



ECS Mid-Atlantic, LLC

Geotechnical Engineering Report

Roanoke Gateway Project – Building 2 Additional Exploration

614 Bullitt Avenue
Roanoke, Virginia

ECS Project No. 12:20641

July 22, 2026

ECS MID-ATLANTIC, LLC
Geotechnical • Construction Materials • Environmental • Facilities

July 22, 2026

Ms. Denise Fazio
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175 Admiral Cochrane Drive
Annapolis, Maryland 21401

ECS Project No. 12:20641-B

Reference: Geotechnical Engineering Report
Roanoke Gateway Project – Building 2 Additional Exploration
614 Bullitt Avenue
Roanoke, Virginia

Dear Ms. Fazio:

ECS Mid-Atlantic, LLC (ECS) has completed the additional subsurface exploration, geophysical testing, laboratory testing, and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our agreed to scope of work. This report presents our understanding of the geotechnical aspects of the project along with the results of the field exploration and laboratory testing conducted, and our design and construction recommendations. The purpose of this exploration was to further explore the karst conditions within the proposed Building 2 footprint and to recommend potential remediation methods.

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

Respectfully submitted,

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EXECUTIVE SUMMARY

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

- The soils encountered at the site generally consisted of CLAYEY GRAVEL (GC), LEAN CLAY (CL), FAT CLAY (CH), SILT (ML), and WEATHERED ROCK (WR) materials. Although not specifically identified in our borings, existing fill and disturbed surficial soils should be expected due to previous residential structures that were located in the area. Epikarst material was identified in Borings B- 02, B-04 and B-21. These very soft materials were identified at depths ranging from 13 to 44.5 feet below existing grades. Evidence of a decreasing strength profile, characteristic of epikarst conditions, was also encountered in Boring B-23 and B-24, though not as severe as in the previously mentioned test locations.

- Due to the inverted strength profile directly over rock, which is indicative of karst conditions, an Electrical Resistivity Imaging (ERI) study was performed. The ERI profile assisted in better characterizing location of underlying rock, wet soil and deeper slots within the rock that contains soft epikarst soil. Generally, the study displayed the potential softer areas to be localized to the central portion of the Building 2 footprint along with an erratic bedrock surface including pinnacles. **If karst features such as voids or sinkholes are encountered during construction, ECS should be notified as further evaluation may be needed in order to address said karst concerns.**

- In order to reduce the risk of excessive settlement due to soft/variable epikarst conditions at depth, a ground improvement method could be considered for the site such as a partial undercut and geogrid reinforced mat (GRM) for the building foundation areas. This remediation would present a lower risk to the owner. **If the design team/owner proceed with traditional shallow foundation construction without remediation, they should accept at least some risk of differential settlement due to variable karst conditions.** The GRM remediation option is further elaborated on in Section 4.3 Foundations of this report.

- Fills of up to 10 feet are required on the southwest central portion of the development area where the Terrace Elevation steps up to the 1st Floor Elevation. Settlement calculations conducted in this area indicate settlements over 1 inch will be induced by the mass fill placement. **We recommend the fill material be placed in advance of any structural elements to pre-load the underlying subgrade. Preliminarily, we recommend a hold period be implemented after mass fill placement to allow settlements to occur prior to construction of structural elements on site. A minimum hold period of 4 weeks should be built into the schedule.** As an alternative to a hold period/preload, a light weight backfill material could be utilized such as Aero Aggregate or Geofoam. If the design team would prefer to utilize a light weight select backfill material, ECS can provide revised lateral earth pressure recommendations and re-assess settlements based on the system selected.

- Based on the depth of the very soft material, the relatively light loads, and considering completion of the settlement during the monitoring period, the building may be supported by conventional shallow foundations consisting of column and/or continuous strip footings bearing on approved subgrades, designed for a net allowable soil bearing pressure of 2,000 psf. Some undercuts below the GRM should be expected, particularly near boring B-24.

- Shallow rock was encountered at the site, including an observed rock outcrop along the northern boundary of the site. The depth of the rock is highly variable but was observed as shallow as EL. 944 feet. Difficulty installing foundations (area of B-01) and utilities depending on location should be expected. The excavation of weathered rock and rock can have a substantial impact on the cost and schedule of the proposed construction.

1.0 INTRODUCTION

The purpose of this study was to further assess the potential karst conditions encountered within the proposed Building 2 footprint from our original exploration (ECS Project 12:20641) and to provide geotechnical information for the design and construction of the multi-family building and associated infrastructure. Designers should reference our April 16, 2026 Geotechnical Report for information pertaining to Building 1 and 3 Areas. The focus of this report is on the Building 2 Area only.

Our services were provided in accordance with our Proposal No. 16605-RP, dated July 24, 2025, as authorized by W. Andrew Hanson on July 29, 2025, which includes our Terms and Conditions of Service. A Change Order was also prepared entitled "Change Order No. 1 – Addition Drilling Exploration", dated January 13, 2026, and was authorized by W. Andrew Hanson on February 10, 2026.

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

The report includes the following items:

- A brief review and description of our field and laboratory test procedures and the results of testing conducted
- A review of surface topographical features and site conditions
- A review of area and site geologic conditions
- A review of subsurface soil/rock stratigraphy with pertinent physical properties
- Final soil exploration/test boring logs
- Results of electrical resistivity survey
- Recommendations for site preparation and construction of compacted fills, including an evaluation of on-site soils for use as compacted fills and identification of potentially unsuitable soils and/or soils exhibiting excessive moisture at the time of sampling
- Recommended foundation type
- Recommendations for design of slabs on grade and construction.
- Recommended lateral earth pressures for below-grade building walls.
- Recommendations for seismic site classification in accordance with the Virginia Construction Code (VCC) 2021 and ASCE 7-22.
- An evaluation of soil and rock excavation issues
- Recommended karst remediation methods
- Recommendations for additional testing and/or consultation that might be required to complete the geotechnical assessment and related engineering for this project.

The recommendations contained herein were developed from the data obtained in the soil test borings and the electrical resistivity survey, which indicate subsurface conditions at these specific locations at the time of exploration. Soil conditions may vary between the soil test borings. If during construction, variations appear evident; the Geotechnical Engineer should be informed so that the conditions can be reviewed and addressed.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION/CURRENT SITE USE/PAST SITE USE

The site is located at 614 Bullitt Avenue within the corporate city limits of Roanoke, Virginia. At the time of our visit, the ground surface over the site was maintained grass. Mature trees border portions of the site and exposed surficial sand/gravel was identified in isolated areas. The overall site is bounded to north by Jamison Avenue SE, to the east by 8th Street, to the south by Bullitt Avenue, and to the west by 7th Street.



Figure 2.1.1. Site Location

Based on our review of historical imagery, there appeared to be previous residential structures within the Building 2 footprint. These structures were demolished between March 1995 and December 2002.

During our site reconnaissance, we observed an area with surficial sand within the footprint of Building 2. The surficial sand area was located close to the southwest corner of the proposed building footprint. An existing utility, presumably a sanitary/sewage line, bisects Building 2 as well. It is unknown if the utility was active at the time of our exploration. Below are images of the surficial debris and sand noted above that were encountered during our site visit:



Figure 2.1.2. Sand area located at southwest corner of Building 2 footprint.

Rock outcrops were observed within the footprint of Building 2 near B-02, indicating shallow rock will likely be encountered in these areas during grading operations. Below are images of the rock outcrops encountered during our field operations:



Figure 2.1.3. Rock outcrop located along ERI Line 2 near boring B-20.

It is not known whether any of the previous residential structures had below grade levels. Existing fill was not observed during visual classification of the samples recovered from drilling. Although not specifically identified in our borings, existing fill and disturbed surficial soils should be expected. Additionally, conditions on site may vary in unexplored areas. The image below depicts the residential structures that were previously present on site and demolished at some point between 1995 and 2002 based on publicly available aerial imagery:



Figure 2.1.4 Aerial Imagery of the Project Site in 1995 (Source: *Historicalaerials.com*)

Based on our site visit and review of the grading plan we were provided that depicts existing grades, the site grades down to the north and northwest with elevations ranging from approximately EL. +946 feet to EL. +962 feet.

2.2 PROPOSED CONSTRUCTION

The following information explains our understanding of the planned development.

Table 2.2.1 Proposed Construction Properties

SUBJECT	DESIGN INFORMATION / ASSUMPTIONS
Usage	Multi-Family Residential with below grade areas
Framing	Wood Framed above grade, concrete walls below grade
Column Loads*	12 kips maximum
Wall Loads*	6 kips per linear foot (klf) maximum
Proposed Grading	Maximum Cut: 3 feet Maximum Fill: 10 feet

* Loads are based on the values provided by Liz Chapman with Grimm and Parker Architects via email on February 3, 2026. If final design loads exceed these loads, this report needs to be revised to update our foundation recommendations, bearing capacity, and settlement calculations.

Based on the existing grades, Building 2 will have a split where portions of the structure will have a lower (walk-out) elevation on the north/west side and a higher first floor on the south/east side of the building. This will create below grade walls within the center of the building in some areas. To reduce exterior grading, the exterior foundations of the structure will follow existing grades creating extended foundation walls in some areas.

Table 2.2.2 Building Characteristics

STRUCTURE	# STORIES	BELOW GRADE WALLS	FINISHED FLOOR ELEVATION
Building 2	4	Interior Wall at split Elevations, and Exterior Foundation Walls to existing grades	Terrace EL. +950 ft 1st Floor EL. +960 ft

The location and depth of utilities was not known at the time of this report. Site retaining walls and stormwater management were not depicted on the provided plan and are not included in this scope.

Driving entrances to the building will be off of 7th and 8th Streets. Parking spaces will be located on the south side of Building 2. Based on information provided by Balzer & Associates (Westwood), dated January 17, 2025 entitled, "*Traffic Narrative for Roanoke Gateway*," we anticipate that Maximum Vehicle Daily Traffic (VDT) for the entire development area (all 3 buildings) will be 146 vehicles. A total of 55 parking spaces are planned directly adjacent the Building 2 development area, with more parking available to the east of Building 3 and north of Building 1.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

Our exploration procedures are explained in greater detail in Appendix B including the inserts titled Subsurface Exploration Procedures and Reference Notes for Electrical Resistivity Imaging (ERI) Surveys. Our scope of work included performing two (2) Electrical Resistivity Imaging (ERI) alignments within the Building 2 footprint and drilling fourteen (14) Standard Penetration Test (SPT) soil borings and six (6) offset borings. It should be noted that Borings B-01 through B-05 and P-04 through P-06 were performed during our original scope of work and were drilled in December 2025. Borings B-19 through B-25 were performed in a supplemental phase of drilling performed in March 2026.

Our borings and ERI endpoints were located with a handheld GPS unit while referencing Google Earth aerial imaging and existing site features. The approximate locations are shown on the Boring Location Diagram in Appendix A.

3.1 SITE GEOLOGY

Based on our review of the “Geology of the Roanoke and Stewartsville Quadrangles, Virginia” (Virginia Division of Mineral Resources, 1981), the project site is located within Virginia’s Blue Ridge Physiographic and Geologic Province.

Specifically, the project site is mapped to be underlain by the Rome Formation (€R). The Rome Formation primarily consists of shale and siltstone with carbonate rock intervals up to approximately 50 feet thick. The carbonate rock formations located in this area typically consist of limestone and dolomite.

The boundary between soil and rock is not sharply defined. A transitional zone termed "weathered rock" is normally found overlying the parent bedrock. Weathered Rock (WR) is defined, for engineering purposes, as residual material with Standard Penetration resistance equal to or greater than 60 blows per foot (bpf). Because weathering is facilitated by fractures, joints, and the presence of less resistant rock types, the profile of the WR and hard rock is typically irregular and erratic, even over short horizontal distances. Also, it is not unusual to find lenses and natural floating boulders of hard rock in zones of WR within the soil mantle, well above the general bedrock level. In carbonate rock formations, the transition between soil and rock can be abrupt with little to no weathered rock zone.

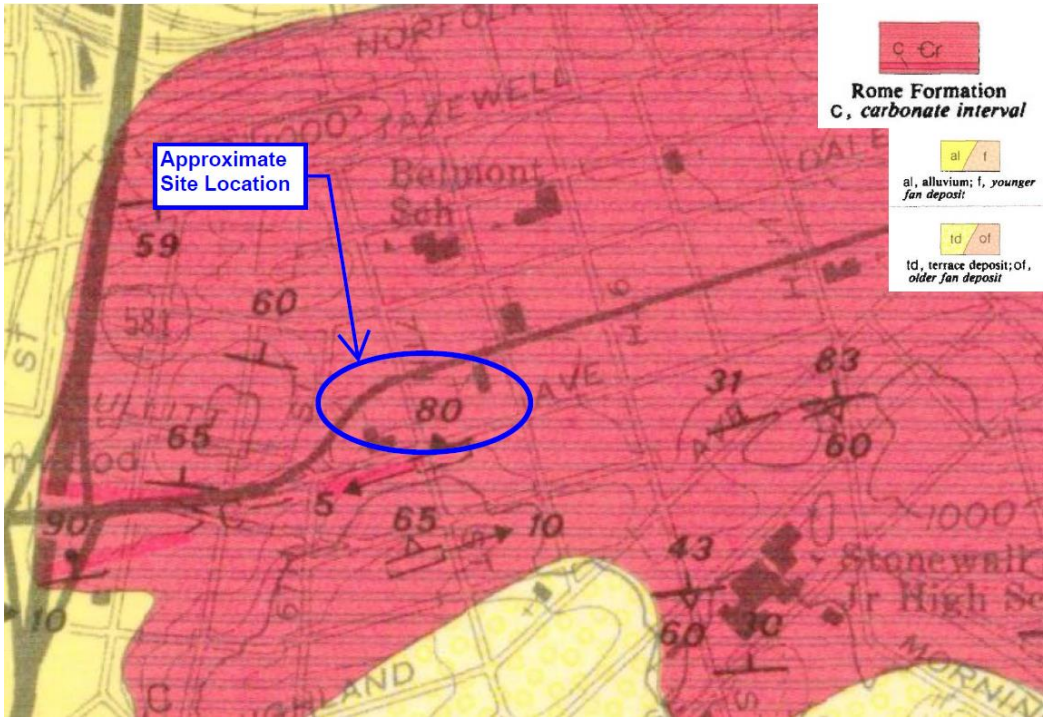


Figure 3.1.1 Site Geology Mapping "Geology of the Roanoke and Stewartsville Quadrangles, Virginia"

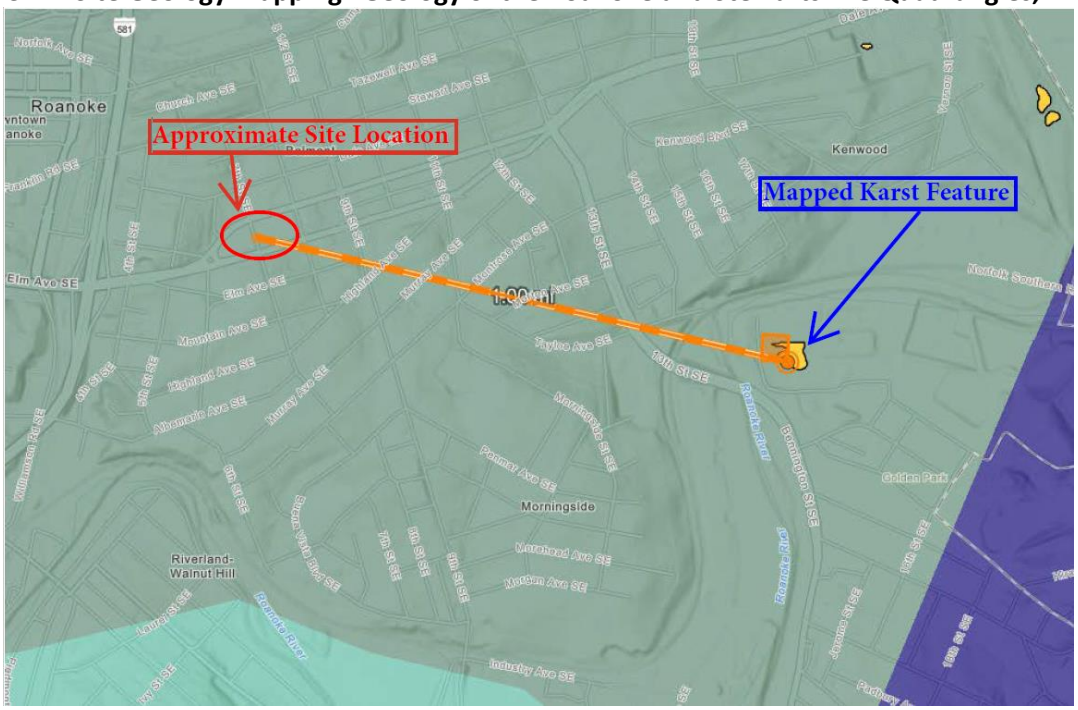


Figure 3.1.2 Site Karst Feature Mapping "Virginia Department of Energy Division of Geology and Mineral Resources"

3.2 SUBSURFACE CHARACTERIZATION

The subsurface conditions encountered were generally consistent with published geological mapping. The following sections provide generalized characterizations of the soil strata. Please note that the ground surface elevations were not surveyed by a licensed surveyor; these elevations are approximate based on the grading plan provided to us by you entitled *Roanoke Gateway* prepared by Balzer & Associates dated January 17, 2025; therefore, elevation ranges are approximate +/- 1 foot. When shallow refusal was encountered, the boring was offset. Please refer to the boring logs in Appendix B for detailed information.

Table 3.2.1 Subsurface Characterization

Approximate Depth (ft)	Stratum	Description	Borings Encountered In	Ranges of SPT(1) N-values (bpf)
0-0.7 (Surface cover)	N/A	Topsoil (2 to 8 inches)	All Borings	N/A
0-45	I - Residuum	Residuum, Lean Clay (CL); Fat Clay (CH); Silty Sand (SM); Silt (ML); Well-Graded Gravel (GW); Clayey Gravel (GC); Silty Gravel (GM)	All Borings	4 to 60
13-44.5	II - Epikarst	Epikarst, (Borings B-02 and B-21) Lean Clay (CL); Fat Clay (CH); Clayey Gravel (GC)	B-02, B-04, B-21 Slight evidence in B-23 and B-24	WOH to 4
3-45	III – Weathered Rock	Weathered Rock Sampled as Gravelly Fat Clay With Sand (WR); Well-Graded Gravel With Sand (WR); Clayey Gravel (WR)	B-02, B-05, B-19, B-20, B-20A, B-21, B-22, B-24, P-03, and P-06	60+

Notes:
(1) Standard Penetration Testing

Although not identified in any of the Building 2 borings, based on the existing pavements and utilities, and the previous structures, Existing Fill should be anticipated in other areas on the site. The surface materials should be expected to be disturbed due to shallow grading, however, where existing utilities are located, fill soil should be anticipated above the utility in a 1H:1V “V” shape from the utility to the ground surface.

Epikarst materials are typically very soft, saturated zones infilling valleys within the calcareous bedrock formation overlying karst/sinkhole features within the parent bedrock geology (Bakalowicz, 2019)[1]. This is a key indicator of the carbonate rock dissolution process of the underlying bedrock in karst environments. Regional geology supports the presence of epikarst/karst formations. The characteristic nature of these materials are high natural moisture contents/percent saturation, very soft consistency and very loose density, presence of perched water conditions, and interbedded layers of weathered/dissolution rock materials within the soil matrix. Borings B-02, B-04 and B-21 reflected probable epikarst materials as shallow as elevation EL +938 feet. Borings B-23 and B-24 encountered some evidence of a decreasing strength profile but did not have as severe of conditions as observed in other locations.

[1] Bakalowicz, M. (2019). Chapter 45: Epikarst. In Encyclopedia of caves. Academic Press. Retrieved from https://catalog.lib.ncsu.edu/catalog/NCSU4706096. P. 394-398

Auger refusal materials are indicators of very hard or very dense zones unable to be advanced by the drilling equipment. These are typical indicators of top of rock, boulders, and/or very hard lenses. A detail illustrating the typical geology of this region is included in Appendix D. Auger refusal was encountered in the following locations:

Boring	Approximate Depth to Auger Refusal (ft)	Approximate Elevation of Auger Refusal (ft)
B-01	3.0	942.0
B-01A	7.2	937.8
B-01B	3.1	941.9
B-02	38.3	910.7
B-19	20.5	925.5
B-20	5.5	941.5
B-20A	18.6	928.4
B-21	45.0	904.0
B-24	17.0	937.0
B-24A	10.0	944.0
B-24B	15.5	938.5

A graphical presentation of the subsurface conditions is shown on the Subsurface Cross Section Diagrams included in Appendix A.

3.3 GROUNDWATER OBSERVATIONS

Water levels were measured in our borings during drilling and at completion of drilling. In auger drilling operations, water is not introduced into the boreholes, and the groundwater position can often be determined by observing water flowing into or out of the boreholes. Furthermore, visual observation of the soil samples recovered during the auger drilling exploration can often be used in evaluating the groundwater conditions. The table below lists the borings in which groundwater was encountered along with their respective depths and elevations:

Boring	Approximate Depth Groundwater Encountered (ft)	Approximate Elevation Groundwater Encountered (ft)
B-02	30	920
B-21	23.5	925.5
B-23	28.5	921.5
B-24	6	948
B-25	23.5	926.5

A static groundwater level was not observed in the other borings; however, the soils were wet in some areas. It should be expected that elevated moisture and/or perched water will be located above very dense materials, auger refusal and cohesive soils. The upper soils at the site should be expected to be on the wet side of optimum.

Variations in the long-term water table may occur as a result of changes in precipitation, evaporation, surface water runoff, construction activities, and other factors.

> **"**Perched water is typically of limited quantity, replenished or recharged very slowly. When encountered in an excavation, perched water will typically drain off very quickly, with limited continuous flow or bleeding, unless a source of recharge, such as a leaking utility is present."
> From: *Construction Dewatering and Groundwater Control – New Methods and Applications, 3rd Addition*

A water table aquifer is distinguished from a perched groundwater table based on the water table aquifer's recharge ability, which may be limitless but can be lowered temporarily through adequate dewatering techniques such as deep wells and well points. Perched groundwater is often alleviated in excavations by pumping from sump pits and French drains.

The highest groundwater observations are normally encountered in the late winter and early spring. Therefore, earthwork operations in the winter and spring are more likely to encounter difficulties with perched conditions than those operations undertaken in the summer or fall.

3.4 LABORATORY TESTING

The laboratory testing consisted of selected tests performed on samples obtained during our field exploration operations. Classification and index property tests were performed on representative soil samples. The laboratory testing program included natural moisture content tests (ASTM D2216), grain size analyses tests (ASTM D6913), Atterberg Limits tests (ASTM D4318), and an Unconfined Compressive Strength test (VTM 140). The results of all laboratory testing conducted are included in Appendix C of this report.

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

3.5 ELECTRICAL RESISTIVITY IMAGING (ERI)

ECS performed the Electrical Resistivity Imaging (ERI) survey at the subject site on February 27, 2026. At the time of our visit, the ground surface over the site was primarily maintained grass. The ERI survey consisted of two (2) lines, designated as Line 1 and Line 2. ERI Line 1 was extended ±550 feet generally southwest to northeast, Line 2 was extended ±550 feet west to east through boring B-02. The ERI line locations were selected by ECS personnel considering the epikarst material observed in B-02. Borings B- 19 through B-25 were located following the ERI testing to try to identify extents of the epikarst conditions.

Line end points were recorded in the field using a handheld Trimble Global Positioning System (GPS). The GPS unit used for the ERI line layout can locate horizontal positions to sub-meter accuracy; therefore, we consider the ERI line locations in the field to be within about ±3 feet of the locations indicated on the diagrams included in **Appendix A** of this report.

The ERI survey was conducted using an Advanced Geosciences, Inc. (AGI) SuperSting™ R8/IP (SuperSting) Electrical Resistivity Meter with 56-channel capability. The survey used a constant electrode spacing of 10 feet. This resistivity array allowed for the collection of high-resolution subsurface resistivity data consisting of one data point every 5 feet horizontally and 3 feet vertically within the top ±30 feet with a slight linear decrease in resolution with depth beyond about ±30 feet. Please see "Reference Notes for Electrical Resistivity Imaging (ERI) Surveys" in the attachments for details regarding ERI data collection, processing, and interpretation.

ERI General Interpretations

The inverted ERI cross-sections for the two (2) ERI transects are included in Appendix B. The figures contain color-contoured cross-section resistivity images of the modeled resistivity for the ERI alignments. In general, the data was modeled and inverted multiple times per model unit the root mean square (RMS) error of the inversion was less than 5 percent, and as per the manufacturer's recommendations.

Low resistivity zones in the subsurface are indicated by modeled responses generally less than approximately 125 Ohm-meters. These zones of low resistivity on the ERI cross-sections may indicate the presence of moist to wet soils. Modeled responses of approximately 50 Ohm-meters or less typically indicate saturated residual soils. In the context of karst formations, these low resistivity zones indicate the potential for highly fractured rock with significant water content that could suggest soil and water filled voids in the rock or subsidence pathways. Additionally, comparatively saturated sections of weathered rock materials are often modeled as low resistivity zones, particularly when imaged at depth. Low resistivity zones would appear as various shades of blue in the ERI profiles in the Appendix.

Moderate resistivity zones are indicated by modeled resistivity responses generally between approximately 125-400 Ohm-meters. Moderate resistivities are modeled as light blue to green. Zones of moderate resistivity on the ERI cross-sections may indicate the presence of moist silty soils, sandy soils, soils containing gravel or cobbles, dry soils and weathered rock materials at varying moisture contents. These zones may be associated with denser residual soils or drier desiccated soils near the surface.

High resistivity zones, indicated by modeled resistivity responses 400 to $\leq$ 1,3250 Ohm-meters, often indicate weathered to unweathered bedrock, very dry sands, or lenses of cobbles or boulders or layers of drier/more dense soils. High resistivity areas are modeled as yellow to red on our selected color scale. Zones of high resistivity were encountered in the ERI transects at depths ranging from the ground surface to ±50 feet below the existing ground surface. The depth to intact bedrock at sites underlain by limestone and dolostone rock may be extremely variable, and boulders, pinnacles, and deeper weathered zones (solution enhanced discontinuities), are common. Areas were observed to have high modeled resistivities values which could correspond to dense rock or air-filled voids or caves. Please note that due to the nature of ERI data processing, data collection and extrapolation, features often are observed to be somewhat larger than the actual in situ condition. Additionally, these features may also indicate significant mineralogic and/or weathering differences between the rock surrounding these highly resistive features.

However, in this geologic environment, a void is a potential interpretation for these highly resistive areas, though based on our experience it is unlikely. Based on the resistivity values encountered, such features were interpreted as rock pinnacles/float boulders and are noted as such on our ERI profiles.

General: The ERI profiles depict a relatively typical limestone bedrock surface where shallow bedrock in some areas and deeper in other often surrounded by more deeply weathered zones.

ECS observed low resistivity zones at various locations relatively near surface, which could be an indication of moist/wet soils and/or karst risk. A deeper low resistivity zone was observed along Line 2 between B-19 and B-20 which could be an indication of groundwater and/or a karst receptor/fracture zone. A very high resistivity zone was also encountered along Line 2 between Borings B-01 and B-19 which could indicate very dense rock or an air-filled void. Based on the conditions encountered onsite, we have interpreted this area as a possible rock pinnacle/boulder. Additionally, it is possible that karst hazards are present at the site in areas that were not explored by ECS.
The karst risk interpretations and conclusions are based on the results of a geophysical (ERI) survey and borings, performed in the immediate vicinity of the site. These interpretations and conclusions may be used for site planning and construction and may also be used to satisfy the geophysical requirements. These results include modeling of non-unique geophysical (earth resistivity) anomalies within the site boundaries. Invasive subsurface exploration was not performed at the site in order to explore any potential modeled features. No warranty or guarantee, either written or implied, applies to our interpretations or conclusions.

4.0 DESIGN RECOMMENDATIONS

4.1 KARST RISK COMMENTARY

Based on our site reconnaissance, karst features were not observed at the surface of the site or in close vicinity of the proposed development. However, the site is mapped to be underlain by geologic parent rock which is known to be carbonate in nature. There are mapped karst features within one mile of the site as seen on **Figure 3.1.2**.

The subsurface conditions encountered in the soil test borings consist of residual soils of varying strength and moisture, as well as an erratic karst bedrock surface. The soil strength profiles encountered in the borings, particularly B-02, B-04, and B-21, decrease with depth. Borings B-02 and B-21 encountered Weight of Hammer (WOH) material from approximately 23 to 40 feet below ground surface before hitting auger refusal at 38 and 45 feet, respectively, below existing grade. Boring B-04 encountered a thinner zone of soft material ranging from about 13 to 17 feet below existing site grades. Slight evidence of a decreasing strength profile was also observed in borings B-23 and B-24. These conditions are indicative of the presence of epikarst material.

General Karst: The local geology includes carbonate rock which is prone to karst activity. As carbonate rock dissolves, the soluble minerals are carried away by the groundwater, leaving behind the insoluble materials (clay minerals and silicates). The process reduces hard rock into soft soil with the consistency of soft paste. The rate of rock solutioning is rapid relative to geologic time (where processes are generally measured in tens of thousands to millions of years), but very slow on a human time scale.

Rock solutioning occurs primarily from the surface downward, along the surfaces of fissures (joints, bedding planes, and fracture zones) in the bedrock. The rock fissures are enlarged, creating soil-filled troughs and channels, surrounded by hard rock. The soil filling is often eroded by flowing groundwater and the troughs and channels become open cavities. These cavities can develop and become interconnected to form caves, which in turn, become open conduits for groundwater flow and sediment transport.

As a cavity in the bedrock grows and expands, the tensile stresses in the roof of the cavity increase, and occasionally the roof will spall slabs of rock as the cavity grows upward toward the ground surface. When a cavity in the rock grows to the point that the roof of rock is too thin or weak to span the void and support the overburden, the cavity can collapse and form a depression or sinkhole at the ground surface. This type of sinkhole development is relatively rare because it is a slow process in terms of human time.

The more common mechanism for sinkhole development is through the erosion of soil overburden into cavities in the underlying bedrock. This erosion starts at the soil-rock interface over an opening in the bedrock. As soil is carried into the opening by percolating groundwater, a cavity is formed in the soil. This cavity grows as the result of raveling of soils from the roof, and can eventually collapse, propagating to the surface and causing a sinkhole. Factors that can contribute to or cause such a collapse include: soil overburden weight, new structural loads, vibrations, construction equipment weight, changes in groundwater levels, and changes to surface water infiltration patterns.

Subsurface soil erosion is aggravated by, among others, the following hydrologic factors: increasing the infiltration of water at the ground surface; lowering of the groundwater level so as to increase the vertical flow gradient and erosion potential at the critical rock-soil interface; and alternately, draining and saturating the soil at the critical rock-soil interface by repeatedly fluctuating the groundwater level from above to below the surface.

Based on observations of soil borings with soil strength profiles which decrease with depth, and ERI results, as well as our experience working in karst terrain, it is our opinion that the potential for future karst-related activity on this site is **moderate to high**. The existing probable karst features present on this site do not exhibit conditions which indicate severe openings or caverns; however, soft wet soils are present above abrupt auger refusal conditions at several locations onsite. In addition, the ERI profiles indicated features such as pinnacles and float boulders which are indicative of a karst geology. Possible fracture zones were also noted. This formation indicates some risk of karst activity including the risk of potential collapse and/or subsidence, especially if loading or site grading were to exceed our understanding of planned development.

As the apparent karst feature(s) were observed within the proposed building footprint, we recommend a ground improvement solution for the site. The final soil overburden depths in this area post development and project loads should be reviewed. Possible remediation in this area during construction, including the potential need for injection grouting, should be anticipated.

Based on our experience, the subject site will be vulnerable to sinkhole development during the actual site grading and foundations phases of construction, when drainage control is typically poor and the critical rock/soil interface may be exposed to water intrusion/flooding from precipitation. Please review **Section 5.5 Karst Construction** of this report for best practices when working in this geologic environment.

As noted, there is a moderate to high risk of karst activity at the site based on the geologic setting and evidence from our subsurface exploration activities. However, such karst activity is typically manageable by implementing the recommendations provided in this report. Elimination of all risk is not possible, although use of deep foundations extended to stable rock would reduce the risk to building foundations. The following recommendation details our recommendations for foundations.

4.2 FILL SETTLEMENT MONITORING

Our borings show that the WOH material and low consistency epikarst conditions were seen in borings localized primarily on the central portion of the building footprint. These soft materials were encountered at depths ranging from 13 to 44.5 feet below ground surface, based on borings B-02, B-04 and B-21, but may vary in unexplored areas.

Fills of up to 10 feet are required on the southwest central portion of the development area where the Terrace Elevation steps up to the 1st Floor Elevation. Settlement calculations conducted in this area indicate settlements over 1 inch will be induced by the mass fill placement. We recommend the fill material be placed in advance of any structural elements to pre-load the underlying subgrade. Preliminarily, we recommend a hold period be implemented after mass fill placement to allow settlements to occur prior to construction of structural elements on site.

As an alternative to a hold period/preload, a light weight backfill material could be utilized such as Aero Aggregate or Geofoam. If the design team would prefer to utilize a light weight select backfill material, ECS can provide revised lateral earth pressure recommendations and re-assess settlements based on the system selected.

We recommend the fill material be placed as a pre-load in the central area of the site in advance of any structural elements. Due to the magnitude of fill placement, it is recommended to perform settlement monitoring following placement of the fills to confirm the fill has stopped settling.

Accordingly, it would be prudent to place the deeper fills as early as possible in the site development phase so that any residual, fill-induced settlement can occur without major impacts to the construction schedules. Typically, the fill-induced settlement rates are highest during the fill placement and begin to taper off shortly after ceasing any fill placement. Construction can begin when subsequent readings indicate settlement of the fill has ceased.

ECS recommend that the settlement plates be placed 3 feet below finished grade for ease of removal and construction. Refer to the Settlement Plate Detail provided in Appendix D. Elevations of a selected point on the steel rod exposed above top of fill should be measured and recorded by a license surveyor and sent to ECS for review every two weeks. A minimum of two settlement plates should be installed in the central area of the site where the 10 feet of filling is planned.

4.3 FOUNDATIONS

As mentioned previously, our borings show that the WOH material and low consistency epikarst conditions were seen in borings localized primarily on the central portion of the building footprint.

Generally, the epikarst materials appear to be below the zone of influence of the building foundations based on provided loading conditions and our subsurface findings. Conventional settlement assessments, with the data collected, indicate total and differential settlement magnitudes within typical industry limit, provided the hold period described above is implemented. However, due to the onsite karst risk, we recommend ground improvement remediation methods be considered onsite to reduce the risk of differential settlement within the proposed structure. These methods are further discussed below.

