gravel with Sand Trace Mica Yellowish Brown
◆	B-20	S-4	8.5-10	63	38	25	88.6	76.2	A-7-5	MH	Elastic Silt with Sand Trace Mica Yellowish Light Brown

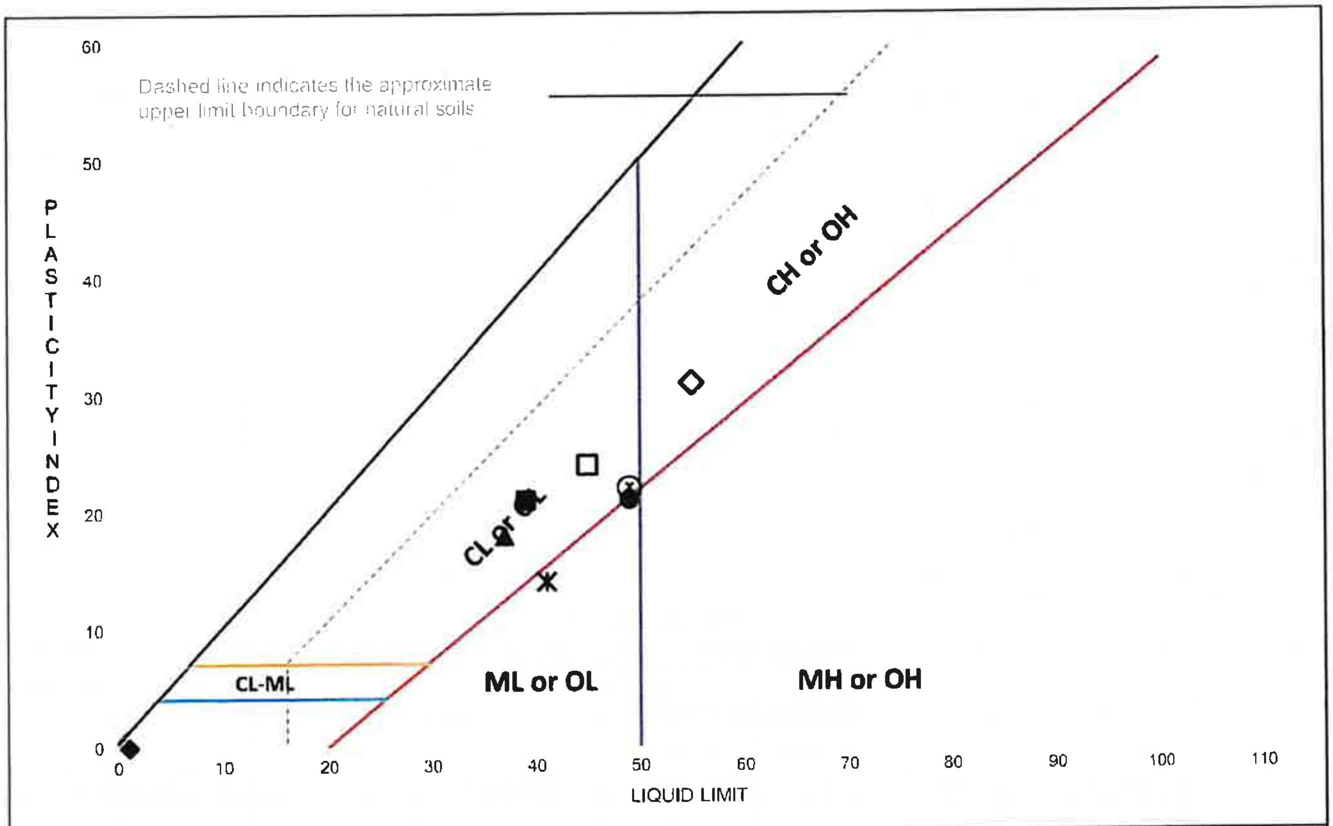
Project: Warrenton Data Center
Client:

Project No.: 01:31153
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by	
jvong	Htran	Dtran	

LIQUID AND PLASTIC LIMITS TEST REPORT



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

	Sample Location	Sample Number	Sample Depth (ft)	LL	PL	PI	%<#40	%<#200	AASHTO	USCS	Material Description
■	B-02	D3S-191	1-6	39	18	21	98.8	85.6	A-6	CL	Lean Clay Yellowish Brown
◆	B-04	D3S-188	1-6	NP	NP	NP	97.9	85.1	A-4	ML	Silt Trace Mica Yellowish Brown
▲	B-07	D3S-193	1-6	37	19	18	96.0	86.5	A-6	CL	Lean Clay Trace Mica Brown
●	B-09	D3S-189	1-6	49	28	21	91.1	76.4	A-7-6	ML	Silt with Sand Brwon
✱	B-11	D3S-194	1-6	41	27	14	97.9	82.5	A-7-6	ML	Silt with Sand Trace Mica Yellowish Brown
⊗	B-14	D3S-186	1-6	49	27	22	95.3	85.7	A-7-6	CL	Lean Clay with Sand Yellowisht Brown
□	B-15	D3S-187	1-6	45	21	24	92.4	81.6	A-7-6	CL	Lean Clay with Sand Yellowish Brown
◇	B-19	D3S-190	1-6	55	24	31	80.6	72.0	A-7-6	CH	Fat Clay with Sand Brown

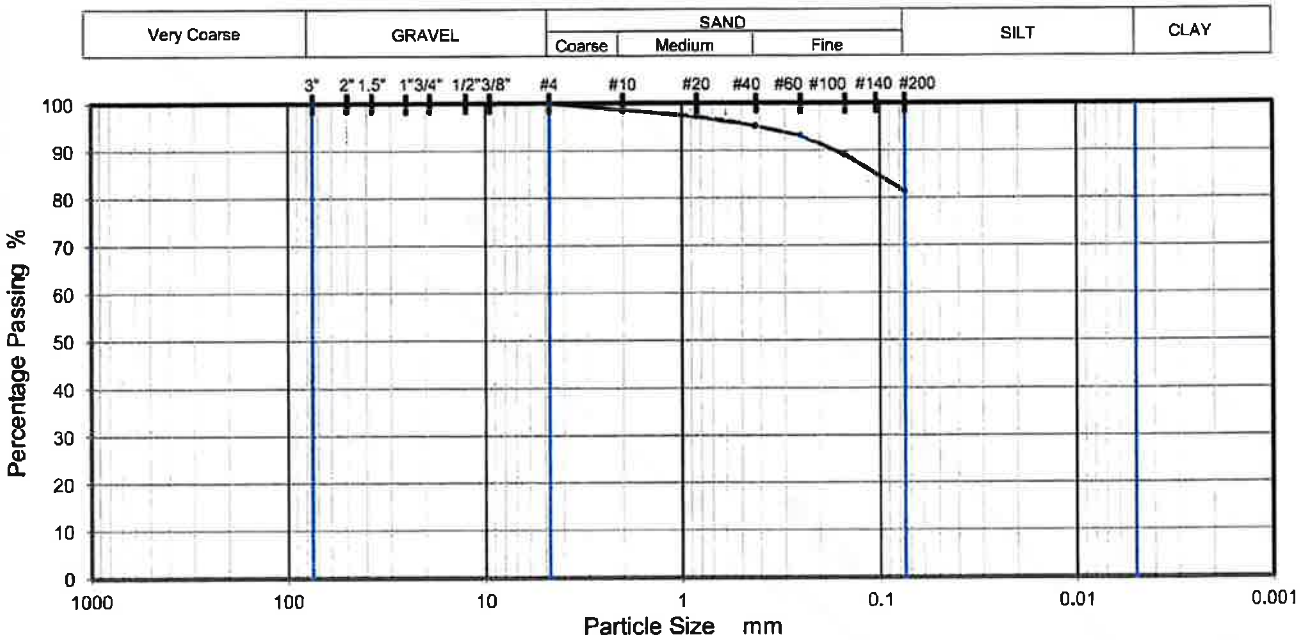
Project: Warrenton Data Center
Client:

Project No.: 01:31153
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by	
jvong	Htran	Dtran	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
#4	100.0		
#10	98.6		
#20	97.2		
#40	95.3		
#60	93.3		
#100	89.1		
#200	81.4		

Dry Mass of sample, g: 40.6

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	0.0
Coarse Sand, #4 to #10 sieve	1.4
Medium Sand, #10 to #40	3.3
Fine Sand, #40 to #200	13.9
Fines <#200	81.4

USCS	ML	Liquid Limit	45	D90	0.167	D50		D10	
AASHTO	A-7-6	Plastic Limit	28	D85	0.104	D30		Cu	
USCS Group Name	Silt with sand	Plasticity Index	17	D60		D15		Cc	

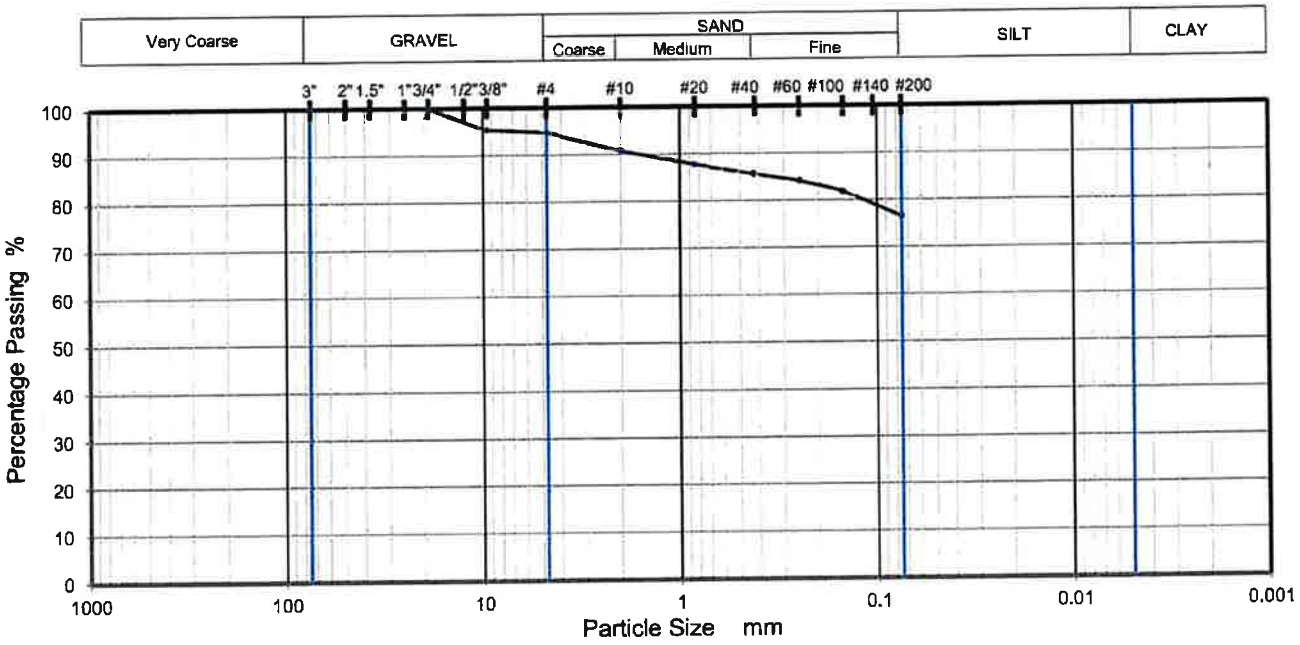
Project: Warrenton Data Center
Client:
Sample Description: Silt with Sand Trace Mica Brown
Sample Source: B-11

Project No.: 01:31153
Depth (ft): 1 - 2.5
Sample No.: S-1
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
3/4"	100.0		
3/8"	95.4		
#4	94.8		
#10	90.8		
#20	87.8		
#40	85.8		
#60	84.3		
#100	82.0		
#200	76.5		

Dry Mass of sample, g	42.3

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	5.2
Coarse Sand, #4 to #10 sieve	4.0
Medium Sand, #10 to #40	5.0
Fine Sand, #40 to #200	9.3
Fines <#200	76.5

USCS	CL	Liquid Limit	44	D90	1.592	D50		D10	
AASHTO	A-7-6	Plastic Limit	26	D85	0.320	D30		Cu	
USCS Group Name	Lean clay with sand	Plasticity Index	18	D60		D15		Cc	

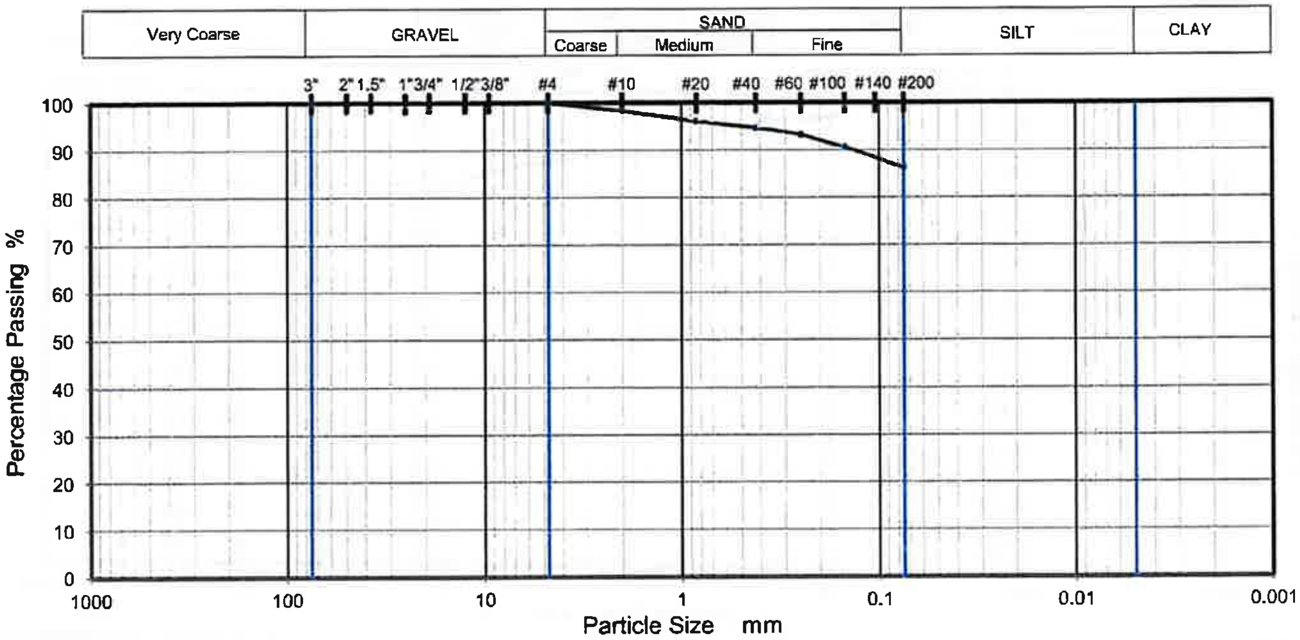
Project: Warrenton Data Center
Client:
Sample Description: Lean Clay with Sand Light Brown
Sample Source: B-15

Project No.: 01:31153
Depth (ft): 1 - 2.5
Sample No.: S-1
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
#4	100.0		
#10	98.3		
#20	96.1		
#40	94.7		
#60	93.4		
#100	90.7		
#200	86.3		

Dry Mass of sample, g	43.6

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	0.0
Coarse Sand, #4 to #10 sieve	1.7
Medium Sand, #10 to #40	3.6
Fine Sand, #40 to #200	8.4
Fines <#200	86.3

USCS	MH	Liquid Limit	51	D90	0.134	D50		D10	
AASHTO	A-7-5	Plastic Limit	30	D85		D30		Cu	
USCS Group Name	Elastic silt	Plasticity Index	21	D60		D15		Cc	

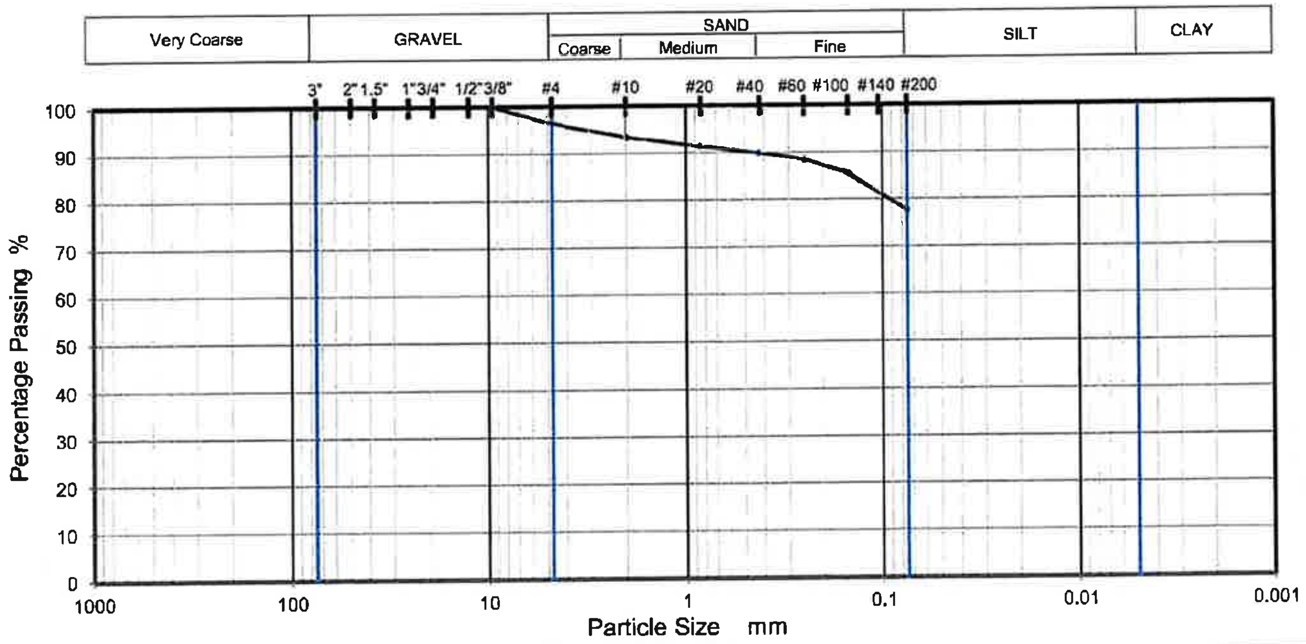
Project: Warrenton Data Center
Client:
Sample Description: Elastic Silt Trace Mica Light Brown
Sample Source: B-14

Project No.: 01:31153
Depth (ft): 3.5 - 5
Sample No.: S-2
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
3/8"	100.0		
#4	96.5		
#10	93.5		
#20	91.4		
#40	89.9		
#60	88.6		
#100	85.7		
#200	77.6		

