ROANOKE COUNTY

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August 28, 2023
ADDENDUM NO. 1 TO ALL OFFERRORS:
Reference – IFB 2024-007
Description: 2024-007 - WEST ROANOKE RIVER GREENWAY, PHASE I
Issue Date: August 1, 2023
Proposal Due: September 6, 2023

This Addendum # 1 Contains the below information:

1) Questions and Responses
2) Clarifications/Modifications
3) Attachments
    a. Pre-Bid Sign in Log
    b. Geotechnical Report
    c. Draft West Roanoke River Greenway Quality Assurance Plan
    d. West Roanoke River Greenway Testing Frequencies
    e. Revised Timber Guardrail

Note: A signed acknowledgment *(Signature Page is at the bottom of the Document)* of this addendum must be received at the location indicated on the original solicitation either prior to the proposal due date or attached to your proposal. Signature on this addendum does not substitute for your signature on the original proposal/bid document. The original proposal/bid document must be signed.

Questions and Responses

1) Does the permit include a maximum height for coffer dams?
    a. There is no maximum height listed in the permit. It is the Contractor's responsibility to ensure coffer dams are designed to handle the typical flow for the Roanoke River.

2) Is the Logperch surveyor required to be present if dewatering outside of the time of year restriction?
    a. Our interpretation of the permit requirements is that the logperch surveyor must be present any time that dewatering is occurring and fish could be present in the dewatering area.

3) Do all stumps within the corridor require grubbing?

a. Stumps which will be more than 5' below base stone elevation may be left in place, but organic material shall be removed from all areas within 5' of finished grade. See VDOT R&B Spec. 301

4) Does the County have a site where the Contractor can dispose of wood chips or can they be disposed of on-site?
   a. The County does not have any local sites where chips can be located and the construction corridor does not have any locations where they can be scattered.

5) What are the approved work hours for construction activities and potential lane closures?
   a. All Construction activities shall be restricted by the County noise ordinance.
   b. All lane closures / flagging operations / temporary signals shall be coordinated through VDOT.

6) What was the permitted impact width within the Roanoke River?
   a. Permitted temporary impacts are shown on PDF pages 275-284 of the Bid Documents. Generally, temporary impacts are defined as 20' from the proposed, top face of retaining wall. These are maximum temporary impact widths and may not be exceeded.

7) Does this project fall under the new Buy America provision or the Old one?
   a. This project requires compliance with the Build America, Buy America Act provisions, dated November 4, 2022. Provisions are shown in SP107-003000-00 on PDF Page 209 of the Bid Documents.

2) Clarifications/Modifications

Please note the below in red and noted with an * is a modification. The other items are items that were discussed/touched on at the Mandatory Pre-Bid Meeting.

1. Scope of Work

a. The Project consists of constructing approximately 0.58 miles of 10' wide paved greenway, MSE retaining walls, paved parking area, and associate appurtenances which includes clearing and grubbing, grading, drainage improvements, and paving.

2. Scheduling

a. Liquidated Damages will be $1350 per day up until Substantial Completion and $1350 per day up until Final Completion.

b. Contract Times will be adjusted for any Work stoppages that are a direct result of environmental permitting requirements which may arise during construction. *

c. Contractors are directed to Section 4.05 of the General Conditions to review Anticipated Normal Inclement Weather Work-Days.

3. Bid Form

a. Unit price format. Items not listed on the bid form will be incidental to other items of work.

***b.* Award of contract will be the lowest responsive and responsible bidder within the announced construction budget for additive bids. See Instructions to Bidders.**

4. Required Documents to be Submitted with Bid: Listed on Page 6 of the Bid Form

a. Bid Security or Bid Bond (5%)

b. Document 00_45_13.11 – Contractor Bid Qualification Certification Va Debarment

c. Form C-104 (With Bids)

d. Form C-105 (With Bids)

e. Form C-111 (With Bids)

f. Form C-112 (With Bids)

g. Form C-48 (With Bids)

h. Form C-49 (With Bids)

i. Proof of being VDOT Pre-Qualified Contractor (Prime)

5. Explanation of "Buy American" Provision *Contractor Shall Certify on All Submittals*

a. Section 1605 of the American Recovery and Reinvestment Act states, "None of the funds appropriated or otherwise made available by this Act may be used for a project for the construction, alteration, maintenance, or repair of a **public building or public work** unless all of the iron, steel, and manufactured goods used in the project are **produced in the United States**".

The U.S. Office of Management and Budget (OMB) has issued guidance to assist in implementing the Recovery Act at 2 CFR Part176. The OMB guidance defines "manufactured good" as a "good brought to the construction site for **incorporation into the building or work** that has been processed into a specific form and shape; or combined with other raw material to create a material that has different properties than the properties of the individual raw materials." 2 CFR § 176.140(a) (1) (emphasis added).

6. Insurance and Bonds

a. Bid Bond - 5% of bid, (Required with bid)

b. Standard Labor and Material Payment Bond

c. Performance Bond

d. Insurance Required (per Contract Documents)

7. Property, Easements, and Existing Utilities

a. Property / Easements – Have been secured by Owner.

b. Utilities – The Contractor shall contact Miss Utility prior to excavation and shall notify the Engineer if utilities are found to be in conflict with the Work.

8. **Staking of work will be Contractor's Responsibility** – The trail baseline needs to be established on the ground, flagged, and labeled at 100' intervals. Surveying will include locating and laying out proposed retaining structures, culvert crossings and ditch improvements, and associated grading, verifying proposed grades of the trail in areas of cut/fill and Retaining walls.

9. **Right-of-Way Work**

   a. Traffic control shall be the Contractor's responsibility and shall be in accordance with the Virginia Work Area Protection Manual. All temporary traffic control must be approved by Owner and shall be considered incident to other items of work**.**

   b. No work to begin in rights of way before issuance of Required Permit from VDOT.

10. **Other Permits Required**

   a. VMRC Permit for in stream work has been obtained by the County. (Contractor is responsible for placard posting)

   - **MONITORING AND REPORTING REQUIREMENTS FROM USFWS**
     Contractors are encouraged to read the permit requirements in their entirety. Biological Opinion is part of the Bidding Documents.

   1. Notify the Service regarding the projected and actual start dates, progress, and completion of the project and verify that the 29,309 ft2 of river bottom disturbance and 2.38 acres of river-edge vegetation removal were not exceeded and all conservation measures were followed. Provide a report containing this information by December 31 of each year until the year after construction is complete to the Virginia Field Office at emily_argo@fws.gov.

   2. Any high-water event that disturbs the construction site, including failure or overtopping of cofferdams, must be reported to the Service at the contact phone number/email address below within 24 hours.

   3. Any spills of motor oil, hydraulic fluid, coolant, or similar fluids, not contained before entry into the action area, must be reported to the Service at the contact number/email provided below and National Response Center (800-424-8802) immediately.

   4. Care must be taken in handling any dead specimens of proposed or listed species to preserve biological material in the best possible state. In conjunction with the preservation of any dead specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead specimens does not imply enforcement proceedings pursuant to the ESA. The reporting of dead specimens is required to enable the Service to determine if take is reached or exceeded and to ensure that the terms and conditions are appropriate and effective. Upon locating a dead specimen, notify the Service's Virginia Law Enforcement Office at 804-771-2883 and the Service's Field Office at the phone number provided below or at 804-693-6694.

   5. A Virginia Logperch Surveyor approved by USFWS, provided by the Contractor, must be present whenever cofferdams are being dewatered and there is the potential that fish could be present within the dewatering area.

b. VSMP Permit has been obtained by the County. Contractor is responsible to write and maintain the SWPPP, obtain placard at preconstruction meeting.

c. E&S Permit has been obtained by the County. Contractor is responsible to attend preconstruction meeting with his Responsible Land Disturber, where the placard will be issued.

d. Building Permit – Contractor is responsible to provide detailed wall design sealed by a Virginia registered professional engineer and submit for building permits from the City of Salem and County of Roanoke. Contractor's design professional will need to certify the wall construction as required by the building permit. Each jurisdiction will permit retaining walls in its respective jurisdiction. Permit fees are Contractor's responsibility. Application and fee information may be located on the City of Salem and County of Roanoke websites

e. VDOT Land Use Permit – Contractor is responsible to assist the County to obtain the VDOT Land Use Permit. There will be no fee or surety required for the VDOT Land Use Permit.

11. **Borrow / Disposal sites** – Will be the responsibility of the Contractor. Approved ESC permit required.

12. **Environmental Requirements:**

a. No construction activities are permitted in the Roanoke River unless specifically noted in the plans.

b. Tree clearing activities shall be performed between November 15 and **March 31*** (Tricolored Bat).

c. All stream activities shall be performed between July 1 and March 14 (Roanoke Logperch).

d. See permit conditions for more detailed requirements.

13. **Other Concerns**

a. Unclassified Excavation – For purposes of payment, material shall not be classified regardless of the type of material encountered.

b. No work outside of secured property without written permission from property owners.

c. Forms for all curb ramps are subject to VDOT approval prior to installation. DWS shall be coordinated at the pre-construction meeting to meet current ADA requirements.

d. All pipes shown within the floodplain shall be RCP. VDOT Pre-approved HDPE and PP materials shall be permitted on pipes outside of the floodplain.

*****Continued on Next Page *****

3)Attachments

Attachments included in Addendum # 1

1. Pre-Bid Sign in Log

2. Geotechnical Report
    a. A geotechnical report prepared by ECS Mid-Atlantic, LLC (ECS Report No. 12:6636, dated August 17, 2012 is posted for Offeror's information.

3. Draft Quality Assurance Plan
    a. A draft Quality Assurance Plan posted for Offeror's information.

4. West Roanoke River Greenway Testing Frequencies
    a. Testing frequencies posted for Offeror's information.

5. Revised Timber Guardrail
    a. Delete the Typical Timber Guardrail detail found at the lower left corner of Sheet C-02 and replace it with the new posted Typical Timber Guardrail detail.

*****Continued on Next Page *****

RFP 2024-007 - WEST ROANOKE RIVER GREENWAY, PHASE I
PRE-PROPOSAL MEETING SIGN-IN LOG

August 21, 2023 10:00 AM

(PLEASE PRINT)

Name/Title Heath Honaker Purchasing Division Director

Organization Roanoke County

Telephone 540.283.8146 Email hhonaker@roanokecountyva.gov

Name/Title Bobby Morgan - Estimator

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RFP 2024-007 - WEST ROANOKE RIVER GREENWAY, PHASE I
PRE-PROPOSAL MEETING SIGN-IN LOG

August 21, 2023 10:00 AM

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Organization VDOT - Civil Rights

Telephone 540-387-5552 Email Brianna.Hatcher@VDOT.virginia.go

Name/Title Chris Moore

Organization Moore excavation LLC

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RFP 2024-007 - WEST ROANOKE RIVER GREENWAY, PHASE I
PRE-PROPOSAL MEETING SIGN-IN LOG

August 21, 2023 10:00 AM

Name/Title Eric Vest - Assistant Director of Parks
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RFP 2024-007 - WEST ROANOKE RIVER GREENWAY, PHASE I
PRE-PROPOSAL MEETING SIGN-IN LOG

August 21, 2023 10:00 AM

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RFP 2024-007 - WEST ROANOKE RIVER GREENWAY, PHASE I
PRE-PROPOSAL MEETING SIGN-IN LOG

August 21, 2023 10:00 AM

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ENGINEERING CONSULTING SERVICES

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PRELIMINARY GEOTECHNICAL ENGINEERING DATA REPORT
ROANOKE RIVER GREENWAY PROJECT – FROM MILL LANE TO GREEN HILL PARK
ROANOKE COUNTY AND CITY OF SALEM, VIRGINIA

ECS REPORT NO. 12:6636





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

August 17, 2012

Mr. Rob Dean, P.E.
AECOM Transportation
1315 Franklin Road
Roanoke, Virginia 24016

ECS Project No. 12:6636
AECOM Project No. 60237986

Reference: Preliminary Geotechnical Engineering Data Report
Roanoke River Greenway – From Mill Lane to Green Hill Park
Roanoke County and City of Salem, Virginia

Dear Mr. Dean:

ECS Mid-Atlantic, LLC (ECS) respectfully submits this Geotechnical Data Report for the above-referenced project. Our services have been provided in accordance with our Scope and Fee Proposal No. 9879-P, dated June 27, 2012. This report includes the results of the soil and rock test borings, laboratory analysis, and geotechnical commentary for this project. Our geotechnical engineering evaluation for the project was based on six (6) soil and rock test borings performed by Blue Ridge Drilling, Inc. under separate subconsultant agreement.

We have appreciated the opportunity to be of service to you. If you have any questions with regard to the data contained in this report, or if we can be of further assistance to you during the construction phase, please do not hesitate to contact us.

Respectfully,
ECS MID-ATLANTIC, LLC

COMMONWEALTH OF VIRGINIA
ADAM TRENT FISHER
No. 2801001791
8/17/2012
CERTIFIED PROFESSIONAL GEOLOGIST

A. Trent Fisher, P.G.
Engineering Geologist

COMMONWEALTH OF VIRGINIA
STEPHEN D. HJELLE
Lic. No. 047697
8/17/12
PROFESSIONAL ENGINEER

Stephen D. Hjelle, P.E.
Principal Geotechnical Engineer

cc: Mrs. Pamela Mann, P.E. – AECOM

REPORT

PROJECT

Preliminary Geotechnical Engineering Data Report
Roanoke River Greenway – From Mill Lane to Green Hill Park
Roanoke County and City of Salem, Virginia

CLIENT

AECOM Transportation
1315 Franklin Road
Roanoke, Virginia 24016

ECS PROJECT No. 12:6636
AECOM PROJECT No. 60237986

August 17, 2012

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PROJECT OVERVIEW

Project Location

The project is located along West Riverside Drive in Roanoke County and the City of Salem, Virginia. Specifically, the proposed new section of the Roanoke River Greenway will trend generally east-west along the Roanoke River, from Green Hill Park in Roanoke County eastward to Mill Lane in the City of Salem. Current plans indicate that there may pedestrian foot bridges constructed along the proposed new section of the greenway, which will convey the trail over the Roanoke River at several locations. However, due to the preliminary status of the project at this time, final bridge locations have not been determined. The general site area and proposed greenway alignment are depicted in Figure 1 and Figure 2, respectively, of the Appendix.

Proposed Construction

The Roanoke River Greenway alignment and design information provided by AECOM is considered to be preliminary. As stated previously, the new section of the alignment will be on the order of 1.5 miles in length, and will be constructed between the east side of Mill Lane in the City of Salem and the existing trail at Green Hill Park, in Roanoke County, Virginia. We understand that this connector will complete 7 miles of greenway trail that will provide links to several commercial, industrial, and residential areas.

Purpose and Scope of Work

The purpose of this exploration is to provide preliminary subsurface data to assist in revealing possible challenges to locating retaining structures adjacent to the greenway path, positioned between West Riverside Drive and the Roanoke River, as well as exploring subsurface conditions at potential pedestrian bridge locations. The purpose of this data report is to present the results of the preliminary subsurface exploration performed on behalf of AECOM by ECS and Blue Ridge Drilling (BRD). Limitations on use of this report, the geotechnical data provided herein, and recommendation for additional exploration, are discussed in the Closing section at the end of the report.

In general, the scope of the subject exploration consisted of six (6) soil test and/or rock core borings performed at locations designated by AECOM along the anticipated alignment of the proposed greenway section, with termination depths extending to as deep as 45.7 feet below the existing ground surface. Drilling operations were performed by BRD, with two (2) of the six (6) borings being performed within the westbound lane of West Riverside Drive. Drilling operations were observed on a full-time basis by an ECS engineering geologist and on a part-time basis by an AECOM representative. Laboratory testing was performed on representative samples obtained during the field exploration. Prior to the exploration, proposed boring locations were staked and/or marked in the field by ECS personnel. During our field exploration, some of the borings were slightly offset, due to either potential underground utility conflicts or terrain issues. The boring locations shown on Figure 2 provided in the Appendix should be considered approximate.

EXPLORATION PROCEDURES

Subsurface Exploration Procedures

In order to characterize the general subsurface conditions, a subsurface exploration program was performed on July 16 and July 26 (return visit), 2012. A total of six (6) borings were performed within the limits of the proposed greenway alignment section construction. The borings included: one (1) potential bridge abutment boring (B-1) and five (5) general alignment borings (B-2, B-3, B-4, B-4-A, and B-5). Some of these borings may have been performed in the vicinity of potential pedestrian foot bridge abutment locations. The borings were performed with all-terrain-vehicle-mounted (ATV) drilling equipment utilizing continuous-flight, hollow stem augers (HSA) to advance the boreholes within the overburden soils to either termination, auger refusal, or spoon refusal. Drilling fluid was not used in the standard soil drilling process. As stated above, initial boring locations were adjusted in the field, as needed, where potential conflicts with existing underground utilities and/or structures dictated, with required offset distances measured and recorded. We have been provided with limited as-drilled boring survey information recorded by others.