4.3.1 Geogrid Reinforced Mats

Although our analyses show that at our boring locations total and differential settlements are within typical industry tolerance limits, based on the variable soil characteristics across the site, we recommend the design team consider ground improvement methods to reduce the risk of differential settlement. The main area of concern is the vicinity around borings B-02, B-04, B-21, and B-24 where soft soils and/or epikarst are near the foundation and/or the zone of influence. Ground improvement through the use of a Geogrid Reinforced Mats (GRM) onsite should be considered. **If the design team/owner proceed with traditional shallow foundation construction without remediation, they should accept at least some risk of differential settlement due to potential variable soil conditions.** Detailed recommendations for the GRM option are provided below:

1) A 2-foot thick GRM should be provided below the building footings. The excavation should extend 1 foot on either side of the foundation.
2) The exposed undercut surface should be carefully reviewed by the geotechnical engineer to identify any exposed soft conditions. Undercuts near B-24 should be anticipated. Additional undercut should be performed at the direction of the geotechnical engineer's representative.
3) Following observation of acceptable conditions for the subgrade preparation, a 6-inch layer of VDOT No. 21-A/B aggregate should be placed and compacted in accordance with the density and moisture requirements of the geotechnical report.
4) A first layer of biaxial geogrid reinforcing such as Tensar TX-130 or its equivalent should be placed taut across the initial layer of compacted aggregate. All geogrid should be lapped at edges by 1 feet.
5) After placement of the initial (first) geogrid layer, two additional 6-inch layers (second and third) of VDOT No. 21-A aggregate should be placed and compacted.
6) A second layer of geogrid should be placed with laps as noted above after the two second and third aggregate lifts.
7) Then the final lift of compacted aggregate should be placed to the design bearing elevation.
8) The Geogrid Reinforced Mat elevations should be adequately controlled such that footing excavations do NOT remove aggregate.

4.3.2 Building 2 Foundations

Provided subgrades and Structural Fills are prepared as recommended in this report, the proposed Building 2 can be supported by shallow foundations including continuous wall footings and any possible column footings. We recommend the foundation design use the following parameters:

Design Parameter	Column Footing	Wall Footing
Net Allowable Bearing Pressure(1)	2,000 psf	2,000 psf
Acceptable Bearing Soil Material	Stratum I, III, Approved Structural Fill, or Modified Ground	Stratum I, III, Approved Structural Fill, or Modified Ground
Minimum Width	36 inches	24 inches
Minimum Interior Footing Embedment Depth (below slab or finished grade) (2)	24 inches	24 inches
Minimum Exterior Footing Depth (below final exterior grade)(2)	30 inches	30 inches
Estimated Total Settlement (3)	On the order of 1- inch	On the order of 1- inch
Estimated Differential Settlement (4)	On the order of ¾ inches between columns	On the order of ¾ inches over 30 feet

Notes:

(1) Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.
(2) For bearing considerations, frost penetration requirements or expansive soil concerns.
(3) Based on provided 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.

Shallow Rock: Early auger refusal was encountered in the northwest and central area of Building 2. Based on the first floor elevation, excavation at this area to reach the subgrade and foundation bearing elevations may be difficult. In addition, excavation for the slab and foundation for the interior below grade wall on the eastern part of the building may also be difficult. The contractor should review the boring logs carefully and be prepared for hard excavation techniques.

The rock is likely to be seamy, with abrupt transitions between soil-supported and rock-supported footings. In such instances, it is recommended to perform isolated undercuts along the footing to reduce the potential for excessive differential settlement across relatively short horizontal distances. Where footings transition from soil-support to rock-support and the length of the rock seam is greater than 4 feet, we recommend that the rock be removed to a depth of 12 inches for a length of 10 feet from the soil/rock interface and be replaced with compacted soil. Removal of additional rock to allow for the installation of a GRM layer is not recommended.

In instances where the rock pinnacle extends for a distance of less than 4 feet along the trench, the rock pinnacle should be removed to a depth of 12 inches below the design bearing level and replaced with compacted soil. Please refer to the Bedrock Pinnacle Undercut Detail in Appendix D for a graphical representation. **If karst features such as voids or sinkholes are encountered during construction, ECS should be notified as further evaluation may be needed in order to address said karst concerns.**

Potential Undercuts: Most of the soils at the foundation bearing elevation are anticipated to be suitable for support of the proposed structure. If soft or unsuitable soils are observed at the footing bearing elevations, the unsuitable soils should be undercut to firm materials. ECS anticipates such materials may be encountered at bearing grades near Boring B-24. Any undercut should be backfilled with compacted dense graded aggregate (VDOT No. 21-A) up to the original design bottom of footing elevation; the original footing shall be constructed at the designed footing elevations.

If shallow foundations are subject to lateral loading, the following engineering parameters can be utilized:

SOIL PARAMETER	ESTIMATED VALUE
Coefficient of Passive Earth Pressure (K_p)	2.66
Soil Moist Unit Weight (γ)	110 pcf
Cohesion (C)	0 psf
Interface Friction Angle [Concrete on Soil] (ϕ_f)	18°
Sliding Friction Coefficient [Concrete on Soil] (μ)	0.32
Passive equivalent fluid pressure	200H (psf)*

*The passive equivalent pressure has been reduced since the amount of movement required for full mobilization is not likely.

4.4 SLABS ON GRADE

Provided subgrades and structural fills are prepared as discussed herein, the proposed floor slabs for Building 2 can be constructed as Ground Supported Slabs (or Slab-On-Grade). It appears that the slabs will bear on newly compacted fill or Stratum I. The following graphic depicts our soil-supported slab recommendations:

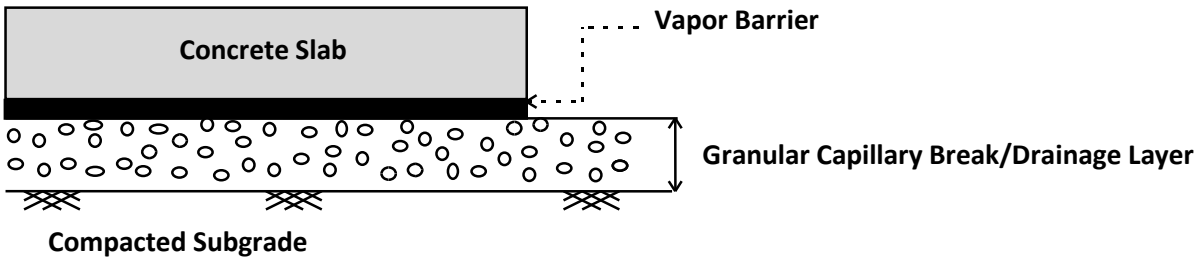


Figure 4.4.1

1. Drainage Layer Thickness: 4 inches
2. Drainage Layer Material: VDOT 21A/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.

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 125 pci (lbs./cu. inch). The modulus of subgrade reaction value is based on a 1 foot by 1 foot plate load test basis.

Vapor Barrier: Before the placement of concrete, a vapor barrier may be placed on top of the granular drainage layer to provide additional protection against moisture penetration through the floor slab. When a vapor barrier is used, special attention should be given to surface curing of the slab to reduce the potential for uneven drying, curling and/or cracking of the slab. Depending on proposed flooring material types, the structural engineer and/or the architect may choose to eliminate the vapor barrier.

Rock Above Design Bearing Elevation: We recommend that sufficient rock be removed to allow placement of the entire drainage layer. This will serve to cushion the slab and reduce the potential for point loads and subsequent cracking of the concrete. In such cases, additional overexcavation of rock should be considered to allow installation of underslab utilities.

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.

4.5 BELOW GRADE WALLS

Below grade interior walls (at split elevations) and exterior foundations walls are planned in the design. We recommend that below grade walls be designed to withstand at-rest lateral earth pressures and surcharge loads from adjacent building foundations and slabs. These recommendations apply to a "drained" condition which is where there is drainage material behind below grade walls that prevents hydrostatic water pressures on the back of the below grade wall.

To accomplish a drained condition, drainage materials such as a free draining gravel, geocomposite drainage panels, and weep holes should be used. The geocomposite and weepholes are primarily for the construction phase of development. This system should consist of weepholes through the wall and/or a 4-inch perforated closed joint drain line located along the backside of the walls above the top of the footing. The drain line should be surrounded by a minimum of 6 inches of VDOT #57 stone wrapped with an approved non-woven geotextile, such as Mirafi 140-N or equivalent. The drains should daylight or be connected to a sump pump that directs water away from the structure.

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

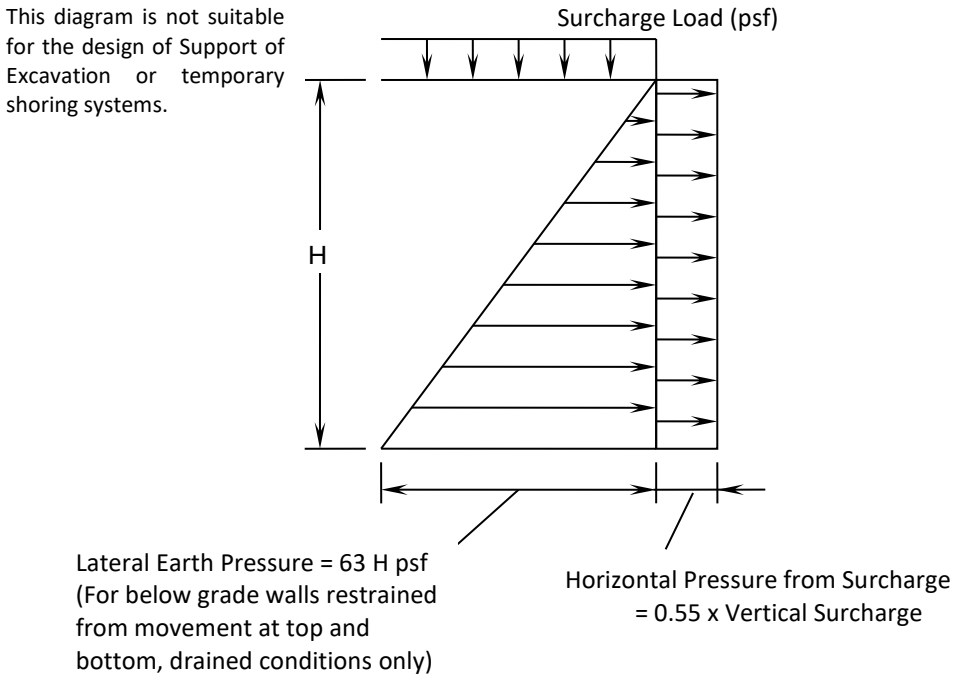


Figure 4.5.1

Surcharge loads imposed within a 45 degree slope from the base of the restrained wall should be considered in the below grade wall design. These surcharge loads should be based on an at-rest pressure coefficient, k_0, of 0.55. Care should be used to avoid the operation of heavy equipment to compact the wall backfill since it may overload and damage the wall; in addition, such loads are not typically considered in the design of below grade walls.

4.6 SEISMIC DESIGN CONSIDERATIONS

The Commonwealth of Virginia has adopted Virginia Construction Code 2021 (VCC) via the Virginia Uniform Statewide Building Code (USBC). The current version of VCC incorporates ASCE 7-22, Minimum Design Loads and Associated Criteria for Building and Other Structures into the building code. This adoption supersedes section 16 of IBC 2021, in respect to seismic site classification.

ASCE 7-22, Chapter 20 has updated the procedure for determining Site Classification. This chapter requires that site classification be conducted based on the average shear wave velocity of the top 100 feet of the site. The shear wave velocity can either be measured or estimated based on established correlations. If site classification is based on estimated values of shear wave velocity (v_s) the site class shall be derived using V_s, $V_s/1.3$ and $V_s(1.3)$. The seismic site class definitions for the weighted average shear wave velocities in the upper 100 feet of the soil profile are presented in Chapter 20 of ASCE 7-22 and in the table below.

SEISMIC SITE CLASSIFICATION		
Site Class	**Soil Profile Name**	**Shear Wave Velocity, Vs, (ft./s)**
A	Hard Rock	Vs > 5,000 ft./s
B	Rock	>3,000 to 5,000 ft./s
BC	Soft Rock	>2,100 to 3,000 ft./s
C	Very Dense Sand or Hard Clay	>1,450 to 2,100 ft./s
CD	Dense Sand or Very Stiff Clay	>1,000 to 1,450 ft./s
D	Medium Dense Sand or Stiff Clay	>700 to 1,000 ft./s
DE	Loose Sand or Medium Stiff Clay	>500 to 700 ft./s
E	Very Loose Sand or Soft Clay	Vs < 500 ft./s

For this project, shear wave velocity of the soil profile was estimated based on the soil densities observed. Based upon our estimate and assumed proposed bearing elevations of the structures we recommend that a **Site Classification D** be used for the design of the structures. This Site Classification is based on a Risk Category of III for the building. This recommendation is in accordance with the procedure outlined in ASCE 7-22.

4.7 PAVEMENTS

Subgrade Characteristics: Based on the results of our borings, it appears that the pavement subgrades in cuts will consist mainly of CLAYEY GRAVEL (GC), LEAN CLAY (CL), POORLY GRADED GRAVEL (GP), and WEATHERED ROCK (WR) material. We anticipate pavement subgrades in fill areas will consist of similar materials from on-site cuts or import material.

California Bearing Ratio (CBR) testing was performed on soil from boring P-05 and P-03. The soils classified as Lean Sandy CLAY (CL) and demonstrated CBR values of 2.9 and 5.0 at approximately 98 and 100% compaction, respectively. Maximum swell was 1.40%. For design purposes, we recommend a design CBR value of 3, approximately two-thirds of the average laboratory value and compact the top 12-inches of pavement subgrade to 100 % of the maximum dry density

Traffic Loading Information: We were provided with traffic loading information by Chris Burns with Westwood via email on January 28, 2026. Based on the information provided, we have utilized 500 ADT for our pavement design with the assumption of no more than 5% trucks. Should traffic loading differ from the data noted, ECS should be contacted to revise our pavement design.

Pavement Design Recommendations: Our pavement design was performed in general accordance with the *VDOT Pavement Design Guide for Subdivision and Secondary Roads in Virginia*. The preliminary pavement sections below are minimum sections. The civil engineer should review potential traffic and contact ECS should the loading be higher.

MATERIAL	FLEXIBLE PAVEMENT	RIGID PAVEMENT
Portland Cement Concrete (f'_c = 4000 psi)	-	6 in
Asphaltic Concrete Surface Course (SM-12.5)	1.5 in	-
Asphaltic Concrete Base Course (BM-25.0)	3.0 in	-
Graded Aggregate Base Course (AASHTO #21A/21B)	8.0 in	6 in
Pavement Thickness	12.5 in	12 in

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

Large, front loading trash dumpsters frequently impose concentrated front wheel loads on pavements during loading. This type of loading typically results in rutting of asphalt pavement and ultimately pavement failures. For preliminary design purposes, we recommend that the pavement in trash pickup areas consist of the heavy duty rigid pavement.

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

Pavement Drainage/Subdrainage: The pavement sections should be designed to mitigate the potential for "bath tub" effects from differential pavement thicknesses. Drainage mechanisms consisting of edge drains should be incorporated into the design to facilitate positive subbase drainage. The onsite ML and CL materials are sensitive to moisture fluctuations and have poor drainage characteristics that can degrade subgrade support over time. Once parking areas and drive lanes have been established to subgrade elevations, it is important to proceed with the placement of all roadway design elements in a timely manner. Where standing water develops, either on the pavement surface or within the base course layer, softening of the subgrades and other problems related to the deterioration of the pavement can be expected. Curbs should be backfilled as soon as possible to reduce the infiltration of water the pavement subbase and soil subgrade.

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 SUBGRADE PREPARATION

5.1.1 Demolition

All existing structures (including all above and below-ground construction) within these areas to be developed should be removed prior to the initiation of new construction. The area of sand and possible fill at the southwest area of the building appeared to be an excavation backfilled with sandy material.

The demolition debris from the existing structures should be completely removed from the site. Removal should include all concrete, asphalt/gravel, underground pipes, tanks, drain fields and utilities at the site that might interfere with the new construction. For all excavations resulting from the removal of abandoned utilities, provisions should be made in the construction specifications and budget to restore the subgrade to a stable condition with properly compacted Structural Fill. Restoration should include backfilling and compaction of the excavated areas. Abandoning and grouting of utilities is not recommended.

5.1.2 Stripping and Grubbing

The subgrade preparation should consist of stripping all vegetation, rootmat, topsoil, existing fill, existing asphalt, subbase materials, and any soft or unsuitable materials from the 5-foot expanded building and pavement limits. Stripping limits should be extended an additional foot for each foot of fill required to reach the design subgrade elevation.

5.1.3 Proofrolling

Prior to fill placement or other construction on subgrades, the subgrades should be evaluated by a representative of ECS. 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.

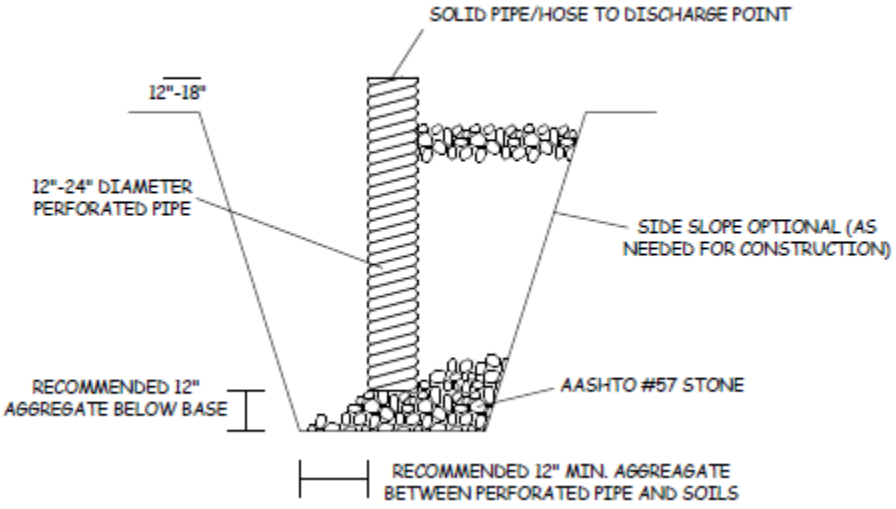
Where proofrolling identifies areas that are unstable or “pumping” subgrade in those areas should be repaired prior to the placement of any subsequent Structural Fill or other construction materials. Methods of stabilization include undercutting, moisture conditioning, or chemical stabilization. The 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.

5.1.4 French Drains & Groundwater Control

We do expect perched water to be encountered over cohesive soil, at the interface of any existing fill and natural soil and over very dense materials.

In perched water conditions, French drains may be required in order to facilitate the placement of new controlled fill. The drains will redirect the water and provide a capillary break that will allow the placement and compaction of new soil over the area. The drains should be extended downstream to daylight away from the construction area, at a stormwater management facility, or to a storm drain.

Conditions in the field at the time of excavation and fill placement will dictate the actual location of any drains. The drain should be carefully marked so that the end is not covered up or blocked during the construction phase or thereafter.



Sump Pit/Pump Diagram

A typical French drain consists of an 24-inch wide by 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. See French Drain Detail in Appendix D for more information.

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 Existing Man-Placed Fill

Although not encountered in our borings, based on the previous developments at the site, Existing Fill soils may be encountered at the site in unexplored areas, and at the sandy area previously identified. The fill may be surficial from shallow surficial grading or backfill for existing utilities or basements of previous residential structures. If materials that appear to be Existing Fill are identified, they should be completely undercut and removed during grading operations as they are not suitable for reuse as structural fill.

5.2.2 High Plasticity Soils

High plasticity soils are those materials classified as FAT CLAY (CH). High plasticity soils were encountered in many of the borings at variable depths. Where high plasticity soils are encountered at design subgrade elevations in slab and pavement areas, the subgrade should be undercut 2 feet and grades restored with approved low plasticity Structural Fill.

5.2.3 Weathered Rock and Rock

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

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

In mass excavations for general site work, overburden soils with standard penetration test N-values of 40 bpf or less can usually be removed with conventional earth excavation equipment. Residual soils or soft weathered (Saprolitic) rock with N-values of 40 to 50 bpf can generally be removed with conventional earth moving equipment after first being loosened with a large single-tooth ripper attached to a large crawler tractor. Harder, less weathered rock will generally require the use of a large single-tooth ripper, dozers, and/or track-mounted backhoes for excavation. However, materials exhibiting N-values of 50 blows or greater for 6 inches of penetration will be more difficult to excavate and generally require hoe ramming, blasting or other rock excavation techniques. The actual excavatability of the bedrock material will be greatly controlled by in-situ jointing and bedding and the type of excavating equipment utilized. The contractor should review the borings and be prepared with appropriate equipment for material removal.

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

We advise ensuring that any blasting performed adheres to local jurisdictions and regulations as the karst conditions encountered within Building 2 may inhibit blasting operations.

5.2.4 Structural Fill

Prior to placement of Structural Fill, representative bulk samples (about 50 pounds) of on-site and/or off-site borrow should be submitted to ECS for laboratory testing, which will typically include Atterberg limits, natural moisture content, grain-size distribution, and moisture-density relationships (i.e., Proctors) for compaction.

Import materials should be tested prior to being hauled to the site to determine if they meet project specifications. Alternatively, Proctor data from other accredited laboratories can be submitted if the test results are within the last 90 days.

Satisfactory Structural Fill Materials: Materials satisfactory for use as Structural Fill should consist of inorganic soils having a USCS classification of CL, ML, SC, SM or more granular free of debris, cobbles or rock fragments greater than 4 inches in diameter. Low plasticity soils consisting of ML or more granular should be used behind below grade walls.

Since import materials are being paid for, we recommend that these materials consist of SM or more granular when possible and have liquid limits and plasticity indices less than 40 and 20, respectively. The onsite and import materials should have the following characteristics and compaction:

STRUCTURAL FILL INDEX PROPERTIES	
Subject	**Property**
Building and Pavement Areas (Borrow Soils)	LL < 40, PI<20
Building and Pavement Areas (On-site Soils)	LL < 50, PI < 25
Max. Particle Size	4 inches

STRUCTURAL FILL COMPACTION REQUIREMENTS	
Subject	**Requirement**
Compaction Standard	Standard Proctor, ASTM D698 or VTM-1
Required Compaction	General: 95% of Max. Dry Density Top 12-inches of Pavement Subgrades: 100% of Max Dry Density
Moisture Content	+/-3 % points of the soil's optimum value
Loose Thickness	8 inches prior to compaction

On-Site Borrow Suitability: Onsite soils that meet the definition of Satisfactory Structural Fill are present on the site. These occur mostly at relatively shallow depth below the surface where residual soils are most weathered. It should be expected that the onsite materials will have moisture above optimum and will be moisture sensitive. Onsite materials from cut or taken from utility excavations should be anticipated to be wet of optimum and require drying.

Drying can be achieved by mechanical discing or chemical drying. Depending on the time of year, mechanical drying may not be practical. Chemical drying can be performed using quicklime or Calciment. Typically, 2 to 3% quicklime by dry weight is suitable for drying purposes. A higher percentage will be required using Calciment.

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.

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 5.1.3 Proofrolling**.

5.4 UTILITY INSTALLATIONS

Utility Subgrades: The soils encountered in our exploration are expected to be generally suitable for support of utility pipes with the exception of the central area around Building 2 where materials become soft and wet with depth. The location and inverts of utility structures were not known. 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 additional pipe stone bedding material.

Shallow weathered rock and auger refusals were encountered on the site. The locations and inverts of proposed utilities were unknown at the time of this report. Depending on the location and depth of utilities, difficult excavation may be encountered. The contractor should review the borings and the proposed utility locations carefully and be prepared for difficult excavation.

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

Excavation Safety: 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.

5.5 KARST CONSIDERATIONS

Although sinkholes stem from geologic conditions within the underlying rock that have developed over significant time periods, they are often triggered by present day changes in the surface and subsurface drainage patterns. In order to reduce the potential for future sinkhole development which could impact the performance of foundations and other development infrastructure, positive surface drainage should be maintained both during and after construction. We recommend that the following preventative measures be followed (where practical) to reduce the potential inducement of sinkhole formation in proposed development areas.

1. All earthwork operations should be graded to drain away from the ground disturbance areas at all times. Upon completion of daily earthwork operations, the ground surface should be sealed by thorough rolling with a smooth-drum roller to facilitate runoff and reduce infiltration of precipitation.
2. Backfill of grading excavations should be performed in lifts that are compacted to minimize settlement. The top two feet of structural backfill should be low permeability material (CL or ML) and should be compacted to at least 95% of the maximum dry density as determined using ASTM D-698 or VTM-1. This will help to minimize the amount of water that can percolate into the subsurface.
3. During construction, care should be taken to reduce the ponding of surface water.
4. Visual observations during all earthwork operations should be carried out in order to detect any previous unexposed or recently created karst features. Any such feature should be called to the Geotechnical Engineer's attention for remedial improvement.
5. All storm piping should be designed such that joints and structure tie-ins remain watertight with allowance for some settlement. Leaking storm pipes promote subsurface seepage and can instigate sinkhole development in the form of surficial dropouts with little or no warning.

It should be noted that these recommendations are provided on an "as practical" basis. We understand that it is not always cost effective to implement all of the recommendations contained herein. ECS would be happy to discuss the contents of this with you in person should you desire.

Although not anticipated, in the event that a karst feature, such as a soft soil zone or void, is encountered during construction, ECS should be contacted so that our personnel can visit the site and evaluate the conditions encountered. We recommend that budgets be established to cover the costs for such consultation efforts.

Several methods are available to remediate sinkholes such as low mobility grouting, cap grouting, and the creation of a reverse-graded filter. Whenever possible, we recommend that a reverse graded filter be used to stabilize sinkholes as this method allows subsurface water to continue to flow in its original flow path. Grouting in karst areas often blocks subsurface flows, backing water up in the karst groundwater system causing the formation of new sinkholes upstream. The decision to utilize a particular method to remediate karst features should be made after the consultation with an ECS engineer or geologist.

As stated previously, settlement analyses show that the epikarst materials seen in the Building 2 borings general lie below the zone of influence of the structure. However, ground improvement methods consisting of a GRM system should still be considered to reduce the risk of settlement from variable onsite karst conditions. **If the design team/owner proceed with traditional shallow foundation construction without remediation, they should accept at least some risk of excessive settlement/differential settlement due to variable karst conditions.**

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.

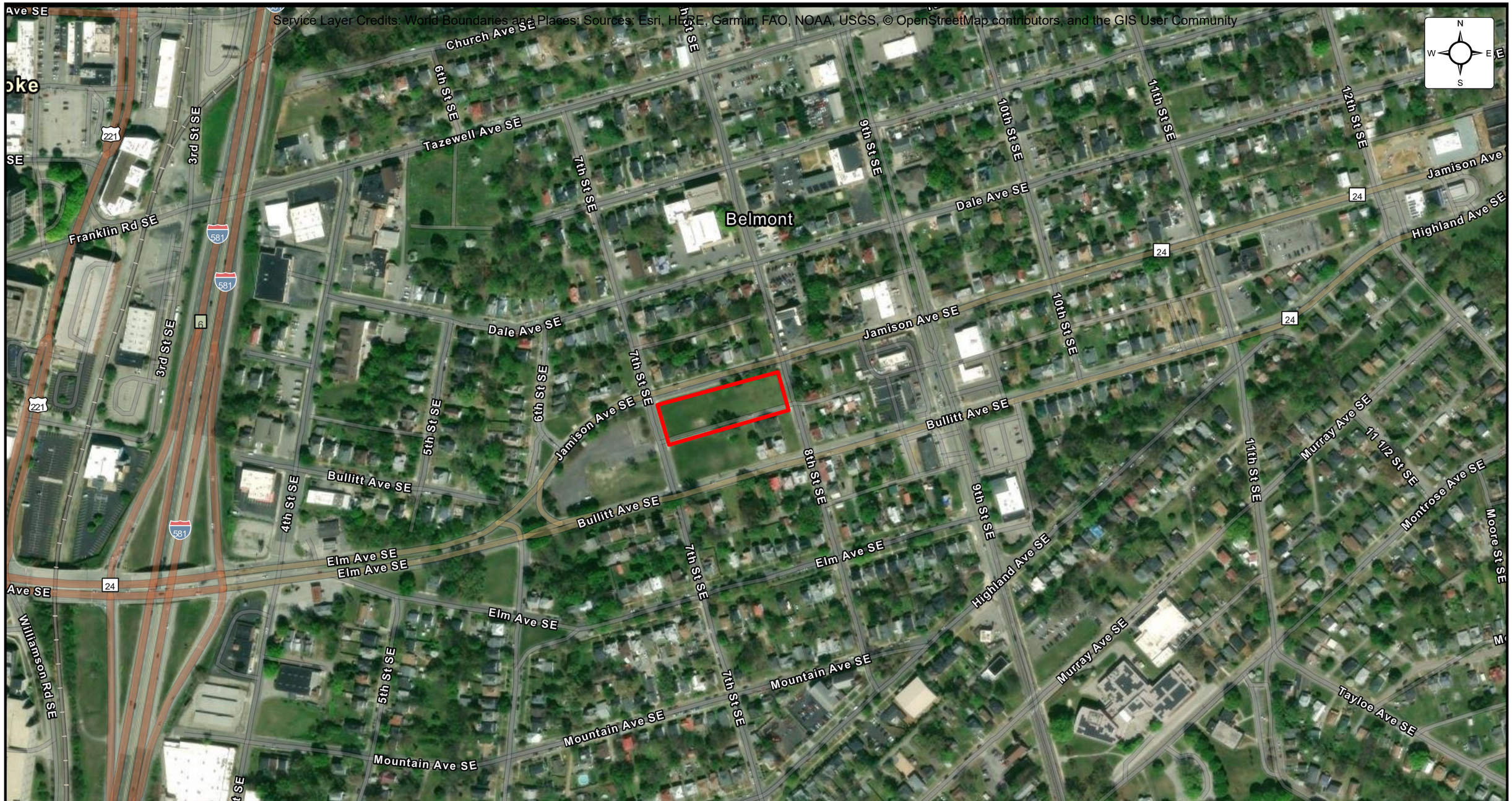
The description of the proposed project is based on information provided to ECS by our client. If any of this information is inaccurate or changes, either because of our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted so we can review our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

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
Subsurface Cross-Sections

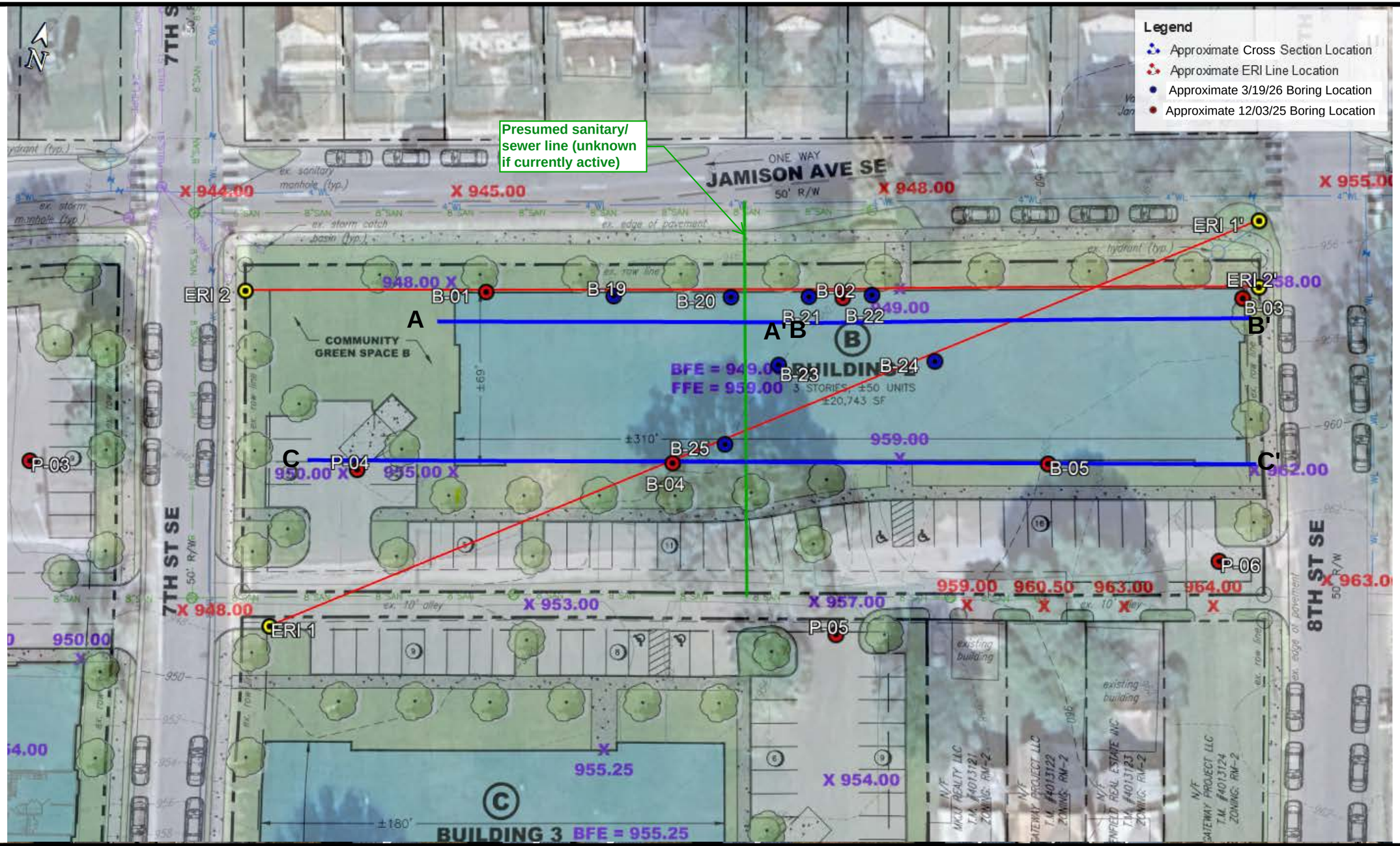


SITE LOCATION DIAGRAM

Roanoke Gateway Project - Building 2 Add. Exploration

624 Bullitt Ave SE, Roanoke, Virginia
Homes for America

ENGINEER	LNB
SCALE	1" = 300'
PROJECT NO.	12:20641-B
SHEET	1
DATE	6/2/2026



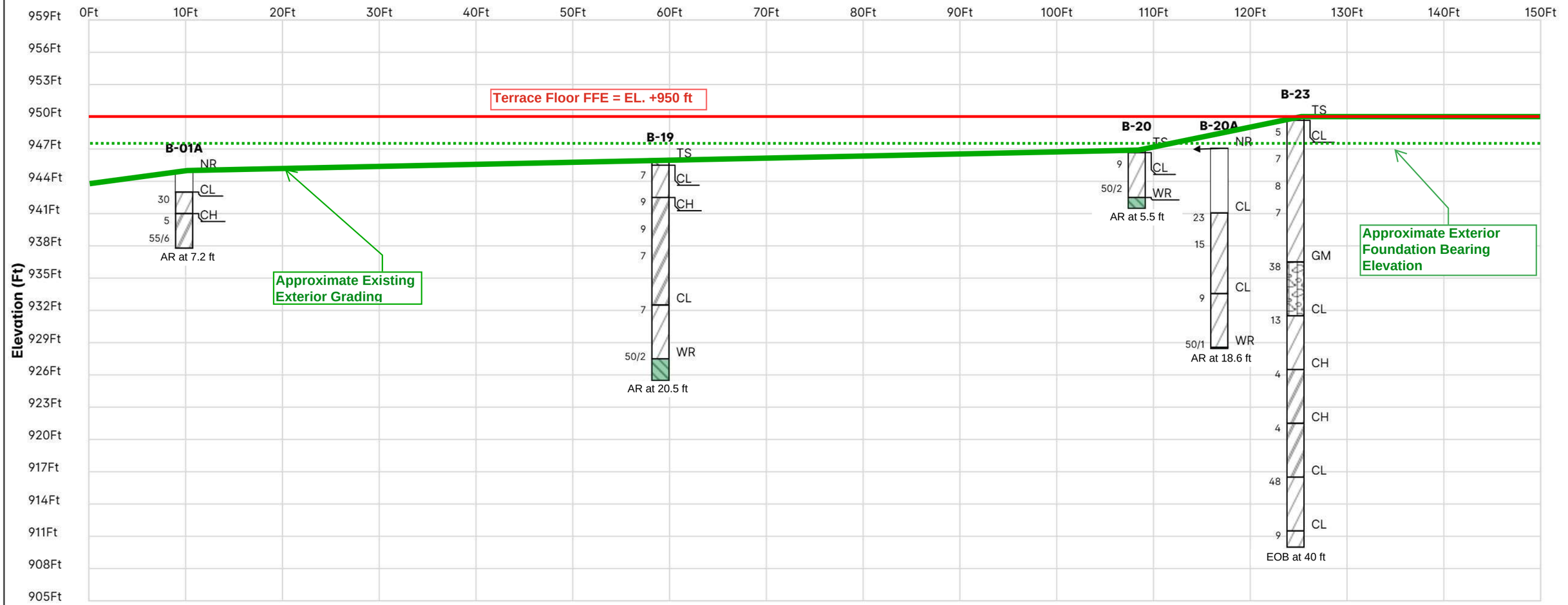
BORING LOCATION DIAGRAM

Roanoke Gateway Project - Building 2 Add. Exploration

624 Bullitt Ave SE, Roanoke, Virginia
Homes for America

ENGINEER	LNB
SCALE	AS SHOWN
PROJECT NO.	12:20641-B
SHEET	2
DATE	6/10/2026

Subsurface Cross Section A-A' (North Face)

