REQUEST FOR EXPRESSIONS OF INTEREST

EOI NO. 01-2021

ELLICOTT CITY NORTH TUNNEL FINAL DESIGN SERVICES

OPENING: MAY 12, 2021 AT 11:00 A.M.
PRE-SUBMITTAL CONFERENCE: APRIL 28, 2021 AT 11:00 A.M.

BUYER: Jennifer Rittenhouse
PHONE: 410-313-6378 ▪ EMAIL: jrittenhouse@howardcountymd.gov

HOWARD COUNTY, MARYLAND

OFFICE OF PROCUREMENT AND CONTRACT ADMINISTRATION

6751 Columbia Gateway Drive, Suite 226, Columbia, MD 21046
https://www.howardcountymd.gov/Departments/County-Administration/Procurement-and-Contract-Administration

Formal EOI Solicitations and Submittal Results are available on our website

TABLE OF CONTENTS

MINORITY BUSINESS ENTERPRISES are encouraged to respond to this solicitation. For more information, please contact Mr. Mahesh Sabnani, Equal Business Opportunity Coordinator, at 410-313-3694.

IMPORTANT NOTICE REGARDING ADDENDA

Addenda to solicitations often occur prior to bid opening. It is the potential Consultant's responsibility to visit the Office of Procurement and Contract Administration web site for updates to solicitations. https://www.howardcountymd.gov/Departments/County-Administration/Procurement-and-Contract-Administration

GENERAL CONDITIONS

1. PROJECT DESCRIPTION: Howard County, Maryland (the "County") desires to secure professional services to provide engineering, permitting, environmental, geotechnical and related professional design services for the final design of the Ellicott City North Tunnel (project).

1.1 The project is a component of the Ellicott City Safe & Sound Plan, a comprehensive plan to mitigate the effects of flash flooding in Historic Ellicott City, MD.

1.1.1 Additional information on the EC Safe & Sound Plan can be found at ecsafeandsound.org.

1.1.2 The project will consist of a deep bedrock tunnel, approximately 5,800 feet long, with a minimum clear area of 15 feet in diameter.

1.1.3 The project will originate in the 8800 Block of Frederick Road, Ellicott City MD 21043, and discharge into the Patapsco River, North of Parking Lot B, Ellicott City, MD 21043.

1.1.3.1 The project will pass below an active railway, owned and operated by CSX Transportation, which parallels the Patapsco River.

1.1.4 The project will primarily intercept storm flows from the Hudson Branch and an unnamed tributary; allowing base flow to bypass the project and continue along its current drainage patterns.

1.1.5 Howard County has engaged a consultant team for preliminary design efforts. These efforts have included preliminary engineering and geotechnical work to confirm the feasibility of the project.

1.1.5.1 Refer to Attachment A for preliminary vertical and horizontal alignments of the tunnel.

1.1.5.2 Refer to Attachment B for applicable geotechnical documentation.

1.1.6 This project will require various approvals and acquisitions.

1.1.6.1 The County has submitted this project as part of a Joint Permit Application (JPA) to the US Army Corps of Engineers (USACE) and Maryland Department of the Environment (MDE). This permit application is currently in review.

1.1.6.2 The County has begun discussions with CSX Transportation, related to preliminary engineering considerations.

1.1.6.3 The County has had preliminary discussions regarding subterranean easements with many potentially impacted property owners.

1.1.6.4 Other approvals that will need to be coordinated and finalized as part of the final design process include, but are not limited to, the following:

1.1.6.4.1 Howard County local permits (Grading Permit, Building Permits, etc.)

1.1.6.4.2 Howard County Historic Preservation Commission approval for visible built features within the Historic District.

1.1.6.4.3 Acquisitions of subterranean easements, where required.

1.1.6.4.4 Modification to the 100-year floodplain downstream or adjacent to the discharge site.

1.1.7 It is the County's desire to have design completed as expeditiously as possible, within approximately one calendar year from Notice to Proceed. Howard County intends to utilize *Construction--Manager--at--Risk (CMAR*) delivery for construction of the Project. It is the County's intent to engage the services of two separate firms for the Project, one for the engineering design services and one for construction management. This EOI is only for the procurement of a professional firm to provide full-service design services, as described in the Project Description, above. The County will issue a separate expression of interest for the procurement of the construction manager at risk.

2 PRE-SUBMITTAL MEETING: A pre-submission meeting will be held virtually, via WebEx, on Wednesday, April 28, 2021 at 11 am, to brief prospective consultants on the scope of the project and provide an opportunity for questions. A brief power point presentation will be made at the meeting and will also be included in an addendum. To join the WebEx, please enter the login information below:
Meeting link:
https://howardcountymd.webex.com/howardcountymd/j.php?MTID=mdf174c99d83c930b13debbb429340568

Meeting number: 160 003 9872
Password: mP3ptmnrn82
Additional instructions on joining a WebEx event can be found in Attachment C.

3 QUESTIONS AND INQUIRIES: Questions concerning this Expression of Interest must be directed to Jennie Rittenhouse, telephone number (410) 313-6378, Fax (410) 313-6388, email *jrittenhouse@howardcountymd.gov* within 10 days prior to bid opening. The Buyer in the Office of Procurement and Contract Administration is the sole point of contact for this solicitation.

4 AGREEMENT:

4.1 The County and Consultant must execute an Agreement resulting from the award of this solicitation. This process typically takes approximately three weeks from the date the successful Consultant is identified. In order to expedite this process, a sample Agreement is attached for review as part of this solicitation. Exceptions, if any, to the County's Consultant Agreement (Appendix B) must be noted in the submission to be considered during evaluation. Exceptions to the County's Agreement may result in rejection of the proposal. The County will not accept any exceptions to the Agreement after the opening date and time of this solicitation.

4.2 Do not fill in or sign the sample Consultant Agreement attached as Appendix B. The County will prepare an Agreement specific to this solicitation for execution by the successful Consultant.

5 TECHNICAL SUBMITTAL:

5.1 The Consultant's technical understanding and approach to the project, including innovativeness and any special expertise or resources that the firm intends to use, or other relevant information shall be submitted on **no more than ten pages** (minimum font size 11 point). Photographic exhibits, charts and figures, if included, will count towards the page limit. The transmittal letter, which shall be limited to one page, shall not be used to circumvent or supplement the above limit. The transmittal letter will not be used in the evaluation. **Failure to comply with the page limit may result in rejection of the Expression of Interest**.

5.2 The respondent to this EOI shall demonstrate the following minimum experience:

5.2.1 Success in preparation of full construction documents (drawings and technical specifications) for the construction of a deep bedrock tunnel constructed via various tunneling techniques, including use of a tunnel boring machine (TBM).

5.2.2 Experience in obtaining required permitting for a rock tunnel.

5.2.3 Experience in accurately estimating the final construction cost of a deep bedrock tunnel.

5.2.3.1 Experience may be demonstrated by including reference project's construction cost estimate, summary of change orders, and final construction cost.

5.2.4 Experience in accurately estimating the construction duration of a deep bedrock tunnel.

5.2.4.1 Experience may be demonstrated by including a reference project's estimated schedule prior to construction, summary of changes during construction, and final duration of project.

5.2.5 Experience in meeting design schedule milestones to deliver full and complete construction documents in a timely manner.

5.2.6 Experience in working on a project similar in nature that utilized a Construction Manager at Risk (CMAR) delivery method.

5.2.7 Experience with a project that goes below an active rail line.

5.3 Respondents must include a minimum of three references and/or recommendations in their response.

5.3.1 The following minimum requirements shall be included:

5.3.1.1 Contact information for references of relevant projects, for the Prime firm.

5.3.2 The following is preferred:

5.3.2.1 Contact information for references of relevant projects, for all firms included on the team.
5.3.2.2 References shall include projects in which key personnel were also key personnel on those projects.
5.3.2.3 Letters of Recommendation from municipal clients, for comparable projects.
5.3.2.4 Letters of Recommendation from municipal clients, specifically addressing and relating to the capabilities of the Project Manager.
5.3.2.5 Annotation of any known issues that arose during design, and how the design team worked to overcome those challenges.

5.4 Respondents are requested to demonstrate their team's technical expertise, as it pertains to the project, with the following disciplines listed below. Others may be included at the respondent's discretion. If services are proposed to be provided by a consultant to the Prime, respondent shall include relevant experience that said firms have in working together.

5.4.1 Tunnel / Subterranean Engineering
5.4.2 Civil Engineering
5.4.3 Geotechnical Engineering
5.4.4 Hydraulics / Hydrology
5.4.5 Structural Engineering
5.4.6 Landscape Architecture
5.4.7 Construction Cost Estimating

5.4.8 Construction Scheduling
5.4.9 Transportation / Traffic Engineering
5.4.10 Archaeology / Historic Resources

5.5 The project's outfall will deposit stormwater directly into the Patapsco River.

5.5.1 It is anticipated that an energy dissipation structure will be required at the outfall. Respondent shall indicate their relative experience in the design of energy dissipation structures.

5.5.2 An existing 36" diameter sewer main that parallels the Patapsco River that must be kept in operation undisturbed. Respondent shall indicate their relative experience in protecting similar utilities during this type of construction.

5.6 The project is anticipated to include one or more drop shafts along its alignment, in addition to the entry structure. Drop shafts will permit flow from various points in the watershed to be discharged into the tunnel. Analysis of fluid and hydraulic dynamics are anticipated to be key considerations in the design of these structures.

5.6.1 Respondent shall demonstrate their experience with de-airing flow in the design of drop shafts to ensure efficacy of the completed project.

5.6.2 It is anticipated that additional drop shaft(s) will be in-line or directly over the tunnel alignment. Respondent shall demonstrate their experience with this type of configuration.

5.6.3 Mitigating the potential accumulation of debris (that is collected by the flow of water) at the inlet and potential drop shaft(s) is an important consideration for the County. Respondent shall include any relevant project experience, including innovative strategies for debris management.

5.6.4 Respondent shall demonstrate experience or strategies for ensuring public safety at inflow and outflow points.

5.7 Respondent shall demonstrate their experience in working on a similar project in an urban setting.

5.7.1 It is anticipated that the tunnel will traverse directly below one or more existing structures. Respondent shall demonstrate their experience with similar efforts, and shall include strategies utilized to ensure protection of these structures.

5.8 Respondent shall indicate their experience working with the following regulatory authorities, if applicable:

5.8.1 US Army Corps of Engineers, Baltimore District
5.8.2 Maryland Department of the Environment,
5.8.3 Howard County Department of Planning and Zoning
5.8.4 Howard County Department of Licensing and Permits
5.8.5 CSX Transportation

5.9 Schedule, cost control, and cost estimating are equally as critical as technical competence in preparation of the Construction Documents.

5.9.1 Respondents shall describe how their experience uniquely qualifies them for this project, including describing team structure relative to schedule and cost estimating.

5.9.2 Respondents shall expand on their relevant experience with the CMAR delivery method. It is anticipated that the selected firm will assist the County with selection of a CMAR for

construction of the project.

5.10 The Project is anticipated to generate a significant amount of soil spoils, or muck. Respondent shall describe innovative strategies instituted on other comparable projects to:

5.10.1 Ensure minimal disturbance to areas surrounding the work site, including strategies utilized to minimize the size of work area or work in congested or urban areas.

5.10.2 Prescribing environmental site controls in and around the work site.

5.10.3 Prescribing the disposition of spoils / muck in such a way that the product becomes an asset to the project.

5.11 The Project's anticipated alignment will pass with relative proximity to numerous historic and culturally sensitive areas, as well as occupied residences and businesses. Respondents shall demonstrate their experience in developing, specifying and verifying compliance with engineering controls intended to minimize or mitigate disturbance to structures along the alignment.

5.12 The construction of the tunnel is anticipated to be partially funded through a loan from the Environmental Protection Agency's Water Infrastructure Finance and Innovation Act (WIFIA). Respondents are encouraged to review and familiarize the program's compliance requirements at https://www.epa.gov/wifia/wifia-federal-compliance-requirements

5.13 Consultants must complete and submit Appendix D and Appendix H with their submission. These forms will not count towards the page limit.

6 FORM SF330:

6.1 Interested firms are required to submit a completed Standard Form 330 which is separate from and does not count towards the page limit of the technical submittal. If your firm does not have a blank SF330, the form may be obtained from the Office of Procurement and Contract Administration website at *https://www.howardcountymd.gov/Departments/County-Administration/Procurement-and-Contract-Administration* under Current Solicitations Standard Form 330.

6.2 SF330 shall include, if applicable, all Howard County Government contract work currently in progress or completed in the last five years, in addition to other relevant contract work completed in the last five years.

6.3 SF330 shall indicate only the number of personnel by discipline the firm proposes to involve in the specific project. It shall identify all sub-consultants, including Equal Business Opportunity (EBO) Enterprises, which will participate in this project. Responses should only address the key personnel who will be specifically assigned to this project (including those of any joint ventures, Consultants, sub-consultants, EBO Enterprise, etc.) and shall include no more than 10 resumes. Each individual resume shall be limited to no more than one standard page. Responses shall list no more than 10 projects and shall include the name and telephone number of a person who may be contacted for references for each listed project and shall indicate which of the key personnel listed were involved on the specific projects listed and in what capacity. Responses shall identify a maximum of 10 projects, with priority given to projects that are similar to the specific project for which services are being procured.

6.4 The Consultant shall provide a separate Project Organizational Chart showing the personnel and their specific involvement/responsibilities in this effort. This chart will not count towards the page limit of the technical submittal. Elaborate brochures or voluminous samples of irrelevant past experience are not required or desired. During the course of the project, the Consultant may not change the key personnel who are listed without written authorization from the County.

6.5 The project manager shall be a registered professional engineer in the State of Maryland, or shall have the ability to attain professional registration in Maryland within 180 days of award; and shall have a minimum of twenty (20) years' experience similar to that required for this project. Documentation of this experience shall be incorporated as part of the SF330 form.

6.5.1 The project manager shall have a minimum of five (5) years experience with the Prime respondent to this EOI.

6.5.2 The project manager shall have managed at least one complete rock tunnel project while employed as a project manager with the Prime respondent to this EOI.

6.5.3 The prime respondent shall identify an alternate key person to serve as Project Manager in case of absence or departure of the Project Manager from the Prime firm during the course of the project.

7 INSURANCE:

7.1 If a contract is awarded, the successful Consultant will be required to indemnify and hold the County and its agents and/or employees harmless from and against all liability and expenses, including attorney's fees, howsoever arising or incurred, alleging damage to property including environmental damage, or injury to, or death of any person arising or attributable to the Consultant or any if its sub-consultant's performance of the contract awarded.

7.2 The Consultant shall purchase and maintain during the term of the contract, including any renewals thereof, such policies of insurance acceptable to the County as will protect the Consultant and the County from claims or losses, regardless of whether such claims or losses result from the Consultant's actions or omissions or those of a sub-consultant or those of anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable. The following coverage is mandatory but may not be all inclusive, based on the parameters of the proposal:

7.2.1 Workers' Compensation Insurance with limits of coverage as follows:

7.2.1.1 Coverage A: Statutory, covering Maryland jurisdiction.

7.2.1.2 Coverage B: $100,000

7.2.2 Automobile Liability Insurance with limits of liability of at least $1,000,000 combined single limit per occurrence. Coverage for non-owned and hired vehicles shall be included. If hazardous materials are transported, insurance shall comply with applicable law relating to such transport.

7.2.3 Commercial General Liability Insurance with combined single limits of $5,000,000 per occurrence, naming "Howard County, Maryland, its officials, employees, agents and volunteers" as Certificate Holder and as Additional Insured. Unless deemed unnecessary by the County, the policy shall contain, but not be limited to, the following coverage endorsements:

7.2.3.1 Contractual Liability, including Sub-Consultants
7.2.3.2 Personal and Advertising Injury
7.2.3.3 Products and Completed Operations
7.2.3.4 Explosion, Collapse, and Underground Hazards (XCU) - required if such exposure exists due to the nature of the work to be performed.

7.2.4 Professional Liability/Errors and Omissions insurance to the Consultant's profession with policy limits of at least $5,000,000 per claim. Consultant shall continue to maintain such

insurance, covering incidents occurring or claims made, for a period of three years after substantial completion of the project.

7.3 If any of the insurance policies required to fulfill the requirements of the work are written on a claims-made basis, Consultant shall continue to maintain such insurance, covering incidents occurring or claims made, for a period of three years after substantial completion of the project.

7.4 All policies of insurance shall be underwritten by companies licensed to do business in the State of Maryland.

7.5 The Consultant shall assure that all sub-consultants performing services in accordance with this EOI carry identical insurance coverage required of the contract, either individually or as an Additional Insured on the policies of the Consultant. Exceptions may be made only with the approval of the County. Consultant shall indemnify the County for any uninsured losses relating to the contractual services involving sub-consultants, including workers' compensation claims.

7.6 The Consultant shall not commence work under the contract until evidence of all required coverage is received by the County. Further, the Consultant shall continue to provide the County with evidence of policy renewals until the completion of the contract and shall not reduce or cancel or change any of the required coverage without 30 days' notice of such change to the County.

7.7 The Consultant will not hold the County liable for any injuries to the employees, servants, agents, sub-consultants or assignees of the contract arising out of or during the course of services relating to this agreement.

7.8 The providing of any insurance required herein does not relieve the Consultant of any of the responsibilities or obligations assumed by the Consultant in the contract awarded of for which the Consultant may be liable by law or otherwise.

7.9 The Consultant shall provide the County with Certificates of Insurance within ten days of award notification, naming "Howard County, Maryland, its officials, employees, agents and volunteers" as Certificate Holder and as Additional Insured on the certificate. Failure to provide the certificates as required shall result in rejection of award by the County. Such certificates shall provide that the County be given at least 30 days prior written notice of any cancellation of, intention to not renew, or material change in such coverage. Failure to maintain such insurance as required above shall be deemed as a material breach of the contract and shall operate as an immediate termination thereof.

8 SUBMISSION OF EXPRESSIONS OF INTEREST:

8.1 All Expressions of Interest shall be submitted in sealed, clearly marked envelopes to the Office of Procurement and Contract Administration. A total of **eight (8)** copies of the Expression of Interest package (one original and **seven (7)** copies) shall be submitted. One electronic copy of the Expression of Interest package shall also be provided on USB thumb drive.

8.2 All firms will be notified of the status of their Expression of Interest. Please do not call the County.

8.3 The County will dispose of, in a secure manner, all Expressions of Interest upon completion of the selection process.

9 EVALUATION OF EXPRESSIONS OF INTEREST:

9.1 Evaluation of Expressions of Interest and subsequent award of the contract shall be made according to the conditions, stipulations, and provisions of the Howard County Code, the Howard County Purchasing Manual and the Qualifications Based Selection (QBS) process. The technical evaluations of the submittals will be made based on the criteria listed in Appendix A, rating the firm's experience, project management ability, approach to the project, understanding of the work

effort and qualifications of personnel to be assigned to the project.

9.2 In accordance with Howard County Code Sec. 4.117 (a) (4), the quality of performance of previous contracts or services shall be considered in the evaluation. Quality of performance may be determined through contracts or services provided to the County or to other entities. Quality of performance to other entities will be determined from reference checks when references are required. The determination of quality performance includes the Consultant's history of reasonable and cooperative behavior and commitment to customer satisfaction and the Consultant's businesslike concern for the interests of the customer. The County reserves the right to reject any bid deemed not responsible or non-responsive.

10 SELECTION OF TOP-RANKED FIRM:

10.1 After evaluation of the Expressions of Interest, the firms will be ranked by a selection committee. The County will select up to three firms to be interviewed, based on ranking by the selection committee. The selection of the top ranked firm will be determined based on this interview.

10.1.1 The County anticipates approximately a 30-day review period after submission for the selection committee to review the submittals and recommend a list of firms for interviews.

10.1.2 The County intends to commence interviews quickly after the selection committee has completed their reviews.

10.2 Upon completion of the interview evaluation, the top ranked firm will be requested to submit a technical cost proposal. The County will then undertake negotiations with that firm. Should the County be unable to negotiate a satisfactory agreement with that firm, negotiations shall be formally terminated. The County shall then undertake negotiations with the second top-ranked firm, and so forth.

10.2.1 The County will utilize its standard QBS consulting services agreement, attached as Appendix B.

10.2.2 The County expects firms to utilize competitive overhead and labor rates. The Department of Public Works has instituted a ceiling multiplier of 2.8 times the hourly rate, inclusive of a maximum profit of 10%. This is not a proffered rate, but a ceiling, with Howard County committed to achieving cost-effective methods and services, At the time of the negotiations, the consulting firm shall submit a certified payroll and a current audited overhead rate.

IMPORTANT: Please note the page limit in paragraph 4, Technical Submittal. Failure to comply with page limit may result in rejection of your submittal.

APPENDIX A

CONSULTANT SELECTION PROCEDURE

1. Experience: Background experience of Consultant within the specialty under review. Evaluation shall reflect the amount of work Consultant has done, the complexity of such work, and relevance of the work to the project tasks under review.

    5 Superior
    4 Excellent
    3 Good
    2 Average
    1 Below Average

2. Diversity: Ability of Consultant to provide the disciplines related to the specific work effort:

    5 All
    4 75%
    3 50%
    2 35%
    1 Specialty Only

3. Consultant's approach to project, including innovativeness:

    5 Superior
    4 Excellent
    3 Average
    2 Below Average
    1 Poor

4. Consultant's understanding of the work effort and of similar projects:

    5 Superior
    4 Excellent
    3 Good
    2 Average
    1 Below Average

5. Qualifications of personnel to be assigned to the project:

    5 Very qualified - has worked on many similar projects
    4 Qualified - has worked on similar projects
    3 Qualified - has worked within discipline
    2 Qualifications vague - may be able to complete work
    1 Qualifications questionnable

APPENDIX B

CONSULTING SERVICES

AGREEMENT CA XX-XX

BY AND BETWEEN

HOWARD COUNTY, MARYLAND

AND

[NAME OF FIRM]

ARTICLE 1. PARTIES

This Agreement is made and entered into by and between **HOWARD COUNTY, MARYLAND**, a body corporate and politic, hereinafter referred to as the "County," and the firm of **[NAME AND ADDRESS OF CONTRACTOR – ALL CAPS AND BOLD]**, hereinafter referred to as "Consultant" as a result of Expression of Interest No. ___-____.

ARTICLE 2. DOCUMENTS

The documents constituting the Agreement between the County and Consultant shall consist of this Agreement and the following exhibits:

A: Scope of Work attached hereto as Exhibit A.
B: Schedule of Prices attached hereto as Exhibit B.
C: Related information attached as Exhibit C.
D: Solicitation as issued, attached as Exhibit D.

ARTICLE 3. WORK EFFORT

A. Consultant hereby agrees to undertake the work efforts generally and specifically defined within Exhibit A, and to adhere to, comply with and respond to all performance requirements, conditions, restrictions and provisions stated therein.

B. Consultant, in consideration of the fee specified hereinafter, covenants and agrees to perform, in connection with this Project, with the assistance of competent registered professional staff, and/or sub-consultants, the professional services detailed in one or more of the following major phases of the Agreement described hereinafter and in the Contract Documents.

C. All professional services are to be performed in accordance with generally accepted professional practices and in accordance with all applicable laws and regulations, including but not limited to, the latest Howard County criteria, Howard County Design Manuals, BOCA Code, Plumbing Code and Electrical Code as well as the criteria of all other Federal, State and local agencies that may have jurisdiction.

D. Consultant acknowledges the importance to the County of the County's project schedule. Where applicable, the project schedule is included in Exhibit A. The Consultant agrees to put forth its best professional efforts to perform its services under this Agreement in a manner consistent with that schedule.

E. Where applicable, the Services to be provided by Consultant shall be performed in the phases described in Exhibit A and shall include, but not be limited to all other services required in

accordance with generally accepted practices consistent with the terms of this Agreement, and specifically identified and described in the Contract Documents.

F.

ARTICLE 4. SCHEDULE

A. Consultant shall commence work within seven (7) days upon receipt of written notice to proceed and a Purchase Order from the County, such notice being contingent upon the execution of this Agreement by the County and Consultant. The work shall be completed in an expeditious manner and in such sequence as agreed upon between the Consultant and the County and as set forth in the Project Schedule. Time is of the essence of this and all other obligations of Consultant under the Agreement. If there is a conflict between the provisions set forth in the Purchase Order Terms and Conditions and/or the General Conditions of the solicitation and/or this Agreement, the terms and conditions set forth in the Agreement shall govern.

B. If the County determines that Consultant is behind schedule, Consultant shall expedite and accelerate its efforts, including providing additional staff and/or overtime, to maintain the Project Schedule, all at no additional cost to the County. In the event that such acceleration is necessary, Consultant shall provide to the County any such verification the County requires in order to allow the County to determine that such accelerated effort is in fact being performed.

C. Except when circumstances beyond the control of Consultant and concurred in writing by the County shall warrant alteration, adjustment or deviation from the Schedule, the following circumstances shall constitute a sufficient basis for the issuance of a Termination Notice in accordance with Article 10 of this Agreement:

1. Failure to meet or maintain the Project Schedule;
2. Failure to maintain the scheduled level of effort as proposed and prescribed; and/or
3. Deviation from the Project Schedule without prior approval of the County.

If Consultant fails to meet or to maintain the Project Schedule, and the County does not terminate, any such forbearance by the County shall not waive its rights to terminate at any time in accordance with this subparagraph or any other provision of this Agreement.

Consultant shall indemnify and hold harmless the County from claims or damages incurred by the County by reason of Consultant's failure to meet or to maintain the Project Schedule.

ARTICLE 5. PERSONNEL AND SUB-CONSULTANTS

Unless otherwise required by the EOI, all key Personnel and Sub-Consultants listed in response to the EOI shall not be changed, except with prior written approval of the County. Consultant must submit to the County's Project Manager a list of all proposed additional Consultants and may not retain any without the prior written approval of the County. Consultant shall utilize the personnel and Sub-consultants listed. All personnel and Sub-consultants shall be and remain satisfactory to the County and shall not be changed without prior written consent of the County unless personnel cease to be in Consultant's employ in which case substitutes must be provided and must be acceptable to the County.

Consultant represents that all necessary personnel required to perform the services under this Agreement are not employees of and do not have any contractual relationship with agencies providing funds for the project.

ARTICLE 6. DEVIATIONS FROM THE DESIGN MANUAL

Any deviations from the standards or criteria established in the Howard County Design Manual which Consultant believes to be necessary for the completion of the design must be listed in a letter to the Project

Manager, either submitted separately or submitted with the drawings and specifications. The deviations are to be clearly identified with reasons why they are necessary. Approval of the deviations will be by return letter from the Bureau of Engineering signed by the Bureau Chief.

ARTICLE 7. COST ESTIMATES AND DESIGN REVISIONS

Unless otherwise required in the EOI, Consultant, based upon approved design documents, shall prepare for approval by the County an estimate of construction cost. The estimate shall be the most reasonable estimate possible and shall be broken down to show for each building, structure or bid items, quantity and unit costs. A 10% contingency shall be included in the final estimate. If the project budget is exceeded by the lowest bona fide bid or negotiated proposal, the County may cooperate in revising the project scope and quality as required to reduce the construction cost. Where applicable, Consultant without additional charge shall modify the contract documents as necessary to comply with the project budget. This article shall be the limit of Consultant's responsibility by reason of the project budget.

ARTICLE 8. CLAIMS AND DISPUTES

A claim is a demand or assertion by Consultant seeking adjustment or interpretation of the terms of this Agreement, payment of money, extension of time or other relief with respect to the terms of this Agreement. "Claim" also includes other disputes and matters in question between Consultant and the County arising out of or relating to this Agreement. Claims must be made by written notice and shall be made by Consultant promptly after the occurrence of the event giving rise to the claim, but in no event later than 21 days after such occurrence or within 21 days after Consultant first recognizes the condition giving rise to the claim, whichever is later. Supporting data shall be provided with the notice of a claim. As to any supporting data that is not available at the time of the notice, Consultant shall provide with the notice its best estimate of the total cost of the claim and further supporting data shall be provided as soon as it becomes available. Consultant shall certify that the claim is made in good faith, that the supporting data is accurate and complete to the best of its knowledge and belief, and that the amount requested accurately reflects the contract adjustment for which Consultant believes the County is liable. All provisions of this paragraph are conditions precedent to any claim and all provisions must be satisfied otherwise the claim shall not be valid. Any additional claim made after the initial claim has been implemented by change order or amendment to this Agreement shall not be considered. No claim by Consultant shall be allowed if demanded or asserted after final payment under this Agreement.

Pending final resolution of the Claim, including litigation, unless otherwise agreed in writing, Consultant shall proceed diligently with the performance of its services under this Agreement and the County shall continue to make payments in accordance with the terms of this Agreement.

Prior to the institution of any litigation by Consultant, and as an express condition precedent thereto, the parties shall attempt to resolve the dispute by agreement between Consultant and the County and any dispute which is not so disposed of by Agreement shall be decided by the Director of the Department of Public Works, or his/her designee who shall reduce his/her decision to writing and mail or otherwise furnish a copy thereof to Consultant. At the sole option of the County, the Appeal to the Director may be designated in writing to the Consultant as a final arbitration proceeding or otherwise as a proceeding under Md. Code Article 25A, §1A "Determination by County Officer Subject to Court Review". In this event, a formal hearing shall be held before the Director or his designee and the Consultant shall have the right to call witnesses and submit documents or other evidence as well as such other rights as are provided in the Howard County Administrative Procedure Act. Either party may appeal the decision of the Director of the Department of Public Works to the appropriate Howard County Court as designated herein. No such appeal or litigation shall be instituted later than 30 days after the date of receipt of the Director's decision. Failure to institute such proceedings within such 30-day period shall result in the Director's decision becoming final and binding upon Consultant and the County.

Any controversy, dispute or claim arising out of, touching upon, or related to this Agreement or the breach thereof shall be resolved in the Circuit Court (or District Court) for Howard County, Maryland and the parties hereby consent to and agree to the jurisdiction of that Court as the exclusive forum for the resolution of such controversies, disputes or claims. Provided, however, in the event the presence of third parties is required for the complete resolution of the dispute, and the Howard County courts do not have jurisdiction over such third parties,

then the County, at its sole option, may elect to have the dispute resolved in any court of appropriate jurisdiction.

At the County's option, Consultant may be joined in any jurisdiction as a party to any dispute initiated by any Third Party.

All references in this Agreement to the Director of the Department of Public Works shall be deemed to include the Director or his/her designee.

Any failure of the Consultant to give any notice, to provide supporting data or claim certification, or to file any appeal within the times set forth in this Agreement, shall forever bar and waive the claim regardless of whether the County incurred or demonstrates any prejudice resulting from the Consultant's failure to meet the time limits set forth in this Agreement.

ARTICLE 9. NOTICES

Any notice required by this Agreement to either party by the other shall be in writing and deemed given when delivered personally or when deposited in the United States Post Office, first class, postage prepaid, addressed as follows:

As to the County: _____
_____
_____

As to the Consultant: _____
_____
_____

or to such other address as shall be duly given by notice meeting the requirement of this Article.

ARTICLE 10. TERMINATION

Upon written notice to Consultant, the County may terminate the performance of work under this Agreement, in whole or part, in accordance with the following criteria:

A. For Default:

Whenever Consultant shall default in performance of the terms of this Agreement and shall fail to cure such default within a period of ten days (or such longer period as the County may allow) after receipt from the County of a notice specifying the default. Consultant shall not be entitled to further payment until the work required under this Agreement is completed. Consultant shall pay to the County any incidental or consequential costs or damages incurred by the County, together with any completion costs incurred by the County in excess of what would otherwise have been payable under this Agreement.

B. For Convenience:

Whenever for any reason the County shall determine that such termination is in the best interest of the County. Any such termination shall be affected by delivery to the Consultant of a Notice of Termination specifying the basis for the termination, the extent to which performance of work is terminated and the effective date of such termination. In the event of termination for convenience under this provision, Consultant shall be entitled to receive compensation for the portion of its fee earned up to the date of termination and all substantiated expenses reimbursable under this Agreement, if any, as of the date of termination. No other or additional sums, whether for lost profits, overhead, consequential damages, or any other damages or claims whether in contract or in tort, shall be payable by the County.

C. If after termination of this Agreement or any part thereof for default under "A" above it is

determined that Consultant was not in default pursuant to "A," or that Consultant's failure to perform satisfactorily is due to causes beyond the control and without fault or negligence on the part of Consultant, the Notice of Termination shall be deemed to have been issued under "B" above, and the rights and obligations of the parties shall be governed and resolved accordingly.