Within the overburden soils, representative soil samples were obtained by means of the split-spoon sampling procedure in accordance with ASTM Specification D 1586. In this procedure, a 2-inch O.D., split-barrel sampler is driven into the soil a distance of 18 inches by a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler through a 12-inch interval is termed the Standard Penetration Test (SPT) N-value and is indicated for each sample on the boring logs. This N-value can be used as a qualitative indication of the in-place relative density of cohesionless soils. In a less reliable way, it also indicates the consistency of cohesive soils. This indication is qualitative, since many factors can significantly affect the Standard Penetration resistance value and prevent a direct correlation between drill crews, drill rigs, drilling procedures, and hammer-rod sampler assemblies. Samples were obtained at 2.5-foot intervals in the upper 10 feet of each boring, and at 5-foot intervals thereafter. After recovery, representative portions of each soil sample were removed from the sampler and sealed in glass jars with identifying marks on the lids. Bulk samples were obtained from the upper 10 feet (auger cuttings) that are generally representative of the soil types encountered in Borings B-1 and B-2.

Upon auger refusal, NQ-Wireline coring methods (ASTM D 2113) were utilized to advance Borings B-3, B-4-A, and B-5 into the underlying hard materials (alluvial Riverjack and/or bedrock), until termination within suitable bedrock. In this process, an 8-foot-long outer core barrel is placed down the hole, accompanied by the inner recovery barrel to obtain the sample. Water is introduced into the borehole in order to cool the rock-cutting bit during drilling operations. Standard run lengths extend about 5 feet. Rock core samples were placed in sample boxes.

During drilling operations, an experienced engineering geologist visually classified each soil sample on the basis of texture and plasticity (ASTM D 2488) and identified each soil sample using the classification group symbols and names as prescribed in the Unified Soil Classification System (USCS) (ASTM D 2487). The group symbols for each soil type are

indicated in parentheses following the soil descriptions on the boring logs. A brief explanation of the USCS is included with this report. The engineering geologist grouped the various soil types into the major strata noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs are approximate; in-situ, the transitions may be gradual.

The engineering geologist also visually classified each run of the rock core samples recovered on the basis of lithology, mineralogy, hardness, weathering, and joint set/fracture spacing. Recovery and Rock Quality Designation (RQD) percentages were calculated and recorded for each run. These values are noted on our boring logs.

The soil and rock core samples were taken to our laboratory in Roanoke, Virginia for further visual classification, as needed, and laboratory testing.

As stated previously, the approximate borings locations are shown on Figure 2 in the Appendix. The soil test and rock core boring logs, as well as photographs of rock cores, are also provided in the Appendix.

Previous Subsurface Exploration

ECS is unaware of any previous subsurface exploration programs being performed for this site and considers the current program as preliminary in nature.

Laboratory Testing Program

Representative soil samples were selected and tested in our laboratory to substantiate visual classifications and to aid in the determination of pertinent engineering properties. The laboratory testing program included: soil natural moisture content tests (ASTM D 2216), percent passing the No. 200 sieve (ASTM D 1140), and Atterberg Limits tests (ASTM D 4318). Grain size analyses tests (ASTM D 422), were performed on two (2) composite bulk soil samples obtained from the upper 10 feet of Borings B-1 and B-2. Due to the average poor quality of the rock core samples obtained, Unconfined Compressive Strength of Intact Rock Core Specimens testing (ASTM D 2938) was not performed.

The soil and rock core samples will be retained in our laboratory for a minimum period of 60 days, after which, they will be discarded, unless other instructions are received as to their disposition.

The results of laboratory testing conducted are included in the Appendix of this report.

SITE AND SUBSURFACE CONDITIONS

Site Conditions

The proposed, approximately 1.5-mile-long, Roanoke River Greenway alignment is located on the south side of and generally parallel to the Roanoke River, in Roanoke County and the City of Salem, Virginia. Based on the current information available within the vicinity of our borings, existing elevations range from approximate EL. 1,071 feet at Boring B-2 to approximate EL. 1,032 feet in the vicinity of Boring B-3, with a topographically-high point of approximate EL. 1,073 feet at Boring B-1, resulting in relief of as much as approximately 41 feet. Based on our review of Google Earth and the survey information provided, the borings were performed along an approximate 3,100-foot-long stretch of West Riverside Drive, which correlates to an estimated average downward grade of 1.3 percent from east to west between the borings. It is noted that the elevations shown on the boring logs have been rounded to the nearest whole foot.

At the time of our exploration, the proposed greenway trail alignment generally consisted of a continuously steep, wooded, roadway embankment, located on the north side of the existing guard rail of the westbound travel lane of West Riverside Drive. The roadway itself is sinuous and curvy throughout much of the subject alignment. We understand that within the easternmost section, in the vicinity of where Borings B-1, B-2, and B-5 were performed, retaining wall structures are being considered, due to the anticipated cut slopes to create the pathway. General commentary regarding these types of structures is discussed later in this report. Based on our observations and the borings, the site conditions within the westernmost section, suggest that a significant portion of the proposed alignment is underlain by alluvial deposits from the Roanoke River.

Site Geology

Based on the Salem Quadrangle, Virginia (1974), the project site is located within the Valley and Ridge Physiographic and Geologic Provinces of Southwestern Virginia. Specifically, the site area is located within the Roanoke Valley, which is a northeast-southwest trending lowlands extending for some 20 miles around the City of Roanoke and whose floor is characterized by easily eroded limestones and shales.

Specifically, the site is located on the Salem Thrust Sheet, which is bordered to the north by the Salem Fault and to the south by the Max Meadows Fault. These are low angle overthrust (reverse) faults that brought the older Cambrian-aged Elbrook Formation (€e) into contact with younger Ordovician-aged bedrock, north of the subject site. The entire Salem Thrust Sheet exposes the Elbrook Formation, with the Max Meadows Fault as the defining boundary with its sister Cambrian-aged Rome Formation (€r). The bedrock of the Elbrook Formation, which typically consists of dolostone, shale, and minor limestone intervals, weathers into residual soils that generally consist of orange-brown silts, clays, and saprolites (literally, “rotten rock”) of variable thickness. The Elbrook Formation is known for its potential for sinkhole development, subsidence, cave openings, and other karst-related activity. In close proximity to fault zones,

such as at the project site, the underlying bedrock is typically pulverized and brecciated, and is comprised of variable-sized crushed rock clasts cemented within the bedrock matrix. In the site area, geologic mapping suggests that the interface between rock strata dips sharply to the northwest at angles ranging from approximately 33 to 46 degrees from horizontal.

Carbonate materials, such as the brecciated limestone and interbedded calcareous shale encountered in the subsurface exploration, solution in groundwater over long periods of time, resulting in loss of rock material. The solution process typically occurs along planes of more soluble material with acidic groundwater and causes the formation of interconnected seams and cavities within carbonate formations. The rate of solutioning is also affected by rates of groundwater flow and groundwater chemistry; however, typical solutioning rates are on the order of 1 inch in 1,000 years. These seams and cavities are frequently filled with soft material which has not dissolved or materials that have infiltrated into the seam or cavity from above. The continued exposure to solution activities can result in the formation of caverns. Sinkholes can also result from the collapse of material bridging over the top of caverns formed during the solution process.

Differential solution activity results in a highly-variable rock surface with soil-filled slots commonly encountered between pinnacles of more solution-resistant rock. Since solution activity is caused by acidic groundwater flow, solution channels are commonly interconnected with narrow zones of solution activity extending from large solution features.

Within the immediate project area, the Roanoke River flows eastward through a flood plain, which contains a thick veneer of alluvial materials, which includes significant zones of large cobbles and boulders referred to as *Riverjack*, overlying the Elbrook and Rome Formations. Young alluvium is present in the current stream channel and flood plain. The transition from these young alluvial materials to hard rock is often times abrupt, with little or no residual soil or saprolite present. The lower-lying portions of the project site are located within this recent flood plain, while the topographically-higher areas are not.

The boundary between soil and rock is not sharply defined. A transitional zone termed "highly weathered rock" (HWR hereafter), is normally found overlying the parent bedrock. HWR is defined, for engineering purposes, as residual material with Standard Penetration resistance greater than 100 blows per foot (bpf). Because weathering is facilitated by fractures, joints, and the presence of less resistant rock types, the profile of the HWR and hard rock (bedrock) is typically irregular and erratic, even over short horizontal distances. Also, it is not unusual to find lenses and natural boulders of hard rock floating in zones of HWR within the soil mantle, well above the general bedrock level.

Subsurface Conditions

Based on the borings, the surface materials at the site generally consist of topsoil, gravel, and/or pavement, underlain by fill, alluvial deposits, and/or residuum. The alluvial and residual soils are underlain by highly weathered to competent carbonate bedrock. The following descriptions provide general soil stratigraphy, with details provided in the boring logs included in the Appendix.

Topsoil: Topsoil was encountered in Borings B-2 and B-3 and was about 3 inches in depth.

Gravel: Gravel was encountered at the ground surface in Borings B-4 and B-4-A, and below the topsoil in Boring B-3. Gravel encountered ranged from about 3 to 8 inches in depth.

Asphalt Pavement: Borings B-1 and B-5 were performed within the westbound travel lane of West Riverside Drive. Asphalt encountered in these locations ranged from about 7 to 12 inches in depth. The asphalt layer in Boring B-5 was underlain by about 6 inches of aggregate base material. It is noted that a discernable, measurable aggregate base material was not encountered in Boring B-1.

Fill or Possible Fill: Fill material, which contained evidence of disturbance and/or debris, was encountered in Borings B-4 and B-5. The fill soils encountered are similar in nature to the alluvial and residual soils in the area and generally consisted of SILT (ML), SILTY GRAVEL (GM), and DECOMPOSED SANDSTONE FRAGMENTS, containing variable amounts of sand, clay, silt, rock fragments, mica, and/or rootlets. The fill depths generally extended from approximately 3.8 to 5.5 feet below the existing ground surface. Consistency of these materials ranged from soft to firm for fine grained soils and from dense to very dense for coarse grained soils. The higher consistencies are attributable to the presence of rock fragments, boulders, or other non-soil materials, which impeded the advancement of the split-spoon sampler.

Alluvium: Alluvial deposits were encountered in Borings B-3 and B-4-A. The alluvium encountered generally consisted of SANDY SILT (ML), SILTY SAND (SM), and large cobbles and small boulders, referred to as RIVERJACK. Based on the SPT N-values, consistencies of the alluvial materials ranged from loose to medium dense. However, some higher SPT N-values are likely unrepresentative of consistencies, due to the presence of Riverjack, which may have impeded the split-spoon sampler. Where present, cobbles and boulders within the alluvial deposits likely resulted in elevated SPT N-values.

In Boring B-4-A, auger refusal occurred on Riverjack, which required advancement of the boring utilizing NQ-Wireline rock coring operations.

Residuum: Residual soils were encountered below the surface materials or existing fill in Borings B-1, B-2, and B-5, which were performed within the topographically-higher, eastern half of the project site. The residuum encountered generally consisted of LEAN to FAT CLAY (CL to CH) and LOW-PLASTICITY to ELASTIC SILT (ML to MH), with varying concentrations of sand, silt, clay, and/or saprolitic rock fragments. It is noted that these soils exhibited a relict rock structure, which is typical in saprolitic, residual soils. SPT N-values in these soils ranged from 3 to 11 bpf, indicating soft to stiff consistencies.

Highly Weathered Rock (HWR): HWR, which consisted of LIMESTONE, was encountered above auger refusal depth in Borings B-1, B-3, and B-5. These layers were encountered from approximately 8.3 to 33 feet below existing grades, and were generally very thin (up to approximately 4.6 feet in thickness). These materials contained variable amounts of silt, sand, and clay.

Hard Rock (Bedrock): Bedrock, which predominantly consisted of gray, BRECCIATED LIMESTONE (in part, containing minor interbedded calcareous shale), with calcite veins or infillings and vuggy porosity throughout, was encountered in all borings except Boring B-2, which was terminated at 20 feet below existing grade. Bedrock is generally identified by auger refusal, spoon refusal, and/or SPT N-values in excess of 50 blows for 1 inch or less of penetration, on naturally-occurring mass stratigraphy, which was not deposited by man, water, or gravity. Depth of bedrock encountered ranged from approximately 5.5 to 35.7 feet below existing grades.

Bedrock was cored in Borings B-3, B-4-A, and B-5. Excluding one (1) minor, approximately 0.5-foot-thick zone of Riverjack coring in Boring B-4-A, percent core recovery ranged from 75% to 94%, averaging approximately 89%, and Rock Quality Designation (RQD) ranged from 16% to 67%, averaging approximately 41%. Based on RQD values, rock quality ranged from very poor to fair, and averaged poor quality. In general, the quality of bedrock was very poor below the western half of the site (close to the Roanoke River elevation), and was generally fair on the eastern, topographically-higher half of the site.

Groundwater Conditions

Groundwater observations were made during soil sampling and upon completion of the drilling operations at each boring location. In standard soil auger drilling operations, water is not introduced into the borehole, and the groundwater position can often be determined by observing water flowing into or out of the borehole. Furthermore, visual observations of the soil samples retrieved during the auger drilling exploration can often be used in evaluating the groundwater conditions. For rock coring, water is introduced into the borehole; therefore, water level readings were not recorded below auger refusal depth.

Generally, the soil samples were moist. Groundwater was only noted during auger drilling operations in Boring B-5, at an approximate depth of 33 feet below existing grade. This depth corresponds to an elevation of approximately 1,033 feet, and at transition from residuum to the HWR zone. It is anticipated that the groundwater in low-lying areas is hydraulically connected to the Roanoke River. We did not have relative surface water elevation data for the Roanoke River during our field exploration. For the remaining borings, groundwater was not encountered above auger refusal depth.

Perched water could be encountered at higher elevations at the interface between higher and lower permeability soils, as well as in unexplored site areas in close proximity to our boring locations. The water level indicated on the boring log for Boring B-5 represents an estimate of the groundwater level that existed at the time of drilling in this localized area. Fluctuations of the groundwater levels, to include the one shown on the boring log referenced above, should be expected with changes in precipitation, river level, surface run-off, and evaporation.

PRELIMINARY GEOTECHNICAL ENGINEERING CONSIDERATIONS DURING DESIGN AND CONSTRUCTION

Bridge Foundations

Based on the borings performed along the anticipated greenway alignment, potential bridge alignment(s), and the anticipated bridge loads, the foundations should be supported on hard rock (bedrock), through spread footings and/or deep foundations. The depth and quality of rock encountered in the borings was highly variable along the testing alignment, including zones of deep weathering and firm to soft soils. Groundwater will impact excavations for foundations along the alignment, particularly those within close proximity to and within the 100-year flood zone of the Roanoke River. The designer should consider the variability of conditions, the potential for impact of karst features, constructability, capacities, and limiting settlements for selection and design of the foundation systems. The design should consider scour analysis for pier foundations and meet VDOT requirements relative to scour depth.

Although deep alluvial soils and extensive Riverjack was not encountered in our borings, it is noted that construction of deep foundations in unexplored areas may encounter these materials, which could impede the process of deep foundation installation. If driven piles are utilized, pre-drilling may be required. If drilled piers (caissons) are utilized, excavation through obstructions could be anticipated.

Retaining Structures

Based on the information provided to us, we understand that retaining structures may be required for alignment alternatives positioned between West Riverside Drive and the Roanoke River in the eastern area of the project corridor (in the vicinities of Borings B-1, B-2, and B-5). Support of the proposed trail in this area may be accomplished with a variety of wall types, including cast-in-place concrete walls; steel sheet pile walls; soldier pile walls; and soil nail walls. When used to retain excavation for trail alignments in cut sections, these walls types may be as tall as 15 to 20 feet. Walls used to support trail alignments constructed on new fill material may reach heights of 30 feet or greater, depending on the alignment. Alignments located close to the Roanoke River with shorter wall heights may be suitable for cast-in-place wall types with spread foundations on bedrock, and should be designed with proper scour resistance. Alignments located on the steeply-sloped area between West Riverside Drive and the Roanoke River, and with greater heights, may require drilled-in or driven-in types of wall construction, with tie-back anchors founded in rock for support. Design of any wall type should consider material strength, global stability, and control of total and differential settlement tolerances. Construction access and stability of the existing slopes after construction will also be important considerations at this site.

Karst

The subsurface conditions encountered in the western area borings (Borings B-3, B-4, and B-4-A) generally consist of fill and alluvial soils overlying an erratic carbonate bedrock surface. The eastern area borings (B-1, B-2, and B-5) generally consist of deep residual soils that are

consistent in strength, but are underlain by an erratic carbonate rock surface as well. Karst features have been mapped in close proximity to the general project vicinity. Borings B-3 and B-4-A performed for the current study encountered very poor quality rock conditions, while Boring B-5 generally encountered fair quality rock conditions. Based on these conditions, the risk of future sinkhole development should be considered during final design.

CLOSING

Final geotechnical recommendations for structural design and overall site development and construction will be provided upon completion of additional geotechnical exploration of the soil and rock beneath the site. This exploration should include detailed exploration and analysis of the soils and rock present below specific structure locations.

The boring logs included in this report depict the subsurface soil, rock, groundwater, and existing surface materials (i.e. pavement, topsoil, and gravel) conditions at the specific locations and time the borings were performed. These conditions may vary at other locations beyond, or between, these specific locations. Accordingly, ECS does not warrant or guarantee that the information provided on the boring logs, or in this report, can be projected as indicative of conditions beyond the limits of the borings, and any such projection is purely interpretive. In addition, the groundwater level recorded on the boring log for Boring B-5 indicates the groundwater conditions that existed at the time of the exploration in that localized area. Groundwater levels may vary considerably, with time, according to prevailing climate, rainfall, river level, surface run-off, evaporation, construction, and other factors.