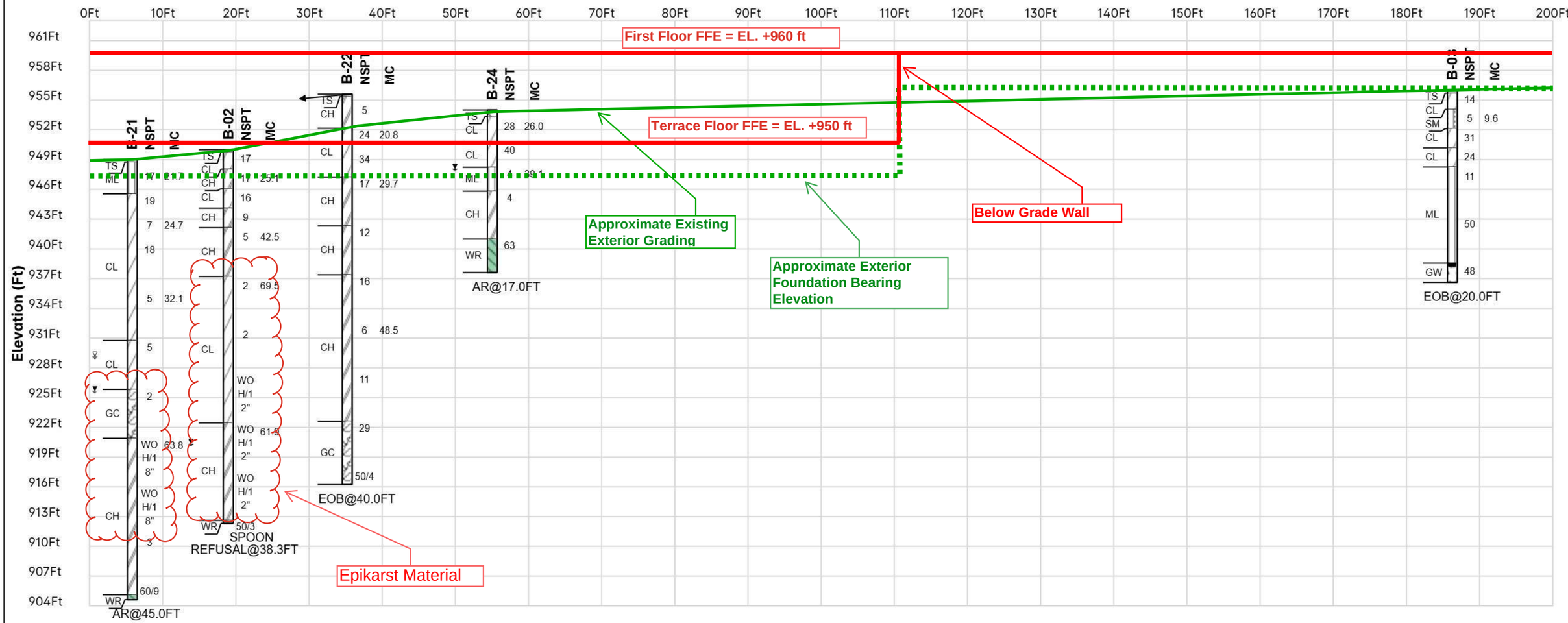


CLIENT:	Homes for America	PROJECT:	Roanoke Gateway Project - Building 2 Add. Exploration
DRAWN DATE:	July 16, 2026	PROJECT NO.:	12:20641-B
CHECKED DATE:	July 16, 2026	SCALE:	AS SHOWN

Notes:
1-EOB: END OF BORING AR: AUGER REFUSALSR: SAMPLER REFUSAL
2-SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
3-STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).
4- TOPOGRAPHIC INFORMATION IS BASED ON PUBLICLY AVAILABLE DATA (GOOGLE OR CESIUM).THE TOPOGRAPHIC LINE SHOWN BETWEEN BORINGS IS FOR VISUAL REFERENCE ONLY.PLEASE REFER TO THE REFERENCE NOTES FOR BORING LOGS FOR SYMBOLOGY MEANING AND ADDITIONAL

Plastic Limit X — Water Content — Liquid Limit △		WL (First Encountered)	Fill
[FINES CONTENT %]		WL (Completion)	Possible Fill
BOTTOM OF CASING		WL (Estimated Seasonal High Water)	Probable Fill
LOSS OF CIRCULATION		WL (Stabilized)	WR/Rock
CALIBRATED PENETROMETER			

Subsurface Cross Section B-B' (North Face)

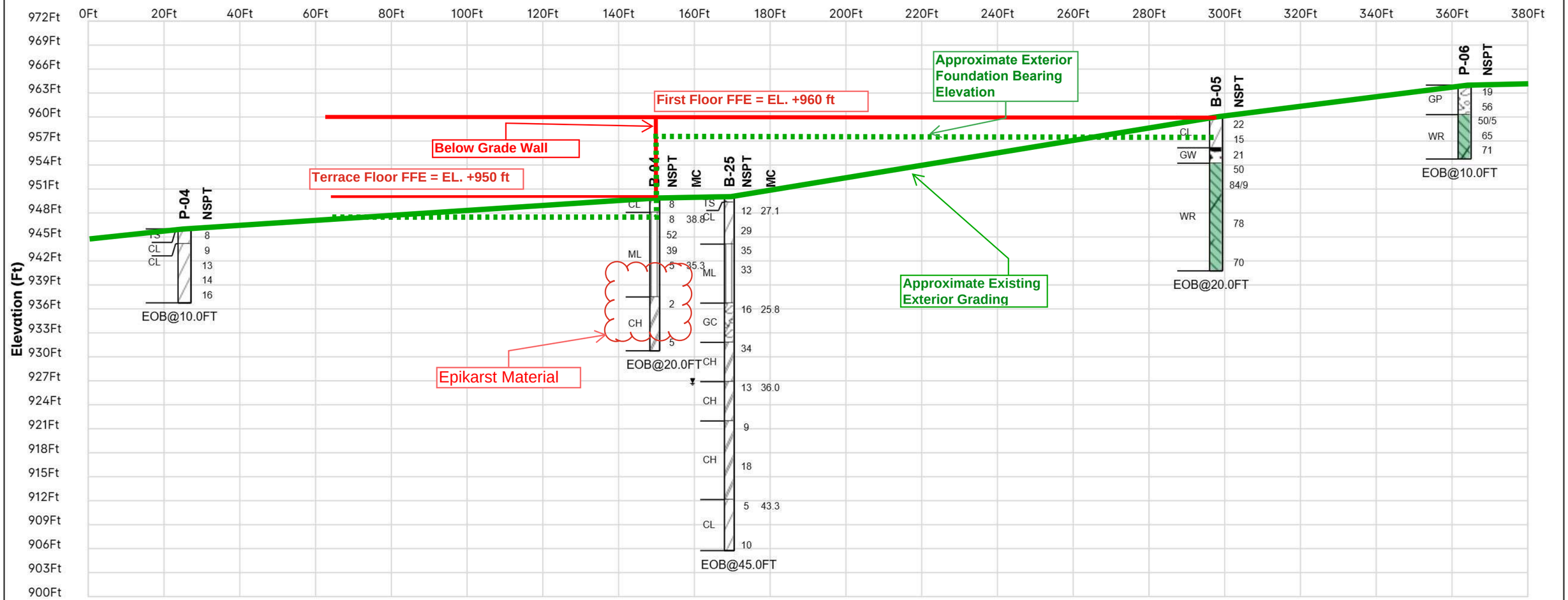


CLIENT:	Homes for America	PROJECT:	Roanoke Gateway Project - Building 2 Add. Exploration
DRAWN DATE:	July 16, 2026	PROJECT NO.:	12:20641-B
CHECKED DATE:	July 16, 2026	SCALE:	AS SHOWN

Notes:
1-EOB: END OF BORING AR: AUGER REFUSALSR: SAMPLER REFUSAL
2-SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
3-STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).
4- TOPOGRAPHIC INFORMATION IS BASED ON PUBLICLY AVAILABLE DATA (GOOGLE OR CESIUM).THE TOPOGRAPHIC LINE SHOWN BETWEEN BORINGS IS FOR VISUAL REFERENCE ONLY.PLEASE REFER TO THE REFERENCE NOTES FOR BORING LOGS FOR SYMBOLOGY MEANING AND ADDITIONAL

Plastic Limit Water Content Liquid Limit X—●—△	WL (First Encountered)		Fill
[FINES CONTENT %]	WL (Completion)		Possible Fill
BOTTOM OF CASING	WL (Estimated Seasonal High Water)		Probable Fill
LOSS OF CIRCULATION	WL (Stabilized)		WR/Rock
CALIBRATED PENETROMETER			

Subsurface Cross Section C-C' (South Face)



Distance (Ft)

CLIENT:	Homes for America	PROJECT:	Roanoke Gateway Project - Building 2 Add. Exploration
DRAWN DATE:	July 16, 2026	PROJECT NO.:	12:20641-B
CHECKED DATE:	July 16, 2026	SCALE:	AS SHOWN

Notes:
1-EOB: END OF BORING AR: AUGER REFUSALSR: SAMPLER REFUSAL
2-SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
3-STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).
4- TOPOGRAPHIC INFORMATION IS BASED ON PUBLICLY AVAILABLE DATA (GOOGLE OR CESIUM).THE TOPOGRAPHIC LINE SHOWN BETWEEN BORINGS IS FOR VISUAL REFERENCE ONLY.PLEASE REFER TO THE REFERENCE NOTES FOR BORING LOGS FOR SYMBOLOGY MEANING AND ADDITIONAL INFORMATION.

Plastic Limit Water Content Liquid Limit X——●——△		▽	WL (First Encountered)		Fill
[FINES CONTENT %]		▼	WL (Completion)		Possible Fill
▰	BOTTOM OF CASING	▽	WL (Estimated Seasonal High Water)		Probable Fill
100%	LOSS OF CIRCULATION	▽	WL (Stabilized)		WR/Rock
◯	CALIBRATED PENETROMETER				

APPENDIX B – Field Operations

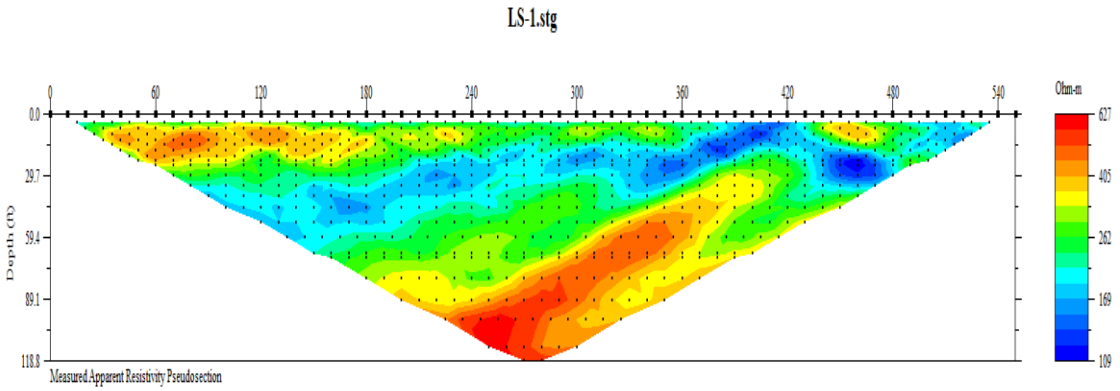
Reference Notes for Electrical Resistivity Imaging (ERI) Surveys
Electrical Resistivity Imaging Profiles
Reference Notes for Boring Logs
Subsurface Exploration Procedure: Standard Penetration Testing (SPT)
Boring Logs B-01 through B-05, B-19 through B-25, and P-03 through P-06

REFERENCE NOTES FOR ELECTRICAL RESISTIVITY IMAGING (ERI) SURVEYS

Data Acquisition

The ERI surveying process is conducted by collecting electrical resistivity data along a linear array of electrodes with a constant electrode spacing. Electrodes generally consist of 18-inch stainless steel rods that are driven into the ground at constant intervals in the survey area. Resistivity data are collected in the field using the dipole-dipole/Slumberger array. The dipole-dipole/Slumberger array provides the highest resolution possible by maximizing the number of achievable resistivity measurement points to a depth approaching or exceeding roughly 30 percent of total ERI line length. Therefore, depth of resistivity penetration is a function of the electrode spacing chosen and the number of electrodes employed for the survey.

The ERI method works by producing a circuit in the subsurface using pairs of current and potential (voltage) electrodes. The dipole-dipole/Slumberger array is employed by sending current to multiple, preprogrammed pairs of current electrodes across a relatively straight line and simultaneously measuring the resistances between each pair. Through the relationship that resistivity equals the resistance over the cross-sectional area that the current travels, a resistivity cross-section can be produced by knowing the spacing of electrodes and which combinations of electrodes were involved in specific measurements. It is noted that the ERI data collection process produces a set of individual resistivity data points that are later processed by the practitioner using commercially available statistical modeling/contouring software. Please note that spacing and the subsequent line length determine the data record densities both vertically and horizontally. The figure below is a color contoured ERI profile that shows the resistivity data points (black dots) used to produce the ERI profile.



As can be seen in the above figure, there are considerably more resistivity data points in the upper 1/3 of the profile as in the lower 1/3 of the profile. Accordingly, the resolution of the ERI profile decreases with depth and our ability to discern small localized features diminishes with depth.

Data Processing

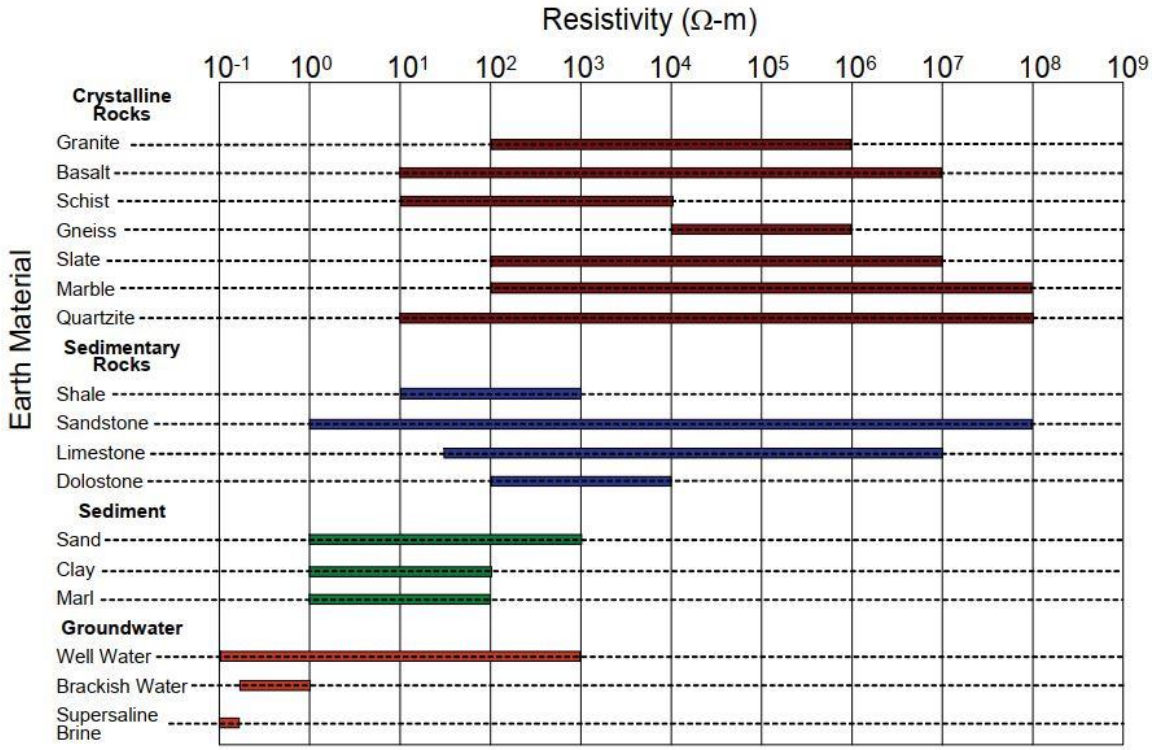
The ERI data are downloaded from the data collection unit at the conclusion of the ERI survey and computer processed using resistivity and IP inversion software. Using the data points collected in the field, the resistivity and IP inversion software extrapolates and inverts the resistivity values recorded between each data point. Based on statistical analysis, the software removes seemingly erroneous data values and then contours areas of similar resistivity values. The processed data are then imported into statistical contouring software such as Surfer™ for display and annotating. The ERI data processing

practitioner controls the inversion process including QA/QC to produce the most geologically realistic model for each ERI dataset without over extending the statistical viability of the data set.

The inverted ERI cross-section for the ERI transect contains color-contoured cross-section resistivity images for the ERI alignment. In general, the data are modeled and inverted multiple times until the root mean square (RMS) error of the inversion is less than 5 percent. This value allows highly erroneous (noisy) data points to be eliminated from the model. Additionally, this prohibits the model from being overextended by inverting the data an excessive number of times. Anthropogenic and geologic conditions can occasionally prevent the data set from being statistically viable by producing irregular current induction patterns which result in significantly different records between each data point collection. Each data point in the above profile is collected multiple times and then compared simultaneously at that location. Data that significantly vary between each record are indicated to have an elevated error percentage and will likely be removed from the data set upon import to the reduction software.

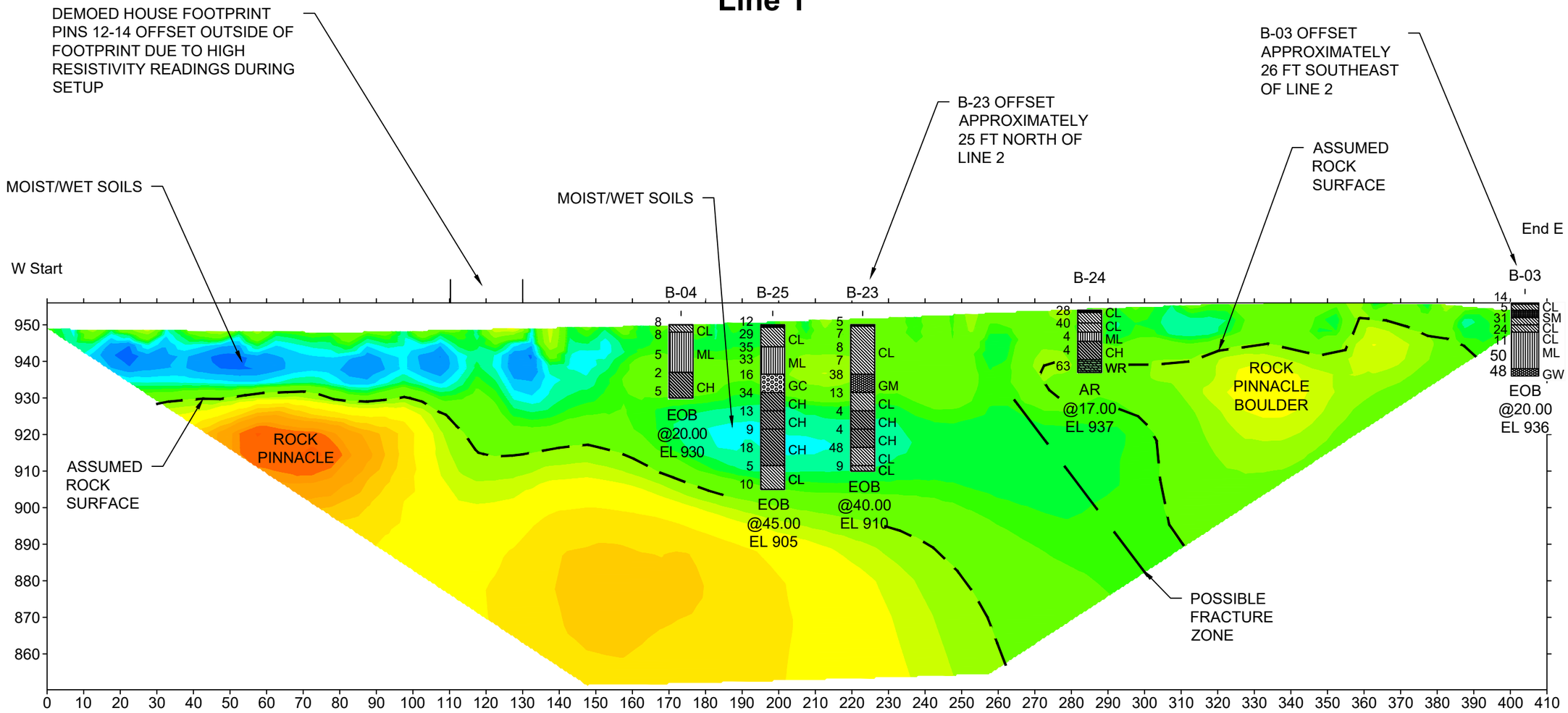
Geologic Interpretation

Resistivity of earthen materials is highly variable and is a function of numerous factors such as bedrock stratigraphy, the degree of weathering, the presence of discontinuities in the bedrock (joints, bedding planes, and faults), bedrock structure, porosity/permeability and the degree of saturation, mineralogy, the presence of groundwater (fresh versus salt water), and soil types and structure. The following table presents ranges of resistivity values for various geologic materials. Actual values derived from site specific field data may or may not fit within the ranges presented below. It is for this reason that sound geophysical practice dictates that geophysical data be field verified using invasive subsurface exploration methods and/or secondary geophysical methods. Additionally, it is important that all available geologic and geotechnical information be reviewed by an experienced geoscience professional in context to the data being considered.



Source: Rutledge, F. Alex, et al, Virginia Tech CGPR#34, 2005

Line 1



Iteration = 3 RMS = 4.20% L2 = 0.73 Electrode Spacing = 10 ft

NOTES

1) ARRAY = DIPOLE-DIPOLE/SCHLUMBERGER
2) EQUIPMENT = AGI SUPERSTING R8
3) ELECTRODE SPACING = 10 FT
4) ELEVATION = FEET

MODELED RESISTIVITY
(Ω-m)

1 10 25 50 75 100 125 150 175 200 300 400 500 750 1000 1250 1500 2000 2250 2750 3000 3250 3750 4000

SCALE (IN FEET)

15 30

30 0

ROANOKE GATEWAY PROJECT - BUILDING 2
624 BULLITT AVE, SE
CITY OF ROANOKE
ROANOKE, VA 24022

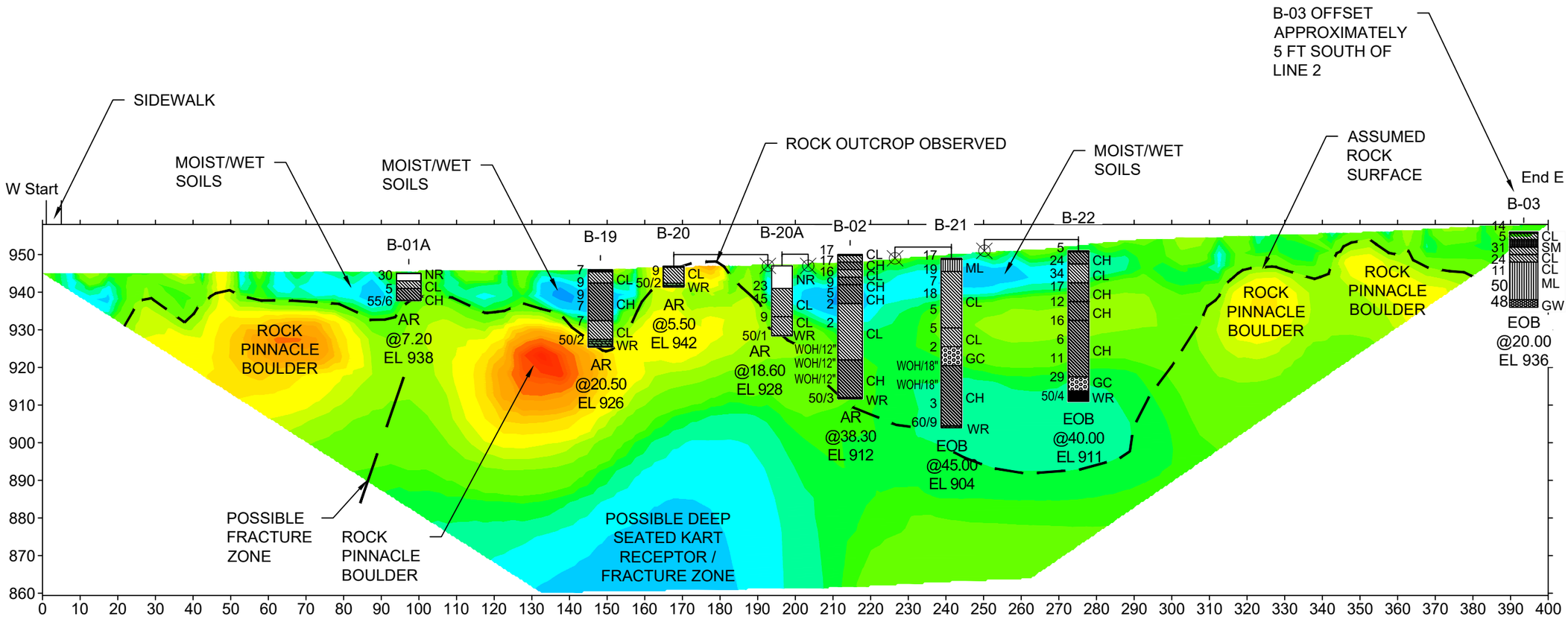
ELECTRICAL RESISTIVITY IMAGING PROFILE ERI LINE-1

ECS REVISIONS

ENGINEER	DRAFTING
LNB	SBM

SCALE	1" = 30'
PROJECT NO.	12-20604-B
SHEET	1 OF 1
DATE	07-17-2026

Line 2



Iteration = 4 RMS = 4.56% L2 = 0.60 Electrode Spacing = 10 ft

NOTES

1) ARRAY = DIPOLE-DIPOLE/SCHLUMBERGER
2) EQUIPMENT = AGI SUPERSTING R8
3) ELECTRODE SPACING = 10 FT
4) ELEVATION = FEET

MODELED RESISTIVITY
(Ω-m)

1 10 25 50 75 100 125 150 175 200 300 400 500 750 1000 1250 1500 2000 2250 2750 3000 3250 3750 4000

SCALE (IN FEET)
15 30
30 0

ROANOKE GATEWAY PROJECT - BUILDING 2
624 BULLITT AVE, SE
CITY OF ROANOKE
ROANOKE, VA 24022

ELECTRICAL RESISTIVITY IMAGING PROFILE ERI LINE-2

ECS REVISIONS

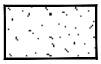
ENGINEER	DRAFTING
LNB	SBM

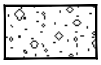
SCALE 1" = 30'
PROJECT NO. 12-20604-B
SHEET 1 OF 1
DATE 07-17-2026

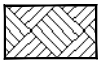
REFERENCE NOTES FOR BORING LOGS

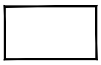
MATERIAL[1,2]

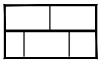

ASPHALT


CONCRETE


GRAVEL

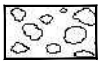

TOPSOIL

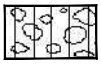

VOID


BRICK

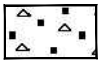

AGGREGATE BASE COURSE

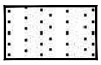

GW **WELL-GRADED GRAVEL**
gravel-sand mixtures, little or no fines

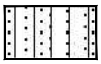

GP **POORLY-GRADED GRAVEL**
gravel-sand mixtures, little or no fines


GM **SILTY GRAVEL**
gravel-sand-silt mixtures

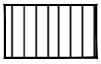

GC **CLAYEY GRAVEL**
gravel-sand-clay mixtures

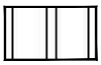

SW **WELL-GRADED SAND**
gravelly sand, little or no fines

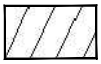

SP **POORLY-GRADED SAND**
gravelly sand, little or no fines


SM **SILTY SAND**
sand-silt mixtures

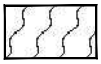

SC **CLAYEY SAND**
sand-clay mixtures

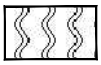

ML **SILT**
non-plastic to medium plasticity

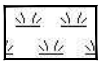

MH **ELASTIC SILT**
high plasticity


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, Q_P[4]	SPT[5] (BPF)	CONSISTENCY[7] (COHESIVE)
<0.25	<2	Very Soft
0.25 - <0.50	2 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

GRAVELS, SANDS & NON-COHESIVE SILTS

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

RELATIVE AMOUNT[7]	COARSE GRAINED (%)[8]	FINE GRAINED (%)[8]
Trace	≤5	≤5
With	10 - 20	10 - 25
Adjective *(ex: "Silty")*	25 - 45	30 - 45

WATER LEVELS[6]

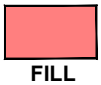

WL (First Encountered)


WL (Completion)


WL (Seasonal High Water)


WL (Stabilized)

FILL AND ROCK


FILL


POSSIBLE FILL


PROBABLE FILL


ROCK

[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 14.

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

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

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

SPT Procedure:

- Involves driving a hollow tube (split-spoon) into the ground by dropping a 140-lb hammer a height of 30-inches at desired depth
- Recording the number of hammer blows required to drive split-spoon a distance of 18-24 inches (in 3 or 4 Increments of 6 inches each)



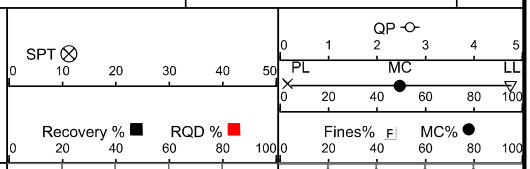
- Auger is advanced* and an additional SPT is performed
- One SPT typically performed for every two to five feet. An approximate 1.5 inch diameter soil sample is recovered.