D. Upon receipt of a Notice of Termination and except as otherwise directed by the County, Consultant shall: (1) stop work under the Agreement on the date and to the extent specified in the Notice of Termination; (2) take all necessary or appropriate steps to limit disbursements and minimize costs; and (3) furnish a report, as of the date or receipt of notice of suspension or termination, of the status of all activities conducted under the terms of this Agreement, including the work effort, funds, results accomplished, conclusions resulting there from and such other matters as the County may require.

E. In the event of termination under this Article, Consultant consents to the County's selection of another Consultant of the County's choice to assist the County in any way in completing the Project. Consultant further agrees to cooperate and provide any information requested by the County in connection with the completion of the Project including assignment of any contract rights the County may require. Consultant consents to and authorizes the making of any reasonable changes to the design of the Project by the County and such other Consultant as the County may desire. Except for the status report required in (D) above, any services provided by Consultant which are requested by the County after termination shall be fairly compensated by the County in accordance with the Rate Schedule set forth in the Contract Documents ("Rate Schedule").

F. Notwithstanding the provisions of this Article, Consultant shall not be relieved of liability to the County for damages sustained by the County by virtue of any breach of this Contract by Consultant and the County may withhold any payments to Consultant for the purpose of set-off until such time as the exact amount of damages due to the County from Consultant is determined.

ARTICLE 11. RECORDS AND AUDIT

A. Consultant and its sub-consultants or subcontractors shall maintain books, records, documents and other evidence directly pertinent to costs, estimates and performance under this Agreement and any Federal, State or local rule or regulation, in accordance with accepted professional practice, appropriate accounting procedures and practices. The County, or any of its duly authorized representatives, shall have access to such books, records, documents and other evidence for the purpose of inspection, audit and copying. Consultant will provide proper facilities for such access and inspection.

B. Audits conducted pursuant to this Article shall be in accordance with generally accepted auditing standards and established procedures and guidelines of the American Institute of Certified Public Accountants. Consultant agrees to the disclosure of all information and reports resulting from access to records pursuant to paragraph (A) above. Where the audit concerns Consultant, the auditing agency shall afford Consultant an opportunity for an audit exit conference and an opportunity to comment on the pertinent portions of the draft audit report. The final audit report will include the pertinent written comments, if any, of the audited parties.

C. Records under paragraph (A) above shall be maintained and made available during performance under this Agreement and until three (3) years from the date of final completion of the Project. In addition, those records that relate to any dispute or litigation, or the settlement of claims arising out of such performance, or costs or items to which an audit exception has been taken shall be maintained and made available until three (3) years after the date of resolution of such dispute, litigation, claim or exception.

D. The Consultant shall include the provisions of this Article in every sub-consultant contract or subcontract for the Work.

E. If Consultant or his subcontractors or sub-consultants fail to retain for the period of time required

by this Article the documents referenced herein, Consultant herein shall be entitled to no damages, compensation or equitable adjustments (including time extensions) for any claims based on information available from, or which may be verified by, documents that have not been retained.

ARTICLE 12. DEFECTIVE WORK

Neither the performance of services by the Consultant nor County acceptance of required reports shall relieve Consultant from the obligation to correct any defective work, whether previously or subsequently noted, and all defective work shall be remedied by Consultant on demand and at no cost to the County. Defective work includes, but is not limited to, such matters as erroneous or missing tabulations, drawings, contract documents, incomplete surveys, maps, or reports and incorrectly assembled reports, publications, etc. which is caused by error or omission. The County may withhold a reasonable amount from funds otherwise due Consultant on account of incomplete or defective work until such defective or incomplete work is cured.

ARTICLE 13. CHANGES OR ADDITIONAL SERVICES

The County may, from time to time, require changes in the scope of the services of Consultant to be performed hereunder. Such authorized changes or additional services, including any increase or decrease in the amount of the compensation to the Consultant, shall be incorporated in written change orders to the purchase order to this agreement and payment or adjustment effected as set forth in Article 25 of this Agreement. No such work shall proceed until Consultant receives an executed Change Order from the County.

ARTICLE 14. WAIVERS

The failure of the parties to enforce, at any time, the provisions of this Agreement or to exercise any option which may be provided herein shall in no way be construed to be a waiver of such provisions nor in any way to affect the validity of this Agreement or any part thereof or the right of the parties to enforce thereafter each and every provision.

ARTICLE 15. COUNTY FURNISHED DATA

Where existing information, data, reports, records, and maps as are existing and identified by Consultant, available to the County without significant cost, and necessary for the carrying out of the work, the County shall furnish such data to Consultant without charge.

The County shall provide no clerical assistance to Consultant for this Project and County personnel shall not be asked to undertake surveys, analyses, tabulations, summaries, etc., of Consultant-produced data or documentation. However, County employees may participate in Consultant-conducted surveys as questionnaire recipients or survey groups for the purpose of providing information and opinions.

ARTICLE 16. MEETINGS

Throughout all phases of the Project, Consultant and its sub-consultants must meet periodically with the County Project Manager when reasonably requested. Attendees shall be as determined by the County Project Manager. When requested by the County Project Manager or the Director, selected Consultant personnel shall attend meetings, conferences and presentations with County staff, public agencies, private organizations and others concerned with this project. Consultant shall take and transcribe minutes of all project meetings and provide them to the County within 10 days of such meeting(s).

ARTICLE 17. PAYMENT

The Consultant hereby agrees to undertake the project for the fee and/or the unit prices set forth in Exhibit B attached hereto and any additional sums added by approved change order. Payment shall be in proportion to the services performed so that the compensation at the completion and issuance of written approval of each phase of the work shall not exceed the amounts set forth in Exhibit B.

County-directed adjustments in direction or emphasis of the work effort will not be considered as adequate justification for cost renegotiation, provided such adjustments do not constitute a change in the general scope of the Project.

Payments for Additional Services of Consultant as described under Article 25 shall be made monthly upon presentation of Consultant's statement of services, fully supported by invoices, time records, and other documentation as requested by the County. The fee for such Additional Service shall be so identified on the Consultant's invoice or statement.

In no event shall the total compensation paid to the contractor exceed the budget appropriation.

All labor rates shall be fixed for a period of two (2) years from the date of Purchase Orders, or six (6) months beyond the applicable completion date set forth in the Project Schedule, whichever is later. Where the Project is extended beyond such date, Consultant shall be entitled to an increase in fee. The increase shall be calculated by comparing Consultant's expenses and payroll rates in effect at the specified completion date for the Project and those expenses incurred and payroll rates in effect as of a date at least six months beyond the completion date shown on the Project Schedule. Consultant shall be allowed the appropriate percentage of increase in payroll and expenses providing such increases actually reflect increases in payroll and expenses occurring since the completion date in the original Project Schedule. Such increases shall be verified by submitting such documentation as the County may require reflecting any cost increases claimed. Such increases shall be limited to direct costs and expenses only and shall not include overhead or profit or any increase in any multiplier.

ARTICLE 18. COVENANT AGAINST CONTINGENT FEES

Consultant warrants that it has not employed or retained any person, partnership, corporation, or other entity, other than a bona fide employee or agent working for Consultant, to solicit or secure this Agreement, and that he has not paid or agreed to pay any person, partnership, corporation, or other entity, other than a bona fide employee or agent, any fee or any other consideration contingent on the making of this Agreement. For breach or violation of this warranty Howard County shall have the right to terminate this Agreement without liability, or, in its discretion, to deduct from the contract price or consideration, or otherwise recover the full amount of such fee, commission, percentage, brokerage fee, gift or contingent fee.

ARTICLE 19. METHOD OF PAYMENT

A. Consultant shall, at the designated time set forth in the Project Schedule incorporated into this Agreement, submit on its standard form an invoice for its services rendered. The invoices shall indicate the percentage completion of each of the major tasks, and the total amount due for the billing period.

B. Consultant will submit the original and two copies of the invoice directly to the Howard County Department of Public Works, Capital Projects Division, 7125 Riverwood Drive, Suite B, Columbia, Maryland 21046. This invoice will be reviewed and verified for work accomplished as set forth in the Scope of Work attached hereto as Exhibit A and when certified as acceptable, will be forwarded to the County's Director of Finance for payment.

C. In event of dispute or defective work, the County reserves the right to withhold payment until such time as the dispute is resolved, the defective work corrected, or settlement is achieved through other means. Any such withholding shall not excuse Consultant from proceeding diligently with the performance of services under the Contract Documents.

ARTICLE 20. EQUAL EMPLOYMENT

By signature hereon Consultant agrees and affirms that it accepts and will conform to the Howard County Affirmative Action Program, which states that:

"Howard County expects that the Consultant will not discriminate against any employee or applicant for employment because of race, creed, color, national origin, gender identity/expression, sex or age. The Consultant will take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, creed, color, national origin, sex or age."

In addition, Consultant further certifies that it now complies and will continue to comply with all federal, state and local laws and regulations pertaining to equal opportunity and equal employment practices.

ARTICLE 21. CONFLICT OF INTEREST

A. No officer or employee of the County and no member of its governing body, and no other public official of the governing body of the locality or localities in which the study is situated or being carried out, or of other local public agencies, who exercises any functions or responsibilities in review or approval of the undertaking or carrying out of this study, during his tenure or one year thereafter shall have any personal interest, direct or indirect, apart from his official duties, in this Agreement or the proceeds thereof.

B. Consultant covenants that it has presently no interest and shall not acquire any interest, direct or indirect, which would conflict in any manner or degree with the performance of services required to be performed under this Agreement. Consultant further covenants that in the performance of this Agreement no person having such interest shall be employed.

ARTICLE 22. INDEMNIFICATION AND INSURANCE

A. Indemnification

1. The Consultant shall be responsible for all damage to life and property arising out of or resulting from the negligent performance of the professional services of consultant's sub-consultants, agents, or employees under this agreement.

   Further, to the extent permitted by law, the Consultant shall indemnify, hold harmless and defend the County, its officials, agents, employees, successors and assigns against and with respect to any and all losses, damages, suits, claims, judgments and expenses whatsoever ("losses"), including without limitation costs of investigation, litigation and attorney's fees, arising directly or indirectly from the negligent performance of this Agreement by the Consultant, its officers, employees, agents, or sub-consultants. The foregoing shall apply, without limitation, to losses of all types including destruction or degradation of the environment and all clean-up costs, fines, penalties and other pollution-related items. This indemnification is not to be deemed as a waiver of any immunity which may exist in any action against Howard County, Maryland. In the event that there is a conflict between the indemnification provision set forth in the Purchase Order Terms and Conditions and/or the General Conditions of the solicitation and/or this Agreement, the terms set forth in the Agreement shall govern.

2. In any and all claims against the County or any of its agents or employees or any employee of the Consultant, or any sub-consultant, or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under subsection 1 above shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Consultant or any sub-consultant under workers' compensation laws, disability benefits acts, or other employee benefits.

3. Unless otherwise stated within this Agreement, any property or work to be provided by the Consultant under this Agreement will remain at the Consultant's risk until written acceptance by the County. Until that time, the Consultant will replace, at Consultant's expense, all property or work damaged or destroyed by any cause whatsoever.

4. The Consultant shall not disclose any work product created by the Consultant under this Agreement to any other parties, except as may be authorized in writing by the County as required or permitted by public law.

5. The Consultant shall be considered for all purposes of this Agreement as an independent Consultant, shall not be an agent of the County and shall have no right or authority to enter into any agreements or otherwise bind the County or create any obligations on behalf of the County with other parties whatsoever.

B. Insurance Requirements

1. Insurance Coverage Required: The Contractor shall provide insurance required by the County pursuant to the insurance requirements specified in Section 7 of the Expression of Interest, including naming "Howard County, Maryland, its officials, employees, agents and volunteers" as Certificate Holder and as Additional Insured. The Contractor shall maintain the insurance coverages required by the County while this Agreement is in force and provide documentation of such insurance in a form satisfactory to the County. Such documentation may, in the discretion of the County, be in the form of binders or declarations from the insurance company.

Unless otherwise stated, the Consultant shall purchase and maintain during the term of the Agreement, the following coverages:

a. Workers' Compensation Insurance with limits of coverage as follows:

(1) Coverage A: Statutory, covering Maryland jurisdiction.
(2) Coverage B: $100,000

In cases where work is subcontracted, the Consultant shall require all sub-consultants to provide evidence that all of its employees are covered under Maryland worker's compensation insurance prior to the commencement of work.

b. Automobile Liability Insurance with limits of liability of at least $1,000,000 combined single limit per occurrence. Coverage for hired and non-owned vehicles shall be added by endorsement.

c. Commercial General Liability Insurance combined single limits of $5,000,000 per occurrence, naming Howard County, Maryland as an additional insured At the discretion of the County, an aggregate limit greater than the occurrence limit may be required. As appropriate to the job and as deemed necessary by the County, the policy shall contain, but not be limited to, the following coverage endorsements:

Contractual Liability, including sub-consultants
Personal Injury
Advertising Injury
Products and Completed Operations
Broad Form Property Coverage
Fire Legal Liability

Explosion, Collapse, and Underground Hazards (XCU) - required if such exposure exists due to the nature of the construction site.

d. The County is not responsible for any damage or loss of materials stored on or

within County-owned facilities. The Consultant shall provide necessary insurance coverage for such losses or shall assume full risk for replacement cost for its own materials and those of all sub-consultants.

e. IF ANY ARCHITECTURAL, ENGINEERING, DESIGN, INSPECTION OR PLANNING SERVICES ARE RENDERED, INCLUDING APPROVAL OF SUCH ACTIVITIES OF OTHERS, the following insurance is also required: Professional Liability\Errors and Omissions coverage appropriate to the profession with limits of at least $5,000,000.00 per claim Such coverage shall contain a retroactive date not later than the effective date of the Consultant's services in relation to this Agreement and shall contain, an agreement to maintain identical insurance, covering incidents occurring or claims made, for a period of three (3) years after substantial completion of the project.

2. General Insurance Provisions:

a. All policies of insurance shall be underwritten by companies licensed to do business in the State of Maryland.

b. The Consultant shall assure that all sub-consultants carry identical coverage as shown above, either individually or as an additional insured on the policies of the Consultant. Exceptions may be made only with the approval of the County.

c. The Consultant and all sub-consultants not named on the policies of the Consultant shall purchase commercial insurance for the coverages listed above. Approval for deductibles higher than $100,000 for the liability policies must be obtained from the County.

d. The purchase of insurance does not relieve the Consultant of any obligations assumed under this Agreement.

e. Monies to become due the Consultant under this Agreement may be retained by the County as may be considered necessary until all suits or claims for damages have been settled or until Consultant furnishes to the County satisfactory evidence of insurance coverage with respect to such suits or claims.

f. The Consultant shall not commence work under the Agreement until satisfactory evidence of all required coverage is received by the County. Further, the Consultant shall not reduce or cancel or change any of the required coverages without 30-day notice of such change to the County. Failure to maintain required insurance shall be viewed as a material breach of the Agreement by the Consultant. Upon notification by the County that required coverage has lapsed for the Consultant or any of its sub-consultants, the County shall have the right to purchase such insurance and the Consultant shall be responsible for the payment of any applicable insurance premiums.

ARTICLE 23. SUBCONTRACTING OR ASSIGNMENT

The benefits and obligations hereunder shall inure to and be binding upon the parties hereto and their respective successors, provided any such successor to the Consultant, whether such successor be an individual, a partnership or a corporation, is acceptable to the County, and neither this Agreement nor the services to be performed thereunder shall be subcontracted, or assigned or otherwise disposed of, either in whole or in part, except with the prior written consent of the Department.

ARTICLE 24. DELAYS AND EXTENSIONS OF TIME

Consultant agrees to prosecute the work continuously and diligently and no charges or claims for damages shall be made by him for any delays or hindrances, from any cause whatsoever during the progress of any portion of the services specified in this Agreement, unless expressly stated elsewhere in the Agreement Documents. Such delays or hindrances, if any, may be compensated for by an extension of time for such reasonable period as the County may decide. Time extensions will be granted only for excusable delays such as delays beyond the control and without the fault or negligence of Consultant.

Consultant must notify the County in writing upon discovery of an excusable delay with documentation concerning the cause(s) for delay. Any delay prior to notification shall not be considered excusable delay.

Consultant shall not be responsible for delay which may be occasioned by actions which a professional could not reasonably foresee but shall be responsible for those which would have been avoided by the exercise of usual and customary professional care. Consultant shall not be held liable for any failure to perform this Agreement within the time limitations if such failure arises out of causes beyond the control and without the fault or negligence of Consultant. Such causes include: Acts of God or of the public enemy; fires, floods; epidemics and quarantine restrictions; but in every case, the failure to perform must be beyond the control and without the fault or negligence of Consultant. However, Consultant shall only be excused if written notification of the delay is received no later than ten (10) days from the beginning of an excusable delay under this Article, and the County ascertains that any failure to perform is excusable under this Article. Except as provided in this Article, the County's contractual rights and remedies in the event of a breach shall remain as provided by this Agreement and applicable law.

ARTICLE 25. CHANGES, ALTERATIONS OR MODIFICATIONS IN THE SERVICES, ADDITIONAL SERVICES

The County shall have the right, at its discretion, to change, alter or modify the services provided for in this Agreement and such changes, alterations or modifications may be made even though it will result in an increase or decrease, or addition to, the services of Consultant or in the contract cost thereof. Such changes, alteration or modification to the services provided for in this Agreement shall be made by written change orders to this Agreement.

Any such change, alteration or modification that either separately or in combination results in a change in the scope of services or an adjustment in the amount payable to Consultant shall be processed by written change order requisition and is effective only when the change order to the purchase order is issued by the County.

Any additional services performed shall be paid in accordance with unit prices set forth in the proposal or, if not covered by unit prices, in accordance with the additional service rates, with multiplier, as set forth in the Contract Documents ("Rate Schedule"). In the event that the scope of any work based upon a lump sum is reduced, any such lump sum reduction shall be based upon the prices set forth in Exhibit B for the particular activity involved or, at the County's option, upon the rates and multipliers as described in the Rate Schedule applied to the breakdown of tasks described herein. As to any lump sum item, Consultant shall submit to the County, prior to the start of the work, a breakdown of the tasks involved in each lump sum item and hours by discipline estimated to be used by Consultant on each task. At the County's option such listing may be the basis for reductions to Consultant's fee for reductions in scope not covered by unit price items.

It is assumed that where development of a design is contemplated by this Agreement, Consultant's work leading to final contract documents is normally an evolutionary process and changes occurring as a result of the County's review and participation in the process will not be considered as a change in scope and the basis for any additional compensation.

No additional services shall be performed by Consultant without prior notice to the County that the activity in question is considered to be an additional service by Consultant, together with a proposed fee adjustment. The County shall issue notice to proceed for the additional services. No additional services shall be paid for without such prior notice to the County and issuance of the County's Notice to Proceed. In the event the amount of or fact of additional services is subject to dispute, Consultant shall promptly proceed to perform the work subject to the dispute resolution provisions of this Agreement. Absent any dispute, payment shall be made upon satisfactory completion of

said additional services. Payment shall be made upon satisfactory completion of any appropriate additional service and submission of additional service itemization on the application for payment.

Consultant shall not be responsible for payment for structural, mechanical, chemical and other laboratory tests, inspections and reports as required by law that are not otherwise called for in this Agreement.

Consultant shall not be responsible for payment for necessary permits, licenses, approvals, easements, assessments, and charges required for the construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

ARTICLE 26. AVAILABILITY OF DATA

Each party hereto shall make available to the other party, without cost, all non-proprietary technical data under its control reasonably necessary to the performance of the services required under this Agreement.

ARTICLE 27. OWNERSHIP OF DOCUMENTS AND RELEASE OF DATA

Consultant agrees that all data including but not limited to reports, drawings, studies, specifications, estimates, maps, photographs and computations prepared by or for him under the terms of this Agreement shall at any time during the performance of the services, or upon termination, be made available to the County upon request by the County and shall become and remain the property of the County upon termination or completion of the services. The County shall have the right to use same without restriction or limitation and without compensation to Consultant other than that provided in the Agreement.

The type and quantity of work product or data to be provided by Consultant as the product of this effort is defined in Exhibit A, and the County reserves the right to use, duplicate and disclose this data, in whole or in part, in any manner for any purpose whatsoever and to authorize others to similarly do so. Consultant shall not release the results of any study or any reports or other material pertaining to it without the express written consent of the County except to comply with appropriate state and federal requirements; and in such instances shall consult with the County prior to so doing. Further, materials approved for release by Consultant cannot be distributed for profit.

ARTICLE 28. DISSEMINATION OF INFORMATION - CONFIDENTIALITY

During the term of this Agreement, the Consultant shall not release any information related to the services or performance of the services under this Agreement nor publish any final reports or documents without the prior written approval of the County.

ARTICLE 29. SANCTIONS UPON IMPROPER ACTS

If Consultant, or any of its officers, partners, principals, or agents, or if an employee of Consultant acting with its acquiescence, is convicted of a crime arising out of or in connection with the procurement of this Agreement or the services or any payment under it, the Agreement may be terminated as provided in Article 10. In the event of a conviction, Consultant shall be liable for the refund of all fee paid under the Agreement. The rights and remedies set forth herein shall be in addition to, and the exercise thereof shall in no way be considered or construed as a waiver of, any other rights or remedies granted or available to the County.

ARTICLE 30. REPRESENTATIONS AND RESPONSIBILITY OF CONSULTANT

A. Consultant shall perform the services with that standard of care, skill, and diligence normally provided by a Consultant, Architect or Engineer in the performance of service similar to the services hereunder.

B. Consultant represents and agrees that it is an experienced firm having the appropriately licensed personnel in sufficient numbers with the ability and skill necessary to perform all of the services required under this Agreement in connection with the design and/or construction and/or supervision of a project having the scope and complexity of the project contemplated herein; that it has the

capacities and resources necessary to perform its obligations hereunder; and that it is fully familiar with all laws, rules, ordinances and regulations, state, federal or county which are applicable to all work required by or which may be ordered under the Contract Documents. This includes appropriate local ordinances, building codes of city, county, state and federal authorities applicable to the project, local sanitary laws and the rules and regulations and appropriate orders and interpretations by governing public authority of such requirements, laws, rules and regulations in effect at the time of commencement of services on the Project, and that all drawings, specifications and other documents prepared by Consultant shall be prepared in accordance with and shall accurately reflect and incorporate appropriate laws, rules and regulations.

C. Consultant represents and agrees that drawings, specifications, reports and other documents prepared by it pursuant to this Agreement shall be complete and functional for the purposes intended and, except as to any deficiencies which are due to causes beyond the control of Consultant, Consultant further agrees that if any construction project is built in accordance with any such document it shall be structurally sound and complete and a properly functioning facility suitable for the purpose for which it is intended.

D. Notwithstanding any review, approval, acceptance or payment by the County for Consultant's services, Consultant shall be and remain responsible for professional and technical accuracy of its work, design, drawings, specifications and other materials furnished by Consultant under this Agreement.

E. If Consultant fails to perform the services, or any part of the services, in conformance with the standard set forth in Paragraph A above, and such failure is made known to Consultant within two years after expiration of this Agreement, it shall, if required by the County perform at its own expense and without additional cost to the County, those services necessary for the correction of any deficiencies or damage resulting, in whole or in part, from Consultant's failure. This obligation is in addition to and not in substitution for any other remedy available to the County.

F. Consultant shall be required to furnish, upon request by the County, proof that it has the financial capacity to provide the services and that it is financially able -- through its own resources or through a qualified surety -- to protect the County from errors and omissions that might arise from direct performance of the services or the performance of the services by third parties relying on the completed design or work product.

G. If applicable, the Contractor has complied with Sections 14-101 through 14-108 of the Election Law Article of the Annotated Code of Maryland, which requires that every person that enters into, during any 24 month period, one or more contracts, leases, or other agreements with the State, a county, or an incorporated municipality, or their agencies, involving a cumulative consideration of at least $200,000 (Two Hundred Thousand Dollars) or more, shall file with the State Administrative Board of Election Laws a statement disclosing contributions to a candidate, or a series of such contributions, in a cumulative amount in excess of $500 made during the reporting period to a candidate for elective office in any primary or general election.

ARTICLE 31. CHOICE OF LAW

A. This Agreement was made and entered into in Maryland and is to be construed under the laws of Maryland. As to Consultant, this Agreement is intended to be a contract under seal and a specialty.

B. The laws of Maryland and Howard County shall govern the resolution of any issue arising in connection with this Agreement, including, but not limited, to all questions on the validity of this Agreement, the capacity of the parties to enter therein, any modification or amendment thereto and the rights and obligations of the parties hereunder.

ARTICLE 32. GOVERNING LAW

This Agreement shall be governed by and construed in accordance with the laws of the State of Maryland without regard to any choice of law principles that would dictate the laws of any other jurisdiction. The parties agree that the exclusive venue for any and all actions related hereto shall be the appropriate Federal or State court located within the State of Maryland.

ARTICLE 33. COMPLIANCE WITH LAWS

Consultant hereby represents and warrants:

A. That it is qualified to do business in the State of Maryland and that it will take such action as, from time to time hereafter, may be necessary to remain so qualified;

B. That it is not in arrears with respect to the payment of any monies due and owing the County, or any department or agency thereof, including but not limited to the payment of taxes and employee benefits, and that it shall not become so in arrears during the term of this Agreement;

C. That is shall comply with all Federal, State and local laws, ordinances and legally enforceable rules and regulations applicable to its activities and obligations under this Agreement.

D. That it shall procure, at its expense, all licenses, permits, insurance and governmental approvals, if any, necessary to the performance of its obligations under this Agreement.

E. That the facts and matters set forth hereafter in the "Affidavit" which is attached to this Agreement and made a part hereof are true and correct.

In addition to any other remedy available to the County, breach of any of the Paragraphs this Article shall, at the election of the County, be grounds for termination as provided for in Section IV, provided, however, that failure of the County to terminate this Agreement shall not be considered or construed as a waiver of such breach nor as a waiver of any rights or remedies granted or available to the County.

ARTICLE 34. COORDINATION WITH THE COUNTY

The respective requirements of County agencies shall be incorporated into the project to assure their concurrence and where required, their written approval of the development of the construction documents. The County will coordinate Consultant's request for specific information available from County agencies.

ARTICLE 35. PRECEDENCE OF DOCUMENTS

The order of precedence for interpretation of the services to be performed under this Agreement shall be this Agreement (including attached Exhibits) and subsequent change orders, if any.

ARTICLE 36. NOTICES AND WAIVER OF LEGAL RIGHTS

A. Failure to provide a required notice or to submit a claim or appeal within the time prescribed in this Agreement shall operate as a waiver of any such claim regardless of whether the County incurred or demonstrates any prejudice by the failure to give such notice or to submit such claim or appeal.

B. The waiver of any breach of the Contract Documents shall not be held to be a waiver of any other or subsequent breach. Any waiver by the County of a requirement of this Agreement or of any of the Contract Documents, including without limitation, any requirement that a notice be made in writing or that a notice or submission be made within a certain time, shall not operate as a waiver of the same or any other requirement of the Contract Documents, in any other circumstance or at any other time. The County need not incur or demonstrate prejudice in order to assert that a waiver of the Construction Manager's rights or claims results from the Construction Manager's failure to comply with any provision of this Agreement or any Contract Document, when this Agreement or the Contract Documents provide for any such waiver of any right or claim.

ARTICLE 37. ETHICS

A. The Contractor certifies that the officer of the corporation who is executing this Agreement has read and understands Attachment A, entitled Howard County Charter and Code References to Ethics, which contains the provisions of Section 901(a) of the Howard County Charter dealing with conflicts of interest and Section 22.204 of the Howard County Code dealing with conflicts of interest.

B. The Contractor certifies that he/she has (1) not been a party to an agreement to bid a fixed or uniform price; (2) not offered nor will offer any gratuity to any county official or employee; and (3) not violated any of the fair employment provisions of Code Sec. 4.119 Ethics and Fair Employment Practices detailed in Attachment A.

ARTICLE 38. MISCELLANEOUS

A. Nothing contained in this Agreement shall create a contractual relationship with or cause of action in favor of a third party against either the County or Consultant.

B. With the County's prior written approval, Consultant shall have the right to include representations of the project, including photographs, among Consultant's promotional and professional materials. Consultant's material shall not include the County's confidential or proprietary information if the County has previously advised Consultant in writing, of the specific information considered by the County to be confidential or proprietary. Whenever renderings, photographs of renderings, photographs of models, photographs, drawings, announcements, or other illustration or information of the Project are released for public information, advertisement or publicity, appropriate and proper credit shall be given to the County and Consultant.

C. This Agreement represents the entire and integrated Agreement between the County and Consultant and supersedes all prior negotiations, representations or agreements, either written or oral. This Agreement may be amended only by written instruments signed by appropriate County personnel and Consultant. The County and Consultant, respectively bind themselves, their partners, successors, assigns, and legal representatives to the other party to this Agreement and to the partners, successors, assigns and legal representatives of such other party with respect to all covenants of this Agreement.

D. This Agreement may be simultaneously executed in several counterparts, each of which shall be deemed to be an original having identical legal effect. This Agreement shall be construed to bind the parties hereto in accordance with the Constitution and laws of the State of Maryland.

IN WITNESS WHEREOF, the parties have caused this Agreement CA-XX-XXXX to be executed by affixing here on their respective seals and that he/she has authority to execute this Agreement on behalf of Consultant.

WITNESS: **[INSERT LEGAL NAME OF CONSULTANT]**

_____
Signature
Print Name: _____ By: _____
[Typed Name] (SEAL)
[Title]

WITNESS: **HOWARD COUNTY, MARYLAND**

_____ By: _____
Lonnie R. Robbins Calvin Ball (Date)
Chief Administrative Officer County Executive

APPROVED FOR LEGAL SUFFICIENCY
this_____day of_____, 20XX:

_____
Gary W. Kuc
County Solicitor

REVIEWING ATTORNEY:

_____
Type Name: _____
Title: _____

APPROVED FOR SUFFICIENCY OF FUNDS:

_____
Rafiu Ighile
Director, Department of Finance

DEPARTMENT APPROVED:

_____
Thomas Meunier
Director of Public Works

HOWARD COUNTY CHARTER AND CODE REFERENCES TO ETHICS

Charter Section 901. Conflict of Interest.

(a) **Prohibitions**. No officer or employee of the County, whether elected or appointed, shall in any manner whatsoever be interested in or receive any benefit from the profits or emoluments of any contract, job, work, or service for the County. No such officer or employee shall accept any service or thing of value, directly or indirectly, from any person, firm or corporation having dealings with the County, upon more favorable terms than those granted to the public generally, nor shall he receive, directly or indirectly, any part of any fee, commission or other compensation paid or payable by the County, or by any person in connection with any dealings with the County, or by any person in connection with any dealings with or proceedings before any branch, office, department, board, commission or other agency of the County. No such officer or employee shall directly or indirectly be the broker or agent who procures or receives any compensation in connection with the procurement of any type of bonds for County officers, employees or persons or firms doing business with the County. No such officer or employee shall solicit or accept any compensation or gratuity in the form of money or otherwise for any act or omission in the course of his public work; provided, however, that the head of any department or board of the County may permit an employee to receive a reward publicly offered and paid for, for the accomplishment of a particular task.

(b) **Rules of construction; exceptions by Council**. The provisions of this Section shall be broadly construed and strictly enforced for the purpose of preventing officers and employees from securing any pecuniary advantages, however indirect, from their public associations, other than their compensation provided by law.

In order, however, to guard against injustice, the Council may, by resolution, specifically authorize any County officer or employee to own stock in any corporation or to maintain a business in connection with any person, firm or corporation dealing with the County, if, on full public disclosure of all pertinent facts to the County Council by such officer or employee, the Council shall determine that such stock ownership or connection does not violate the public interest.

The County Council may, by ordinance, delegate to the Howard County Ethics Commission the power to make such determinations and to authorize the ownership or connection. Any ordinance which delegates this power shall provide for procedures including a public hearing, and shall establish criteria for determining when the ownership or connection does not violate the public interest.

(c) **Penalties**. Any officer or employee of the County who willfully violates any of the provisions of this Section shall forfeit his office. If any person shall offer, pay, refund or rebate any part of any fee, commission, or other form of compensation to any officer or employee of the County in connection with any County business or proceeding, he shall, on conviction, be punishable by imprisonment for not less than one or more than six months or a fine of not less than $100.00 or more than $1,000.00, or both. Any contract made in violation of this Section may be declared void by the Executive or by resolution of the Council. The penalties in this Section shall be in addition to all other penalties provided by law.