Dry Mass of sample, g: 41.7

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	3.5
Coarse Sand, #4 to #10 sieve	3.0
Medium Sand, #10 to #40	3.6
Fine Sand, #40 to #200	12.3
Fines <#200	77.6

USCS	ML	Liquid Limit	46	D90	0.445	D50		D10	
AASHTO	A-7-6	Plastic Limit	28	D85	0.141	D30		Cu	
USCS Group Name	Silt with sand	Plasticity Index	18	D60		D15		Cc	

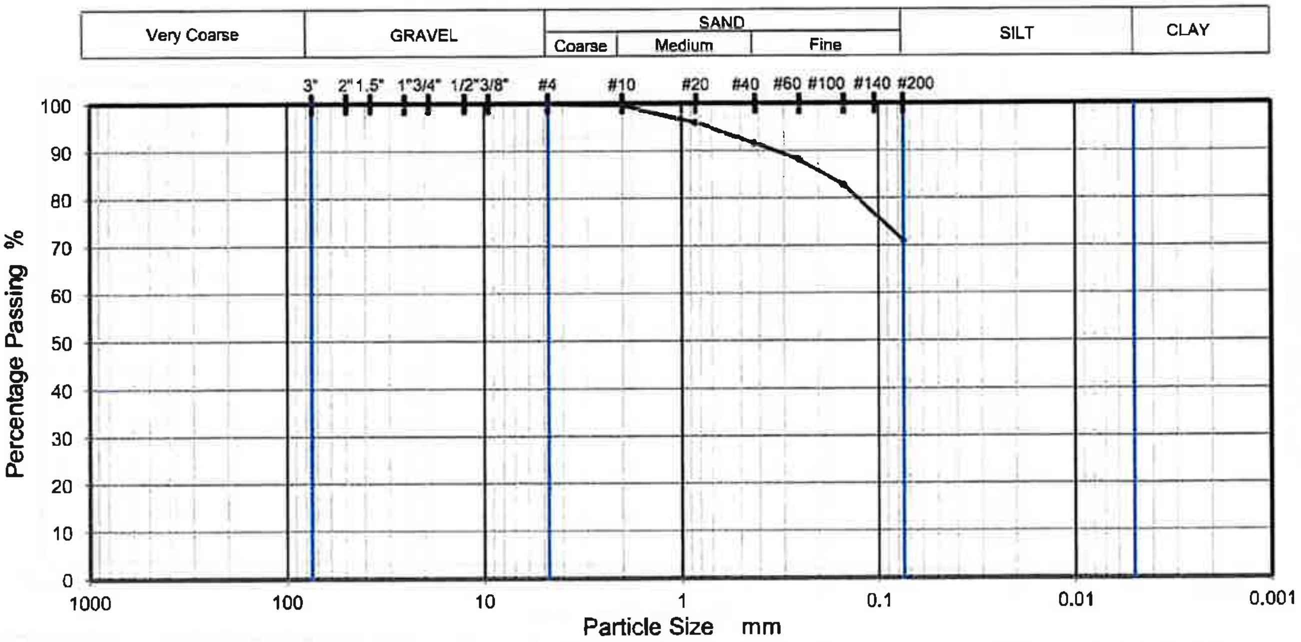
Project: Warrenton Data Center
Client:
Sample Description: Silt with Sand Trace Mica Yellowish Light Brown
Sample Source: B-13

Project No.: 01:31153
Depth (ft): 3.5 - 5
Sample No.: S-2
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
#4	100.0		
#10	99.6		
#20	96.1		
#40	91.7		
#60	88.2		
#100	82.9		
#200	71.0		

Dry Mass of sample, g	40.9

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	0.0
Coarse Sand, #4 to #10 sieve	0.4
Medium Sand, #10 to #40	7.9
Fine Sand, #40 to #200	20.7
Fines <#200	71.0

USCS	ML	Liquid Limit	44	D90	0.328	D50		D10	
AASHTO	A-7-6	Plastic Limit	28	D85	0.184	D30		Cu	
USCS Group Name	Silt with sand	Plasticity Index	16	D60		D15		Cc	

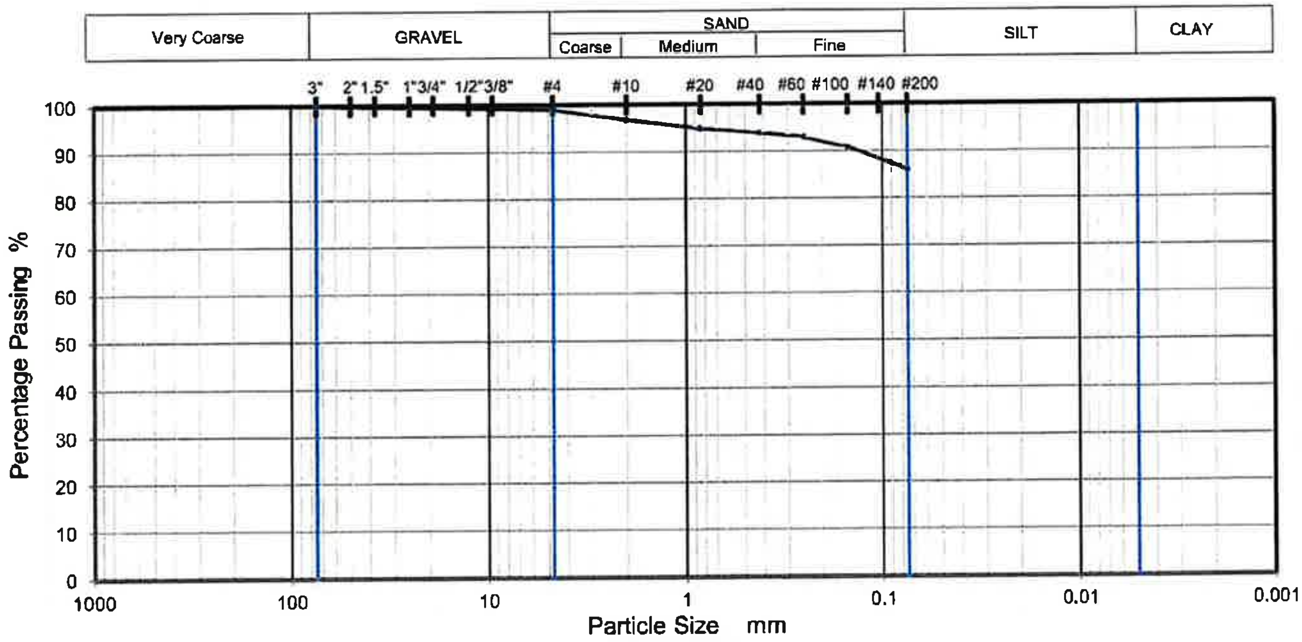
Project: Warrenton Data Center
Client:
Sample Description: Silt with Sand Trace Mica Yellow Light Brown
Sample Source: B-03

Project No.: 01:31153
Depth (ft): 3.5 - 5
Sample No.: S-2
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
#4	99.0		
#10	96.7		
#20	94.9		
#40	93.9		
#60	93.0		
#100	90.9		
#200	86.0		

Dry Mass of sample, g	42.5

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	1.0
Coarse Sand, #4 to #10 sieve	2.3
Medium Sand, #10 to #40	2.8
Fine Sand, #40 to #200	7.9
Fines <#200	86.0

USCS	CH	Liquid Limit	60	D90	0.132	D50		D10	
AASHTO	A-7-6	Plastic Limit	28	D85		D30		Cu	
USCS Group Name	Fat clay	Plasticity Index	32	D60		D15		Cc	

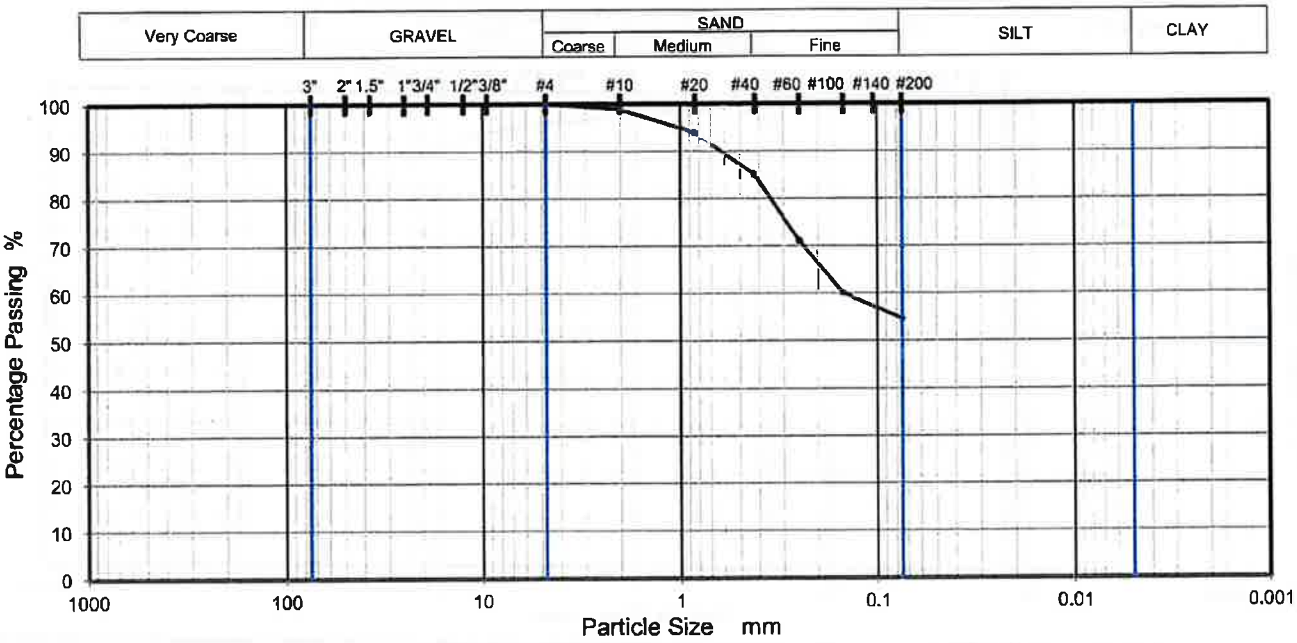
Project: Warrenton Data Center
Client:
Sample Description: Fat Clay Light Brown
Sample Source: B-07

Project No.: 01:31153
Depth (ft): 6 - 7.5
Sample No.: S-3
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
#4	100.0		
#10	98.9		
#20	94.1		
#40	85.3		
#60	71.2		
#100	60.1		
#200	54.6		

Dry Mass of sample, g 41.9

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	0.0
Coarse Sand, #4 to #10 sieve	1.1
Medium Sand, #10 to #40	13.6
Fine Sand, #40 to #200	30.7
Fines <#200	54.6

USCS	ML	Liquid Limit	NP	D90	0.615	D50		D10	
AASHTO	A-4	Plastic Limit	NP	D85	0.420	D30		Cu	
USCS Group Name	Sandy silt	Plasticity Index	NP	D60	0.148	D15		Cc	

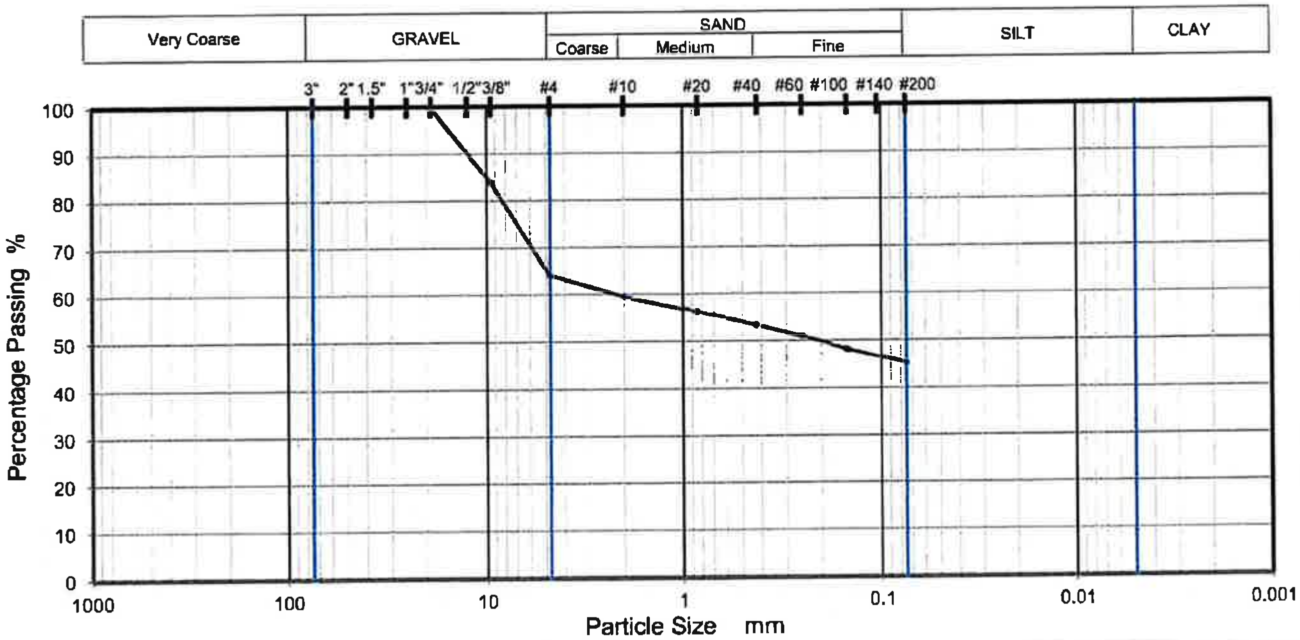
Project: Warrenton Data Center
Client:
Sample Description: Sandy Silt Trace Mica Yellowish Light Brown
Sample Source: B-16

Project No.: 01:31153
Depth (ft): 6 - 7.5
Sample No.: S-3
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving	
Particle Size	% Passing
3"	100.0
3/4"	100.0
3/8"	83.9
#4	64.1
#10	59.5
#20	56.3
#40	53.5
#60	51.0
#100	48.3
#200	45.3

Hydrometer Sedimentation	
Particle Size mm	% Passing

Dry Mass of sample, g	41.9

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	35.9
Coarse Sand, #4 to #10 sieve	4.6
Medium Sand, #10 to #40	6.0
Fine Sand, #40 to #200	8.2
Fines <#200	45.3

USCS	GM	Liquid Limit	61	D90	12.350	D50	0.207	D10	
AASHTO	A-7-5	Plastic Limit	38	D85	9.961	D30		Cu	
USCS Group Name	Silty gravel with sand	Plasticity Index	23	D60	2.197	D15		Cc	

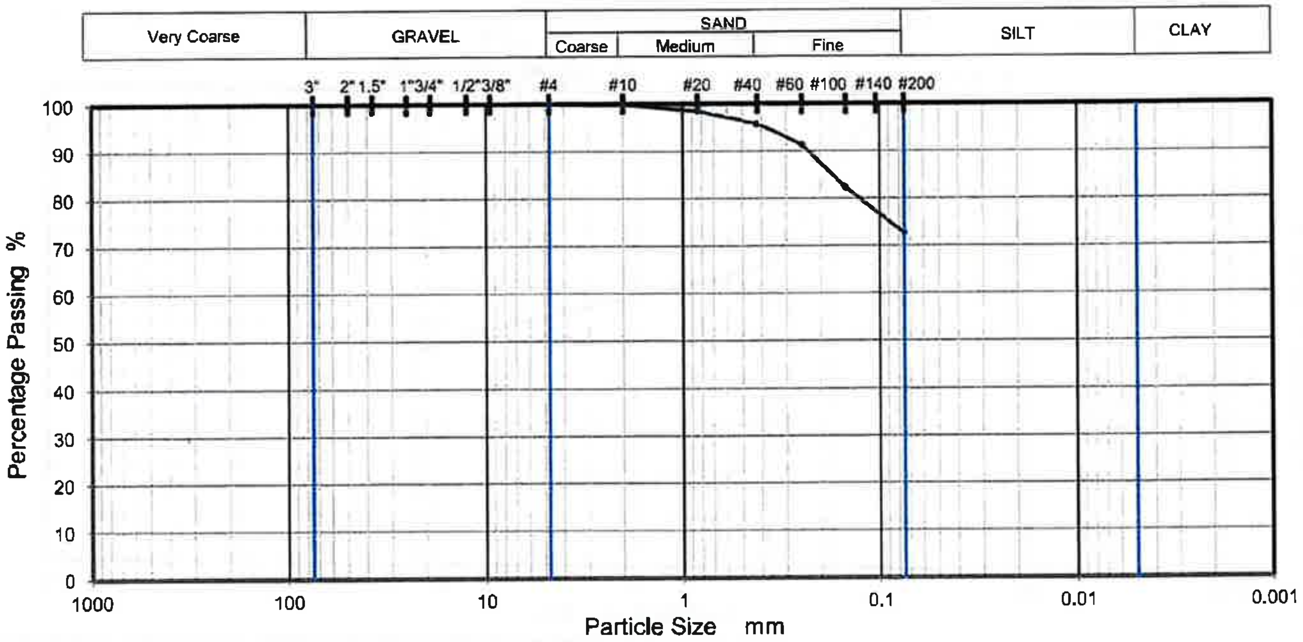
Project: Warrenton Data Center
Client:
Sample Description: Silty Gravel with Sand Trace Mica Yellowish Brown
Sample Source: B-19

Project No.: 01:31153
Depth (ft): 6 - 7.5
Sample No.: S-3
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving	
Particle Size	% Passing
3"	100.0
#4	100.0
#10	99.8
#20	98.5
#40	95.9
#60	91.5
#100	82.4
#200	72.7

Hydrometer Sedimentation	
Particle Size mm	% Passing

Dry Mass of sample, g	41.7

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	0.0
Coarse Sand, #4 to #10 sieve	0.2
Medium Sand, #10 to #40	3.9
Fine Sand, #40 to #200	23.2
Fines <#200	72.7

USCS	ML	Liquid Limit	NP	D90	0.230	D50		D10	
AASHTO	A-4	Plastic Limit	NP	D85	0.174	D30		Cu	
USCS Group Name	Silt with sand	Plasticity Index	NP	D60		D15		Cc	