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

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Homes for America	**12:20641-B**	**B-01**	**1 OF 1**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **SEQ Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.2684341**	LONGITUDE: **-79.93137282**	STRUCTURE: **Building 2**	SURFACE ELEVATION: **945**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
	S-1	SS	24	16	Topsoil [Thickness=2"]. (CL) Residuum, LEAN CLAY WITH SAND - trace gravel, light brown, moist, stiff.				3-5-6-11 (11)
					AUGER REFUSAL at 3.0 FT				



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

WL (First Encountered):	Dry	BORING STARTED:	12/03/2025	CAVE IN DEPTH:	Not Observed
WL (Completion):	Dry	BORING COMPLETED:	12/03/2025	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-3')
WL (Stabilized):		Track CME-550X	LNB		

GEOTECHNICAL BOREHOLE LOG

CLIENT: Homes for America	PROJECT NO.: 12:20641-B	BORING NO.: B-01A	SHEET: 1 OF 1
PROJECT NAME: Roanoke Gateway Project - Building 2 Add. Exploration	DRILLER/CONTRACTOR: SEQ Drilling, Inc.		
SITE LOCATION: 624 Bullitt Ave SE, Roanoke, Virginia, 24022			LOSS OF CIRCULATION
LATITUDE: 37.2684341	LONGITUDE: -79.93137282	STRUCTURE: Building 2	SURFACE ELEVATION: 945	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
					AUGER PROBE.				
	S-1	SS	24	13	(CL) Residuum, LEAN CLAY WITH SAND - trace gravel, light brown, moist, very stiff.				8-19-11-6 (30)
5.0	S-2	SS	24	17	(CH) FAT CLAY WITH SAND - brown, moist, firm.			940	3-2-3-5 (5)
	S-3	SS	14	9					4-5-50/2" (55/6)
					AUGER REFUSAL at 7.2 FT				

NOTE: Offset approximately 3 ft S of B-01

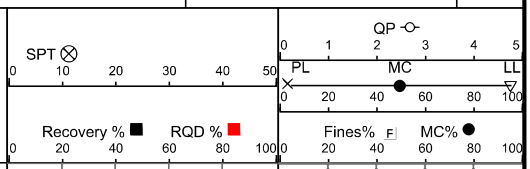
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WL (First Encountered):	Dry	BORING STARTED:	12/03/2025	CAVE IN DEPTH:	Not Observed
WL (Completion):	Dry	BORING COMPLETED:	12/03/2025	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-7.2')
WL (Stabilized):		Track CME 550X	LNB		

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Homes for America**	PROJECT NO.: **12:20641-B**	BORING NO.: **B-01B**	SHEET: **1 OF 1**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **SEQ Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.2684341**	LONGITUDE: **-79.93137282**	STRUCTURE: **Building 2**	SURFACE ELEVATION: **945**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
					AUGER PROBE.				
	S-1	SS	1	0	**AUGER REFUSAL at 3.1 FT** **NOTE:** Offset approximately 5 ft E of B-01				50/1" (50/1)



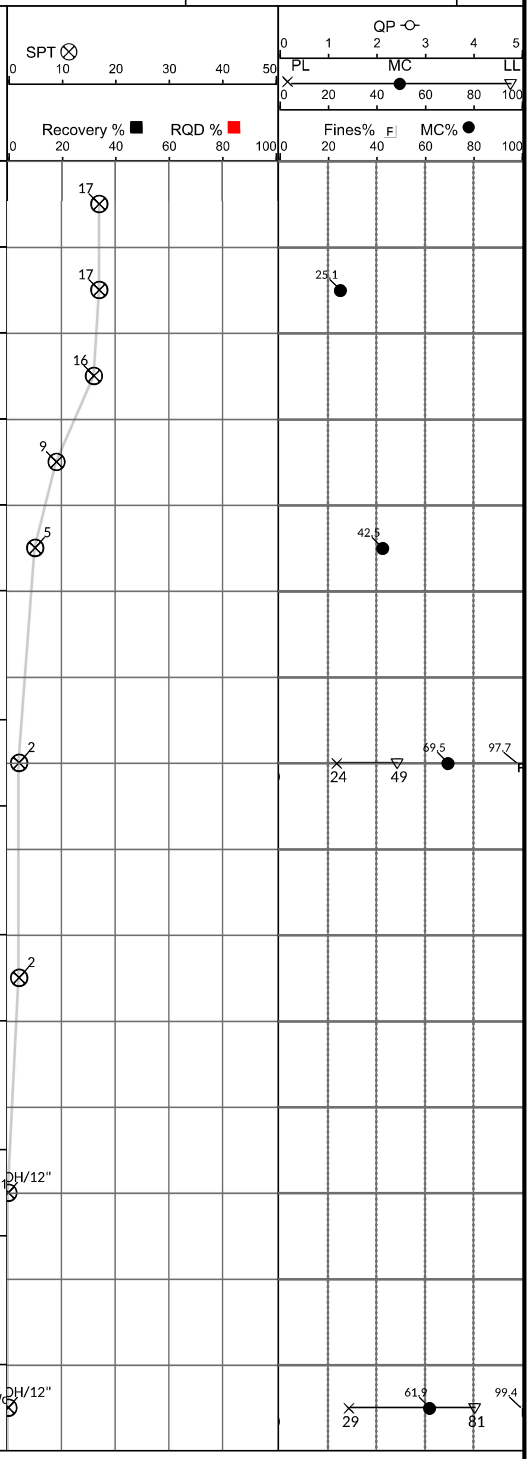
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WL (First Encountered):	Dry	BORING STARTED:	12/03/2025	CAVE IN DEPTH:	Not Observed
WL (Completion):	Dry	BORING COMPLETED:	12/03/2025	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-3.1')
WL (Stabilized):		Track CME 550X	LNB		

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Homes for America	**12:20641-B**	**B-02**	**1 OF 2**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **SEQ Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.26853065**	LONGITUDE: **-79.93089813**	STRUCTURE: **Building 2**	SURFACE ELEVATION: **950**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/IRS/MC/SPT-N VALUE)*
	S-1	SS	24	9	Topsoil [Thickness=3"]. (CL) GRAVELLY LEAN CLAY WITH SAND - reddish brown, moist, very stiff.				3-7-10-11 (17)
	S-2	SS	24	14	(CH) FAT CLAY WITH SAND - trace gravel, reddish brown, moist, very stiff.				7-8-9-14 (17)
5.0	S-3	SS	24	16	(CL) LEAN CLAY WITH SAND - trace gravel, orangish brown, moist, very stiff.			945	8-7-9-13 (16)
	S-4	SS	24	17	(CH) FAT CLAY WITH GRAVEL - trace sand, orangish brown, moist, stiff.				2-4-5-6 (9)
	S-5	SS	24	20	(CH) FAT CLAY - trace sand, light brown, moist, firm.				3-2-3-2 (5)
10.0								940	
	S-6	SS	24	20	(CL) LEAN CLAY - trace sand, orangish brown, wet, very soft to soft.				1-1-1-1 (2)
15.0								935	
	S-7	SS	24	24					1-1-1-1 (2)
20.0								930	
	S-8	SS	24	19					WoH-WoH-WoH-1 (WOH/12")
25.0								925	
	S-9	SS	24	24	(CH) FAT CLAY - trace sand, orangish brown, wet, very soft.				oH-WoH-WoH-Wo (WOH/12")



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

WL (First Encountered):	30 FT	BORING STARTED:	12/03/2025	CAVE IN DEPTH:	Not Observed
WL (Completion):	30 FT	BORING COMPLETED:	12/03/2025	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-40')
WL (Stabilized):		Track CME-550X	LNB		

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Homes for America	**12:20641-B**	**B-02**	**2 OF 2**

PROJECT NAME:	DRILLER/CONTRACTOR:
Roanoke Gateway Project - Building 2 Add. Exploration	**SEQ Drilling, Inc.**

SITE LOCATION:	LOSS OF CIRCULATION
624 Bullitt Ave SE, Roanoke, Virginia, 24022	

LATITUDE:	LONGITUDE:	STRUCTURE:	SURFACE ELEVATION:	BOTTOM OF CASING
37.26853065	**-79.93089813**	**Building 2**	**950**	

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/IRS/MC/SPT-N VALUE)*
					(CH) FAT CLAY - trace sand, orangish brown, wet, very soft. (continued)				WOH/12"
35.0	S-10	SS	24	22				915	WoH-WoH-WoH-WoH (WOH/12")
	S-11	SS	3	3	(WR) WEATHERED ROCK sampled as GRAVELLY FAT CLAY WITH SAND - brown, wet, hard. **SPOON REFUSAL at 38.3 FT**				50/3" (50/3)

SPT: 0 10 20 30 40 50 | Recovery % ■ 0 20 40 60 80 100 | RQD % ■ 0 20 40 60 80 100

QP: 0 1 2 3 4 5 | PL MC LL: 0 20 40 60 80 100 | Fines% F 0 20 40 60 80 100 | MC% ● 0 20 40 60 80 100

61.9 99.4

50/3

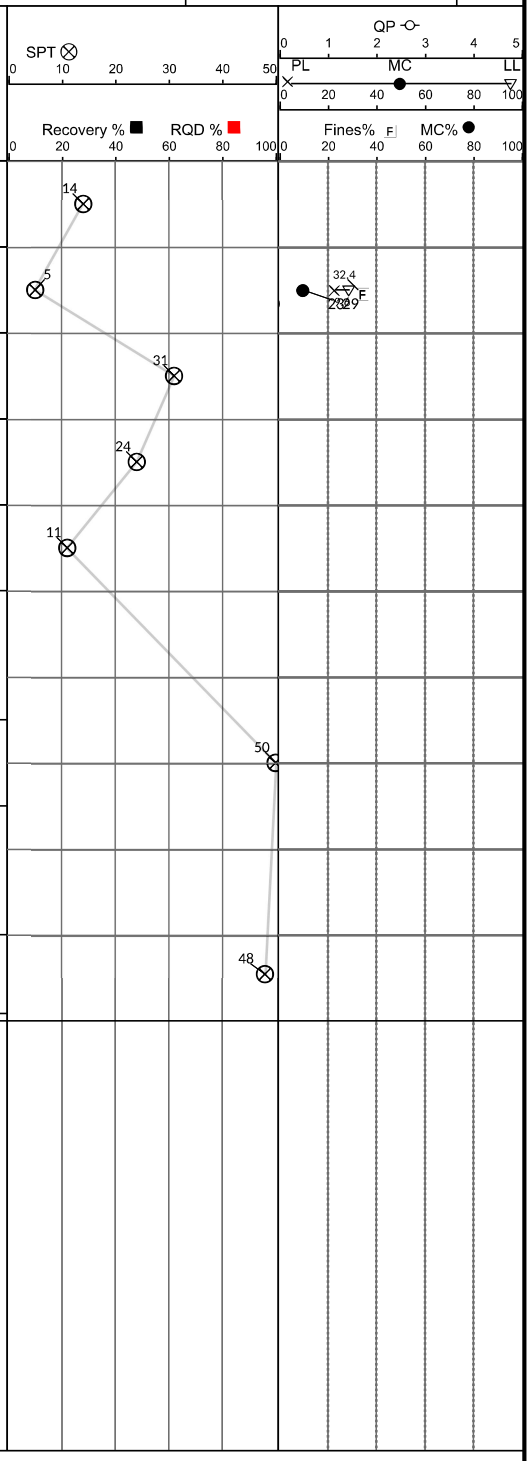
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WL (First Encountered):	30 FT	BORING STARTED:	12/03/2025	CAVE IN DEPTH:	Not Observed
WL (Completion):	30 FT	BORING COMPLETED:	12/03/2025	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	
WL (Stabilized):		Track CME-550X	LNB	Hollow Stem Auger (0'-40')	

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Homes for America	**12:20641-B**	**B-03**	**1 OF 1**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **SEQ Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.26864635**	LONGITUDE: **-79.93034054**	STRUCTURE: **Building 2**	SURFACE ELEVATION: **956**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
	S-1	SS	24	10	Topsoil [Thickness=4"]. (CL) Residuum, LEAN CLAY WITH GRAVEL - trace sand, light brown, moist, stiff.			955	4-6-8-7 (14)
	S-2	SS	24	11	(SM) SILTY SAND WITH GRAVEL - light brown, moist, loose.				3-2-3-4 (5)
5.0	S-3	SS	24	11	(CL) GRAVELLY LEAN CLAY WITH SAND - grayish brown, moist, hard.				10-16-15-14 (31)
	S-4	SS	24	19	(CL) LEAN CLAY WITH SAND - trace gravel, orangish brown, moist, very stiff.			950	3-10-14-15 (24)
	S-5	SS	24	14	(ML) SANDY SILT - trace gravel, orangish brown, moist, stiff, medium dense to dense.				4-5-6-10 (11)
10.0								945	
	S-6	SS	24	16					7-20-30-33 (50)
15.0								940	
	S-7	SS	22	8	(GW) WELL-GRADED SANDY GRAVEL - reddish brown, moist, dense.				7-15-33-50/4" (48)
					END OF BORING at 20.0 FT				



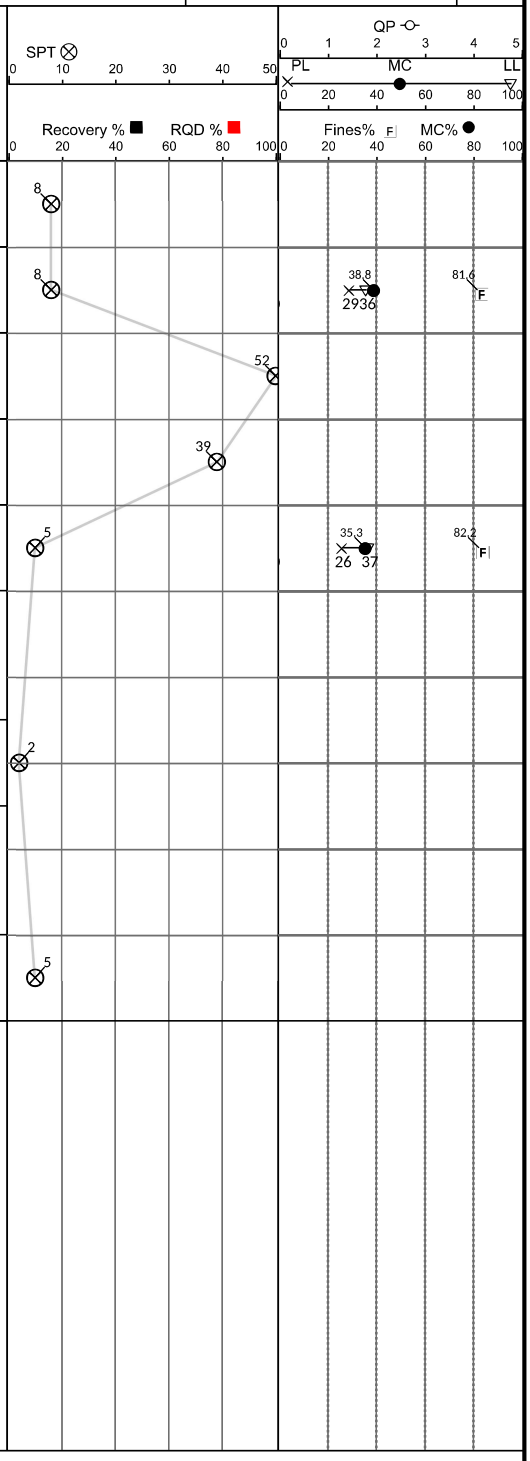
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered):	Dry	BORING STARTED:	12/03/2025	CAVE IN DEPTH:	Not Observed
WL (Completion):	Dry	BORING COMPLETED:	12/03/2025	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-20')
WL (Stabilized):		Track CME 550X	LNB		

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Homes for America**	PROJECT NO.: **12:20641-B**	BORING NO.: **B-04**	SHEET: **1 OF 1**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **SEQ Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.26830761**	LONGITUDE: **-79.9310621**	STRUCTURE: **Building 2**	SURFACE ELEVATION: **950**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
	S-1	SS	24	18	(CL) Residuum, LEAN CLAY WITH SAND - trace gravel, light brown to orangish brown, moist, firm.				2-3-5-5 (8)
	S-2	SS	24	20	(ML) SILT WITH SAND - trace gravel and clay, light brown, moist, loose to very dense.				1-4-4-8 (8)
5.0	S-3	SS	24	20				945	8-27-25-32 (52)
	S-4	SS	24	16					13-24-15-13 (39)
	S-5	SS	24	20					1-2-3-4 (5)
10.0								940	
	S-6	SS	24	22	(CH) FAT CLAY WITH SAND - trace silt, orangish brown, moist, soft to firm.				1-1-1-3 (2)
15.0								935	
	S-7	SS	24	21					1-2-3-3 (5)
					END OF BORING at 20.0 FT				



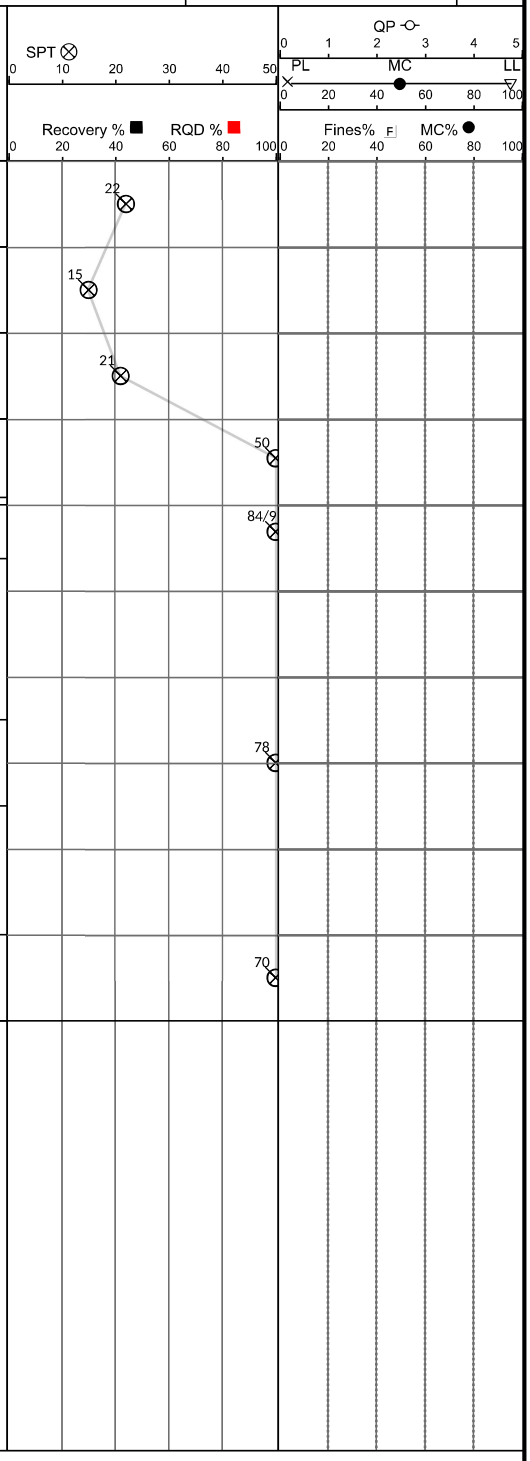
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WL (First Encountered):	Dry	BORING STARTED:	12/03/2025	CAVE IN DEPTH:	Not Observed
WL (Completion):	Dry	BORING COMPLETED:	12/03/2025	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-20')
WL (Stabilized):		Track CME-550X	LNB		

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Homes for America	**12:20641-B**	**B-05**	**1 OF 1**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **SEQ Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.26841512**	LONGITUDE: **-79.93057425**	STRUCTURE: **Building 2**	SURFACE ELEVATION: **960**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
	S-1	SS	24	17	(CL) Residuum, LEAN CLAY WITH SAND - trace gravel and silt, brown to orangish brown, moist, stiff to very stiff.				3-10-12-10 (22)
	S-2	SS	24	17					4-6-9-11 (15)
5.0	S-3	SS	24	20	(GW) WELL-GRADED GRAVEL WITH SAND - trace silt, reddish brown, moist, medium dense.			955	3-3-18-24 (21)
	S-4	SS	22	16	(WR) WEATHERED ROCK sampled as WELL-GRADED GRAVEL WITH SAND - trace clay, reddish brown, moist, dense to very dense.				12-20-30-50/4" (50)
	S-5	SS	15	15					22-34-50/3" (84/9)
10.0								950	
	S-6	SS	24	19					20-40-38-30 (78)
15.0								945	
	S-7	SS	24	4					20-28-42-34 (70)
					END OF BORING at 20.0 FT				



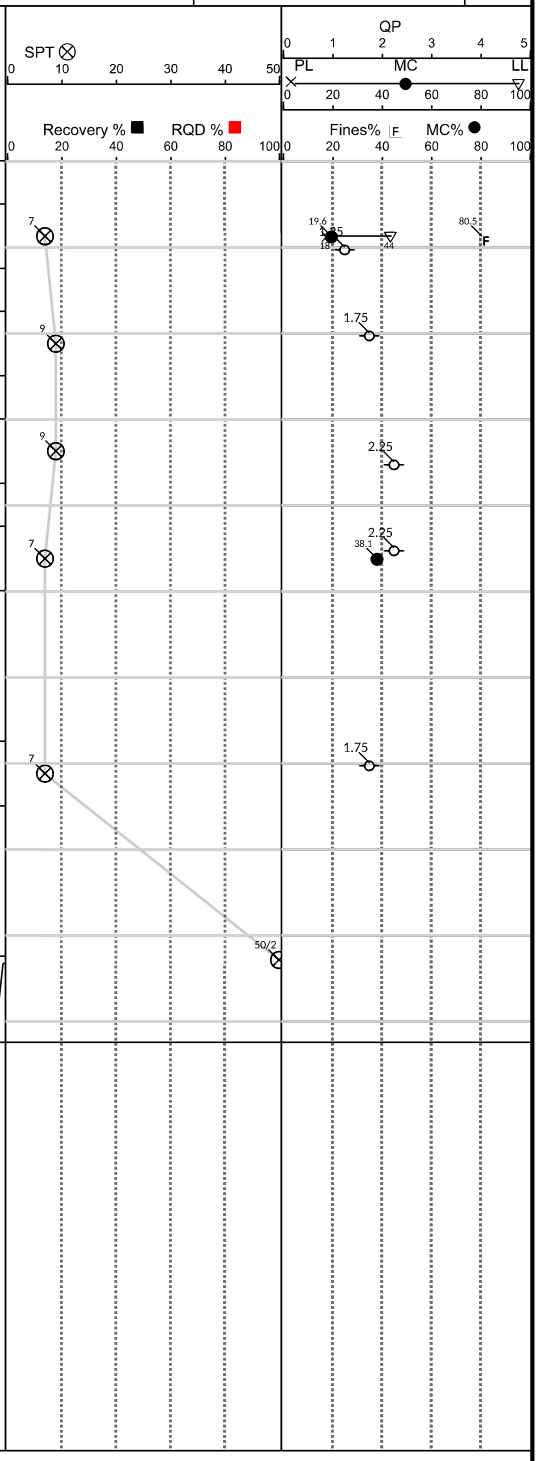
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WL (First Encountered):	Dry	BORING STARTED:	12/03/2025	CAVE IN DEPTH:	Not Observed
WL (Completion):	Dry	BORING COMPLETED:	12/03/2025	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-20')
WL (Stabilized):		Track CME-550X	LNB		

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Homes for America	**12:20641-B**	**B-19**	**1 OF 1**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **Blue Ridge Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.26846677**	LONGITUDE: **-79.93120182**	STRUCTURE: **Building 2**	SURFACE ELEVATION: **946**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
					Topsoil [Thickness=6"].				
	S-1	SS	18	16	(CL) Residuum, LEAN CLAY WITH SAND - trace gravel, reddish brown, moist, firm.			945	3-3-4 (7)
	S-2	SS	18	16	(CH) Residuum, FAT CLAY WITH SAND - trace gravel, reddish brown to brown, moist, firm to stiff.				5-4-5 (9)
5.0	S-3	SS	18	14				940	3-4-5 (9)
	S-4	SS	18	16					3-3-4 (7)
10.0								935	
	S-5	SS	18	18	(CL) LEAN CLAY WITH SAND - trace gravel, brown, moist, firm.				3-3-4 (7)
15.0								930	
	S-6	SS	2	0	(WR) WEATHERED ROCK SAMPLED AS NO RECOVERY.				50/2" (50/2)
20.0					**AUGER REFUSAL at 20.5 FT**				



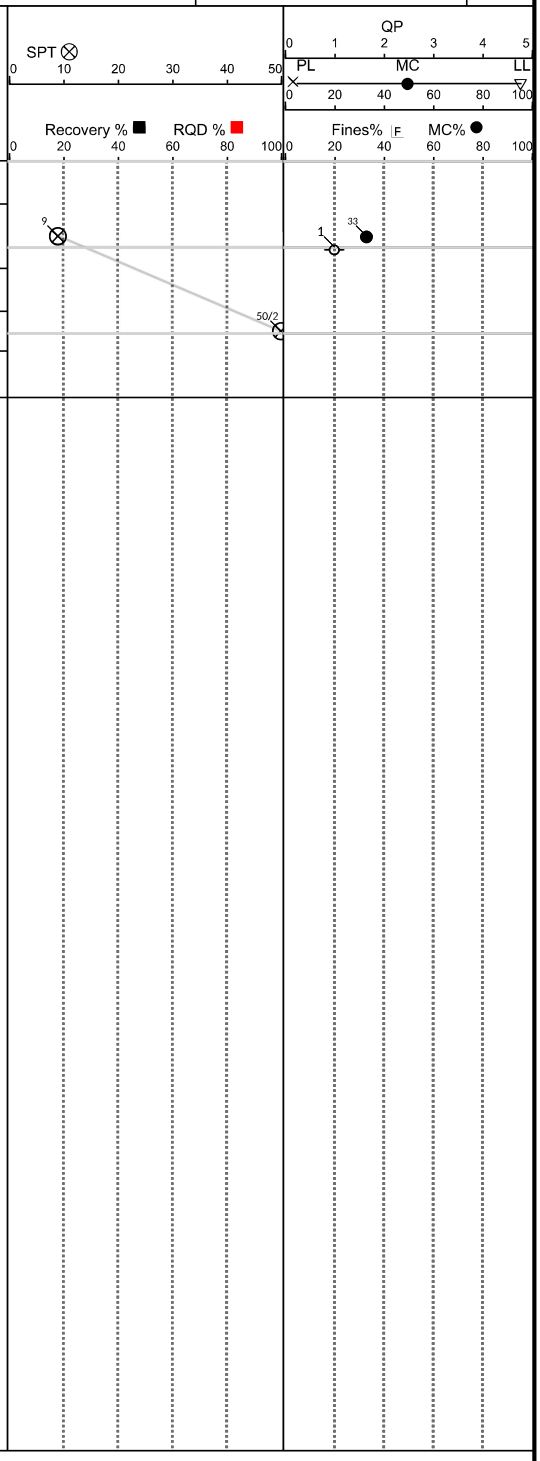
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered):	Dry	BORING STARTED:	03/19/2026	CAVE IN DEPTH:	4.3 FT
WL (Completion):	Dry	BORING COMPLETED:	03/19/2026	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-20.5')
WL (Stabilized):		ATV CME-55	LNB		

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Homes for America	**12:20641-B**	**B-20**	**1 OF 1**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **Blue Ridge Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.26850008**	LONGITUDE: **-79.93104603**	STRUCTURE: **Building 2**	SURFACE ELEVATION: **947**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
					Topsoil [Thickness=4"].				
	S-1	SS	18	18	(CL) Residuum, LEAN CLAY WITH SAND - trace gravel, yellowish brown, moist, stiff.			945	3-4-5 (9)
	S-2	SS	11	7					2-50/5" (50/2)
5.0					(WR) WEATHERED ROCK SAMPLED AS CLAYEY GRAVEL - trace sand, gray and orangish brown, moist, very dense.				
					AUGER REFUSAL at 5.5 FT				



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

WL (First Encountered):	Dry	BORING STARTED:	03/13/2026	CAVE IN DEPTH:	3.8 FT
WL (Completion):	Dry	BORING COMPLETED:	03/13/2026	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-5.5')
WL (Stabilized):		ATV CME-55	LNB		

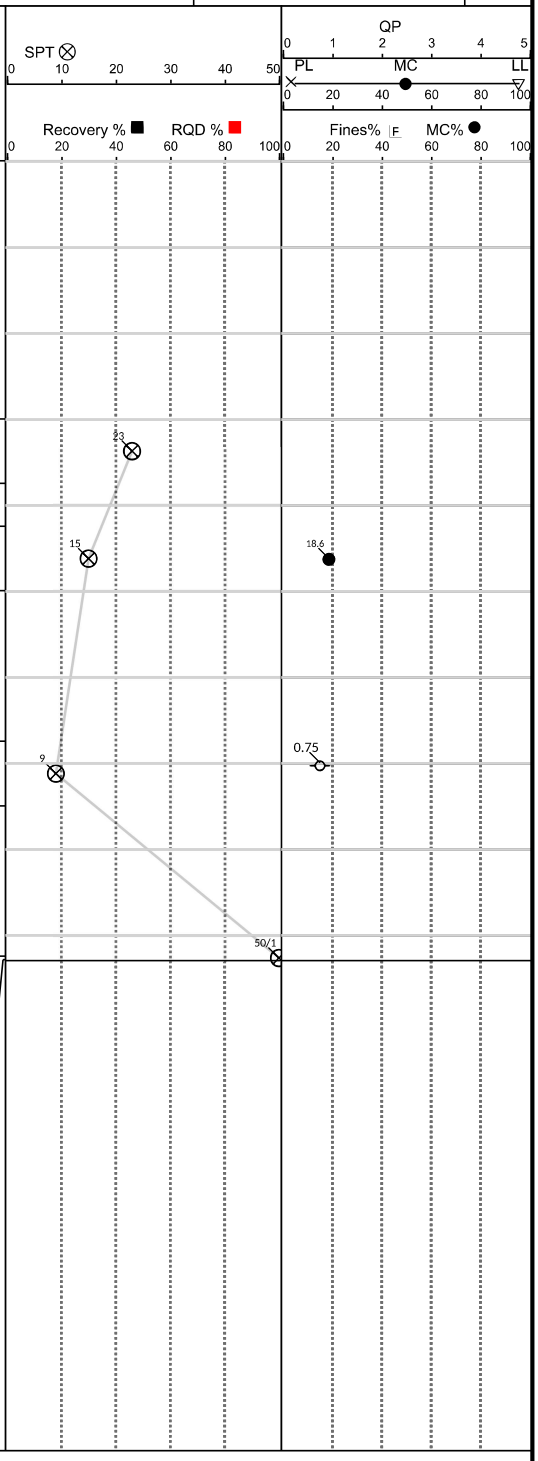
GEOTECHNICAL BOREHOLE LOG

CLIENT: **Homes for America**	PROJECT NO.: **12:20641-B**	BORING NO.: **B-20A**	SHEET: **1 OF 1**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **Blue Ridge Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.268506**	LONGITUDE: **-79.931019**	STRUCTURE: **Building 2**	SURFACE ELEVATION: **947**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
					AUGER PROBE.			945	
5.0	S-1	SS	18	18	(CL) Residuum, GRAVELLY LEAN CLAY WITH SAND - trace silt, reddish brown and gray, moist, stiff to very stiff.			940	9-10-13 (23)
	S-2	SS	18	18					8-7-8 (15)
10.0								935	
	S-3	SS	18	18	(CL) LEAN CLAY - trace sand, yellowish brown, moist, stiff.				6-4-5 (9)
15.0								930	
	S-4	SS	1	0	(WR) WEATHERED ROCK SAMPLED AS NO RECOVERY.				50/1" (50/1)

AUGER REFUSAL at 18.6 FT

NOTE: Offset approximately 7 ft E of B-20



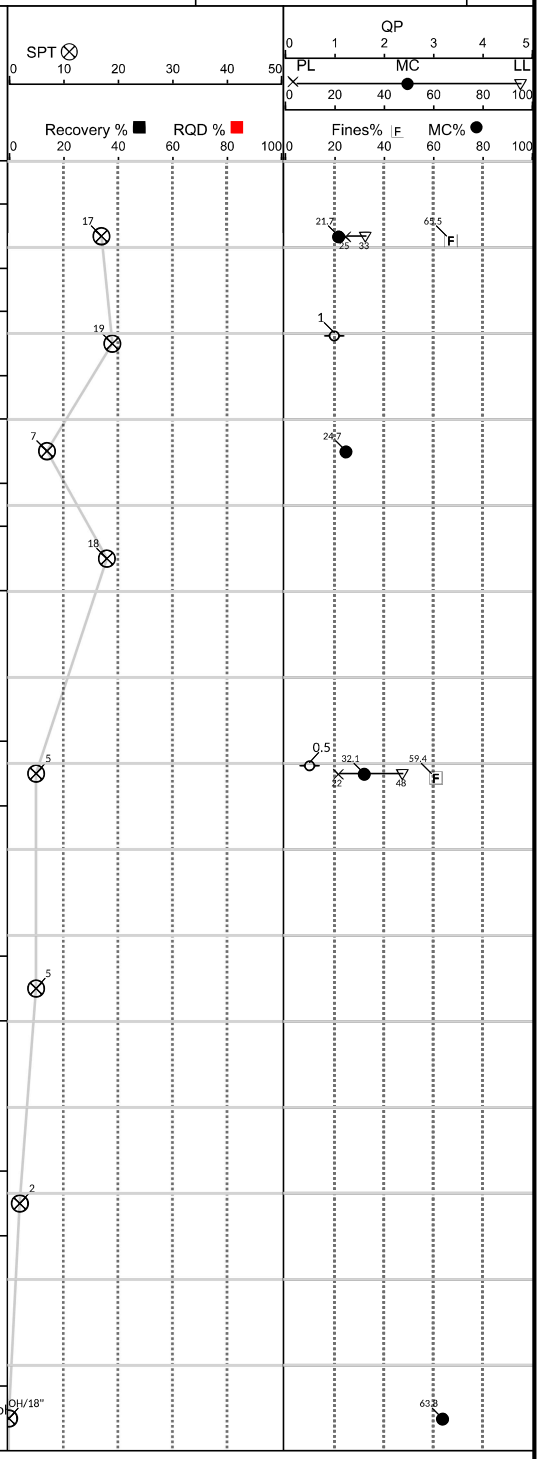
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered):	Dry	BORING STARTED:	03/13/2026	CAVE IN DEPTH:	13.3 FT
WL (Completion):	Dry	BORING COMPLETED:	03/13/2026	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-18.6')
WL (Stabilized):		ATV CME-55	LNB		

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Homes for America	**12:20641-B**	**B-21**	**1 OF 2**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **Blue Ridge Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.26852255**	LONGITUDE: **-79.93094298**	STRUCTURE: **Building 2**	SURFACE ELEVATION: **949**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
					Topsoil [Thickness=3"].				
	S-1	SS	18	18	(ML) Residuum, SANDY SILT - reddish brown, moist, medium dense.				3-5-12 (17)
	S-2	SS	18	18	(CL) SANDY LEAN CLAY - trace gravel, reddish brown, moist, firm to very stiff.			945	10-9-10 (19)
5.0	S-3	SS	18	15					7-3-4 (7)
	S-4	SS	18	18				940	5-10-8 (18)
10.0									
	S-5	SS	18	18				935	3-2-3 (5)
15.0									
	S-6	SS	18	15	(CL) LEAN CLAY WITH SAND - trace gravel, orangish brown, moist, firm.		▽	930	4-3-2 (5)
20.0									
	S-7	SS	18	18	(GC) CLAYEY GRAVEL WITH SAND - orangish brown, wet, very loose.		▼	925	WoH-1-1 (2)
25.0									
	S-8	SS	18	18	(CH) FAT CLAY - trace sand, reddish...Continued on next page			920	WoH-WoH-WoH/18" (WOH/18")



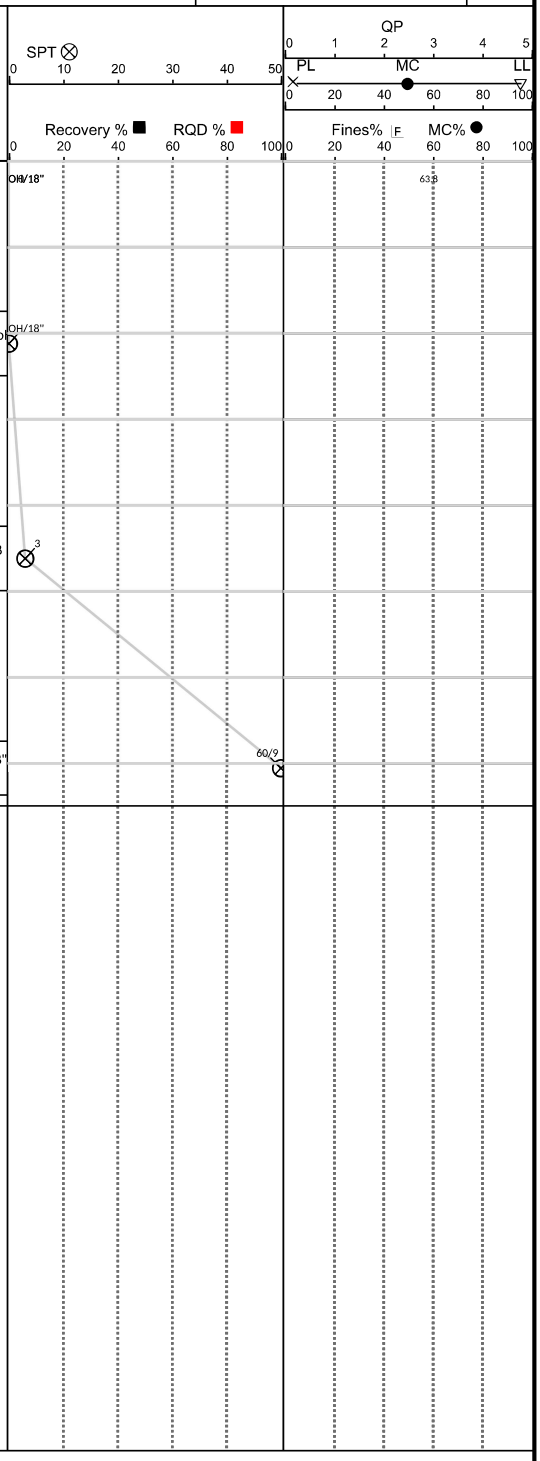
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered):	20 FT	BORING STARTED:	03/13/2026	CAVE IN DEPTH:	18.8 FT
▼ WL (Completion):	23.5 FT	BORING COMPLETED:	03/13/2026	HAMMER TYPE:	Automatic
▽ WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	
▽ WL (Stabilized):		ATV CME-55	LNB	Hollow Stem Auger (0'-45')	

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Homes for America**	PROJECT NO.: **12:20641-B**	BORING NO.: **B-21**	SHEET: **2 OF 2**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **Blue Ridge Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.26852255**	LONGITUDE: **-79.93094298**	STRUCTURE: **Building 2**	SURFACE ELEVATION: **949**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
					(CH) FAT CLAY - trace sand, reddish brown, wet, very soft to soft. (continued)				
	S-9	SS	18	18				915	WoH-WoH-WoH (WOH/18")
35.0									
	S-10	SS	18	14				910	WoH-WoH-3 (3)
40.0									
	S-11	SS	15	13				905	WoH-10-50/3" (60/9)
					(WR) WEATHERED ROCK SAMPLED AS GRAVELLY FAT CLAY - trace sand, gray and brown, wet, very hard.				
					AUGER REFUSAL at 45.0 FT				



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

WL (First Encountered):	20 FT	BORING STARTED:	03/13/2026	CAVE IN DEPTH:	18.8 FT
WL (Completion):	23.5 FT	BORING COMPLETED:	03/13/2026	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-45')
WL (Stabilized):		ATV CME-55	LNB		