Code Section 4.119. Ethics and Fair Employment Practices.

(a) **Conflict of Interest**. Bidders, vendors, purchasers and county employees involved in the purchasing process shall be governed by the provisions of the Howard County Charter and Howard County law regarding conflict of interest. No vendor shall offer a gratuity to an official or employee of the county. No official or employee shall accept or solicit a gratuity.

(b) **Discouragement of Uniform Bidding**.

(1) It is the policy of the county to discourage uniform bidding by every possible means and to endeavor to obtain full and open competition on all purchases and sales.

(2) No bidder may be a party with other bidders to an agreement to bid a fixed or uniform price.

(3) No person may disclose to another bidder, nor may a bidder acquire, prior to the opening of bids, the terms and conditions of a bid submitted by a competitor.

(c) **Fair Employment Practices**

(1) Bidders, vendors and purchases may not engage in unlawful employment practices as set forth in Subtitle 2 "Human Rights" of Title 12 of the Howard County Code, Subtitle 6 of Title 20 of the State Government Article, Annotated Code of Maryland or Sections 703 and 704 of Title VII of the Civil Rights Act of 1964 as amended. Should any bidders, vendors or purchasers engage in such unlawful employment practices, they shall be subject to being declared irresponsible or being debarred pursuant to the provisions of this subtitle.

(2) The Howard County Office of Human Rights shall notify the county purchasing agent when any bidder is found, by a court of competent jurisdiction, to have engaged in any high unlawful employment practices.

(3) If any bidder has been declared to be an irresponsible bidder for having engaged in an unlawful employment practice and has been debarred from bidding pursuant to this subtitle, the Howard County Office of Human Rights shall review the employment practices of such bidder after the period of debarment has expired to determine if violations have been corrected and shall, within 30 days, file a report with the county purchasing agent informing the agent of such corrections before such bidder can be declared to be a responsible bidder by the County Purchasing agent.

(4) Payment of subcontractors. All contractors shall certify in writing that timely payments have been made to all subcontractors supplying labor and materials in accordance with the contractual arrangements made between the contractor and the subcontractors. No contractor will be paid a second or subsequent progress payment or final payment until such written certification is presented to the county purchasing agent.

Code Section 22.204. - Prohibited Conduct and Interests.

(a) **Participation Prohibitions.**

(1) Except as permitted by Commission regulation or opinion, an official or employee may not participate in:

(i) Except in the exercise of an administrative or ministerial duty that does not affect the disposition or decision of the matter, any matter in which, to the knowledge of the official or employee, the official or employee or a qualified relative of the official or employee has an interest.

(ii) Except in the exercise of an administrative or ministerial duty that does not affect the disposition or decision with respect to the matter, any matter in which any of the following is a party:

a. A business entity in which the official or employee has a direct financial interest of which the official or employee may reasonably be expected to know;

b. A business entity for which the official, employee, or a qualified relative of the official or employee is an officer, director, trustee, partner, or employee;

c. A business entity with which the official or employee or, to the knowledge of the official or employee, a qualified relative is negotiating or has any arrangement concerning prospective employment;

d. If the contract reasonably could be expected to result in a conflict between the private interests of the official or employee and the official duties of the official or employee, a business entity that is a party to an existing contract with the official or employee, or which, to the knowledge of the official or employee, is a party to a contract with a qualified relative;

e. An entity, doing business with the County, in which a direct financial interest is owned by another entity in which the official or employee has a direct financial interest, if the official or employee may be reasonably expected to know of both direct financial interests; or

f. A business entity that:

1. The official or employee knows is a creditor or obligee of the official or employee or a qualified relative of the official or employee with respect to a thing of economic value; and

2. As a creditor or obligee, is in a position to directly and substantially affect the interest of the official or employee or a qualified relative of the official or employee.

(2) A person who is disqualified from participating under paragraph 1. of this subsection shall disclose the nature and circumstances of the conflict and may participate or act if:

(i) The disqualification leaves a body with less than a quorum capable of acting;

(ii) The disqualified official or employee is required by law to act; or

(iii) The disqualified official or employee is the only person authorized to act.

(3) The prohibitions of paragraph 1 of this subsection do not apply if participation is allowed by regulation or opinion of the Commission.

(b) **Employment and Financial Interest Restrictions.**

(1) Except as permitted by regulation of the commission when the interest is disclosed or when the employment does not create a conflict of interest or appearance of conflict, an official or employee may not:

(i) Be employed by or have a financial interest in any entity:

a. Subject to the authority of the official or employee or the County agency, board, commission with which the official or employee is affiliated; or

b. That is negotiating or has entered a contract with the agency, board, or commission with which the official or employee is affiliated; or

(ii) Hold any other employment relationship that would impair the impartiality or independence of judgment of the official or employee.

(2) The prohibitions of paragraph (1) of this subsection do not apply to:

(i) An official or employee who is appointed to a regulatory or licensing authority pursuant to a statutory requirement that persons subject to the jurisdiction of the authority be represented in appointments to the authority;

(ii) Subject to other provisions of law, a member of a board or commission in regard to a financial interest or employment held at the time of appointment, provided the financial interest or employment is publicly disclosed to the appointing authority and the Commission;

(iii) An official or employee whose duties are ministerial, if the private employment or financial interest does not create a conflict of interest or the appearance of a conflict of interest, as permitted and in accordance with regulations adopted by the Commission; or

(iv) Employment or financial interests allowed by regulation of the Commission if the employment does not create a conflict of interest or the appearance of a conflict of interest or the financial interest is disclosed.

(c) **Post-Employment Limitations and Restrictions.**

(1) A former official or employee may not assist or represent any party other than the County for compensation in a case, contract, or other specific matter involving the County if that matter is one in which the former official or employee significantly participated as an official or employee.

(2) For a year after the former member leaves office, a former member of the County Council may not assist or represent another party for compensation in a matter that is the subject of legislative action.

(d) **Contingent Compensation.** Except in a judicial or quasi-judicial proceeding, an official or employee may not assist or represent a party for contingent compensation in any matter before or involving the County.

(e) **Use of Prestige of Office.**

(1) An official or employee may not intentionally use the prestige of office or public position for the private gain of that official or employee or the private gain of another.

(2) This subsection does not prohibit the performance of usual and customary constituent services by an elected

official without additional compensation.

(f) **Solicitation and Acceptance of Gifts.**

(1) An official or employee may not solicit any gift.

(2) An official or employee may not directly solicit or facilitate the solicitation of a gift, on behalf of another person, from an individual regulated lobbyist.

(3) An official or employee may not knowingly accept a gift, directly or indirectly, from a person that the official or employee knows or has the reason to know:

(i) Is doing business with or seeking to do business with the County office, agency, board or commission with which the official or employee is affiliated;

(ii) Has financial interests that may be substantially and materially affected, in a manner distinguishable from the public generally, by the performance or nonperformance of the official duties of the official or employee;

(iii) Is engaged in an activity regulated or controlled by the official's or employee's governmental unit; or

(iv) Is a lobbyist with respect to matters within the jurisdiction of the official or employee.

(4) (i) Subsection (4)(ii) does not apply to a gift:

a. That would tend to impair the impartiality and the independence of judgment of the official or employee receiving the gift;

b. Of significant value that would give the appearance of impairing the impartiality and independence of judgment of the official or employee; or

c. Of significant value that the recipient official or employee believes or has reason to believe is designed to impair the impartiality and independence of judgment of the official or employee.

(ii) Notwithstanding paragraph (3) of this subsection, an official or employee may accept the following:

a. Meals and beverages consumed in the presence of the donor or sponsoring entity;

b. Ceremonial gifts or awards that have insignificant monetary value;

c. Unsolicited gifts of nominal value that do not exceed $20.00 in cost or trivial items of informational value;

d. Reasonable expenses for food, travel, lodging, and scheduled entertainment of the official or the employee at a meeting which is given in return for the participation of the official or employee in a panel or speaking engagement at the meeting;

e. Gifts of tickets or free admission extended to an elected official to attend a charitable, cultural, or political event, if the purpose of this gift or admission is a courtesy or ceremony extended to the elected official's office;

f. A specific gift or class of gifts that the Commission exempts from the operation of this subsection upon a finding, in writing, that acceptance of the gift or class of gifts would not be detrimental to the impartial conduct of the business of the County and that the gift is purely personal and private in nature;

g. Gifts from a person related to the official or employee by blood or marriage, or any other individual who is a member of the household of the official or employee; or

h. Honoraria for speaking to or participating in a meeting, provided that the offering of the honorarium is not related, in any way, to the official's or employee's official position.

(g) **Disclosure of Confidential Information.** Other than in the discharge of official duties, an official or employee may not disclose or use confidential information, that the official or employee acquired by reason of the official's or employee's public position and that is not available to the public, for the economic benefit of the official or employee or that of another person.

(h) **Participation in Procurement.**

(1) An individual or a person that employs an individual who assists a County, agency or unit in the drafting of specifications, an invitation for bids, or a request for proposals for a procurement, may not submit a bid or proposal for that procurement, or assist or represent another person, directly or indirectly, who is submitting a bid or proposal for the procurement.

(2) The Commission may establish exemptions from the requirements of this section for providing descriptive literature, sole source procurements, and written comments solicited by the procuring agency.

APPENDIX C

AFFIDAVIT

Must be signed by an officer of the company (President, CEO, Vice President, etc.)

Contractor _____

Address _____

I, _____, the undersigned, _____ of the above named
(Print Signer's Name) (Title)

Contractor does declare and affirm this _____ day of _____, _____, that I hold the aforementioned office
(Month) (Year)
in the above named Contractor and I affirm the following:

AFFIDAVIT I

The Contractor, his Agent, servants and/or employees, have not in any way colluded with anyone for and on behalf of the Contractor or themselves, to obtain information that would give the Contractor an unfair advantage over others, nor have they colluded with anyone for and on behalf of the Contractor, or themselves, to gain any favoritism in the award of the contract herein.

AFFIDAVIT II

No officer or employee of Howard County, whether elected or appointed, has in any manner whatsoever, any interest in or has received prior hereto or will receive subsequent hereto any benefit, monetary or material, or consideration from the profits or emoluments of this contract, job, work or service for the County, and that no officer or employee has accepted or received or will receive in the future a service or thing of value, directly or indirectly, upon more favorable terms than those granted to the public generally, nor has any such officer or employee of the County received or will receive, directly or indirectly, any part of any fee, commission or other compensation paid or payable to the County in connection with this contract, job, work, or service for the County, excepting, however, the receipt of dividends on corporation stock.

AFFIDAVIT III

Neither I, nor the Contractor, nor any officer, director, or partners, or any of its employees who are directly involved in obtaining contracts with Howard County have been convicted of bribery, attempted bribery, or conspiracy to bribe under the laws of any state, or of the federal government for acts of omissions committed after July 1, 1977.

AFFIDAVIT IV

Neither I, nor the Contractor, nor any of our agents, partners, or employees who are directly involved in obtaining contracts with Howard County have been convicted within the past 12 months of discrimination against any employee or applicant for employment, nor have we engaged in unlawful employment practices as set forth in Section 12.200 of the Howard County Code, or Subtitle 6 of Title 20 of the State Government Article, Annotated Code of Maryland or, of Sections 703 and 704 of Title VII of the Civil Rights Act of 1964 as amended.

AFFIDAVIT V

The Contractor:

i. Is not currently identified on the list created by the Maryland State Board of Public Works as a person engaging in investment activities in Iran as described in Section 17-702 of the *Maryland State Finance and Procurement Article* ; or

ii. Is not currently engaging in investment activities in Iran as described in Section 17-702 of the *Maryland State Finance and Procurement Article*.

If the person is unable to make the certification, it will provide the County, a detailed description of the Contractor's investment activities in Iran.

AFFIDAVIT VI

If applicable, the Contractor has complied with Sections 14-101 through 14-108 of the Election Law Article of the Annotated Code of Maryland, which requires that every person that enters into, during any 24 month period, one or more contracts, leases, or other agreements with the State, a county, or an incorporated municipality, or their agencies, involving a cumulative consideration of at least $200,000 or more, shall file with the State Administrative Board of Election Laws a statement disclosing contributions to a candidate, or a series of such contributions, in a cumulative amount in excess of $500 made during the reporting period to a candidate for elective office in any primary or general election.

I do solemnly declare and affirm under the penalties of perjury that the contents of the foregoing affidavits are true and correct to the best of my knowledge, information and belief.

_____
Signature

_____
Printed Name

_____
Title

Rev. 01/29/2020

APPENDIX D

TECHNICAL SUBMITTAL SIGNATURE COVER PAGE

ELLICOTT CITY NORTH TUNNEL FINAL DESIGN SERVICES

TO: HOWARD COUNTY OFFICE OF PROCUREMENT AND CONTRACT ADMINISTRATION
6751 Columbia Gateway Drive, Suite 226
Columbia, MD 21046

The undersigned agrees to furnish and deliver the above services in accordance with the specifications issued for same, and subject to all terms, conditions, and requirements in the solicitation, and in the various solicitation documents:

COMPANY NAME:_____

FEDERAL TAX IDENTIFICATION NO./SOCIAL SECURITY NO.:_____

ADDRESS:_____

_____

TELEPHONE_____ E-MAIL ADDRESS _____

REPRESENTATIVE'S NAME: _____

Provide the name and title of the person with legal authority to sign on behalf of the Contractor. If the title of the individual is not "President" or "Vice President", provide verification of the signatory authority with your submittal.

NAME OF COMPANY SIGNATORY (Printed): _____

TITLE OF COMPANY SIGNATORY (Printed): _____

Howard County prefers to email Purchase Orders when possible, please provide an **EMAIL ADDRESS FOR RECEIPT OF PURCHASE ORDERS**:_____

Is the company a Minority-, Women-, or Disabled-Owned Business Enterprise? ☐ YES ☐NO
If yes, indicate the type of minority ownership:
☐ African American ☐ Asian American ☐ Disabled ☐ Eskimo
☐ Female ☐ Hispanic ☐ Native American

Is the company certified? If yes, indicate the certification(s) held:
☐ Howard County Government ☐ MD Dept. of Transportation ☐ City of Baltimore ☐ Other

Certification Number(s) and Expiration Date(s) _____

Does the company have a written non-discrimination policy (i.e.: race, creed, religion, handicap, color, sex, national origin, age, occupation, marital status, political opinion, sexual orientation, gender identity/expression, personal appearance, familial status, source of income)? ☐ YES ☐ NO
(The County reserves the right to request such documentation, if desired, at a later date.)

Payment Terms: (The payment terms shall be considered net 30 days unless otherwise indicated.) _____

ACKNOWLEDGEMENT OF ADDENDA: The company shall identify by number and date the following addenda and agree that the prices shown in the bid reflect all changes made by addenda. In addition to acknowledging addenda here, the actual addenda must be signed and returned with the bid. To check for addenda go to: https://www.howardcountymd.gov/Departments/County-Administration/Procurement-and-Contract-Administration

Number: _____ Date: _____ Number: _____ Date: _____
Number: _____ Date: _____ Number: _____ Date: _____

SIGNATURE _____ DATE: _____

PRINTED NAME _____ TITLE: _____

APPENDIX E

EQUAL BUSINESS OPPORTUNITY PARTICIPATION

NOTICE TO PRIME CONTRACTORS
15% SUBCONTRACTING GOAL ON CONTRACTS
VALUED AT $50,000 OR MORE

Howard County Code Section 4.122 established an Equal Business Opportunity program to foster overall equity and fairness to all citizens in relation to business enterprises conducting business with the County.

If a contract is $50,000 or more, the Prime Contractor shall make a good faith effort to comply with the Howard County Equal Business Opportunity (EBO) program's 15% subcontracting goal. The Prime Contractor shall make a good faith effort to obtain minority subcontractor participation even if the Prime Contractor has the capability to complete the work with its own workforce. Certified MBE/WBE/DBE prime contractors can count 100% of the work they self-perform on contracts with EBO subcontracting goals. The subcontracting goal percentage may vary if the contract is funded by a federal or state agency. Prime Contractors should submit the following completed *Equal Business Opportunity Subcontractor Participation Form* with the bid. Identify subcontractors prior to submitting the proposal. After contract award, changes in subcontractors require the written approval of the EBO Coordinator.

Possible areas of obtaining subcontracting participation include, but are not limited to, flagging services, hauling, copying and printing, and the purchase of materials used in performing the contract. Contractors may use minority, women or disabled business enterprises certified by Howard County, Maryland; the Maryland Department of Transportation; the City of Baltimore, Maryland; or another certifying entity in order to satisfy the 15% subcontracting goal. The website addresses for lists of minority businesses are:

https://www.howardcountymd.gov/Departments/County-Administration/Procurement-and-Contract-Administration
http://www.mdot.state.md.us/MBE_Program/index.html
http://cityservices.baltimorecity.gov/mwboo

Contractors should submit a completed *Equal Business Opportunity Subcontractor Participation Form* with the bid identifying each certified EBO firm they intend to use on the contract. However, if the EBO Subcontractor Participation Form is not submitted with the bid, the County may request EBO subcontractor participation of the successful contractor.

Contractors failing to achieve the Equal Business Opportunity Program goal following a good faith effort to obtain participation must complete the *Equal Business Opportunity Program Request for Subcontracting Waiver* and provide documentation of its good faith attempts to obtain EBO participation. The County will determine if the efforts made satisfy a good faith attempt. A waiver will only be considered in rare contracts after a determination that the Contractor has made a good faith effort and thoroughly documented the efforts. Contractors should submit the *Equal Business Opportunity Program Request for Subcontracting Waiver* with the bid. However, if the request for waiver form is not submitted with the bid, the County may obtain the request for waiver of the successful contractor.

If the County exercises its option to renew the contract, it is expected that the EBO subcontracting goal will be met for each subsequent contract year when the contract amount is $50,000.00 or more. Questions relating to the EBO program shall be directed to the EBO Coordinator 410-313-6370.

PRIME CONTRACTORS' COMPLIANCE OF EBO SUBCONTRACTOR PARTICIPATION

Prime Contractors that are awarded County contracts shall maintain adequate records of EBO participation on County contracts. The County may require that prime contractors report whether or not they met the proposed EBO subcontracting goal, so that the County can track compliance of EBO participation on County contracts.

Revised 12/05/2017

HOWARD COUNTY. MARYLAND

EQUAL BUSINESS OPPORTUNITY (EBO)

SUBCONTRACTOR PARTICIPATION FORM

COUNTY USE ONLY

EBO APPROVAL

CONTRACT TITLE:		
SOLICITATION #	**CAPITAL PROJECT #**	**CONTRACT / PO #**
TERM:	**RENEWAL #**	**AMOUNT $**

PRIME CONTRACTOR NAME:			
ADDRESS:			**PHONE:**
EBO STATUS (Y/N):	***EBO TYPE:**	**CERTIFYING AGENCY:**	**CERTIFICATION #**

PRIME CONTRACTOR SHOULD LIST ALL EBO SUBCONTRACTORS / SUBCONSULTANTS / SUPPLIERS

INSTRUCTIONS FOR COMPLETING THIS FORM

- Complete the section below identifying each certified EBO firm (Minority (MBE), Woman (WBE), and Disabled (DBE) Business Enterprises) you intend to use on this project. Attach additional sheets if more than two (2) subcontractors.
- This form represents the contractor's commitment to utilize the named EBO firms at the percentages indicated should the contract be awarded to the contractor. This form should accompany your bid or proposal.
- ***EBO Types:** AA (African American), ASA (Asian American), HIS (Hispanic American), NA (Native American), FEM (Female), DIS (Disabled)

SUBCONTRACTOR NAME:						
ADDRESS:						**PHONE:**
CONTACT REPRESENTATIVE:					**EMAIL:**	
***EBO TYPE (**Check One)	☐ **AA**	☐ **ASA**	☐ **HIS**	☐ **NA**	☐ **FEM**	☐ **DIS**
CERTIFYING AGENCY:		**CERTIFICATION #**			**EBO PARTICIPATION %**	
DESCRIPTION OF WORK:					**EBO PARTICIPATION $**	

SUBCONTRACTOR NAME:						
ADDRESS:						**PHONE:**
CONTACT REPRESENTATIVE:					**EMAIL:**	
***EBO TYPE (**Check One)	☐ **AA**	☐ **ASA**	☐ **HIS**	☐ **NA**	☐ **FEM**	☐ **DIS**
CERTIFYING AGENCY:		**CERTIFICATION #**			**EBO PARTICIPATION %**	
DESCRIPTION OF WORK:					**EBO PARTICIPATION $**	

PRINTED NAME EMAIL

SIGNATURE (VENDOR OFFICIAL) TITLE DATE

APPENDIX F
Veteran-Owned Business Enterprise Program Form

In accordance with Section 4.130 of the Howard County Code, it is the policy of Howard County Government to encourage increased participation by Veteran-Owned Business Enterprises in the procurement of all goods and services through all solicitations by the County. The Veteran-Owned Business Enterprise (VOBE) program includes an overall aspirational goal of 1% of the County's total dollar value of procurement contracts to be made directly or indirectly with Veteran-Owned Business Enterprises. Participation may be either on a direct basis in response to this solicitation or on a subcontractor basis.

For the purposes of the Veteran-Owned Business Enterprise Program, a Veteran-Owned Business Enterprise (VOBE) is defined as a business enterprise that is verified by the Center for Verification and Evaluation of the United States Department of Veterans Affairs as a Veteran-Owned Small Business Enterprise. To search the database of business enterprises that are verified by the Center for Verification and Evaluation of the United States Department of Veterans Affairs visit https://www.vip.vetbiz.va.gov.

Complete this form and return it with your response to the solicitation.

Complete Part 1 below if: Supplier is verified by the Center for Verification and Evaluation of the United States Department of Veterans Affairs as a Veteran-Owned Small Business Enterprise.

Complete Part 2 below if: Supplier is proposing to subcontract with a business that is verified by the Center for Verification and Evaluation of the United States Department of Veterans Affairs as a Veteran-Owned Small Business Enterprise.

Complete Part 3 below if: Supplier proposes NO Veteran-Owned Business Enterprise participation.

Check as applicable

1. ☐ **Veteran-Owned Business Enterprise Certification:**
Supplier is verified by the Center for Verification and Evaluation of the United States Department of Veterans Affairs

2. ☐ **Veteran-Owned Business Enterprise Subcontract Participation:**
Supplier proposes to subcontract with a business that is verified by the Center for Verification and Evaluation of the United States Department of Veterans Affairs in the contract as described below:

Name(s) of VOBE Subcontractor(s): _____
_____
Description of Work: _____
Percentage of Participation: _____ %

3. ☐ **NO Veteran-Owned Business Enterprise Subcontract Participation Proposed.**

Name of company: _____
Printed name: _____ Title: _____
Authorized signature: _____ Date: _____
Email: _____ Phone: _____

Appendix G

Basics of the Howard County Living Wage Legislation

In 2007, the Howard County Council passed legislation requiring a minimum "living wage" for employees of certain contractors and subcontractors of Howard County. A Contractor that is defined as a "Covered Employer" under Howard County Code Section 4.122A shall pay each employee an hourly rate sufficient to at least equal 125% of the federal poverty guidelines for a family of four individuals calculated on the basis of a 40-hour work week for 52 weeks.

Howard County Code Sec. 4.122A applies to service contracts estimated to be over $100,000.00 per year. The code does not apply to commodities contracts, contractors who employ fewer than 5 employees during the contract term, public entities, non-profit organizations, or contracts awarded under sole source, emergency, or expedited procedures. Other contractors may also be exempt; see the complete list of exemptions in Section 1 on the front of this form.

The living wage requirements do not apply to an employee:

- who performs no measurable work related to any contract with the County
- who participates in a government-operated or government-sponsored program that restricts the earnings of or wages paid to employees to a level below the wage required under the law
- who participates for not longer than 120 days in a calendar year in a government-operated or government-sponsored summer youth employment program
- for whom a different wage rate is expressly set in a collective bargaining agreement, or
- for whom a higher wage is required by a federal, state, or County law.

This form serves as written certification to the County of your firm's intent to comply with the County's wage requirements during this term and any subsequent renewals. A Covered Employer shall not subdivide a contract; pay an employee through a third party; or treat an employee as a subcontractor or independent Contractor to avoid the imposition of any requirement under this law. Failure to comply with this requirement at any time during the initial term and subsequent renewals may be sufficient cause for termination for default. A violation of this law is a Class A civil offense; in addition to a fine, the County may suspend or debar the violator under Howard County Code Sec. 4.117.

Current Living Wage Rate in Howard County
As of January 13, 2021, the Living Wage Rate is **$15.93 per hour**.

How the Living Wage Rate is Calculated
The Howard County Living Wage Rate is calculated by taking 125% of the Federal Poverty Guideline for a family of 4, then using this amount to determine the hourly rate based on 40 hours/week. On January 13, 2021, the Federal HHS Poverty Guideline was published as $26,500 for a family of 4 (see https://aspe.hhs.gov/poverty-guidelines).

125% of $26,500 = $33,125.00 $33,125.00 ÷ 52 weeks ÷ 40 hrs./week = **$15.93 per hour**

This hourly rate must be paid to employees (full-time or part-time) during the time the employees actually provide services to the County. The current Living Wage remains in effect until new federal poverty guidelines are published, which is usually the following January. If there is a change, the Office of Procurement and Contract Administration will attempt to notify all current contractors via email using the email address provided on this form. The current rate is posted on our website at https://www.howardcountymd.gov/Departments/County-Administration/Procurement-and-Contract-Administration. It is the contractor's responsibility to ascertain the current rate.

Since the rate is subject to change annually, you must ensure that your bid pricing is sufficient to cover the cost of any increases during the term of the contract, including subsequent renewals. All prices shall take the current wage rate, and subsequent increases in the wage rate, if any, into account and there shall be no unit price adjustment for future wage rate increases during the initial term of this agreement and any subsequent renewals thereof. Future wage rate increases are hereby defined as any new rates approved by the County that take effect after and supersede the rate shown in this solicitation.

If you have questions about the Living Wage Requirement or how to complete this form, please contact the Office of Procurement and Contract Administration at purchasing@howardcountymd.gov or 410-313-6370.

Howard County, Maryland Wage Rate Requirements for Service Contracts
Exemption Status Subtitle 1, Howard County Code Section 4.122A(b)(2)

Prime Contr.	Sub-Contr.	Section 1: Exemptions	Check all that apply, then continue to Section 2. If none of these statements apply to your company or the Subcontractor, check the last box in this section and continue to Section 2.
☐	☐		Contractor or Subcontractor employs fewer than 5 employees at any time during the contract term.
☐	☐		Contractor or Subcontractor received less than $100,000 from the County in the most recent 12-month period prior to the start date, and will be entitled to receive less than $100,000 from the County within the next 12-month period.
☐	☐		Contractor or Subcontractor is a nonprofit organization that has qualified for an exemption from federal income taxes under Section 501(c)(3) of the Internal Revenue Code.
☐	☐		Contractor or Subcontractor is expressly precluded from complying with Howard County Code Sec. 4.122A by the terms of any federal, state, or County law, federal or state contract or grant, and the contract falls within that preclusion.
☐	☐		Contractor or Subcontractor is a public entity.
☐	☐		Contractor or Subcontractor participates in a contract awarded under Howard County Code Secs. 4.110 (Sole Source), 4.111 (Emergency), or 4.112 (Expedited).
☐	☐		Contractor or Subcontractor is a regulated public utility.
☐	☐		Contract was awarded under a cooperative procurement with another government or organization of governments.

Check here ☐ if none of the above statements are applicable to your company or to the Subcontractor, then continue to Section 2.

Section 2: Certifications

- If you checked any exemptions in Section 1, skip this section and continue to Section 3.
- If you did not check any exemptions in Section 1, check each box in Section 2 that applies to your company, then complete Section 3 below.

I do hereby certify that I have read and understand the provisions of Section 4.122A of the Howard County Code, that I am an authorized representative of the Contractor named below, and that:

☐ As a "covered employer," the Contractor and all Subcontractors will comply with the County's Wage Rate Requirements for Service Contracts (Howard County Code Sec. 4.122A) and will pay all employees not exempt under the wage requirements, and who perform direct measurable work for the County, the applicable wage requirements at the time the work is performed. The Contractor will keep the records necessary to show compliance and will submit such records to the Purchasing Agent on request of the Purchasing Agent; and will publicize the requirements of this law to any employees who may be covered by the law. The Contractor's proposed pricing is sufficient to meet the current living wage rate requirements during the initial term of the agreement and any increases applicable to subsequent renewals.

☐ **If health insurance is provided to employees**, the per employee hourly cost of the premium for health insurance to an employee who provides services to the County that appears in the bid or proposal is correct.

Section 3: Contact Information

Provide your contact information in the space below, then sign and date this form and submit it with your bid.

Contractor Name _____ Vendor Federal ID Number _____

Address _____ Phone Number _____

_____ Email Address _____

Authorized Signature _____ Date _____

Print Name of Signatory _____ Title of Signatory _____

To be completed by the Buyer	Contract Title:		Buyer's Initials:
	Contract #:	Contract Term:	
	Capital Project No:	Renewal #:	

Rev. 01-13-21

APPENDIX H

HOWARD COUNTY, MARYLAND
OFFICE OF PROCUREMENT AND CONTRACT ADMINISTRATION
FOREIGN SERVICES DISCLOSURE FORM
FOR
CONSTRUCTION-RELATED SERVICES, ARCHITECTURAL SERVICES, ENGINEERING SERVICES AND ENERGY PERFORMANCE CONTRACT SERVICES OF $2 MILLION OR MORE

Section 12-111 of the Maryland State Finance and Procurement Article requires bidders to make certain disclosures regarding plans, at the time the bid is submitted, to perform any services under the contract outside the United States. This provision applies to: (1) construction-related services; (2) architectural services; (3) engineering services; or (4) energy performance contract services with an estimated value of $2 million or more. The provision requires bidders to disclose:

1. Whether the bidder or any contractor that the bidder will subcontract with to perform the contract has plans, at the time the bid is submitted, to perform any services required under the contract outside the United States; and

2. If the services under the contract are anticipated to be performed outside the United States;

   i. Where the services will be performed; and

   ii. The reasons why it is necessary or advantageous to perform the services outside the United States.

Indicate below whether or not the bidder has information to disclose.

[ ] The bidder has **no** plans, at the time the bid is submitted, to perform any services under the contract outside the United States.

[ ] The bidder has plans, at the time the bid is submitted, to perform services under the contract outside the United States.

   i. The services will be performed in the following location: _____

   ii. It is necessary or advantageous to perform the services outside the United States for the following reason(s): _____

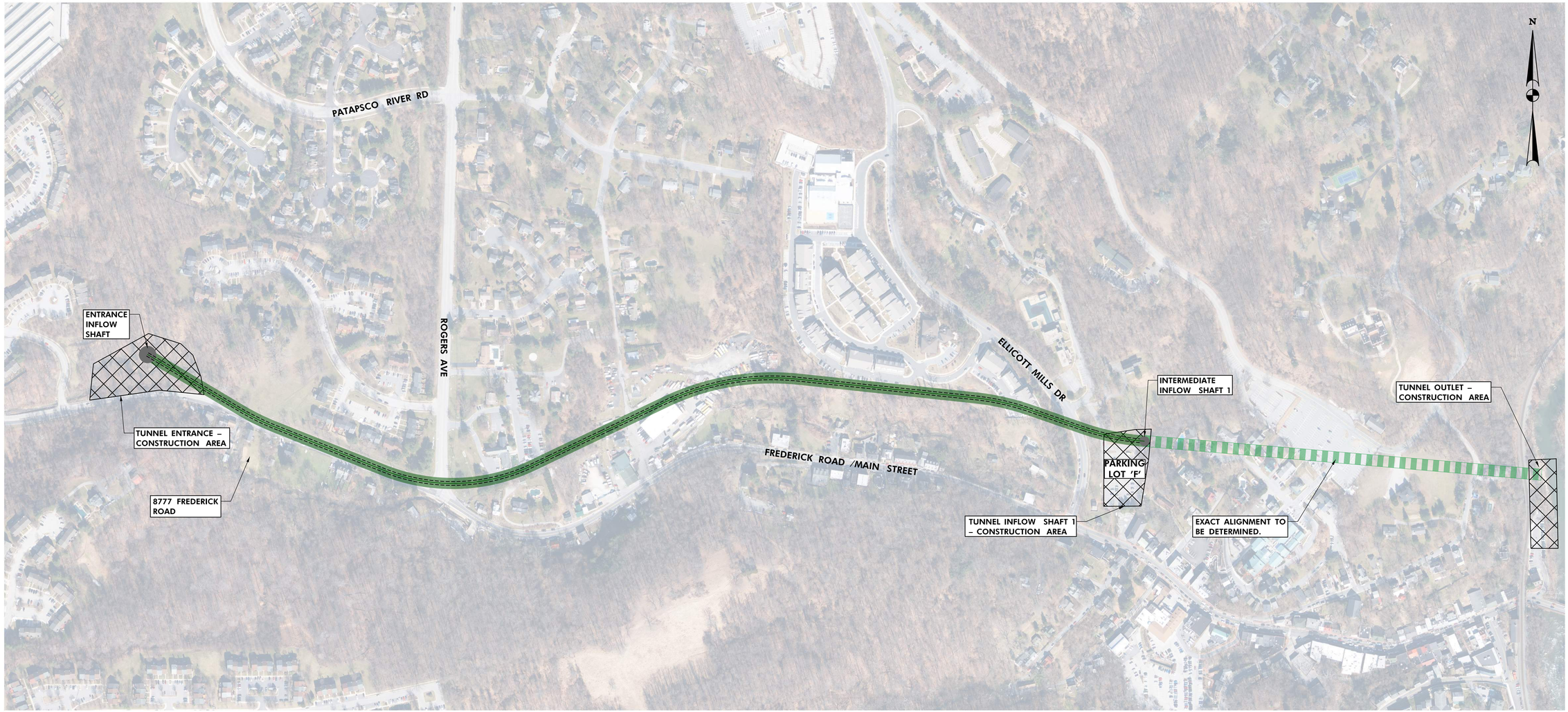
The contents of the disclosure form are true and correct to the best of my knowledge, information and belief.