The discussion of general geotechnical considerations as presented in this data report are based on the information revealed by the preliminary exploration. We have attempted to provide for normal contingencies, but the possibility remains that unexpected conditions may be encountered during subsequent site explorations and construction. Additional soil and rock test borings, in addition to laboratory testing, should be performed to meet the minimum requirements outlined in Chapter 3 of the current VDOT Material Division's Manual of Instructions (MOI) and the current AASHTO Standard Specifications for the Design of Highway Bridges.

We have endeavored to complete the services identified herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions as this project.

APPENDIX

Figures

- Figure 1 – Site Location Map
- Figure 2 – Boring Location Diagram

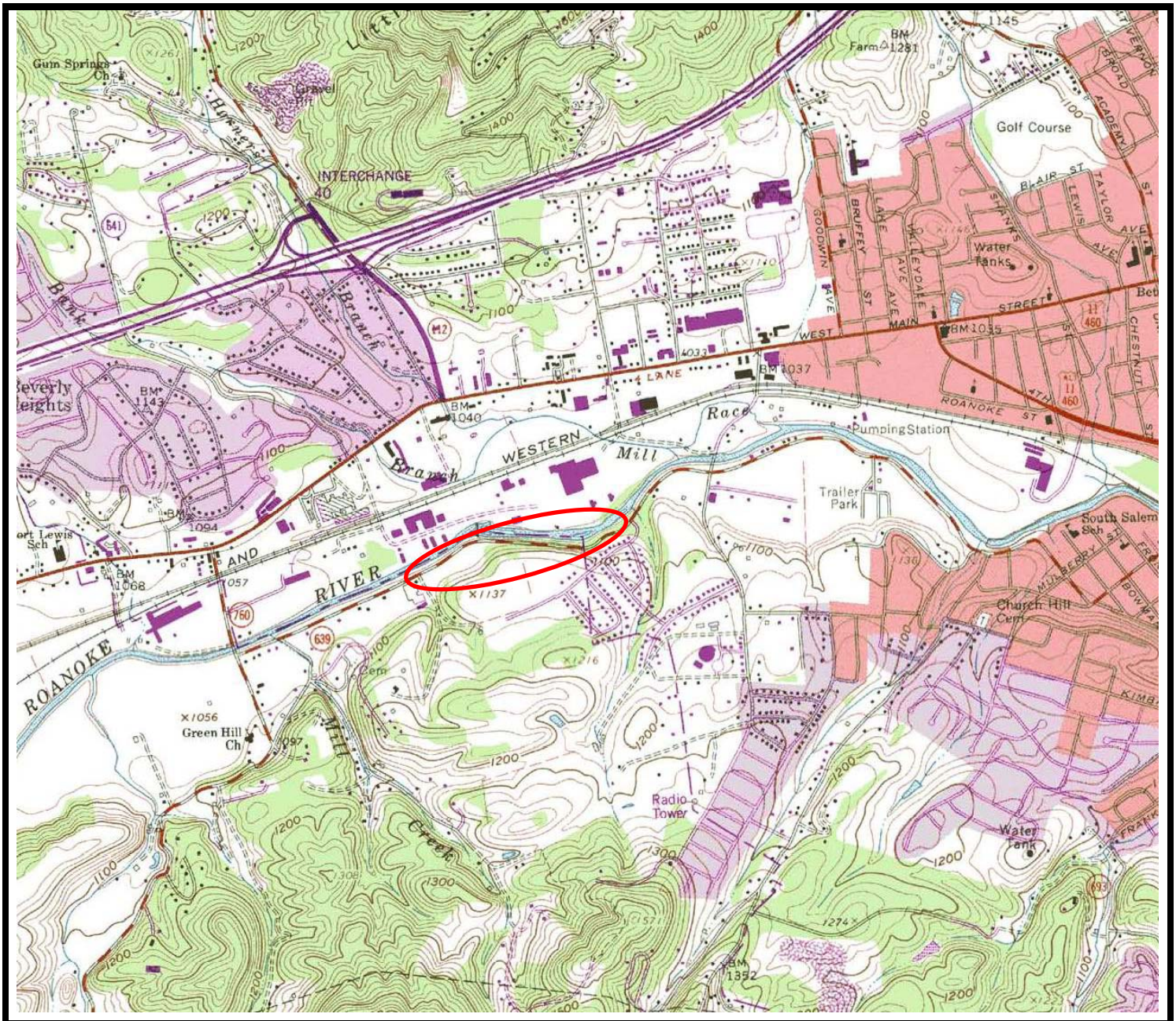
Unified Soil Classifications

Reference Notes for Boring Logs

Boring Logs

Rock Core Photographs

Laboratory Test Results



LEGEND

○ - Approximate Site Location

SCALE (IN FEET)

1000 2000

2000 0

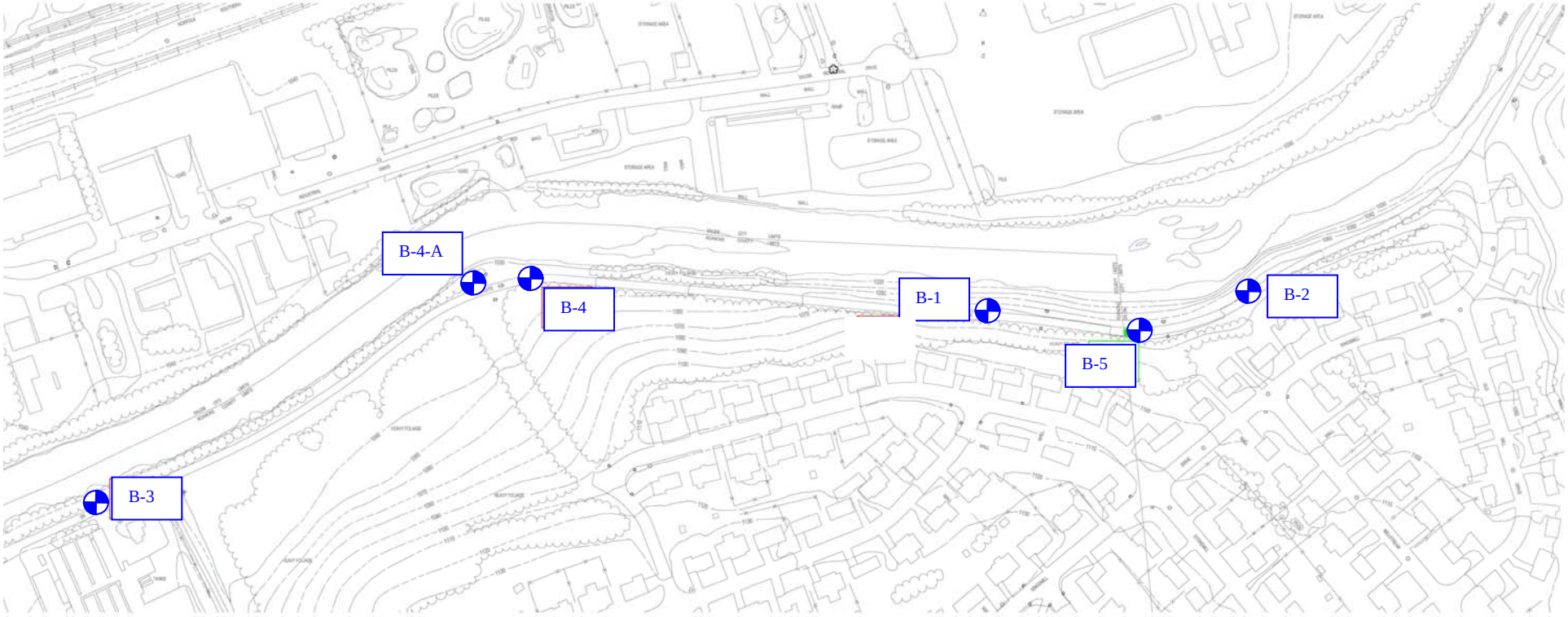
SOURCE:
U.S.G.S. 7.5 MINUTE SERIES
TOPOGRAPHIC MAP
SALEM
QUADRANGLE, VIRGINIA

DATED: 1963
PHOTOREVISED: 1984

FIGURE 1

SITE LOCATION MAP

ROANOKE RIVER GREENWAY PROJECT - GREEN HILL PARK
ROANOKE COUNTY & CITY OF SALEM, VIRGINIA
ECS PROJECT NO. 12:6636

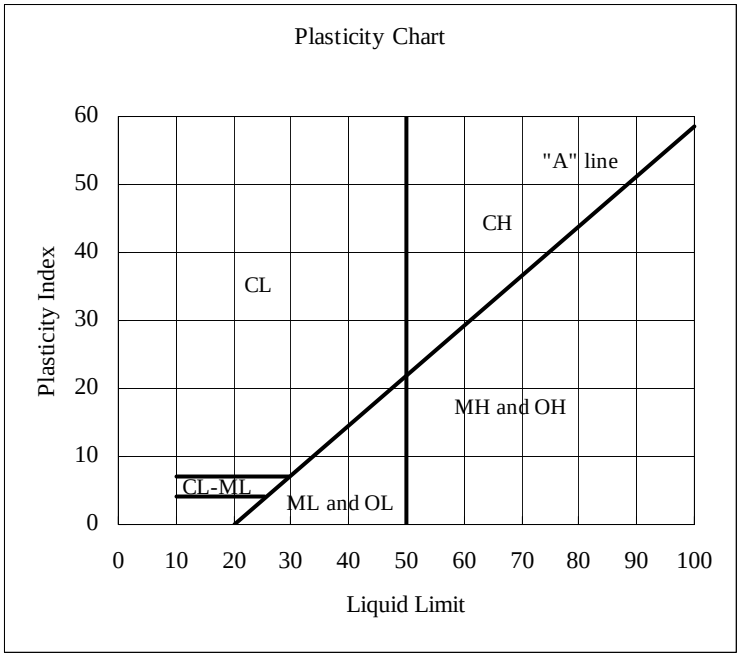


ECS	SOURCE: AECOM	N W E S	SCALE: NOT TO SCALE	LEGEND: - Approximate Boring Location	FIGURE 2 BORING LOCATION DIAGRAM ROANOKE RIVER GREENWAY PROJECT- GREEN HILL PARK ROANOKE COUNTY & CITY OF SALEM, VIRGINIA ECS PROJECT NO. 12:6636

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

Major Divisions			Group Symbols		Typical Names	Laboratory Classification Criteria	
Coarse-grained soils (More than half of material is larger than No. 200 Sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u = D_{60}/D_{10}$ greater than 4 $C_c = (D_{30})^2/(D_{10}xD_{60})$ between 1 and 3	
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM[a]	d	Silty gravels, gravel-sand mixtures	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
				u			
			GC		Clayey gravels, gravel-sand-clay mixtures	Atterberg limits below "A" line or P.I. less than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines	$C_u = D_{60}/D_{10}$ greater than 6 $C_c = (D_{30})^2/(D_{10}xD_{60})$ between 1 and 3	
			SP		Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM[a]	d	Silty sands, sand-silt mixtures	Atterberg limits above "A" line or P.I. less than 4	Limits plotting in CL-ML zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
				u			
			SC		Clayey sands, sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7	
Fine-grained soils (More than half material is smaller than No. 200 Sieve)	Silts and clays (Liquid limit less than 50)		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity		
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			OL		Organic silts and organic silty clays of low plasticity		
	Silts and clays (Liquid limit greater than 50)		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			CH		Inorganic clays of high plasticity, fat clays		
			OH		Organic clays of medium to high plasticity, organic silts		
	Highly Organic soils		Pt		Peat and other highly organic soils		

Determine percentages of sand and gravel from grain-size curve.
Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:
Less than 5 percent — GW, GP, SW, SP
More than 12 percent — GM, GC, SM, SC
5 to 12 percent — Borderline cases requiring dual symbols[b]



[a] Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u used when L.L. is greater than 28.
[b] Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC,well-graded gravel-sand mixture with clay binder. (From Table 2.16 - Winterkorn and Fang, 1975)

REFERENCE NOTES FOR BORING LOGS

I. Drilling Sampling Symbols

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

II. Correlation of Penetration Resistances to Soil Properties

Standard Penetration (blows/ft) refers to the blows per foot of a 140 lb. hammer falling 30 inches on a 2-inch OD split-spoon sampler, as specified in ASTM D 1586. The blow count is commonly referred to as the N-value.

A. Non-Cohesive Soils (Silt, Sand, Gravel and Combinations)

Density		*Relative Properties*	
Under 4 blows/ft	Very Loose	Adjective Form	12% to 49%
5 to 10 blows/ft	Loose	With	5% to 12%
11 to 30 blows/ft	Medium Dense		
31 to 50 blows/ft	Dense		
Over 51 blows/ft	Very Dense		

Particle Size Identification		
Boulders		8 inches or larger
Cobbles		3 to 8 inches
Gravel	Coarse	1 to 3 inches
	Medium	½ to 1 inch
	Fine	¼ to ½ inch
Sand	Coarse	2.00 mm to ¼ inch (dia. of lead pencil)
	Medium	0.42 to 2.00 mm (dia. of broom straw)
	Fine	0.074 to 0.42 mm (dia. of human hair)
Silt and Clay		0.0 to 0.074 mm (particles cannot be seen)

B. Cohesive Soils (Clay, Silt, and Combinations)

Blows/ft	*Consistency*	*Unconfined Comp. Strength Q_p (tsf)*	*Degree of Plasticity*	*Plasticity Index*
Under 2	Very Soft	Under 0.25	None to slight	0 – 4
3 to 4	Soft	0.25-0.49	Slight	5 – 7
5 to 8	Medium Stiff	0.50-0.99	Medium	8 – 22
9 to 15	Stiff	1.00-1.99	High to Very High	Over 22
16 to 30	Very Stiff	2.00-3.00		
31 to 50	Hard	4.00–8.00		
Over 51	Very Hard	Over 8.00		

III. Water Level Measurement Symbols

WL	Water Level	BCR	Before Casing Removal	DCI	Dry Cave-In
WS	While Sampling	ACR	After Casing Removal	WCI	Wet Cave-In
WD	While Drilling	▽	Est. Groundwater Level	▽●	Est. Seasonal High GWT

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 a granular soil. In clay and plastic silts, the accurate determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally applied.

VDOT Virginia Department of Transportation

PROJECT #: AECOM NO. 60237986
LOCATION: ROANOKE CO. AND SALEM, VA
STRUCTURE: GREENWAY ALIGNMENT

B-1
PAGE 1 OF 1

STATION: N/A
OFFSET: N/A
LATITUDE: 37.282053° N
LONGITUDE: 80.089517° W
SURFACE ELEVATION: 1,073.0 ft
COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/12/2012 - 07/12/2012
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s):
Driller: BLUE RIDGE DRILLING
Logger: ECS

GROUND WATER
NOT ENCOUNTERED DURING DRILLING

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
0	1072	5 4 4	89		1						0.0 / 1,073.0 ASPHALT (7")			
					2.5						0.6 / 1,072.4 RESIDUUM, consisting of orange-yellow and brown, LEAN CLAY, with fine sand and silt, firm to stiff, moist, (CL) [Relict Rock Structure]			32.7
2	1070	3 4 4	100		3.5									
4	1068				5									28.3
6	1066	3 4 6	100		6									23.1
8	1064	3 3 4	95		7.5									
10	1062				8.5									21.5
12	1060				10						10.0 / 1,063.0 Yellow-orange and brown, SILT, with fine sand, trace clay, stiff to firm, moist, (ML) [Relict Rock Structure]			
14	1058	4 4 5	100		13.5									25.8
16	1056				15									
18	1054	3 3 5	100		18.5									23.1
20	1052				20									
22	1050													
24	1048	36 50/1"	97		23.5 24.1						24.0 / 1,049.0 Gray-brown, HIGHLY WEATHERED LIMESTONE, with silt and fine sand, trace clay, very dense, moist to dry			15.3
26	1046													
28		50/1"	0		28.5 28.6						***Spoon Refusal @ 28.6' [EL. 1,044.4']***			

REMARKS: RIG TYPE: CME 55 ATV.
Cave-in Depth = 18.2'
Composite Bulk Soil Sample Obtained From Upper 10 Feet
No Observable Stone Base Below Asphalt

PAGE 1 OF 1
B-1

SPT_LOG:6636 ROANOKE RIVER GREENWAY.GPJ:8.1.025:021209:8/15/12

VDOT Virginia Department of Transportation

PROJECT #: AECOM NO. 60237986
LOCATION: ROANOKE CO. AND SALEM, VA
STRUCTURE: GREENWAY ALIGNMENT

B-2
PAGE 1 OF 1

STATION: N/A
OFFSET: N/A
LATITUDE: 37.282181° N
LONGITUDE: 80.087592° W
SURFACE ELEVATION: 1,071.0 ft
COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/12/2012 - 07/12/2012
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s):
Driller: BLUE RIDGE DRILLING
Logger: ECS