GEOTECHNICAL BOREHOLE LOG

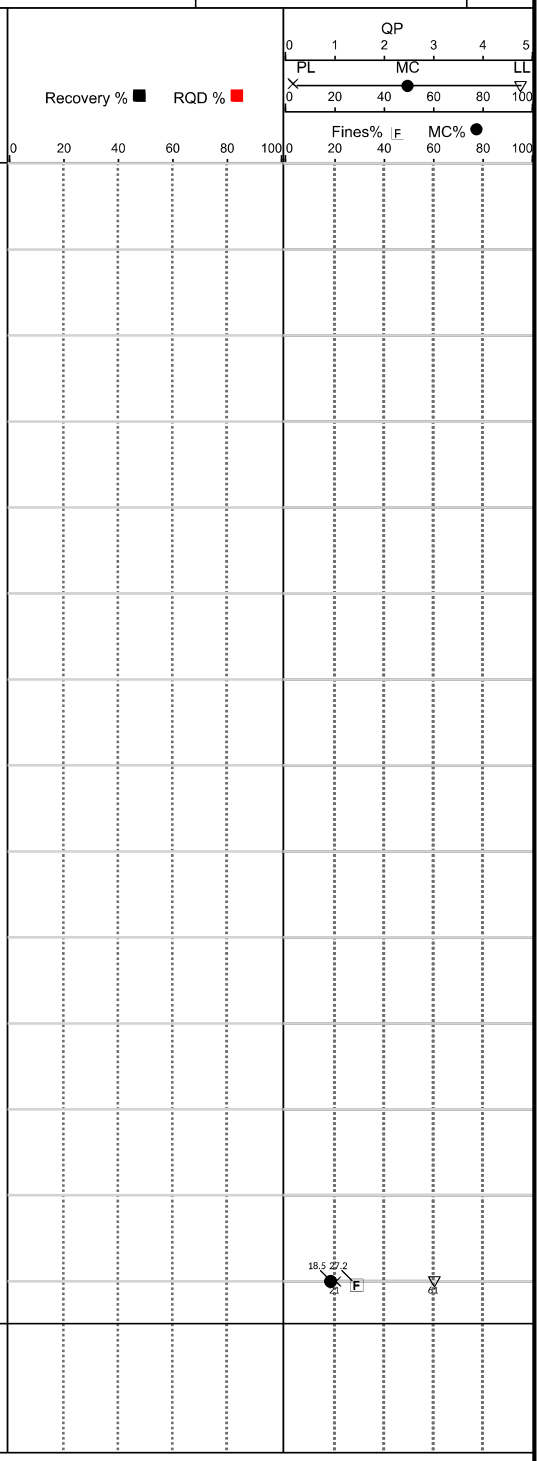
CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Homes for America	**12:20641-B**	**B-21A**	**1 OF 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Roanoke Gateway Project - Building 2 Add. Exploration	**Blue Ridge Drilling, Inc.**

SITE LOCATION:	LOSS OF CIRCULATION
624 Bullitt Ave SE, Roanoke, Virginia, 24022	

LATITUDE:	LONGITUDE:	STRUCTURE:	SURFACE ELEVATION:	BOTTOM OF CASING
37.268525	**-79.930933**	**Building 2**	**949**	

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
0					AUGER PROBE (Offset boring performed to collect Shelby Tube sample).			949	
5.0								945	
10.0								940	
15.0								935	
20.0								930	
25.0	ST-01	ST	24	24	(GC) Residuum, CLAYEY GRAVEL WITH SAND - yellowish brown, wet.			925	
					END OF BORING at 27.0 FT				



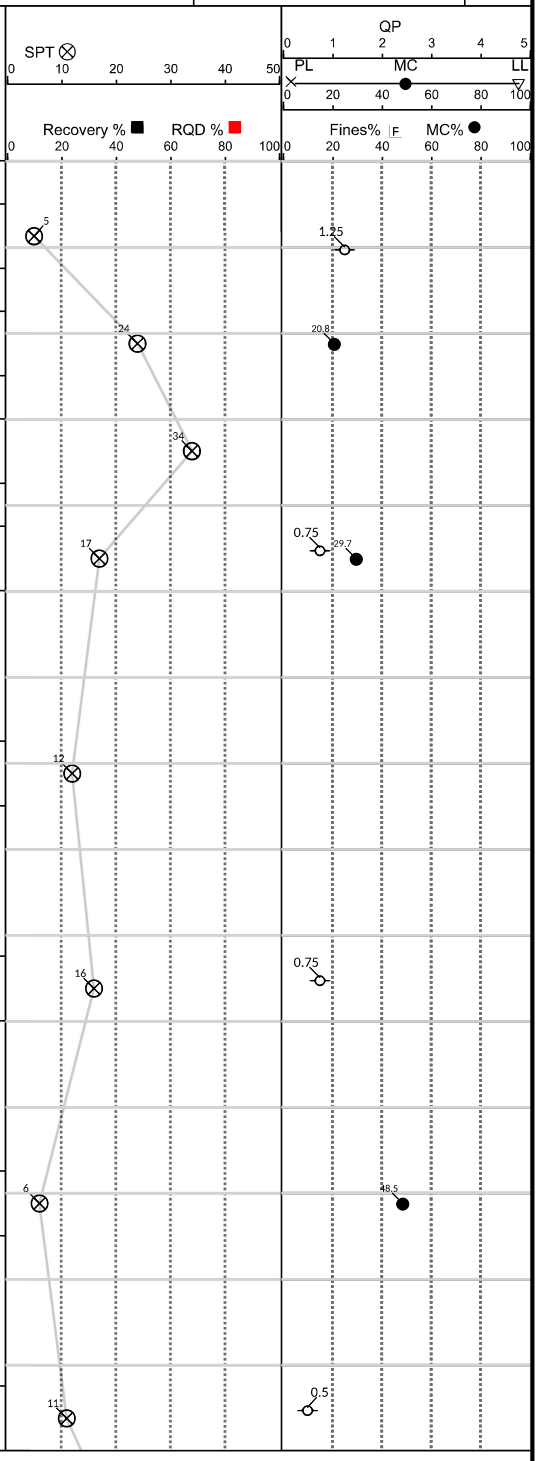
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered):	Not Measured	BORING STARTED:	03/19/2026	CAVE IN DEPTH:	Not Recorded
WL (Completion):	Not Measured	BORING COMPLETED:	03/19/2026	HAMMER TYPE:	
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	
WL (Stabilized):		ATV CME-55	LNB	Hollow Stem Auger (0'-25')	

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Homes for America	**12:20641-B**	**B-22**	**1 OF 2**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **Blue Ridge Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.26854225**	LONGITUDE: **-79.93086107**	STRUCTURE: **Building 2**	SURFACE ELEVATION: **951**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
					Topsoil [Thickness=3"].				
	S-1	SS	18	18	(CH) Residuum, FAT CLAY WITH SAND - reddish brown, moist, firm.			950	2-2-3 (5)
	S-2	SS	18	18	(CL) LEAN CLAY WITH SAND - trace gravel, reddish brown, moist, very stiff to hard.				5-10-14 (24)
5.0	S-3	SS	18	18				945	9-21-13 (34)
	S-4	SS	18	16	(CH) FAT CLAY - trace sand, reddish brown, moist, very stiff.				9-9-8 (17)
10.0	S-5	SS	18	15	(CH) GRAVELLY FAT CLAY WITH SAND - light brown and gray, moist, stiff.			940	5-6-6 (12)
15.0	S-6	SS	18	17	(CH) FAT CLAY WITH SAND - trace gravel, light brown, moist, firm to very stiff.			935	10-8-8 (16)
20.0	S-7	SS	18	18				930	2-3-3 (6)
25.0	S-8	SS	18	18				925	3-5-6 (11)



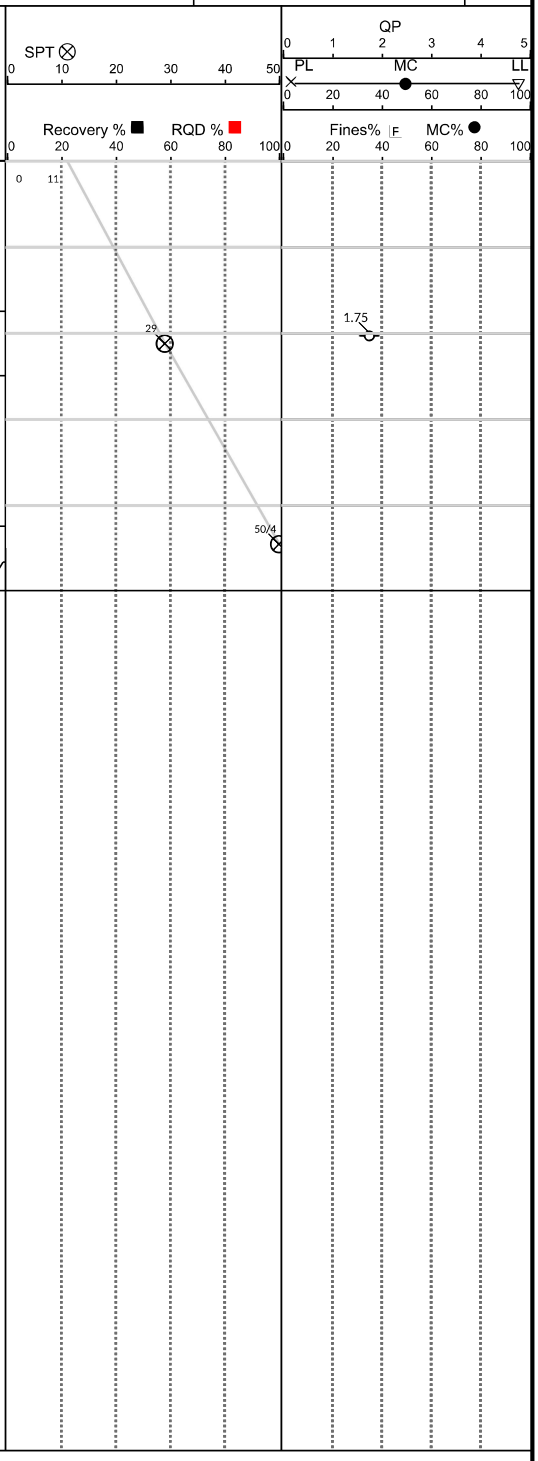
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered):	Dry	BORING STARTED:	03/13/2026	CAVE IN DEPTH:	17.3 FT
WL (Completion):	Dry	BORING COMPLETED:	03/13/2026	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-40')
WL (Stabilized):		ATV CME-55	LNB		

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Homes for America**	PROJECT NO.: **12:20641-B**	BORING NO.: **B-22**	SHEET: **2 OF 2**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **Blue Ridge Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.26854225**	LONGITUDE: **-79.93086107**	STRUCTURE: **Building 2**	SURFACE ELEVATION: **951**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
					(CH) FAT CLAY WITH SAND - trace gravel, light brown, moist, firm to very stiff.			920	
	S-9	SS	18	18	(GC) CLAYEY GRAVEL WITH SAND - orangish brown, moist, medium dense.				5-13-16 (29)
35.0								915	
					(WR) WEATHERED ROCK SAMPLED AS NO RECOVERY.				
	S-10	SS	10	0					29-50/4" (50/4)
					END OF BORING at 40.0 FT				



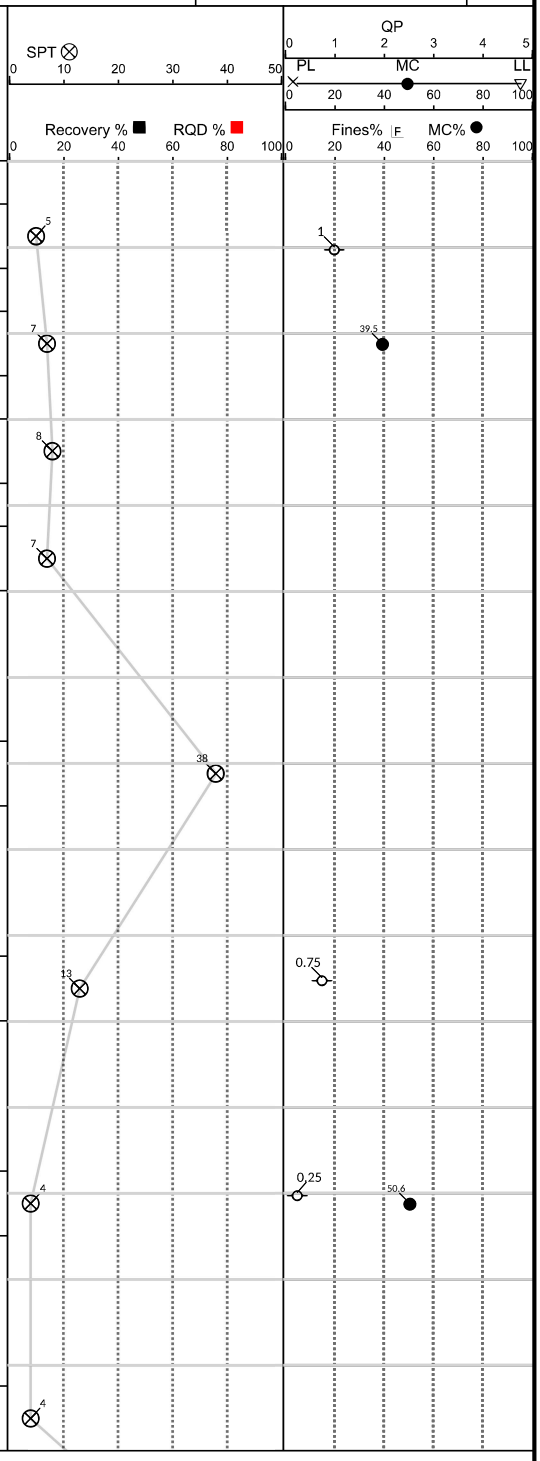
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered):	Dry	BORING STARTED:	03/13/2026	CAVE IN DEPTH:	17.3 FT
WL (Completion):	Dry	BORING COMPLETED:	03/13/2026	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-40')
WL (Stabilized):		ATV CME-55	LNB		

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Homes for America	**12:20641-B**	**B-23**	**1 OF 2**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **Blue Ridge Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.26844202**	LONGITUDE: **-79.93095811**	STRUCTURE: **Building 2**	SURFACE ELEVATION: **950**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
					Topsoil [Thickness=4"].				
	S-1	SS	18	18	(CL) Residuum, LEAN CLAY WITH SAND - yellowish brown, moist, firm.				2-3-2 (5)
	S-2	SS	18	18					2-3-4 (7)
5.0	S-3	SS	18	16				945	3-3-5 (8)
	S-4	SS	18	18					2-2-5 (7)
10.0								940	
	S-5	SS	18	16	(GM) SILTY GRAVEL WITH SAND - light brown and gray, moist, dense.				11-17-21 (38)
15.0								935	
	S-6	SS	18	16	(CL) LEAN CLAY WITH GRAVEL - trace sand, yellowish brown, moist, stiff.				5-5-8 (13)
20.0								930	
	S-7	SS	18	15	(CH) FAT CLAY - trace sand, reddish brown, moist, soft.				2-1-3 (4)
25.0								925	
	S-8	SS	18	18	(CH) FAT CLAY WITH SAND - trace silt, yellowish brown, wet, soft.				2-1-3 (4)



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

WL (First Encountered):	28 FT	BORING STARTED:	03/13/2026	CAVE IN DEPTH:	16.9 FT
WL (Completion):	28.5 FT	BORING COMPLETED:	03/13/2026	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-40')
WL (Stabilized):		ATV CME-55	LNB		

GEOTECHNICAL BOREHOLE LOG

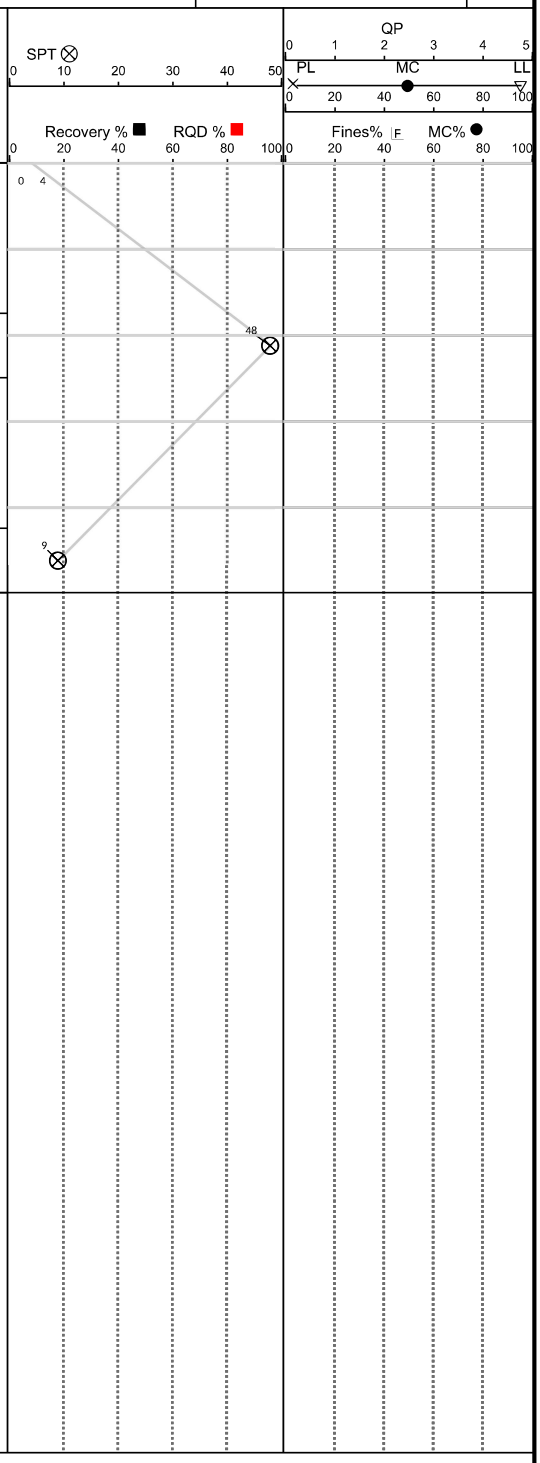
CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Homes for America	**12:20641-B**	**B-23**	**2 OF 2**

PROJECT NAME:	DRILLER/CONTRACTOR:
Roanoke Gateway Project - Building 2 Add. Exploration	**Blue Ridge Drilling, Inc.**

SITE LOCATION:	LOSS OF CIRCULATION
624 Bullitt Ave SE, Roanoke, Virginia, 24022	

LATITUDE:	LONGITUDE:	STRUCTURE:	SURFACE ELEVATION:	BOTTOM OF CASING
37.26844202	**-79.93095811**	**Building 2**	**950**	

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
					(CH) FAT CLAY WITH SAND - trace silt, yellowish brown, wet, soft. (continued)				
	S-9	SS	18	16	(CL) GRAVELLY LEAN CLAY WITH SAND - reddish brown, moist, hard.				9-22-26 (48)
35.0								915	
	S-10	SS	18	14	(CL) LEAN CLAY WITH GRAVEL - trace sand, yellowish brown, wet, stiff.				4-4-5 (9)
					END OF BORING at 40.0 FT				



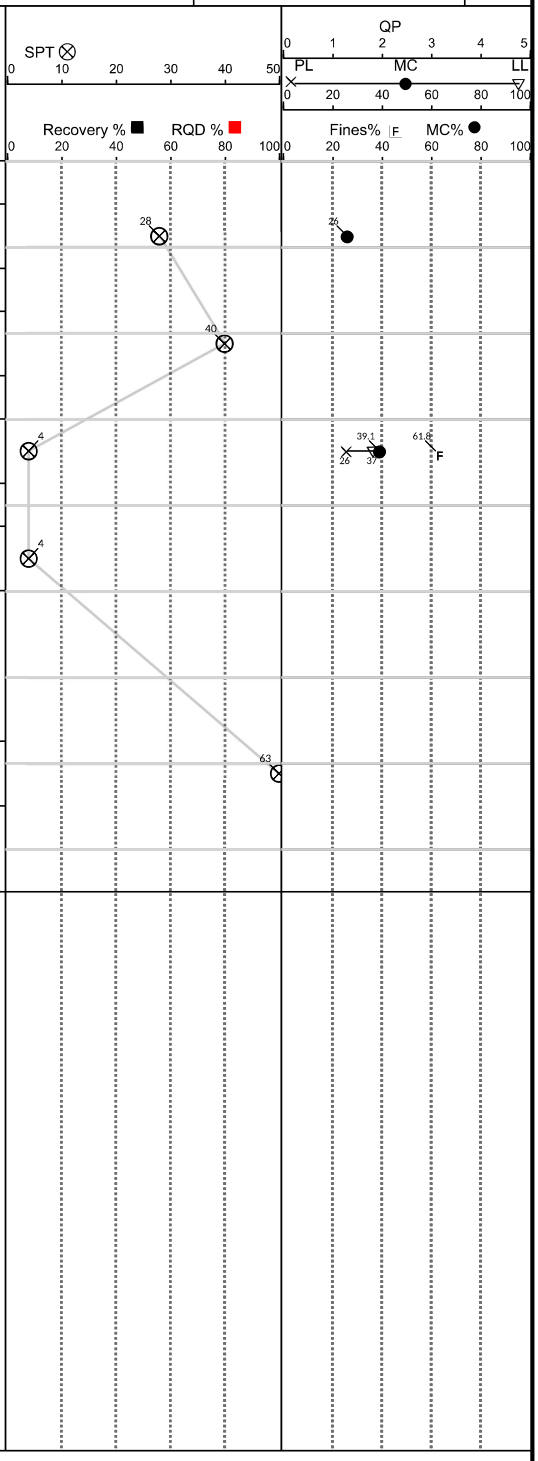
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered):	28 FT	BORING STARTED:	03/13/2026	CAVE IN DEPTH:	16.9 FT
WL (Completion):	28.5 FT	BORING COMPLETED:	03/13/2026	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-40')
WL (Stabilized):		ATV CME-55	LNB		

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Homes for America	**12:20641-B**	**B-24**	**1 OF 1**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **Blue Ridge Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.26849022**	LONGITUDE: **-79.93075551**	STRUCTURE: **Building 2**	SURFACE ELEVATION: **954**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
					Topsoil [Thickness=8"].				
	S-1	SS	18	16	(CL) Residuum, LEAN CLAY WITH SAND - trace silt, light brown, moist, very stiff.				7-9-19 (28)
	S-2	SS	18	16	(CL) SANDY LEAN CLAY WITH GRAVEL - light brown, moist, hard.			950	13-21-19 (40)
5.0	S-3	SS	18	14	(ML) SANDY SILT - trace gravel, yellowish brown, wet, very loose.				3-2-2 (4)
	S-4	SS	18	14	(CH) FAT CLAY - trace sand, reddish brown, moist, soft.			945	2-2-2 (4)
10.0									
	S-5	SS	18	14	(WR) WEATHERED ROCK SAMPLED AS LEAN CLAY WITH GRAVEL - trace sand, light brown, moist, very hard.			940	17-29-34 (63)
15.0									
					AUGER REFUSAL at 17.0 FT				
					NOTE: Boring terminated and offset due to augers skewing				



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

WL (First Encountered):	6 FT	BORING STARTED:	03/19/2026	CAVE IN DEPTH:	12.1 FT
WL (Completion):	6 FT	BORING COMPLETED:	03/19/2026	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-17')
WL (Stabilized):		ATV CME-55	LNB		

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Homes for America	**12:20641-B**	**B-24A**	**1 OF 1**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **Blue Ridge Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.268486**	LONGITUDE: **-79.930772**	STRUCTURE: **Building 2**	SURFACE ELEVATION: **954**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
5.0					AUGER PROBE.			950 945	
					AUGER REFUSAL at 10.0 FT **NOTE:** Offset approximately 5 ft W of B-24				

Recovery % ■ RQD % ■ (0 20 40 60 80 100)

QP (0 1 2 3 4 5) PL MC LL (0 20 40 60 80 100)

Fines% F MC% ● (0 20 40 60 80 100)

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

▽ WL (First Encountered):	Not Measured	BORING STARTED:	03/19/2026	CAVE IN DEPTH:	Not Recorded
▼ WL (Completion):	Not Measured	BORING COMPLETED:	03/19/2026	HAMMER TYPE:	
▼ WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	
▽ WL (Stabilized):		ATV CME-55	LNB	Hollow Stem Auger (0'-10')	

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Homes for America	**12:20641-B**	**B-24B**	**1 OF 1**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **Blue Ridge Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.2685**	LONGITUDE: **-79.930776**	STRUCTURE: **Building 2**	SURFACE ELEVATION: **954**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
0					AUGER PROBE.			954	
5.0								950	
10.0								945	
15.0								940	
					AUGER REFUSAL at 15.5 FT				

Recovery % ■ RQD % ■ (0 20 40 60 80 100)

QP (0 1 2 3 4 5) PL MC LL (0 20 40 60 80 100) Fines% F MC% ● (0 20 40 60 80 100)

NOTE: Offset approximately 5 ft N of B-24A

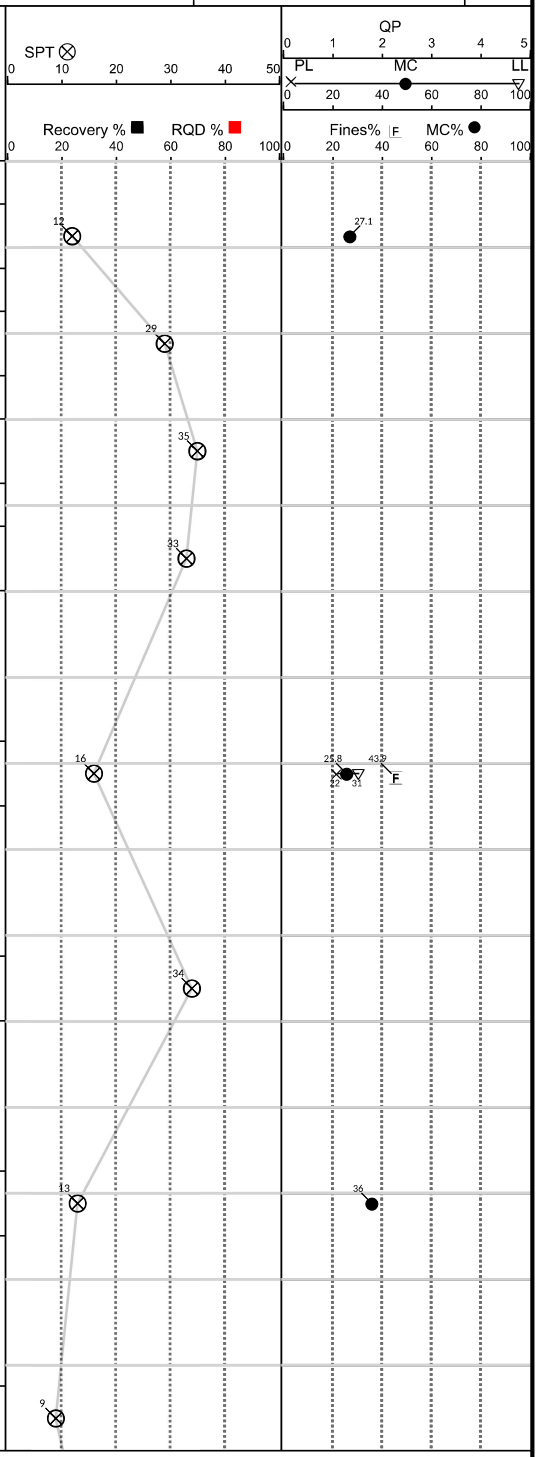
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered):	Not Measured	BORING STARTED:	03/19/2026	CAVE IN DEPTH:	0 FT Not Recorded
WL (Completion):	Not Measured	BORING COMPLETED:	03/19/2026	HAMMER TYPE:	
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	
WL (Stabilized):		ATV CME-55	LNB	Hollow Stem Auger (0'-15.5')	

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Homes for America	**12:20641-B**	**B-25**	**1 OF 2**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **Blue Ridge Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.26834285**	LONGITUDE: **-79.93100008**	STRUCTURE: **Building 2**	SURFACE ELEVATION: **950**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
					Topsoil [Thickness=8"].				
	S-1	SS	18	18	(CL) Residuum, LEAN CLAY WITH SAND - trace gravel and silt, brown, moist, stiff to very stiff.				2-4-8 (12)
	S-2	SS	18	18					6-13-16 (29)
5.0								945	
	S-3	SS	18	18	(ML) SILT WITH SAND - trace gravel, brown, moist, dense.				8-17-18 (35)
	S-4	SS	18	18					10-18-15 (33)
10.0								940	
	S-5	SS	18	18	(GC) CLAYEY GRAVEL WITH SAND - orangish brown, moist, medium dense.				4-4-12 (16)
15.0								935	
	S-6	SS	18	16	(CH) GRAVELLY FAT CLAY WITH SAND - reddish brown, moist, hard.				10-18-16 (34)
20.0								930	
	S-7	SS	18	18	(CH) FAT CLAY WITH SAND - trace gravel, yellowish brown, wet, stiff.				3-5-8 (13)
25.0								925	
	S-8	SS	18	16	(CH) GRAVELLY FAT CLAY WITH ...Continued on next page				3-5-4 (9)



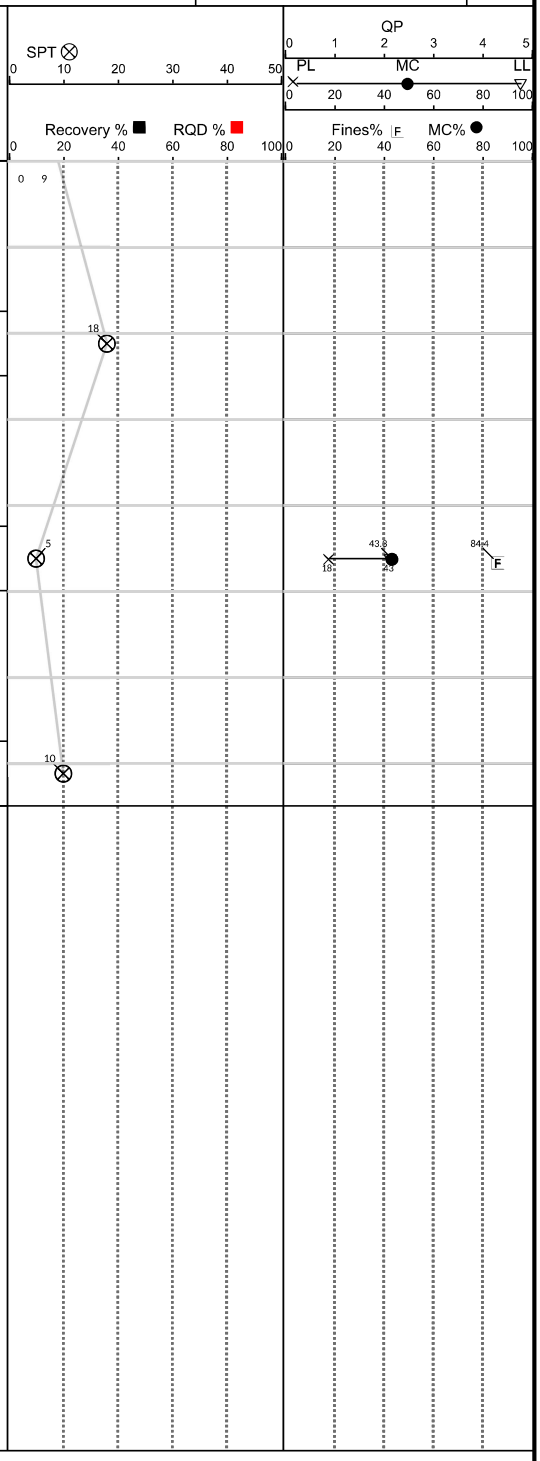
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered):	23.5 FT	BORING STARTED:	03/19/2026	CAVE IN DEPTH:	6.4 FT
WL (Completion):	23.5 FT	BORING COMPLETED:	03/19/2026	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-45')
WL (Stabilized):		ATV CME-55	LNB		

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Homes for America**	PROJECT NO.: **12:20641-B**	BORING NO.: **B-25**	SHEET: **2 OF 2**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **Blue Ridge Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.26834285**	LONGITUDE: **-79.93100008**	STRUCTURE: **Building 2**	SURFACE ELEVATION: **950**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
					(CH) GRAVELLY FAT CLAY WITH SAND - yellowish brown to orangish brown, moist to wet, firm to very stiff. (continued)				
	S-9	SS	18	16					6-8-10 (18)
35.0								915	
					(CL) LEAN CLAY WITH SAND - trace gravel, reddish brown, moist, firm to stiff.				
	S-10	SS	18	16					3-3-2 (5)
40.0								910	
	S-11	SS	18	18					3-5-5 (10)
					END OF BORING at 45.0 FT				



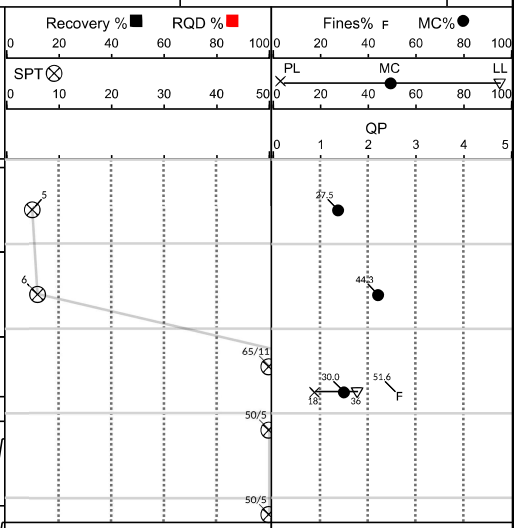
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered):	23.5 FT	BORING STARTED:	03/19/2026	CAVE IN DEPTH:	6.4 FT
WL (Completion):	23.5 FT	BORING COMPLETED:	03/19/2026	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-45')
WL (Stabilized):		ATV CME-55	LNB		

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Homes for America	**12:20641**	**P-03**	**1 OF 1**
PROJECT NAME:	DRILLER/CONTRACTOR:		
Roanoke Gateway Project Phase I	**SEQ Drilling, Inc.**		
SITE LOCATION:			LOSS OF CIRCULATION
624 Bullitt Ave SE, Roanoke, Virginia, 24022			
LATITUDE:	LONGITUDE:	STRUCTURE:	SURFACE ELEVATION:
37.26808314	**-79.93197668**		**947**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
					Asphalt [Thickness=2"].				
	S-1	SS	24	10	(CL) SANDY LEAN CLAY WITH GRAVEL - orangish brown, moist, firm.			945	14-3-2-3 (5)
	S-2	SS	24	21					3-3-3-3 (6)
5.0	S-3	SS	17	17	(WR) WEATHERED ROCK sampled as LEAN CLAY WITH SAND - light brown, moist, very hard.				3-15-50/5" (65/11)
	S-4	SS	5	5	(WR) WEATHERED ROCK sampled as FAT CLAY WITH SAND - light brown, moist, very hard.			940	50/5" (50/5)
	S-5	SS	5	4	(WR) WEATHERED ROCK sampled as WELL-GRADED GRAVEL WITH SAND - gray and light brown, moist, very dense.				50/5" (50/5)
					AUGER REFUSAL at 8.6 FT				



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

WL (First Encountered):	Dry	BORING STARTED:	11/17/2025	CAVE IN DEPTH:	7FT
WL (Completion):	Dry	BORING COMPLETED:	11/17/2025	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	
WL (Stabilized):		Track CME300	LNB	Hollow Stem Auger (0'-8.6')	