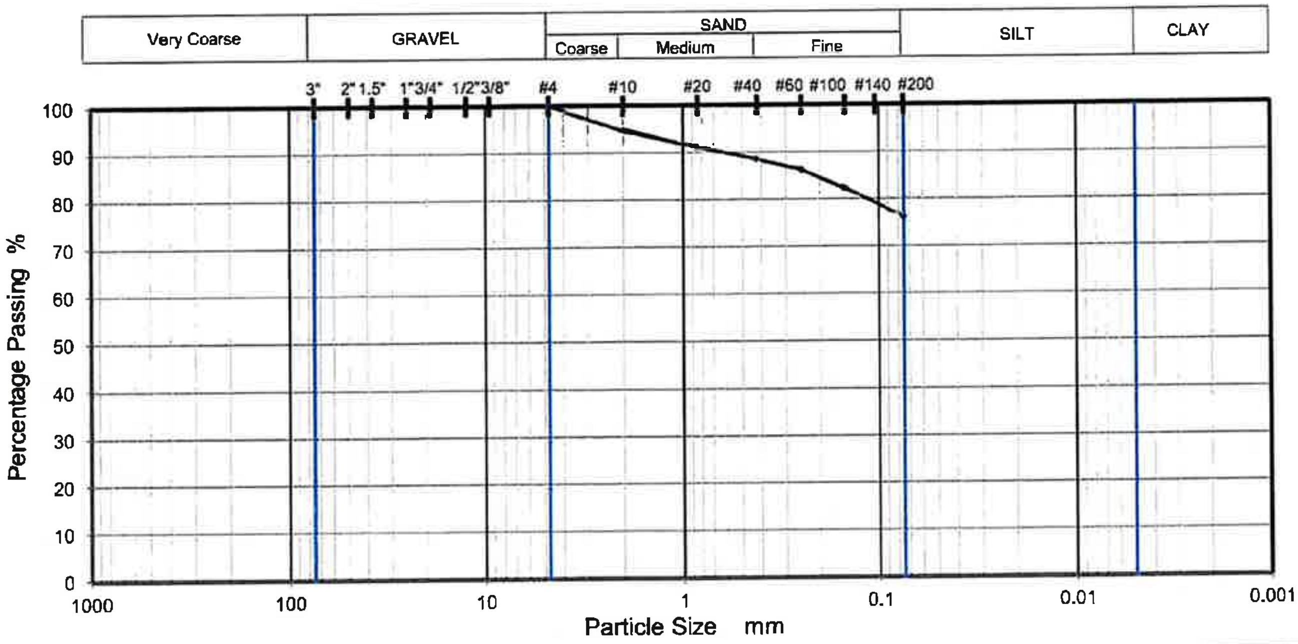
Project: Warrenton Data Center
Client:
Sample Description: Silt with Sand Trace Mica Yellow Light Brown
Sample Source: B-09

Project No.: 01:31153
Depth (ft): 8.5 - 10
Sample No.: S-4
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
#4	100.0		
#10	94.8		
#20	91.2		
#40	88.6		
#60	86.4		
#100	82.4		
#200	76.2		

Dry Mass of sample, g	44.4

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	0.0
Coarse Sand, #4 to #10 sieve	5.2
Medium Sand, #10 to #40	6.2
Fine Sand, #40 to #200	12.4
Fines <#200	76.2

USCS	MH	Liquid Limit	63	D90	0.617	D50		D10	
AASHTO	A-7-5	Plastic Limit	38	D85	0.209	D30		Cu	
USCS Group Name	Elastic silt with sand	Plasticity Index	25	D60		D15		Cc	

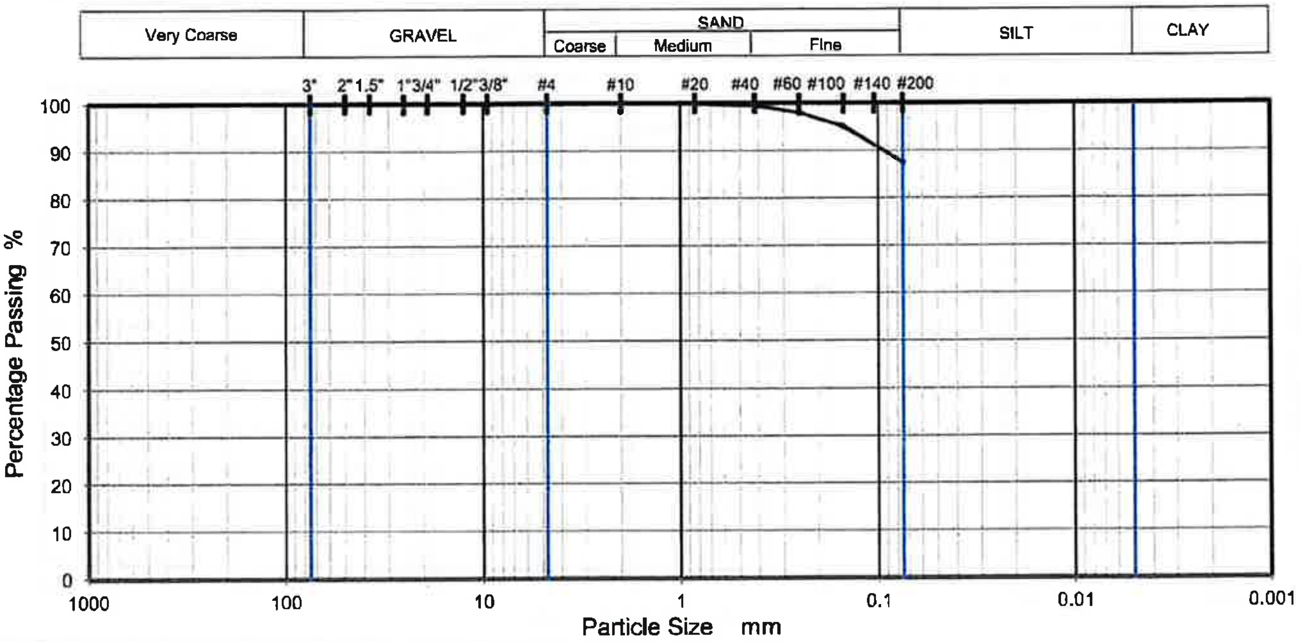
Project: Warrenton Data Center
Client:
Sample Description: Elastic Silt with Sand Trace Mica Yellowish Light Brown
Sample Source: B-20

Project No.: 01:31153
Depth (ft): 8.5 - 10
Sample No.: S-4
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
#4	100.0		
#10	100.0		
#20	100.0		
#40	99.5		
#60	98.1		
#100	95.2		
#200	87.5		

Dry Mass of sample, g: 41.8

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	0.0
Coarse Sand, #4 to #10 sieve	0.0
Medium Sand, #10 to #40	0.5
Fine Sand, #40 to #200	12.0
Fines <#200	87.5

USCS	ML	Liquid Limit	45	D90	0.094	D50		D10	
AASHTO	A-7-5	Plastic Limit	30	D85		D30		Cu	
USCS Group Name	Silt	Plasticity Index	15	D60		D15		Cc	

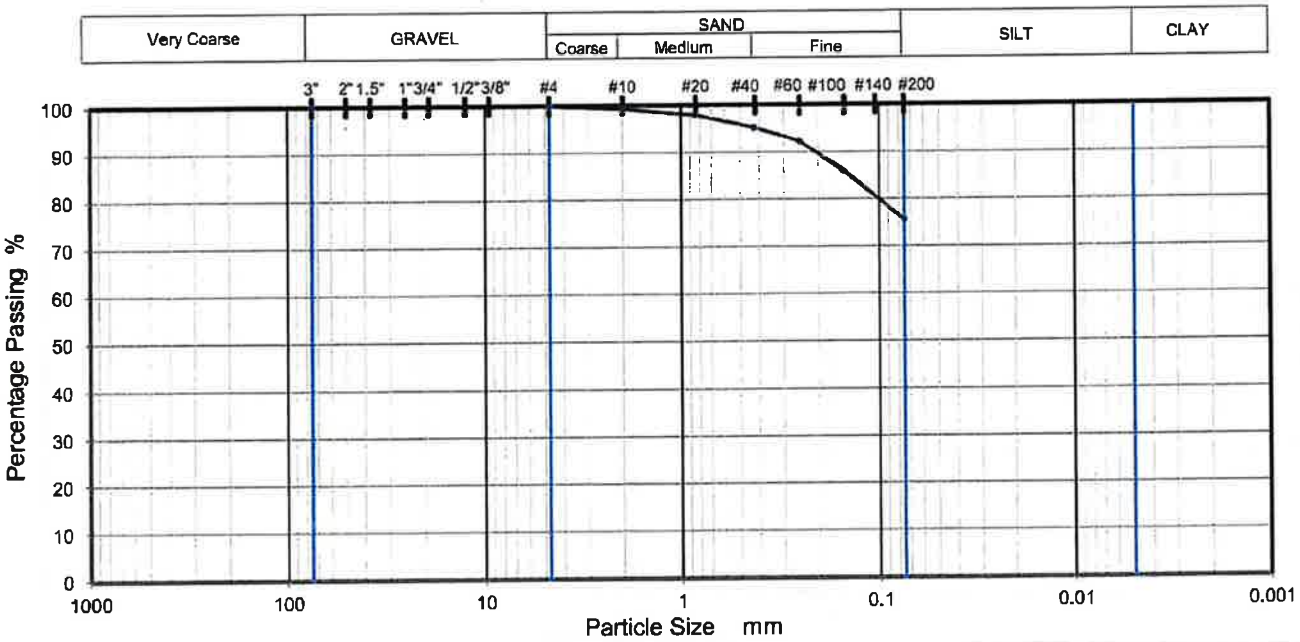
Project: Warrenton Data Center
Client:
Sample Description: Silt Trace Mica Yellow Light Brown
Sample Source: B-05

Project No.: 01:31153
Depth (ft): 33.5 - 35
Sample No.: S-9
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving	
Particle Size	% Passing
3"	100.0
#4	100.0
#10	99.3
#20	97.9
#40	95.3
#60	92.4
#100	86.1
#200	75.6

Hydrometer Sedimentation	
Particle Size mm	% Passing

Dry Mass of sample, g	41.5

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	0.0
Coarse Sand, #4 to #10 sieve	0.7
Medium Sand, #10 to #40	4.0
Fine Sand, #40 to #200	19.7
Fines <#200	75.6

USCS	ML	Liquid Limit	NP	D90	0.206	D50		D10	
AASHTO	A-4	Plastic Limit	NP	D85	0.140	D30		Cu	
USCS Group Name	Silt with sand	Plasticity Index	NP	D60		D15		Cc	

Project: Warrenton Data Center
Client:
Sample Description: Silt with Sand Trace Mica Yellow Light Brown
Sample Source: B-01

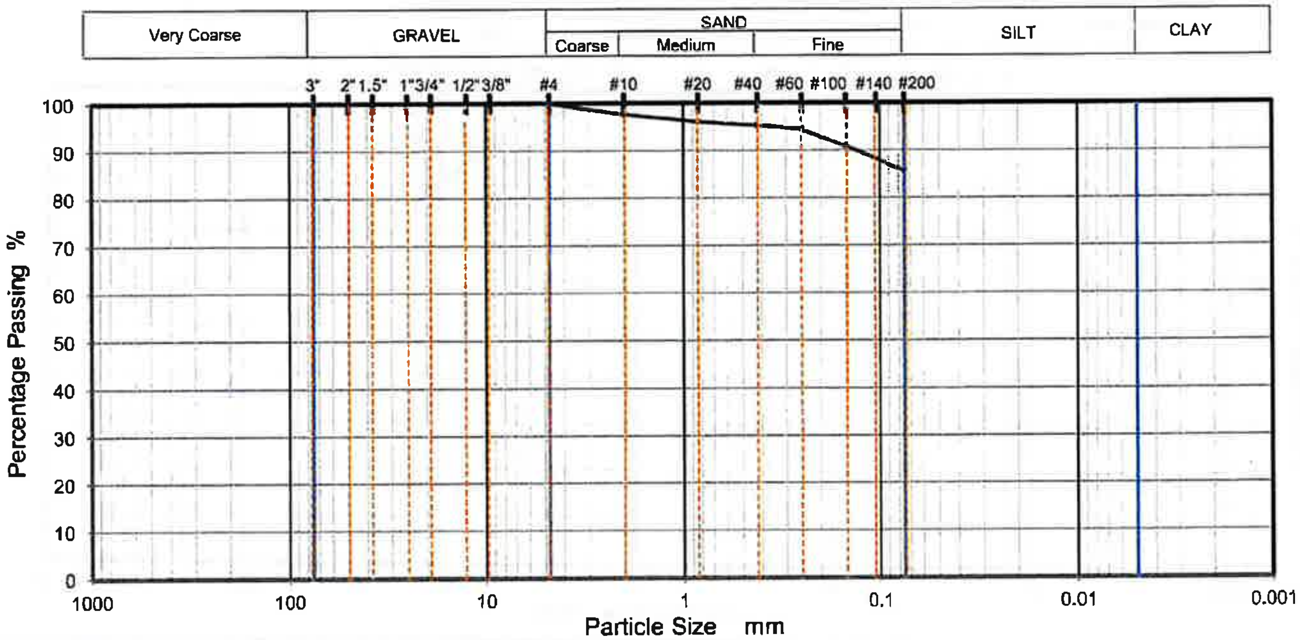
Project No.: 01:31153
Depth (ft): 38.5 - 39.75
Sample No.: S-10
Date Reported:

ECS

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving	
Particle Size	% Passing
3"	100.0
#4	100.0
#10	97.6
#20	96.1
#40	95.3
#60	94.5
#100	91.0
#200	85.7

Hydrometer Sedimentation	
Particle Size mm	% Passing

Dry Mass of sample, g: 53.3

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	0.0
Coarse Sand, #4 to #10 sieve	2.4
Medium Sand, #10 to #40	2.3
Fine Sand, #40 to #200	9.6
Fines <#200	85.7

USCS	CL	Liquid Limit	49	D90	0.132	D50		D10	
AASHTO	A-7-6	Plastic Limit	27	D85		D30		Cu	
USCS Group Name	Lean clay	Plasticity Index	22	D60		D15		Cc	

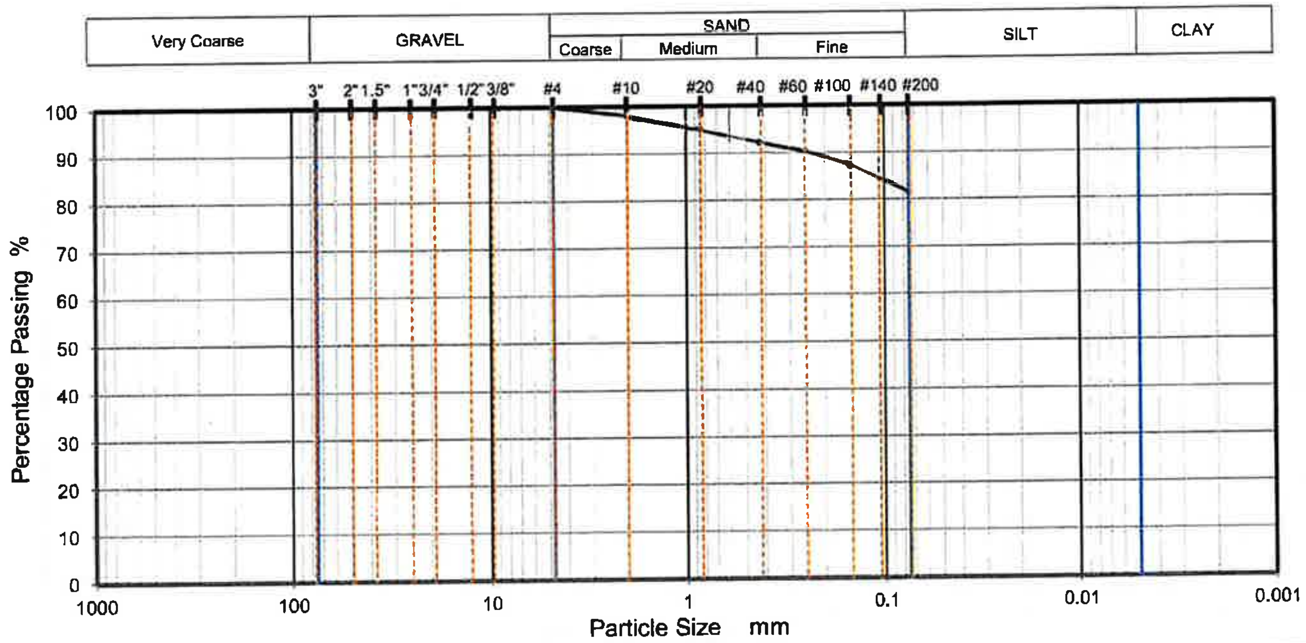
Project: Warrenton Data Center
Client:
Sample Description: Lean Clay with Sand Yellowisht Brown
Sample Source: B-14

Project No.: 01:31153
Depth (ft): 1 - 6
Sample No.: D3S-186
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
#4	100.0		
#10	98.1		
#20	95.1		
#40	92.4		
#60	90.3		
#100	87.6		
#200	81.6		

Dry Mass of sample, g	64.5

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	0.0
Coarse Sand, #4 to #10 sieve	1.9
Medium Sand, #10 to #40	5.7
Fine Sand, #40 to #200	10.8
Fines <#200	81.6

USCS	CL	Liquid Limit	45	D90	0.236	D50		D10	
AASHTO	A-7-6	Plastic Limit	21	D85	0.111	D30		Cu	
USCS Group Name	Lean clay with sand	Plasticity Index	24	D60		D15		Cc	

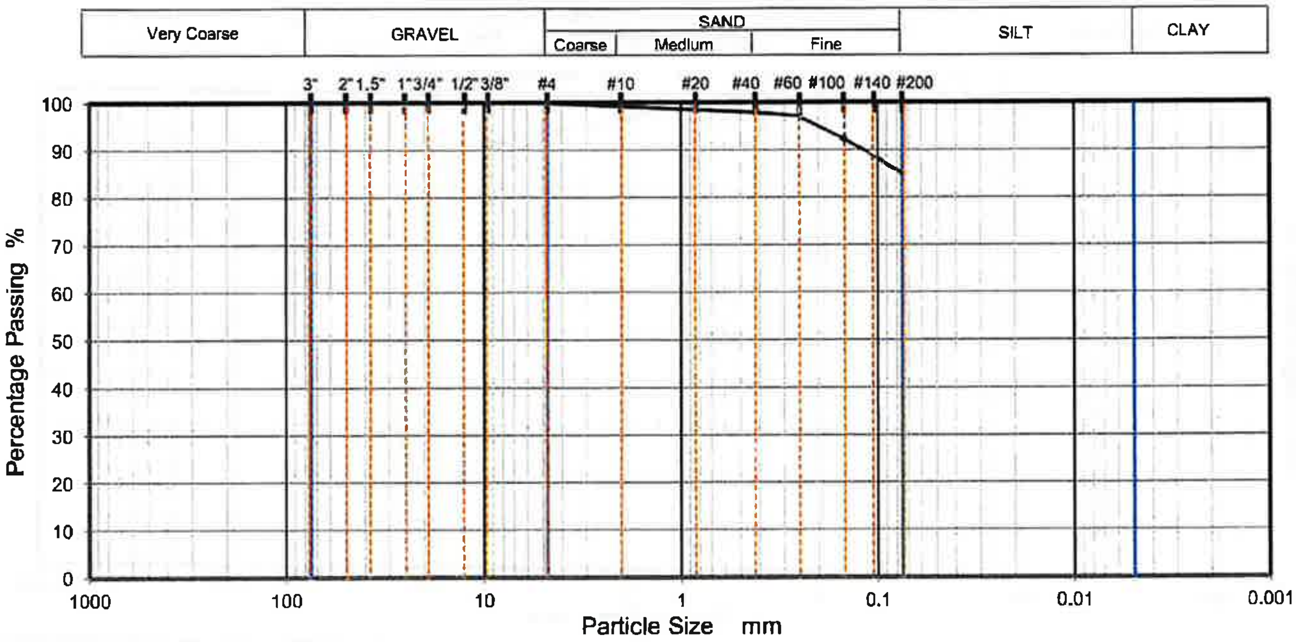
Project: Warrenton Data Center
Client:
Sample Description: Lean Clay with Sand Yellowish Brown
Sample Source: B-15