_____ _____
Company Name (Bidder) Signature

_____ _____
Date Printed Name

_____
Title

Est. 09/25/2013



EXTENDED NORTH TUNNEL – OVERALL PLAN VIEW

400' 0 400' 800'

SCALE

LEGEND

ALTERNATIVE B ALIGNMENT

CONSTRUCTION AREA

DEPARTMENT OF PUBLIC WORKS
HOWARD COUNTY, MARYLAND

CHIEF, STORMWATER MANAGEMENT DIVISION DATE

McCORMICK TAYLOR
509 South Exeter Street
4th Floor
Baltimore, Maryland 21202
(410) 662-7400

Howard County MARYLAND
Storm Water Management Division
Bureau of Environmental Services
9801 Broken Land Parkway
Columbia, Maryland 21046
(410) 313–6444

DES: EZS
DRN: EZS
CHK: ADM
DATE: 12/07/20

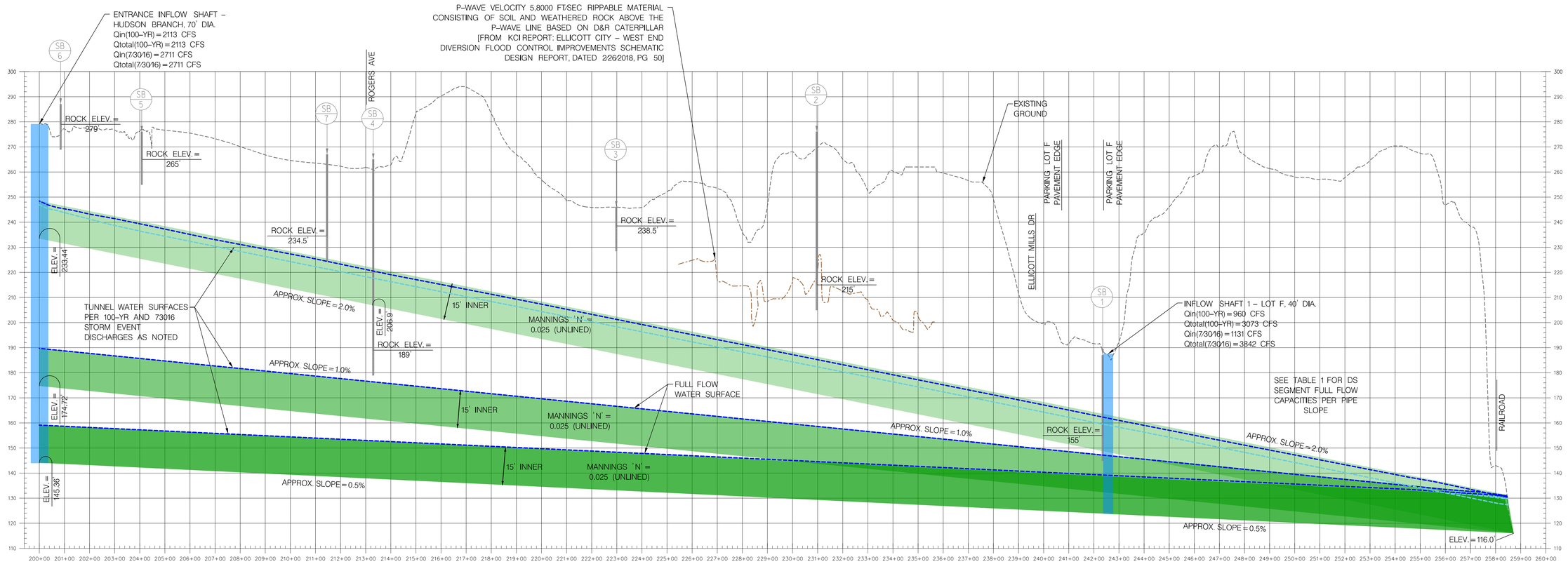
BY	NO.	REVISION	DATE

NORTH TUNNEL
PRELIMINARY DESIGN
CAPITAL PROJECT #C–0337
HOWARD COUNTY
HSCD# TBD

EXTENDED NORTH TUNNEL
OVERALL PLAN VIEW

SCALE 1" = 200'

SHEET 1 OF 1



NOTE:
ALL EXPLORATORY BORINGS ARE PROJECTED ONTO THE ALIGNMENT. BORINGS MAY APPEAR LOWER OR HIGHER THAN THE SHOWN EXISTING GRADE AS A RESULT. BORING LOCATIONS AND ROCK ELEVATIONS ARE APPROXIMATE.

ALTERNATIVE ALIGNMENT B (GREEN) [SOUTH] PROFILE

SCALE: HORIZONTAL: 1" = 200'
VERTICAL: 1" = 10'

73016 STORM WATER SURFACE
100–YR WATER SURFACE
P–WAVE VELOCITY 5,8000 FT/SEC RIPPABLE MATERIAL

OPTION B
OPTION B1
OPTION B2

TABLE 1:

US INV. (FT)	DS INV. (FT)	SLOPE (%) [L = 5,872']	FULL FLOW CAPACITY (CFS), OPEN CHANNEL TW CONDITION*	FULL FLOW CAPACITY (CFS), CONSTANT TW [134.49'] CONDITION**
145.36'	116	0.5	2000	1700
174.72'	116	1.0	2700	2500
233.44'	116	1.5	3900	3600

*VALUE TAKEN WHEN NORMAL DEPTH IS EQUAL TO DIAMETER OF PIPE. (FLOW CONDITION IS NOT TRULY FULL FLOW BUT IS LISTED AS 7–M2c.)
**VALUE TAKEN WHEN FULL FLOW CONDITION (4–FFf) IS FIRST MET, PRIOR TO NORMAL DEPTH BEING EQUAL TO PIPE DIAMETER.

DEPARTMENT OF PUBLIC WORKS
HOWARD COUNTY, MARYLAND

CHIEF, STORMWATER MANAGEMENT DIVISION DATE

McCORMICK TAYLOR
509 South Exeter Street
4th Floor
Baltimore, Maryland 21202
(410) 662-7400

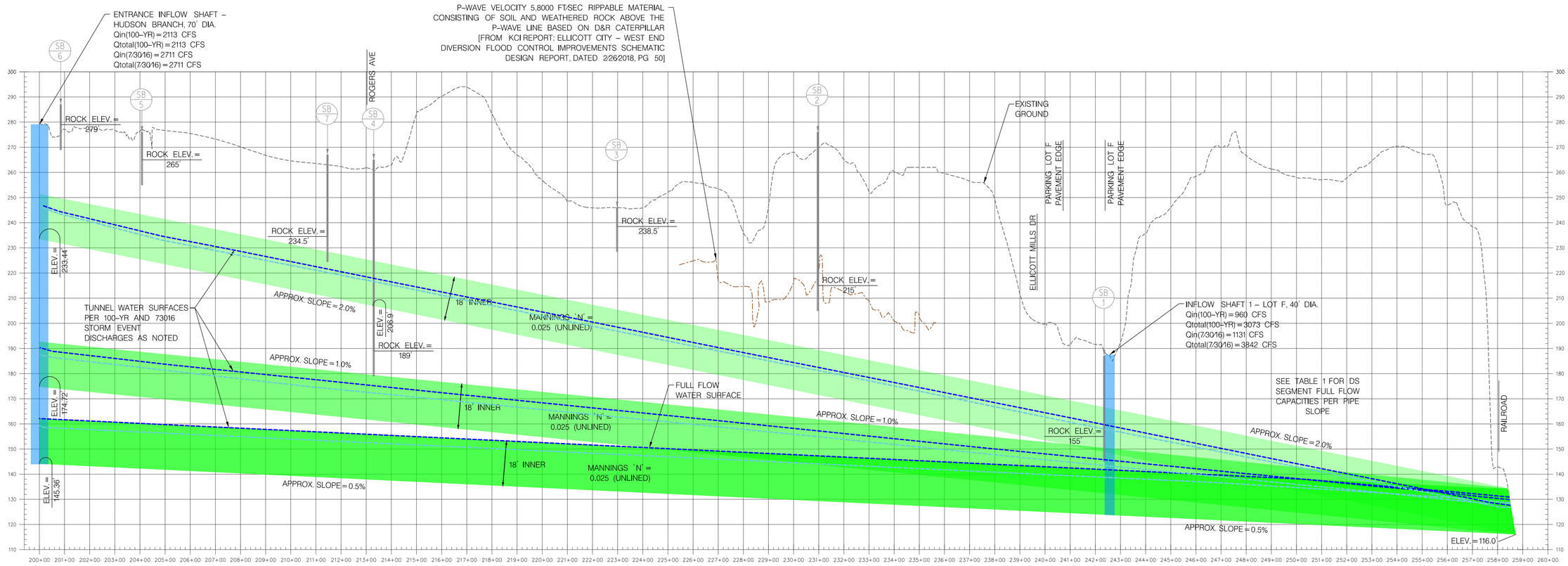
Howard County MARYLAND
Storm Water Management Division
Bureau of Environmental Services
9801 Broken Land Parkway
Columbia, Maryland 21046
(410) 313–6444

DES: EZS
DRN: EZS
CHK: ADM
DATE: 12/07/20

BY	NO.	REVISION	DATE

NORTH TUNNEL
PRELIMINARY DESIGN
CAPITAL PROJECT #C–0337
HOWARD COUNTY
HSCD# TBD
PROPOSED NORTH TUNNEL ALTERNATIVE ALIGNMENT B (GREEN) PROFILE

SCALE: AS SHOWN
SHEET: 2 OF 2



NOTE:
ALL EXPLORATORY BORINGS ARE PROJECTED ONTO THE ALIGNMENT. BORINGS MAY APPEAR LOWER OR HIGHER THAN THE SHOWN EXISTING GRADE AS A RESULT. BORING LOCATIONS AND ROCK ELEVATIONS ARE APPROXIMATE.

ALTERNATIVE ALIGNMENT B (GREEN) [SOUTH] PROFILE -18' DIA. TUNNEL

SCALE: HORIZONTAL: 1" = 200'
VERTICAL: 1" = 10'

73016 STORM WATER SURFACE
100–YR WATER SURFACE
P–WAVE VELOCITY 5,8000 FT/SEC RIPPABLE MATERIAL

OPTION B3
OPTION B4
OPTION B5

TABLE 1:

US INV. (FT)	DS INV. (FT)	SLOPE (%) [L = 5,872']	FULL FLOW CAPACITY (CFS), OPEN CHANNEL TW CONDITION*	FULL FLOW CAPACITY (CFS), CONSTANT TW [134.49'] CONDITION**
145.36'	116	0.5	3200	2900
174.72'	116	1.0	4400	4200
233.44'	116	1.5	6300	5900

*VALUE TAKEN WHEN NORMAL DEPTH IS EQUAL TO DIAMETER OF PIPE. (FLOW CONDITION IS NOT TRULY FULL FLOW BUT IS LISTED AS 7–M2c.)
**VALUE TAKEN WHEN FULL FLOW CONDITION (4–FFf) IS FIRST MET, PRIOR TO NORMAL DEPTH BEING EQUAL TO PIPE DIAMETER.

DEPARTMENT OF PUBLIC WORKS
HOWARD COUNTY, MARYLAND

CHIEF, STORMWATER MANAGEMENT DIVISION DATE

McCORMICK TAYLOR
509 South Exeter Street
4th Floor
Baltimore, Maryland 21202
(410) 662-7400

Howard County MARYLAND
Storm Water Management Division
Bureau of Environmental Services
9801 Broken Land Parkway
Columbia, Maryland 21046
(410) 313–6444

DES: EZS
DRN: EZS
CHK: ADM
DATE: 12/07/20

BY	NO.	REVISION	DATE

NORTH TUNNEL
PRELIMINARY DESIGN
CAPITAL PROJECT #C–0337
HOWARD COUNTY
HSCD# TBD
PROPOSED NORTH TUNNEL ALTERNATIVE ALIGNMENT B (GREEN) PROFILE -18' DIA. TUNNEL

SCALE: AS SHOWN
SHEET: 1 OF 1

HOWARD COUNTY
MARYLAND

Ellicott City
North Tunnel Project

Geotechnical Baseline Report – Concept Level

Report Status (Draft)
Revision No. 1

McMILLEN JACOBS ASSOCIATES

August 2020

This page intentionally left blank.

Table of Contents

List of Tables

List of Figures

Appendices

Distribution

To: Andrew McLean, PE
McCormick Taylor

From: David Corkum, PE

Prepared By: Jamie Schick, CEG (OR)
McMillen Jacobs Associates

Renée L. Fippin, PE, GE
McMillen Jacobs Associates

Reviewed By: David Corkum, PE
McMillen Jacobs Associates

Revision Log

Revision No.	Date	Revision Description
0	June 26, 2020	Draft Submittal to Howard County
1	August 19, 2020	Response to Draft comments – submitted final

This page intentionally left blank

Acronyms and Abbreviations

Avg	Average
bgs	below ground surface
GBR	Geotechnical Baseline Report
GDR	Geotechnical Data Report
gpm	Gallons per minute
ksi	Thousands of pounds per cubic inch
LF	Linear feet
MJA	McMillen Jacobs Associates
NA	Not Applicable
pcf	Pounds per cubic foot
psi	Pounds per square inch
RQD	Rock Quality Designation
SPT	Standard Penetration Test
UCS	Unconfined Compressive Strength

This page intentionally left blank

.

1.0 Introduction

1.1 Purpose

This Geotechnical Baseline Report (GBR) is a contract document intended to allocate geotechnical risk between the County (Howard County, MD) and the Contractor. It represents the Engineer/Owner's baselines of anticipated underground conditions and ground behaviors based on data from site investigations as well as from inspection, adjacent construction activities coupled with the judgement of those preparing the document.

The Ellicott City North Tunnel Project (Project) GBR establishes baseline ground conditions for the concept level design. The purpose of a GBR is to provide prospective contractors with baselines of subsurface conditions on which to base their bids for the work associated with new underground construction and associated surface excavations. The GBR is also the starting point for evaluating potential change of conditions claims which may arise during construction.

The GBR includes a discussion of general construction considerations for the Project's underground components known at this time. These considerations will ultimately enhance the Contractor's understanding of key project constraints and requirements in the Contract Plans and Specifications which will be developed by the future design consultant.

The Geotechnical Data Report (AB Consultants, 2020) presents factual data from very specific locations obtained during the geotechnical exploration program. The GBR synthesizes, summarizes, interprets, and interpolates the information in the Geotechnical Data Report (GDR), information from direct observations at site, and experience of the engineers preparing the report in order to develop the baseline presented.

A GBR establishes a contractual basis for the allocation of geotechnical and construction risk during the performance of the new underground work. The actual geotechnical and construction conditions encountered in the field are expected to be generally within the range of conditions discussed herein. This baseline report presents the range of conditions to be assumed for bidding purposes, and for which the Contractor is responsible during construction.

This GBR will need to be updated by the future design consultant based on future geotechnical information obtained and final design determinations and to coordinate with the Contract Plans and Specifications. This document provides recommendations for where additional information can be included in the Final GBR.

1.2 Report Organization

This GBR contains baselines with respect to certain subsurface and surface conditions that are expected to be encountered during the construction of the new underground structures for the Project. The GBR baselines pertain exclusively to the specific project components and scope of work discussed in this report. Baselines are presented in the following sections:

- Section 4.0: Ground Conditions

- Section 5.0: North Tunnel Inlet Structure
- Section 6.0: North Tunnel
- Section 7.0: North Tunnel Outlet Structure

1.3 Sources of Information

As stated above, a GDR (AB Consultants, 2020) was developed for the Project. The GDR includes data used to develop the conceptual design of underground elements and is the basis for this report and the baselines included herein. The Contractor is responsible for reviewing the GDR and considering its content with respect to the work. This GBR also relied on existing boreholes completed for other facilities along the tunnel alignment. These borings will be incorporated into the final GDR.

The GDR, like the GBR, will be a Contract Document that contains subsurface soil, rock, and groundwater data relevant to the design and construction of the Project. These data include the results of a site investigation program with attendant field, laboratory, and hydrogeologic testing. Laboratory tests were performed on selected rock core samples from project exploratory borings to evaluate the physical characteristics and engineering properties, some of which are baselined in this report. The detailed results from testing conducted on the rock samples can be found in the GDR.

Additional borings and data collection as part of final design will likely be beneficial as the design is developed and finalized. This includes additional rock strength evaluation from laboratory testing and point load tests of core samples and piezometers to assess groundwater levels within the bedrock. In addition, field mapping along the Patapsco River, and road cuts would be useful to characterize joint orientation and persistence that can be used to design ground support requirements.

2.0 Overview of Project

The North Tunnel Project (the Project) is one component of Howard County's Ellicott City Safe and Sound Flood Mitigation and Public Safety Plan to minimize flooding along Main Street in Old Ellicott City by diverting storm water from the Hudson Branch to a newly constructed tunnel that will discharge to the Patapsco River. The Project is located in Ellicott City, Maryland, approximately 6 miles to the west of Baltimore City and 22 miles north of Washington, DC.

The primary purpose of the Project is to divert flows from the Hudson Branch to the Patapsco River during storm events. The primary elements of the Project include:

- Approximately 1,630 linear feet (LF) of tunnel assumed to be constructed using drill and blast methods
- An approach channel and a flume or shaft structure located at the upstream connection to the Hudson Branch
- An outfall/discharge structure located at the Patapsco River

Project alignment alternatives are currently being evaluated with the downstream end constrained by the elevation of the Patapsco River. Three alignments are under considerations, although variations of them might be evaluated during final design. The alignments all begin at the southeast corner of public Parking Lot "F" near the intersection of Ellicott Mills Drive and Main Street and end at the Patapsco River just east of the CSX railroad tracks. Refer to Figure A-1, which shows the location of the Project as well as the current concept alignments.

3.0 Geologic Conditions

3.1 Regional Geology

The Project is located along the eastern edge of the Piedmont Physiographic Province. The eastern Piedmont is generally characterized by relatively low, rolling topography, with major streams incised into narrow, steep-sided valleys (Reger and Cleaves, 2008). Thin soil deposits are underlain by igneous and metamorphic rock.

The underlying bedrock in the project area consists of Ellicott City Granite, an Ordovician Period crystalline intrusive igneous bedrock (Crowley and Reinhardt, 1980). The Ellicott City Granite is described as dark gray, medium- to coarse-grained, porphyritic, biotite-quartz-plagioclase granite. It is weakly foliated to massive and contains inclusions of gneiss and crystalline dikes. Near surface the bedrock is weathered except near major drainages where the weathered horizon is eroded away.

The crystalline bedrock is generally overlain by regolith and local alluvial deposits associated with streams and rivers. These alluvial deposits vary from gravels and sands to silts and clays. These deposits are present at the tunnel inlet structure.

Drainage in the Project area is by small streams that flow towards the Patapsco River (Duigon et al., 1995). Groundwater is present within joints and fractures of the underlying bedrock. Groundwater can also occur within the overlying unconsolidated and alluvial deposits.

3.2 Project Geologic Hazards

3.2.1 Seismicity and Faulting

The Project area is in a relatively low seismic hazard area, and no active faults are known to traverse the alignment. Seismic hazards including surface rupture are not considered a hazard.

3.2.2 Toxic and Combustible Gases

Based on the geologic origin and composition of soil and rock at the Project site, methane, hydrogen sulfide, or other combustible, toxic, or radioactive gases will not be encountered during construction. The new tunnel is not considered a gassy or potentially gassy tunnel under federal Occupational Safety and Health (OSHA) standards (29 CFR 1926.800).

4.0 Ground Conditions

Soil and bedrock within the excavation for the North Tunnel Inlet, Tunnel, and Outlet are classified into three engineering units. These engineering units are described below and summarized in Table 4-1. Ground conditions for each underground element are described in Sections 5.0, 6.0, and 7.0. Rock strength ranges have been developed based on laboratory test data.

Table 4-1. Engineering Unit Summary

Engineering Unit	Description	Depth Below Ground Surface (ft)[a]	RQD[b]	Unit Weight (pcf)	"N" Value		Intact Rock Strength (ksi)[c]
					Range	Avg	
1	Overburden	0–15	NA	130	2–84	20	NA
2	Decomposed to moderately Weathered Granite	15–30[e]	NA	150	50/0" – 50/6"[f]	50/3"	NA
3	Slightly Weathered to Fresh Granite	>30	0–100	165	NA	NA	5.0–18.0

[a] Below Ground Surface (bgs): Depth measured from existing ground surface. Contacts between engineering units will vary up to 5 feet in depth.

[b] RQD histograms are included in Appendix B, Figures B-1 and B-2.

[c] See Table 9-5 for correlation between rock hardness and intact strength.

[e] Histogram of rock strength is included in Appendix B, Figure B-3.

[d] "N" Values refer to the number of blows required to advance a SPT sampler 12 inches. "N" Values are field recorded and not corrected for hammer efficiency or sample depth.

[e] Depth of North Tunnel Engineering Unit near the Inlet Structure is 35 feet.

[f] 50/1" = 50 blows to advance SPT sampler 1 inch.

4.1 North Tunnel Engineering Unit 1: Overburden

North Tunnel Engineering Unit 1 represents the overburden at the site, which consists of a thin mantle of colluvial and residuum deposits typically less than 15 feet thick. These deposits consist of a variable mix of loose to dense sands, silty sands, and silty gravels. Soil density increases with depth.

4.2 North Tunnel Engineering Unit 2: Decomposed to Intensely Weathered Granite

North Tunnel Engineering Unit 2 consists of decomposed to intensely weathered granite that varies from tan to reddish brown to grey. It has a very dense soil consistency and is intensely to moderately fractured. Rock strength increases with depth. Up to 5 percent of this unit consists of corestones of moderately strong to strong, moderately to slightly weathered granite up to 5 feet in diameter.

4.3 North Tunnel Engineering Unit 3: Slightly Weathered to Fresh Granite

North Tunnel Engineering Unit 3 is a slightly weathered to fresh granite that varies from dark grey to pink to white. Fracture spacing is very close to wide. A histogram of intact rock strength for North Tunnel Engineering Unit 3 based on unconfined compressive strengths is presented in Figure B-3. Additional

strength data will be collected through additional laboratory testing and point load tests as part of final design. A photograph of rock core representative of North Tunnel Engineering Unit 3 is presented in Figure 4-1. Additional core photographs can be found in the GDR (AB Consultants, 2020).

Figure 4-1. Photograph of North Tunnel Engineering Unit 3 Rock Core

4.4 Fracture Sets

The rock mass has a minimum of three joint sets. These include a subhorizontal set and two steeper sets dipping between 45 and 60 degrees (Figure 4-2). The orientation and persistence of these joint sets will be determined as part of final design. It is recommended that the Final GBR be expanded to describe the joints and baseline the fracture zones including number of fracture zones and fracture zone thickness. Currently fracture zones are anticipated in less than 5 percent of the rock mass and will have a true thickness of less than 5 feet. These data will be collected as part of final design through field mapping and supplemental rock coring.

Figure 4-2. Photograph of Rock Outcrop Near Eastern Portal

5.0 North Tunnel Inlet Structure

The North Tunnel Inlet Structure and baseline ground conditions are described below.

5.1 Description of Work

The underground work at the North Tunnel Inlet Structure consists of developing an intake and portal structure to receive floodwaters from the Hudson Branch during extreme precipitation events.

The portal will be excavated as a trench cut into the existing parking lot as shown in Figure A-2. The exact dimensions of this cut will be determined by the final designer but it is assumed it will be excavated vertically and will require top-down construction with supporting walls such as a soil nail wall. The final grading and final inlet structure will be designed to divert floodwaters over an adjustable weir and channel them into a flume structure that then transitions into the tunnel portal. Cut slopes will be excavated in the overburden and weathered rock to develop the portal area. The cut face at the portal is anticipated to be 33 feet high.

5.2 Baseline Ground Conditions

5.2.1 Ground Conditions

The tunnel inlet structure will be excavated through North Tunnel Engineering Units 1 and 2. The rock strength within Unit 2 generally increases and the degree of weathering decreases with depth in the excavation. The North Tunnel Engineering Units are shown in Figure A-2. Table 5-1 summarizes the ground conditions within the tunnel inlet excavation. Rock mass structure terms are presented in Table 9-3.

Table 5-1. North Tunnel Inlet Structure: Baseline Ground Conditions

North Tunnel Engineering Unit	Depth from Top of Cut (ft)	Ground Conditions
1	0–15	Soil-like
2	15–35	Decomposed to intensely weathered, disintegrated to very blocky and seamy

5.2.2 Groundwater Conditions

Perched groundwater related to seasonal rainfall will be locally encountered in the tunnel inlet excavation. Seepage into the tunnel inlet portal area from perched groundwater will be less than 10 gpm.

5.3 Construction Considerations

Construction considerations for the North Tunnel Inlet include the following:

- *Excavation Methods:* The upper 15 feet of excavation for the North Tunnel Inlet will be in Engineering Unit 1, which will behave as soil. Below a depth of 15 feet, the ground conditions will become more competent and the ground will become more difficult to excavate. Excavation by mechanical means, such as large excavators, will be possible through Engineering Unit 1.

Within Engineering Unit 2, mechanical excavation will become less efficient with depth as rock strength and quality increase. As the depth increases, efficient excavation of Engineering Unit 2 will require methods, such as pneumatic-hammer breakers and/or line drilling and blasting. Because of the proximity of existing structures, blasting methods such as short rounds and tighter drill hole pattern will be required.

- *Blasting Near Existing Facilities:* Several historical structures are located near the North Tunnel Inlet Structure. Blasting plans and construction operations must be executed to avoid damaging these facilities if blasting methods are used during excavation.
- *Groundwater Inflows:* Groundwater will be encountered below a depth of 8 feet within the excavation. Dewatering methods will be required to maintain a stable work zone. These inflows can be significantly reduced depending on the selected temporary shoring methods selected such as soldier pile walls. If a sloping excavation is used, the portal area will require protection from surface runoff.
- *Floodwater Inundation:* The proximity of the Intake Structure to the Hudson Branch presents a risk of inundation during construction. Weather monitoring and evacuation protocols will need to be developed to address this project risk.

6.0 North Tunnel

6.1 Description of Work

The new North Tunnel extends approximately 1,630 feet from the Inlet structure to the Outlet structure immediately east of the CSX rail line to the shoreline of the Patapsco River. The excavated tunnel is an approximately 15-foot-wide ID horseshoe-shaped tunnel and, if determined as part of final design, may be lined with a shotcrete or cast-in-place concrete. The tunnel will be sloped downward towards the Patapsco River with a grade of less than 2 percent.

6.2 Baseline Ground Conditions

6.2.1 Ground Conditions

The North Tunnel will be constructed in granite (North Tunnel Engineering Units 2 and 3). A geologic profile along the tunnel is presented in Figure A-2. Table 6-1 summarizes the anticipated ground conditions within the North Tunnel.

Table 6-1. North Tunnel: Baseline Ground Conditions

North Tunnel Station Range	North Tunnel Engineering Unit	Ground Conditions
201+20 to 201+40	2, 3	Intensely to slightly weathered, blocky and seamy to moderately jointed
201+40 to 218+45	3	Fresh, moderately jointed to massive

6.2.2 Fracture Sets

The rock mass has a minimum of three joint sets. These include a subhorizontal set and two steeper sets dipping between 45 and 60 degrees. The orientation and persistence of these joint sets will be determined as part of final design. It is recommended that the Final GBR be expanded to describe the joints and baseline the fracture zones, including number of fracture zones and fracture zone thickness. Currently fracture zones are anticipated in less than 5 percent of the rock mass and will have a true thickness of less than 5 feet.

6.2.3 Groundwater

During the construction of the North Tunnel, groundwater inflows will occur through fractures and fracture zones. The groundwater inflow baselines are as follows:

- Total sustained flow of groundwater for the entire length of the North Tunnel during construction will be no more than 50 gpm. This flow could increase marginally during or directly after significant rainfall events.
- Peak flush inflows during construction through discrete ungrouted fracture zones or weathered zones will be no more than 20 gpm over a 10-foot tunnel length. These peak flows will decrease by 50 percent within 24 hours.

6.3 North Tunnel Construction Considerations

Construction considerations for the North Tunnel include the following:

- *Excavation Methods:* Mechanical excavation of the entire new North Tunnel is not feasible because of the high rock strength. Drill and blast excavation methods will be required.
- *Ground Support Methods:* Within Engineering Unit 3, ground support will be controlled by kinematic block stability with support likely comprising pattern bolts with wire mesh. Supplemental support at the inlet and beneath the CSX tracks is described below.
- *Poor Ground Conditions at the Inlet*: As the tunnel turns under at the Inlet portal it will be advanced through decomposed to intensely weathered granite. Localized overbreak is expected where Engineering Unit 2 is present in the crown and sidewalls. Ground support will be required to address the poor ground conditions at the turn under. The blast design and round length will need to be modified to address these ground conditions. Supplementary initial support consisting of spiles will be required for the first 20 feet of the tunnel.
- *Low Ground Cover beneath CSX tracks*: Vertical clearance to the top of tunnel beneath the CSX railroad is limited; therefore, appropriate excavation methods such as drill and hydraulic splitting in addition to supplementary initial support such as shotcrete or steel sets will be necessary to satisfy CSX and avoid overbreak and settlement.
- *Blasting Near Existing Facilities:* Several historical structures are located near and above the North Tunnel (MJA, 2020a, Figure A-1). In addition, the tunnel crosses beneath the CSX railroad at the east end (MJA 2020b). Carefully prepared blasting plans, construction operation work plans and monitoring must be executed to avoid damaging these facilities and in accordance with the final specifications.
- *Groundwater Management:* If the new tunnel is excavated downgrade toward the Patapsco River, appropriate water management and collection measures at the heading will be necessary. Similarly, mining upgrade will require a water management plan that avoids discharge to the river.

7.0 North Tunnel Outlet Structure

7.1 Description of Work

The North Tunnel Outlet Structure will be constructed along the banks of the Patapsco River. The structure will be partially excavated into rock and partially free standing.

7.2 Baseline Ground Conditions

7.2.1 Ground Conditions

The North Tunnel Outlet Structure will be constructed in a single engineering unit, North Tunnel Engineering Unit 3. Its location was chosen to take advantage of prominent outcropping of granite into which a bench was blasted in the early 19th century to form the rail bed. A geologic profile along the outlet structure is presented in Figure A-2. Table 7-1 summarizes the anticipated ground conditions for the tunnel outlet structure.

Table 7-1. Tunnel Outlet Structure: Baseline Ground Conditions

North Tunnel Engineering Unit	Depth from Ground Surface (ft)	Ground Conditions
3	4.5–50	Fresh, moderately jointed

7.2.2 Groundwater

Groundwater is not anticipated at the Tunnel Outlet Structure, although it is proximate to the Patapsco River.