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Homes for America	**12:20641-B**	**P-04**	**1 OF 1**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **SEQ Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.26820181**	LONGITUDE: **-79.93147677**	STRUCTURE:	SURFACE ELEVATION: **946**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
	S-1	SS	24	16	Topsoil [Thickness=2"]. (CL) Residuum, SANDY LEAN CLAY - trace gravel, light brown, moist, firm.			945	2-4-4-5 (8)
	S-2	SS	24	15	(CL) LEAN CLAY WITH SAND - brown to orangish brown, moist, stiff to very stiff.				3-5-4-7 (9)
5.0	S-3	SS	24	16					3-6-7-9 (13)
	S-4	SS	24	19				940	3-5-9-12 (14)
	S-5	SS	24	20					3-7-9-10 (16)
					END OF BORING at 10.0 FT				

SPT 0 10 20 30 40 50 — Recovery % 0 20 40 60 80 100 — RQD % 0 20 40 60 80 100

QP 0 1 2 3 4 5 — PL MC LL 0 20 40 60 80 100 — Fines% 0 20 40 60 80 100 — MC% 0 20 40 60 80 100

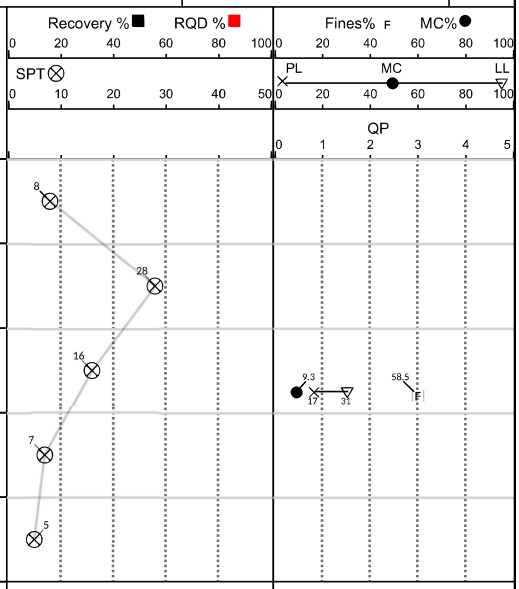
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered):	Dry	BORING STARTED:	12/03/2025	CAVE IN DEPTH:	Not Observed
WL (Completion):	Dry	BORING COMPLETED:	12/03/2025	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-10')
WL (Stabilized):		Track CME-550X	LNB		

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Homes for America	**12:20641-A**	**P-05**	**1 OF 1**
PROJECT NAME: **Roanoke Gateway Project Phase II**	DRILLER/CONTRACTOR: **SEQ Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.26811612**	LONGITUDE: **-79.93077803**	STRUCTURE:	SURFACE ELEVATION: **955**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
	S-1	SS	24	20	Topsoil [Thickness=2"]. (CL) Residuum, SANDY LEAN CLAY - trace gravel, brown, moist, firm to stiff.				2-3-5-8 (8)
	S-2	SS	24	17					5-12-16-20 (28)
5.0	S-3	SS	24	12				950	6-7-9-7 (16)
	S-4	SS	24	14					2-3-4-3 (7)
	S-5	SS	24	7					2-2-3-2 (5)
					END OF BORING at 10.0 FT			945	



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

WL (First Encountered):	Dry	BORING STARTED:	12/03/2025	CAVE IN DEPTH:	8FT
WL (Completion):	Dry	BORING COMPLETED:	12/03/2025	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	
WL (Stabilized):		Track CME-550X	LNB	Hollow Stem Auger (0'-10')	

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Homes for America**	PROJECT NO.: **12:20641-B**	BORING NO.: **P-06**	SHEET: **1 OF 1**
PROJECT NAME: **Roanoke Gateway Project - Building 2 Add. Exploration**	DRILLER/CONTRACTOR: **SEQ Drilling, Inc.**		
SITE LOCATION: **624 Bullitt Ave SE, Roanoke, Virginia, 24022**			LOSS OF CIRCULATION
LATITUDE: **37.26837679**	LONGITUDE: **-79.93033181**	STRUCTURE:	SURFACE ELEVATION: **964**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE (IN)	SAMPLE RECOVERY (IN)	DESCRIPTION OF MATERIAL	STRATIGRAPHY	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/RS/MC/SPT-N VALUE)*
	S-1	SS	24	13	(GP) POORLY GRADED GRAVEL WITH SAND - reddish brown, moist, medium dense to very dense.				4-8-11-15 (19)
	S-2	SS	24	18					10-20-36-40 (56)
	S-3	SS	11	9	(WR) WEATHERED ROCK sampled as POORLY GRADED GRAVEL WITH SAND - reddish brown, moist, very dense.			960	16-50/5" (50/5)
5.0									
	S-4	SS	23	8					18-27-38-50/5" (65)
	S-5	SS	22	8				955	17-25-46-50/4" (71)
					END OF BORING at 10.0 FT				

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

WL (First Encountered):	Dry	BORING STARTED:	12/03/2025	CAVE IN DEPTH:	Not Observed
WL (Completion):	Dry	BORING COMPLETED:	12/03/2025	HAMMER TYPE:	Automatic
WL (Seasonal High Water):		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	Hollow Stem Auger (0'-10')
WL (Stabilized):		Track CME-550X	LNB		

GEOTECHNICAL BOREHOLE LOG

APPENDIX C – Laboratory Testing

Laboratory Test Results Summary
Plasticity Charts
Grain Size Analyses
Moisture-Density Relationship Curves
CBR Test Results
Unconfined Compressive Strength Test Results

Laboratory Testing Summary

Sample Location	Sample Number	Depth (ft)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-02	S-2	2.0-4.0	25.1										
B-02	S-5	8.0-10.0	42.5										
B-02	S-6	13.0-15.0	69.5	CL	49	24	25	97.7					
B-02	S-9	28.0-30.0	61.9	CH	81	29	52	99.4					
B-03	S-2	2.0-4.0	9.6	SM	29	23	6	32.4					
B-04	S-2	2.0-4.0	38.8	ML	36	29	7	81.6					
B-04	S-5	8.0-10.0	35.3	ML	37	26	11	82.2					
P-05	D3S-88	1.0-10.0	9.3	CL	31	17	14	58.5	108.8	15.8	2.9	2.4	

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: Roanoke Gateway Project Phase II
Client: Homes for America

Project No.: 12:20641-A
Date Reported: 1/14/2026



Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received
JHrysenko	JMurphy	JMurphy	1212/2025

Laboratory Testing Summary

Sample Location	Sample Number	Depth (ft)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-19	S-1	1.0-2.5	19.6	CL	44	18	26	80.5					
B-19	S-4	8.5-10.0	38.1										
B-20	S-1	1.0-2.5	33.0										
B-20A	S-2	8.5-10.0	18.6										
B-21	S-1	1.0-2.5	21.7	ML	33	25	8	65.5					
B-21	S-3	6.0-7.5	24.7										
B-21	S-5	13.5-15.0	32.1	CL	48	22	26	59.4					
B-21	S-8	28.5-30.0	63.8										
B-22	S-2	3.5-5.0	20.8										
B-22	S-4	8.5-10.0	29.7										

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: Roanoke Gateway Project - Building 2 Add. Exploration
Client: Homes for America

Project No.: 12:20641-B
Date Reported: 4/21/2026



Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received
JHrysenko	JMurphy	JMurphy	3/26/2026

Laboratory Testing Summary

Sample Location	Sample Number	Depth (ft)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-22	S-7	23.5-25.0	48.5										
B-23	S-2	3.5-5.0	39.5										
B-23	S-7	23.5-25.0	50.6										
B-24	S-1	1.0-2.5	26.0										
B-24	S-3	6.0-7.5	39.1	ML	37	26	11	61.8					
B-25	S-1	1.0-2.5	27.1										
B-25	S-5	13.5-15.0	25.8	GC	31	22	9	43.9					
B-25	S-7	23.5-25.0	36.0										
B-25	S-10	38.5-40.0	43.3	CL	43	18	25	84.4					

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: Roanoke Gateway Project - Building 2 Add. Exploration
Client: Homes for America

Project No.: 12:20641-B
Date Reported: 4/21/2026



Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received
JHrysenko	JMurphy	JMurphy	3/26/2026

Laboratory Testing Summary

Sample Location	Sample Number	Depth (ft)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-21A	ST-01	25.0-27.0	18.5	GC	61	21	40	27.2					

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

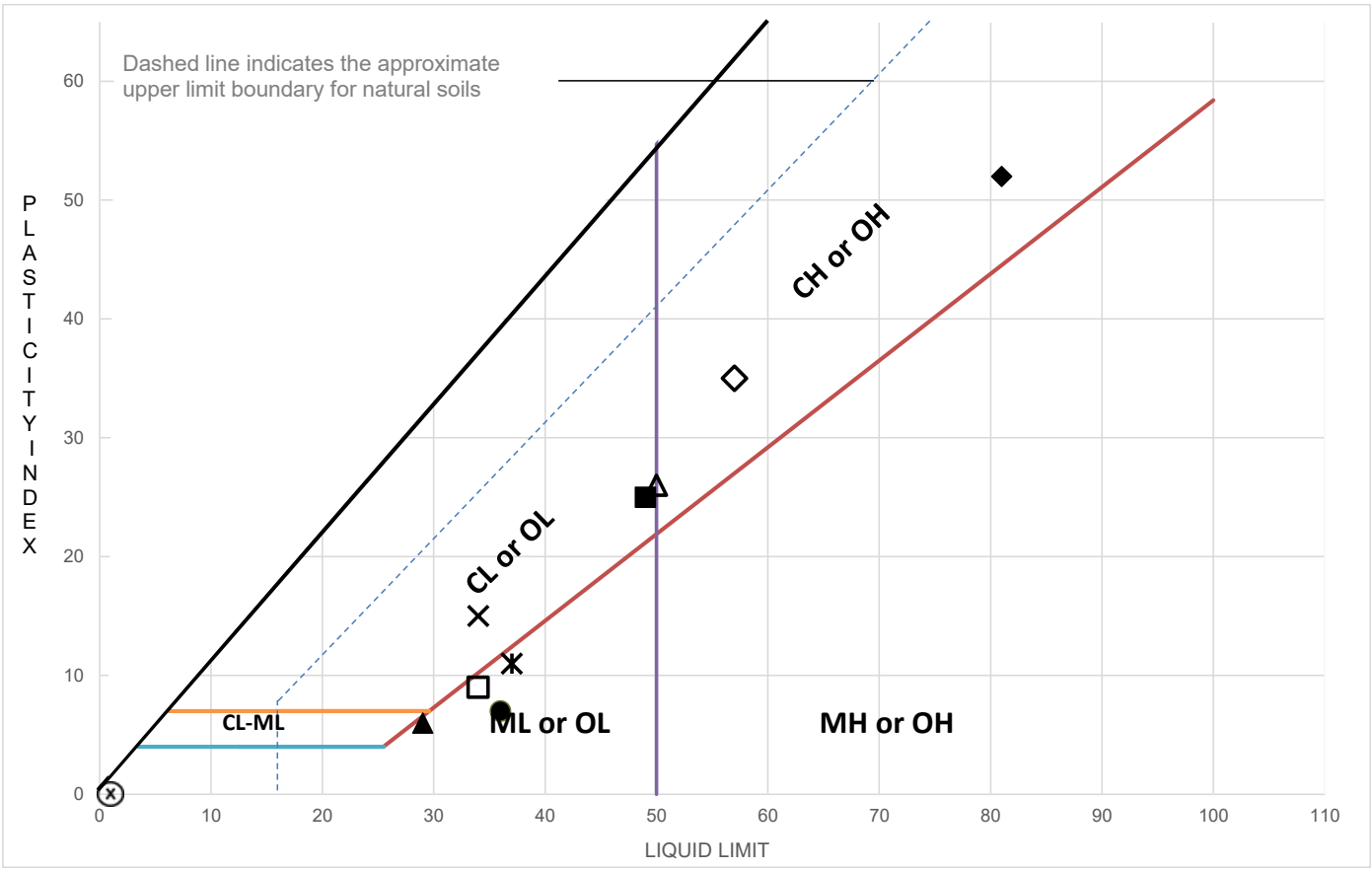
Project: Roanoke Gateway Project - Building 2 Add. Exploration
Client: Homes for America

Project No.: 12:20641-B
Date Reported: 4/10/2026

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	Date Received
jvong	Htran	MUzun	4/8/2026

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	S-6	13.00-15.00	49	24	25	99.4	97.7	A-7-6	CL	Light Brown LEAN CLAY
◆	B-02	S-9	28.00-30.00	81	29	52	99.9	99.4	A-7-6	CH	Orange Brown FAT CLAY
▲	B-03	S-2	2.00-4.00	29	23	6	42.7	32.4	A-2-4	SM	Brown SILTY SAND with Gravel
●	B-04	S-2	2.00-4.00	36	29	7	93.8	81.6	A-4	ML	Yellow SILT with Sand

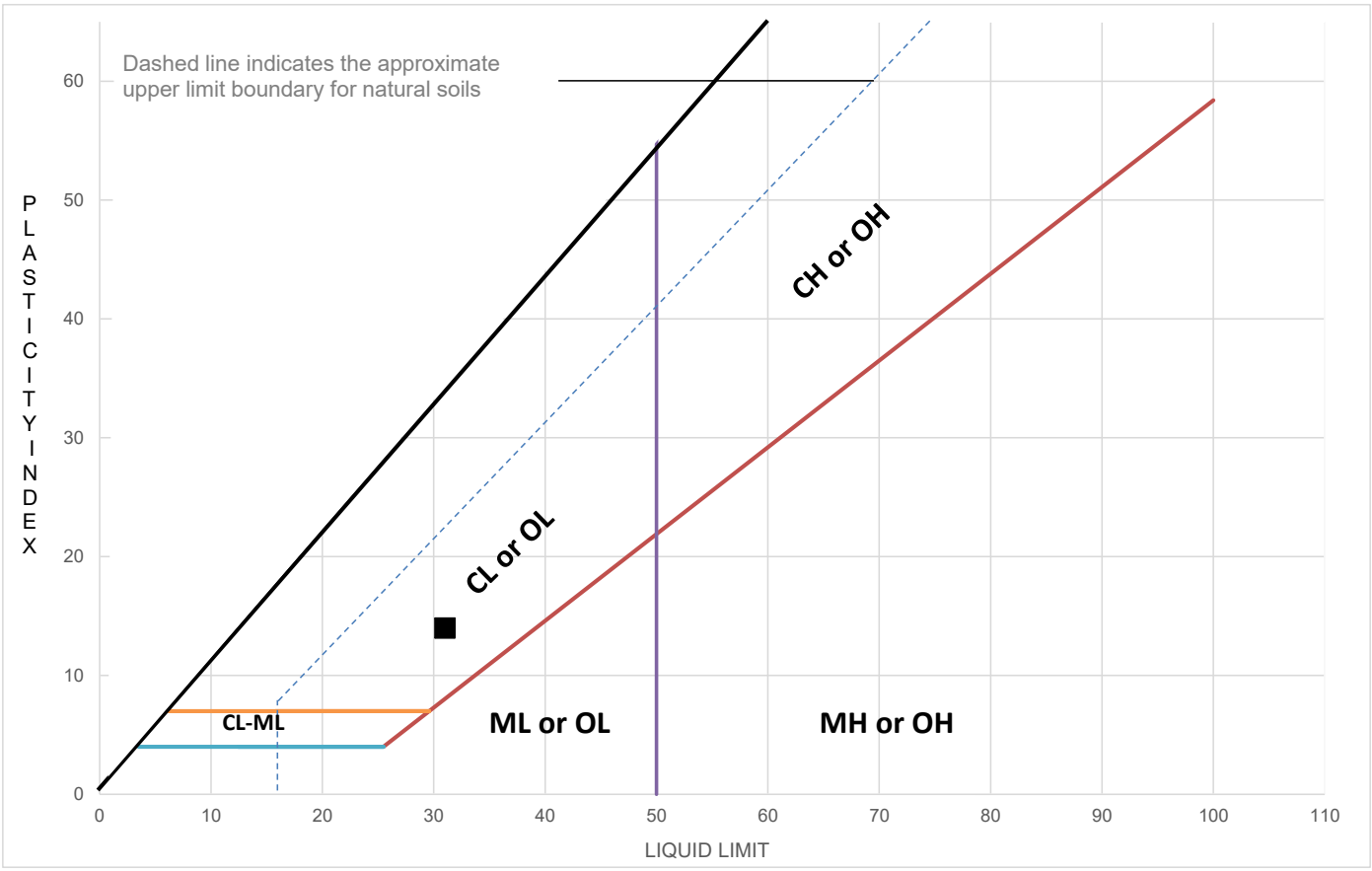
Project: Roanoke Gateway Project Phase II
Client: Homes for America

Project No.: 12:20641-A
Date Reported: 1/14/2026

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received
JHrysenko	JMurphy	JMurphy	1212/2025

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
■	P-05	D3S-88	1.00-10.00	31	17	14	71.7	58.5	A-6	CL	Sandy Lean Clay Brown

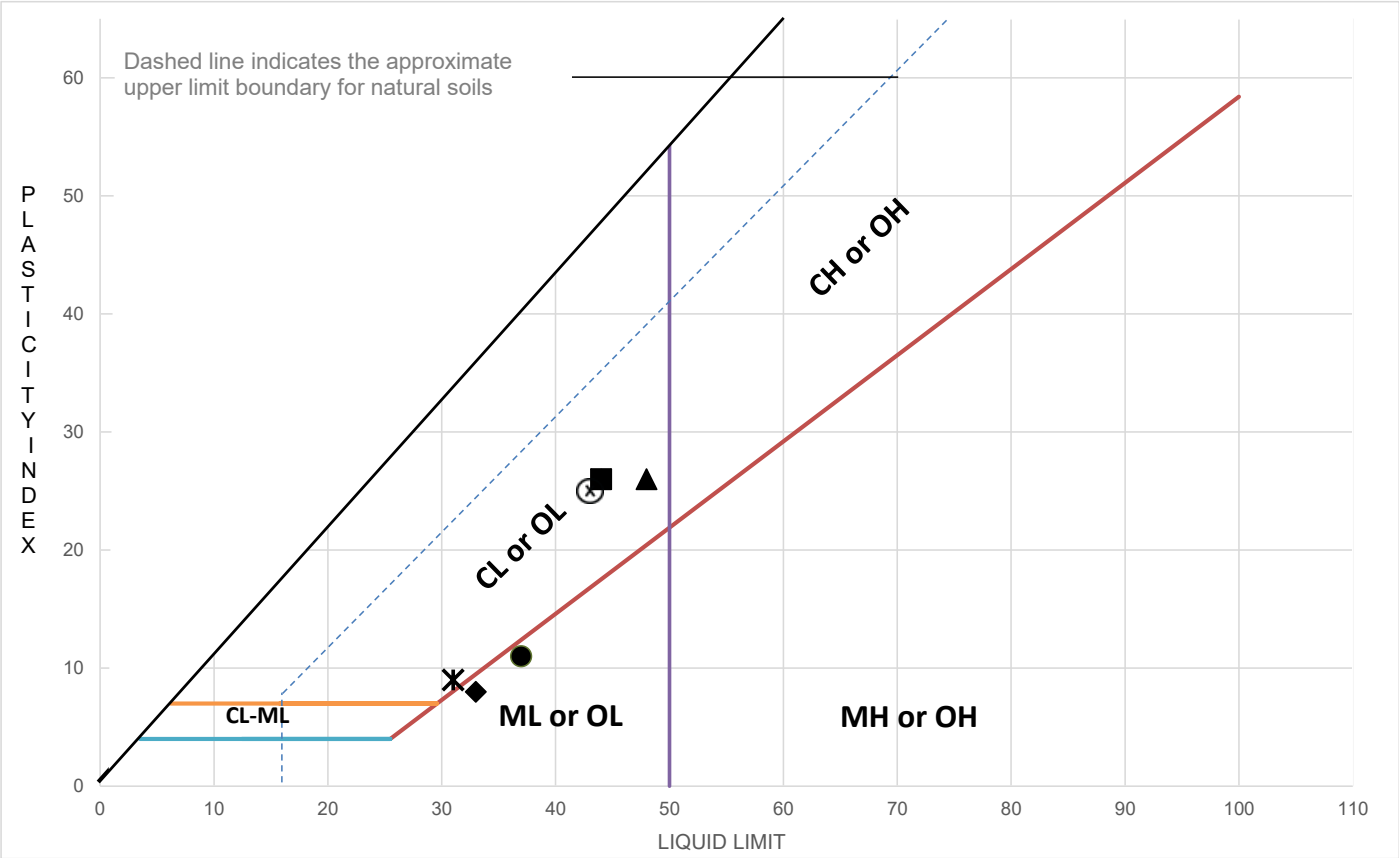
Project: Roanoke Gateway Project Phase II
Client: Homes for America

Project No.: 12:20641-A
Date Reported: 1/14/2026

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received
jvong	Htran	MUzun	12/16/2025

LIQUID AND PLASTIC LIMITS TEST REPORT



TEST RESULTS ()

	Sample Location	Sample Number	Sample Depth ()	LL	PL	PI	%<#40	%<#200	AASHTO	USCS	Material Description
■	B-19	S-1	1.00-2.50	44	18	26	89.0	80.5	A-7-6	CL	Red Brown LEAN CLAY with Sand
◆	B-21	S-1	1.00-2.50	33	25	8	70.3	65.5	A-4	ML	Light Brown SANDY SILT
▲	B-21	S-5	13.50-15.00	48	22	26	68.3	59.4	A-7-6	CL	Light Brown SANDY LEAN CLAY
●	B-24	S-3	6.00-7.50	37	26	11	70.4	61.8	A-6	ML	Yellow SANDY SILT
✳	B-25	S-5	13.50-15.00	31	22	9	50.6	43.9	A-4	GC	Dark Brown CLAYEY GRAVEL with Sand
⊗	B-25	S-10	38.50-40.00	43	18	25	90.5	84.4	A-7-6	CL	Brown LEAN CLAY with Sand

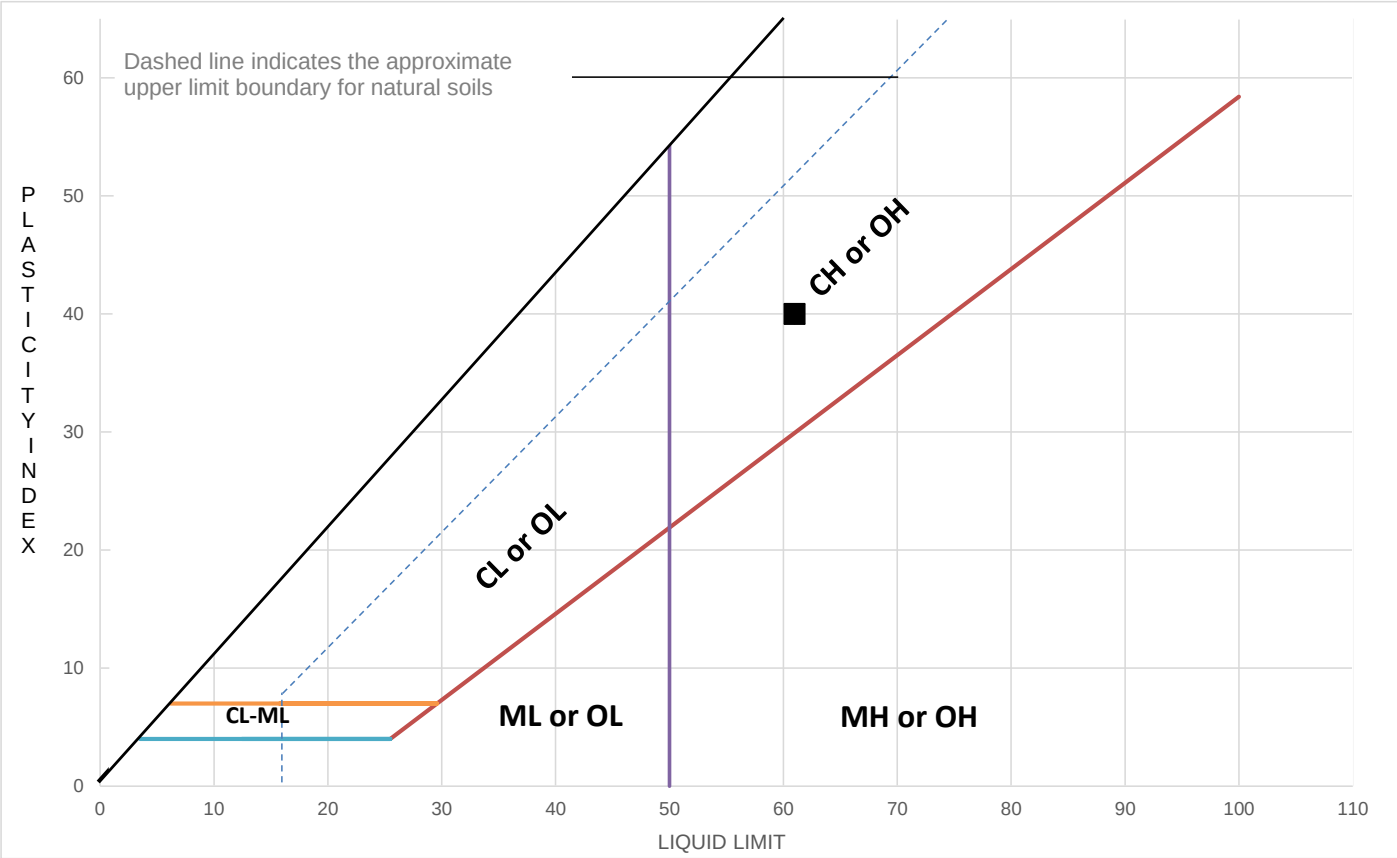
Project: Roanoke Gateway Project - Building 2 Add. Exploration
Client: Homes for America

Project No.: 12:20641-B
Date Reported: 4/21/2026

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received
JHrysenko	JMurphy	JMurphy	3/26/2026

LIQUID AND PLASTIC LIMITS TEST REPORT



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

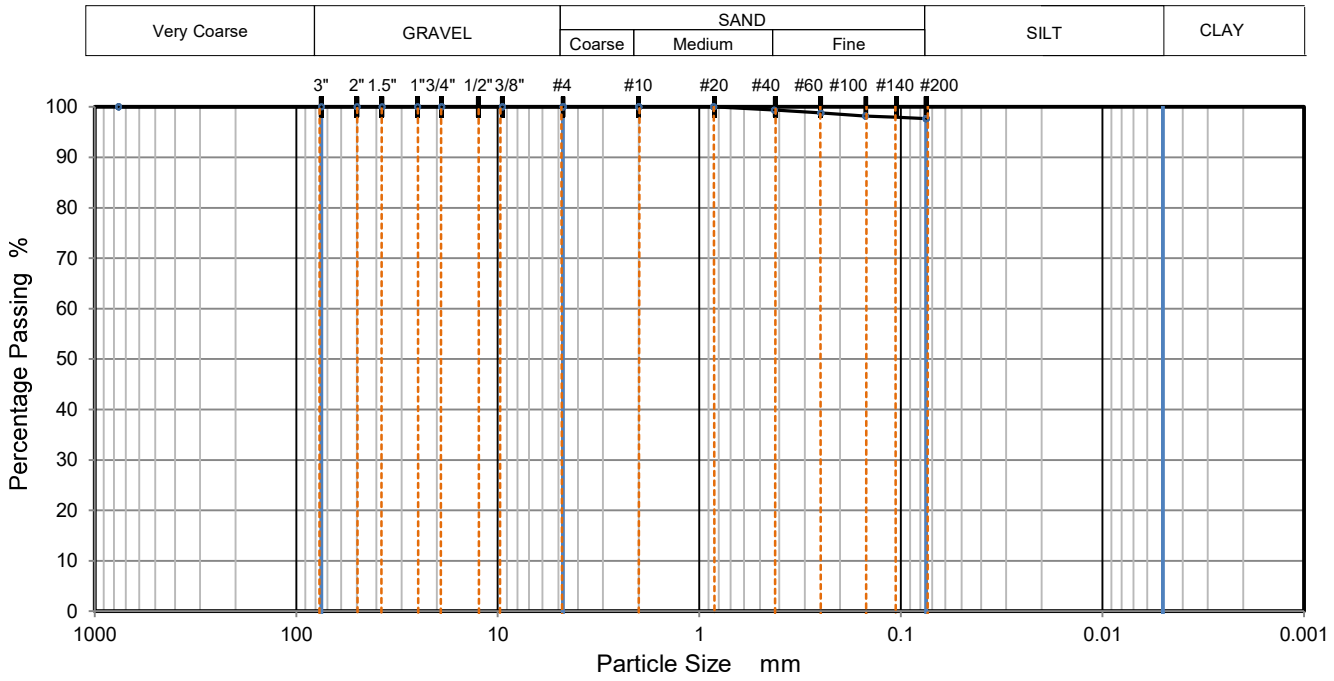
	Sample Location	Sample Number	Sample Depth (ft)	LL	PL	PI	%<#40	%<#200	AASHTO	USCS	Material Description
■	B-21A	ST-01	25.00-27.00	61	21	40	31.3	27.2	A-2-7	GC	Clayey Gravel with Sand Yellowish Brown

Project: Roanoke Gateway Project - Building 2 Add. Exploration
Client: Homes for America
Project No.: 12:20641-B
Date Reported: 4/10/2026

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	Date Received
jvong	Htran	MUzun	4/8/2026

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D6913M-17-METHOD A)

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100		
2"	100		
1 1/2"	100		
1"	100		
3/4"	100		
3/8"	100		
#4	100		
#10	100		
#20	100		
#40	99		
#60	99		
#100	98		
#200	98		

Dry Mass of sample, g: 28.1

Sample Proportions	% dry mass
Very coarse, >3" sieve	0
Gravel, 3" to # 4 sieve	0
Coarse Sand, #4 to #10 sieve	0
Medium Sand, #10 to #40	1
Fine Sand, #40 to #200	2
Fines <#200	98

USCS	CL	Liquid Limit	49	D90		D50		D10	
AASHTO	A-7-6	Plastic Limit	24	D85		D30		Cu	
USCS Group Name	Lean clay	Plasticity Index	25	D60		D15		Cc	

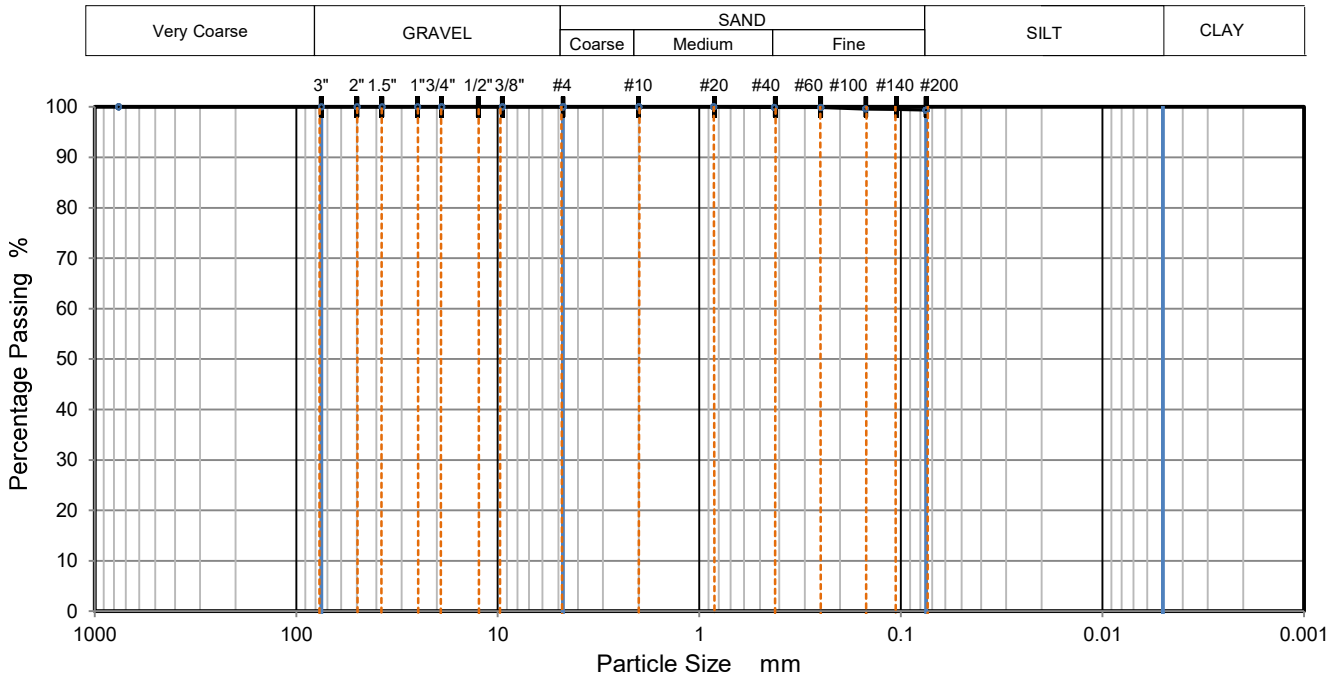
Project: Roanoke Gateway Project Phase II
Client: Homes for America
Sample Description: Light Brown LEAN CLAY
Sample Source: B-02

Project No.: 12:20641-A
Depth (ft): 13.0 - 15.0
Sample No.: S-6
Date Reported: 1/14/2026

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received	Remarks
JHrysenko	JMurphy	JMurphy	1212/2025	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D6913M-17-METHOD A)

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100		
2"	100		
1 1/2"	100		
1"	100		
3/4"	100		
3/8"	100		
#4	100		
#10	100		
#20	100		
#40	100		
#60	100		
#100	100		
#200	99		

Dry Mass of sample, g: 9.6

Sample Proportions	% dry mass
Very coarse, >3" sieve	0
Gravel, 3" to # 4 sieve	0
Coarse Sand, #4 to #10 sieve	0
Medium Sand, #10 to #40	0
Fine Sand, #40 to #200	1
Fines <#200	99

USCS	CH	Liquid Limit	81	D90		D50		D10	
AASHTO	A-7-6	Plastic Limit	29	D85		D30		Cu	
USCS Group Name	Fat clay	Plasticity Index	52	D60		D15		Cc	

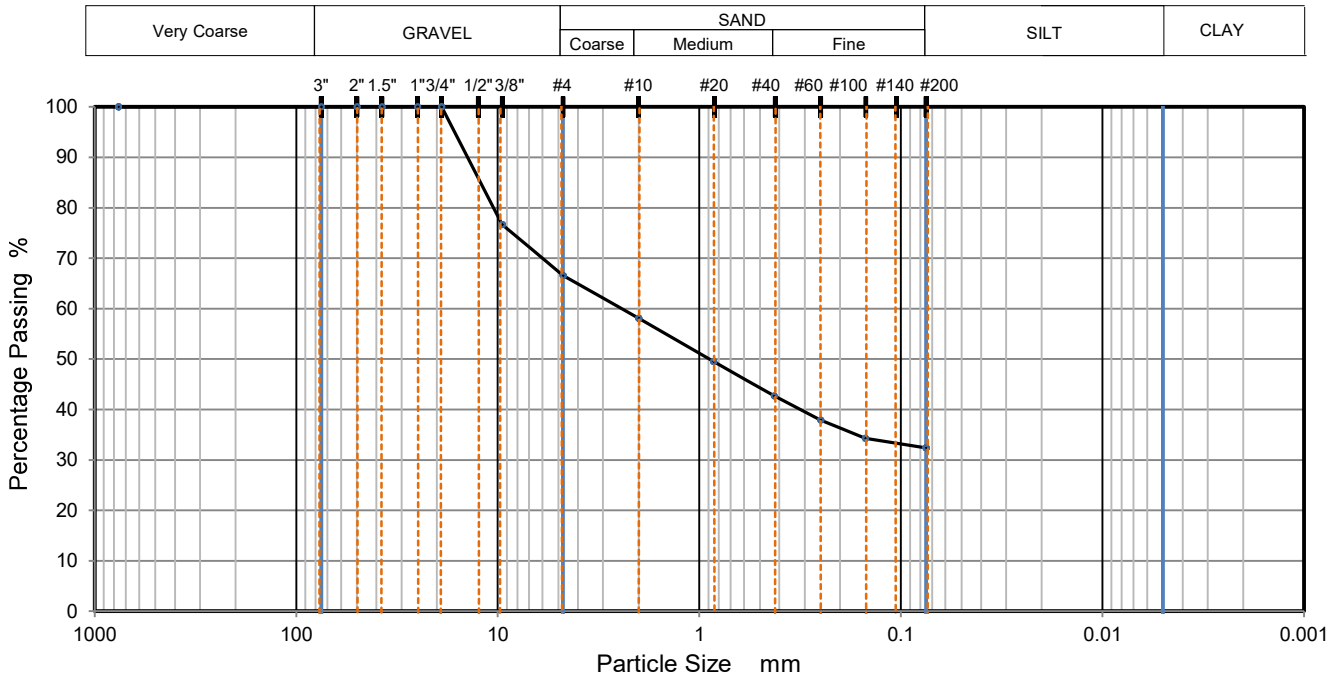
Project: Roanoke Gateway Project Phase II
Client: Homes for America
Sample Description: Orange Brown FAT CLAY
Sample Source: B-02