GROUND WATER
NOT ENCOUNTERED DURING DRILLING

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
0	1070	4 5	5	95	1						0.0 / 1,071.0 TOPSOIL (3")			
					2.5						0.25 / 1,070.75 RESIDUUM, consisting of orange-brown to orange-yellow and brown, SANDY FAT CLAY, contains trace rootlets [in upper 5 feet], firm to stiff, moist, (CH) [Relict Rock Structure]			27.2
2	1068	3 4	5	95	3.5									
					5									34.4
4	1066	3 4	4	89	6									
					7.5									41.3
6	1064	3 5	6	95	8.5									
					10									20.6
8	1062										10.0 / 1,061.0 Orange-yellow and brown, SILT, with fine sand, trace clay, stiff, moist, (ML) [Relict Rock Structure]			
10	1060													
12	1058	3 4	5	83	13.5									
					15									36.8
14	1056													
16	1054													
18	1052	3 4	5	83	18.5									
					20									27.0
20											***Boring Terminated @ 20.0' [EL. 1,051.0']***			

REMARKS: RIG TYPE: CME 55 ATV.
Cave-in Depth = 8.2'
Composite Bulk Soil Sample Obtained From Upper 10 Feet

PAGE 1 OF 1
B-2

SPT_LOG:6636 ROANOKE RIVER GREENWAY.GPJ:8.1.025:021209:8/15/12

VDOT Virginia Department of Transportation

PROJECT #: AECOM NO. 60237986
LOCATION: ROANOKE CO. AND SALEM, VA
STRUCTURE: GREENWAY ALIGNMENT

B-3
PAGE 1 OF 1

STATION: N/A
OFFSET: N/A
LATITUDE: 37.280728° N
LONGITUDE: 80.096547° W
SURFACE ELEVATION: 1,032.0 ft
COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/12/2012 - 07/12/2012
Drilling Method(s): HSA & NQ-WIRELINE
SPT Method: Automatic Hammer
Other Test(s):
Driller: BLUE RIDGE DRILLING
Logger: ECS

GROUND WATER
NOT ENCOUNTERED DURING DRILLING

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)	FINES CONTENT #200 (%)
2	1030	5 3 2	67		1 2.5						0.0 / 1,032.0 TOPSOIL (3") 0.25 / 1,031.75 GRAVEL (3") 0.5 / 1,031.5 ALLUVIUM, consisting of brown, SANDY SILT, contains rock fragments and organics, firm to stiff, dry to moist, (ML)			9.8	49.0
4	1028	6 5 5	7		3.5 5									10.2	
6	1026	6 14 15	45		6 7.5									8.8	
8	1024	48 50/2"	47		8.5 9.2						6.8 / 1,025.2 ALLUVIUM, consisting of gray-brown, RIVERJACK, trace quartz fragments, medium dense, dry, (GW) 8.3 / 1,023.7 RESIDUUM, consisting of gray-brown, HIGHLY WEATHERED LIMESTONE, with silt and fine sand, trace clay, very dense, dry ***Auger Refusal @ 10.5'***			6.7	
10	1022				10.5										
12	1020					75	17				10.5 / 1,021.5 Slightly weathered [some limonite staining on naturally-fractured surfaces], hard to very hard, intensely to moderately fractured and jointed, gray, BRECCIATED LIMESTONE, with calcite veins and vuggy porosity throughout				
14	1018				15.5						***Boring Terminated @ 15.5' [EL. 1,016.5']***				

REMARKS: RIG TYPE: CME 55 ATV.
Cave-in Depth Not Measured

PAGE 1 OF 1
B-3

SPT_LOGB:6636 ROANOKE RIVER GREENWAY.GPJ:8.1.025:021209:8/15/12

VDOT Virginia Department of Transportation

PROJECT #: AECOM NO. 60237986
LOCATION: ROANOKE CO. AND SALEM, VA
STRUCTURE: GREENWAY ALIGNMENT

B-4
PAGE 1 OF 1

STATION: N/A
OFFSET: N/A
LATITUDE: 37.282203° N
LONGITUDE: 80.093422° W
SURFACE ELEVATION: 1,033.0 ft
COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/12/2012 - 07/12/2012
Drilling Method(s): HSA
SPT Method: Automatic Hammer
Other Test(s):
Driller: BLUE RIDGE DRILLING
Logger: ECS

GROUND WATER
NOT ENCOUNTERED DURING DRILLING

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT (LL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)
	1032	5	52		1						0.0 / 1,033.0 GRAVEL (6")			
2		9 50/4"			2.3						0.5 / 1,032.5 FILL, consisting of brown and gray, SILTY GRAVEL, with fine sand, contains rootlets, very dense, dry, (GM)			7.2
	1030													
4		27			4						3.5 / 1,029.5 POSSIBLE FILL or ALLUVIUM, consisting of gray-brown, DECOMPOSED SANDSTONE FRAGMENTS, with sand and silt, dense, dry			4.7
	1028	24 16	33		5.5									
											Auger Refusal @ 5.5' [EL. 1027.5']			

REMARKS: RIG TYPE: CME 55 ATV.
First Auger Refusal @ 1.5' on Boulder
Insufficient Auger Cuttings Returned for Obtaining Composite Bulk Soil Sample
Cave-in Depth = 2.0'

PAGE 1 OF 1
B-4

SPT_LOG:6636 ROANOKE RIVER GREENWAY.GPJ:8.1.025:021209:8/15/12

VDOT Virginia Department of Transportation

PROJECT #: AECOM NO. 60237986
LOCATION: ROANOKE CO. AND SALEM, VA
STRUCTURE: GREENWAY ALIGNMENT

B-4-A
PAGE 1 OF 1

STATION: N/A
OFFSET: N/A
LATITUDE: 37.282139° N
LONGITUDE: 80.093711° W
SURFACE ELEVATION: 1,033.0 ft
COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/26/2012 - 07/26/2012
Drilling Method(s): HSA & NQ-WIRELINE
SPT Method: Automatic Hammer
Other Test(s):
Driller: BLUE RIDGE DRILLING
Logger: ECS

GROUND WATER
NOT ENCOUNTERED DURING DRILLING

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
0	1032	3									0.0 / 1,033.0 GRAVEL (8")			
2		2 9	55		1 2.5						0.67 / 1,032.33 ALLUVIUM, consisting of brown, SILTY, FINE TO COARSE SAND, contains rock fragments and mica, medium dense, moist, (SM)			
	1030	3			3.5									
4		5 12	67		5									
	1028				5.5						***Auger Refusal @ 5.5'***			
6											5.5 / 1,027.5 RIVERJACK, consisting of calcareous sandstone fragments and rounded cobbles			
	1026													
8						94	16				6.0 / 1,027.0 Moderately weathered to unweathered, soft to hard, intensely jointed and fractured, gray, BRECCIATED LIMESTONE, with [interbedded CALCAREOUS SHALE to 9 feet], calcite infilling, and vuggy porosity throughout			
	1024													
10					10.5						***Boring Terminated @ 10.5' [EL. 1,022.5']***			

REMARKS: RIG TYPE: CME 55 ATV.
Offset Approximately 70 Feet West From B-4
Cave-in Depth Not Measured

PAGE 1 OF 1
B-4-A

SPT_LOG:6636 ROANOKE RIVER GREENWAY.GPJ:8.1.025:021209:8/15/12

VDOT Virginia Department of Transportation

PROJECT #: AECOM NO. 60237986
LOCATION: ROANOKE CO. AND SALEM, VA
STRUCTURE: GREENWAY ALIGNMENT

B-5
PAGE 1 OF 2

STATION: N/A
OFFSET: N/A
LATITUDE: 37.282011° N
LONGITUDE: 80.088008° W
SURFACE ELEVATION: 1,066.0 ft
COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/26/2012 - 07/26/2012
Drilling Method(s): HSA & NQ-WIRELINE
SPT Method: Automatic Hammer
Other Test(s):
Driller: BLUE RIDGE DRILLING
Logger: ECS

GROUND WATER
▽ FIRST ENCOUNTERED AT 33.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
		3 2 2	83		1 2.5						0.0 / 1,066.0 ASPHALT (12")			
2	1064										1.0 / 1,065.0 GRAVEL (6")			
4	1062	2 3 3	100		3.5 5						1.5 / 1,064.5 FILL, consisting of orange-brown, SILT, with fine sand and clay, contains rock fragments and mica, soft, moist, (ML)			
6	1060	3 4 5	100		6 7.5						3.8 / 1,062.2 RESIDUUM, consisting of orange-brown, LEAN CLAY, with fine sand, contains trace mica, firm, moist, (CL) [Relict Rock Structure]			
8	1058	2 3 5	100		8.5 10						5.8 / 1,060.2 Orange-yellow and brown, ELASTIC SILT, with clay and fine sand, contains saprolitic rock fragments and trace mica, soft to stiff, moist, (MH) [Relict Rock Structure]			
10	1056													
12	1054													
14	1052	1 2 3	100		13.5 15									
16	1050													
18	1048	2 2 4	100		18.5 20									
20	1046													
22	1044													
24	1042	2 1 2	100		23.5 25									
26	1040													
28	1038	2 2 5	100		28.5 30						28.0 / 1,038.0 SAME, orange-gray and brown, firm, (MH) [Relict Rock Structure]			
30	1036													
32	1034													
▽ 34	1032	50/5"	83		33.5 33.9						33.0 / 1,033.0 Gray-brown, HIGHLY WEATHERED LIMESTONE, with silt and sand, very dense, wet			

REMARKS: RIG TYPE: CME 55 ATV.
Cave-in Depth = 4.7'

SPT_LOG:6636 ROANOKE RIVER GREENWAY.GPJ:8.1.025:021209:8/15/12

VDOT Virginia Department of Transportation

PROJECT #: AECOM NO. 60237986
LOCATION: ROANOKE CO. AND SALEM, VA
STRUCTURE: GREENWAY ALIGNMENT

B-5
PAGE 2 OF 2

STATION: N/A
OFFSET: N/A
LATITUDE: 37.282011° N
LONGITUDE: 80.088008° W
SURFACE ELEVATION: 1,066.0 ft
COORD. DATUM: NAD 83

FIELD DATA

Date(s) Drilled: 07/26/2012 - 07/26/2012
Drilling Method(s): HSA & NQ-WIRELINE
SPT Method: Automatic Hammer
Other Test(s):
Driller: BLUE RIDGE DRILLING
Logger: ECS

GROUND WATER
▽ FIRST ENCOUNTERED AT 33.0 ft DEPTH
NO LONG TERM MEASUREMENTS TAKEN

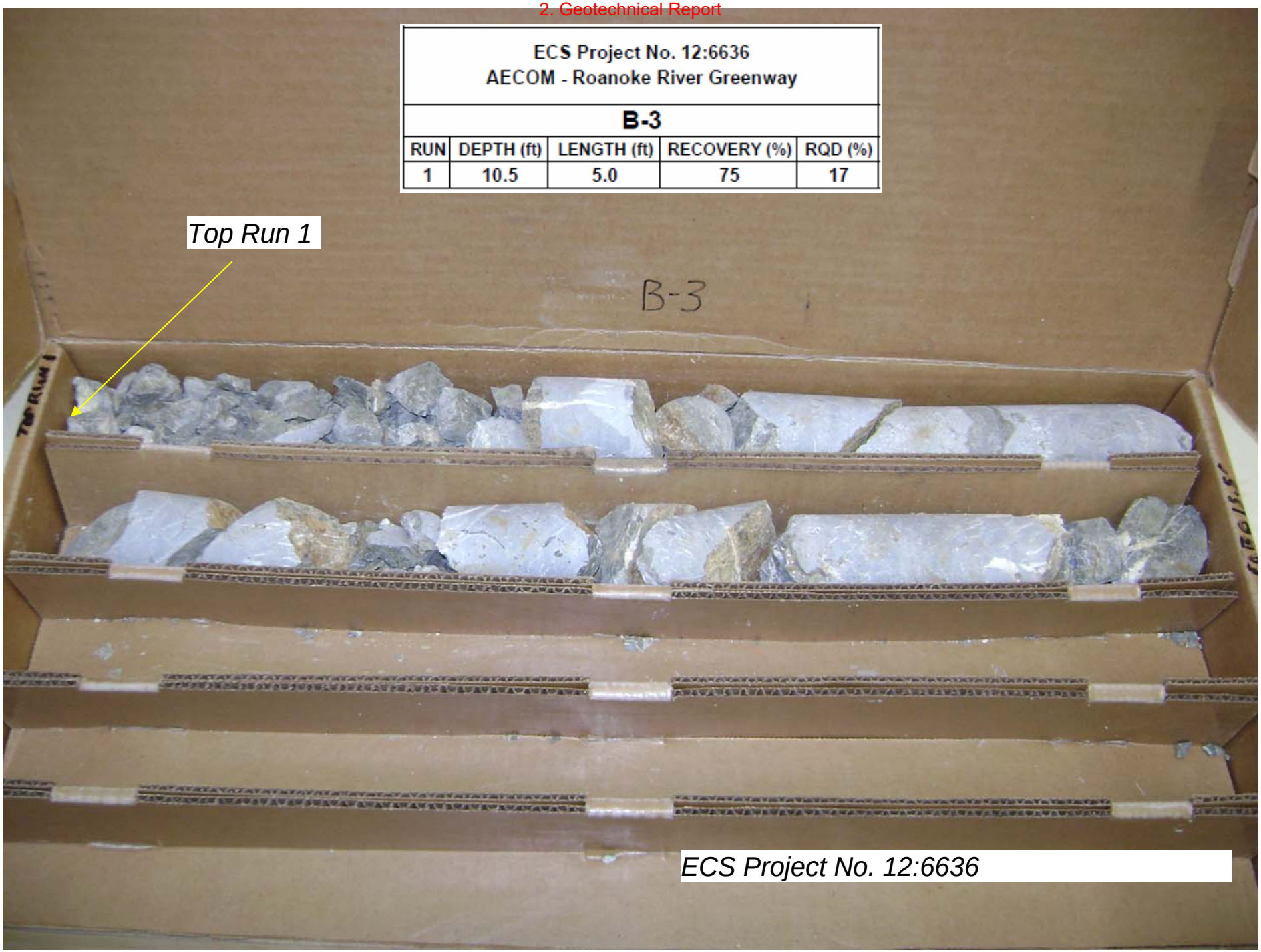
LAB DATA

DEPTH (ft)	ELEVATION (ft)	SOIL: STANDARD PENETRATION TEST HAMMER BLOWS	SOIL: SOIL RECOVERY (%)	SAMPLE LEGEND	SAMPLE INTERVAL	ROCK: CORE RECOVERY (%)	ROCK: ROCK QUALITY DESIGNATION	ROCK: DIP ° STRATA	ROCK: DIP ° JOINTS	STRATA LEGEND	FIELD DESCRIPTION OF STRATA	LIQUID LIMIT LL	PLASTICITY INDEX PI	MOISTURE CONTENT (%)
36	1030				35.7						***Auger Refusal @ 35.7'***			
											35.7 / 1,030.3 35.7'-38.1': Slightly weathered to unweathered, hard, intensely jointed, gray, BRECCIATED LIMESTONE, with calcite infilling and vuggy porosity throughout. 38.1'-40.7': Highly to slightly weathered, soft to moderately hard, intensely jointed, light gray and tan, SHALY LIMESTONE, vuggy porosity throughout			
38	1028					93	67							
40	1026				40.7						40.7 / 1,025.3 Moderately to slightly weathered, soft to hard, intensely to moderately jointed, gray, BRECCIATED LIMESTONE, with calcite infilling and vuggy porosity throughout			
42	1024					94	64							
44	1022				45.7						***Boring Terminated @ 45.7' [EL. 1,020.3']***			

REMARKS: RIG TYPE: CME 55 ATV.
Cave-in Depth = 4.7'