7.3 Construction Considerations

Construction considerations for the North Tunnel Outlet Structure include the following:

- *Blasting Near Existing Facilities:* The CSX rail line is located immediately west of this element. Blasting plans and construction operations must be executed to avoid damaging the rail line and will require close coordination with CSX. Blasting methods such as short rounds and tighter drill hole pattern will be required. If vibrations from blasting cannot be kept within CSX allowable limits, then non-explosive demolition agents or hydraulic splitters will need to be considered.
- *Site Access:* The available work area for the outlet structure is tightly constrained by the Patapsco River to the east and the CSX rail line to the west. The Contractor's means and methods should consider the difficult access, limited staging area, and steep haul roads. The construction area will also need to be isolated from the river because of elevated water surface elevations in the Patapsco River due to seasonal precipitation events and its position within the 100yr floodplain of the Patapsco River. This will require a coffer dam or other separation structure.

8.0 References

AB Consultants. 2020. *Ellicott City Flood Relief North Tunnel, Howard County, Maryland*, Prepared for McCormick Taylor.

Crowley, W.P. and Reinhardt, Juergen. 1980. *Geologic Map of the Ellicott City Quadrangle, Maryland*. Maryland Geological Survey, scale 1:24,000 (https://ngmdb.usgs.gov/Prodesc/proddesc_37448.htm).

Duigon, M.T., Dine, J.R., and Adamski, J.C. 1995. *Water Resources of Howard County, Maryland,* Maryland Geological Survey, Bulletin 38.

International Society for Rock Mechanics (ISRM). 1981. *Rock Characterization, Testing and Monitoring: ISRM Suggested Methods*, edited by E.T. Brown. London: Pergamon Press, 211 pp.

McMillen Jacobs Associates (MJA). 2020a. Construction Impacts Assessment Report, North Tunnel Alternatives, for Howard County, Maryland.

McMillen Jacobs Associates (MJA). 2020b. Construction Impacts Assessment Report, CSX Crossing, for Howard County, Maryland.

Occupational Safety and Health Administration (OSHA). Underground Construction (Tunneling), Part 1926, Section 800 of Title 29 of the Code of Federal Regulations (https://www.osha.gov/Publications/osha3115.html, accessed June 2020).

Reger, J.P., and E.T. Cleaves. 2008. *Physiographic Map of Maryland*, Maryland Geological Survey, Open-File Report 08-03-1

Terzaghi, K. 1946. Rock defects and loads on tunnel supports. In *Rock Tunneling with Steel Supports,* R.V. Proctor and T.L. White, eds. Youngstown, Ohio: The Commercial Shearing and Stamping Co., 15–99.

U.S. Department of the Interior Bureau of Reclamation (USBR). 2001. *Engineering Geology Field Manual*, Second Edition, Volume I: U.S. Department of the Interior, Bureau of Reclamation. Washington, D.C.: US Government Printing Office.

9.0 Glossary and Rock Descriptions

Table 9-1. Glossary

Term	Definition
Corestone	Rounded boulder, occurring individually or in piles at the ground surface, or in exposed sections. It results from an initial phase of subsurface chemical weathering, of a joint-bounded block, followed or accompanied by surface erosion that exposes the corestone.
Fault	A discrete surface or zone of discrete surfaces separating two rock masses across which one mass has slid past the other.
Foliation	A penetrating metamorphic rock fabric characterized by the parallel orientation of tabular minerals.
Fracture Zone	Region of the rock that has a higher fracture density, resulting in a lower quality rock mass. This includes intervals with RQD of less than 50 percent. Fractures are often subparallel and can include crushed rock.
Igneous	A rock that solidified from a molten or partially molten state.
Metamorphism	The mineralogical, chemical, and structural adjustment of existing rocks to physical and chemical conditions created by high pressure and high temperature environments. Commonly causes the formation of new minerals and directional rock textures that reflect the new thermal and stress environment.
Perched Groundwater	Subsurface water that forms a saturated horizon within pervious soil and rock zones at a higher elevation than the local or regional groundwater table.
Porphyritic	Description of igneous rock where there is the presence of phenocrysts (crystals) scattered in a fine-grained groundmass.
Phaneritic	Description of igneous rock where the crystals are coarse enough that individual minerals can be distinguished with the naked eye.
True Thickness	The orthogonal thickness of a structure or bed, measured at right angles to its surface.

Table 9-2. Definitions of Rock Weathering

Description	General Characteristics	Discoloration	Fractures
Fresh	Hammer rings when crystalline rocks are struck.	No discoloration; not oxidized.	No discoloration or oxidation.
Slightly Weathered	Hammer rings when crystalline rocks are struck; body of rock not weakened.	Discoloration or oxidation limited to surface of, or short distance from, fractures; some feldspar crystals are dull.	Minor to complete discoloration or oxidation of most surfaces.
Moderately Weathered	Hammer does not ring when rock is struck; body of rock is slightly weakened.	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are “rusty”; feldspar crystals are “cloudy.”	All fracture surfaces are discolored or oxidized.

Description	General Characteristics	Discoloration	Fractures
Intensely Weathered	Dull sound when struck with hammer; usually can be broken with moderate to heavy manual pressure or by light hammer blow with reference to planes of weakness such as incipient or hairline fractures, or veinlets; rock is significantly weakened.	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in situ disaggregation.	All fracture surfaces are discolored or oxidized, surfaces friable.
Decomposed	Can be granulated by hand; resistant minerals such as quartz can be present as “stringers” or dikes.	Discoloration or oxidation throughout, but resistant minerals such as quartz can be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay.	

Table 9-3. Descriptions of Rock Mass Structure

Structure	Description[a]
Intact or Massive	Intact rock specimens or massive in situ rock with few widely spaced discontinuities.
Stratified	Rock consisting of individual strata with little or no resistance against separation along the boundaries between strata. The strata can or cannot be weakened by transverse joints.
Moderately Jointed	Rock containing joints and hair cracks, but the blocks between joints are locally grown together or so interlocked that vertical walls do not require lateral support.
Blocky and Seamy	Rock consists of chemically intact or almost intact rock fragments that are entirely separated from each other and imperfectly interlocked. In such rock, vertical walls will require lateral support.
Disintegrated or Crushed	Rock consists of chemically intact or nearly intact rock fragments that are gravel size or smaller. It often occurs in fault and shear zones and can be associated with clay and sand gouge. If most or all the fragments are as small as fine sand grains and no recementation has taken place, crushed rock below the water table exhibits the properties of a water-bearing sand.

[a] Modified from Terzaghi (1946).

Table 9-4. Rock Quality Designation and Description

RQD	Rock Quality Description
0 to 25	Very Poor
26 to 50	Poor
51 to 75	Fair
76 to 90	Good
91 to 100	Excellent

Table 9-5. Description of Rock Strength

Hardness Description	ISRM Rock Strength Terminology	General Characteristics	Strength Range (psi)[a]
Very Soft	Extremely weak	Can be readily indented, grooved, or gouged with fingernail; can be carved by a knife.	36–144
Soft	Very Weak	Can be grooved or gouged easily with a knife, can be scratched with a fingernail.	144–725
Moderately Soft	Weak	Can be grooved 1/16 inch (2 mm) with a knife with moderate or heavy pressure.	725–3,625
Moderately Hard	Moderately Strong	Can be scratched with a knife with light or moderate pressure	3,625–7,250
Hard	Strong	Can be scratched with a knife with difficulty (heavy pressure)	7,250–14,500
Very Hard	Very Strong	Cannot be scratched with a knife, breaks with repeated heavy hammer blows.	14,500–36,000
Extremely Hard	Extremely Strong	Cannot be scratched with a knife; can only be chipped with repeated heavy hammer blows	+36,000

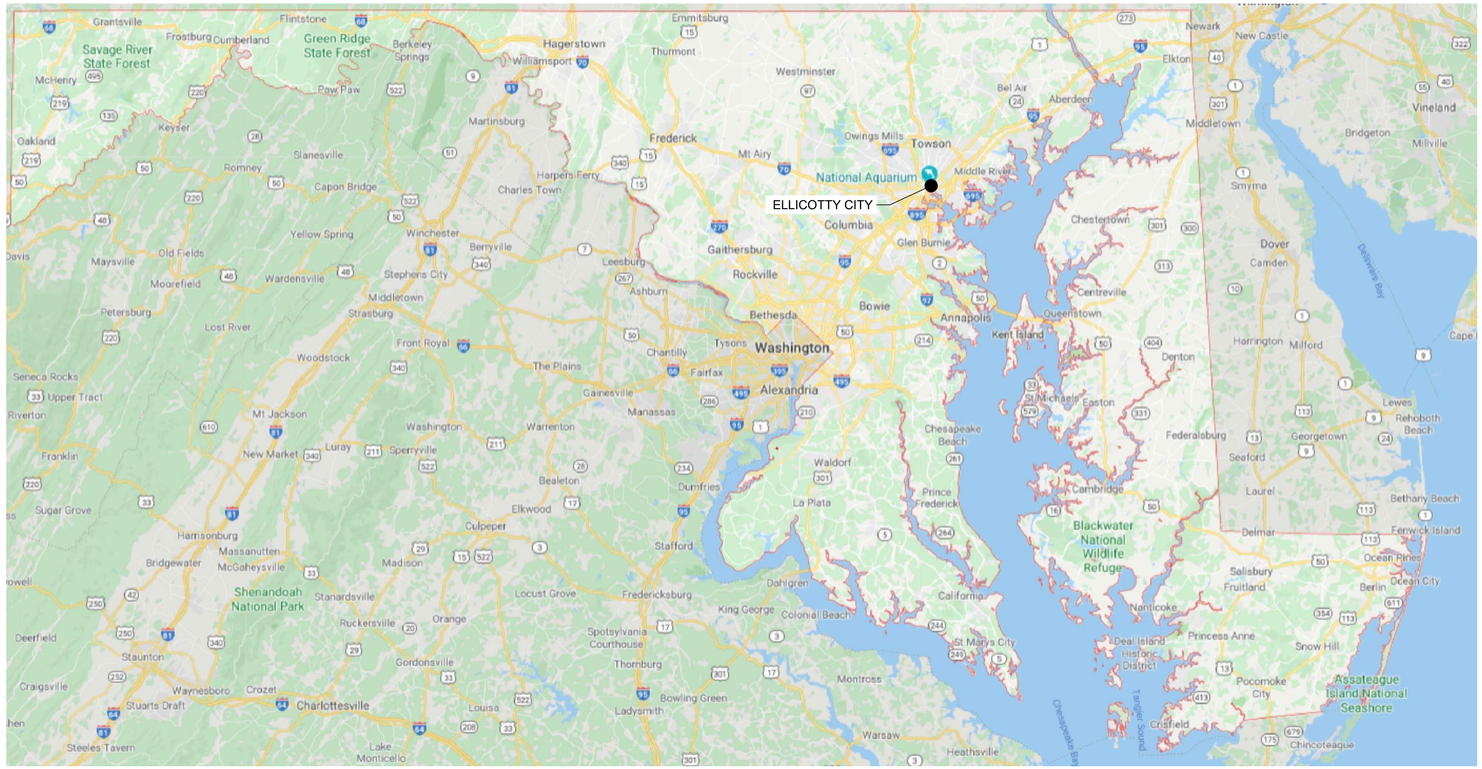
[a] Intact rock strength ranges are based on correlating field test methods described in ISRM (1981) with hardness criteria presented in USBR (2001).

Table 9-6. Description of Fracture Density

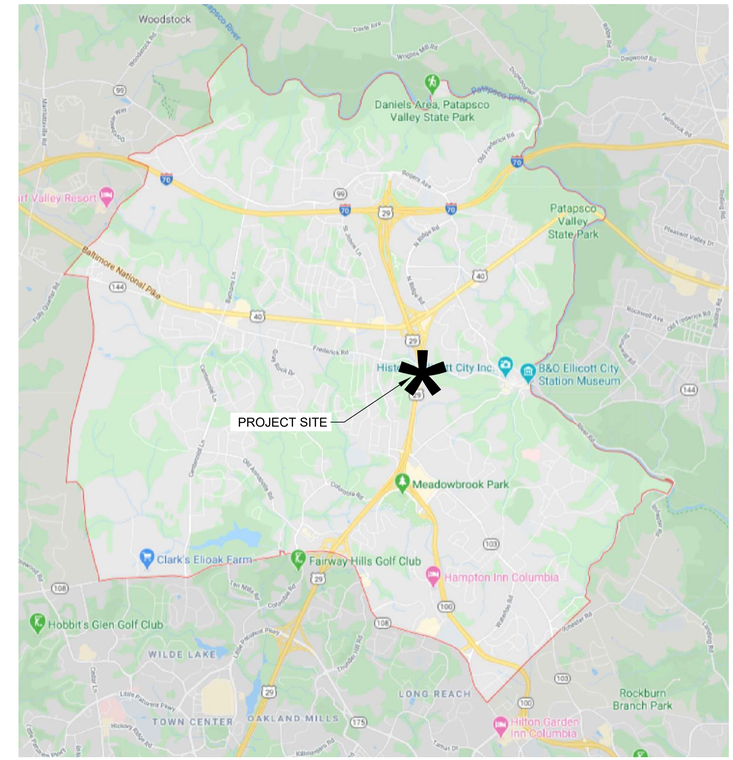
Description	Core Recovery Lengths
Extremely closely spaced	less than 1 inch
Very closely spaced	1 to 3 inches
Closely spaced	3 inches to 9 inches
Medium spaced	9 inches ft to 2.4 feet
Widely spaced	2.4 ft to 6.6 feet
Very widely spaced	Greater than 6.6 feet

Appendix A Additional Figures

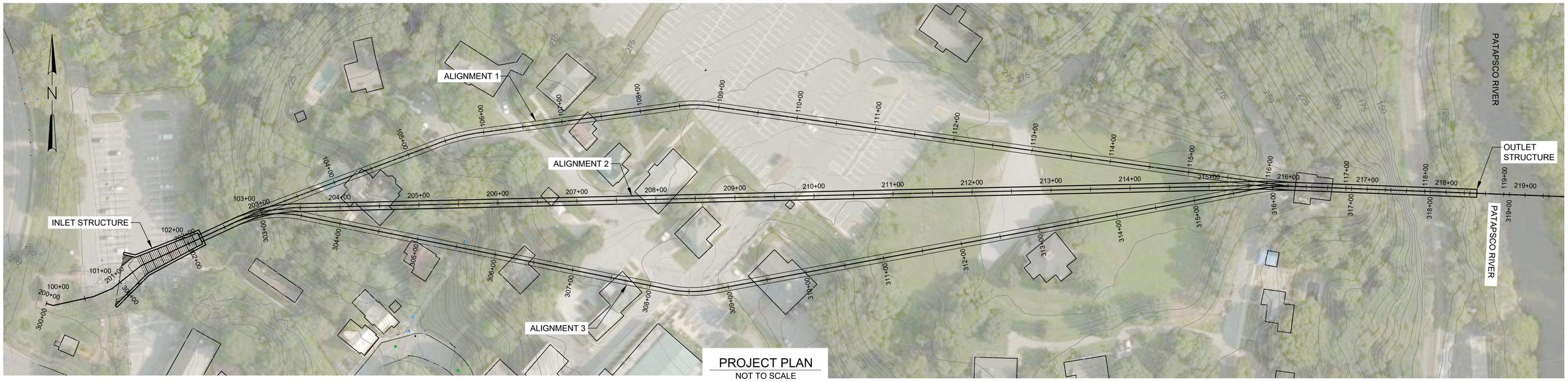
This page intentionally left blank



VICINITY MAP
NOT TO SCALE



LOCATION MAP
NOT TO SCALE



PROJECT PLAN
NOT TO SCALE

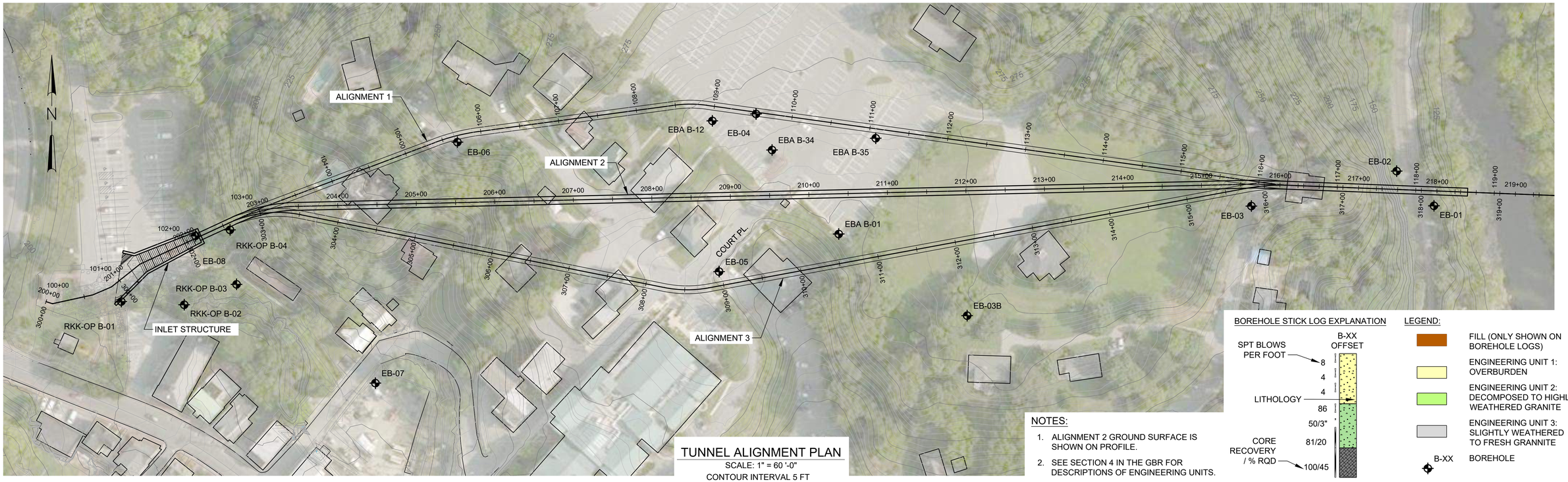
McMILLEN JACOBS ASSOCIATES

ELLICOTT CITY NORTH TUNNEL
CAPITAL PROJECT #C-0337

VICINITY MAP, LOCATION MAP AND PROJECT PLAN

PROJECT NO.	DATE
6046.0	AUG 2020
SCALE	FIGURE NO
AS SHOWN	FIGURE A-1

C:\VAULT\6046 ECNT\DOCUMENTS\CONTRACT DOCS\GEOTECHNICAL\FIGURE A-1.DWG Aug 5, 2020 - 12:03 PM



TUNNEL ALIGNMENT PLAN

SCALE: 1" = 60 '-0"
CONTOUR INTERVAL 5 FT

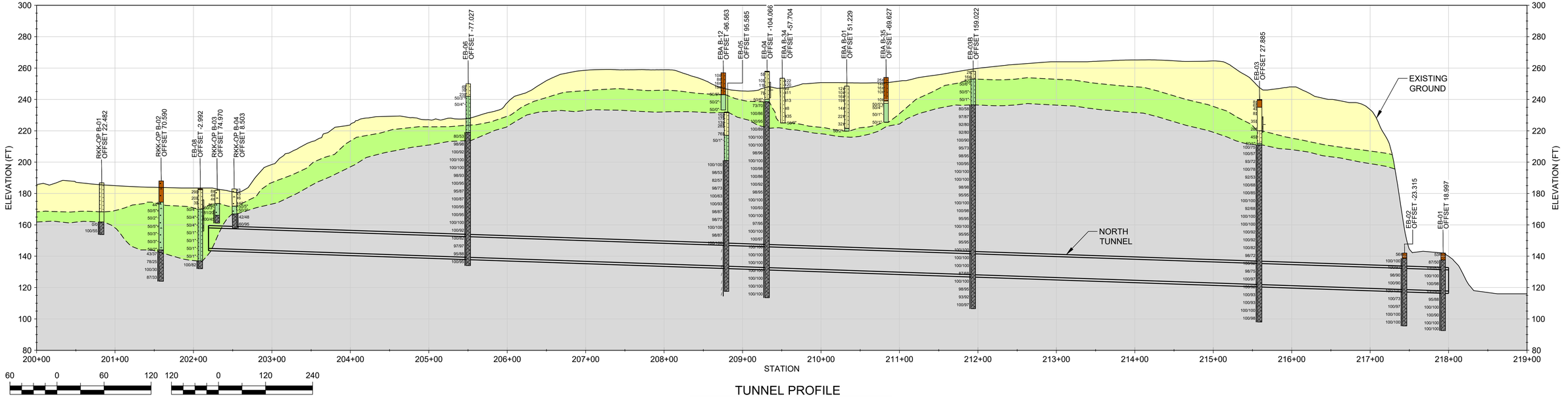
BOREHOLE STICK LOG EXPLANATION

LEGEND:

- FILL (ONLY SHOWN ON BOREHOLE LOGS)
- ENGINEERING UNIT 1: OVERBURDEN
- ENGINEERING UNIT 2: DECOMPOSED TO HIGHLY WEATHERED GRANITE
- ENGINEERING UNIT 3: SLIGHTLY WEATHERED TO FRESH GRANNITE
- B-XX BOREHOLE

NOTES:

1. ALIGNMENT 2 GROUND SURFACE IS SHOWN ON PROFILE.
2. SEE SECTION 4 IN THE GBR FOR DESCRIPTIONS OF ENGINEERING UNITS.



HORIZ. SCALE: 1" = 60'-0"
VERT. SCALE: 1" = 120'-0"

TUNNEL PROFILE

SCALE: 1" = 60'-0" (HORZ.); 1" = 120'-0" (VERT.)

McMILLEN JACOBS ASSOCIATES

ELLICOTT CITY NORTH TUNNEL
CAPITAL PROJECT #C-0337

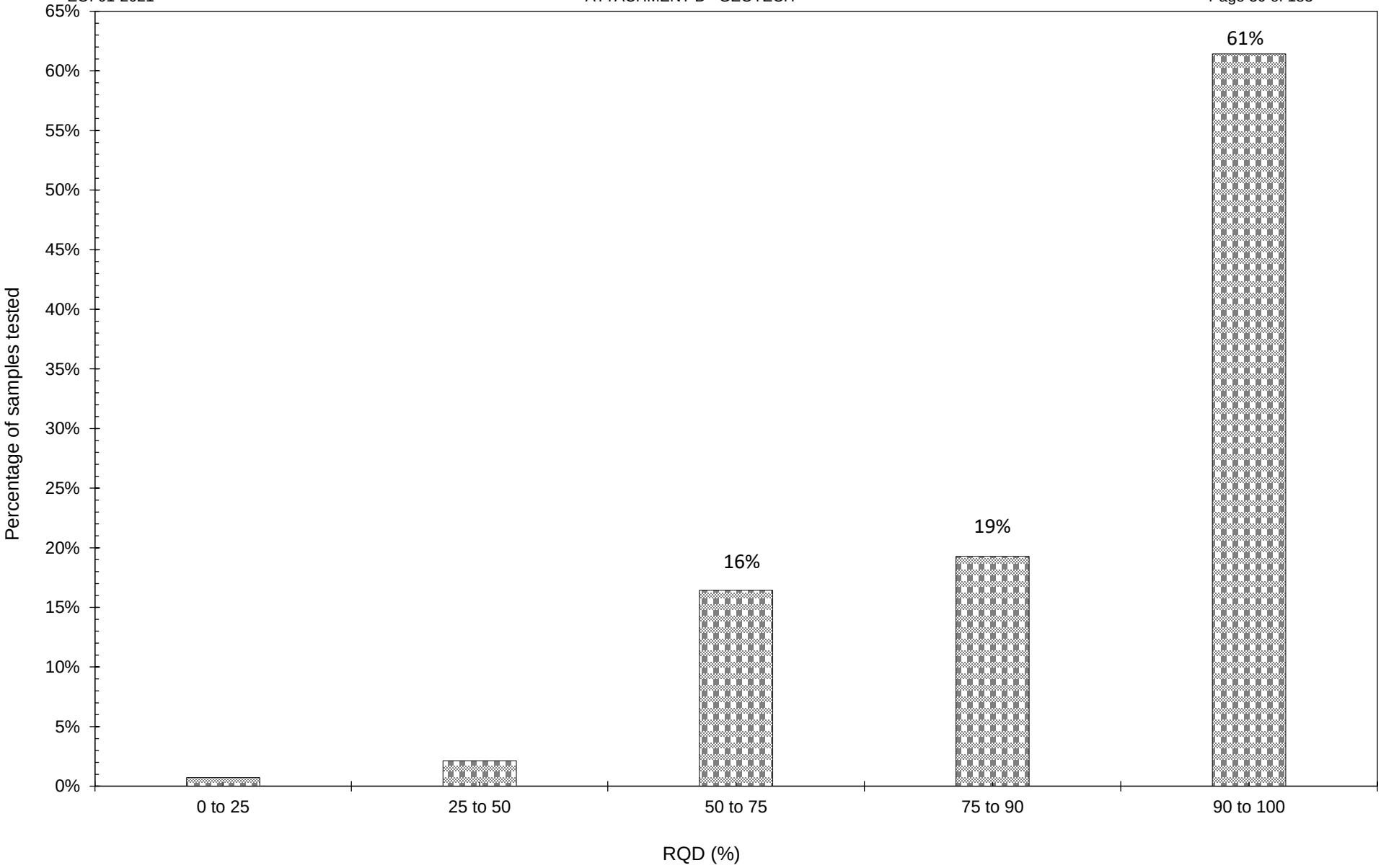
GEOTECHNICAL DATA REPORT
PLAN AND PROFILE

PROJECT NO.	DATE
6046.0	AUG 2020
SCALE	FIGURE NO
AS SHOWN	FIGURE A-2

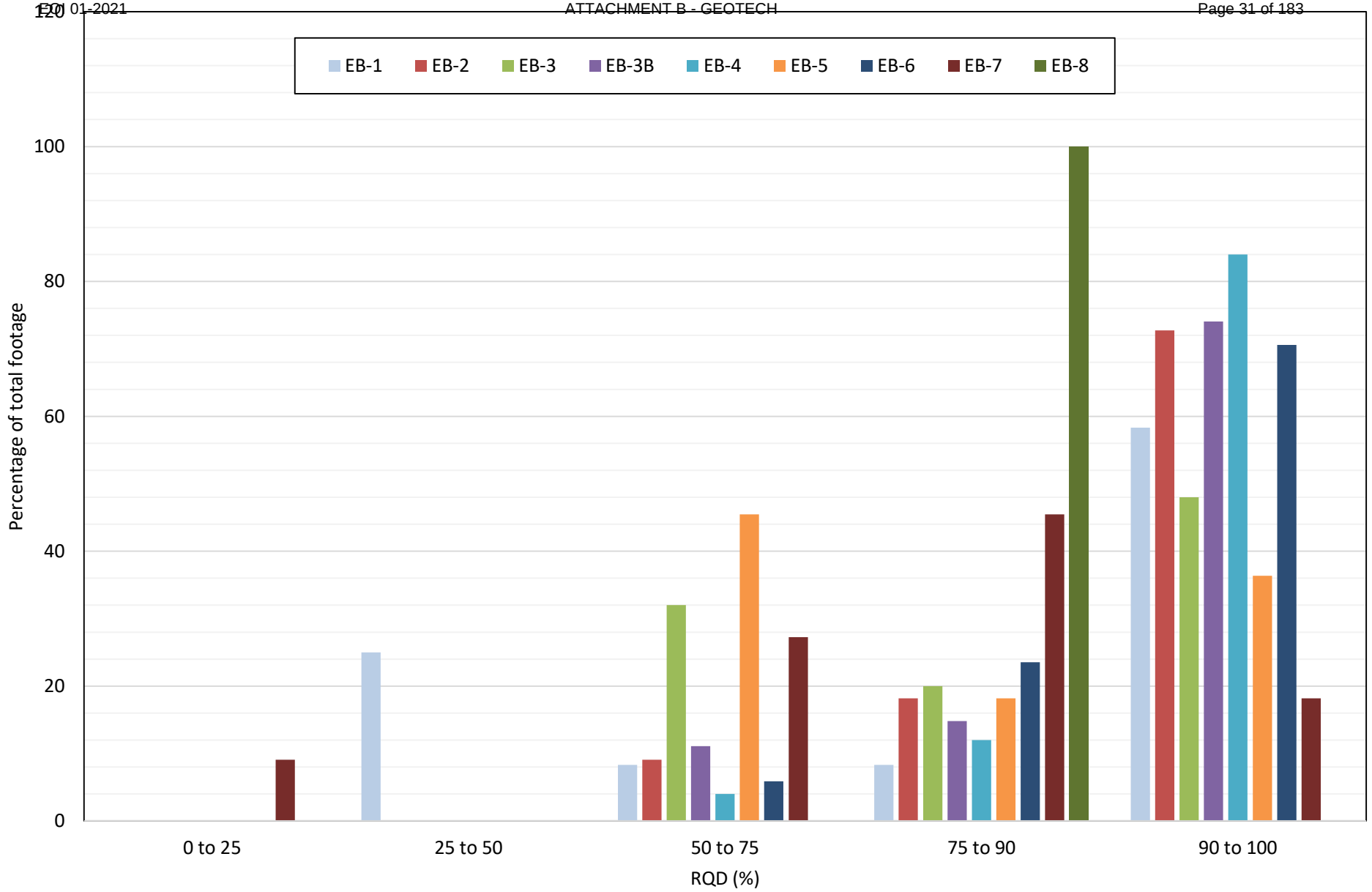
C:\VAULT\6046 ECNT\DOCUMENT\CONTRACT DOCS\GEOTECHNICAL\FIGURE A-2.DWG Aug 5, 2020 - 12:00 PM

Appendix B Rock Quality Designation (RQD) and Rock Strength Histograms

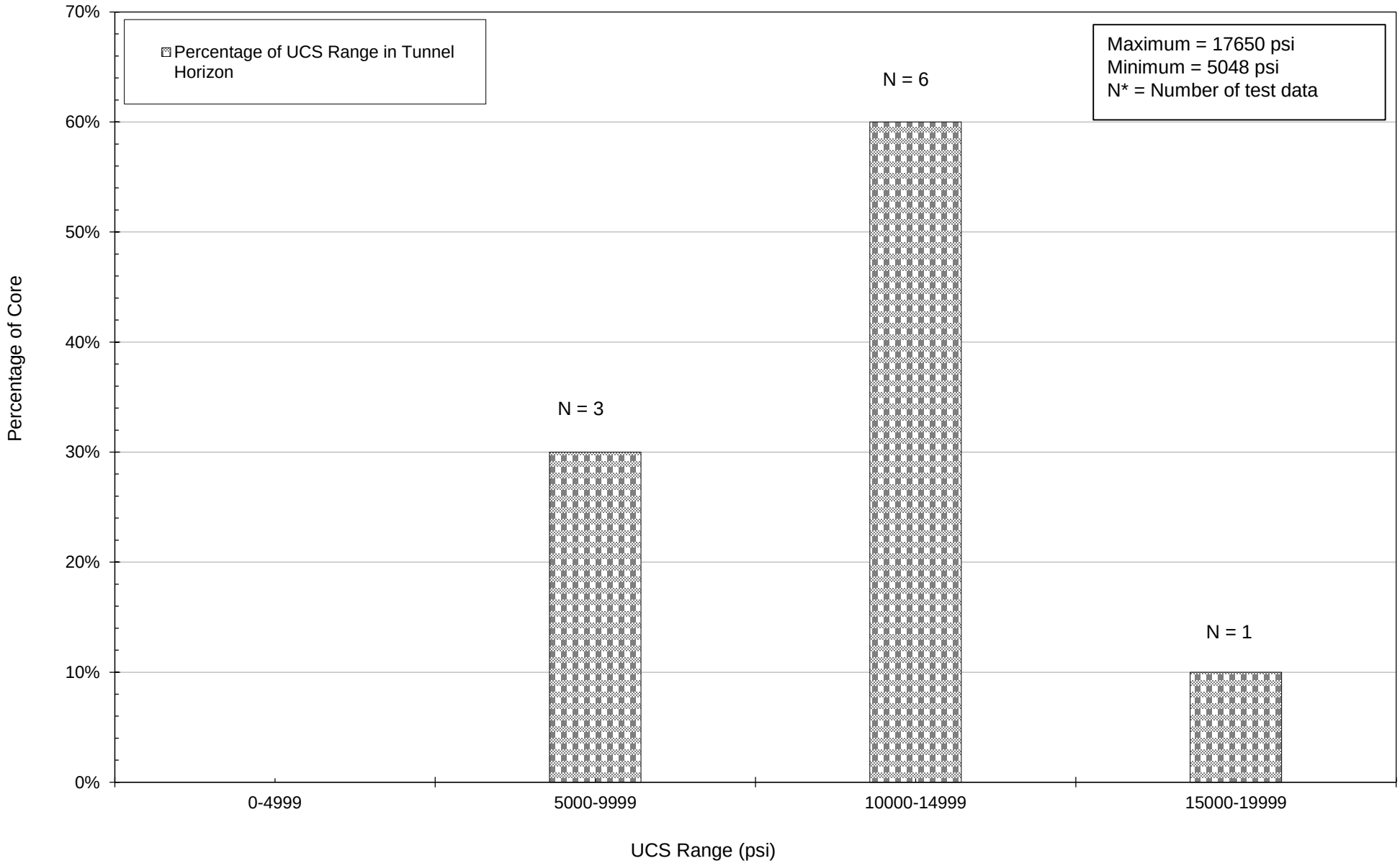
This page intentionally left blank



McMILLEN JACOBS ASSOCIATES	**ELLICOTT CITY NORTH TUNNEL CAPITAL PROJECT #C-0337** **ELLICOTT CITY, MARYLAND**	**FIGURE** **B-1**
	GEOTECHNICAL BASELINE REPORT **RQD HISTOGRAM SUMMARY**	**AUGUST 2020**



McMILLEN JACOBS ASSOCIATES	**ELLICOTT CITY NORTH TUNNEL CAPITAL PROJECT #C-0337** **ELLICOTT CITY, MARYLAND**	**FIGURE** **B-2**
	GEOTECHNICAL BASELINE REPORT **RQD HISTOGRAM SUMMARY BY BORING**	**AUGUST 2020**



McMILLEN JACOBS ASSOCIATES	**ELLICOTT CITY NORTH TUNNEL CAPITAL PROJECT #C-0337** **ELLICOTT CITY, MARYLAND**	**FIGURE** **B-3**
	GEOTECHNICAL BASELINE REPORT **UNCONFINED COMPRESSIVE STRENGTH SUMMARY**	**AUGUST 2020**

GEOTECHNICAL DATA REPORT

Ellicott City Flood Relief North Tunnel
Howard County, Maryland

PREPARED FOR:

McCormick Taylor
905 South Exeter Street, 4th Floor
Baltimore, Maryland 21202

PREPARED BY:

AB CONSULTANTS, INC.
9450 ANNAPOLIS ROAD
LANHAM, MARYLAND 20706

May 28, 2020

AB CONSULTANTS, INC.
9450 Annapolis Road
Lanham, Maryland 20706
Ph: (301) 306-3091
; Fax: (301) 306-3092
www.abconsultantsinc.com

May 28, 2020

Attn: Mr. Chris Brooks, PE
McCormick Taylor, Inc.
509 South Exeter Street, 4th floor
Baltimore, MD 21202

REF: Report of Subsurface Investigation and Studies
Ellicott City Flood Relief North Tunnel
Howard County, Maryland
AB Job No. 2017091.042

Dear Mr. Brooks,

AB Consultants, Inc. (AB) is pleased to submit this report containing the results of geotechnical investigation for the above referenced project. To obtain information of the subsurface condition, a total of nine (9) 49 to 151.5 feet deep soil borings and rock coring were performed. The purpose of this study was to explore the subsurface conditions of the proposed new flood relief tunnel in Ellicott City, Maryland. The following report sections discuss the results of field and laboratory studies for the proposed project.