Project No.: 01:31153
Depth (ft): 1 - 6
Sample No.: D3S-187
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
2"	100.0		
1 1/2"	100.0		
1"	100.0		
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	99.2		
#20	98.5		
#40	97.9		
#60	97.1		
#100	92.5		
#200	85.1		

Dry Mass of sample, g: 54.9

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	0.0
Coarse Sand, #4 to #10 sieve	0.8
Medium Sand, #10 to #40	1.3
Fine Sand, #40 to #200	12.8
Fines <#200	85.1

USCS	ML	Liquid Limit	NP	D90	0.119	D50		D10	
AASHTO	A-4	Plastic Limit	NP	D85		D30		Cu	
USCS Group Name	Silt	Plasticity Index	NP	D60		D15		Cc	

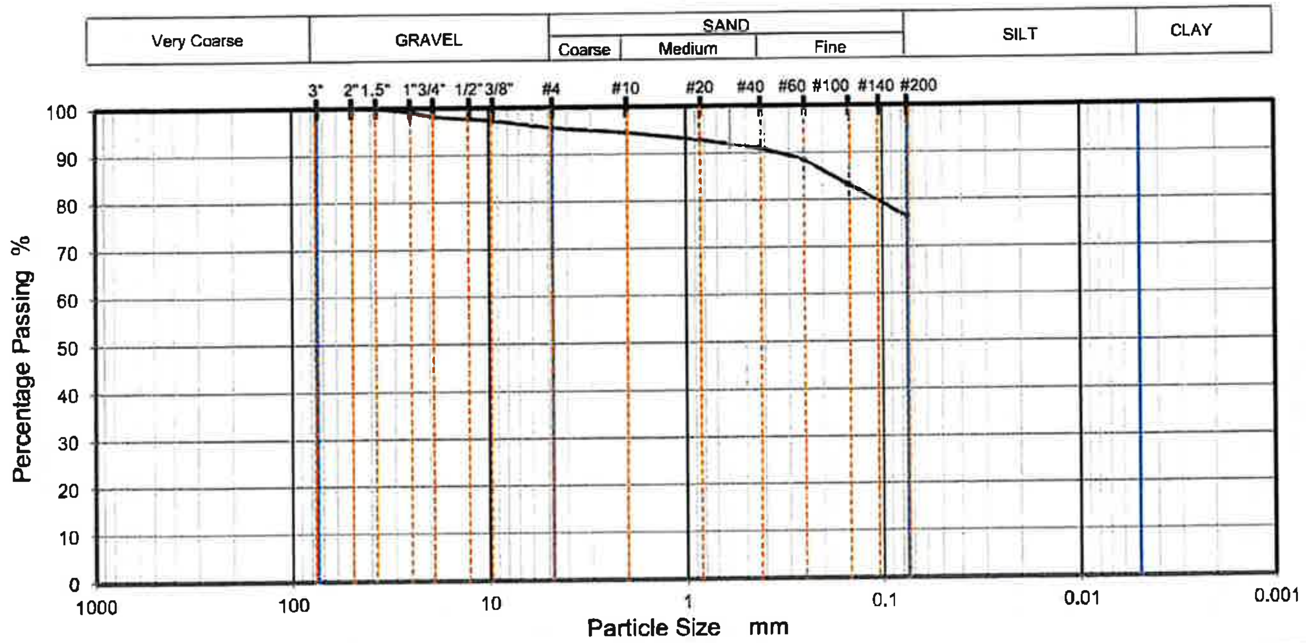
Project: Warrenton Data Center
Client:
Sample Description: Silt Trace Mica Yellowish Brown
Sample Source: B-04

Project No.: 01:31153
Depth (ft): 1 - 6
Sample No.: D3S-188
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
	Htran	Dtran		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
2"	100.0		
1 1/2"	100.0		
1"	99.2		
3/4"	98.2		
3/8"	97.3		
#4	95.7		
#10	94.6		
#20	92.9		
#40	91.1		
#60	88.6		
#100	83.4		
#200	76.4		

Dry Mass of sample, g: 5235.0

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	4.3
Coarse Sand, #4 to #10 sieve	1.1
Medium Sand, #10 to #40	3.5
Fine Sand, #40 to #200	14.7
Fines <#200	76.4

USCS	ML	Liquid Limit	49	D90	0.337	D50		D10	
AASHTO	A-7-6	Plastic Limit	28	D85	0.176	D30		Cu	
USCS Group Name	Silt with sand	Plasticity Index	21	D60		D15		Cc	

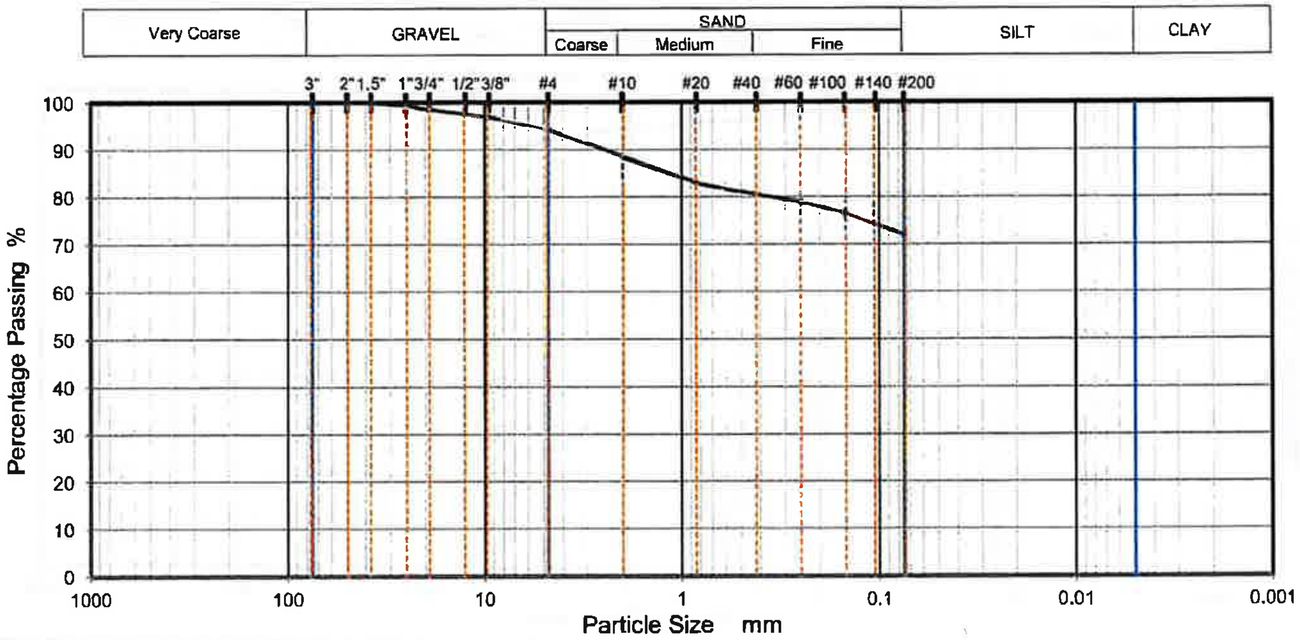
Project: Warrenton Data Center
Client:
Sample Description: Silt with Sand Brwon
Sample Source: B-09

Project No.: 01:31153
Depth (ft): 1 - 6
Sample No.: D3S-189
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
2"	100.0		
1 1/2"	100.0		
1"	99.4		
3/4"	98.5		
3/8"	96.9		
#4	94.4		
#10	88.7		
#20	83.1		
#40	80.6		
#60	79.0		
#100	76.7		
#200	72.0		

Dry Mass of sample, g	10996.0

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	5.6
Coarse Sand, #4 to #10 sieve	5.7
Medium Sand, #10 to #40	8.1
Fine Sand, #40 to #200	8.6
Fines <#200	72.0

USCS	CH	Liquid Limit	55	D90	2.436	D50		D10	
AASHTO	A-7-6	Plastic Limit	24	D85	1.136	D30		Cu	
USCS Group Name	Fat clay with sand	Plasticity Index	31	D60		D15		Cc	

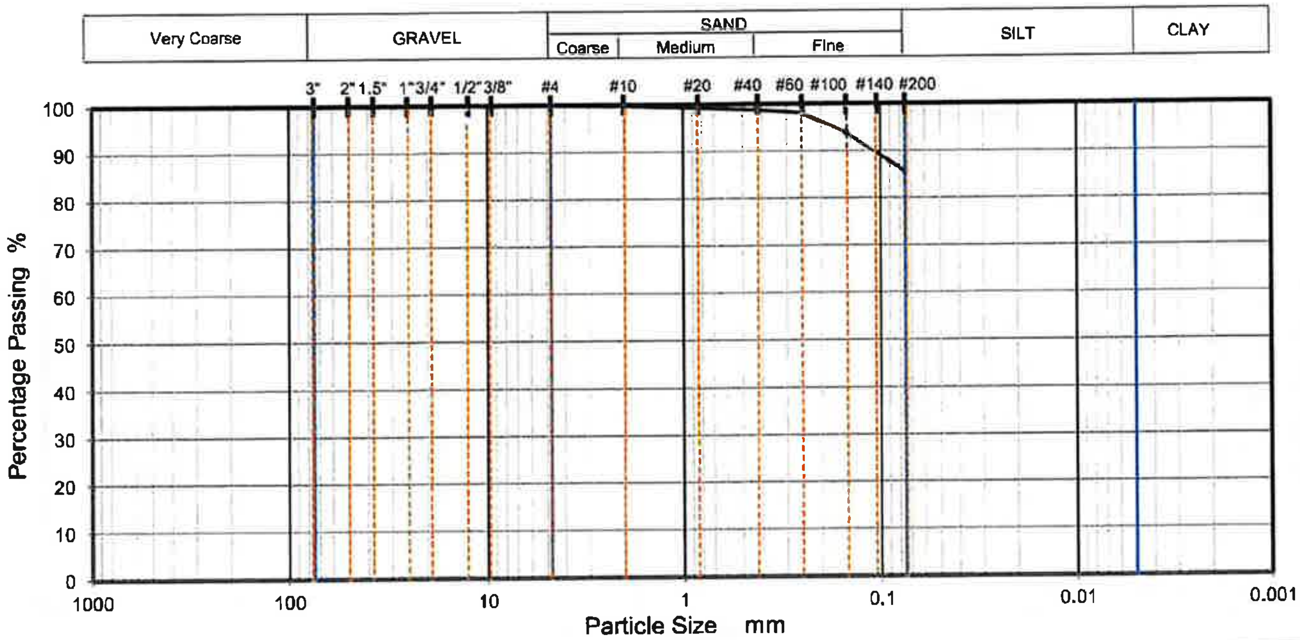
Project: Warrenton Data Center
Client:
Sample Description: Fat Clay with Sand Brown
Sample Source: B-19

Project No.: 01:31153
Depth (ft): 1 - 6
Sample No.: D3S-190
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
#4	100.0		
#10	99.8		
#20	99.3		
#40	98.8		
#60	98.1		
#100	94.0		
#200	85.6		

Dry Mass of sample, g	54.9

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	0.0
Coarse Sand, #4 to #10 sieve	0.2
Medium Sand, #10 to #40	1.0
Fine Sand, #40 to #200	13.2
Fines <#200	85.6

USCS	CL	Liquid Limit	39	D90	0.108	D50		D10	
AASHTO	A-6	Plastic Limit	18	D85		D30		Cu	
USCS Group Name	Lean clay	Plasticity Index	21	D60		D15		Cc	

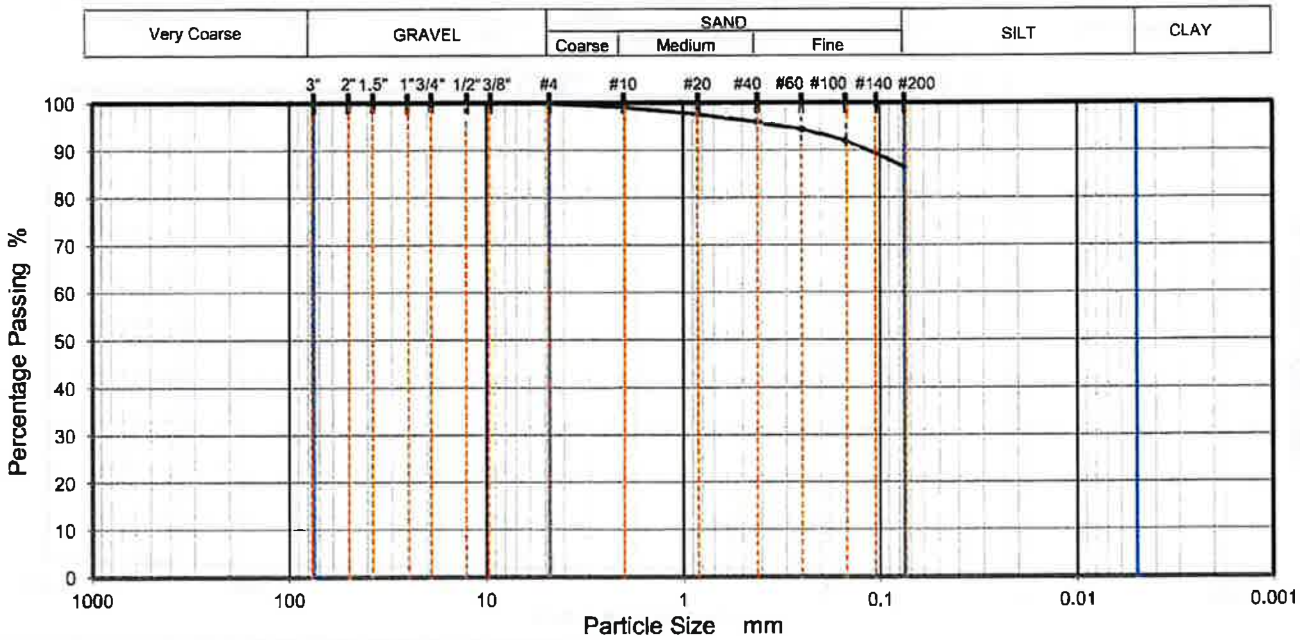
Project: Warrenton Data Center
Client:
Sample Description: Lean Clay Yellowish Brown
Sample Source: B-02

Project No.: 01:31153
Depth (ft): 1 - 6
Sample No.: D3S-191
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
#4	100.0		
#10	99.1		
#20	97.6		
#40	96.0		
#60	94.6		
#100	92.2		
#200	86.5		

Dry Mass of sample, g	64.0

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	0.0
Coarse Sand, #4 to #10 sieve	0.9
Medium Sand, #10 to #40	3.1
Fine Sand, #40 to #200	9.5
Fines <#200	86.5

USCS	CL	Liquid Limit	37	D90	0.115	D50		D10	
AASHTO	A-6	Plastic Limit	19	D85		D30		Cu	
USCS Group Name	Lean clay	Plasticity Index	18	D60		D15		Cc	

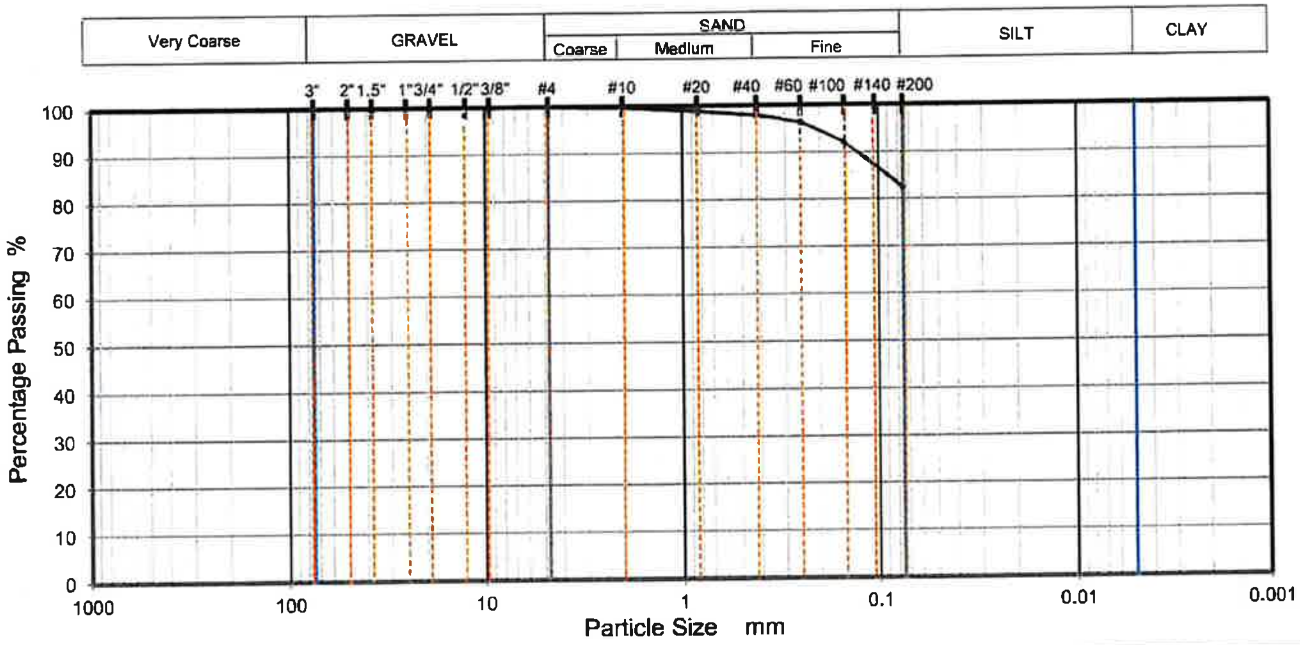
Project: Warrenton Data Center
Client:
Sample Description: Lean Clay Trace Mica Brown
Sample Source: B-07