Project No.: 12:20641-A
Depth (ft): 28.0 - 30.0
Sample No.: S-9
Date Reported: 1/14/2026

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received	Remarks
JHrysenko	JMurphy	JMurphy	1212/2025	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D6913M-17-METHOD A)

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100		
2"	100		
1 1/2"	100		
1"	100		
3/4"	100		
3/8"	77		
#4	67		
#10	58		
#20	50		
#40	43		
#60	38		
#100	34		
#200	32		

Dry Mass of sample, g: 47.6

Sample Proportions	% dry mass
Very coarse, >3" sieve	0
Gravel, 3" to # 4 sieve	33
Coarse Sand, #4 to #10 sieve	8
Medium Sand, #10 to #40	15
Fine Sand, #40 to #200	10
Fines <#200	32

USCS	SM	Liquid Limit	29	D90	14.110	D50	0.893	D10	
AASHTO	A-2-4	Plastic Limit	23	D85	12.160	D30		Cu	
USCS Group Name	Silty sand with gravel	Plasticity Index	6	D60	2.427	D15		Cc	

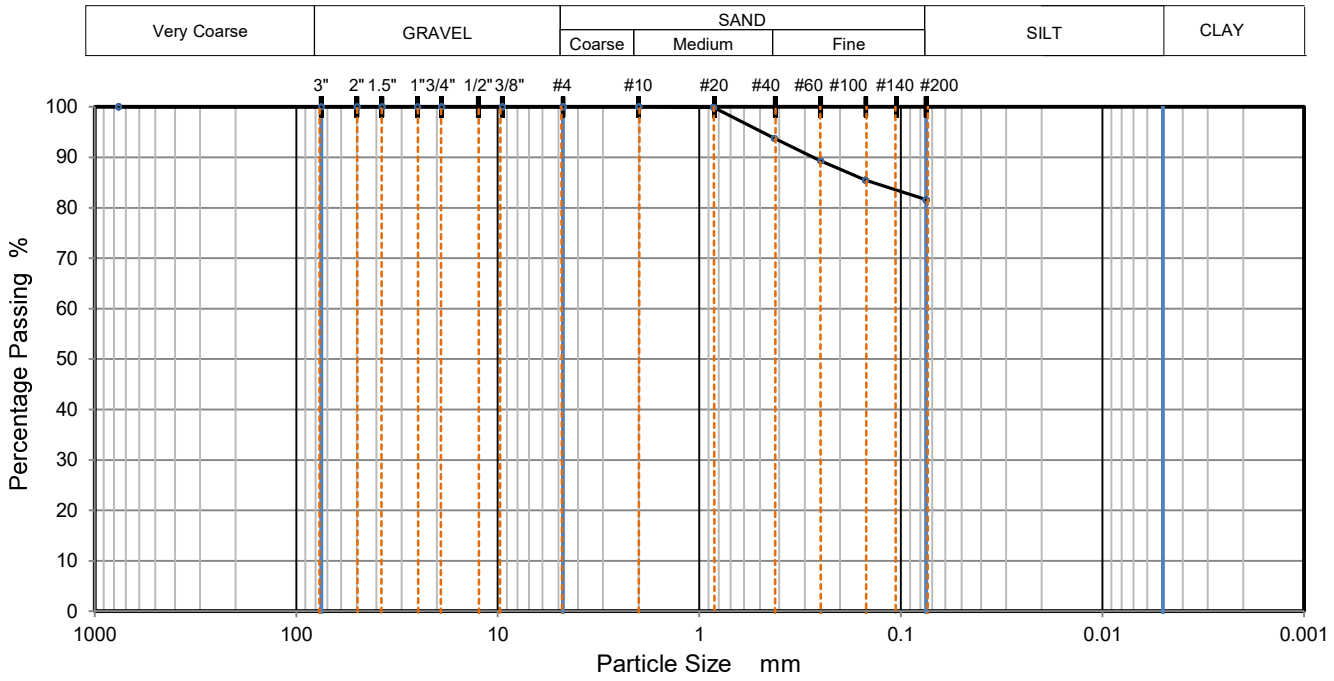
Project: Roanoke Gateway Project Phase II
Client: Homes for America
Sample Description: Brown SILTY SAND with Gravel
Sample Source: B-03

Project No.: 12:20641-A
Depth (ft): 2.0 - 4.0
Sample No.: S-2
Date Reported: 1/14/2026

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received	Remarks
JHrysenko	JMurphy	JMurphy	1212/2025	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D6913M-17-METHOD A)

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100		
2"	100		
1 1/2"	100		
1"	100		
3/4"	100		
3/8"	100		
#4	100		
#10	100		
#20	100		
#40	94		
#60	89		
#100	86		
#200	82		

Dry Mass of sample, g	37.1

Sample Proportions	% dry mass
Very coarse, >3" sieve	0
Gravel, 3" to # 4 sieve	0
Coarse Sand, #4 to #10 sieve	0
Medium Sand, #10 to #40	6
Fine Sand, #40 to #200	12
Fines <#200	82

USCS	ML	Liquid Limit	36	D90	0.272	D50		D10	
AASHTO	A-4	Plastic Limit	29	D85	0.137	D30		Cu	
USCS Group Name	Silt with sand	Plasticity Index	7	D60		D15		Cc	

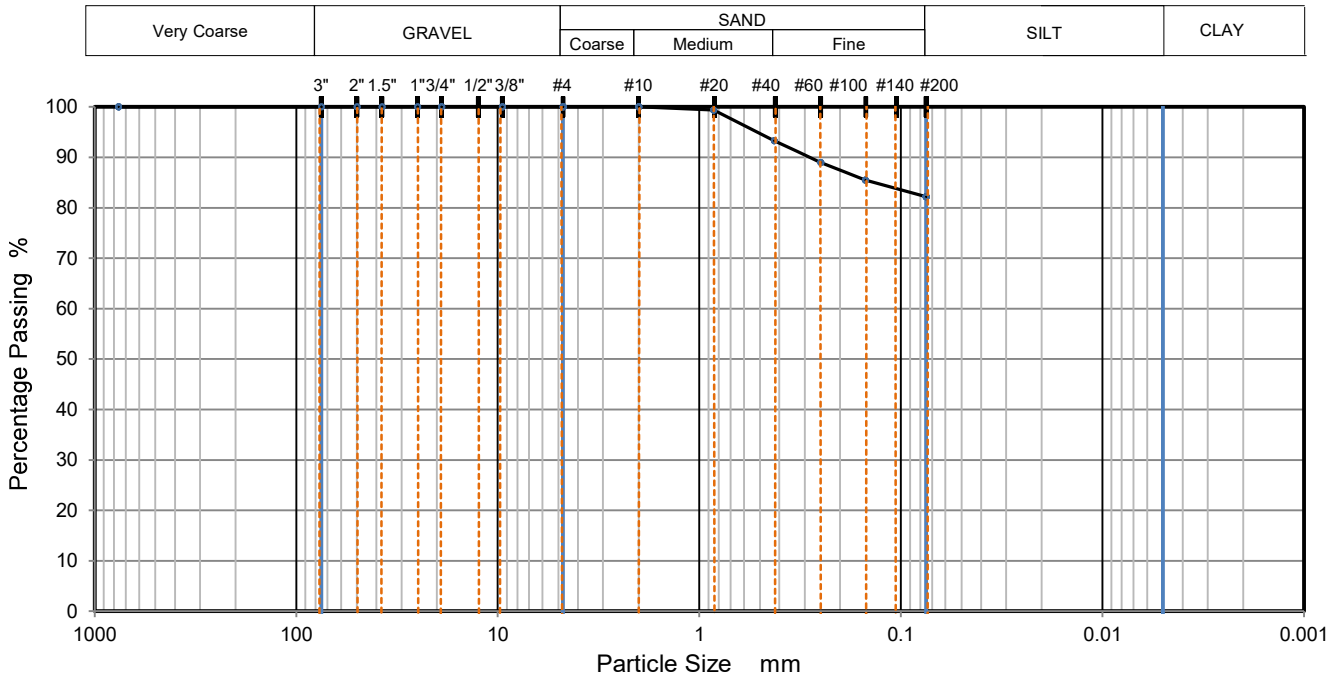
Project: Roanoke Gateway Project Phase II
Client: Homes for America
Sample Description: Yellow SILT with Sand
Sample Source: B-04

Project No.: 12:20641-A
Depth (ft): 2.0 - 4.0
Sample No.: S-2
Date Reported: 1/14/2026

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received	Remarks
JHrysenko	JMurphy	JMurphy	1212/2025	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D6913M-17-METHOD A)

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100		
2"	100		
1 1/2"	100		
1"	100		
3/4"	100		
3/8"	100		
#4	100		
#10	100		
#20	99		
#40	93		
#60	89		
#100	86		
#200	82		

Dry Mass of sample, g: 38.0

Sample Proportions	% dry mass
Very coarse, >3" sieve	0
Gravel, 3" to # 4 sieve	0
Coarse Sand, #4 to #10 sieve	0
Medium Sand, #10 to #40	7
Fine Sand, #40 to #200	11
Fines <#200	82

USCS	ML	Liquid Limit	37	D90	0.283	D50		D10	
AASHTO	A-6	Plastic Limit	26	D85	0.135	D30		Cu	
USCS Group Name	Silt with sand	Plasticity Index	11	D60		D15		Cc	

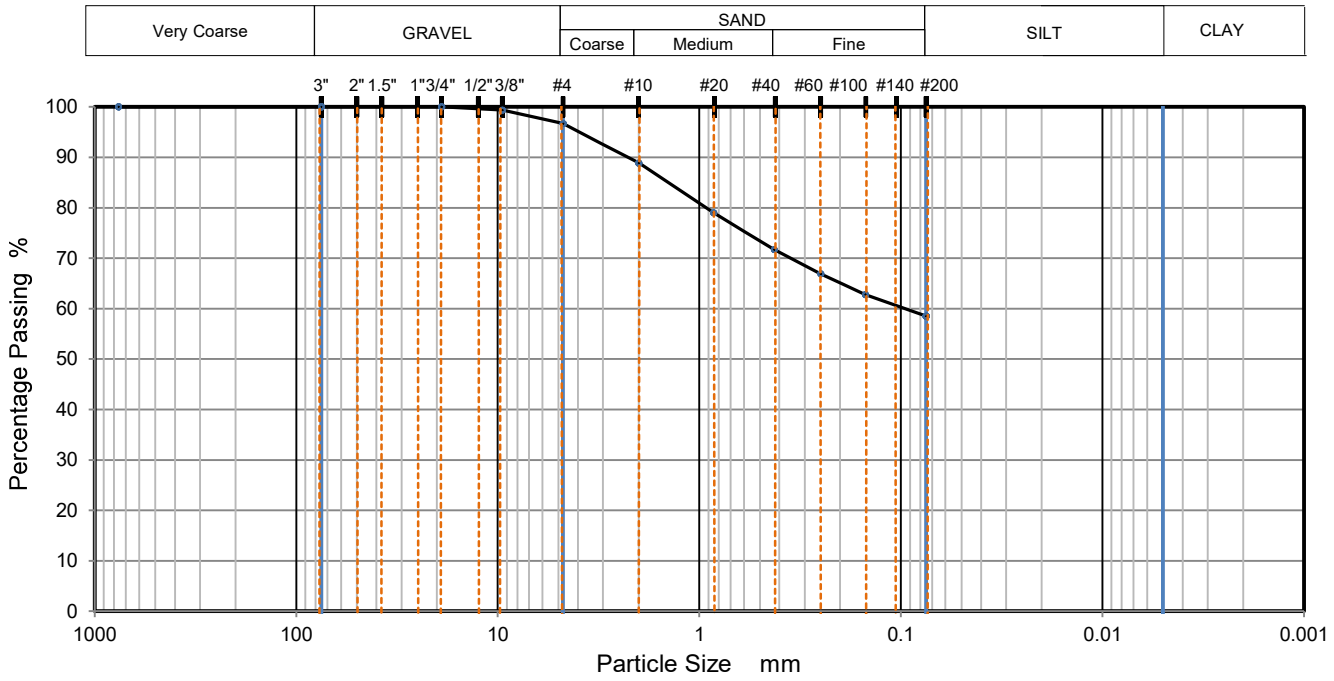
Project: Roanoke Gateway Project Phase II
Client: Homes for America
Sample Description: Red Brown SILT with Sand
Sample Source: B-04

Project No.: 12:20641-A
Depth (ft): 8.0 - 10.0
Sample No.: S-5
Date Reported: 1/14/2026

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received	Remarks
JHrysenko	JMurphy	JMurphy	1212/2025	

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"	99.4		
#4	96.7		
#10	88.9		
#20	79.0		
#40	71.7		
#60	66.9		
#100	62.8		
#200	58.5		

Dry Mass of sample, g: 12850.0

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	3.3
Coarse Sand, #4 to #10 sieve	7.8
Medium Sand, #10 to #40	17.2
Fine Sand, #40 to #200	13.2
Fines <#200	58.5

USCS	CL	Liquid Limit	31	D90	2.259	D50		D10	
AASHTO	A-6	Plastic Limit	17	D85	1.428	D30		Cu	
USCS Group Name	Sandy lean clay	Plasticity Index	14	D60	0.096	D15		Cc	

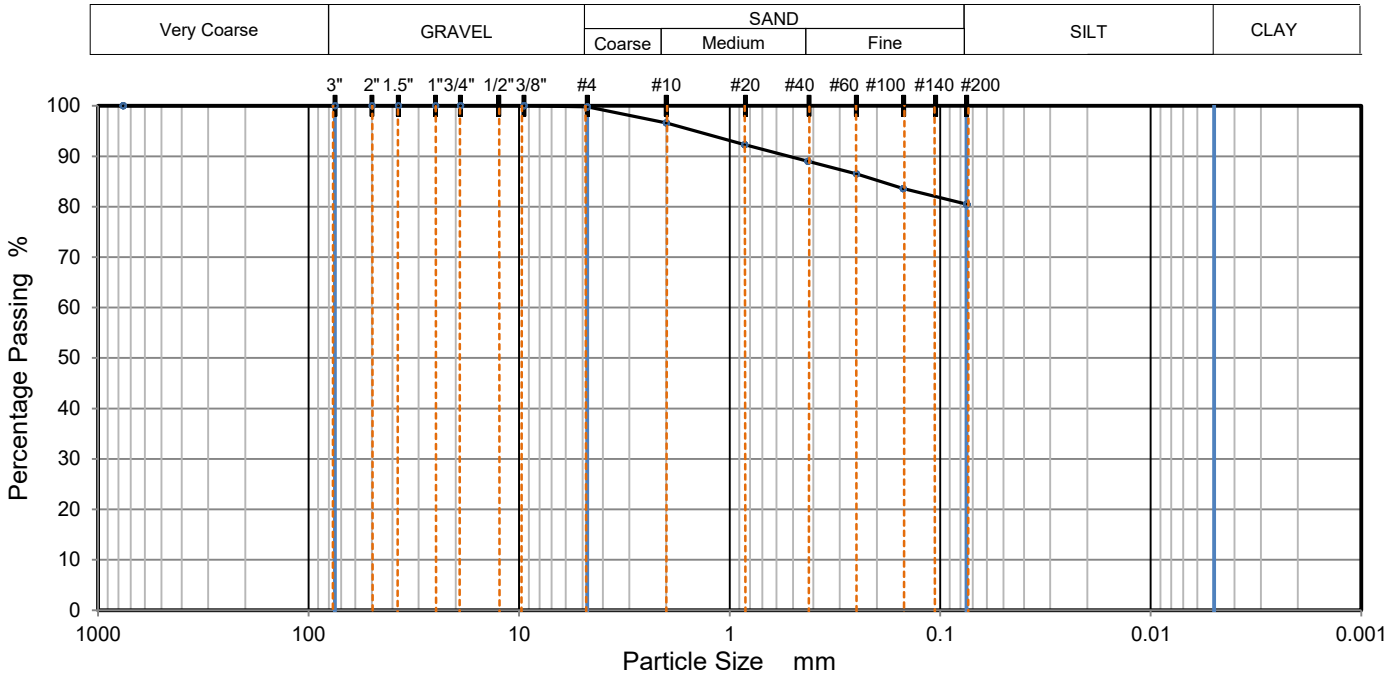
Project: Roanoke Gateway Project Phase II
Client: Homes for America
Sample Description: Sandy Lean Clay Brown
Sample Source: P-05

Project No.: 12:20641-A
Depth (ft): 1.0 - 10.0
Sample No.: D3S-88
Date Reported: 1/14/2026

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received	Remarks
jvong	Htran	MUzun	12/16/2025	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D6913M-17-METHOD A)

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100		
2"	100		
1 1/2"	100		
1"	100		
3/4"	100		
3/8"	100		
#4	100		
#10	97		
#20	92		
#40	89		
#60	87		
#100	84		
#200	81		

Dry Mass of sample, g: 43.3

Sample Proportions	% dry mass
Very coarse, >3" sieve	0
Gravel, 3" to # 4 sieve	0
Coarse Sand, #4 to #10 sieve	3
Medium Sand, #10 to #40	8
Fine Sand, #40 to #200	9
Fines <#200	81

USCS	CL	Liquid Limit	44	D90	0.524	D50		D10	
AASHTO	A-7-6	Plastic Limit	18	D85	0.192	D30		Cu	
USCS Group Name	Lean clay with sand	Plasticity Index	26	D60		D15		Cc	

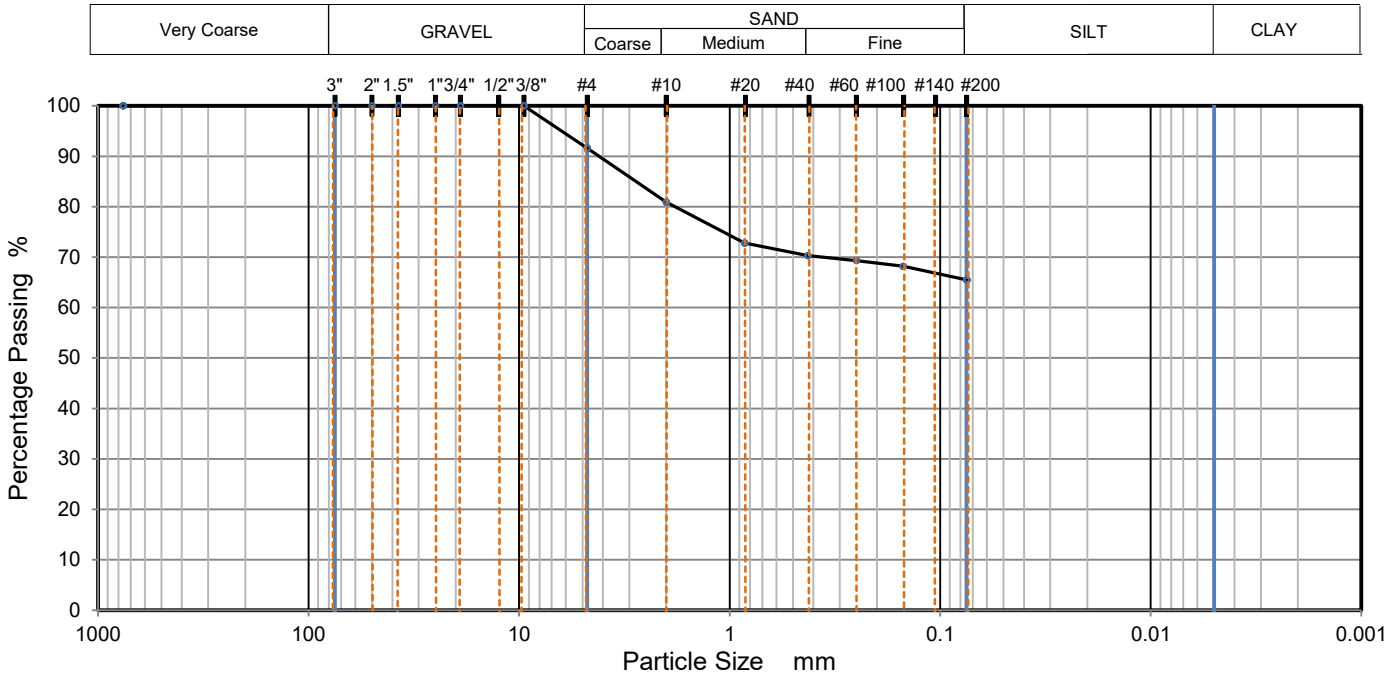
Project: Roanoke Gateway Project - Building 2 Add. Exploration
Client: Homes for America
Sample Description: Red Brown LEAN CLAY with Sand
Sample Source: B-19

Project No.: 12:20641-B
Depth (ft): 1.0 - 2.5
Sample No.: S-1
Date Reported: 4/21/2026

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received	Remarks
JHrysenko	JMurphy	JMurphy	3/26/2026	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D6913M-17-METHOD A)

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100		
2"	100		
1 1/2"	100		
1"	100		
3/4"	100		
3/8"	100		
#4	92		
#10	81		
#20	73		
#40	70		
#60	69		
#100	68		
#200	66		

Dry Mass of sample, g	41.1

Sample Proportions	% dry mass
Very coarse, >3" sieve	0
Gravel, 3" to # 4 sieve	8
Coarse Sand, #4 to #10 sieve	11
Medium Sand, #10 to #40	11
Fine Sand, #40 to #200	5
Fines <#200	66

USCS	ML	Liquid Limit	33	D90	4.174	D50		D10	
AASHTO	A-4	Plastic Limit	25	D85	2.786	D30		Cu	
USCS Group Name	Sandy silt	Plasticity Index	8	D60		D15		Cc	

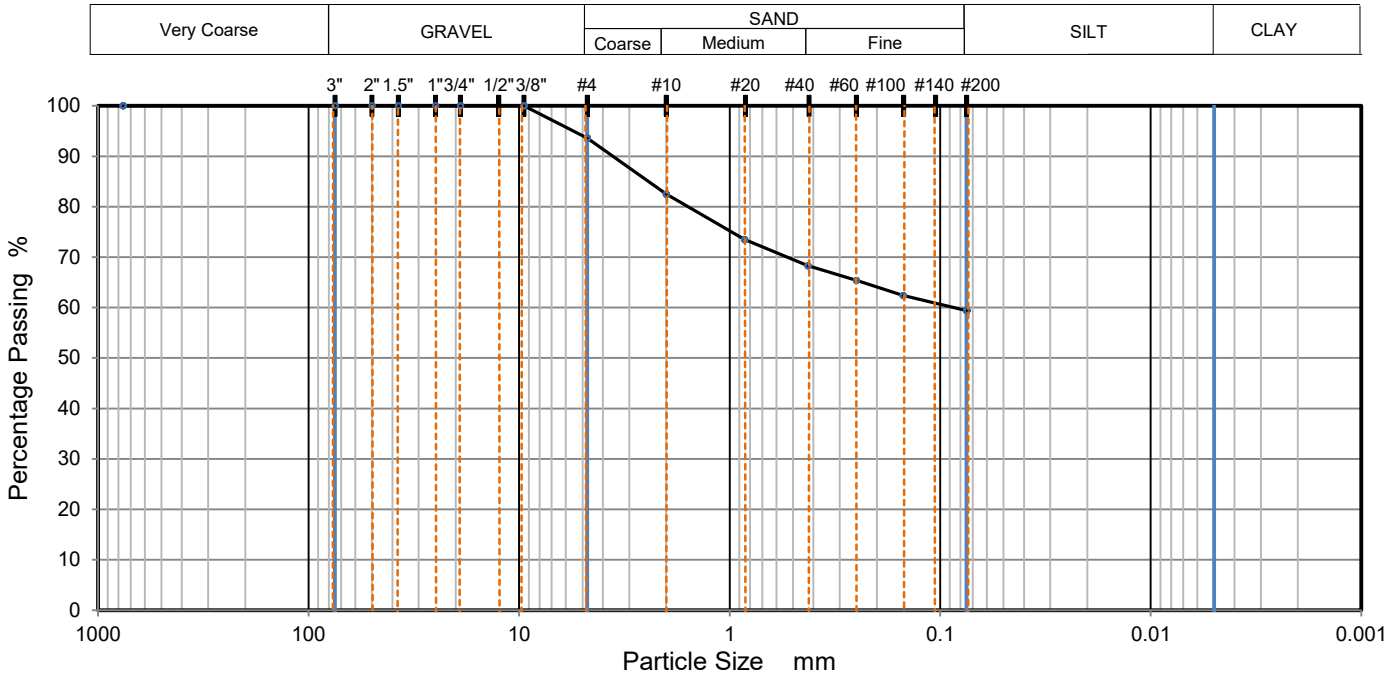
Project: Roanoke Gateway Project - Building 2 Add. Exploration
Client: Homes for America
Sample Description: Light Brown SANDY SILT
Sample Source: B-21

Project No.: 12:20641-B
Depth (ft): 1.0 - 2.5
Sample No.: S-1
Date Reported: 4/21/2026

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received	Remarks
JHrysenko	JMurphy	JMurphy	3/26/2026	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D6913M-17-METHOD A)

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100		
2"	100		
1 1/2"	100		
1"	100		
3/4"	100		
3/8"	100		
#4	94		
#10	83		
#20	74		
#40	68		
#60	65		
#100	62		
#200	59		

Dry Mass of sample, g: 40.2

Sample Proportions	% dry mass
Very coarse, >3" sieve	0
Gravel, 3" to # 4 sieve	6
Coarse Sand, #4 to #10 sieve	11
Medium Sand, #10 to #40	14
Fine Sand, #40 to #200	9
Fines <#200	59

USCS	CL	Liquid Limit	48	D90	3.588	D50		D10	
AASHTO	A-7-6	Plastic Limit	22	D85	2.430	D30		Cu	
USCS Group Name	Sandy lean clay	Plasticity Index	26	D60	0.086	D15		Cc	

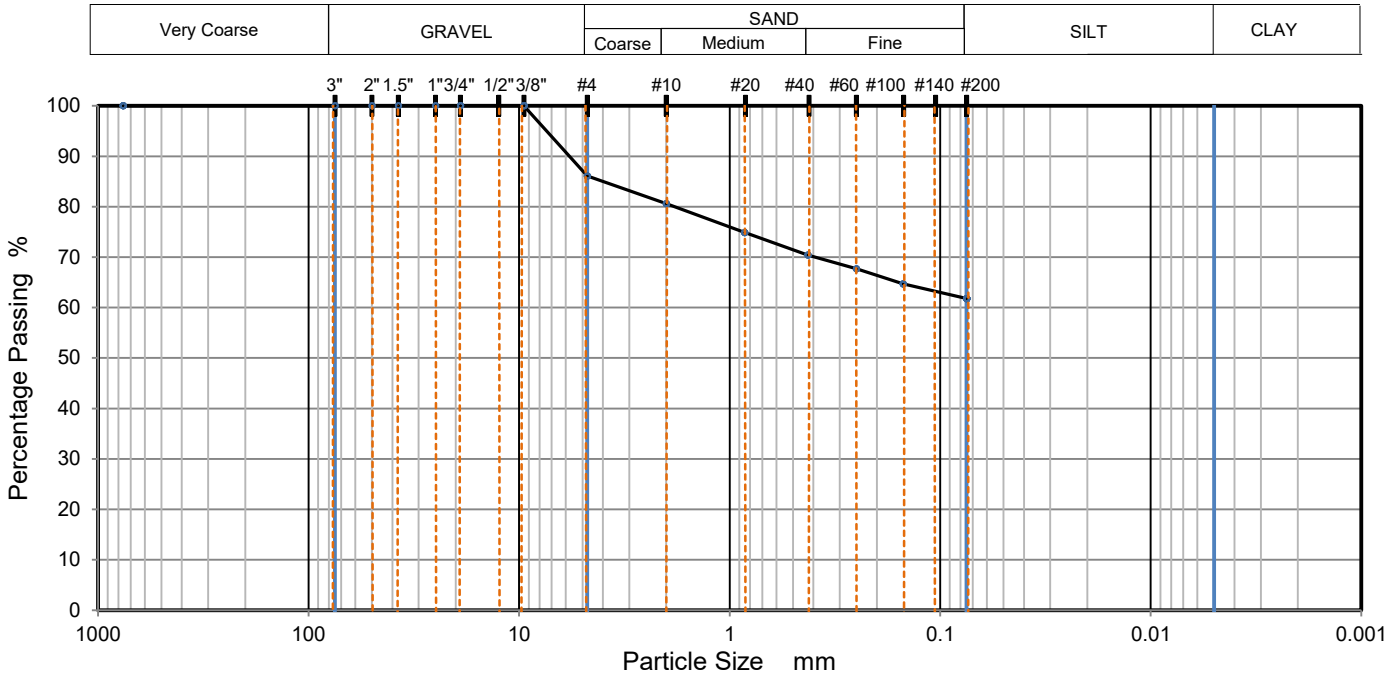
Project: Roanoke Gateway Project - Building 2 Add. Exploration
Client: Homes for America
Sample Description: Light Brown SANDY LEAN CLAY
Sample Source: B-21

Project No.: 12:20641-B
Depth (ft): 13.5 - 15.0
Sample No.: S-5
Date Reported: 4/21/2026

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received	Remarks
JHrysenko	JMurphy	JMurphy	3/26/2026	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D6913M-17-METHOD A)

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100		
2"	100		
1 1/2"	100		
1"	100		
3/4"	100		
3/8"	100		
#4	86		
#10	81		
#20	75		
#40	70		
#60	68		
#100	65		
#200	62		

Dry Mass of sample, g	34.2

Sample Proportions	% dry mass
Very coarse, >3" sieve	0
Gravel, 3" to # 4 sieve	14
Coarse Sand, #4 to #10 sieve	6
Medium Sand, #10 to #40	10
Fine Sand, #40 to #200	9
Fines <#200	62

USCS	ML	Liquid Limit	37	D90	5.770	D50		D10	
AASHTO	A-6	Plastic Limit	26	D85	3.995	D30		Cu	
USCS Group Name	Sandy silt	Plasticity Index	11	D60		D15		Cc	

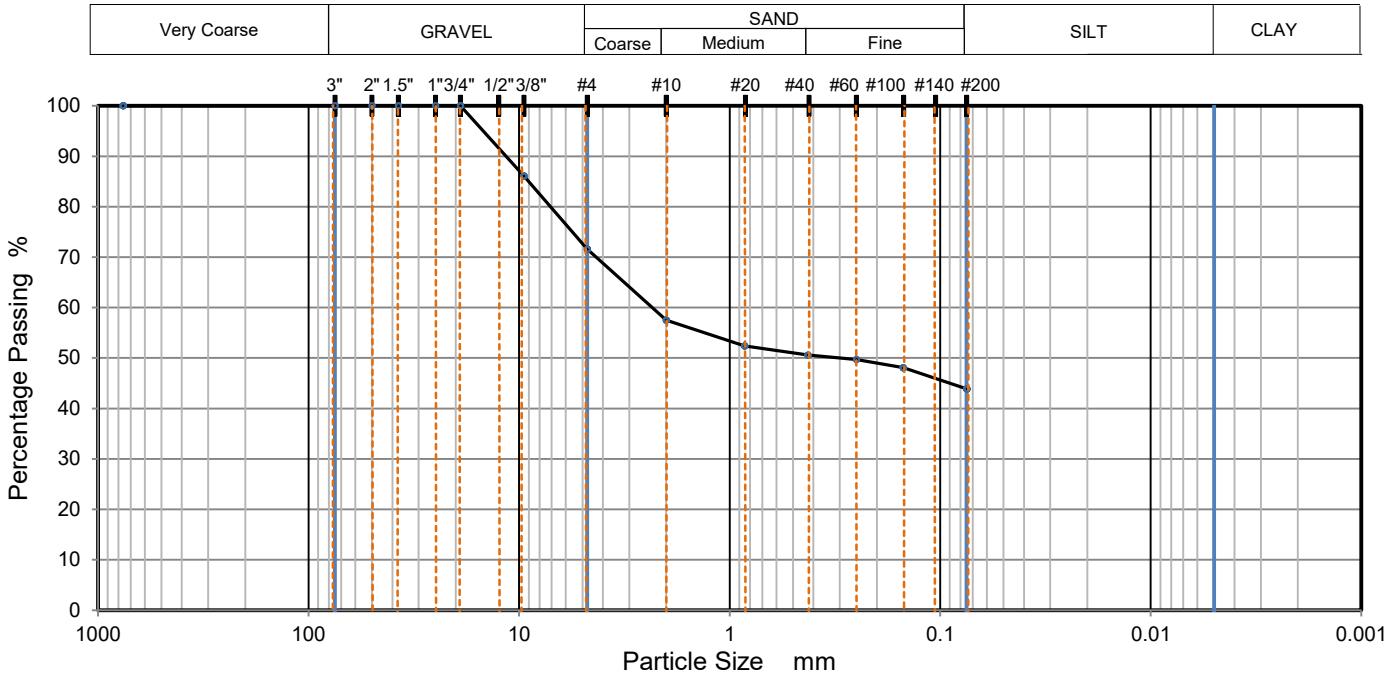
Project: Roanoke Gateway Project - Building 2 Add. Exploration
Client: Homes for America
Sample Description: Yellow SANDY SILT
Sample Source: B-24

Project No.: 12:20641-B
Depth (ft): 6.0 - 7.5
Sample No.: S-3
Date Reported: 4/21/2026

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received	Remarks
JHrysenko	JMurphy	JMurphy	3/26/2026	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D6913M-17-METHOD A)

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100		
2"	100		
1 1/2"	100		
1"	100		
3/4"	100		
3/8"	86		
#4	72		
#10	58		
#20	52		
#40	51		
#60	50		
#100	48		
#200	44		

Dry Mass of sample, g	53.3

Sample Proportions	% dry mass
Very coarse, >3" sieve	0
Gravel, 3" to # 4 sieve	28
Coarse Sand, #4 to #10 sieve	14
Medium Sand, #10 to #40	7
Fine Sand, #40 to #200	7
Fines <#200	44

USCS	GC	Liquid Limit	31	D90	11.540	D50	0.298	D10	
AASHTO	A-4	Plastic Limit	22	D85	9.013	D30		Cu	
USCS Group Name	Clayey gravel with sand	Plasticity Index	9	D60	2.332	D15		Cc	