SPT_LOG:6636 ROANOKE RIVER GREENWAY.GPJ:8.1.025:021209:8/15/12

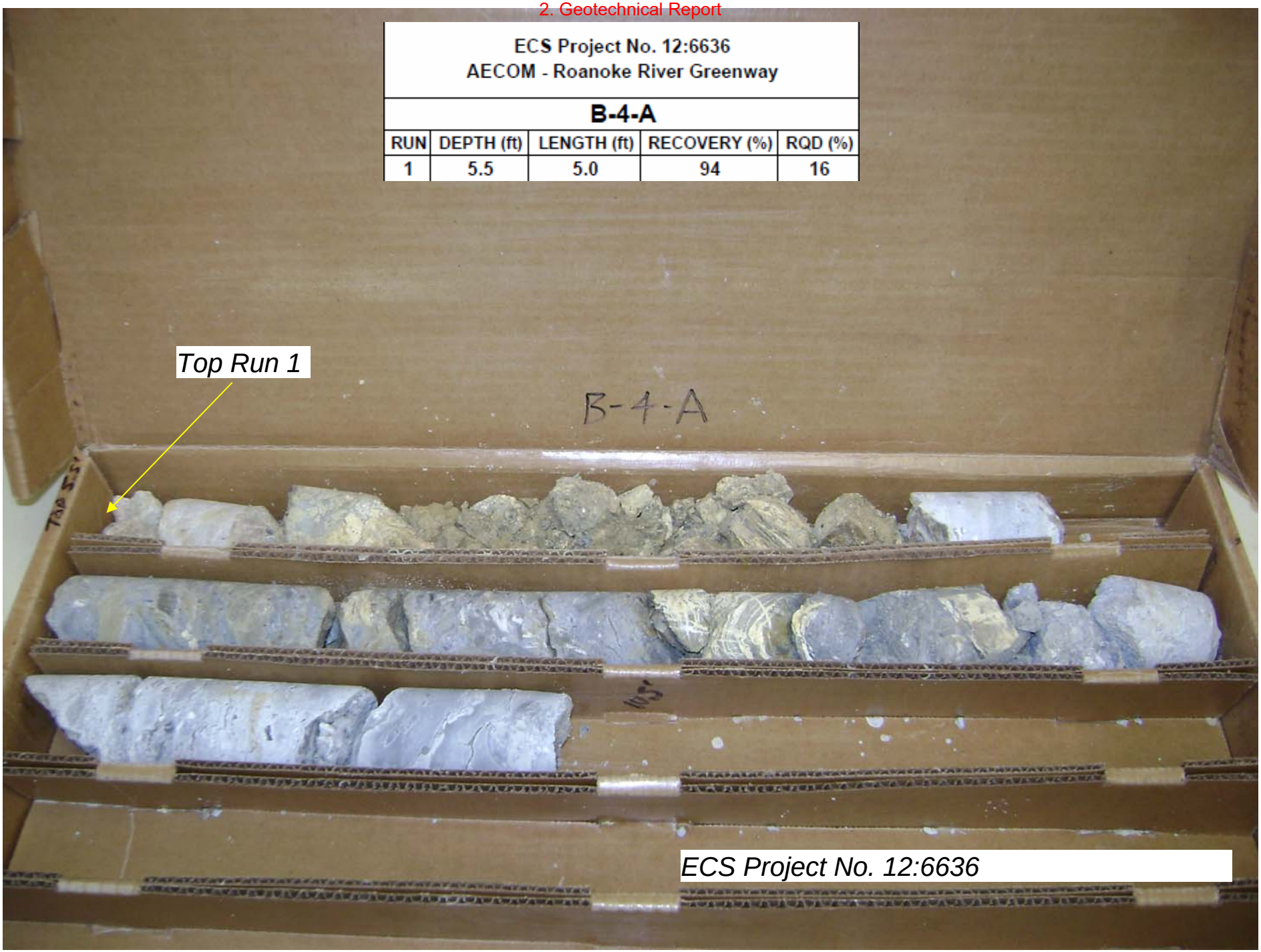
ECS Project No. 12:6636 AECOM - Roanoke River Greenway				
B-3				
RUN	DEPTH (ft)	LENGTH (ft)	RECOVERY (%)	RQD (%)
1	10.5	5.0	75	17



ECS Project No. 12:6636
AECOM - Roanoke River Greenway

B-4-A

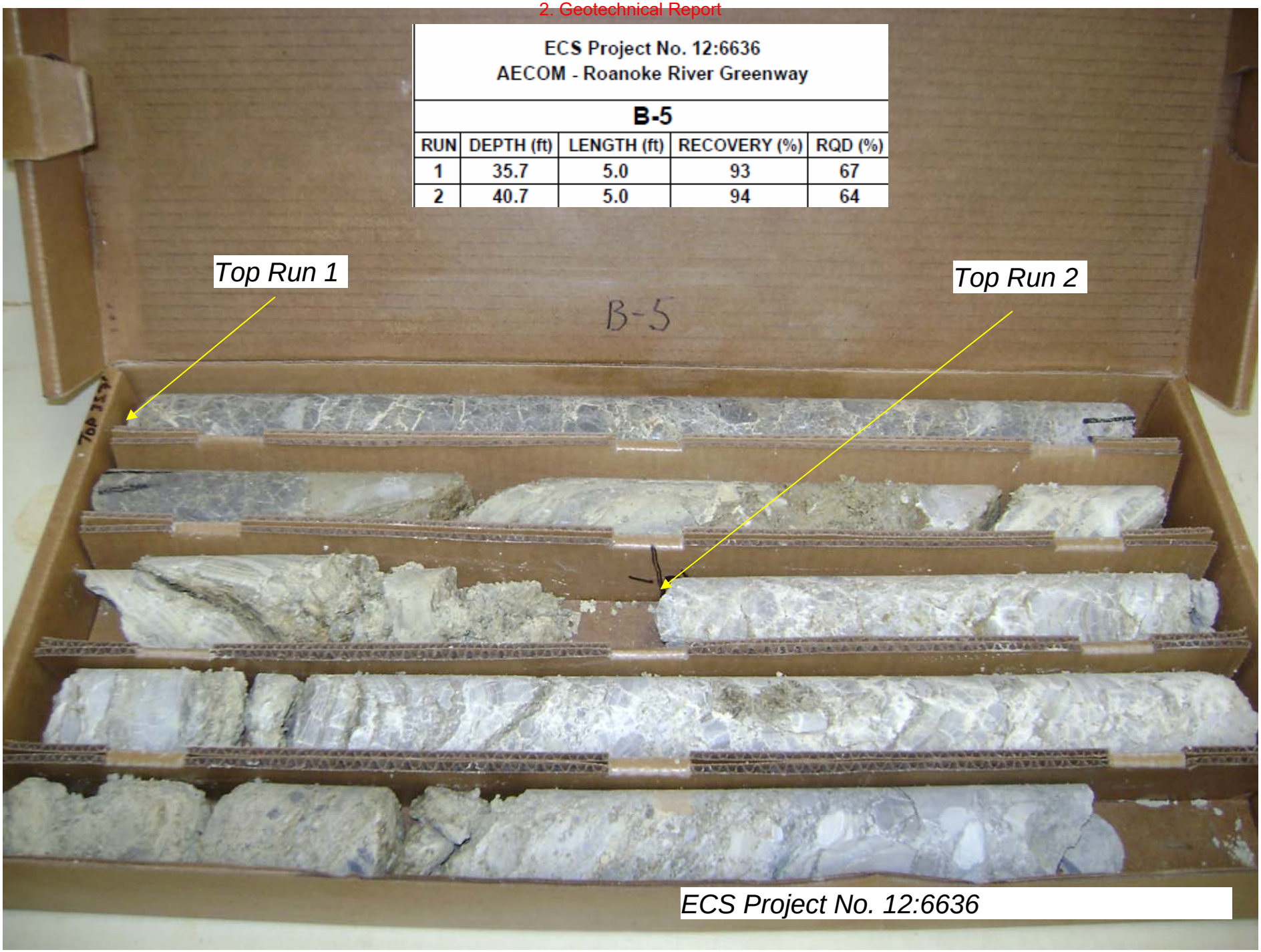
RUN	DEPTH (ft)	LENGTH (ft)	RECOVERY (%)	RQD (%)
1	5.5	5.0	94	16



ECS Project No. 12:6636
AECOM - Roanoke River Greenway

B-5

RUN	DEPTH (ft)	LENGTH (ft)	RECOVERY (%)	RQD (%)
1	35.7	5.0	93	67
2	40.7	5.0	94	64



Laboratory Testing Summary

Sample Source	Sample Number	Depth (feet)	MC[1] (%)	Soil Type[2]	Atterberg Limits[3]			Percent Passing No. 200 Sieve[4]	Moisture - Density (Corr.)[5]		CBR Value[6]	Other
					LL	PL	PI		Maximum Density (pcf)	Optimum Moisture (%)		
B-1												
	6636-1	0.00 - 10.00	25.6	CL	44	19	25	87.4				
	S-1	1.00 - 2.50	32.7									
	S-2	3.50 - 5.00	28.3									
	S-3	6.00 - 7.50	23.1									
	S-4	8.50 - 10.00	21.5									
	S-5	13.50 - 15.00	25.8									
	S-6	18.50 - 20.00	23.1									
	S-7	23.50 - 24.10	15.3									
B-2												
	6636-2	0.00 - 10.00	25.2	CH	65	31	34	67.1				
	S-1	1.00 - 2.50	27.2									
	S-2	3.50 - 5.00	34.4									
	S-3	6.00 - 7.50	41.3									
	S-4	8.50 - 10.00	20.6									
	S-5	13.50 - 15.00	36.8									
	S-6	18.50 - 20.00	27.0									
B-3												
	S-1	1.00 - 2.50	9.8					49				
	S-2	3.50 - 5.00	10.2									
	S-3	6.00 - 7.50	8.8									
	S-4	8.50 - 9.20	6.7									
B-4												
	S-1	1.00 - 2.30	7.2									
	S-2	4.00 - 5.50	4.7									

Notes: 1. ASTM D 2216, 2. ASTM D 2487, 3. ASTM D 4318, 4. ASTM D 1140, 5. See test reports for test method, 6. See test reports for test method

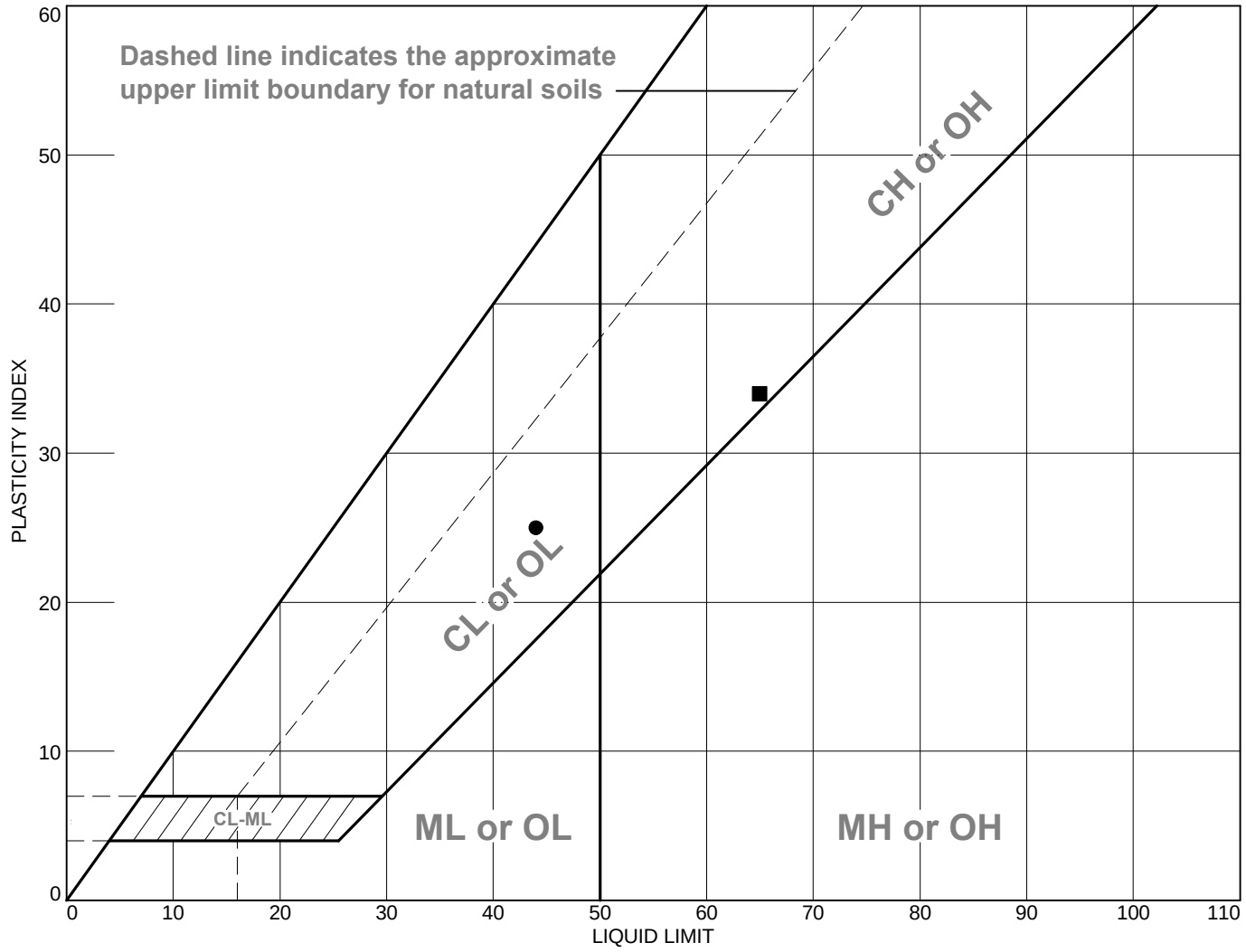
Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content (ASTM D 2974)

Project No.	**6636**
Project Name:	**Roanoke River Greenway - From Mill Lane to Green Hill Park (Project No. 60237986)**
PM:	**Trent Fisher, P.G.**
PE:	**Stephen Hjelle, P.E.**
Printed On:	**Friday, August 17, 2012**

ECS Mid-Atlantic, LLC

Roanoke, VA

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	LEAN CLAY, With Fine Sand and Silt, Orange-Yellow and Brown, (CL)	44	19	25		87.4	CL
■	SANDY FAT CLAY, Contains Trace Rootlets [in Upper 5 Feet], Orange-Brown, (CH) [Relict Rock Structure]	65	31	34		67.1	CH

Project No. 6636 **Client:** AECOM Transportation

Project: Roanoke River Greenway - From Mill Lane to Green Hill Park (Project No. 60237986)

● **Source of Sample:** B-1 **Depth:** 0.00-10.00 **Sample Number:** 6636-1

■ **Source of Sample:** B-2 **Depth:** 0.00-10.00 **Sample Number:** 6636-2

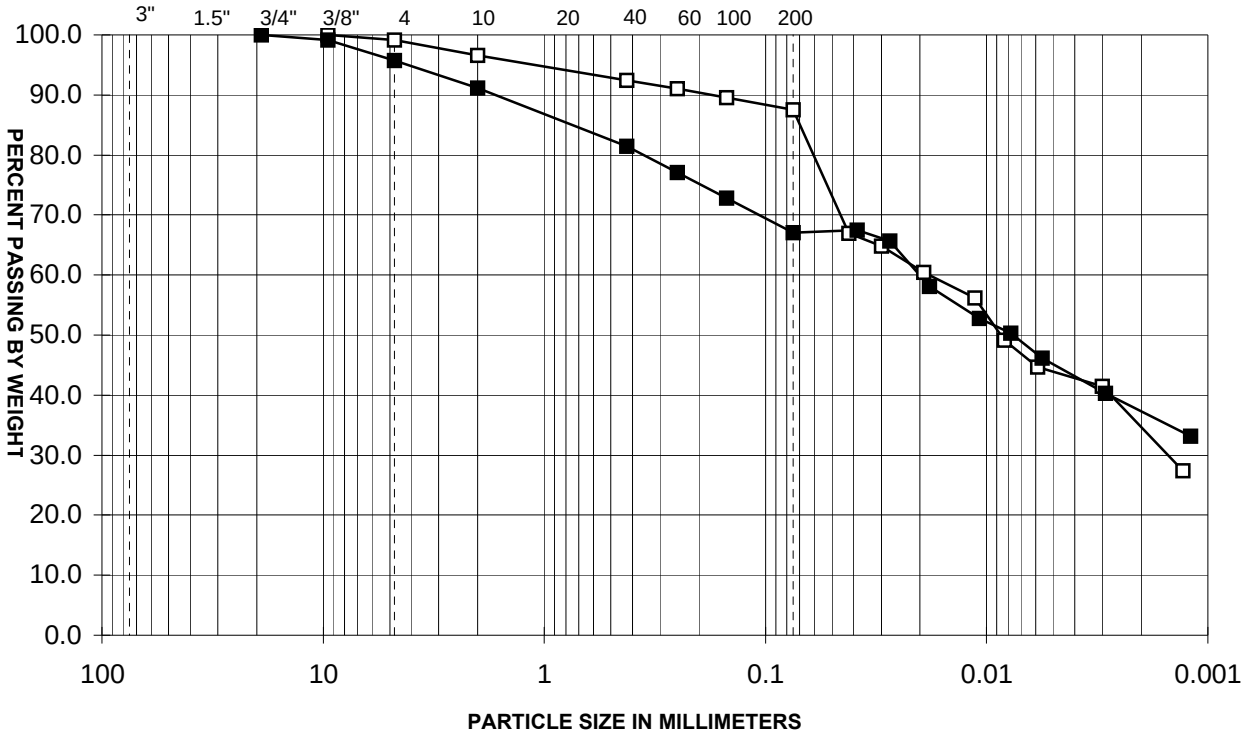
Remarks:

ECS Mid-Atlantic, LLC
5320 Peters Creek Road, Suite F
Roanoke, VA 24019
Phone: (540) 362-2000 Fax: (540) 301-6337

Figure

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

U.S. STANDARD SIEVE OPENING IN INCHES	U.S. STANDARD SIEVE NUMBERS	HYDROMETER



Boring/ Sample No.	Depth (feet)	Symbol	LL	PI	Description
B-1 / 6636-1	0-10	□	44	25	LEAN CLAY, With Fine Sand and Silt, Orange-Yellow and Brown, (CL)
B-2 / 6636-2	0-10	■	65	34	SANDY FAT CLAY, Contains Trace Rootlets [in Upper 5 Feet], Orange-Brown, (CH)

Project: Roanoke River Greenway

Project No.: 6636

Date: 08/17/2012

ECS MID-ATLANTIC, LLC
Roanoke, Virginia

Grain Size Analysis

Construction Quality Assurance Plan (CQAP) for

West Roanoke River Greenway, Phase I Project

Roanoke County, VA

August 18, 2022

LAP Construction Quality Assurance Plan (CQAP)

West Roanoke River Greenway, Phase I Project

State Project # EN08-080-105, P102, C502

Federal Project # RSTP-5128(495)

UPC# 97171

Roanoke County, VA

Project Description

I. The Project consists of constructing approximately 0.58 miles of 10' wide paved greenway, MSE retaining walls, paved parking area, and associate appurtenances which includes clearing and grubbing, grading, drainage improvements, and paving.