All samples obtained from soil test borings and rock coring will be retained in our laboratory for a period of thirty (30) days from the date of this report. They will be available for inspection during this period. After that time, the samples will be discarded.

It has been a pleasure serving you on this project. If you have any questions regarding this report, or if we can be of further service in any way, please contact us.

Very truly yours,
AB Consultants, Inc.

Fu Guo, P.E.
Project Engineer

Kim-Hou Chan, P.E.
Vice President

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 General

This report presents the results of the subsurface exploration and laboratory test results performed for the new flood relief tunnel project located in Howard County, Maryland. This study was conducted for McCormick Taylor and has been performed in general accordance with our revised letter proposal dated on October 2019 and subsequent conversations.

1.2 Scope of Work

The investigation of existing subsurface soil conditions at the site consisted of the following:

- Planning and executing subsurface exploration programs to evaluate soil and rock condition for the proposed culvert tunnel.
- Installing monitoring wells to monitor groundwater level.
- Performing laboratory tests on soil samples and rock core samples that were obtained from the borings.
- Providing a geotechnical report that includes summary of field studies and laboratory test results to assist in the design.

1.3 Site Location

The project site location is in Old Town Ellicott City, Maryland. Soils borings were drilled starting from the Parking Lot F on Ellicott City Mills Drive to Parking Lot B next to the Patapsco River.

2.0 FIELD ACTIVITIES AND SUBSURFACE EXPLORATION

2.1 Coordination

Prior to the start of the drilling operation, soil borings were staked out in the field by McCormick Taylor and AB representatives. A full-time engineer was assigned to this project to overseeing, documenting and logging samples for the duration of the subsurface exploration program. MOT plan and Erosion control plans are also discussed with the client prior to drilling. CSX safety training class were also completed for all field personal prior to accessing boreholes located next to the CSX tracks.

2.2 Soil Borings

A total of nine (9) borings were drilled at the referenced sites to depths of 49 to 151.5 ft below the existing ground surface from November 21, 2019 to April 17, 2020. Due to issue with entry agreement, overhead power line and underground utilities, some borings were offset from original proposed locations. Boring coordinates, boring locations, boring depths and duration are summarized in the following tables. Boring coordinates are collected using Trimble R8 Model 3 and S6 DR. Site location and boring plans are included in the Appendix.

Table-1: SUMMARY OF BORING LOCATIONS

Boring No.	Northing	Easting	Elevation	Boring Location
EB-1	583704.2	1370447.8	142	East of Existing CSX Railroad Track
EB-2	583748.4	1370400.2	141	West of Existing CSX Railroad Track
EB-3	583689.5	1370222.4	242	Near 3727 Church Road
EB-3B	583560.0	1369845.9	256	3778 Church Road
EB-4	583818.5	1369584.9	257	Circuit Courthouse Parking Lot
EB-5	583615.4	1369547.8	233	Howard County Old Jail House
EB-6	583779.2	1369199.8	250	Near 3674 Park Ave
EB-7	583477.2	1369098.9	183	Howard County Parking Lot E
EB-8	583661.6	1368871.4	184	Howard County Parking Lot F

Table-2: SUMMARY OF BORING DEPTHS

Boring No.	Total Boring Depth (ft)	Thickness of Soft Stratum (ft)	Thickness of Rock Coring (ft)	Start Date	Finish Date
EB-1	49.5	4.5	45	1/8/20	1/10/20
EB-2	46.5	3.5	43	1/15/20	1/17/20
EB-3	142	29	113	12/18/19	12/31/19
EB-3B	151.5	21.5	130	4/3/20	4/17/20
EB-4	144.5	19.5	125	11/25/19	12/3/19
EB-5	114.5	31	83.5	1/29/20	2/14/20
EB-6	116	31	85	2/17/20	3/16/20
EB-7	75.5	21	54.5	1/22/20	1/24/20
EB-8	51	46	5	11/21/19	11/21/19

2.3 Subsurface Investigation

Borings were drilled using Truck-mounted CME-45B and All-Terrain Vehicle (ATV) D-50 drilling rigs. Test borings were advanced by using hollow-stem augers and soil samples were obtained using the Standard Penetration Tests (SPT) in accordance with ASTM D1586. SPT samples were obtained for each boring at depth intervals of approximately 2.5 feet for up to 10 feet and at 5 feet intervals thereafter. A representative portion of each split spoon sample was placed in a glass jar and was transported to our laboratory.

In the split-barrel sampling procedure, a 2-inch O.D. split-barrel sampling spoon was driven into the ground with a 140-pound hammer, free falling a distance of 30 inches. The blows required to advance the sampling spoon to a specified distance are reported as the penetration resistance values. The values are shown on boring logs at the corresponding depths. The N-value is the sum of standard penetration resistance values that advanced through the last 12-inches of sampling. The N-value is an indication of the relative density of in-place granular soils and, to a lesser degree of accuracy, the consistency of cohesive soils.

Rock coring was performed at all boring locations to approximately the proposed finishing depth. Core sample was obtained using a 5-ft-long, NQ_{WL}-size double-tube core barrel with a diamond bit (NO2, N2, CME#8, CME#10, R10.04). Each core run is shown at the appropriate depth on the log with the percent recovery and Rock Quality Designation (RQD). The percent of recovery was determined as the ratio of recovery to the total length of the run. RQD, expressed in percent, was determined as the sum of intact, sound rock core greater than 4-inch length divided by the total length of the run. Rock core was removed from the core barrel and placed in wooden box and transported to our laboratory.

Rock core samples collected

Samples obtained from the boring were inspected by a geotechnical engineer and the field logs were edited accordingly. The final logs with correlation of all laboratory test results that indicated the subsurface conditions encountered is included in the Appendix.

2.4 On-site Packer Test and Results

Packer tests were performed at all borings for this project except for borehole EB-8. HX double expander packer assembly with rubber expansion elements set between 5 ft apart are used. Packer test are performed every 5 ft within the proposed tunnel envelope. Packer testing depths and duration are summarized in the following tables. Packer test results are included in the Appendix.

Table-3: SUMMARY OF PACKER TEST.

Boring No.	Starting Elevation	Finishing Elevation	Start Date	Finish Date
EB-1	135	96	1/13/20	1/14/20
EB-2	134	97.5	1/17/20	1/20/20
EB-3	179	106	1/2/20	1/6/20
EB-3B	178	108	4/20/20	4/22/20
EB-4	126*	115	12/5/19	12/5/19
EB-5	180	120	2/6/20	2/12/20
EB-6	197	137	3/17/20	3/19/20
EB-7	150	110	1/27/20	1/28/20

**Packer was jammed in borehole so no testing above elev.126 ft.*

Packer testing setup

2.5 Borehole Sealing

After completion of packer test, all boreholes were grout backfilled from the bottom of the hole to the ground surface. A smooth slurry mixture of water, cement, bentonite, and aluminum hydroxide were used for the backfill. The grout was pumped through PVC pipes and initiated with pipes located approximately 10 ft. off the bottom of the hole.

2.6 Monitoring Wells

Three (3) monitoring wells with depths ranging from 19 to 29 feet below existing ground were drilled within 5 ft radius of the completed boring EB-3, EB-4, and EB-8 on January 9, 2020. Screen and solid PVC pipes that were utilized in this project are 2-in Schedule 80 PVC pipe and the screen have uniformly spaced at 0.020-in slots. The monitoring wells were setup with 2-ft of solid PVC silt trap at the bottom follow by 10 ft slotted well screen, and then solid PVC pipes extended to exiting ground. Sand were placed to 1 ft above the top of the well screen and then sealed with a layer of bentonite pi-pellets with thickness of about 12-in. Bentonite were waited to swell for 2 hours minimum before backfilling hole. Borehole was seal by backfilling the top two (2) ft of the hole with a bentonite/concrete seal. 8-in diameter surface roadway metal box were

installed to cover the monitoring wells. Upon completion of the observation well installation, an initial water reading was taken. The following table present the locations, depths of the well, and initial water readings.

Table-4: SUMMARY OF MONITORING WELLS

Boring No.	Latitude	Longitude	Well Depth Below Existing Ground (ft)	Initial Groundwater Reading Below Existing Ground (ft)
EB-3	39.26923	76.79558	23	Dry
EB-4	39.26958	76.79782	19	Dry
EB-8	39.26910	76.80029	29	8

3.0 LABORATORY TESTING PROGRAM

3.1 Soil Testing

Laboratory tests were performed on selected representative samples as instructed by McMillen Jacobs Associates representatives. Sieve analysis for selected samples were performed in our laboratory and results are included in the Appendix.

3.2 Rock Core Testing

Rock coring samples were reviewed by ABC and McMillen Jacobs Associates representatives and testing assignment was developed. Rock core samples were then delivered to specific material testing sub-consultant (Geotesting Express) for testing. Rock core testing including uniaxial compression strength and Brazilian splitting tensile tests were performed on the samples. Summary of rock cores test results are presented in the Appendix.

4.0 GENERAL SITE AND SUBSURFACE CONDITIONS

4.1 Site Condition

Field drillings were performed in various locations in Old Town Ellicott City, Maryland. Boreholes were drilled starting from Parking Lot F to Circuit Courthouse Parking Lot to Parking Lot B. Single family housings, commercial building, courthouse and CXS tracks and museum are noticed within the site vicinity. Underground and overhead utilities are noticed in the project site.

4.2 Site Geology

According to the *Maryland Geological Map* published by The Maryland Geologic Survey (1968), the subject project is located within Ellicott City Granodiorite. It consists of biotite granodiorite along margin of body to quartz monzonite in core; age of quartz monzonite core 420 +/- 50 million years by radiogenic dating.

4.3 Subsurface Soil and Rock Condition

Encountered soils are grouped into major types. These soil types were grouped into the major zones and presented in subsurface diagram. The stratification lines designating the interfaces between earth materials on the boring logs are approximate; in situ, the transitions may be gradual. Detailed description and depth of various soil and rock strata are given in boring logs.

4.4 Groundwater Observations

Groundwater levels were measured in every borehole during drilling operations. As noted on boring logs, groundwater was encountered during drilling in boring EB-7 and EB-8. Water level observations are presented at the lower left hand corner of boring logs and a summary is presented in the table below. Fluctuations in the level and quantity of ground water occurs due to variations in rainfall, temperature, soil permeability and other factors not evident at the time of the water level measurements.

Table-5: SUMMARY OF GROUNDWATER OBSERVATION

Boring No.	Boring Elevation	Water Encountered Elevation at Drilling
EB-1	142	Dry, before rock coring
EB-2	141	Dry, before rock coring
EB-3	242	Dry, before rock coring
EB-3B	256	Dry, before rock coring
EB-4	257	Dry, before rock coring
EB-5	233	Dry, before rock coring
EB-6	250	Dry, before rock coring
EB-7	183	172
EB-8	184	176.5

5.0 GENERAL COMMENTS

The soil classifications presented in this report are based upon the data obtained from the soil borings performed at indicated locations and from any other information

discussed in this report. This report does not reflect any variations that may occur across the site. The nature and extent of such variations may not become evident until construction. If variations appear evident, of this report should then be reviewed by an AB geotechnical engineer in light of the new information.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No other warranties, either expressed or implied, are intended or made. In the event that any changes in the nature, design or location of the project as outlined in this report are planned, the conclusions contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report modified or verified in writing by the AB geotechnical engineer of record.

APPENDIX

A. General Notes

B. Vicinity Map

C. Boring Plans

D. Boring Logs

E. Lab Test Results

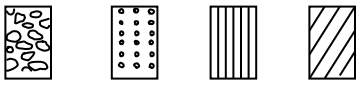
F. Lab Test Results from Geotesting

G. Packer Test Results

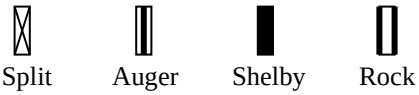
H. Monitoring Well Results

A. GENERAL NOTES

Drilling and Sampling Symbols



Gravel Sand Silt Clay



Split Spoon (SS) Auger Cutting (AU) Shelby Tube (ST) Rock Core (RC)

N = Standard penetration, blows per foot of a 140 lbs hammer for 30" drop
RQD = Rock Quality Designation
LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index

Cohesionless Soils

If the sand or silt content of a soil is great enough, the soil becomes non-cohesive or semi-cohesive. The soil classification becomes SAND or SILT with the other soil constituents being modifying.

Based on N-Value

0 to 4 Blows…….Very Loose	30 to 59 Blows…….Dense
5 to 9 Blows…….Loose	Over 60 Blows…….Very Dense
10 to 29 Blows…….Medium Dense	

Cohesive Soils

If clay content is sufficient so that clay dominates soil properties, then CLAY becomes the major soil constituent as modifier. Other minor soil constituents may be added according to classification breakdown for cohesion less soils: i.e. silty clay, trace of some sand, trace of gravel.

Based on N-Value

0 to 3 Blows…….Very Soft	16 to 30 Blows……..Stiff
4 to 5 Blows…….Soft	30 to 60 Blows……..Very Stiff
6 to 16 Blows……...Firm	Over 61 Blows……..Hard

Based on Penetrometer Value

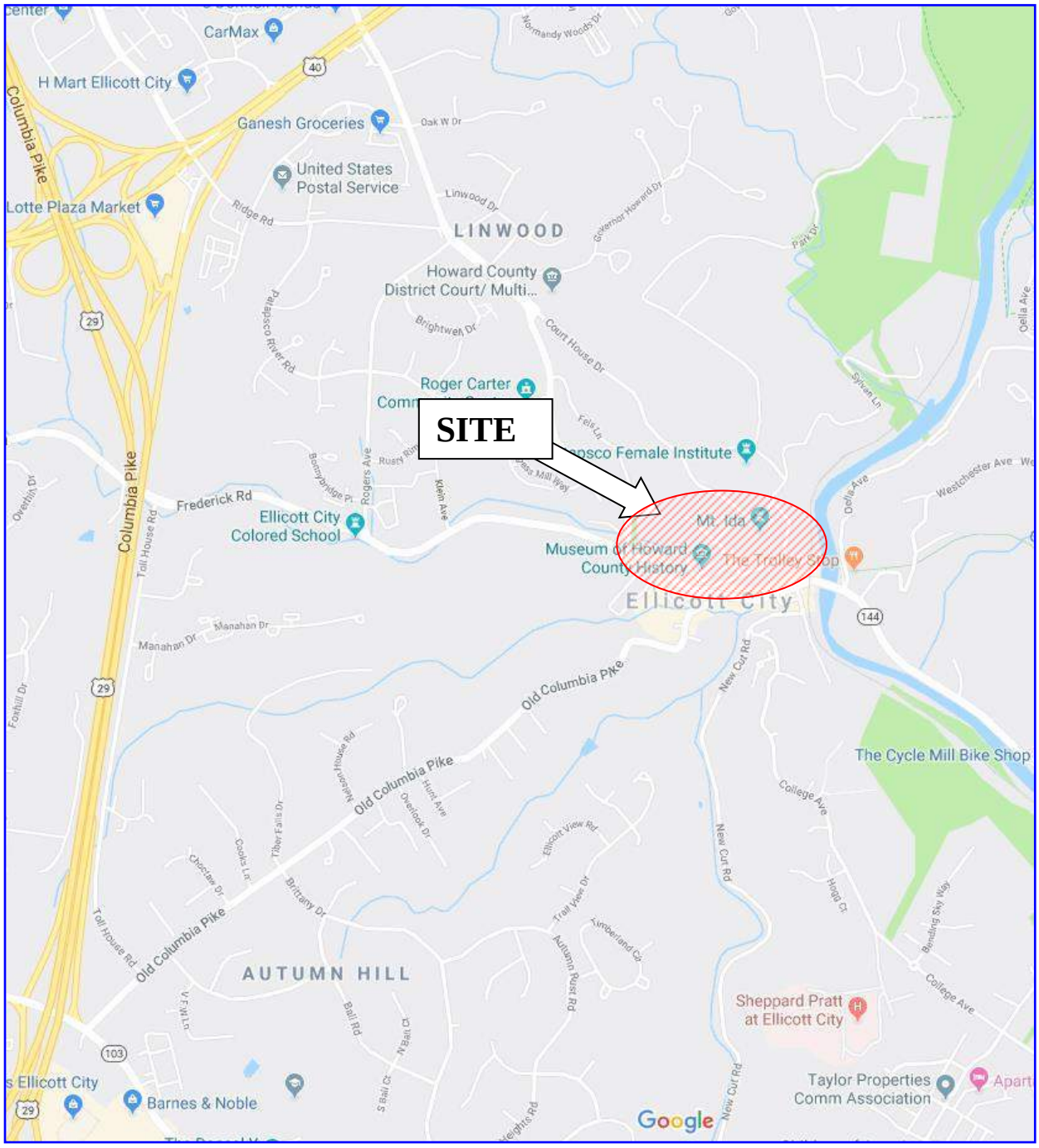
Below 0.25……...Very Soft	1.00 to 1.99……..Stiff
0.25 to 0.49……..Soft	2.00 to 3.99……...Very Stiff
0.50 to 0.99……..Firm	Over 4.00…….Hard

Quantity Modifiers

Term	% of Dry Weight
trace	0 to 10
little	11 to 20
some	21 to 35
and/with	36 to 50

Particle Size Identifications

Boulder …….....Over 8 inch diameter
Cobbles……...3 inch to 8 inch
Gravel……..Coarse……1 inch to 3 inch
Medium…….1/2 inch to 1 inch
Fine……....4.75 mm to 1/2 inch
Sand……....Coarse……....2 mm to 4.75 mm
Medium……..0.425 mm to 2 mm
Fine……....0.075 mm to 0.425 mm
Silt/Clay…….....Below 0.075 mm

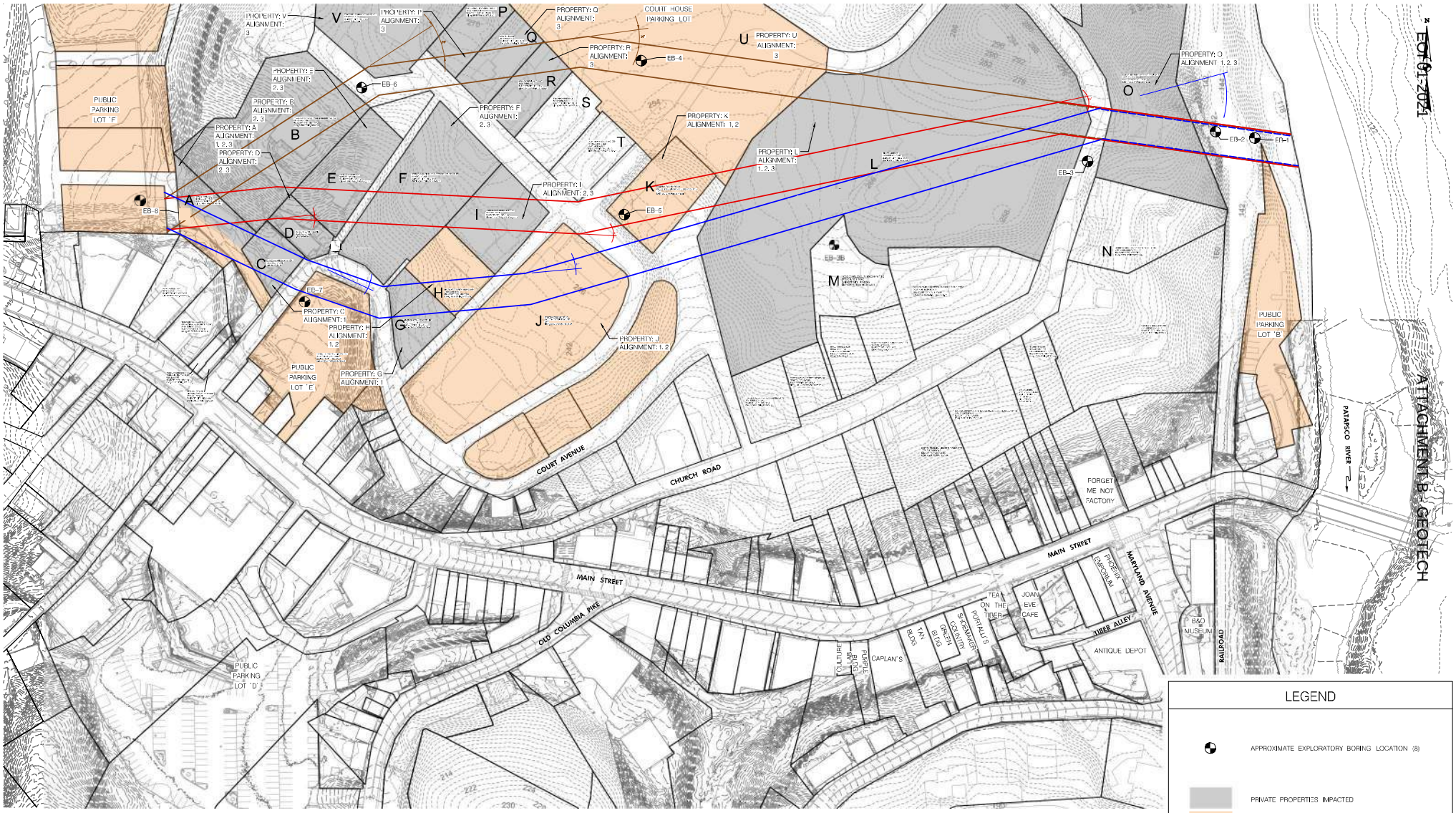


B. VICINITY MAP

Ellicott City Flood Relief North Tunnel
Howard County, Maryland

JOB NO: 2017091.042
SCALE: N.T.S.
DATE: 5/3/20

C. BORING PLAN



North Tunnel - Alternative Alignments Summary and Private Property Impacts

Alignment	Total Length (LF)	Total Private Properties Impacted	Private Properties Impacted													
			A	B	C	D	E	F	G	I	L	O	P	Q	R	V
			MAGIS FARM LLC 8388 COURT AVE L:09131/F:0067	MICHAEL & KRISTINE COPEMAN 3676 PARK AVE L:03554 F:00464	DAVID & ANALISA ARCHER 8386 COURT AVE L:17865 F:00404	JARED & AUTUMN LEWIS 8382 COURT AVE L:17749 F:0096	GEORGE GOELLER 8378 COURT AVE L:01075 F:00250	DAVID BARBER & DONNA LANCELOTTA 8374 COURT AVE L:03123 F:00019	AMERICAN TOURESORTS INC 8370 COURT AVE L:01801 F:00070	AMERICAN TOURESORTS INC 3706 COURT PL L:01755 F:00639	THE MILLER FAMILY FOUNDATION INC 3748 CHURCH RD L:18372 F:00435	JEFFREY & VIRGINIA SCHAD 3727 CHURCH RD L:15955 F:00241	COURTHOUSE OVERLOOK LLC 3675 PARK AVE L:05666 F:00637	MOJAN BAGHA 3677 PARK AVE L:07857 F:00649	REGINALD MALLOY 3685 PARK AVE L:05483 F:0433	SEAN STAFFORD & WENDY NOBLE 3673 N PARK AVE L/F:
1 (Blue)	1,677	5	X		X				X		X	X				
2 (Red)	1,632	8	X	X		X	X	X		X	X	X				
3 (Brown)	1,682	8	X	X							X	X	X	X	X	X

PROPOSED NORTH TUNNEL (45' WIDTH) CONCEPT ALIGNMENTS

60' 0 60' 120'

SCALE: 1" = 60'

EOF 01-2021

ATTACHMENT B: GEOTECH

D. BORING LOGS

Project No. 2017091.042

LOG OF BOREHOLE EB-1

Sheet 1 of 2

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **1/8/20**

END DATE: **1/10/20**

NORTHING: 583722.7
EASTING: 1370459.5

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

Surface Elev.: **142.0** ft.

DEPTH (FT.)	GRAPHIC LOG	DESCRIPTION	SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	DRILLING: BLOWs/6" N-VALUE RQD	DISCONTINUITY: FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
		SILTY GRAVEL (GM); black with sand	1			2-3-50/5"									
4.5		-Spoon and Auger Refusal at 4.5 ft -End of Soil Boring													
137.5															
		Gray, pink and white GRANITE, medium to coarse grained, predominantly close to very close fracture spacing, slightly weathered, hard, minerals mainly quartz, fractures dip at 10-25 degrees	1	87%	3	RQD= 50%		4.6	10	J	O	SD	Pa	IR	R
								4.8	10	J	O	SD	Pa	PL	R
								5.4	15	J	O	SD	Pa	IR	R
								5.7	10	J	O	SD	Pa	PL	R
7.0								6	25	J	O	SD	Pa	IR	R
135.0			2	100%	3	RQD= 83%		6.4	20	J	PO	SD	Pa	PL	S
		Gray, pink and white GRANITE, medium to coarse grained, predominantly close to moderately close fracture spacing, slightly weathered, hard, minerals mainly quartz, fractures dip at 10-60 degrees						7.2	10	J	PO	SD	Pa	IR	R
								7.6	10	J	T			PL	R
								8	15	J	T			PL	R
								8.4	25	J	T	SD	Pa	PL	S
								9.8	60	J	PO			IR	S
12.0															
130.0			3	100%	4	RQD= 100%									
		Gray, pink and white GRANITE, medium to coarse grained, predominantly close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 15 degrees						14.5	15	J	PO	SD	Pa	IR	R
								15.3	15	J	T			PL	R
17.0								16.3	15	J	T			PL	R
125.0			4	100%	4	RQD= 98%									
		Gray, pink and white GRANITE, medium to coarse grained, predominantly close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 10-15 degrees						19.3	15	J	T			IR	R
								19.4	15	J	T			IR	R
								20.2	10	J	T			IR	R
22.0								21.5	10	J	T			IR	S
120.0			5	100%	5	RQD= 95%		22.2	15	J	T			PL	R
		Gray, pink and white GRANITE, medium to coarse grained, predominantly close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 10-15 degrees						22.7	15	J	PO	SD	Pa	IR	S
								23.1	10	J	T			IR	R
27.0															
115.0			6	95%	5	RQD= 88%		27.5	50	J	O	SD	Pa	IR	S
								27.6	10	J	O	SD	Pa	IR	S
								27.7	15	J	O	SD	Pa	IR	S

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	NO2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

Project No. 2017091.042

LOG OF BOREHOLE EB-1

Sheet 2 of 2

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **1/8/20**

END DATE: **1/10/20**

NORTHING: 583722.7
EASTING: 1370459.5

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

			DRILLING				DISCONTINUITY								
	GRAPHIC LOG	DEPTH (FT.)	SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
32.0 Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, slight weathered, hard, minerals mainly quartz, fractures dip at 10-50 degrees *(continued)* 110.0			7	100%	4	RQD= 100%									
Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-15 degrees		35						34.1	5	J	PO	SD	Pa	IR	S
37.0								36	15	J	PO	SD	Pa	IR	S
105.0 Gray, pink and white GRANITE, medium to coarse grained, predominantly close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5 degrees			8	100%	4	RQD= 90%		37.5	5	J	PO	SD	Pa	PL	S
								37.8	5	J	PO	SD	Pa	PL	S
								38	5	J	PO	SD	Pa	PL	S
		40						40.6	5	J	PO	SD	Pa	PL	S
42.0								41.5	5	J	PO	SD	Pa	PL	S
100.0 Gray, pink and white GRANITE, medium to coarse grained, predominantly wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5 degrees			9	100%	10	RQD= 100%									
		45						45.6	5	J	T			IR	R
47.0															
95.0 Gray, pink and white GRANITE, medium to coarse grained, predominantly wide fracture spacing, fresh, very hard, minerals mainly quartz			10	100%	38	RQD= 100%									
49.5															
92.5 Coring Setup @ 4.5 ft End of Boring @ 49.5 ft Borehole was backfilled with cement/bentonite grout upon completion															

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	NO2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

BORING LOG (SOIL) 2017091.042 ELLICOTT CITY TUNNEL.GPJ AB_CONS.GDT 5/14/20

Project No. 2017091.042

LOG OF BOREHOLE EB-2

Sheet 1 of 2

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **1/15/20**

END DATE: **1/17/20**

NORTHING: 583733.4
EASTING: 1370401.6

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

Surface Elev.: **142.0** ft.