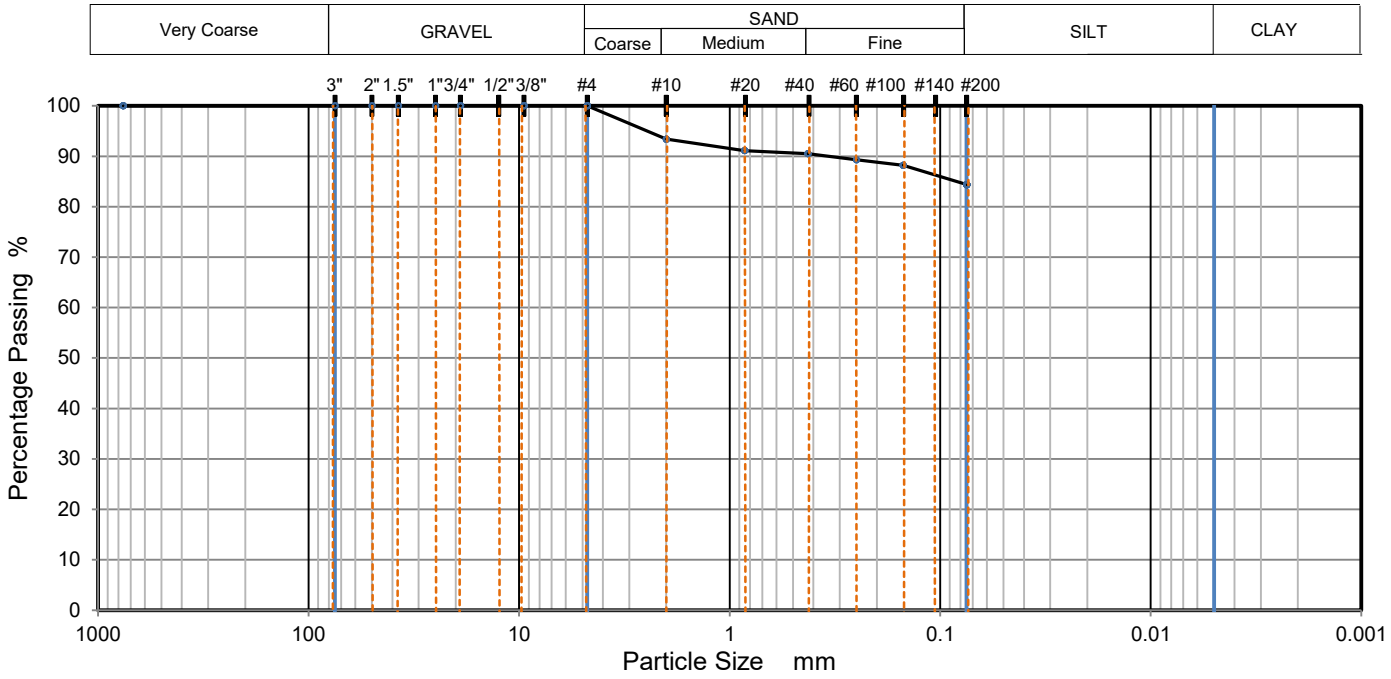
Project: Roanoke Gateway Project - Building 2 Add. Exploration
Client: Homes for America
Sample Description: Dark Brown CLAYEY GRAVEL with Sand
Sample Source: B-25

Project No.: 12:20641-B
Depth (ft): 13.5 - 15.0
Sample No.: S-5
Date Reported: 4/21/2026

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received	Remarks
JHrysenko	JMurphy	JMurphy	3/26/2026	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D6913M-17-METHOD A)

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100		
2"	100		
1 1/2"	100		
1"	100		
3/4"	100		
3/8"	100		
#4	100		
#10	93		
#20	91		
#40	91		
#60	89		
#100	88		
#200	84		

Dry Mass of sample, g	43.3

Sample Proportions	% dry mass
Very coarse, >3" sieve	0
Gravel, 3" to # 4 sieve	0
Coarse Sand, #4 to #10 sieve	7
Medium Sand, #10 to #40	3
Fine Sand, #40 to #200	6
Fines <#200	84

USCS	CL	Liquid Limit	43	D90	0.341	D50		D10	
AASHTO	A-7-6	Plastic Limit	18	D85	0.084	D30		Cu	
USCS Group Name	Lean clay with sand	Plasticity Index	25	D60		D15		Cc	

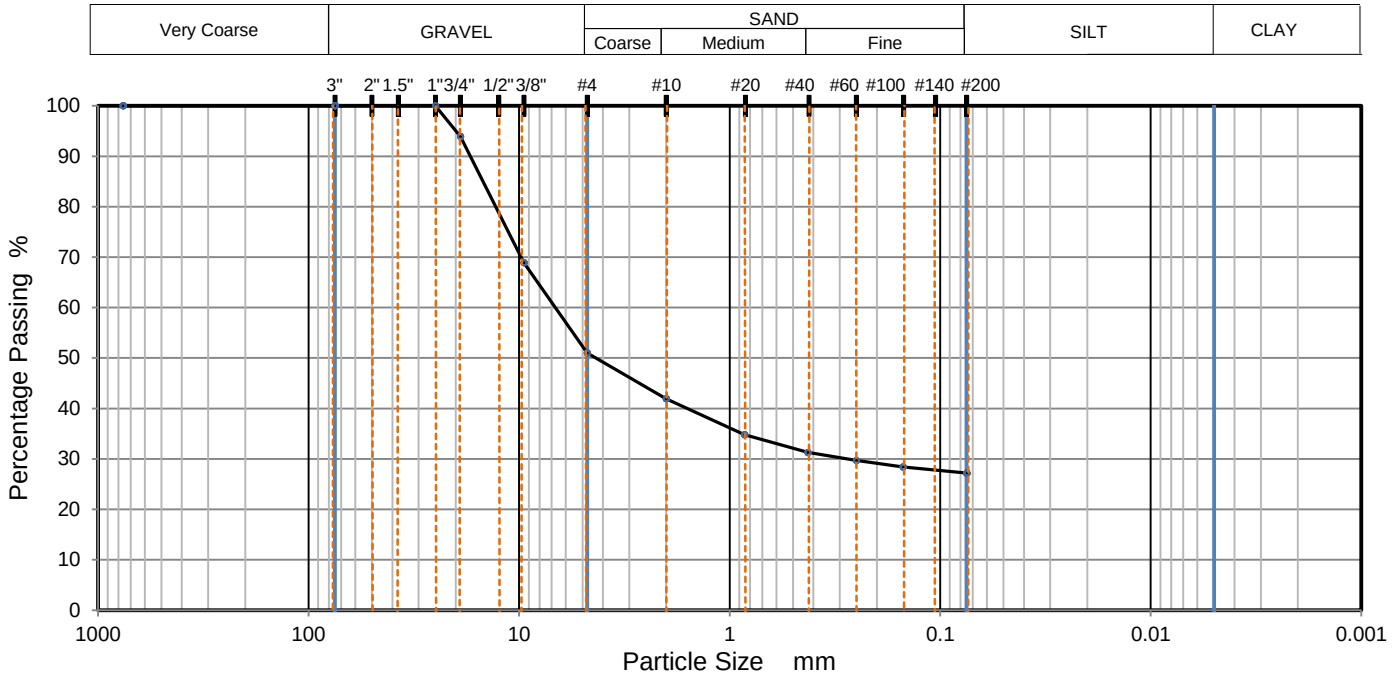
Project: Roanoke Gateway Project - Building 2 Add. Exploration
Client: Homes for America
Sample Description: Brown LEAN CLAY with Sand
Sample Source: B-25

Project No.: 12:20641-B
Depth (ft): 38.5 - 40.0
Sample No.: S-10
Date Reported: 4/21/2026

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received	Remarks
JHrysenko	JMurphy	JMurphy	3/26/2026	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
1"	100.0		
3/4"	93.9		
3/8"	68.9		
#4	51.0		
#10	41.9		
#20	34.8		
#40	31.3		
#60	29.7		
#100	28.4		
#200	27.2		

Dry Mass of sample, g	2017.3

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	49.0
Coarse Sand, #4 to #10 sieve	9.1
Medium Sand, #10 to #40	10.6
Fine Sand, #40 to #200	4.1
Fines <#200	27.2

USCS		Liquid Limit	61	D90	17.050	D50	4.319	D10	
AASHTO		Plastic Limit	21	D85	14.850	D30	0.276	Cu	
USCS Group Name		Plasticity Index	40	D60	6.731	D15		Cc	

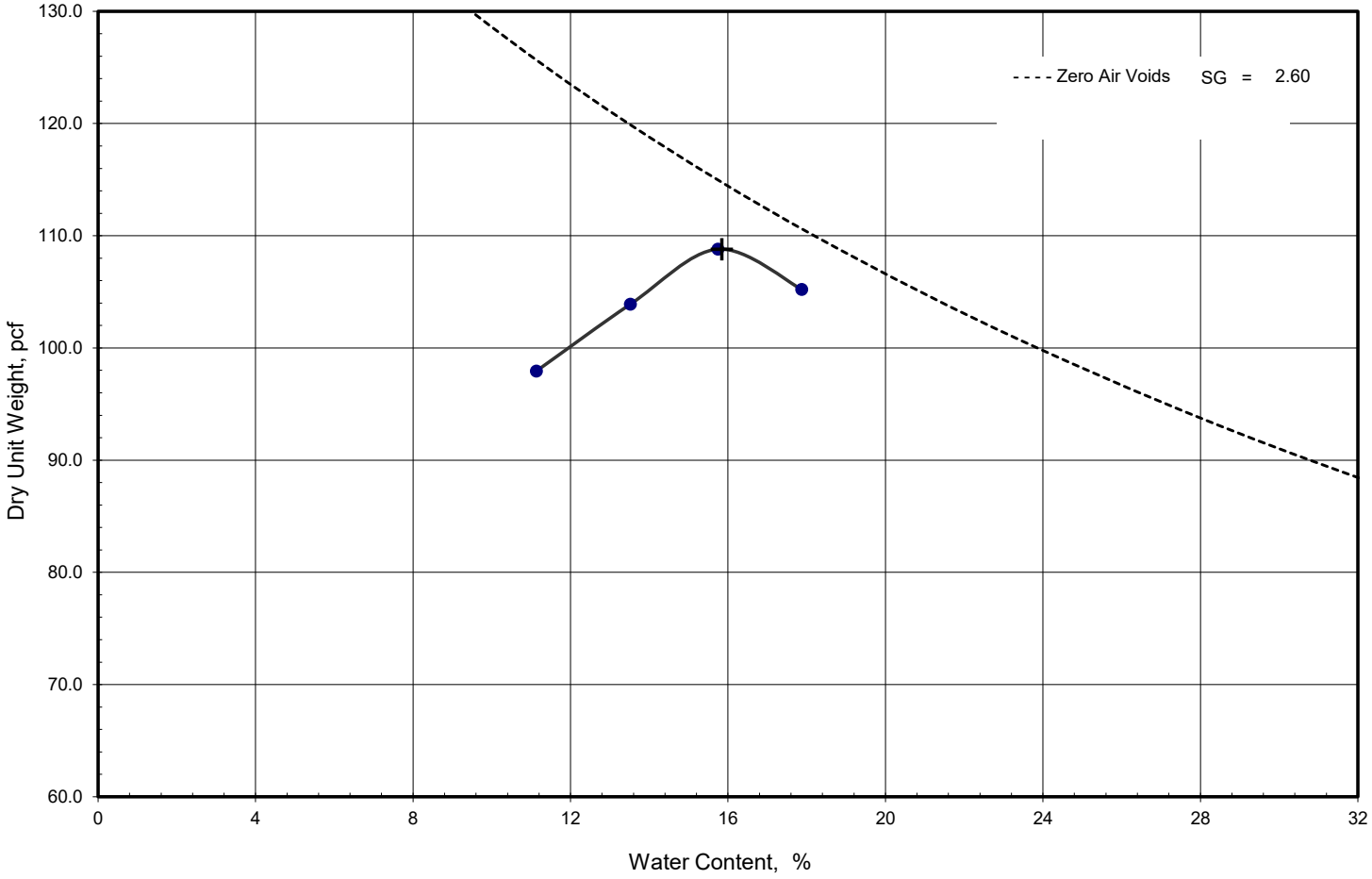
Project: Roanoke Gateway Project - Building 2 Add. Exploration
Client: Homes for America
Sample Description: Clayey Gravel with Sand Yellowish Brown
Sample Source: B-21A

Project No.: 12:20641-B
Depth (ft): 25.0 - 27.0
Sample No.: ST-01
Date Reported: 4/10/2026

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	Date Received	Remarks
jvong	Htran	MUzun	4/8/2026	

Laboratory Compaction Characteristics of Soil
Using Standard Effort



Optimum Moisture Content		**15.8**	%
Maximum Dry Unit Weight		**108.8**	pcf
Cumulative material retained on:	3/4 in. sieve	0.0	%
	3/8 in. sieve	0.6	%
	#4 sieve	3.4	%

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	Historical
Coarse Aggregate Specific Gravity -		

Soil Description	Nat. Moist. %	Liquid Limit	Plasticity Index	%< #200	USCS	AASHTO
Sandy Lean Clay Brown	9.3	31	14	58.5	CL	A-6

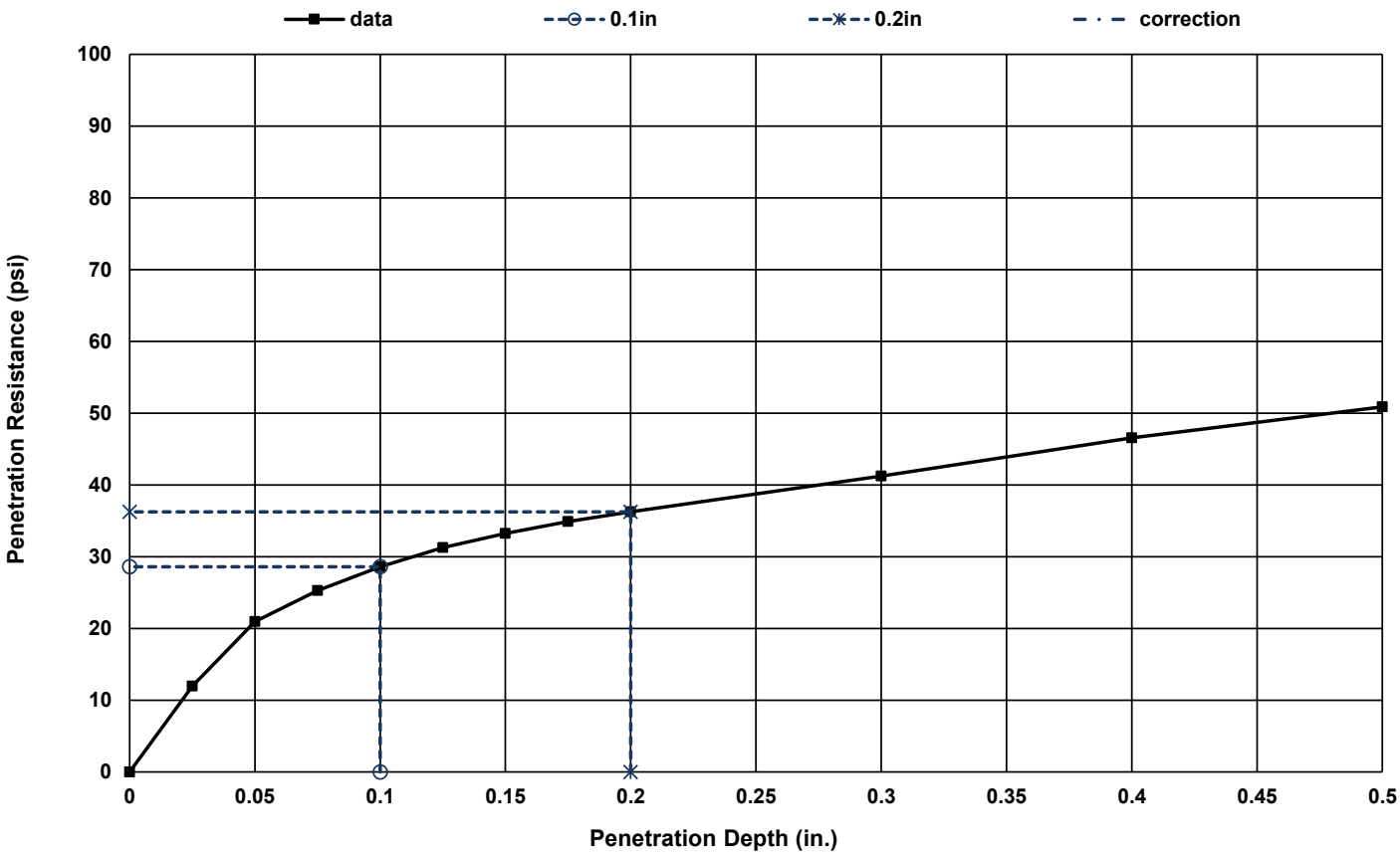
Project: Roanoke Gateway Project Phase II
Client: Homes for America
Sample / Source: P-05
Test Reference/No.:

Project No.: 12:20641-A
Depth (ft.): 1 - 10
Sample No.: D3S-88
Date Reported: 1/14/2026

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received	Remarks
jvong	Htran	MUzun	12/16/2025	

California Bearing Ratios (CBR) of Laboratory-Compacted Soils



TEST RESULTS (ASTM D1883-21)

Molded			Soaked			CBR (%)		Linearity 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.					
106.9	98.3	16.1	98.1	90.2	24.8	2.9	2.4	0.00	10		1.40	
Material Description			AASHTO	USCS	MAX. Dens. (pcf)	Optimum Moisture (%)	LL	PI	% Fines	% Gravel		
Sandy Lean Clay Brown			A-6	CL	108.8	15.8	31	14	58.5	3.3		

Project: Roanoke Gateway Project Phase II
Client: Homes for America
Sample / Source: P-05
Test Reference/No.: 1

Project No.: 12:20641-A
Depth (ft.): 1 - 10
Sample No.: D3S-88
Date Reported: 1/14/2026

Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - Roanoke	7670 Enon Drive Suite 101 Roanoke, VA 24019	(540)362-2000 (540)362-1202

Tested by	Checked by	Approved by	Date Received	Remarks
jvong	Htran	MUzun	12/16/2025	

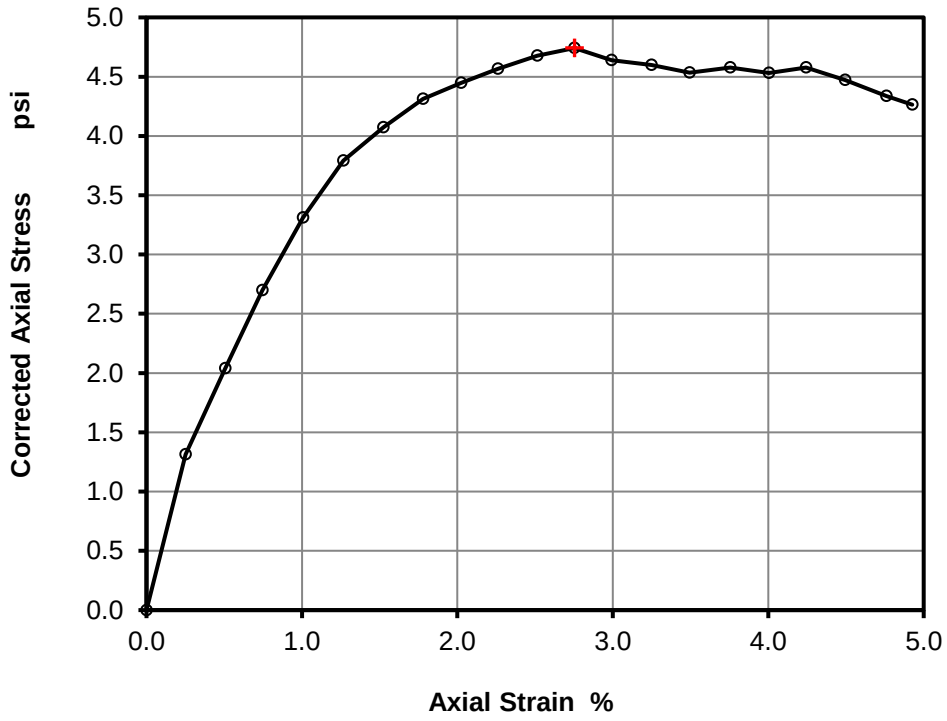
Unconfined Compressive Strength Test Report

VTM 140

Initial Conditions

Avg. Height		in	6.00	Bulk Density (as tested)		pcf	116.05
Avg. Diameter		in	2.88	Water Content (as tested)		%	18.5
Area		sq, in.	6.5	Dry Density (as tested)		pcf	97.92
Condition			Undisturbed	Resilient Modulus		psi	12756
Compaction type			Impact (remold)				
Voids Ratio			0.657	Corrected Max Dry Density		pcf	
(Specific gravity assumed 2.60)				Corrected Optium Moisture Cont.		%	
Degree of Saturation		%	73	% Fines		%	27.2
Rate of Strain applied		%/min	1.00	LL			61
At failure	Axial Strain	%	2.8	PI			40
	Maximum Stress	psi	4.7	USCS Classification			CH
	Shear Strength	psi	2.4	AASHTO Classification			

Stress vs Axial Strain





SAMPLE TESTED

Project: Roanoke Gateway Project - Building 2 Add.
Client: Homes for America
Sample Source: B-21A
Sample Description: Yellowish brown CLAYEY GRAVEL WITH SAND (GC)

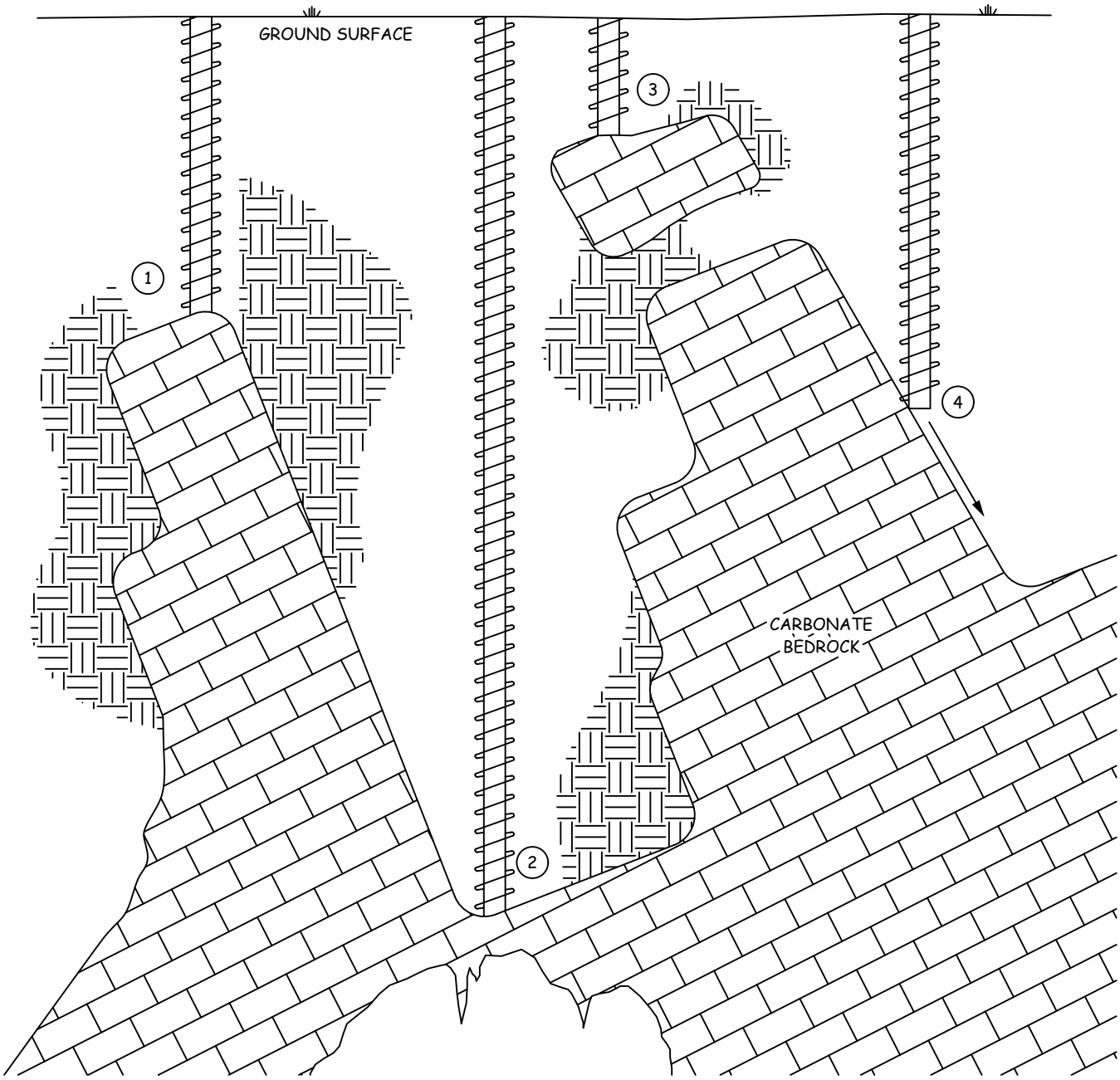
Project No.: 12:20641-B
Depth (ft): 25 - 27
Sample No.: ST-01
Date Reported: 4/10/2026

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	Date Received	Remarks
jvong	Htran	MUzun	4/8/2026	

APPENDIX D – Supplemental Documents

Karst Auger Refusal Detail
Bedrock Pinnacle Undercut Detail
French Drain Detail
Settlement Plate Detail



1. AUGER REFUSAL AT RELATIVELY SHALLOW DEPTH ON A BEDROCK PINNACLE

2. AUGER REFUSAL IN A DEEP SOIL CUTTER

3. AUGER REFUSAL ON A FLOAT BOULDER GIVING A FALSE INDICATION OF SHALLOW BEDROCK

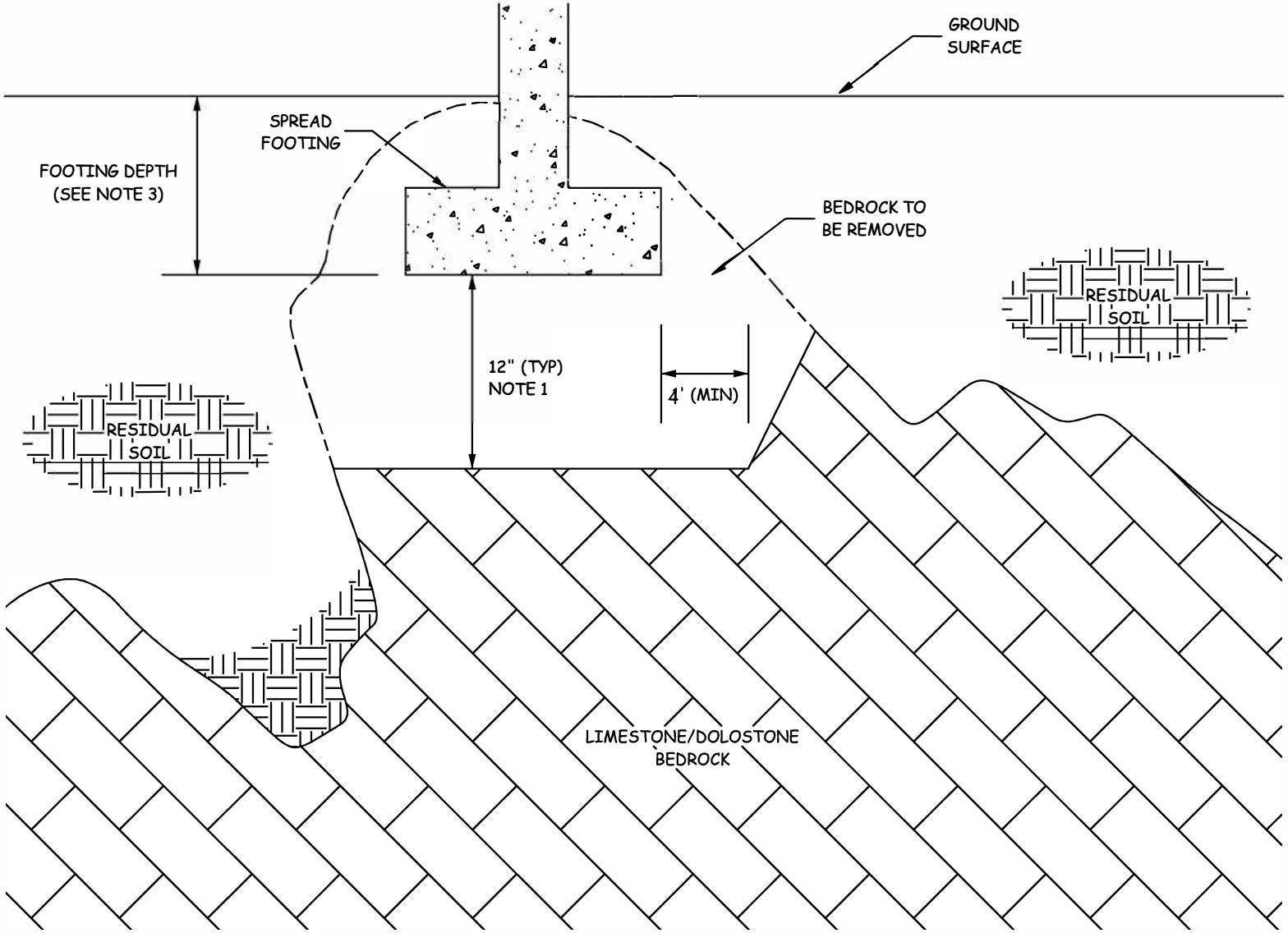
4. AUGER REFUSAL DUE TO DEFLECTING AUGERS - CONTINUED DOWNWARD FORCE CAN CAUSE THE FAILURE OF AUGER CONNECTIONS AND LOSS OF DRILL STRING IN THE BOREHOLE

NOTE: AUGER REFUSAL IN ALL SCENARIO'S MAY MASK THE PRESENCE OF KARST VOIDS

KARST AUGER REFUSAL SCENARIO DIAGRAM

NOT TO SCALE

C:\data\dwg\details\Karst Auger Refusal.dwg, Layout1, 3/23/2022 10:19:14 AM



BEDROCK PINNACLE UNDERCUT DETAIL

Not to Scale

NOTES:

1) BACKFILL BEDROCK UNDERCUT WITH SUITABLE ENGINEERED FILL COMPACTED TO 95 PERCENT OF THE MAXIMUM DRY DENSITY AS DETERMINED USING ASTM D698-12.

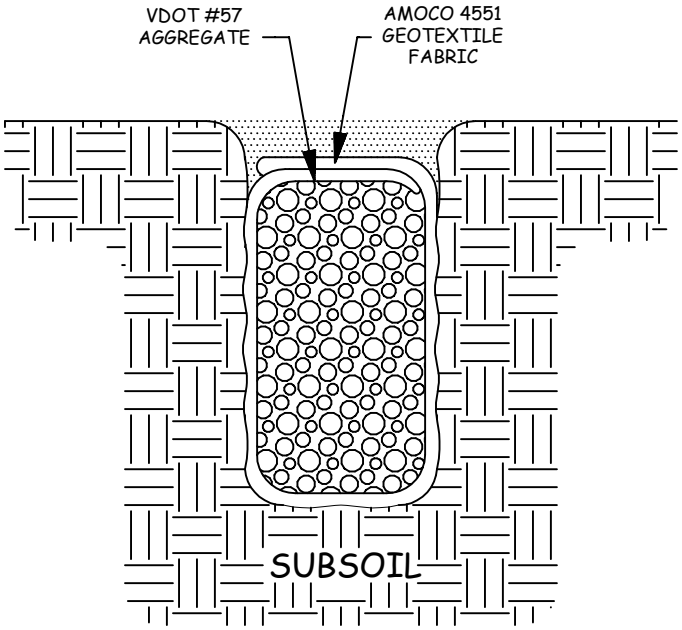
2) SHEAR LOADING SHOULD BE EVALUATED DURING FOUNDATION DESIGN.

3) REFER TO REPORT SECTION 4.2 FOUNDATION RECOMMENDATIONS.

FRENCH DRAIN
INSTALLATION PROCEDURE

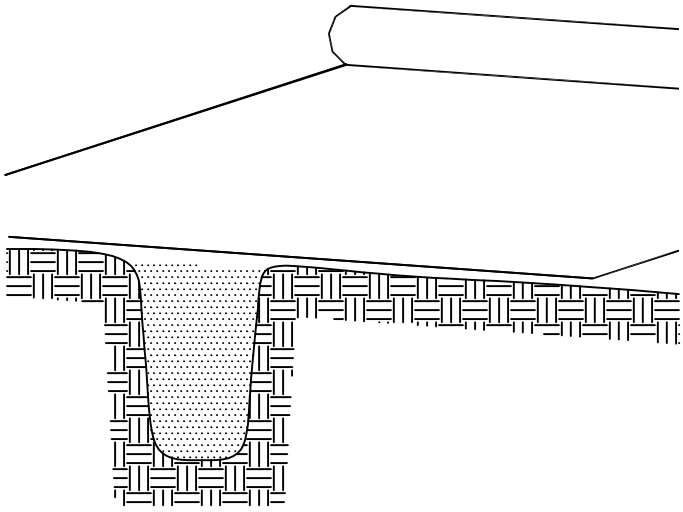
NOT TO SCALE

FINAL CONFIGURATION



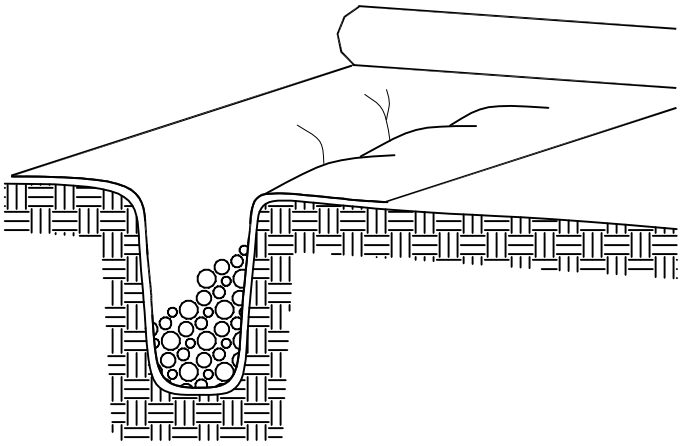
SUBDRAIN USING FILTER FABRIC

STEP 1



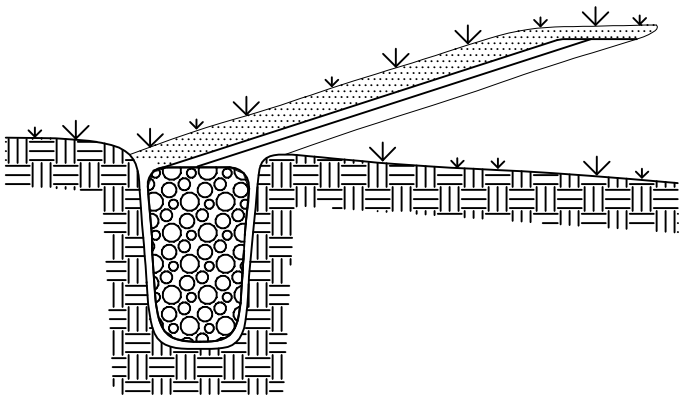
FABRIC IS UNROLLED DIRECTLY OVER TRENCH

STEP 2



THE TRENCH IS FILLED WITH AGGREGATE

STEP 3



THE FABRIC IS LAPPED CLOSED AND
COVERED WITH BASE STONE

ECS LLC
MID-ATLANTIC

SETTLEMENT PLATE DETAIL