II. Date of Original CQAP Submittal: Draft attached to Addendum #1

III. CQAP Revision Date (if applicable):

IV. Locality Name and Physical Address:

Roanoke County
5204 Bernard Drive
P.O. Box 29800
Roanoke, VA 24018
Attn. David M. Henderson, PE

V. Roanoke County Project Management Team:

David M. Henderson, PE

Responsible Charge Person:

Printed Name: David M Henderson, PE

Construction Quality Assurance Plan (CQAP) for

West Roanoke River Greenway, Phase I Project
Roanoke County, VA

August 18, 2022

Signature of Responsible Charge Person: _____
Contact Information: DHENDERSON@roanokecountyva.gov
Phone number: 540-772-2083

Engineer of Record (EOR):
Printed Name: Michael Johnson, Hurt and Proffitt
Signature of EOR: _____
Contact Information: mjohnson@handp.com
Phone Number: 540-998-0173

CEI Project Manager/Contact for CQAP:
Printed Name of PM/CQAP Contact Person: Mark Betterton
Signature of Contact Person: _____
Contact Information: mbetterton@mbpce.com
Phone number: 540-420-6176

QA Testing & Laboratory:
ECS

In-Plan Utility Owner(s) –

VI. Contractor's name and address:
TBD

Project Manager (PM):
TBD

Superintendent:
TBD

QC Testing & Laboratory:
TBD

Construction Quality Assurance Plan (CQAP) for

West Roanoke River Greenway, Phase I Project

Roanoke County, VA

August 18, 2022

VII. Organizational Chart:

a. See Appendix A

Table of Contents

Construction Quality Assurance Plan (CQAP) for

West Roanoke River Greenway, Phase I Project

Roanoke County, VA

August 18, 2022

Construction Quality Assurance Plan (CQAP) Narrative

I. Mission Statement

This Construction Quality Assurance Plan (CQAP) identifies the guidelines under which the QC/QA staff(s) will perform their respective roles and responsibilities.

The contractor's QC staff will consist of VDOT certified technicians employed by XXXX. Technicians from XXXXX will be performing both onsite and laboratory QC materials testing in accordance with the guidelines set forth in Chapter 13 of the LAP Manual.

The QA staff will consist of VDOT certified personnel from MBP/ECS. MBP/ECS will perform QA materials testing as required by the County, and in compliance with the current VDOT LAP Manual, Chapter 13 (Ref. Appendix C), to ensure Contractor QC tests are performed in compliance with the applicable test methods and specifications and are representative of the quality of the on-site product.

Independent Assurance (IA) and Verification Sampling and Testing (VST) will be performed as required for a state funded, state-maintained projects. IA inspections/testing shall be performed by either MBP or ECS and the technician and equipment shall be independent of the QA Testing personnel and equipment.

All materials shall be approved, sampled, and/or tested in conformance with contract specifications and the current version of the VDOT Locally Administered Projects Manual (LAP MANUAL).

The contractor will ultimately be responsible for the quality of the construction, *including the performance of QC testing as required in Chapter 13 of VDOT's current LAP Manual (see Appendix C).* MBP will serve as the County's on-site representative and assist in managing the Construction Quality program, including the performance

of QA Testing. MBP will provide on-site Quality Assurance (QA) inspection services (CEI) to assess the effectiveness of the construction processes, means and methods relative to the contract terms and conditions, approved for construction plans, and applicable County and State standards and specifications. The QC and QA testing firms/agencies will perform testing in accordance with this Construction QA Plan which is based on VDOT's Local Assistance Program (LAP) Manual Chapter 13 Guidelines and provide feedback to the Project Manager (PM) and/or their on-site representative. MBP will assure that all necessary QA/QC inspections and testing of materials and in-place construction has been performed and adheres to the contract, and that all associated documentation is in hand and acceptable before any payment is recommended for approval.

Any deviation from this CQAP shall not occur without a revised submittal of this CQAP to the both the County Engineer and the Salem VDOT District LAP Project Coordinator (or designee) for his or her review and approval.

II. Personnel Certification and Licenses

Copies of Personnel Certifications and Licenses as required by the Contract and/or VDOT LAP Manual are available upon request and are kept on file readily available for review. All personnel performing materials testing shall have the necessary certifications and experience/expertise required by the contract documents and the most current version of the VDOT LAP MANUAL. No work shall be performed otherwise.

The MBP QA Staff will provide inspection and testing to assess construction processes relative to the applicable standards and specifications. The MBP QA staff will provide daily reports of contractor's activities, inspection findings, and all other pertinent information. The MBP QA staff will also review all pay applications provided by the contractor prior to payment and make recommendation to the County Engineer regarding payment.

The QC staff will be responsible for performing and reporting of all QC sampling, testing, visual inspections, certifications, and daily reports directly to the MBP QA Inspector.

The Engineer of Record's (EOR's) role is as defined in the scope of work of the Construction Administration Contract. Generally, the EOR will be consulted for all design related changes, questions, or RFIs applicable to the plans and the contract documents. They may also be consulted for Shop Drawing submittals as applicable.

The Responsible Charge/Owner's Representative for this project is Michael Johnson, PE (Hurt and Proffitt). Generally, the Responsible Charge individual will represent the Owner and approve work performed and recommend approval of changes to the contract. Payment applications will be approved by the Owner. The Contractor, EOR, Responsible Charge, and the QA Inspector will perform services for the Owner as defined in their respective agreements.

The Contractor's role is as defined in the contract with the County. Generally, as related to this plan, the contractor is responsible for all construction means and methods to ensure a quality finished product is achieved on time and within budget as practicable. He is also responsible for carrying out the project QC requirements as described herein, and in accordance the contract terms and conditions and with Chapter 13 of the most current version of the VDOT LAP Manual. With respect to this project, the respective VDOT LAP requirements that apply to *locally and state funded projects that are locally maintained.*

III. Independent Assurance (IA)

IA materials testing is required for this project in accordance with the chapter 13 of the LAP Manual. MBP will handle the coordination of this aspect of the CQAP.

IV. Communication Channels

Once construction starts, MBP will coordinate, as appropriate, with the Contractor regarding the inspection and testing frequencies outlined and/or referenced in the CQAP, ensuring that adequate inspection and testing resources are available to meet the scheduled construction activities. During the prosecution of LAP related construction activities, the MBP QA Inspector, TBD, will communicate daily with the Contractor and as needed with QC team to ensure adequate testing services are available. The QA Inspector's primary point of contact on site will be the Superintendent from *Contractor Name*, MBP's PM, Mark Betterton, will review/audit the project and project documentation routinely (no less than monthly) to assure the CQAP is being followed and required documentation is accurate and complete. Results of QA/QC laboratory testing may be submitted at a later date in conjunction with internal QA/QC reviews. Any unacceptable work identified by the QA/QC staff will be documented, brought to the contractor's attention, and in concert with the contractor's plan for corrective action, scheduled for correction, to include additional inspection and testing requirements as appropriate and/or necessary. In conjunction with the contractor's two-week look-ahead schedule, MBP will verify that upcoming work activities are inspected and tested in accordance with the approved CQAP.

Communications will be handled by the QA Staff via the following meetings:

1. Preparatory Inspection Meetings (PIMs): Inspection preparatory meetings will be held in advance of specific work activities such as: Earthwork, Subgrade preparation, Stone Placement, Concrete Placement, Asphalt Placement, Pavement Markings, and any other activities identified as needing preparatory meetings. Appropriate Contractor representatives (to include Prime and Subs as applicable), County, Designer, QC, and QA staff will be invited to attend these meetings. The meetings will serve to verify the process for submitting and approving documents, materials, and permits specific to the upcoming work packages. The QA and QC inspection and testing requirements, as detailed in the approved CQAP, will be reviewed, and scheduled. Materials sampling and testing by the respective QC

personnel will also be scheduled. This meeting will be scheduled by the QA staff in conjunction with the project schedule.

2. Monthly Progress Meetings: The Responsible Charge Representative and/or the CEI PM will lead the monthly progress meeting, to include the County's Design Engineer (Hurt and Proffitt), QC, QA, and the Prime Contractor's staff. VDOT may attend at their discretion.

At a minimum, the Contractor will provide two-week look ahead schedules as well as daily coordination with the MBP QA Inspector for advanced notice of inspection/testing. The MBP QA Inspector will oversee QC materials testing and provide QA inspection and testing as required.

V. Submittal Procedures

The QA CEI Project Manager, Mark Betterton, will be responsible for initially reviewing, recommending for approval, and tracking all submittals regarding compliance with the contract requirements, to the best of his knowledge. The County's Responsible Charge person is the ultimate approving authority on all submittals unless it is determined they require the Engineer of Record's (EOR's) review and approval. Once received from the Contractor, the QA Project Manager is responsible for timeliness and delivery of submittals to the appropriate authority for approval as necessary and will work directly with the QA Inspector to maintain a log of all submittals.

VI. Resolution Procedure

In the event of inconsistencies or ambiguities, the most stringent requirement will be considered the controlling requirement. In the event of unclear contract specifications, published guidelines, or disputes related to substandard materials, the dispute will be resolved in the following manner: The Contractor shall immediately report to the Responsible Charge individual, in writing, all discrepancies found between the Contract Documents and site conditions and/or any

inconsistencies or ambiguities in the Contract Documents. The Responsible Charge shall promptly either correct such discrepancies, inconsistencies, or ambiguities in writing, or respond promptly detailing the course of action that will be implemented to bring the matter to resolution. Work performed by the Contractor after discovery of such discrepancies, inconsistencies, or ambiguities, but before the Responsible Charge has provided a written response, shall be performed at the Contractor's risk.

VII. Progress Reports

Progress reports will be provided by MBP to Roanoke County on a monthly basis or as requested by the Responsible Charge.

VIII. Materials Acceptance Records and Test Data

Materials Acceptance Records and Test Data shall be maintained by the MBP QA inspector during the construction of the project and are to be always readily available for inspection by the Salem VDOT district's LAP Engineer, or designee. These records shall be kept by the County for a minimum of 5 years after project completion.

This section describes the responsibilities and requirements for the identification, preparation, and maintenance of records that furnish objective documented evidence of quality. The term "records," used throughout this section, refers to QC and QA records attesting to the achievement of the quality and technical requirements of the work generated during the various phases of project construction activities of the contractor and its subcontractors and suppliers. Quality records shall be available for review by the Owner and VDOT.

General

A quality record is defined as a completed document that furnishes objective evidence attesting to the quality of items and/or activities. Quality records shall be legible, identifiable, and retrievable. These records shall be protected against

damage, deterioration, or loss. Requirements and responsibilities for record transmittal, distribution, retention, maintenance, disposition, and department or organization responsibilities shall be in accordance with the contract documents and the appropriate rules and regulations contained therein, and the VDOT Construction Manual, where applicable.

Each of the QC/ QA inspectors and/or technicians shall summarize their daily inspections, tests, and material sampling activities in a daily report. The report will include a summary of the Contractor's daily construction activities. Supporting inspection data sheets will be attached to the daily report where needed. Copies of the inspector's records shall be provided to VDOT upon request. All reports will be completed and incorporated in the project records within 24 hours.

At a minimum, the construction QA Inspection report will include the following information:

- Work performed by the firm, subcontractor, or material supplier, identified by Work Package notation
- Weather conditions
- Inspections performed and their results
- Communications
- Type, location, and results of all tests performed
- Delays encountered
- Safety related problems and corrective action taken
- Non-conforming work and the corrective action taken
- Reports on any meetings held and their results
- Record of visitors to site
- Signature of inspector

MBP will be responsible for the creation and/or management of the following additional reports and logs:

- Project Daily Work Reports

- Test Reports (provided by Contractor QC & MBP/ECS QA inspector/ technicians)
- Nonconformance Log
- Punch List
- Preparatory Inspection Meeting Minutes
- Progress Meeting Minutes

MBP will use the VDOT C-107 form to document erosion and sediment inspections.

The QA inspectors will refer to the following documents during inspection and testing:

- Most Current Version of the VDOT LAP Manual
- West Roanoke River Greenway, Phase I Project Manual
- Most Current Version of Roanoke County Specifications
- Roanoke County Approved for Construction Plans
- VDOT Construction Resource Guidebook
- VDOT Construction Quality Improvement Program Checklists
- VDOT Construction Manual (2005 with 2008 amendments)
- VDOT Post Construction Manual (May 2011)
- VDOT Road and Bridge Standards, Vol. 1, and Vol. 2 (2016 and
- VDOT Road and Bridge Specifications (2020)
- VDOT Survey Manual
- VDOT Manual of Instruction for Material Division
- VDOT Virginia Work Area Protection Manual (2011 Revision 2)

Control of Quality Records

MBP's Construction Manager verifies QA record accuracy and maintains copies of all quality-related documentation. These records will be stored in files maintained in the project document control files in the MBP Roanoke office. All original documents pertaining to project information will be maintained in the project file in the MBP Roanoke office. A complete set of project records (paper copies and electronic copies) will be provided to the Owner at the completion of the project. These records will be made available to VDOT upon request.

IX. Materials Testing Methods and Frequencies

Field and/or laboratory sampling will be performed for each material type to ensure compliance with all applicable specifications. Work will be sampled so that it meets the current County Specifications, VDOT Road and Bridge Specifications, and be carried out in compliance with the most current VDOT LAP Manual (Chapter 13) requirements. In addition, any material that appears defective or inconsistent with similar material being produced will be sampled, unless such material is voluntarily removed and replaced or corrected. Samples will be taken in accordance with American Association of Highway and Transportation Officials (AASHTO) procedures or other acceptable procedures by personnel approved by VDOT.

To the extent practicable Contractor QC testing will be performed in the presence of the MBP QA Inspector. Field and laboratory testing will be performed for each material type that meets the frequencies outlined in the LAP Manual. Copies of all test results will be furnished to the QA Inspector as soon as possible after the test has been performed, recorded, and the results checked to ensure compliance with the appropriate testing guidelines. The requirements for furnishing test results do not include sample aging or curing time; therefore, reporting times will be extended accordingly. If necessary, proposals will be submitted in writing for approval to use alternate AASHTO or state-approved test methods.

Specific testing quantities and/or frequencies will be established by the QC/QA team in conjunction with the contractor's two-week look ahead schedule and before initiation of corresponding construction activities. At a minimum, the project schedule will be evaluated in 30-day increments to establish more finite testing quantities applicable within that period, with two-week look ahead' s preferred. This will be discussed at inspection preparatory meetings specific to planned work activities and their corresponding testing and inspection requirements.

Laboratory materials sampling and testing to be performed by QA/QC will be performed by a laboratory that is either:

A. Accredited in the applicable AASHTO procedures by the AASHTO Accreditation Program, or
B. Complies with the requirements of AASHTO R18 (18th edition) for those tests to be performed and compliance with R18 for those tests not covered by ASSHTO Material Reference Laboratory, or
C. A laboratory approved by VDOT's Materials Division or other accreditation program meeting the requirements of R18.

All materials testing laboratories shall meet the requirements as outlined in the LAP MANUAL, Chapter 13.2 for "Qualified Laboratories". No work shall be authorized otherwise.

X. Right to Inspect

The "right to inspect" by the VDOT LAP Engineer or designee is agreed upon for any and all project items and recognized by submittal of this CQAP.

VDOT has the right to inspect the work, in accordance with the LAP Manual, as noted herein.

Potential HOLD POINTS:

- **Subgrade Approval:** Requires written approval of the QA Inspector prior to the placement of the aggregate base layer.
- **Aggregate Base Approval:** Requires written approval by the QA Inspector prior to the placement of asphalt concrete pavement layer(s).
- **Erosion & Sediment Controls and Stormwater Pollution Prevention:** Requires written approval by the QA Inspector and the Roanoke County E&S Inspector prior to installation and/or modification.
- **Curb and Curb Ramps:** Requires written approval by the QA inspector prior to concrete placement.
- **Grass Swale:** Requires written approval by the QA inspector prior to permanent seeding.

- **Permanent Pavement Markings and Markers:** Requires written approval by the QA Inspector prior to installation, following the placement of the asphalt concrete pavement surface layer.

XI. Non-compliance

Non-compliance to this CQAP shall be promptly reported through the established communications process outlined in this CQAP.

Throughout the course of a project, items may be identified that do not meet specifications. Most of these items are identified as they happen and consequently, are corrected immediately. There are two classifications of non-compliant work:

1. Level 1: Deficient work identified and corrected on the same day. The Inspector points out the deficiency to the Superintendent, who corrects it immediately. This issue is noted in the DWR by the Inspector. The Inspector notes what he found and what the Contractor did to correct the issue. The issue is closed.

2. Level 2: Deficient work identified and corrected at a later date. These are items that an inspector identifies in the field, notifies the Superintendent, the Superintendent agrees to fix the item, and the inspector notes in his DWR what the issue is, the corrective action agreed to, and the date it will be completed. The issue is then recorded in the project Issue Log so it can be tracked to ensure it is resolved. The Issue Log is reviewed by the QA team on a weekly basis to ensure that all items are corrected. The QA team performs re-inspection of the item prior to removing it from the Issue Log. All issues must be corrected before the Contractor receives 100% payment for that item.

In the event of disputes, or noncompliant work that is not resolved by the contractor refer to Part V of this CQAP, and the applicable contract documents.