DEPTH (FT.)	GRAPHIC LOG	DRILLING: SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	DISCONTINUITY: FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
0		1	29%		4-6-50/5"									
3.5	SILTY GRAVEL (GM); black with sand -Spoon and Auger Refusal at 3.5 ft -End of Soil Boring													
138.5							3	25	J	O	SD	Pa	IR	S
	Gray, pink and white GRANITE, medium to coarse grained, predominantly close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 25 degrees	1	100%	13	RQD= 100%									
6.5														
135.5	Gray, pink and white GRANITE, medium to coarse grained, predominantly close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-15 degrees	2	100%	4	RQD= 92%		7.6 8.1 9	10 10 15	J J J	O PO T	SD SD	Pa Pa	IR IR PL	S S R
11.5														
130.5	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-45 degrees	3	98%	4	RQD= 90%		11.6 11.7 12.5 14.1 14.9	5 5 45 5 45	J J J J J	PO O PO PO PO	SD SD SD SD SD	Pa Pa Pa Pa Pa	PL IR PL PL PL	R S S R R
16.5														
125.5	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-60 degrees	4	100%	3	RQD= 90%		18.3 19.8 20.2 20.3	60 15 5 5	J J J J	PO PO PO PO	SD SD SD SD	Pa Pa Pa Pa	IR PL PL PL	R S S S
21.5														
120.5	Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 0 degrees	5	100%	6	RQD= 100%		24.5	0	J	PO	SD	Pa	IR	R
26.5														
115.5	Gray, pink and white GRANITE, medium to coarse grained, predominantly close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 15-60 degrees	6	100%	5	RQD= 73%		26.9 27 27.1 27.6 28.5	15 15 60 45 45	J J J J J	PO PO PO PO PO	SD SD SD SD SD	Pa Pa Pa Pa Pa	PL PL PL PL PL	R R R S S

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	NO2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

Project No. 2017091.042

LOG OF BOREHOLE EB-2

Sheet 2 of 2

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **1/15/20**

END DATE: **1/17/20**

NORTHING: 583733.4
EASTING: 1370401.6

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

		GRAPHIC LOG	DEPTH (FT.)	DRILLING: SAMPLE/ RUN NO.	DRILLING: RECOVERY (%)	DRILLING: CORING TIME MIN/FT (AVG)	DRILLING: BLOWs/6" N-VALUE RQD	DISCONTINUITY: FRACTURE FREQUENCY (BREAK/FT)	DISCONTINUITY: DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
31.5	110.5								29	15	J	PO	SD	Pa	PL	S
									29.5	45	J	PO	SD	Pa	PL	R
	Gray, pink and white GRANITE, medium to coarse grained, predominantly close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-60 degrees			7	100%	2	RQD= 97%									
			35						34.4	60	J	PO	SD	Pa	PL	S
									34.6	60	J	PO	SD	Pa	PL	S
36.5	105.5								35.9	5	J	T			PL	S
	Gray, pink and white GRANITE, medium to coarse grained, predominantly close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 0-10 degrees			8	100%	4	RQD= 100%		36.7	0	J	PO	SD	Pa	IR	R
			40						38.5	10	J	T			PL	R
41.5	100.5															
	Gray, pink and white GRANITE, medium to coarse grained, fresh, hard, minerals mainly quartz			9	100%	5	RQD= 100%									
			45													
46.5	95.5															
	Coring Setup @ 3.5 ft End of Boring @ 46.5 ft Borehole was backfilled with cement/bentonite grout upon completion															

WATER LEVEL OBSERVATIONS

WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	NO2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

BORING LOG (SOIL) 2017091.042 ELLICOTT CITY TUNNEL.GPJ AB_CONS.GDT 5/14/20

Project No. 2017091.042

LOG OF BOREHOLE EB-3

Sheet 1 of 5

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **12/18/19**

END DATE: **12/31/19**

NORTHING: 583703.9
EASTING: 1370215.3

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

Surface Elev.: **240.0** ft.

			GRAPHIC LOG	DEPTH (FT.)	DRILLING: SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	DISCONTINUITY: FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
0.4	5" Asphalt	239.6															
	POORLY GRADED SAND (SP); tan, medium dense, moist				1	50%		7-5-3 3 N=8									
	POORLY GRADED SAND (SP); tan, with some rock fragments, loose, moist				2	25%		6-4-2 2 N=6									
5.0		235.0		5													
	SILTY SAND (SM); dark brown, with mica, very loose, moist				3	13%		3-1-3 4 N=4									
8.0		232.0															
	SANDY SILT (ML); brown, with trace of clay and mica, loose, moist				4	75%		3-3-5 5 N=8									
				10													
	SANDY SILT (ML); brown, with trace of clay and mica, dense, moist				5	75%		10-15-20 20 N=35									
				15													
	SANDY SILT (ML); brown, with mica, medium dense, moist				6	100%		13-11-17 17 N=28									
20.0		220.0		20													
	SILTY SAND (SM); brown and tan, dense, moist				7	100%		17-18-27 27 N=45									
				25													
28.0		212.0															
29.0	SILTY SAND (SM) (Decomposed Rock); brown, with rock fragments, very dense, moist	211.0			8	100%		50/1"									
				30	1	100%	3	RQD=		29.3	10	J	T			PL	S

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	NO2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

BORING LOG (SOIL) 2017091.042 ELLICOTT CITY TUNNEL.GPJ AB_CONS.GDT 5/14/20

Project No. 2017091.042

LOG OF BOREHOLE EB-3

Sheet 2 of 5

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **12/18/19**

END DATE: **12/31/19**

NORTHING: 583703.9
EASTING: 1370215.3

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

DEPTH (FT.)	GRAPHIC LOG	DRILLING: SAMPLE/RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	DISCONTINUITY: FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
					75%		30.7	60	J	T			PL	S
32.0	-Spoon and Auger Refusal at 29 ft -End of Soil Boring						31.6	60	J	T			PL	S
	Gray, pink and white GRANITE, medium to coarse grained, predominantly close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 10-60 degrees *(continued)*	2	100%	3	RQD= 57%		33.3	45	J	PO	SD	Pa	PL	S
							33.5	15	J	T			PL	S
35							35.3	45	J	PO	SD	Pa	PL	R
							35.5	45	J	PO	SD	Pa	PL	R
37.0	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, slightly weathered, hard, minerals mainly quartz, fractures dip at 15-45 degrees 203.0						35.8	45	J	PO	SD	Pa	PL	R
		3	93%	2	RQD= 72%		35.9	45	J	PO	SD	Pa	PL	R
							36.5	45	J	PO	SD	Pa	PL	S
							36.7	30	J	PO	SD	Pa	PL	S
							36.8	45	J	PO	SD	Pa	PL	S
							37.3	20	J	T	SD	Pa	PL	S
40							37.8	20	J	PO	SD	Pa	PL	S
							37.9	15	J	VW	SD	Pa	IR	S
42.0	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, slightly weathered, hard, minerals mainly quartz, fractures dip at 15-45 degrees 198.0						38	45	J	PO	SD	Pa	PL	S
							38.4	15	J	VW	SD	Pa	IR	S
		4	100%	2	RQD= 78%		38.5	35	J	PO	SD	Pa	PL	S
							39.1	15	J	T	SD	Pa	PL	S
							41.8	25	J	PO	SD	Pa	PL	S
							41.9	45	J	PO			PL	S
45							42.5	10	J	PO			PL	S
							43.1	45	J	T	SD	Pa	PL	S
							43.2	20	J	T	SD	Pa	PL	S
47.0	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 10-45 degrees 193.0						44.5	25	J	VW	SD	Pa	IR	S
							44.6	15	J	VW	SD	Pa	IR	S
		5	92%	3	RQD= 53%		44.7	45	J	PO	SD	Pa	PL	S
							45.1	10	J	T			PL	S
							45.7	10	J	T	SD	Pa	PL	S
							46	60	J	PO	SD	Pa	PL	S
50							47.2	45	J	VW	SD	Pa	IR	R
							48	5	J	PO			PL	S
							48.6	5	J	PO			PL	S
52.0	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, slightly weathered, moderately hard to hard, minerals mainly quartz, fractures dip at 5-80 degrees 188.0						49.3	5	J	PO			IR	S
							49.6	45	J	T	SD	Pa	PL	S
		6	100%	3	RQD= 68%		49.8	80	J	T			PL	S
							51.5	20	J	PO	SD	Pa	IR	R
							52.4	15	J	VW	SD	Pa	IR	R
55							53	25	J	VW	SD	Pa	IR	R
							53.9	45	J	VW			IR	S
							54.7	10	J	PO	SD	Pa	PL	S
57.0	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, slightly weathered, moderately hard to hard, minerals mainly quartz, fractures dip at 10-45 degrees 183.0						55	45	J	PO	SD	Pa	PL	S
							55.6	10	J	T			IR	S
							55.7	45	J	T	SD	Pa	PL	S
		7	100%	2	RQD= 85%		56	45	J	T			PL	S
							56.7	45	J	PO			PL	S
60							57.3	45	J	T			PL	S
							58	45	J	T			PL	S
							58.1	5	J	T			PL	S

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	NO2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

Project No. 2017091.042

LOG OF BOREHOLE EB-3

Sheet 3 of 5

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **12/18/19**

END DATE: **12/31/19**

NORTHING: 583703.9
EASTING: 1370215.3

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

		GRAPHIC LOG	DEPTH (FT.)	DRILLING: SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	DISCONTINUITY: FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, slightly weathered, hard, minerals mainly quartz, fractures dip at 5-45 degrees *(continued)*								58.6	5	J	T			PL	S
									58.8	45	J	T			PL	S
62.0				8	100%	2	RQD= 100%									
178.0																
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, slightly weathered, hard, minerals mainly quartz, fractures dip at 5-45 degrees								63.9	45	J	PO	SD	Pa	PL	S
									64.2	5	J	PO	SD	Pa	PL	S
			65						65	45	J	T			PL	S
67.0																
173.0																
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 10-35 degrees			9	93%	2	RQD= 68%		68	10	J	T			IR	R
									68.4	35	J	T			PL	S
			70						70.4	15	J	PO	SD	Pa	IR	S
									70.9	10	J	T			PL	R
72.0									71	10	J	T			IR	R
168.0																
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 10-45 degrees			10	100%	2	RQD= 100%		71.3	20	J	T			PL	S
									74.3	45	J	T			PL	S
			75													
77.0									76	10	J	T			PL	R
163.0									76.4	45	J	T			PL	S
	Gray, pink and white GRANITE, medium to coarse grained, fresh, very hard, minerals mainly quartz			11	100%	2	RQD= 100%		76.8	25	J	T			PL	S
			80													
82.0																
158.0																
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 10-30 degrees			12	100%	3	RQD= 92%		84.6	25	J	T			IR	R
									84.7	25	J	T			PL	S
			85						85.3	30	J	T			PL	S
87.0									86.3	10	J	T			IR	R
153.0																
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 10-30 degrees			13	100%	3	RQD= 92%		89	10	J	T			IR	R
			90													

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	NO2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

LOG OF BOREHOLE EB-3

Project No. 2017091.042 | **Sheet 4 of 5**

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **12/18/19**

END DATE: **12/31/19**

NORTHING: 583703.9
EASTING: 1370215.3

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

		GRAPHIC LOG	DEPTH (FT.)	DRILLING: SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	DISCONTINUITY: FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
92.0									90.3	15	J	T			PL	S
									90.9	30	J	T			PL	S
									91.6	15	J	PO	SD	Pa	IR	S
									91.7	15	J	PO	SD	Pa	IR	S
									92.3	15	J	T			PL	S
									93.6	40	J	T			PL	S
									93.7	40	J	T			PL	S
			95						94.3	45	J	T			PL	R
									95.6	50	J	T			PL	R
97.0									96.5	45	J	T			PL	R
									97.3	15	J	PO	SD	Pa	IR	S
									97.8	35	J	PO	SD	Pa	IR	R
									98.5	45	J	T			PL	S
									99.3	60	J	T			PL	S
			100						99.5	25	J	T			PL	S
									99.8	10	J	T			PL	S
									100.9	30	J	T			PL	S
									102.9	10	J	T			PL	R
									103.3	35	J	T			IR	S
									103.7	45	J	T			PL	S
			105						104.5	10	J	T			PL	S
									105.9	10	J	T			PL	S
									106.1	15	J	T			IR	S
									106.5	15	J	T	SD	Pa	IR	S
									107.3	45	J	PO			PL	S
									107.5	10	J	T			PL	R
									108.3	45	J	T			PL	S
			110						108.5	40	J	T			PL	S
									108.6	5	J	T			PL	S
									110.2	45	J	T			PL	S
									110.9	45	J	PO	SD	Pa	PL	S
112.0									111.2	55	J	T			PL	S
									112.5	45	J	T			PL	S
									113.7	50	J	T			PL	S
			115						114.7	5	J	T			PL	S
									114.8	45	J	T			PL	S
117.0									116.5	50	J	T			PL	R
									117.2	45	J	T			PL	S
									117.4	45	J	T			PL	S
									118.8	5	J	T			IR	R
			120													

148.0 — Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 15-50 degrees

14	100%	5	RQD= 82%	97.0 – 143.0

143.0 — Gray, pink and white GRANITE, medium to coarse grained, predominantly extremely close to moderately close fracture spacing, slightly weathered, hard, minerals mainly quartz, fractures dip at 10-60 degrees

15	98%	5	RQD= 72%	102.0 – 138.0

138.0 — Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 10-45 degrees

16	100%	3	RQD= 92%	107.0 – 133.0

133.0 — Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5-45 degrees

17	98%	4	RQD= 75%	112.0 – 128.0

128.0 — Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5-50 degrees

18	100%	5	RQD= 97%	117.0 – 123.0
19	100%	4	RQD= 92%	

123.0

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	NO2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

Project No. 2017091.042

LOG OF BOREHOLE EB-3

Sheet 5 of 5

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **12/18/19**

END DATE: **12/31/19**

NORTHING: 583703.9
EASTING: 1370215.3

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

			DRILLING				DISCONTINUITY								
	GRAPHIC LOG	DEPTH (FT.)	SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
Gray, pink and white GRANITE, medium to coarse grained, predominantly close to moderately close fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5-45 degrees *(continued)*								120.8	10	J	T			IR	R
122.0 118.0								121.7	35	J	T			PL	S
			20	100%	4	RQD= 93%		122.3	45	J	T			PL	S
								122.6	5	J	T			IR	S
								123.1	45	J	VN			PL	S
Gray, pink and white GRANITE, medium to coarse grained, predominantly close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5-45 degrees		125						124.2	45	J	T			PL	S
127.0 113.0															
Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5-50 degrees			21	100%	7	RQD= 93%		128.2	45	J	T			PL	S
								129.1	45	J	T			PL	S
		130						129.2	50	J	VN			PL	S
								129.4	45	J	T			PL	S
								130.2	45	J	T			PL	S
132.0 108.0								130.6	5	J	T			PL	S
Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5-45 degrees			22	100%	6	RQD= 100%		132.7	30	J	VN			PL	S
		135						134.1	5	J	VN			PL	S
								135.6	15	J	T			PL	S
137.0 103.0								136.3	45	J	T			PL	S
Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 15-45 degrees			23	100%	5	RQD= 98%		136.6	45	J	T			PL	S
								137.9	15	J	VN			PL	S
								138.1	45	J	VN			PL	S
		140						139.6	45	J	T			PL	S
								140.1	30	J	T			PL	S
142.0 98.0								140.4	45	J	VN			PL	S

Coring Setup @ 29 ft
End of Boring @ 142 ft
Borehole was backfilled with cement/bentonite grout upon completion

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	NO2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

BORING LOG (SOIL) 2017091.042 ELLICOTT CITY TUNNEL.GPJ AB_CONS.GDT 5/14/20

Project No. 2017091.042

LOG OF BOREHOLE EB-3B

Sheet 1 of 6

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **4/3/20**

END DATE: **4/17/20**

NORTHING: 583564.3
EASTING: 1369853.4

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

Surface Elev.: **258.0** ft.

DEPTH (FT.)	GRAPHIC LOG	DRILLING: SAMPLE/RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	DISCONTINUITY: FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
0.1		1" Topsoil												
257.9		SILTY SAND (SM); dark brown and tan, very loose, moist	1	100%		1-1-1 N=2								
		SILTY SAND (SM); brown and tan, medium dense, moist	2	67%		7-5-11 N=16								
5.0														
253.0		SILTY SAND (SM); tan and gray, very dense, moist	3	71%		15-32-50/5"								
		SILTY SAND (SM); tan and gray, very dense, dry	4	100%		50/6"								
13.0														
245.0		SILTY SAND (SM) (Decomposed Rock); gray and light brown, with rock fragments, very dense, dry	5	100%		50/5"								
		SILTY SAND (SM) (Decomposed Rock); gray and light brown, with rock fragments, very dense, dry -Spoon Refusal at 19 ft	6	100%		50/1"								
21.5		-Auger Refusal at 21.5 ft												
236.5		-End of Soil Boring Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, slightly weathered, hard, minerals mainly quartz, fractures dip at 5-45 degrees	1	80%	5	RQD= 58%	21.7 21.9 22.3 22.6 23.4 23.9 24.3	5 5 45 5 45 45 5	J J J J J J J	PO PO T T PO PO T	SD SD SD SD 	Pa Pa Pa Pa 	PL PL PL PL IR PL PL	Sr Sr S S S S S
26.5														
231.5		Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, slightly weathered, hard, minerals mainly quartz, fractures dip at 5-65 degrees	2	97%	3	RQD= 87%	27.3 28.7 29.1	5 45 65	J J J	PO T PO	SD SD	Pa Pa	PL PL PL	S S S

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	N2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

Project No. 2017091.042

LOG OF BOREHOLE EB-3B

Sheet 2 of 6

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **4/3/20**

END DATE: **4/17/20**

NORTHING: 583564.3
EASTING: 1369853.4

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

			DRILLING				DISCONTINUITY									
	GRAPHIC LOG	DEPTH (FT.)	SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
31.5 – 226.5								29.3	5	J	T	SD	Pa	PL	S
								29.4	5	J	T			PL	S
								29.8	45	J	PO			IR	S
Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, slightly weathered, hard, minerals mainly quartz, fractures dip at 5-60 degrees			3	92%	3	RQD= 80%		30.4	45	J	T	SD	Pa	PL	S
								31.6	15	J	PO	SD	Pa	IR	S
								32	45	J	PO	SD	Pa	PL	S
								32.4	45	J	T			PL	S
								32.6	5	J	T			PL	S
		35						32.8	15	J	PO			IR	S
								33.3	15	J	T			PL	S
								34.3	45	J	T			PL	S
36.5 – 221.5								35	60	J	T			IR	S
Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, slightly weathered, hard, minerals mainly quartz, fractures dip at 5-60 degrees			4	92%	3	RQD= 80%		37.7	45	J	T			PL	S
		40						39.9	60	J	PO	SD	Pa	PL	S
								40.1	45	J	T			IR	S
								40.4	5	J	T			PL	S
41.5 – 216.5								41	5	J	T			IR	S
Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-45 degrees			5	100%	3	RQD= 90%		42.4	5	J	T			PL	S
								42.6	5	J	T	SD	Pa	PL	S
								42.9	5	J	PO			PL	S
		45						43.7	45	J	T			IR	Sr
								44.4	5	J	T			PL	S
								45.3	5	J	T			PL	S
46.5 – 211.5								45.8	5	J	T			IR	S
Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, slightly weathered, hard, minerals mainly quartz, fractures dip at 5-45 degrees			6	95%	3	RQD= 73%		47.2	45	J	T			PL	S
								47.8	45	J	T			PL	S
								48.1	45	J	T	SD	Pa	PL	S
								48.4	40	J	PO	SD	Pa	PL	S
		50						48.9	15	J	PO	SD	Pa	IR	S
								49.2	15	J	PO	SD	Pa	IR	S
								49.4	5	J	PO	SD	Pa	PL	S
51.5 – 206.5								49.6	5	J	PO			PL	S
Gray, pink and white GRANITE, medium to coarse grained, predominantly close to widely close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 15-45 degrees			7	98%	4	RQD= 95%		49.7	45	J	T			PL	S
								50.3	45	J	T			PL	S
								50.8	45	J	T	SD	Pa	PL	S
								51.2	45	J	T			PL	S
		55						52	45	J	T			PL	S
								52.5	45	J	T			IR	S
								53	40	J	PO			PL	S
								53.9	15	J	T			PL	S
56.5 – 201.5								54	15	J	T			PL	S
Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-60 degrees			8	100%	6	RQD= 95%		57	10	J	PO	SD	Pa	PL	S
								58.3	30	J	PO	SD	Pa	PL	S
		60													

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	N2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

Project No. 2017091.042

LOG OF BOREHOLE EB-3B

Sheet 3 of 6

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **4/3/20**

END DATE: **4/17/20**

NORTHING: 583564.3
EASTING: 1369853.4

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

			DRILLING				DISCONTINUITY								
GRAPHIC LOG	DEPTH (FT.)	SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
							59.9	60	J	T			PL	S
							60.1	5	J	T	SD	Pa	PL	S
							60.8	45	J	PO			PL	S
		9	100%	9	RQD= 100%		62.1	45	J	T			PL	S
	65						65.3	50	J	T			PL	S
		10	100%	10	RQD= 100%		68.1	45	J	T			PL	S
							68.3	5	J	T			PL	S
							69.2	60	J	T			PL	S
	70						69.8	60	J	T			PL	S
		11	98%	10	RQD= 98%		74.5	45	J	PO	SD	Pa	PL	S
	75						75.6	60	J	PO	SD	Pa	PL	S
		12	95%	22	RQD= 95%		77.2	45	J	PO	SD	Pa	PL	S
							78.6	5	J	T			PL	S
	80						80.6	5	J	T			PL	S
		13	100%	21	RQD= 100%		83.3	15	J	T			PL	S
	85						86.6	15	J	T			PL	S
		14	100%	32	RQD= 98%		89.4	45	J	T			PL	S
	90													

61.5 196.5

Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to very wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 45-50 degrees

66.5 191.5

Gray, pink and white GRANITE, medium to coarse grained, predominantly close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-60 degrees

71.5 186.5

Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 40-60 degrees

76.5 181.5

Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-45 degrees

81.5 176.5

Gray, pink and white GRANITE, medium to coarse grained, predominantly wide to very wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 15 degrees

86.5 171.5

Gray, pink and white GRANITE, medium to coarse grained, predominantly close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 15-45 degrees

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	N2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

Project No. 2017091.042

LOG OF BOREHOLE EB-3B

Sheet 4 of 6

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **4/3/20**

END DATE: **4/17/20**

NORTHING: 583564.3
EASTING: 1369853.4

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

		GRAPHIC LOG	DEPTH (FT.)	DRILLING: SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	DISCONTINUITY: FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
-Replace with new CME #8 bit at 56 ft									90.3	45	J	T			PL	S
91.5	166.5															
Gray, pink and white GRANITE, medium to coarse grained, fresh, hard, minerals mainly quartz			95	15	95%	13	RQD= 95%									
96.5	161.5															
Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to very wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-45 degrees				16	100%	72	RQD= 100%		97	5	J	T			PL	S
									97.5	45	J	T			PL	S
-Replace with new N2 bit at 101 ft			100													
101.5	156.5															
Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to very wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 45 degrees				17	95%	5	RQD= 95%									
106.5	151.5		105						105.8	45	J	T			PL	S
Gray, pink and white GRANITE, medium to coarse grained, fresh, hard, minerals mainly quartz				18	95%	7	RQD= 95%									
111.5	146.5		110													
Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-65 degrees				19	100%	38	RQD= 100%		111.9	5	J	T			PL	S
									113.6	65	J	PO	SD	Pa	PL	S
-Replace with new N2 bit at 116 ft			115						115.2	45	J	T			PL	S
116.5	141.5															
Gray, pink and white GRANITE, medium to coarse grained, fresh, hard, minerals mainly quartz				20	100%	3	RQD= 100%									
			120													

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	N2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

LOG OF BOREHOLE EB-3B

Project No. 2017091.042 | **Sheet 5 of 6**

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **4/3/20**

END DATE: **4/17/20**

NORTHING: 583564.3
EASTING: 1369853.4

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

		GRAPHIC LOG	DEPTH (FT.)	DRILLING: SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	DISCONTINUITY: FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
121.5	136.5															
	Gray, pink and white GRANITE, medium to coarse grained, fresh, hard, minerals mainly quartz			21	100%	3	RQD= 100%									
126.5	131.5		125													
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 45-65 degrees			22	87%	3	RQD= 68%		127.9	65	J	PO	SD	Pa	PL	S
									128.1	45	J	PO	SD	Pa	PL	S
									128.6	65	J	PO	SD	Pa	PL	S
			130						129	45	J	T			PL	S
									130.4	50	J	T			PL	S
131.5	126.5															
	Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to very wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 10 degrees			23	100%	3	RQD= 100%									
136.5	121.5		135													
	Gray, pink and white GRANITE, medium to coarse grained, predominantly close to very wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 15 degrees			24	98%	3	RQD= 95%		136.1	10	J	T			PL	S
									136.8	15	J	PO	SD	Pa	IR	S
141.5	116.5		140						140.9	15	J	T			PL	S
	Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to very wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 30-60 degrees			25	93%	4	RQD= 92%									
			145						145.2	30	J	PO	SD	Pa	PL	S
146.5	111.5								146.1	60	J	PO	SD	Pa	PL	S
	Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 45 degrees			26	100%	3	RQD= 97%		147.2	45	J	PO	SD	Pa	PL	S
									148.9	45	J	PO	SD	Pa	PL	S
			150													

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	N2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

Project No. 2017091.042

LOG OF BOREHOLE EB-3B

Sheet 6 of 6

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **4/3/20**

END DATE: **4/17/20**

NORTHING: 583564.3
EASTING: 1369853.4

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

		GRAPHIC LOG	DEPTH (FT.)	DRILLING: SAMPLE/ RUN NO.	DRILLING: RECOVERY (%)	DRILLING: CORING TIME MIN/FT (AVG)	DRILLING: BLOWs/6" N-VALUE RQD	DISCONTINUITY: FRACTURE FREQUENCY (BREAK/FT)	DISCONTINUITY: DEPTH (FT.)	DISCONTINUITY: DIP (DEG.)	DISCONTINUITY: TYPE	DISCONTINUITY: APERTURE	DISCONTINUITY: INFILL	DISCONTINUITY: AMOUNT	DISCONTINUITY: SHAPE	DISCONTINUITY: ROUGHNESS
									149.9	45	J	PO	SD	Pa	PL	S
151.5	106.5															

Coring Setup @ 21.5 ft
End of Boring @ 151.5 ft
Borehole was backfilled with cement/bentonite grout upon completion

WATER LEVEL OBSERVATIONS

WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	N2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

BORING LOG (SOIL) 2017091.042 ELLICOTT CITY TUNNEL.GPJ AB_CONS.GDT 5/14/20

Project No. 2017091.042

LOG OF BOREHOLE EB-4

Sheet 1 of 5

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **11/25/19**

END DATE: **12/3/19**

NORTHING: 583821.2
EASTING: 1369584.6

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

Surface Elev.: **258.0** ft.

DEPTH (FT.)	GRAPHIC LOG	DESCRIPTION	SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
0.4		2.5" Asphalt 257.6 2.5" Gravel Base SILTY SAND (SM); brown, with some gravel and mica, loose, moist	1	46%		2-2-4 3 N=6									
5.0		253.0 SILTY SAND (SM); gray, with some rock fragments and mica, medium dense, moist	2	75%		4-4-6 8 N=10									
		SILTY SAND (SM); gray, with mica, medium dense, moist	3	100%		4-5-6 8 N=11									
		SILTY SAND (SM); gray, with mica and trace of clay, loose, moist	4	75%		1-3-4 5 N=7									
18.0		240.0 SILTY SAND (SM) (Decomposed Rock); gray and brown, with rock fragments and mica, very dense, moist	5	100%		50/6"									
19.5		238.5 -Spoon and Auger Refusal at 19.5 ft -End of Soil Boring	1	73%	3	RQD= 70%									
		Gray, pink and white GRANITE, medium to coarse grained, predominantly extremely close to moderately close fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5-45 degrees, with decomposed rock between 22.1 to 23.7 ft						21 21.1 22.1	45 5 15	J J J	O O CA	SD SD SD	Pa Pa Pa	IR PL IR	S S S
24.5		233.5						23.7	45	J	T			ST	S
		Gray, pink and white GRANITE, medium to coarse grained, predominantly close to moderately close fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5-15 degrees	2	100%	5	RQD= 88%		24.9 25.7 26 26.5	5 10 5 5	J J J J	T T T O	SD	Pa	PL PL IR PL	S S S S
29.5		228.5						28.3	5	J	O	SD	Pa	PL	S
			3	100%	6	RQD=		29.2	15	J	T			ST	S

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	CME-45B	AUGER TYPE:	CME#8/#10
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	PS
LOG BY:	FG		

Project No. 2017091.042

LOG OF BOREHOLE EB-4

Sheet 2 of 5

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **11/25/19**

END DATE: **12/3/19**

NORTHING: 583821.2
EASTING: 1369584.6

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

		GRAPHIC LOG	DEPTH (FT.)	DRILLING: SAMPLE/RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	DISCONTINUITY: FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 0-45 degrees *(continued)*						95%		30.4	O	J	T			PL	R
									30.6	O	J	T			PL	R
									31.3	45	J	O	SD	Pa	PL	S
									32.8	5	J	MW	SD	Pa	IR	VR
34.5									33.7	5	J	O	SD	Pa	PL	R
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5-45 degrees		35	4	100%	3	RQD= 89%		34.9	5	J	MW	SD	Pa	IR	R
									36.7	5	J	T			PL	S
									37.1	45	J	O	SD	Pa	PL	S
									38.1	5	J	MW	SD	Pa	IR	R
									38.2	5	J	MW	SD	Pa	IR	R
									38.3	5	J	MW	SD	Pa	IR	R
39.5									38.4	5	J	MW	SD	Pa	IR	R
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 10-60 degrees		40	5	100%	4	RQD= 100%		38.5	10	J	MW	SD	Pa	IR	R
									40.9	60	J	T			PL	S
									41.3	60	J	T			PL	S
									43.1	10	J	T			PL	S
44.5																
	Gray, pink and white GRANITE, medium to coarse grained, predominantly close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5-60 degrees		45	6	100%	4	RQD= 100%		45.1	60	J	T			PL	S
									46.4	5	J	T			PL	S
									46.8	5	J	T			PL	S
49.5																
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5-20 degrees		50	7	98%	5	RQD= 96%		49.9	20	J	PO	SD	Pa	IR	S
									50	20	J	T			PL	S
									52.2	10	J	T			PL	S
54.5									53.8	5	J	T			PL	R
	Gray, pink and white GRANITE, medium to coarse grained, predominantly close to moderately close fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5 degrees		55	8	100%	4	RQD= 100%		54.9	5	J	WM	SD	Pa	WA	S
									56.2	5	J	O	SD	Pa	PL	S
									57	5	J	T			PL	R
									57.6	5	J	T			PL	S
59.5																
			60	9	100%	4	RQD=		59.5	20	J	O	SD	Pa	WA	R

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	CME-45B	AUGER TYPE:	CME#8/#10
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	PS
LOG BY:	FG		

Project No. 2017091.042

LOG OF BOREHOLE EB-4

Sheet 3 of 5

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **11/25/19**

END DATE: **12/3/19**

NORTHING: 583821.2
EASTING: 1369584.6

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

			DRILLING					DISCONTINUITY								
	GRAPHIC LOG	DEPTH (FT.)	SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 0-20 degrees *(continued)*						98%		60.2	10	J	PO	SD	Pa	PL	R
								61.2	5	J	T			PL	R
64.5 193.5								63.3	10	J	PO	SD	Pa	WA	S
Gray, pink and white GRANITE, medium to coarse grained, predominantly close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 0-10 degrees		65	10	100%	4	RQD= 86%		64.1	0	J	T	SD	Pa	WA	S
								64.5	0	J	VW			PL	R
69.5 188.5								64.9	5	J	T			PL	S
Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5-15 degrees		70	11	100%	5	RQD= 92%		68.9	10	J	O	SD	Pa	WA	R
								69.2	10	J	T	SD	Pa	WA	S
								69.7	15	J	O	SD	Pa	PL	R
								69.8	15	J	O	SD	Pa	PL	R
								70.1	10	J	MW			PL	R
								70.9	5	J	T	SD	Pa	PL	S
								71.9	5	J	MW	SD	Pa	WA	R
74.5 183.5								72	5	J	MW			WA	R
Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5 degrees		75	12	98%	6	RQD= 95%		74	5	J	PO	SD	Pa	PL	R
								74.6	5	J	O	SD	Pa	PL	R
								75.5	5	J	PO	SD	Pa	PL	S
79.5 178.5															
Gray, pink and white GRANITE, medium to coarse grained, predominantly close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 0-5 degrees		80	13	100%	9	RQD= 100%		80.2	0	J	PO	SD	Pa	PL	S
								81.7	5	J	T			PL	R
84.5 173.5															
Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 15 degrees		85	14	100%	17	RQD= 93%									
89.5 168.5								88.7	15	J	T			WA	S
		90	15	100%	9	RQD=									

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	CME-45B	AUGER TYPE:	CME#8/#10
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	PS
LOG BY:	FG		

Project No. 2017091.042

LOG OF BOREHOLE EB-4

Sheet 4 of 5

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **11/25/19**

END DATE: **12/3/19**

NORTHING: 583821.2
EASTING: 1369584.6

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

		GRAPHIC LOG	DEPTH (FT.)	DRILLING: SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	DISCONTINUITY: FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
	Gray, pink and white GRANITE, medium to coarse grained, fresh, very hard, minerals mainly quartz *(continued)*						100%									
94.5																
163.5	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5 degrees		95	16	97%	10	RQD= 95%									
99.5																
158.5	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5 degrees		100	17	100%	20	RQD= 100%		99.3 99.5	5 5	J J	O PO	SD SD	Pa Pa	WA WA	S S
104.5																
153.5	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5 degrees		105	18	100%	17	RQD= 97%									
109.5																
148.5	Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 10 degrees		110	19	100%	29	RQD= 100%		109.4 111.4	5 10	J J	O T	SD	Pa	WA PL	S S
114.5																
143.5	Gray, pink and white GRANITE, medium to coarse grained, predominantly close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 15 degrees		115	20	100%	6	RQD= 100%									
119.5																
138.5			120	21	100%	6	RQD=		119	15	J	T			PL	S

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	CME-45B	AUGER TYPE:	CME#8/#10
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	PS
LOG BY:	FG		

Project No. 2017091.042

LOG OF BOREHOLE EB-4

Sheet 5 of 5

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **11/25/19**

END DATE: **12/3/19**

NORTHING: 583821.2
EASTING: 1369584.6

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

			DRILLING				DISCONTINUITY								
	GRAPHIC LOG	DEPTH (FT.)	SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
Gray, pink and white GRANITE, medium to coarse grained, fresh, very hard, minerals mainly quartz *(continued)*						100%									
124.5 133.5															
Gray, pink and white GRANITE, medium to coarse grained, fresh, very hard, minerals mainly quartz		125	22	100%	7	RQD= 100%									
129.5 128.5															
Gray, pink and white GRANITE, medium to coarse grained, fresh, very hard, minerals mainly quartz		130	23	100%	8	RQD= 100%									
134.5 123.5															
Gray, pink and white GRANITE, medium to coarse grained, fresh, very hard, minerals mainly quartz		135	24	100%	7	RQD= 100%									
139.5 118.5															
Gray, pink and white GRANITE, medium to coarse grained, fresh, very hard, minerals mainly quartz		140	25	100%	7	RQD= 100%									
144.5 113.5															
Coring Setup @ 19.5 ft End of Boring @ 144.5 ft Borehole was backfilled with cement/bentonite grout upon completion															

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	CME-45B	AUGER TYPE:	CME#8/#10
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	PS
LOG BY:	FG		

BORING LOG (SOIL) 2017091.042 ELLICOTT CITY TUNNEL.GPJ AB_CONS.GDT 5/14/20

Project No. 2017091.042

LOG OF BOREHOLE EB-5

Sheet 1 of 4

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **1/29/20**

END DATE: **2/14/20**

NORTHING: 583620.4
EASTING: 1369537.6

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

Surface Elev.: **232.0** ft.