Project No.: 01:31153
Depth (ft): 1 - 6
Sample No.: D3S-193
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving

Particle Size	% Passing
3"	100.0
#4	100.0
#10	99.7
#20	98.9
#40	97.9
#60	96.5
#100	92.3
#200	82.5

Hydrometer Sedimentation

Particle Size mm	% Passing

Dry Mass of sample, g	51.5

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	0.0
Coarse Sand, #4 to #10 sieve	0.3
Medium Sand, #10 to #40	1.8
Fine Sand, #40 to #200	15.4
Fines <#200	82.5

USCS	ML	Liquid Limit	41	D90	0.128	D50		D10	
AASHTO	A-7-6	Plastic Limit	27	D85	0.090	D30		Cu	
USCS Group Name	Silt with sand	Plasticity Index	14	D60		D15		Cc	

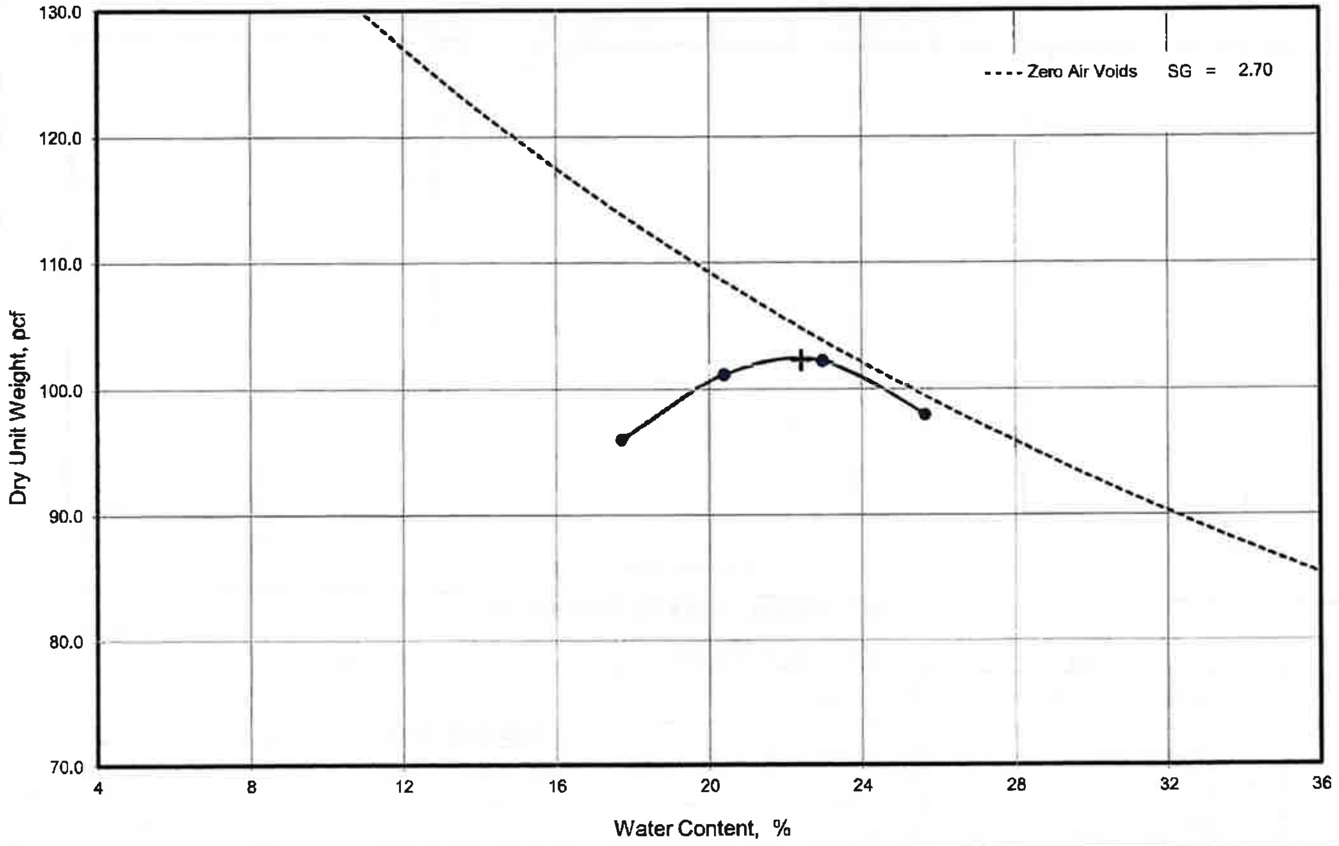
Project: Warrenton Data Center
Client:
Sample Description: Silt with Sand Trace Mica Yellowish Brown
Sample Source: B-11

Project No.: 01:31153
Depth (ft): 1 - 6
Sample No.: D3S-194
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

Laboratory Compaction Characteristics of Soil
Using Standard Effort



Optimum Moisture Content	22.4	%
Maximum Dry Unit Weight	102.3	pcf

Preparation	ASTM moist preparation
Type of rammer	Manual - 5.5lbf (24.5N)
Test Specfication / Method	ASTM D698-12e2-method A
Specific gravity - D854 water pycnometer	2.70 Assumed
Coarse Aggregate Specific Gravity -	

Cumulative material retained on:			
	3/4 in. sieve	0.0	%
	3/8 in. sieve	0.0	%
	#4 sieve	0.0	%

Soil Description	Nat. Moist. %	Liquid Limit	Plasticity Index	%< #200	USCS	AASHTO
Lean Clay with Sand Yellowisht Brown	5.6	49	22	85.7	CL	A-7-6

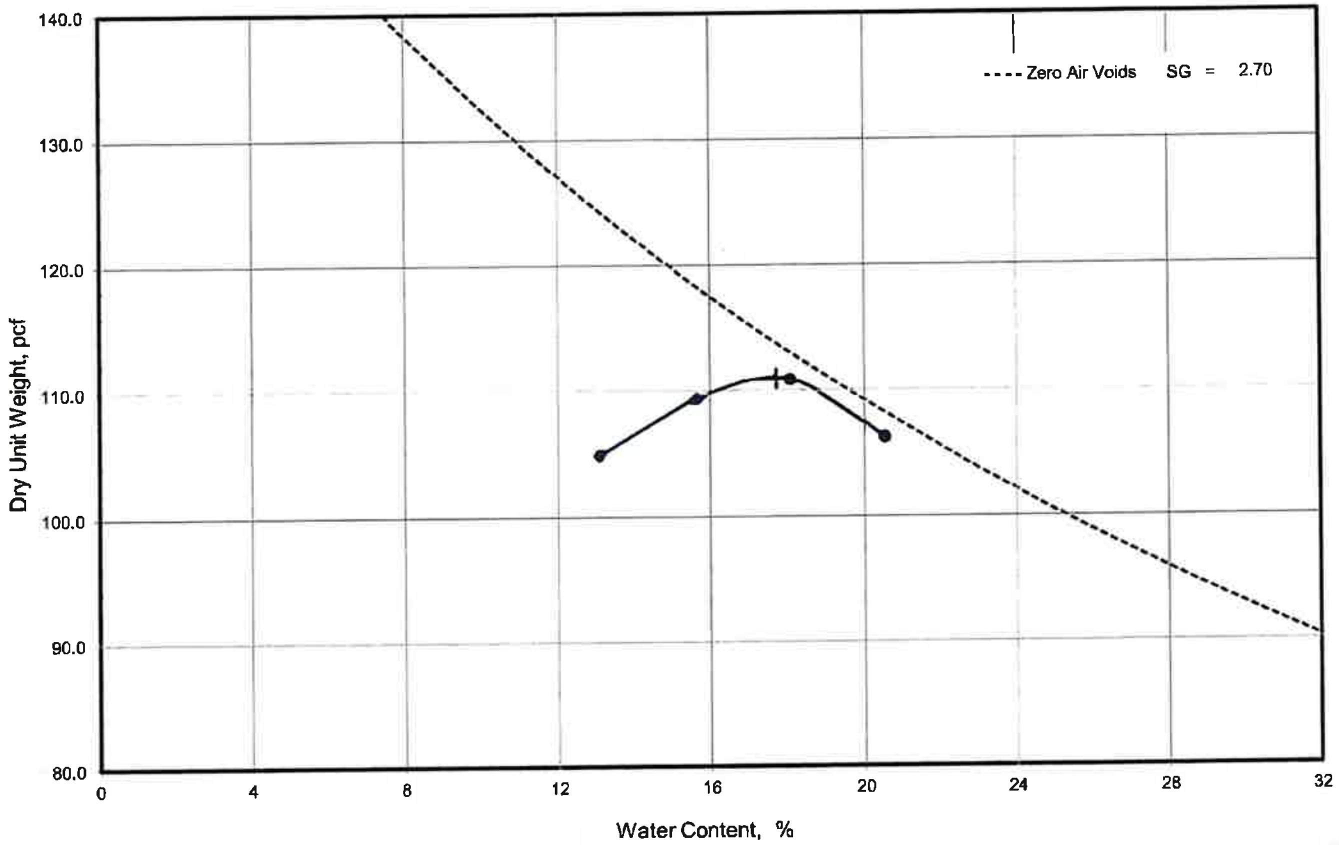
Project: Warrenton Data Center
Client:
Sample / Source B-14
Test Reference/No.:

Project No.: 01:31153
Depth (ft.): 1 - 6
Sample No.: D3S-186
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

Laboratory Compaction Characteristics of Soil
Using Standard Effort



Optimum Moisture Content 17.7 %

Maximum Dry Unit Weight 111.0 pcf

Cumulative material retained on:

	3/4 in. sieve	0.0	%
	3/8 in. sieve	0.0	%
	#4 sieve	0.0	%

Preparation	ASTM moist preparation	
Type of rammer	Manual - 5.5lbf (24.5N)	
Test Specfication / Method	ASTM D698-12e2-method A	
Specific gravity - D854 water pycnometer	2.70	Assumed
Coarse Aggregate Specific Gravity -		

Soil Description	Nat. Moist. %	Liquid Limit	Plasticity Index	%< #200	USCS	AASHTO
Lean Clay with Sand Yellowish Brown	5.6	45	24	81.6	CL	A-7-6

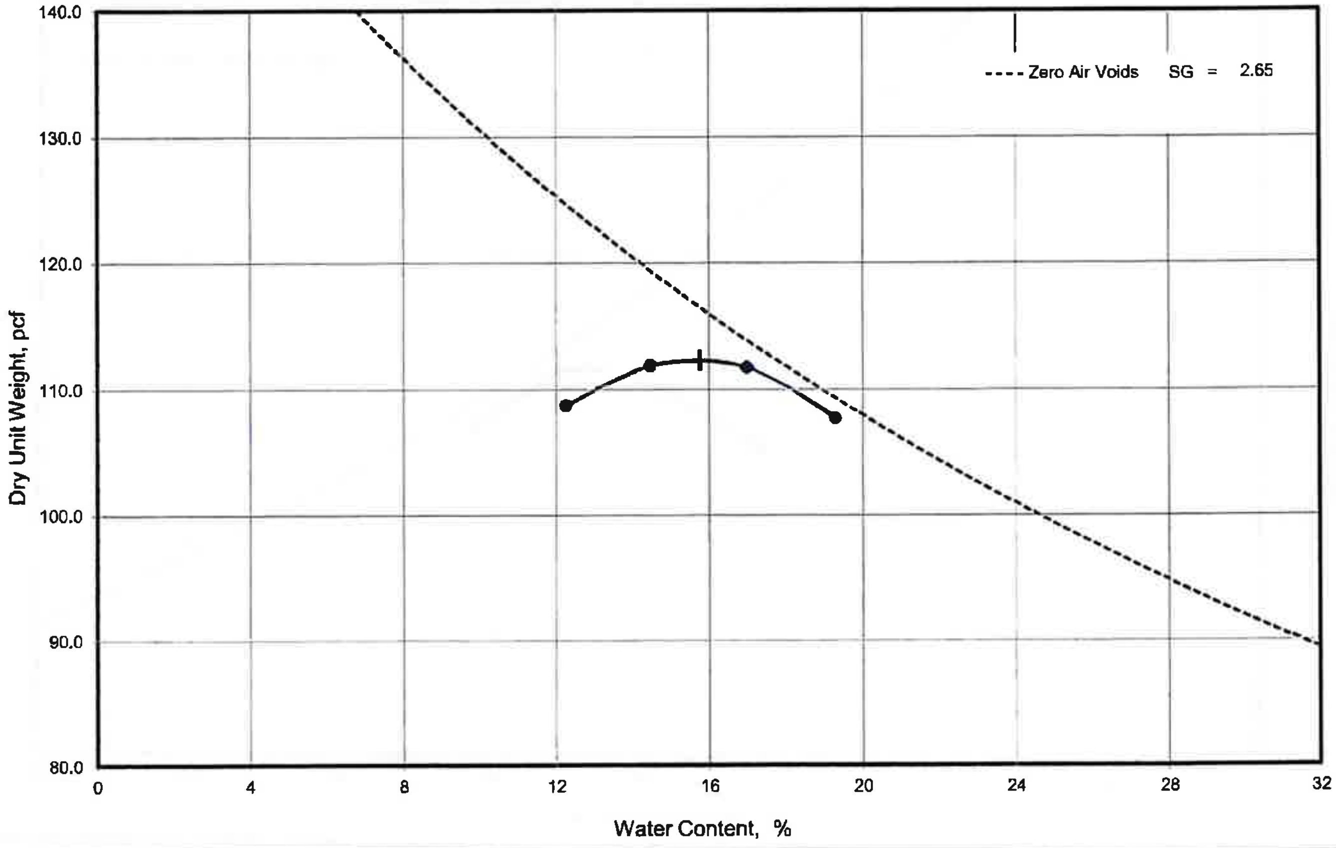
Project: Warrenton Data Center
Client:
Sample / Source B-15
Test Reference/No.:

Project No.: 01:31153
Depth (ft.): 1 - 6
Sample No.: D3S-187
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

Laboratory Compaction Characteristics of Soil
Using Standard Effort



Optimum Moisture Content		**15.8**	%	
Maximum Dry Unit Weight		**112.3**	pcf	
Cumulative material retained on:	3/4 in. sieve	0.0	%	
	3/8 in. sieve	0.0	%	
	#4 sieve	0.0	%	

Preparation	ASTM moist preparation	
Type of rammer	Manual - 5.5lbf (24.5N)	
Test Specfication / Method	ASTM D698-12e2-method A	
Specific gravity - D854 water pycnometer	2.65	Assumed
Coarse Aggregate Specific Gravity -		

Soil Description	Nat. Moist. %	Liquid Limit	Plasticity Index	%< #200	USCS	AASHTO
Silt Trace Mica Yellowish Brown	2.2	NP	NP	85.1	ML	A-4

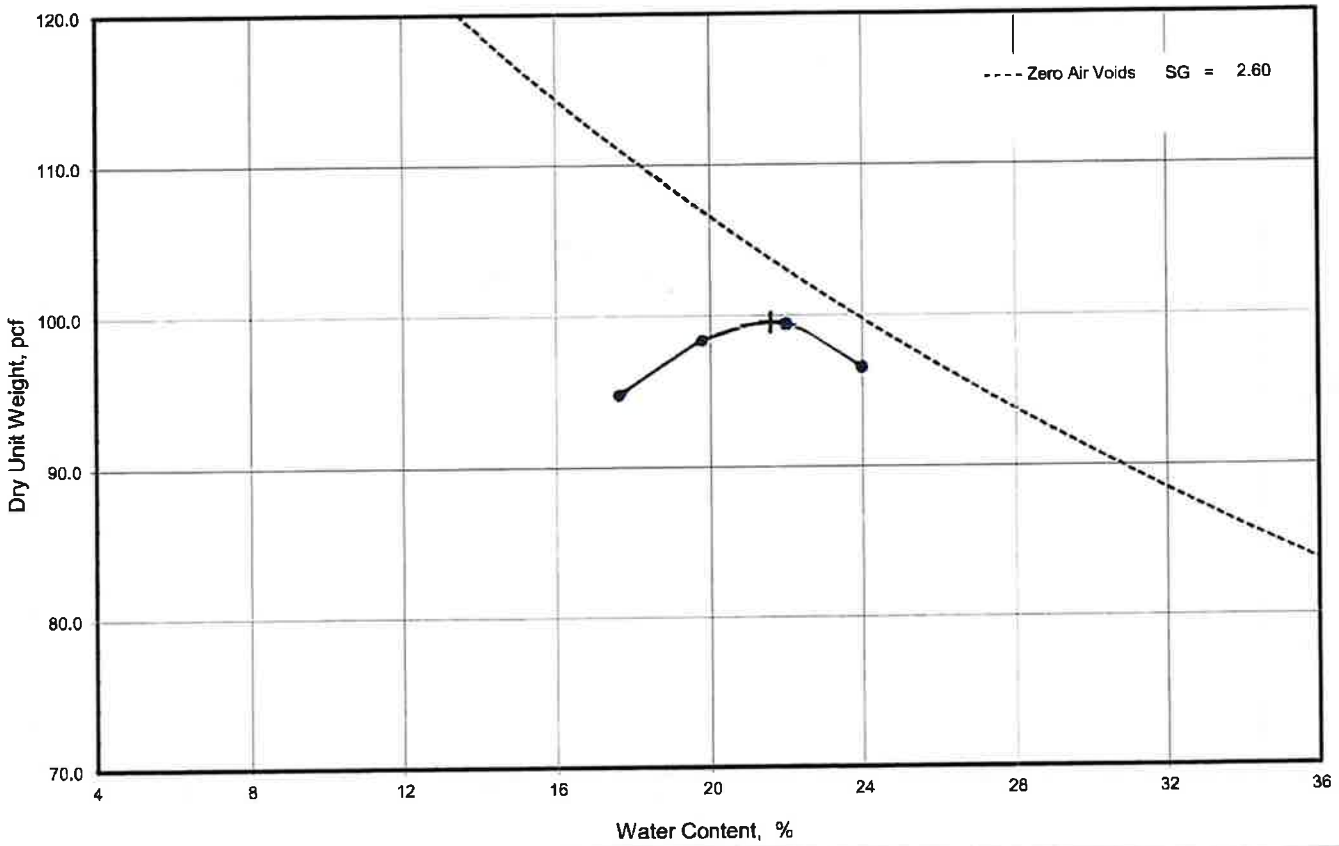
Project: Warrenton Data Center
Client:
Sample / Source B-04
Test Reference/No.:

Project No.: 01:31153
Depth (ft.): 1 - 6
Sample No.: D3S-188
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
	Htran	Dtran		

Laboratory Compaction Characteristics of Soil
Using Standard Effort



Optimum Moisture Content		**21.6**	%	
Maximum Dry Unit Weight		**99.5**	pcf	
Cumulative material retained on:	3/4 in. sieve	1.8	%	
	3/8 in. sieve	2.7	%	
	#4 sieve	4.3	%	

Preparation	ASTM moist preparation	
Type of rammer	Manual - 5.5lbf (24.5N)	
Test Specfication / Method	ASTM D698-12e2-method A	
Specific gravity - D854 water pycnometer	2.60	Assumed
Coarse Aggregate Specific Gravity -		Assumed

Soil Description	Nat. Moist. %	Liquid Limit	Plasticity Index	%< #200	USCS	AASHTO
Silt with Sand Brown	5.2	49	21	76.4	ML	A-7-6

Project: Warrenton Data Center
Client:
Sample / Source B-09
Test Reference/No.:

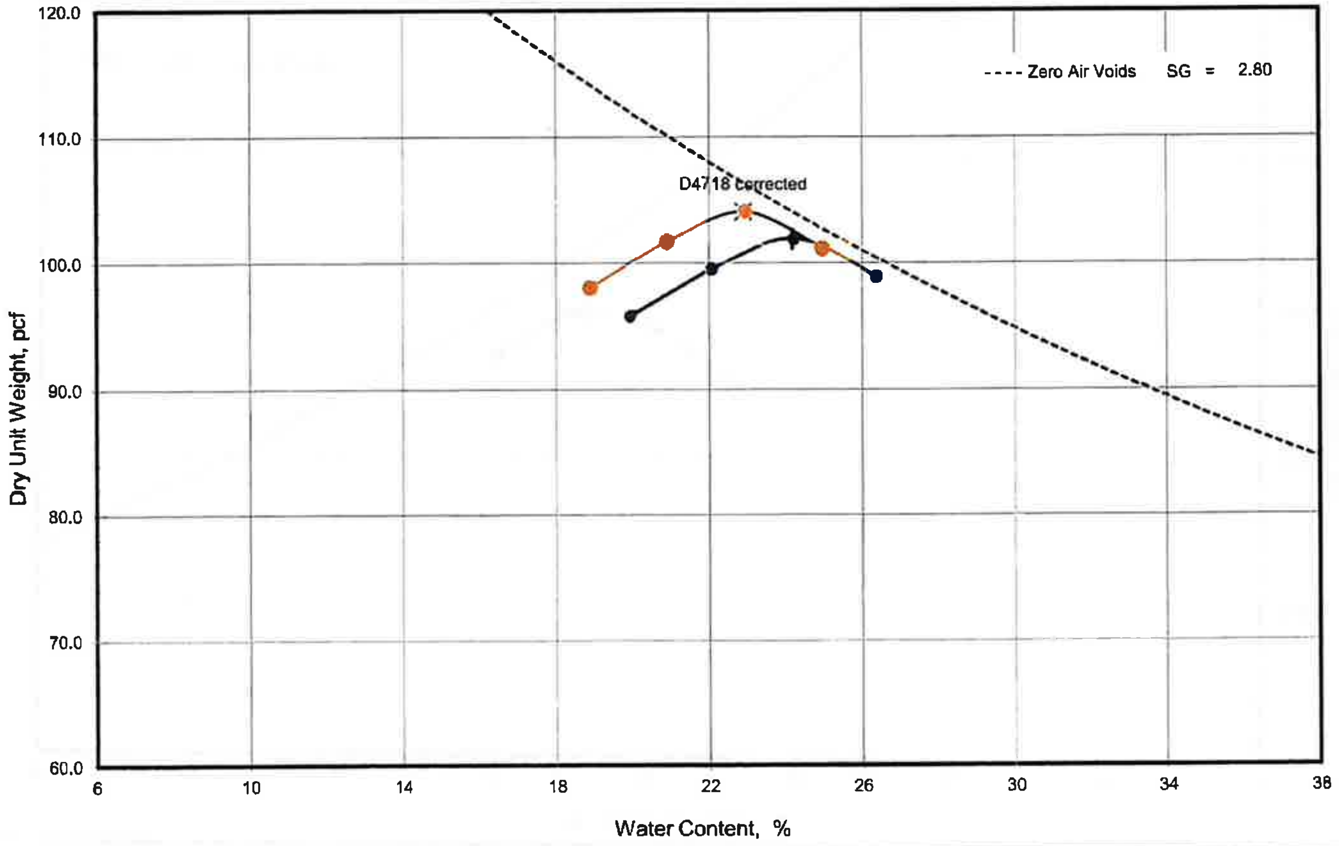
Project No.: 01:31153
Depth (ft.): 1 - 6
Sample No.: D3S-189
Date Reported:

ECS

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

Laboratory Compaction Characteristics of Soil
Using Standard Effort



Optimum Moisture Content		**24.2**	%	Preparation	ASTM moist preparation
Maximum Dry Unit Weight		**101.9**	pcf	Type of rammer	Manual - 5.5lbf (24.5N)
Corrected Opt. Moisture Content		22.9	%	Test Specfication / Method	ASTM D698-12e2-method A
Corrected Max. Dry Density		104.0	pcf	Specific gravity - D854 water pycnometer	2.80 Assumed
Cumulative material retained on:	3/4 in. sieve	1.5	%	Coarse Aggregate Specific Gravity -	2.60 Assumed
	3/8 in. sieve	3.1	%		
	#4 sieve	5.6	%		

5.58 % retained on #4 sieve.

Soil Description	Nat. Moist. %	Liquid Limit	Plasticity Index	%< #200	USCS	AASHTO
Fat Clay with Sand Brown	33.6	55	31	72.0	CH	A-7-6

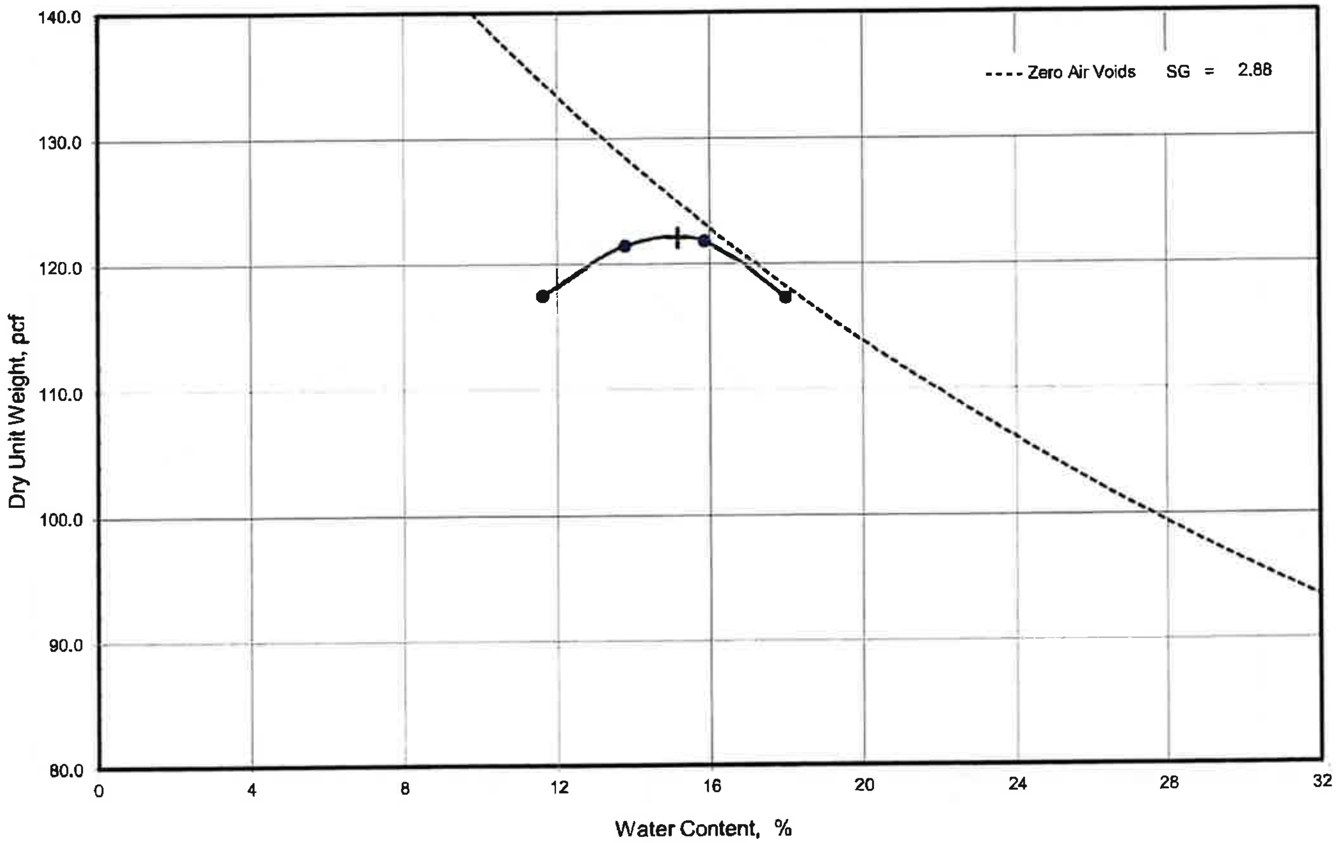
Project: Warrenton Data Center
Client:
Sample / Source B-19
Test Reference/No.:

Project No.: 01:31153
Depth (ft.): 1 - 6
Sample No.: D3S-190
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

Laboratory Compaction Characteristics of Soil
Using Standard Effort



Optimum Moisture Content	**15.2**	%	Preparation	ASTM moist preparation
Maximum Dry Unit Weight	**122.1**	pcf	Type of rammer	Manual - 5.5lbf (24.5N)
			Test Specfication / Method	ASTM D698-12e2-method A
			Specific gravity - D854 water pycnometer	2.88 Historical
Cumulative material retained on: 3/4 in. sieve	0.0	%	Coarse Aggregate Specific Gravity -	
3/8 in. sieve	0.0	%		
#4 sieve	0.0	%		

Soil Description	Nat. Moist. %	Liquid Limit	Plasticity Index	%< #200	USCS	AASHTO
Lean Clay Yellowish Brown	11.7	39	21	85.6	CL	A-6

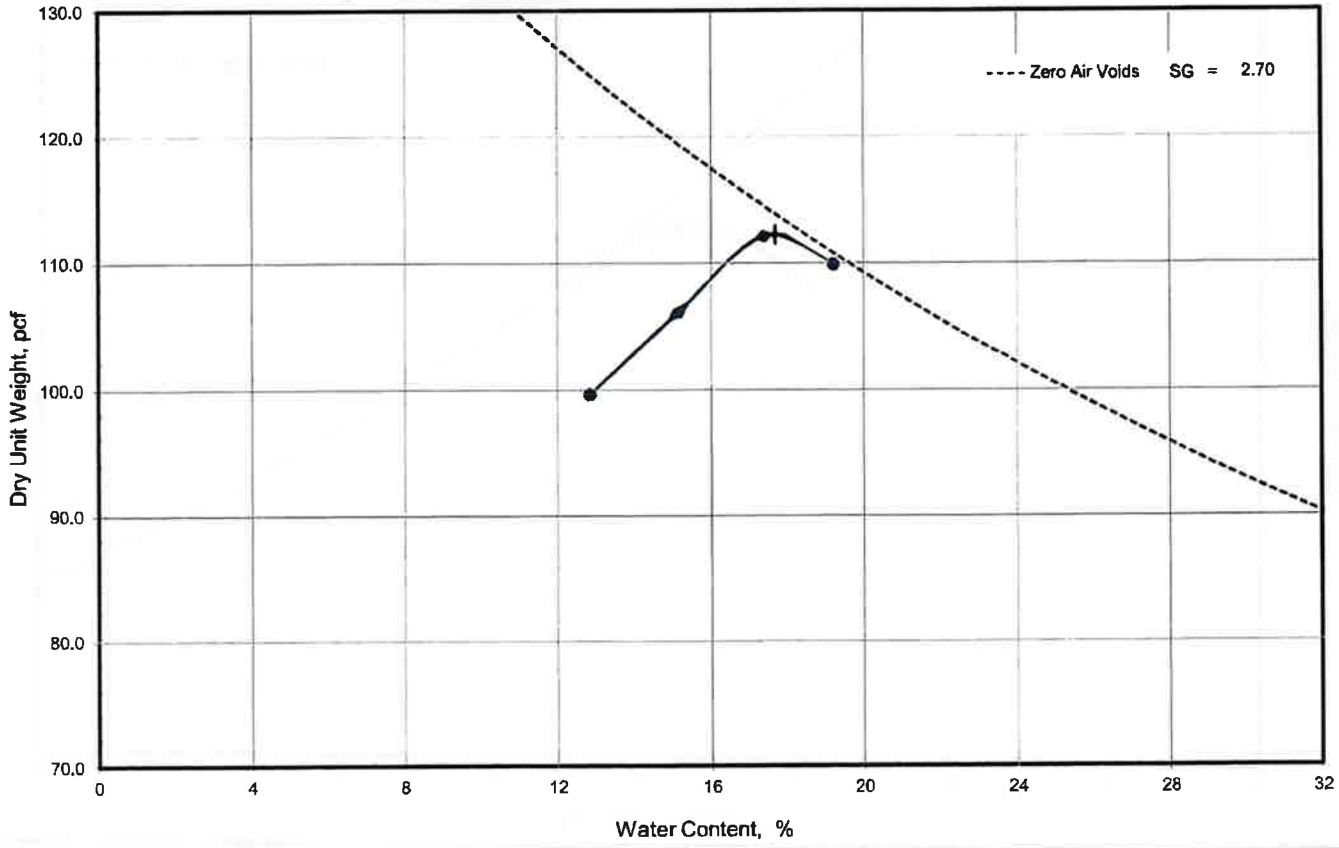
Project: Warrenton Data Center
Client:
Sample / Source B-02
Test Reference/No.:

Project No.: 01:31153
Depth (ft.): 1 - 6
Sample No.: D3S-191
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

Laboratory Compaction Characteristics of Soil
Using Standard Effort



Optimum Moisture Content	17.7	%	Preparation	ASTM moist preparation
Maximum Dry Unit Weight	112.2	pcf	Type of rammer	Manual - 5.5lbf (24.5N)
			Test Specfication / Method	
			Specific gravity - D854 water pycnometer	2.70 Historical
Cumulative material retained on: 3/4 in. sieve	0.0	%	Coarse Aggregate Specific Gravity -	
3/8 in. sieve	0.0	%		
#4 sieve	0.0	%		

Soil Description	Nat. Moist. %	Liquid Limit	Plasticity Index	%< #200	USCS	AASHTO
Lean Clay Trace Mica Brown	2.6	37	18	86.5	CL	A-6

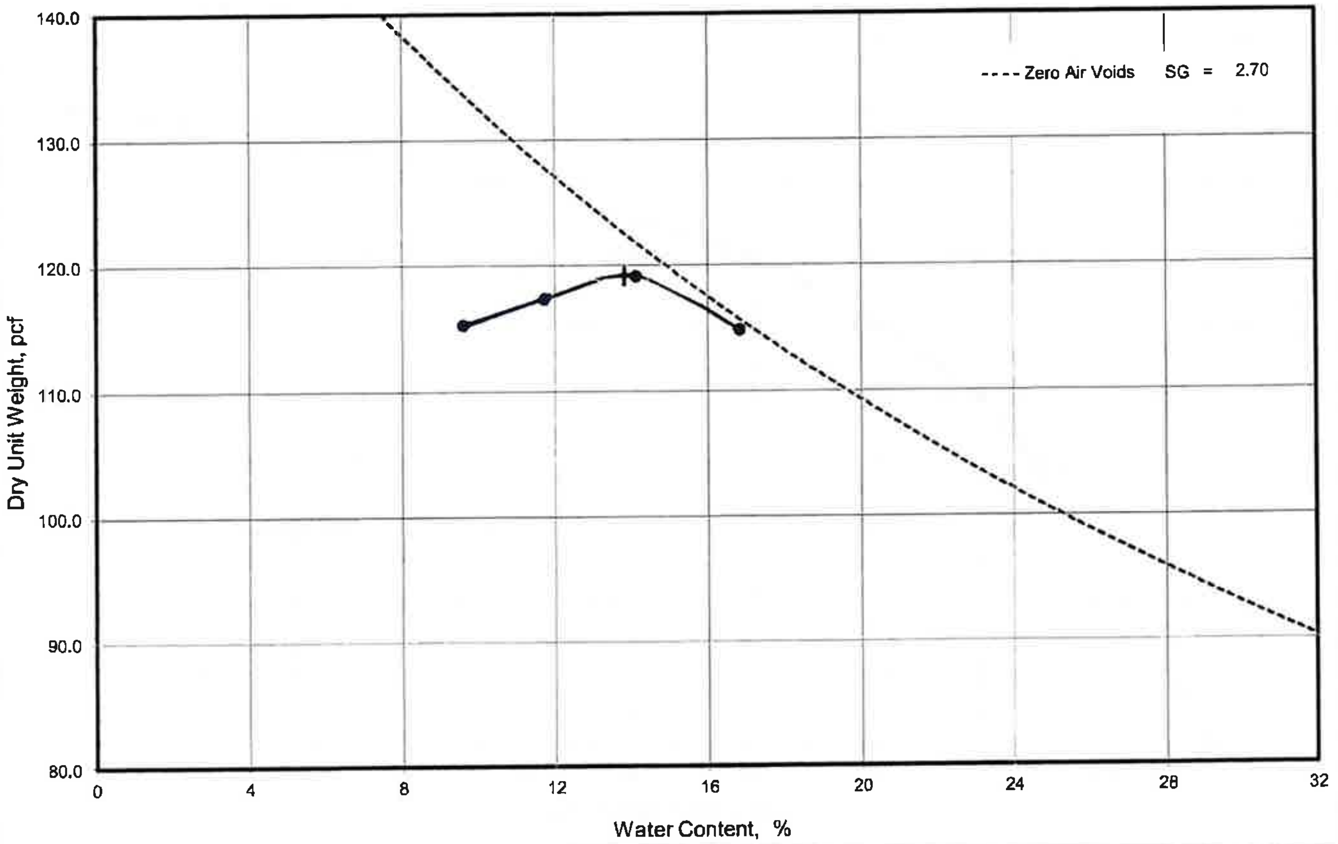
Project: Warrenton Data Center
Client:
Sample / Source B-07
Test Reference/No.:

Project No.: 01:31153
Depth (ft.): 1 - 6
Sample No.: D3S-193
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

Laboratory Compaction Characteristics of Soil
Using Standard Effort



Optimum Moisture Content	**13.8**	%
Maximum Dry Unit Weight	**119.2**	pcf

Cumulative material retained on:	3/4 in. sieve	0.0	%
	3/8 in. sieve	0.0	%
	#4 sieve	0.0	%

Preparation	ASTM moist preparation	
Type of rammer		
Test Specfication / Method	ASTM D698-12e2-method A	
Specific gravity - D854 water pycnometer	2.70	Historical
Coarse Aggregate Specific Gravity -		

Soil Description	Nat. Moist. %	Liquid Limit	Plasticity Index	%< #200	USCS	AASHTO
Silt with Sand Trace Mica Yellowish Brown	2.1	41	14	82.5	ML	A-7-6

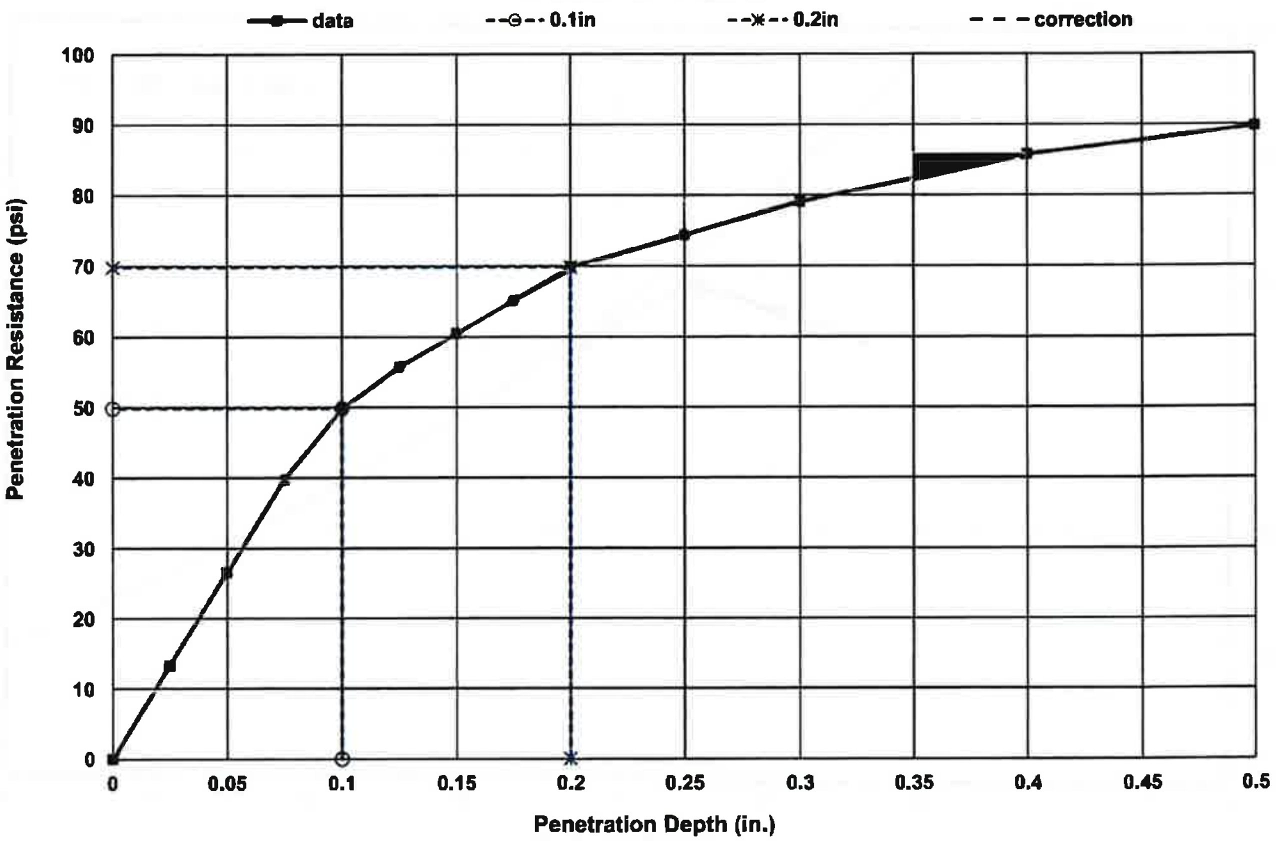
Project: Warrenton Data Center
Client:
Sample / Source B-11
Test Reference/No.:

Project No.: 01:31153
Depth (ft.): 1 - 6
Sample No.: D3S-194
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

California Bearing Ratios (CBR) of Laboratory-Compacted Soils



TEST RESULTS (ASTM D1883-16)

Molded			Soaked			CBR (%)		Linearty Correction (in.)	Surcharge (lbs.)	Swell (%)
Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.1 in.	0.2 in.			
101.8	99.5	22.3	91.1	89.1	33.8	5.0	4.7	0.00	10	2.22

Material Description	AASHTO	USCS	MAX. Dens. (pcf)	Optimum Moisture (%)	LL	PI	% Fines	% Gravel
Lean Clay with Sand Yellowish Brown	A-7-6	CL	102.3	22.4	49	22	85.7	0.0

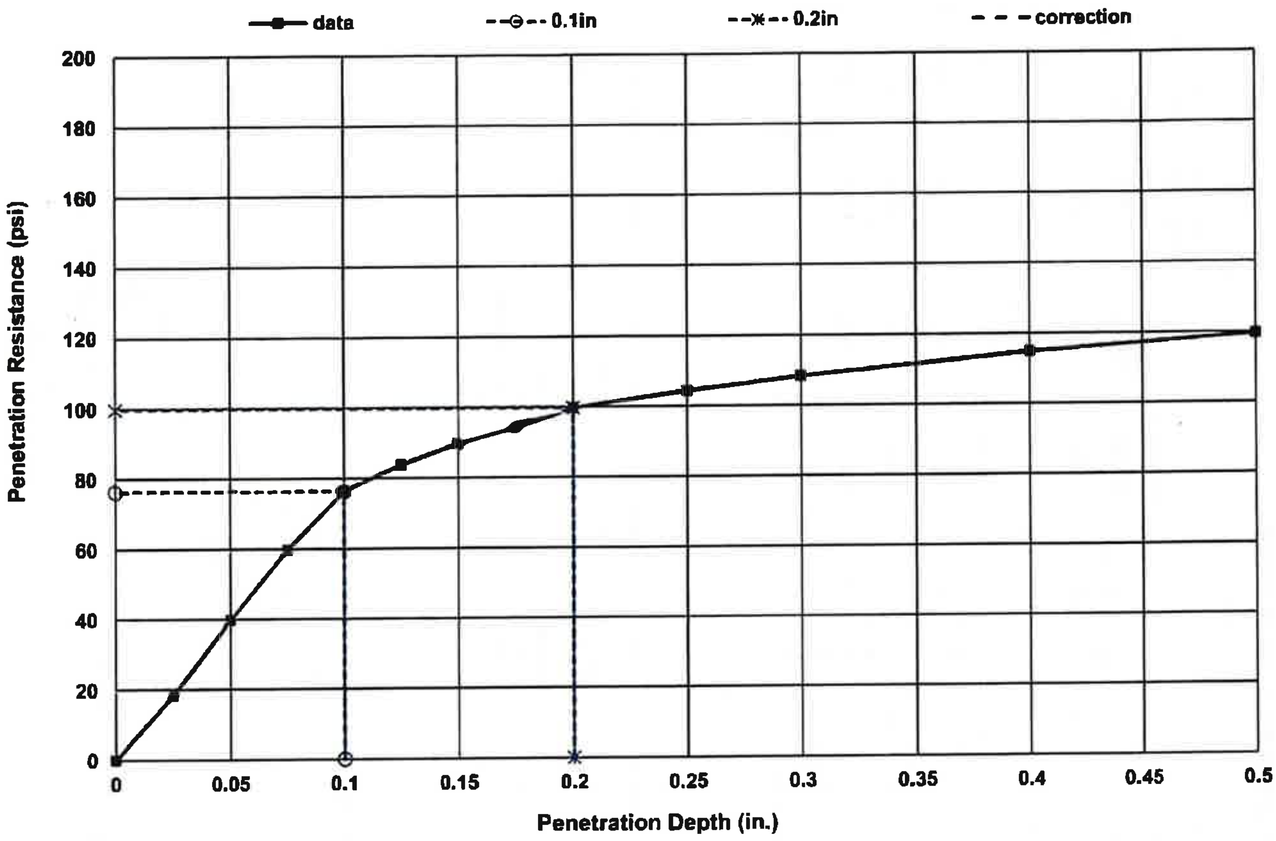
Project: Warrenton Data Center
Client:
Sample / Source B-14
Test Reference/No.: 1

Project No.: 01:31153
Depth (ft.): 1 - 6
Sample No.: D3S-186
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

California Bearing Ratios (CBR) of Laboratory-Compacted Soils



TEST RESULTS (ASTM D1883-16)

Molded			Soaked			CBR (%)		Linearty Correction (in.)	Surcharge (lbs.)	Swell (%)
Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.1 in.	0.2 in.			
110.5	99.5	17.6	100.2	90.3	27.3	7.6	6.6	0.00	10	1.85

Material Description	AASHTO	USCS	MAX. Dens. (pcf)	Optimum Moisture (%)	LL	PI	% Fines	% Gravel
Lean Clay with Sand Yellowish Brown	A-7-6	CL	111	17.7	45	24	81.6	0.0

Project: Warrenton Data Center
Client:
Sample / Source B-15
Test Reference/No.: 1

Project No.: 01:31153
Depth (ft.): 1 - 6
Sample No.: D3S-187
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	14026 Thunderbolt Place Suite 100 Chantilly, VA 20151-3232	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

Determination of thermal properties using a thermal needle probe

Thermal Conductivity of Soil/Soft Rock ASTM D5334

Test Point	Moisture Content %	Corrected Conductivity									Average Conductivity	Average Resistivity
		1st Reading			2nd Reading			3rd Reading				
		K=W/mK	Error Value	Initial Temp	K=W/mK	Error Value	Initial Temp	K=W/mK	Error Value	Initial Temp	K=W/mK	Rho=°C·cm/W
Dry Point	0.39	0.450	0.0024	21.3	0.467	0.0042	20.8	0.476	0.0042	20.9	0.464	215.471
Moist Point 1	5.60	0.836	0.0017	21.6	0.849	0.0026	21.3	0.845	0.0018	21.1	0.843	118.624
Moist Point 2	10.30	1.238	0.0020	19.4	1.294	0.0016	19.3	1.283	0.0015	19.3	1.272	78.642
Moist Point 3	12.41	1.353	0.0012	19.2	1.382	0.0013	19.1	1.359	0.0011	19.1	1.365	73.286
Moist Point 4	14.36	1.593	0.0029	19.1	1.480	0.0012	19	1.485	0.0012	19	1.519	65.821
Moist Point 5	16.26	1.534	0.0015	18.9	1.516	0.0013	18.9	1.473	0.0010	18.8	1.508	66.332
Moist Point 6												
Moist Point 7												
Moist Point 8												
Moist Point 9												

K Material (Standard)	0.2730
K Measured	0.2980
Calibration Factor	0.9161

Volume of Mold (cf)	0.0333
Volume of Mold (M^3)	0.00094
Weight of Test Sample (lb)	3.888
Mass of Dry Soil (kg)	1.764

LL	39
PI	21
USCS Symbol	CL

Test Material screened with #4 sieve.

Needle Insertion Methoı Pre-drill

Test performed at: 95 % compactive effort @ blows per layer.

Project: Warrenton Data Center

Client:

Sample / Source: B-02

Project No.: 01:31153

Depth (ft.): 1 - 6

Sample No.: D3S-191

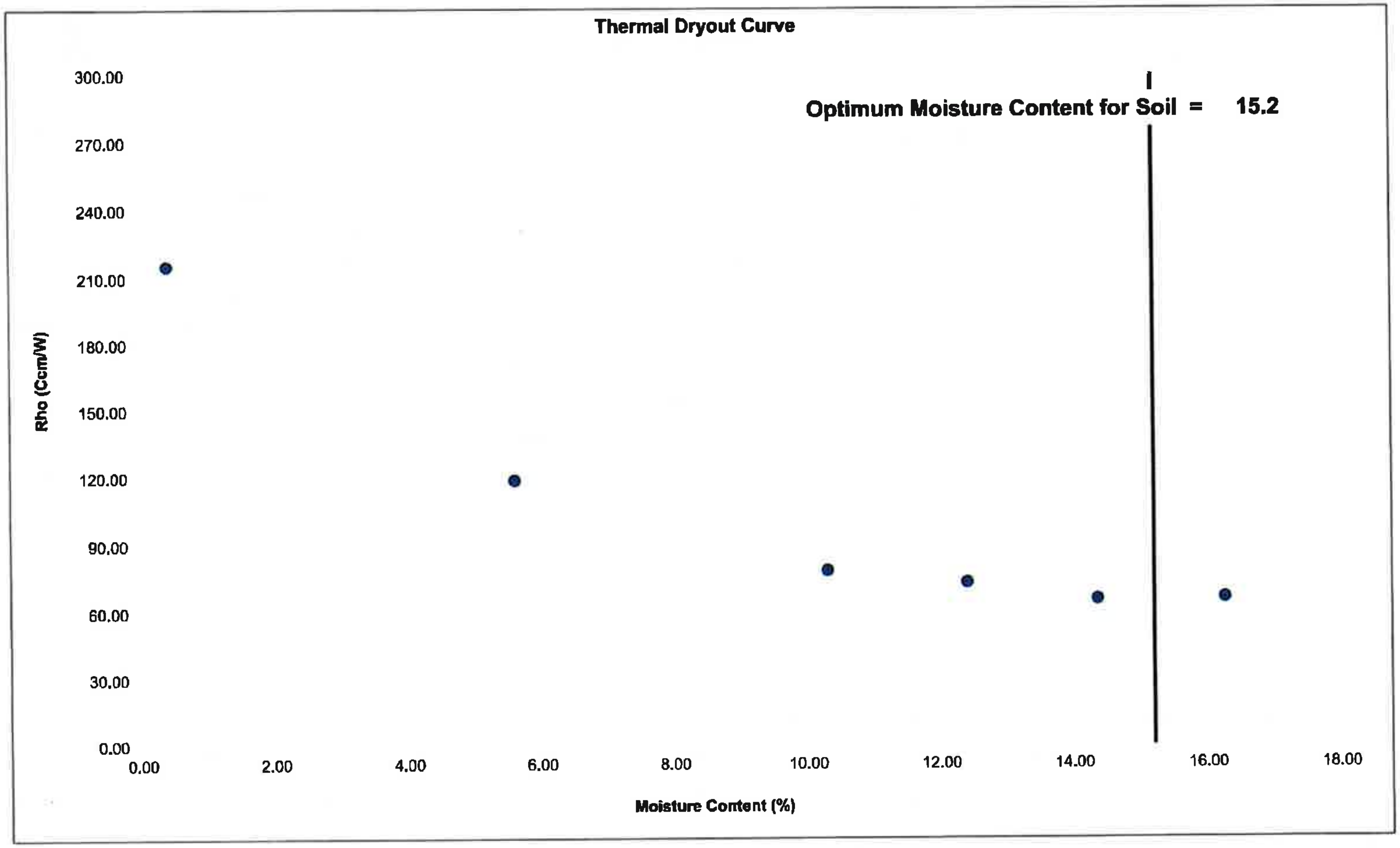
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	026 Thunderbolt Place Suite 100 Chantilly, VA 20151-32	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

Determination of thermal properties using a thermal needle probe

Thermal Conductivity of Soil/Soft Rock ASTM D5334



Project: Warrenton Data Center

Client:

Sample / Source: B-02

Project No.: 01:31153

Depth (ft.): 1 - 6

Sample No.: D3S-191

Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	026 Thunderbolt Place Suite 100 Chantilly, VA 20151-32	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Hiran	Dtran		

Determination of thermal properties using a thermal needle probe

Thermal Conductivity of Soil/Soft Rock ASTM D5334

Test Point	Moisture Content %	Corrected Conductivity									Average Conductivity	Average Resistivity
		1st Reading			2nd Reading			3rd Reading				
		K=W/mK	Error Value	Initial Temp	K=W/mK	Error Value	Initial Temp	K=W/mK	Error Value	Initial Temp	K=W/mK	Rho=°C-cm/W
Dry Point	0.00	0.548	0.0045	22	0.531	0.0030	20.8	0.535	0.0035	20.8	0.538	185.874
Moist Point 1	6.39	1.010	0.0012	20.8	1.058	0.0018	20.4	1.068	0.0019	20.4	1.045	95.668
Moist Point 2	13.78	1.625	0.0013	19.5	1.572	0.0014	19.5	1.580	0.0015	19.5	1.593	62.786
Moist Point 3	15.45	1.692	0.0032	18.8	1.692	0.0016	18.6	1.637	0.0012	18.6	1.674	59.751
Moist Point 4	17.15	1.909	0.0016	18.7	1.852	0.0016	18.7	1.772	0.0010	18.7	1.845	54.214
Moist Point 5	19.24	1.936	0.0013	18.7	1.895	0.0012	18.7	1.867	0.0011	18.7	1.899	52.648
Moist Point 6												
Moist Point 7												
Moist Point 8												
Moist Point 9												

K Material (Standard)	0.2730
K Measured	0.2980
Calibration Factor	0.9161

Volume of Mold (cf)	0.0333
Volume of Mold (M^3)	0.00094
Weight of Test Sample (lb)	3.573
Mass of Dry Soil (kg)	1.621

LL	37
PI	18
USCS Symbol	CL

Test Material screened with #4 sieve.

Needle Insertion Metho Pre-drill

Test performed at: 95 % compactive effort @ blows per layer.