Construction Quality Assurance Plan (CQAP) for

West Roanoke River Greenway, Phase I Project

Roanoke County, VA

August 18, 2022

XII. Appendices

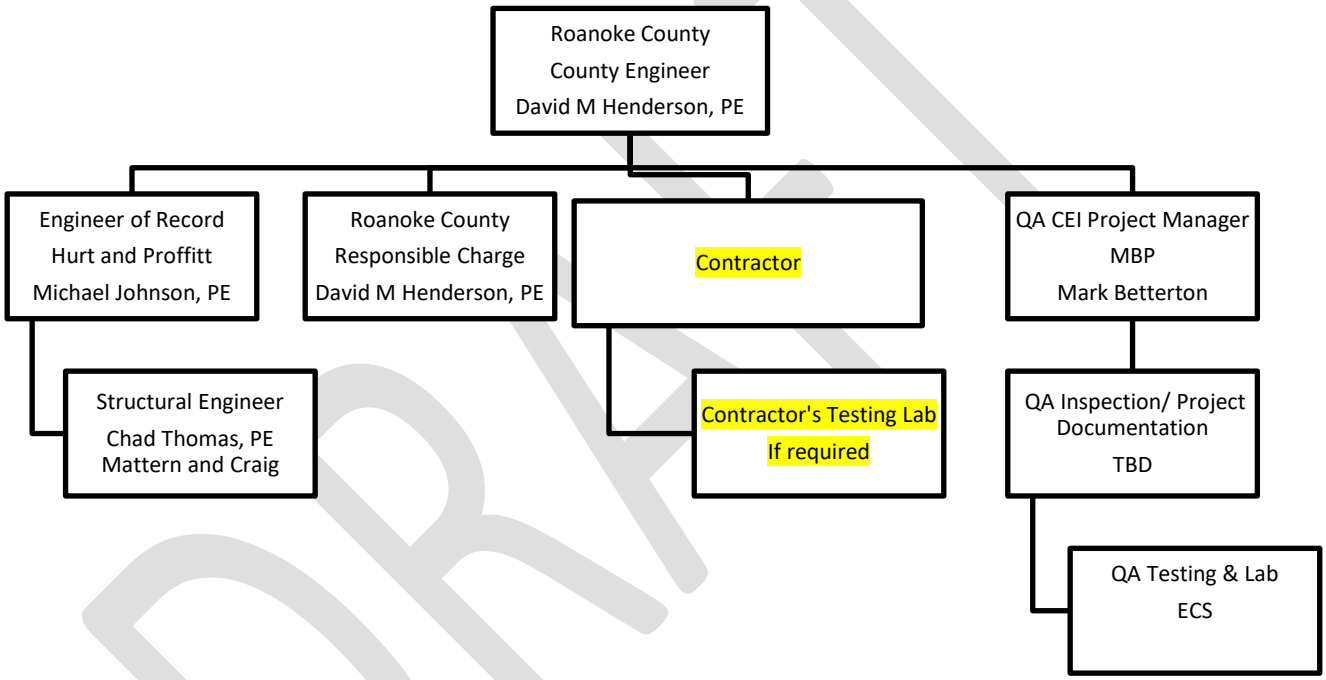
Construction Quality Assurance Plan (CQAP) for

West Roanoke River Greenway, Phase I Project

Roanoke County, VA

August 18, 2022

Appendix A – Organizational Chart



Construction Quality Assurance Plan (CQAP) for

West Roanoke River Greenway, Phase I Project

Roanoke County, VA

August 18, 2022

Appendix B - Staff Qualifications Matrix

Inspector Name	Firm	Experience	Asphalt Concrete Field	ACI Concrete	Soils & Aggregate	Hazmat	Pavement Marking	GRIT	OSHA 30--HR	DEQ Dual Inspector	Flagger	Work Zone Training (Intermediate)
QA CEI Project Manager **Mark Betterton**	MBP	11 yrs.										
QA Inspector	MBP	.										
QC Manager												
QC Inspector(s)												

Shall use the Tables of Minimum Requirements for Quality Assurance and Quality Control on Design-Build and P3 Projects published in the latest Minimum Requirements for Quality Assurance and Quality Control on Design Build and Public-Private Transportation Act Projects.

Appendix 13.2– G

Materials Testing Methods and Frequencies

Locally Administered Projects using:

1. Design-Bid-Build model where the locality is providing:
    a. The inspection and testing staff
    b. Requesting VDOT to provide inspection and testing
    c. Hiring an Engineering consultant firm for inspection and testing*

        *The consultant must be independent from the contractor performing the construction work.

Shall use the Acceptance/VST/IA Frequency tables included in this appendix for acceptance and Independent Assurance (IA) testing. If a testing method or frequencies is not cited, the Materials Manual of Instruction test method and frequencies shall be used. Some Quality Assurance programs depend on project samples to be tested for verification. These are denoted as verification samples and tests (VST) in the tables.

Locally Administered Projects using:

1. Design-Build model
2. Public-Private Partnership delivery model
3. Contractor performs testing (QC testing)

Scope performed by Contractor QC highlighted this color.

Scope performed by MBP/ECS highlighted this color.

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Acceptance/VST/IA Frequency - Soil & Aggregate

Material Type	Spec Section	Test Reference	Acceptance Testing (Scope performed by Contractor QC highlighted this color.)	VST	IA (Scope performed by MBP/ECS highlighted this color.)
Backfill	Contract Special Provisions				
Moisture Density Relations-Standard Proctor, Atterberg Limits & Grain Size Analysis (All Backfill Types)		VTM-1, VTM-7, & VTM-25	Done during project development	NA	Non required if performed in VDOT or AMRL accredited laboratory
One Point Proctor Check Compare to Nuclear Gauge		VTM 012	As needed.	NA	Run split sample when needed. 1 test per project to check procedure and equipment.
In Place Density Tests:					
Box Culverts, Pipes & other Drainage Structures	302,303	VTM-10	A minimum of one (1) test shall be performed per lift on alternating sides of the structure for each 300 linear ft. or portion thereof in structure length. This test pattern shall begin after the first 4-in. compacted layer above the structure's bedding and shall continue to one (1) foot above the top of the structure.	NA	One IA shall be conducted on each compaction technician once per project regardless of the structure or material type (box culvert, pipe, Abutment, retaining wall or embankment). IA shall consist of a split density test in situ, observing technician technique, checking equipment calibrations and calculations.

ECS is AMRL accredited

A different Inspector & equipment supplied by either MBP or ECS, Independent from inspector performing acceptance testing.

A different Inspector & equipment supplied by either MBP or ECS, Independent from inspector performing acceptance testing.

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Abutments, Retaining Walls and MSE Walls	Sections 303,401	VTM-10	A minimum of two (2) tests every other lift up to 100 linear ft. shall be performed. Testing shall be performed behind these structures at a distance from the heel no farther than a length equal to the height of the structure plus 10 ft. For MSE Walls, Less than 100 linear ft. a minimum of one (1) test every other lift shall be performed. The testing shall be performed a minimum distance of 8 ft. away from the face of the wall, to within three feet of the back edge of the zone of the reinforced fill area. Test sites shall be staggered throughout the length of the wall to obtain uniform coverage. Testing shall begin after the first two (2) lifts of reinforced fill have been placed and compacted. Walls more than 100 linear ft., a minimum of two (2) tests every other lift not to exceed 200 linear ft. shall be performed.	NA	One IA shall be conducted on each compaction technician once per project regardless of the structure or material type (box culvert, pipe, Abutment, retaining wall or embankment). IA shall consist of a split density test in situ, observing technician technique, checking equipment calibrations and calculations.
SOILS/ EMBANKMENT					

Moisture Density Relations-Standard Proctor, Atterberg Limits & Grain Size Analysis (Soils/Embankment)		VTM-1, VTM-7, & VTM-25	Done during project development	NA	1 test per year during production; minimally perform one (1) in first five (5) tests taken for QA	A different Inspector & equipment supplied by either MBP or ECS, Independent from inspector performing acceptance testing.
One Point Proctor Check Compare to Nuclear Gauge (Soils/Embankment)		VTM 012	As needed.	NA	1 test per year during production; minimally perform one (1) in first five (5) tests taken for QA	
Embankment in Place Density (Soils/Embankment)	Sect. 303	VTM-10	The minimum number of field density tests required shall be one for each 2500 yd^3 or less of fill material placed, with the following additional requirements: (a) For fill areas less than 500 ft. in length, a minimum of one (1) field density test for every other 6-in. compacted layer from the bottom to the top of fill starting with the second lift. (b) For fills 500 to 2000 ft. in length, a minimum of two (2) field density tests for each 6-in. compacted layer within the top five (5) ft. of fill. (c) For fills greater than 2000 ft. in length, break into equal sections not to exceed 2000 ft. and test each section in accordance with (b) above.	NA	One IA shall be conducted on each compaction technician once per project regardless of the structure or material type (box culvert, pipe, Abutment, retaining wall or embankment). IA shall consist of a split density test in situ, observing technician technique, checking equipment calibrations and calculations	A different Inspector & equipment supplied by either MBP or ECS, Independent from inspector performing acceptance testing.
Subgrade	Sec. 305	VTM-10	In the finished subgrade in both cut and fill sections, a minimum of one (1) test represented by the average of five nuclear density	NA	One IA shall be conducted on each compaction technician once per project regardless of the structure or material type (box culvert, pipe, Abutment,	A different Inspector & equipment supplied by either MBP or ECS, Independent from inspector performing acceptance testing.

			readings shall be performed for each 2000 linear ft. of subgrade for each roadway (full width).		retaining wall or embankment). IA shall consist of a split density test in situ, observing technician technique, checking equipment calibrations and calculations	A different Inspector & equipment supplied by either MBP or ECS, Independent from inspector performing acceptance testing.
Aggregate Base and Subbase Material	VDOT Sections 306, 307, & 309					
Depth Checks		VTM-38	For Method VTM-38A, one (1) depth test shall be conducted for each one-half (1/2) mile of stabilization per paver (mixer) application width. In other words, each separately applied width of stabilization, regardless of roadway width, shall require a series of tests. For method VTM-38B, the project shall be divided into lots, with each lot stratified, and the location of each test within the stratified section determined randomly. A lot of material is defined as the quantity being tested for	NA	Minimum of one per project, unless quantity of individual material(Base, sub-base, etc.) is less than 500 tons per project, in which case no IA test required for that material	A different Inspector & equipment supplied by either MBP or ECS, Independent from inspector performing acceptance testing.

			acceptance, except the maximum lot size shall be two (2) miles for each paver application width. The randomization procedure used shall be at the direction of the Engineer. (See VTM-38 for example.) Samples shall be taken from the lot at the following rate: Lot Size No. of Samples Required 0 - 1 Mile 2 1 - 1 1/2 Miles 3 1 1/2 - 2 Miles 4		
In Place Density		VTM-10	When the subgrade, consisting of material-in-place or imported material other than aggregate base, subbase, or select material, is stabilized with cement or lime, one density test (average of 5 readings) shall be conducted for each one-half (1/2) mile of stabilization per paver (mixer) application width. In other words, each separately applied width of stabilization, regardless of roadway width, shall require a separate series of tests.	NA	One test per project, consisting of the average of 5 readings. Minimum of 5 readings per project, unless total quantity of individual material(Base, sub-base, etc.) is less than 500 tons per project, in which case no IA test

A different Inspector & equipment supplied by either MBP or ECS, Independent from inspector performing acceptance testing.

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Treated Subgrade/Subbase, Aggregate Base Material, and Cement Treated Aggregate Base Material	VDOT Sections 306, 307, & 309				
Depth Checks		VTM-38	For Method VTM-38A, one (1) depth test shall be conducted for each one-half (1/2) mile of stabilization per paver (mixer) application width. In other words, each separately applied width of stabilization, regardless of roadway width, shall require a series of tests. For method VTM-38B, the project shall be divided into lots, with each lot stratified, and the location of each test within the stratified section determined randomly. A lot of material is defined as the quantity being tested for acceptance, except the maximum lot size shall be two (2) miles for each paver application width. The randomization procedure used shall be at the direction of the Engineer.	NA	Minimum of one per project, unless quantity of individual material(Base, sub-base, etc.) is less than 500 tons per project, in which case no IA test required for that material

			(See VTM-38 for example.) Samples shall be taken from the lot at the following rate: Lot Size No. of Samples Required 0 - 1 Mile 2 1 - 1 1/2 Miles 3 1 1/2 - 2 Miles 4		
In Place Density		VTM-10	When the subgrade, consisting of material-in-place or imported material other than aggregate base, subbase, or select material, is stabilized with cement or lime, one density test (average of 5 readings) shall be conducted for each one-half (1/2) mile of stabilization per paver (mixer) application width. In other words, each separately applied width of stabilization, regardless of roadway width, shall require a separate series of tests.	NA	One test per project, consisting of the average of 5 readings. Minimum of 5 readings per project, unless total quantity of individual material(Base, sub-base, etc.) is less than 500 tons per project, in which case no IA test
Clearing and Grubbing	VDOT Section 301				
Ensure activities are confined to limits and seeded within 30 days of disturbance		N/A	Daily		Weekly

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Erosion and Siltation Control	VDOT Section 303.03 & Current Virginia DCR Specifications				
Monitor for correct installation and Maintenance		N/A	Daily		After rain event
Undercut	VDOT Section 303.04				
Review area to determine need for undercut		N/A	Prior to start of work at each location	All reports reviewed by Locality Project Manager to verify qualified inspector and correct equipment	One (1) report reviewed per month during production to verify qualified inspector and qualified personnel
Measure undercut area		N/A	Prior to backfill at each location	All calculations/reports checked/reviewed by Locality Project Manager to verify qualified inspector and correct equipment	One (1) calculation/report checked/reviewed to verify qualified inspector and correct equipment
Overlay Sands					
Grade D Silica Sand	Special Provision		One bag per project tested in AMRL lab.	NA	NA

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Acceptance/VST/IA Frequency - Hydraulic Cement Concrete

Material Type	Spec Section	Test Reference	Acceptance Testing	VST	IA
Cast-In-Place Structures and Bridge Concrete	VDOT Section 217				
Concrete Entrained Air Content (CIP Concrete)	217.08	ASTM C231 or C173	Test every load, except for bridge decks, in which case one test per truck-load for the first 3 trucks and then one test for every third truckload thereafter, provided results remain within 1.0% of median of design range. Test also required when making compressive specimens	NA	One test shall be made on the same batches of concrete from which cylinders are taken
Slump of Hydraulic Cement Concrete (CIP Concrete)	217.08	ASTM 143	Test every load and when making compressive specimens	NA	One test shall be made on the same batches of concrete from which cylinders are taken
Temperature of Concrete (CIP Concrete)	217.10	ASTM C1064	Test every load and when making compressive specimens	NA	One test shall be made on the same batches of concrete from which cylinders are taken

Compressive Strength of Concrete Cylinders (CIP Concrete)	217.08	ASTM C31 & C39	One set of three cylinders per every 100 CY and at least two sets of cylinders per structure per class of concrete.	NA	Minimum of one set per 1000 cubic yards of structural concrete. Not required for projects having less than 300 cubic yards. Cylinders should be from the same load as acceptance samples.
Chloride Permeability Concrete Cylinders (CIP Concrete)	Check Plan sheets	VTM-112	One set of two cylinders per every 100 CY and at least two sets of cylinders per structure per class of concrete.	NA	Non required if performed in VDOT or AMRL accredited laboratory
Concrete Reinforcing Steel (CIP Concrete) elongation, yield strength and ultimate strength	223	ASTM A615	Accepted based on certification provided by the fabricator. Verify manufacturer's certificates for every shipment for acceptance prior to placement.	One sample per project per manufacturer per most common size bar.	Non required if performed in VDOT or AMRL accredited laboratory
Pavement	VDOT Section 217				
Concrete Entrained Air Content (Pavement)	217.08	ASTM C231 or C173	One test per hour & when casting flexural specimens	NA	One test per four roadway miles or fraction thereof, with a minimum of one per project

Slump of Hydraulic Cement Concrete (Pavement)	217.08	ASTM 143	Two tests daily & when making flexural specimens	NA	One test shall be made on the same batches of concrete from which cylinders taken
Temperature of Concrete (Pavement)	217.10	ASTM C1064	One test per hour & when casting flexural specimens	NA	One test shall be made on the same batches of concrete from which cylinders taken.
Compressive Strength of Concrete Cylinders (Pavement)	217.08	ASTM C31 & C39	If pavement is accepted based on cylinder strength. One (1) set of three (3) cylinders cast for every 100 cy and at least one for each days concreting operation	NA	Minimum one set per 1000 cubic yards of structural concrete, except that IA will not be required for projects having less than 300 cubic yards.
Flexural Strength Beams	316.04	ASTM C293	If pavement is to be used as haul road or prior to 14 days then, At least one beam cast for each days concreting operation.	NA	NA
Concrete Reinforcing Steel (pavement) elongation, yield strength and ultimate strength	223	ASTM A615	Accepted based on certification provided by the fabricator. Verify manufacturer's certificates for every shipment for acceptance prior to placement.	One sample of two pieces 24 inches long from the most prevalent bar size per structure, with no two samples being the same size	Non required if performed in VDOT or AMRL accredited laboratory
Miscellaneous Concrete	VDOT Section 217				
Concrete Entrained Air Content (Miscellaneous Concrete)	217.08	ASTM C231 & C173	One test per day and when making compressive specimens	NA	NA