Project: Warrenton Data Center

Client:

Sample / Source: B-07

Project No.: 01:31153

Depth (ft.): 1 - 6

Sample No.: D3S-193

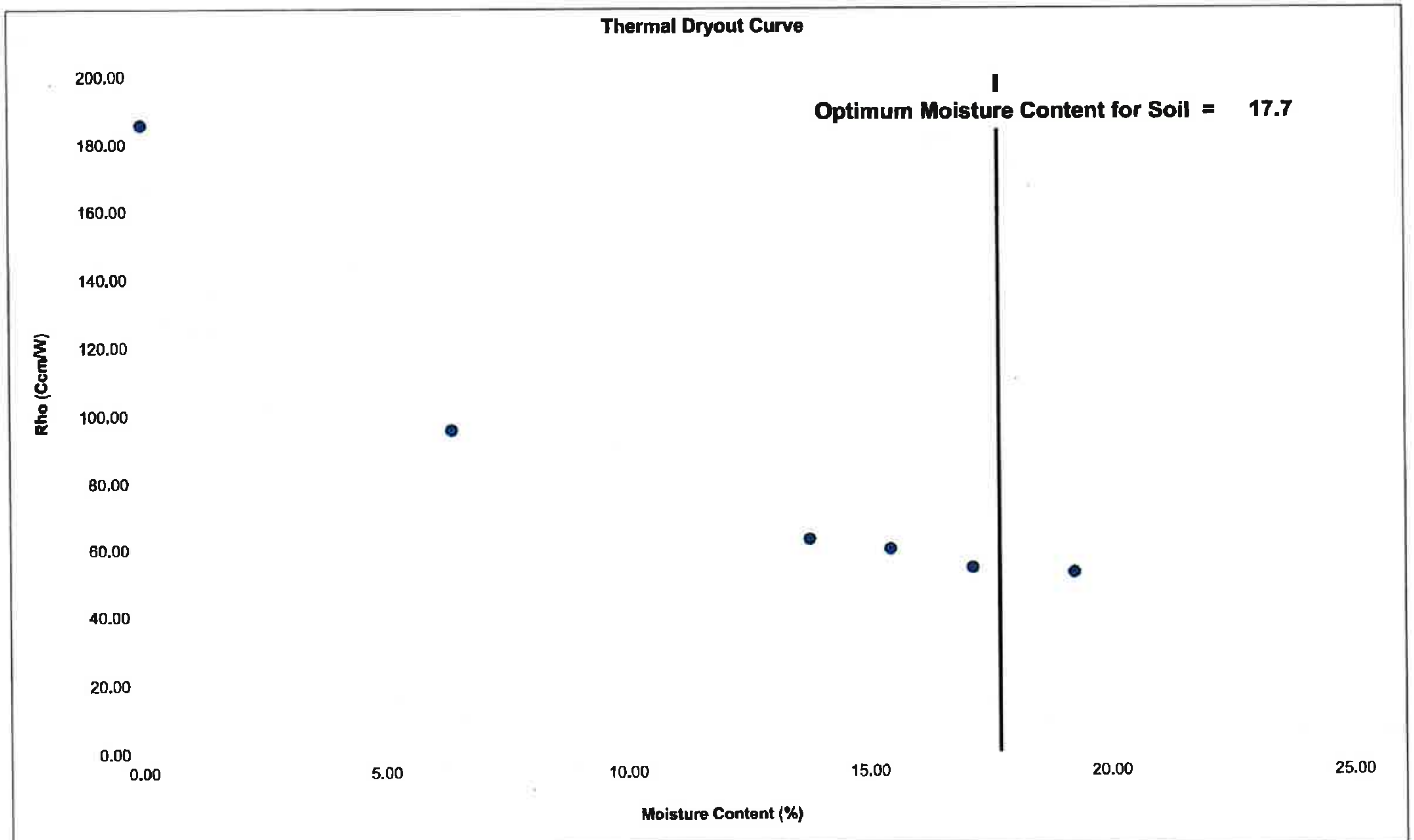
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	026 Thunderbolt Place Suite 100 Chantilly, VA 20151-32	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

Determination of thermal properties using a thermal needle probe

Thermal Conductivity of Soil/Soft Rock ASTM D5334


Thermal Dryout Curve

Project: Warrenton Data Center
Client:
Sample / Source: B-07

Project No.: 01:31153
Depth (ft.): 1 - 6
Sample No.: D3S-193
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	026 Thunderbolt Place Suite 100 Chantilly, VA 20151-32	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

Determination of thermal properties using a thermal needle probe

Thermal Conductivity of Soil/Soft Rock ASTM D5334

Test Point	Moisture Content %	Corrected Conductivity									Average Conductivity	Average Resistivity
		1st Reading			2nd Reading			3rd Reading				
		K=W/mK	Error Value	Initial Temp	K=W/mK	Error Value	Initial Temp	K=W/mK	Error Value	Initial Temp	K=W/mK	Rho=°C·cm/W
Dry Point	0.04	0.494	0.0025	22	0.485	0.0033	22	0.489	0.0050	21.8	0.490	204.274
Moist Point 1	6.58	0.919	0.0026	20.3	0.916	0.0018	20.3	0.895	0.0019	20.5	0.910	109.864
Moist Point 2	9.60	1.332	0.0015	19.6	1.322	0.0015	19.5	1.355	0.0018	19.7	1.337	74.812
Moist Point 3	11.77	1.471	0.0022	18.8	1.481	0.0031	18.9	1.471	0.0022	18.5	1.474	67.835
Moist Point 4	14.23	1.741	0.0018	18.5	1.723	0.0018	18.7	1.731	0.0020	18.6	1.732	57.749
Moist Point 5	16.89	1.837	0.0015	18.8	1.843	0.0015	18.6	1.838	0.0012	18.5	1.839	54.365
Moist Point 6												
Moist Point 7												
Moist Point 8												
Moist Point 9												

K Material (Standard)	0.2730
K Measured	0.2935
Calibration Factor	0.9302

Volume of Mold (cf)	0.0333
Volume of Mold (M^3)	0.00094
Weight of Test Sample (lb)	4.326
Mass of Dry Soil (kg)	1.962

LL	41
PI	14
USCS Symbol	ML

Test Material screened with #4 sieve.

Needle Insertion Methoi Pre-drill

Test performed at: 95 % compactive effort @ blows per layer.

Project: Warrenton Data Center

Client:

Sample / Source: B-11

Project No.: 01:31153

Depth (ft.): 1 - 6

Sample No.: D3S-194

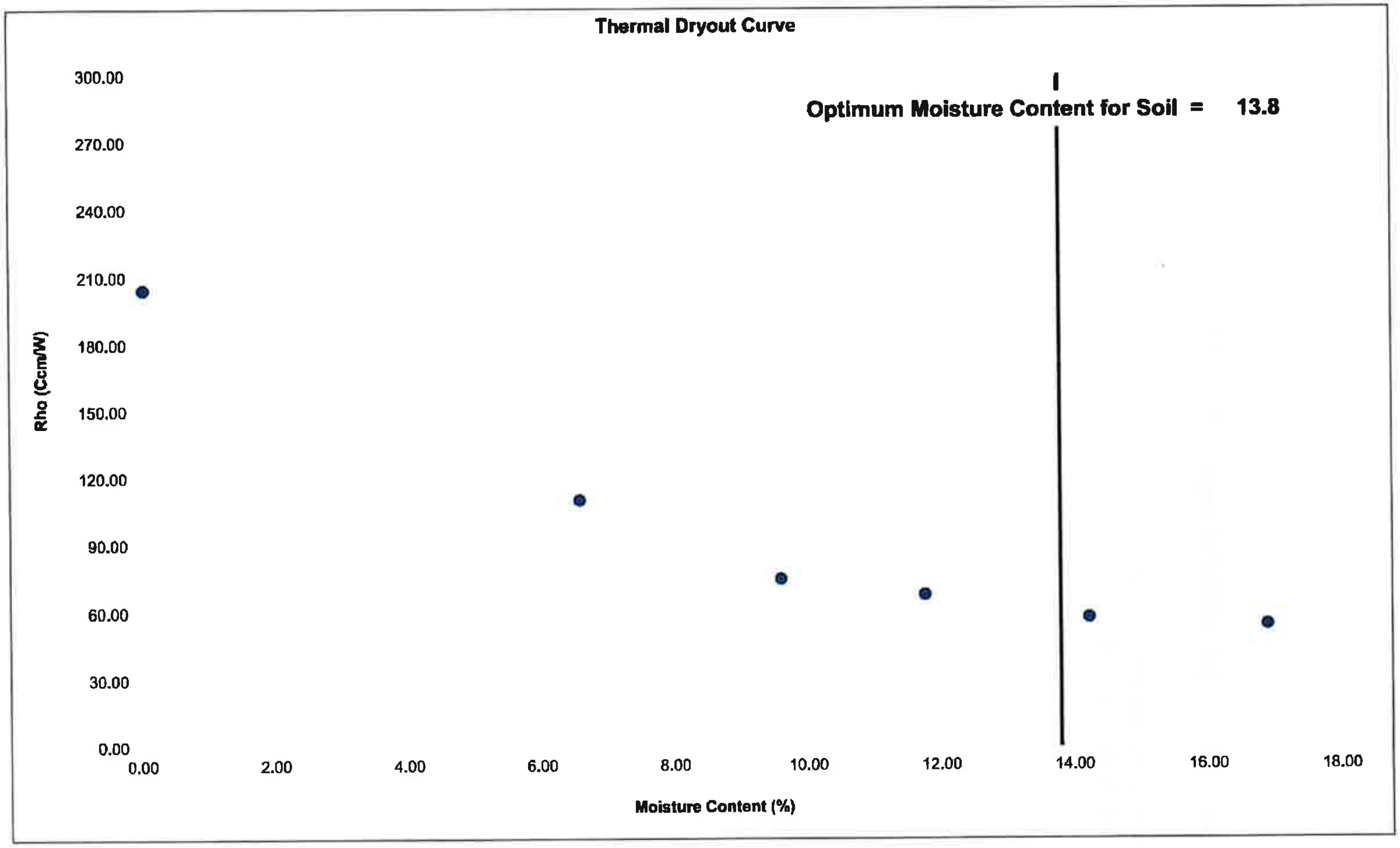
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	026 Thunderbolt Place Suite 100 Chantilly, VA 20151-32	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

Determination of thermal properties using a thermal needle probe

Thermal Conductivity of Soil/Soft Rock ASTM D5334



Project: Warrenton Data Center

Client:

Sample / Source: B-11

Project No.: 01:31153

Depth (ft.): 1 - 6

Sample No.: D3S-194

Date Reported:

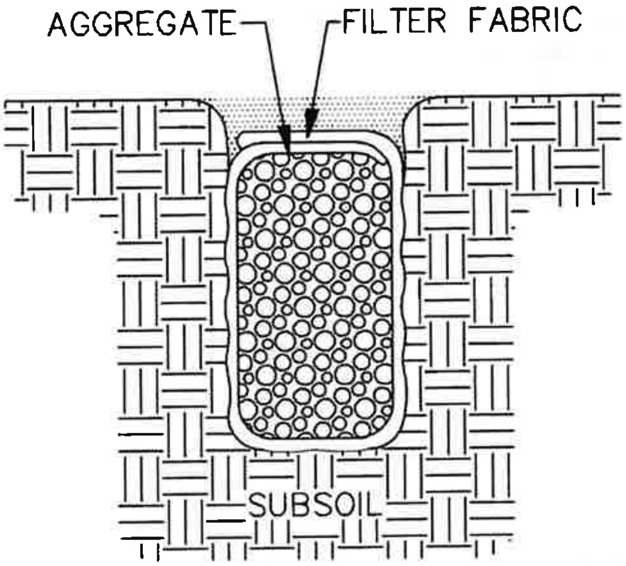
Office * Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Chantilly	026 Thunderbolt Place Suite 100 Chantilly, VA 20151-32	(703)471-8400 (703)834-5527

Tested by	Checked by	Approved by		Remarks
jvong	Htran	Dtran		

APPENDIX D – Supplemental Report Documents

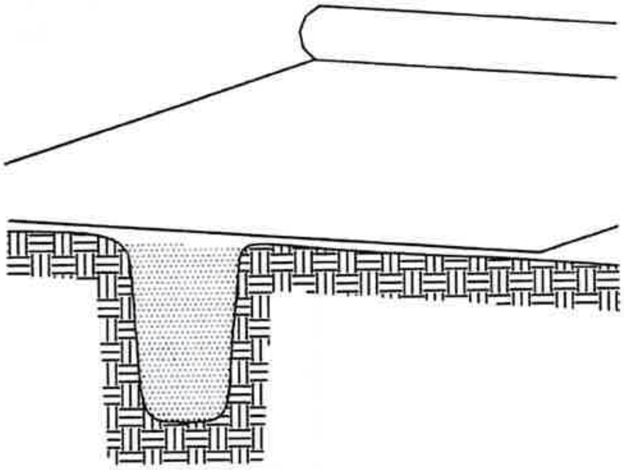
French Drain Installation Procedure
Zone of Influence Diagram

FINAL CONFIGURATION



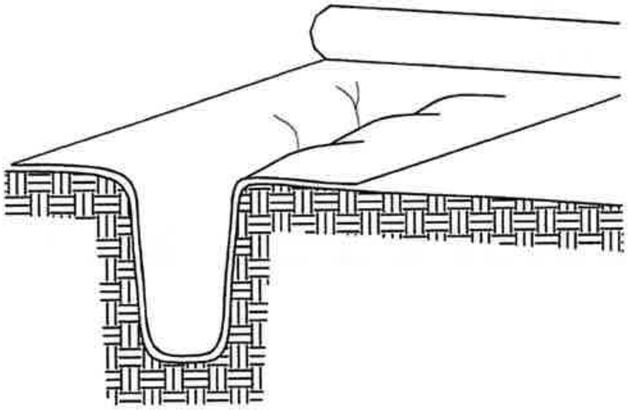
SUBDRAIN USING FILTER FABRIC

STEP 1



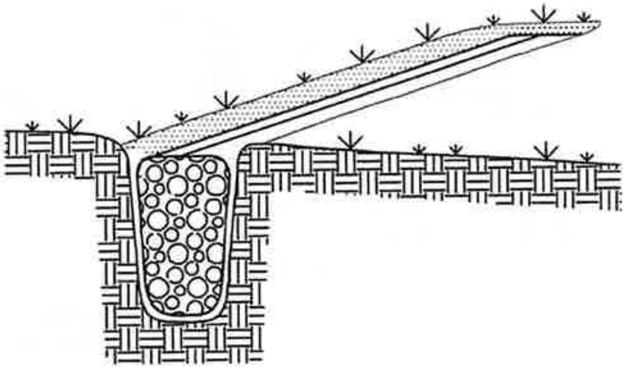
FABRIC IS UNROLLED
DIRECTLY OVER TRENCH

STEP 2



THE TRENCH IS FILLED
WITH AGGREGATE

STEP 3



THE FABRIC IS LAPPED CLOSED
AND COVERED WITH SOIL

ECS LLC
MID-ATLANTIC

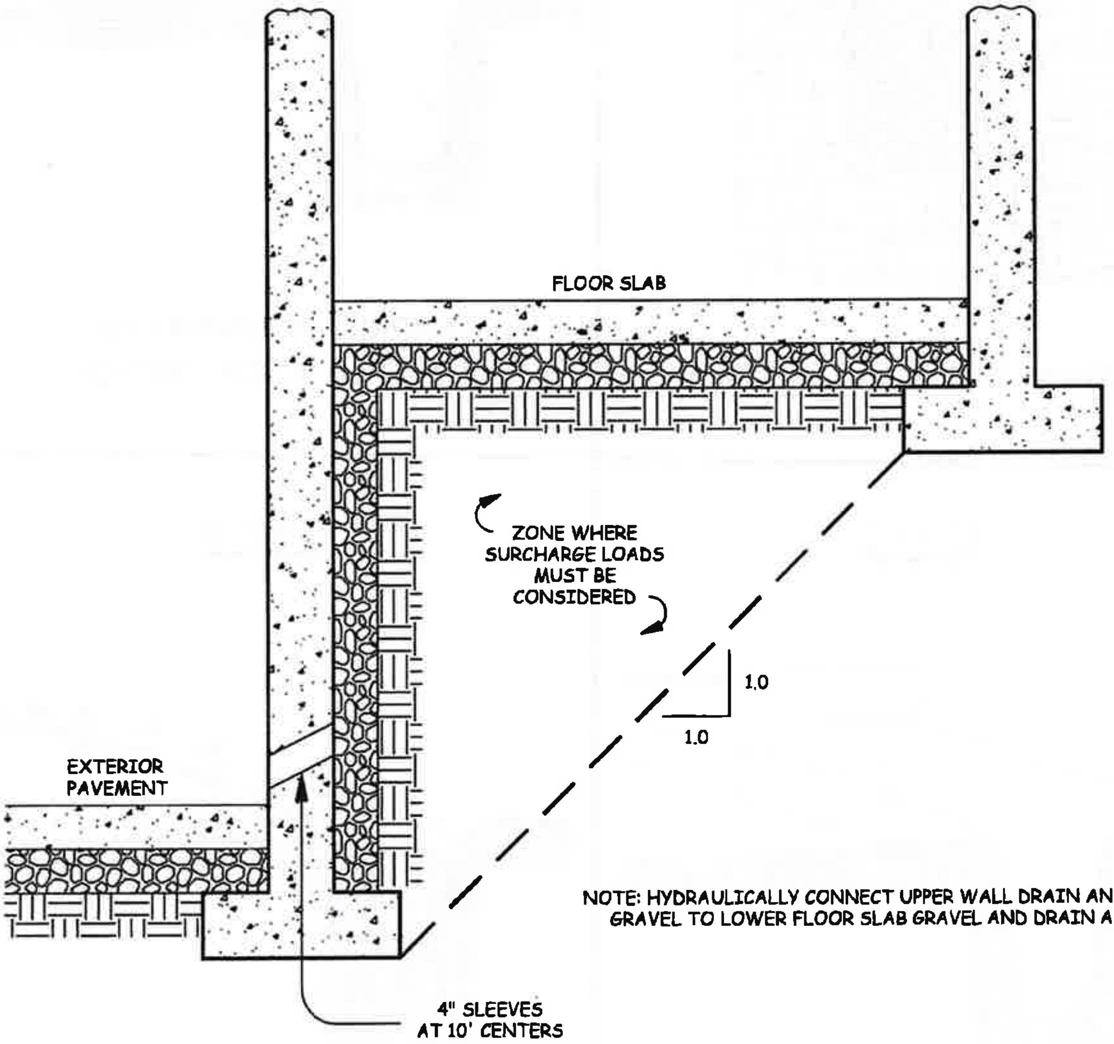
9409 Innovation Drive
Manassas, Virginia 20110
703-396-6259
Fax 703-396-6298

FRENCH DRAIN ©
INSTALLATION PROCEDURE

ZONE OF INFLUENCE DIAGRAM

(EXTERIOR WALLS)

NOT TO SCALE



NOTE: HYDRAULICALLY CONNECT UPPER WALL DRAIN AND UNDERSLAB GRAVEL TO LOWER FLOOR SLAB GRAVEL AND DRAIN AS SHOWN.

ECS LLC
MID-ATLANTIC