Slump of Hydraulic Cement Concrete (Miscellaneous Concrete)	217.08	ASTM C143	One test per day and when making compressive specimens	NA	NA
Temperature of Concrete (Miscellaneous Concrete)	217.10	ASTM C1064	One test per day and when making compressive specimens	NA	NA
Compressive Strength of Concrete Cylinders (Miscellaneous Concrete)	217.08	ASTM C31 & C 39	One (1) set of three (3) cylinders per every 250 CY and at least one set per day	NA	One (1) set of three (3) cylinders per every 25,000 CY (cumulative) minimum 1 per project.
Concrete Reinforcing Steel (Miscellaneous Concrete)	223	ASTM A615	Accepted based on certification provided by the fabricator. Verify manufacturer's certificates for every shipment for acceptance prior to placement.	One sample of two pieces 24 inches long from the most prevalent bar size per structure, with no two samples being the same size	Non required if performed in VDOT or AMRL accredited laboratory
Concrete Curing Materials	VDOT Section 220				
Burlap		AASHTO M182, class 3	Verification of LM # and lot numbers if from QA supplier Approved list 44, if not test one sample per lot number	NA	Non required if performed in VDOT or AMRL accredited laboratory
White liquid membrane Curing Compound		VTM - 2	Verification of LM # and batch numbers if from QA supplier Approved list 44, if not test one sample per batch number	NA	Non required if performed in VDOT or AMRL accredited laboratory
Fugitive Dye Liquid Membrane Curing Compound		VTM - 2	Verification of LM # and batch numbers if from QA supplier Approved list 44, if not test one sample per batch number	NA	Non required if performed in VDOT or AMRL accredited laboratory

A different Inspector & equipment supplied by either MBP or ECS, Independent from inspector performing acceptance testing. IA cylinders to be cured and broken at Salem District Materials Lab

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Polyethylene Film		AASHTO M171	Verification of LM # and lot numbers if from QA supplier Approved list 44, if not test one sample per lot number	NA	Non required if performed in VDOT or AMRL accredited laboratory

QC/VST/IA Frequency - Asphalt

Material Type	Spec Section	Test Reference	Contractor QC Testing	VST	IA
Asphalt Concrete Pavement	VDOT Section 315				
Pavement Density by Nuclear Method with In Place Pavement Density (Asphalt Pavement)		VTM-76, VTM-6	Establish Roller pattern, control strips and test sections, 10 stratified random density test sites per test section (5,000 ft.)	VST is performed on Twenty (20) percent of QC lots. Obtain two cores in one randomly selected QC lot out of five lots to verify in place density. Minimum one VST sample per project.	IA=10%*QC Readings Locality representative observe and witness QC testing to assure gauge is calibrated and accurate. Observe and verify test sites are random and match selected sites. Verify that QC tests are done using proper procedures. Observe one control strip per density technician and obtain all cores from control strip for reweighing in laboratory (randomly select a minimum 10% of cores) to confirm field density testing.

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In Place Pavement Density (for all asphalt except Stone Matrix Asphalt (SMA))		VTM-006; VTM-32	**Density** - min. 1 core per location not long enough to establish roller pattern/control strip	**Density -** One (1) random core per 10 QC locations. Independent of contractor cores.	Obtain cores taken for density. Reweigh at least 10% of these cores in laboratory to confirm density. Observe one (1) density determination per ten (10) locations performed by QC technician. Minimum 1 per project.
Depth Checks		VTM-32	Depth checks of surface and intermediate material required only if specific plan depths are called for, not when plans specify rate of application. One (1) per 1/2 mile per lane width, minimum one (1) test per roadway, maximum lot size 2 mile (4 tests)	NA	Select one (1) QC core per five (5) lots and remeasure thickness. A minimum of one (1) per project.
In Place Pavement Density and Depth Checks by cores for Stone Matrix Asphalt (SMA)		VTM-006	Establish trial section and test sections. Minimum of one (1) sample per 1,000 feet with a maximum of 5 samples per day/night's production for density and depth for test sections. Three (3) cores for test strip.	Two (2) stratified random cores per one day/ night production obtained independently of contractor. Minimum two (2) per project.	Locality Representative Independently weigh and measure a minimum of one (1) QC core per day/night's production Locality representative will observe the taking of these cores and will maintain control of these cores once obtained
Permanent Pavement Marking	VDOT Section 512		**Contractor QC Testing**	**VST**	**IA**

A different Inspector & equipment supplied by either MBP or ECS, Independent from inspector performing acceptance testing.

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Permanent Pavement Marking - Preformed Tape		VTM-94	Daily perform VTM 94 at start up with periodic checks every three hours of operation	Randomly select three (3) ten foot in place sections of markings per day and measure thickness and width. Skip lines and edge lines are considered separately. Inspect PM for correct placement, straightness and edges. Observe the bead embedment, color (night and day) and brightness/reflectivity Inspect structure of tape to ensure patterned waffles have not been damaged by roller	Review all C-85 reports during production to verify that plan quantities match application quantities and that daily measurements are performed according to VTM 94.
Permanent Pavement Marking - Liquid Materials (Paint, thermoplastic and epoxy)		VTM-94	Daily perform VTM 94 at start up with periodic checks every three hours of operation	Randomly select three (3) ten-foot in place sections of markings per day and measure thickness and width. Skip lines and edge lines are considered separately. Inspect PM for correct placement, straightness and edges. Observe the bead embedment, color (night and day) and brightness/reflectivity. Review application rates to ensure proper thickness has been applied	Review start up calibrations. Ensure one plate sample is taken and tested for thickness, width, bead distribution and embedment. Retain sample for further testing if needed. Review all C-85 reports during production to verify that calculated quantities match application rates and that daily measurements are performed according to VTM 94.

QC/VST/IA Frequency - Misc Roadway and Structure

Material Type	Spec Section	Test Reference	QC Testing	VST	IA
Pre-cast Structures	VDOT Section 404				
Verify bedding material is installed properly and that pre-cast materials are not chipped or cracked		N/A	Daily and when shipment arrives on project	Inspect Precast structure before backfilling operations begin.	Inspect Pre-cast structures when received on job site. Inspect bedding before setting structure.
Load Bearing Piles	VDOT Section 403				
Monitor operation and document blow counts		N/A	Continuously	Review documentation weekly.	Daily
Perform Center of Gravity Calculations		N/A	For each Foundation	one out of every twenty (20) foundations	one out of every ten (10) foundations
Structural Steel	VDOT Section 407				
Receive Bolts, sample, verify the documentation is complete and perform laboratory Skidmore, tension and galvanized coating testing	VDOT 226.02(h)		Each nut-bolt-washer (NBW) assembly lot shall be sampled at a minimum rate of 2 assemblies per NBW lot. The documentation	Ea. NBW assembly lot shall be tested, one bolt in direct tension, one assembly for galvanized coating and one nut and bolt for rotational capacity testing (Rot-	The documentation shall be reviewed to insure all parts are present and that the required tests have been performed by the producers and that the markings match the

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			shall be collected from the bolt supplier and the galvanizer for each lot and supplied along with the samples to the QAM. QC personnel shall monitor the storage and conditions of the bolts to insure they remain in good well lubricated condition.	Cap) as per section 226	suppliers. The results of the VST shall be reviewed to insure the material passed the tests.
Verify daily Skidmore testing is performed IAW (in accordance with) proper procedures for each lot Note: NBW assembly may be reused after Skidmore testing in a connection if no defects are noted in visual inspection and the nut runs freely up the bolt for the full thread length - Only new NBW assemblies may be tested each day	VDOT 407.06(c)		Ea. Day & Ea. NBW lot (3 bolts per lot) used shall be Rot-Cap tested in the Skidmore device IAW proper procedures	Minimum three (3) NBW assemblies for each lot being installed shall be observed by the IA inspector	Three NBW assemblies from each lot shall be Rot-Cap tested at the QAMs lab independently each week during erection
Verify the installation crews are using proper installation procedures IAW specs. to tension the bolts	VDOT 407.06		Monitor ea. Crew (2-3 workers) during erection to insure proper technique (TOTN – turn-of-the-nut or DTI – direct tension indicating washers) is followed	NA	Monitor ea. Crew (2-3 workers) for a half dozen NBW assemblies once at the beginning of each four hour work period
Verify the bolted connections have been tensioned properly using statistical sampling frequency and a calibrated torque wrench	VDOT 407.06(c)4	ASTM 325	For each connection, test 10% or a minimum of 2 NBW assemblies verifying the required torque. Complete testing before the deck is formed.	Test 2 NBW assemblies in 25% of the slip critical connections (minimum of 2 connections per transverse line of splices) and 2 NBW assemblies in 10% of the secondary member connections	Monitor all the torque testing for each main member connection (slip-critical connections) and at the beginning of each period where secondary members are being checked.

Rebar Splicer (Tension Test)		ASTM A615	1 sample per manufacturer per most common size per structure (Contractor is to install pieces)	NA	Verify Machine Calibration annually
Protective Coating of Metal Structures	VDOT Section 411		**Contractor QC testing**	**VST**	**IA**
Monitor surface preparation		SSPC-PA	Three surface profile measurements per day of blasting.	Review all reports showing the preparation protocols	Two (2) surface profile measurements per week of blasting.
check coating thickness according to SSPC -PA		SSPC-PA	Five(5) spot measurements (15 Readings) per day as defined in PA-2 for coating thickness after each layer of paint at each location	Review all reports showing-painting application rates including the tests performed on profiles and thicknesses.	One spot measurement (3 readings) as defined in PA-2 for coating thickness after each layer of paint at each location
Underdrains	VDOT Section 501				
Inspect to ensure no deficiencies		VTM 108	All accessible outlet locations; Additionally a minimum of 10% of longitudinal sections	One (1) every twenty-five (25) outlet locations. A minimum of one per project independent of IA.	Observe 10% of outlet locations; Additionally a minimum of 1% of longitudinal sections
Guardrail	VDOT Section 505				
Verify that guardrail is installed per specifications and at proper height			Daily	Spot-check every 50 linear feet for proper height	Spot-check every 500 linear feet for proper height.

Fencing	VDOT Section 507				
Verify fencing type, height and location		N/A	Daily	Weekly	
Barbed Wire	VDOT Section 242	ASTM A121	One sample every 50 rolls or spools	NA	NA
Chainlink Fence	VDOT Section 242	AASHTO M181	One sample from 3 rolls for every 50 rolls.	NA	NA
ROW Monuments	VDOT Section 503				
Verify monument type and location		N/A	10% of ROW monuments	1% of ROW monuments	
Maintenance of Traffic	VDOT Section 512				
Monitor installation and maintenance and use Work Zone Safety Checklist		N/A	Daily (Locality Inspector)	Weekly (Locality Project Manager)	
Sound Wall Barriers	VDOT Section 519				
Verify location and installation with shop drawings		N/A	Daily	Weekly	
Topsoil and Seeding	VDOT Section 602/603				

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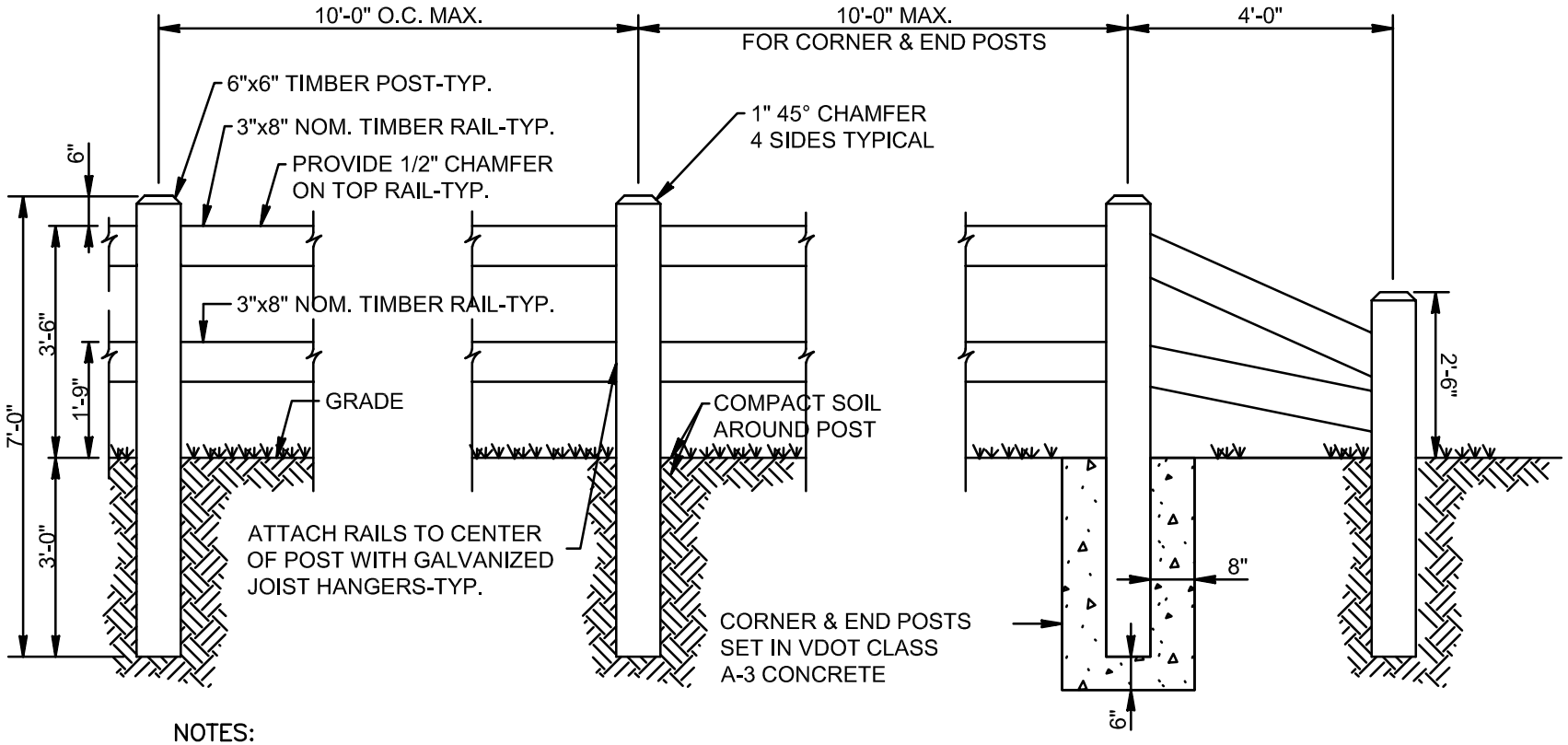
Verify proper material is utilized at application rates from plans		N/A	Daily	Weekly	
Traffic Signs	VDOT Section 512				
Verify that signs meeting current standards are utilized in locations per plans		N/A	Daily	Weekly	
Traffic Signals	VDOT Section 703				
Monitor installation for conformance with plans and specifications		N/A	Daily	Weekly	
Water and Sewer Facilities	VDOT Section 520				
Monitor installation for conformance with plans and specifications		N/A	Daily	Weekly	
Electrical and Signal Components	VDOT Section 238				
Tether Wire		ASTM A475	One sample per project	NA	NA
Span Wire		ASTM A475	One sample per project	NA	NA
Masonry	VDOT Section 202				
Wall Units			one sample consisting of 10 units per 10,000	NA	NA

			units		

- Verification testing shall be required if contractor's workforce performs QC testing that is used for Acceptance testing. If Locality or its consultant performs Acceptance testing, Verification testing shall not be required.
- IA testing shall be conducted by different personnel and different equipment than used for the QC/acceptance testing, QC/acceptance sampling or Verification testing.



NOTES:

1) TIMBER POSTS SHALL BE 6"X6"X7' #1 SYP (SOUTHERN YELLOW PINE), S4S (SURFACE FOUR SIDES), GM (GRADE MARKED), ACQ PRESERVATIVE TO 0.40 LB./CU. FT., PET (PRECISION END TRIM), 1" CH4TE (1" CHAMFER AROUND TOP FOUR EDGES).

2) TIMBER RAILS SHALL BE #1 SYP (SOUTHERN YELLOW PINE), S4S (SURFACE FOUR SIDES), GM (GRADE MARKED), ACQ PRESERVATIVE TO 0.40 LB./CU. FT., DET (DOUBLE END TRIM), 1/2" CHAMFER ON BOTH EDGES OF TOP RAIL, DOH (DEPARTMENT OF HIGHWAYS). RAILS SHALL BE ATTACHED TO POST WITH TYPE 316 GALVANIZED STEEL (18 GAUGE) JOIST HANGERS WITH GALVANIZED STEEL SCREWS.

3) ALL CUT ENDS SHALL BE FIELD TREATED IN ACCORDANCE WITH AWPA STANDARDS.

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T-3

TYPICAL TIMBER GUARDRAIL

NTS

***SIGNATURE PAGE ***

Note: A signed acknowledgment of this addendum must be received at the location indicated on the original solicitation either prior to the proposal due date or attached to your proposal. Signature on this addendum does not substitute for your signature on the original proposal/bid document. The original proposal/bid document must be signed.

Thank you,

W.L. Heath Honaker
Phone: (540) 283-8146
HHonaker@roanokecountyva.gov

2024-007 - WEST ROANOKE RIVER GREENWAY, PHASE I

Addendum # 1 Signature Page

Sign Name: _____ Print Name: _____

Name of Firm: _____ Date: _____