DEPTH (FT.)	GRAPHIC LOG	SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	DESCRIPTION
0.3						1" Asphalt 4" Concrete (231.7)
		1	75%		6-7-8 8 N=15	SILTY SAND (SM); brown, medium dense, dry
		2	75%		8-8-9 7 N=17	SILTY SAND (SM); brown, medium dense, dry
5						
		3	100%		5-6-7 8 N=13	SILTY SAND (SM); tan, medium dense, dry
		4	100%		10-11-17 19 N=28	SILTY SAND (SM); tan, medium dense, dry
10						
		5	87%		27-40-36 50/5" N=76	SILTY SAND (SM); tan, medium dense, dry
15.0						(217.0)
15						SILTY SAND (SM) (Decomposed Rock); tan, with rock fragments, very dense, dry
		6	100%		50/1"	
20						-Spoon Refusal at 19.5 ft
25						
						-Auger Refusal at 31 ft
30						

DISCONTINUITY: FRACTURE FREQUENCY (BREAK/FT) | DEPTH (FT.) | DIP (DEG.) | TYPE | APERTURE | INFILL | AMOUNT | SHAPE | ROUGHNESS

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	NO2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

BORING LOG (SOIL) 2017091.042 ELLICOTT CITY TUNNEL.GPJ AB_CONS.GDT 5/14/20

Project No. 2017091.042

LOG OF BOREHOLE EB-5

Sheet 2 of 4

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **1/29/20**

END DATE: **2/14/20**

NORTHING: 583620.4
EASTING: 1369537.6

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

			DRILLING					DISCONTINUITY								
		GRAPHIC LOG	DEPTH (FT.)	SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
31.0	-End of Soil Boring 201.0															
	Gray, pink and white GRANITE, medium to coarse grained, predominantly close to moderately close fracture spacing, slightly weathered, hard, minerals mainly quartz, fractures dip at 30-60 degrees			1	100%	3	RQD= 100%		32.2	45	J	T			PL	R
									33.7	45	J	T			IR	R
									34.3	60	J	T			PL	R
36.0	196.0		35						35	45	J	T			PL	R
									35.6	30	J	T			PL	R
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, slightly to moderately weathered, medium hard, minerals mainly quartz, fractures dip at 5-60 degrees			2	98%	3	RQD= 53%		36.1	5	J	PO			IR	R
									36.2	5	J	PO			IR	R
									36.3	10	J	PO			IR	R
									37.1	45	J	T			IR	R
									37.4	5	J	O			IR	R
									37.8	10	J	O			IR	R
									37.9	5	J	O			IR	R
41.0	191.0		40						38	15	J	O			IR	R
									38.5	15	J	O			IR	R
	Gray, pink and white GRANITE, medium to coarse grained, predominantly extremely close to moderately close fracture spacing, fresh to moderately weathered, hard to medium hard, minerals mainly quartz, fractures dip at 5-60 degrees, with decomposed rock between 43.5 to 44.5 ft			3	82%	3	RQD= 57%		39	60	J	PO			PL	R
									39.4	30	J	PO			PL	R
									40.4	45	J	PO			PL	R
									40.5	5	J	PO			PL	R
									40.8	15	J	PO			IR	R
									41.5	60	J	T			PL	R
46.0	186.0		45						41.9	5	J	T			IR	R
									43.6	5	J	PO			PL	R
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 10-60 degrees			4	98%	4	RQD= 73%		43.7	5	J	PO			PL	R
									44.5	5	J	PO			PL	R
									44.6	5	J	PO			PL	R
									44.7	15	J	PO			PL	R
									45.5	25	J	PO			PL	R
									45.8	45	J	PO			PL	S
									47	60	J	T			PL	R
51.0	181.0		50						47.5	60	J	T			PL	R
									47.6	60	J	T			PL	R
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, slightly weathered, moderately hard to hard, minerals mainly quartz, fractures dip at 5-60 degrees			5	100%	3	RQD= 63%		48	10	J	T			PL	R
									48.1	25	J	T			PL	R
									48.4	10	J	T			PL	R
									48.7	60	J	T			PL	R
									49.6	45	J	T			PL	S
									49.9	60	J	T			PL	S
									51.1	5	J	T			PL	R
56.0	176.0		55						51.5	15	J	T			PL	R
									51.6	5	J	PO			IR	R
	Gray, pink and white GRANITE, medium to coarse grained, predominantly close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 0-15 degrees			6	100%	3	RQD= 93%		51.9	10	J	T			PL	R
									52.1	10	J	T			IR	R
									52.5	60	J	T			PL	S
									52.6	5	J	T			PL	R
									52.7	60	J	T			PL	R
									53.3	5	J	T			PL	R
									53.8	5	J	T			PL	R
			60						54.8	5	J	T			IR	R

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	NO2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

Project No. 2017091.042

LOG OF BOREHOLE EB-5

Sheet 3 of 4

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **1/29/20**

END DATE: **2/14/20**

NORTHING: 583620.4
EASTING: 1369537.6

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

			DRILLING				DISCONTINUITY								
		GRAPHIC LOG	DEPTH (FT.)	SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
61.0	171.0								55.8	5	J	T			PL	R
	Gray, pink and white GRANITE, medium to coarse grained, predominantly close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-20 degrees			7	98%	3	RQD= 87%		56.3	5	J	T			PL	R
									56.8	15	J	T			PL	R
									57.1	0	J	T			PL	R
									57.9	0	J	T			PL	R
									59.5	0	J	T			PL	R
									60.1	0	J	T			PL	R
									61.3	5	J	T			IR	R
			65						62	10	J	T			IR	S
66.0	166.0								62.4	15	J	T			PL	S
									65.5	20	J	T			IR	S
	Gray, pink and white GRANITE, medium to coarse grained, predominantly close to moderately hard fracture spacing, slightly weathered, medium hard, minerals mainly quartz, fractures dip at 15-60 degrees			8	98%	3	RQD= 73%		65.6	5	J	T	SD	Pa	IR	S
									66.2	45	J	O			PL	S
									66.5	60	J	PO			PL	S
									67.8	45	J	T			PL	R
									68.2	60	J	T			PL	R
									68.5	15	J	T			PL	R
			70						69.6	45	J	T			PL	R
71.0	161.0								69.9	45	J	T			PL	R
	Gray, pink and white GRANITE, medium to coarse grained, predominantly close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 45 degrees			9	100%	3	RQD= 100%		71.5	45	J	T			PL	S
			75						74.4	45	J	T			PL	R
76.0	156.0															
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 45 degrees			10	98%	4	RQD= 87%									
									78.5	45	J	T			PL	S
									78.6	45	J	T			PL	S
			80													
81.0	151.0								80.4	45	J	T			PL	S
	Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 60 degrees			11	100%	3	RQD= 100%		80.6	45	J	PO			IR	S
									82.4	60	J	T			PL	S
			85													
86.0	146.0															
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 30-45 degrees								86.2	30	J	PO			PL	S
									87.6	45	J	T			PL	S
			90													

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	NO2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

Project No. 2017091.042

LOG OF BOREHOLE EB-5

Sheet 4 of 4

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **1/29/20**

END DATE: **2/14/20**

NORTHING: 583620.4
EASTING: 1369537.6

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

		GRAPHIC LOG	DEPTH (FT.)	DRILLING: SAMPLE/ RUN NO.	DRILLING: RECOVERY (%)	DRILLING: CORING TIME MIN/FT (AVG)	DRILLING: BLOWs/6" N-VALUE RQD	DISCONTINUITY: FRACTURE FREQUENCY (BREAK/FT)	DISCONTINUITY: DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
91.0	141.0															
	Gray, pink and white GRANITE, medium to coarse grained, predominantly close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 30-45 degrees								91.9	45	J	T			PL	S
									94.1	45	J	T			PL	S
			95						94.4	30	J	T			PL	S
96.0	136.0															
	Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 30 degrees															
101.0	131.0		100													
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moedrately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-45 degrees								100.7	30	J	T			PL	S
									101.7	5	J	T			IR	R
									101.9	5	J	T			IR	R
									102.7	45	J	T			PL	S
									103.4	5	J	T			PL	S
			105						104.4	5	J	PO			PL	S
106.0	126.0															
	Gray, pink and white GRANITE, medium to coarse grained, predominantly close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5 degrees								106.4	5	J	PO			PL	S
111.0	121.0		110													
	Gray, pink and white GRANITE, medium to coarse grained, predominantly close to moderately close fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5-30 degrees								111.5	30	J	PO			PL	S
114.5	117.5								113.3	5	J	T			PL	S
	Coring Setup @ 31 ft End of Boring @ 114.5 ft Borehole was backfilled with cement/bentonite grout upon completion		115													

WATER LEVEL OBSERVATIONS

WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	NO2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

BORING LOG (SOIL) 2017091.042 ELLICOTT CITY TUNNEL.GPJ AB_CONS.GDT 5/14/20

Project No. 2017091.042

LOG OF BOREHOLE EB-6

Sheet 1 of 4

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **2/17/20**

END DATE: **3/16/20**

NORTHING: 583785.3
EASTING: 1369204.4

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

Surface Elev.: **250.0** ft.

				DRILLING				DISCONTINUITY								
		GRAPHIC LOG	DEPTH (FT.)	SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
0.3	3" Asphalt															
	249.8															
	SILTY SAND (SM); dark gray, very loose, moist			1	75%		4-3-1 1 N=4									
	SILTY SAND (SM); dark gray, very loose, moist			2	100%		2-1-2 4 N=3									
6.0	244.0		5													
	SILTY SAND (SM); brown and gray, medium dense, dry			3	100%		5-8-15 28 N=23									
	SILTY SAND (SM); tan and gray, very dense, dry			4	100%		21-50-50/3"									
13.0	237.0		10													
	SILTY SAND (SM) (Decomposed Rock); tan and white, with rock fragments, very dense, dry -Spoon Refusal at 13.5 ft			5	100%		50/4"									
			15													
			20													
			25													
	-Auger Refusal at 31 ft		30													

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	CME#8/R10.04
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

BORING LOG (SOIL) 2017091.042 ELLICOTT CITY TUNNEL.GPJ AB_CONS.GDT 5/14/20

Project No. 2017091.042

LOG OF BOREHOLE EB-6

Sheet 2 of 4

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **2/17/20**

END DATE: **3/16/20**

NORTHING: 583785.3
EASTING: 1369204.4

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

		GRAPHIC LOG	DEPTH (FT.)	DRILLING: SAMPLE/RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	DISCONTINUITY: FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
31.0	-End of Soil Boring 219.0															
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, slightly weathered, hard, minerals mainly quartz, fractures dip at 5-60 degrees			1	80%	3	RQD= 53%		32.1	5	J	O	SD	Pa	IR	R
									32.5	15	J	T			PL	S
									33	45	J	T	SD	Pa	PL	S
									33.1	5	J	PO			PL	R
									33.2	10	J	T			PL	S
			35						34	45	J	T			PL	S
36.0	214.0								34.1	60	J	T			PL	SR
	Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-15 degrees			2	98%	4	RQD= 98%		34.6	15	J	T			PL	S
									34.8	10	J	T			PL	SR
									36.7	15	J	T			PL	S
									37.5	5	J	T			PL	SR
			40						39.7	5	J	T			PL	SR
41.0	209.0															
	Gray, pink and white GRANITE, medium to coarse grained, predominantly close to wide fracture spacing, slightly weathered to fresh, hard, minerals mainly quartz, fractures dip at 5-45 degrees			3	100%	7	RQD= 92%		41.3	5	J	T			IR	SR
									44.1	40	J	T			PL	S
			45						44.7	15	J	PO	SD	Pa	IR	S
46.0	204.0								45.5	45	J	PO	SD	Pa	PL	S
	Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-65 degrees			4	100%	10	RQD= 100%		46.9	5	J	T			PL	S
									48.9	65	J	PO	SD	Pa	PL	S
			50						49.5	65	J	PO	SD	Pa	PL	S
51.0	199.0															
	Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-45 degrees			5	100%	36	RQD= 100%		52.5	5	J	PO	SD	Pa	PL	S
									53.4	15	J	T			PL	S
	-Replace with new CME #8 bit at 56 ft		55						55.1	45	J	T			PL	S
56.0	194.0															
	Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-45 degrees			6	98%	5	RQD= 93%		56.1	5	J	PO	SD	Pa	PL	S
									58.9	45	J	T			PL	S
			60													

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	CME#8/R10.04
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

Project No. 2017091.042

LOG OF BOREHOLE EB-6

Sheet 3 of 4

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **2/17/20**

END DATE: **3/16/20**

NORTHING: 583785.3
EASTING: 1369204.4

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

			DRILLING				DISCONTINUITY								
	GRAPHIC LOG	DEPTH (FT.)	SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
61.0								59.8	30	J	T			PL	S
189.0															
Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to wide fracture spacing, fresh to slightly weathered, hard, minerals mainly quartz, fractures dip at 5-60 degrees			7	100%	11	RQD= 95%		61.9	5	J	T			PL	S
								63.9	5	J	O	SD	Pa	PL	S
66.0		65													
184.0								65.7	60	J	O	SD	Pa	PL	S
Gray, pink and white GRANITE, medium to coarse grained, predominantly moderately close to wide fracture spacing, slightly weathered, hard, minerals mainly quartz, fractures dip at 5-60 degrees			8	95%	17	RQD= 87%		66.3	5	J	O	SD	Pa	PL	S
								67.9	60	J	T	SD	Pa	PL	S
								68.3	5	J	PO			PL	S
71.0		70						69.7	15	J	PO	SD	Pa	PL	S
179.0								70.1	15	J	PO	SD	Pa	PL	S
Gray, pink and white GRANITE, medium to very coarse grained, predominantly very close to moderately close fracture spacing, fresh, very hard, alot of minerals mainly pink quartz, fractures dip at 5-60 degrees -Replace with new CME#8 bit at 72.5 ft -Replace with new NO 2 bit at 73 ft			9	100%	132	RQD= 87%		71.8	5	J	T	SD	Pa	PL	S
								72.7	60	J	T			IR	SR
								72.9	60	J	T			PL	S
								73.7	45	J	T	SD	Pa	PL	S
								73.8	10	J	PO	SD	Pa	PL	S
		75						73.9	10	J	PO	SD	Pa	PL	S
76.0 -Replace with new R10.04 bit at 73.5 ft								74	10	J	PO			PL	S
174.0								74.1	10	J	T			PL	S
Gray, pink and white GRANITE, medium to very coarse grained, predominantly close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5-15 degrees			10	100%	5	RQD= 95%		74.4	45	J	T			IR	S
								76.4	5	J	T			IR	S
								76.5	5	J	T			IR	S
								78.3	15	J	PO	SD	Pa	PL	S
		80						79.7	15	J	PO	SD	Pa	PL	S
81.0															
169.0															
Gray, pink and white GRANITE, medium to very coarse grained, predominantly moderately close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5-15 degrees			11	100%	9	RQD= 97%		82.7	15	J	PO	SD	Pa	PL	S
								83.8	15	J	T			PL	S
								84.3	5	J	PO	SD	Pa	IR	S
		85						84.9	5	B	PO	SD	Pa	PL	S
86.0															
164.0															
Gray, pink and white GRANITE, medium to very coarse grained, predominantly moderately close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 10-45 degrees			12	100%	117	RQD= 100%		87	15	J	T			PL	S
								87.8	30	J	T			PL	S
								88.5	30	J	T			PL	S
		90						89.3	10	J	PO	SD	Pa	PL	S

Continued Next Page

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	CME#8/R10.04
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

Project No. 2017091.042

LOG OF BOREHOLE EB-6

Sheet 4 of 4

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **2/17/20**

END DATE: **3/16/20**

NORTHING: 583785.3
EASTING: 1369204.4

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

			GRAPHIC LOG	DEPTH (FT.)	DRILLING: SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	DISCONTINUITY: FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
91.0	-Replace with new R10.04 bit at 91 ft	159.0															
	Gray, pink and white GRANITE, medium to very coarse grained, predominantly close to wide fracture spacing, slightly weathered to fresh, very hard, minerals mainly quartz, fractures dip at 10-45 degrees				13	100%	6	RQD= 92%		90.4	45	J	PO	SD	Pa	PL	S
										92.7	45	J	T			PL	S
				95						94.7	10	J	T			PL	S
96.0		154.0								95.6	15	J	T	SD	Pa	PL	S
	Gray, pink and white GRANITE, medium to very coarse grained, predominantly very close to moderately close fracture spacing, slightly weathered to fresh, very hard, minerals mainly quartz, fractures dip at 5-45 degrees				14	100%	6	RQD= 82%		95.8	15	J	PO			PL	S
										96.2	5	J	T	SD	Pa	PL	S
										96.4	45	J	T	SD	Pa	PL	S
										96.7	30	J	T	SD	Pa	PL	S
										96.8	45	J	PO	SD	Pa	IR	S
										97.1	45	J	PO	SD	Fi	PL	S
				100						97.8	5	J	PO			PL	S
										97.9	45	J	T			PL	S
101.0		149.0								98.4	10	J	O			PL	S
	Gray, pink and white GRANITE, medium to very coarse grained, predominantly moderately close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-15 degrees				15	97%	52	RQD= 97%		99.4	5	J	T			PL	S
										100.1	5	J	T			PL	S
										101.5	15	J	T			PL	S
										103.1	15	J	PO	SD	Pa	PL	S
										103.7	5	J	PO	SD	Pa	PL	S
										104.3	5	J	T			PL	S
				105													
106.0		144.0								105.2	5	J	T			PL	S
	Gray, pink and white GRANITE, medium to very coarse grained, predominantly close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-65 degrees				16	95%	72	RQD= 88%		106.3	65	J	PO	SD	Pa	PL	S
										107.1	65	J	PO	SD	Pa	PL	SR
										107.4	5	J	PO	SD	Pa	IR	S
										107.8	65	J	PO	SD	Pa	PL	SR
										108.9	5	J	T			PL	S
	-Replace with new R10.04 bit at 107 ft			110													
111.0		139.0															
	Gray, pink and white GRANITE, medium to very coarse grained, predominantly close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 5-65 degrees				17	100%	36	RQD= 95%		111.4	30	J	PO	SD	Pa	PL	S
										111.7	5	J	PO	SD	Pa	PL	S
										113.2	65	J	T			PL	S
				115													
116.0		134.0															
	Coring Setup @ 31 ft End of Boring @ 116 ft Borehole was backfilled with cement/bentonite grout upon completion																

WATER LEVEL OBSERVATIONS	
WL	Dry @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	CME#8/R10.04
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

Project No. 2017091.042

LOG OF BOREHOLE EB-7

Sheet 1 of 3

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **1/22/20**

END DATE: **1/24/20**

NORTHING: 583478.4
EASTING: 1369100

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

Surface Elev.: **183.0** ft.

DEPTH (FT.)	GRAPHIC LOG	SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	FRACTURE FREQUENCY (BREAK/FT)	DISCONTINUITY DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
0.5														
182.5	6" Asphalt													
	CLAYEY SAND (SC); brown to gray, with trace of asphalt, medium dense, moist	1	100%		5-6-4 3 N=10									
3.0														
180.0	SANDY CLAY (CL); tan, firm, moist	2	75%		6-4-4 5 N=8									
5														
	SANDY CLAY (CL); tan, firm, moist	3	50%		5-5-5 6 N=10									
	SANDY CLAY (CL); tan and gray, firm, moist	4	100%		3-3-4 4 N=7									
10.0														
173.0	SILTY SAND (SM); gray to tan, with mica and gravel, very dense, wet ▽													
10		5	42%		20-50/4"									
15														
20														
21.0	-Spoon and Auger Refusal at 21 ft -End of Soil Boring													
162.0	Gray, pink and white GRANITE, medium to coarse grained, predominantly extremely close to close fracture spacing, medium severe weathered, medium hard, minerals mainly quartz, fractures dip at 0-5 degrees, with decomposed rock between 23 to 26 ft	1	35%	2	RQD= 8%		21 21.1 21.2 21.3 21.4 21.5 21.6 21.7 22 22.4 22.5	0 5 0 0 5 0 0 0 5 0 0	J J J J J J J J J J J	O O O O O O O O T PO PO	SD SD SD SD SD SD SD SD	Fi Fi Fi Fi Fi Fi Fi Fi	IR IR IR IR IR IR IR IR IR IR IR	R R R R R R R R S S S
25														
26.0														
157.0	SILTY SAND (SM); gray, white and pink, Decomposed Rock between 26 to 30.5 ft													
30														

Continued Next Page

WATER LEVEL OBSERVATIONS

WL	▽	11 @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	NO2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

Project No. 2017091.042

LOG OF BOREHOLE EB-7

Sheet 2 of 3

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **1/22/20**

END DATE: **1/24/20**

NORTHING: 583478.4
EASTING: 1369100

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

			DRILLING					DISCONTINUITY								
	GRAPHIC LOG	DEPTH (FT.)	SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
30.5															
Gray, pink and white GRANITE, medium to coarse grained, predominantly extremely close to moderately close fracture spacing, fresh to severe weathered, medium hard to hard, minerals mainly quartz, fractures dip at 5-60 degrees			2	100%	5	RQD= 67%		31	60	J	PO			PL	R
								31.6	5	J	O			IR	S
								32.6	15	J	O	SD	Pa	IR	S
								32.8	5	J	O	SD	Pa	PL	S
								33	25	J	O	SD	Pa	IR	S
								33.5	5	J	O	SD	Pa	IR	R
35.5		35						34	45	J	O	SD	Pa	PL	R
Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-45 degrees			3	100%	4	RQD= 82%		35.6	15	J	T			PL	S
								37.3	45	J	T			PL	S
								37.4	5	J	T			PL	S
								37.5	10	J	PO			PL	S
								38.5	5	J	T			PL	S
								38.8	10	J	T			PL	S
40.5		40						39	10	J	T			PL	S
Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-60 degrees			4	100%	4	RQD= 90%		39.5	10	J	T			PL	S
								40	10	J	T			PL	S
								42	45	J	T			PL	S
								43.1	60	J	PO	SD	Pa	PL	R
								43.3	60	J	PO	SD	Pa	PL	R
								44.4	5	J	T			PL	S
45.5		45						45.1	50	J	O	SD	Pa	PL	R
Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 10-65 degrees			5	95%	5	RQD= 70%		45.3	45	J	PO	SD	Pa	PL	R
								46.5	65	J	O	SD	Pa	PL	R
								46.8	65	J	PO	SD	Pa	PL	R
								47.1	10	J	T			PL	S
								49.2	45	J	T			PL	S
								49.7	45	J	T	SD	Pa	PL	S
50.5		50						49.9	15	J	O	SD	Pa	IR	R
Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-65 degrees			6	100%	6	RQD= 83%		50.7	65	J	PO			PL	S
								51.8	30	J	T			IR	S
								51.9	45	J	T			PL	S
								52.8	45	J	T			PL	S
								54	60	J	T			PL	S
55.5		55						54.8	5	J	O	SD	Pa	IR	R
Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-60 degrees			7	90%	5	RQD= 70%		55.1	5	J	O	SD	Pa	IR	R
								55.4	15	J	O	SD	Pa	IR	R
								55.6	30	J	PO	SD	Pa	PL	R
								56	15	J	T	SD	Pa	IR	R
								56.2	30	J	O	SD	Pa	IR	R
								56.3	30	J	PO	SD	Pa	PL	S
								56.4	45	J	PO	SD	Pa	IR	R
								56.7	50	J	T	SD	Pa	PL	R
		60													

Continued Next Page

WATER LEVEL OBSERVATIONS		
WL	▽	11 @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	NO2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

Project No. 2017091.042

LOG OF BOREHOLE EB-7

Sheet 3 of 3

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **1/22/20**

END DATE: **1/24/20**

NORTHING: 583478.4
EASTING: 1369100

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

		GRAPHIC LOG	DEPTH (FT.)	DRILLING: SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	DISCONTINUITY: FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
60.5									56.8	5	J	PO	SD	Pa	IR	S
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, moderately weathered, hard, minerals mainly quartz, fractures dip at 5-70 degrees			8	92%	4	RQD= 78%		56.9	15	J	O	SD	Pa	PL	S
									57	45	J	T	SD	Pa	PL	S
									57.2	60	J	PO	SD	Pa	IR	S
									57.4	45	J	PO	SD	Pa	PL	S
									57.6	30	J	T	SD	Pa	PL	S
									57.9	45	J	O	SD	Pa	IR	S
									58.2	50	J	O	SD	Pa	IR	S
									59.1	45	J	PO	SD	Pa	PL	S
65.5			65						59.5	10	J	O	SD	Pa	IR	R
	Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-45 degrees			9	100%	6	RQD= 87%		60.1	45	J	T	SD	Pa	PL	S
									60.8	50	J	T			PL	S
									61.1	50	J	PO			PL	S
									61.5	50	J	O	SD	Pa	PL	S
									61.7	5	J	T	SD	Pa	PL	S
									62	45	J	O			IR	R
									62.1	60	J	PO			IR	R
70.5			70						62.4	60	J	T			PL	R
	Gray, pink and white GRANITE, medium to coarse grained, predominantly close to wide fracture spacing, fresh, very hard, minerals mainly quartz, fractures dip at 15-45 degrees			10	100%	5	RQD= 100%		63	70	J	T			PL	S
									63.5	70	J	T	SD	Pa	PL	S
									66.2	5	J	T			PL	R
									67.1	10	J	PO			IR	R
									67.4	45	J	PO			PL	S
									68.7	45	J	T			PL	S
									68.9	45	J	T			PL	S
									70.4	5	J	PO			PL	S
									70.8	30	J	T			PL	S
75.5			75						71.7	15	J	T			PL	S
									73.2	45	J	T			PL	S
107.5																
112.5																
117.5																
122.5																

Coring Setup @ 21 ft
End of Boring @ 75.5 ft
Borehole was backfilled with cement/bentonite grout upon completion

WATER LEVEL OBSERVATIONS		
WL	▽	11 @ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	D-50	AUGER TYPE:	NO2
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	KM
LOG BY:	FG		

BORING LOG (SOIL) 2017091.042 ELLICOTT CITY TUNNEL.GPJ AB_CONS.GDT 5/14/20

Project No. 2017091.042

LOG OF BOREHOLE EB-8

Sheet 1 of 2

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **11/21/19**

END DATE: **11/21/19**

NORTHING: 583665.9
EASTING: 1368870.9

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

Surface Elev.: **183.0** ft.

DEPTH (FT.)	GRAPHIC LOG	SAMPLE/ RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	DESCRIPTION
0.6						7" Asphalt
182.4						
		1	96%		11-15-14 14 N=29	SILTY SAND (SM); brown and gray, with some rock fragments, dense, moist
5		2	21%		4-13-7 4 N=20	SILTY SAND (SM); brown and gray, with some rock fragments, medium dense, moist
▽						
		3	75%		2-1-2 10 N=3	SILTY SAND (SM); gray, with some rock fragments, very loose, wet
10						
13.0						
170.0						
		4	100%		50/3"	SILTY SAND (SM); reddish brown and brown, with rock fragments, very dense, moist
15						
		5	100%		50/3"	SILTY SAND (SM); reddish brown and brown, with rock fragments, very dense, moist
20						
		6	100%		50/3"	SILTY SAND (SM); reddish brown and brown, with rock fragments, very dense, moist
25						
28.0						
155.0						
		7	100%		50/1"	SILTY SAND (SM) (Decomposed Rock); reddish brown and brown, with rock fragments. very dense, moist
30						

Continued Next Page

DRILLING

DISCONTINUITY

FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS

WATER LEVEL OBSERVATIONS

WL	▽ 7.5	@ Drilling

AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	CME-45B	AUGER TYPE:	CME#8
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	PS
LOG BY:	FG		

BORING LOG (SOIL) 2017091.042 ELLICOTT CITY TUNNEL.GPJ AB_CONS.GDT 5/14/20

Project No. 2017091.042

LOG OF BOREHOLE EB-8

Sheet 2 of 2

CLIENT: **McCormick Taylor**

PROJECT: **Ellicott City Flood Relief North Tunnel**

SITE: **Howard County, Maryland**

START DATE: **11/21/19**

END DATE: **11/21/19**

NORTHING: 583665.9
EASTING: 1368870.9

Horizontal Datum: NAD 83
Vertical Datum: NAVD 1988

(continued)

	GRAPHIC LOG	DEPTH (FT.)	DRILLING: SAMPLE/RUN NO.	RECOVERY (%)	CORING TIME MIN/FT (AVG)	BLOWs/6" N-VALUE RQD	DISCONTINUITY: FRACTURE FREQUENCY (BREAK/FT)	DEPTH (FT.)	DIP (DEG.)	TYPE	APERTURE	INFILL	AMOUNT	SHAPE	ROUGHNESS
SILTY SAND (SM) (Decomposed Rock); reddish brown and brown, with rock fragments. very dense, moist *(continued)*															
SILTY SAND (SM) (Decomposed Rock); reddish brown and brown, with rock fragments. very dense, moist		35	8	100%		50/1"									
SILTY SAND (SM) (Decomposed Rock); reddish brown and brown, with rock fragments. very dense, moist		40	9	100%		50/1"									
SILTY SAND (SM) (Decomposed Rock); reddish brown and brown, with rock fragments. very dense, moist		45	10	100%		50/1"									
-Spoon and Auger Refusal at 46 ft -End of Soil Boring															
46.0 137.0															
Gray, pink and white GRANITE, medium to coarse grained, predominantly close to very close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 15-70 degrees		50	1	100%	8	RQD= 82%		47 47.6 48 48.9 49.7 49.8 50.5 51.1 51.2	70 30 50 60 20 15 50 40 40	J J J J J J J J J	O O T T T T O PO MW	SD SD SD SD 	Pa Pa Pa Fi 	WA WA PL PL PL PL ST PL PL	R R S S R S S S S
51.0 132.0															
Coring Setup @ 46 ft End of Boring @ 51 ft Borehole was backfilled with cement/bentonite grout upon completion															

WATER LEVEL OBSERVATIONS

WL	▽	7.5 @ Drilling

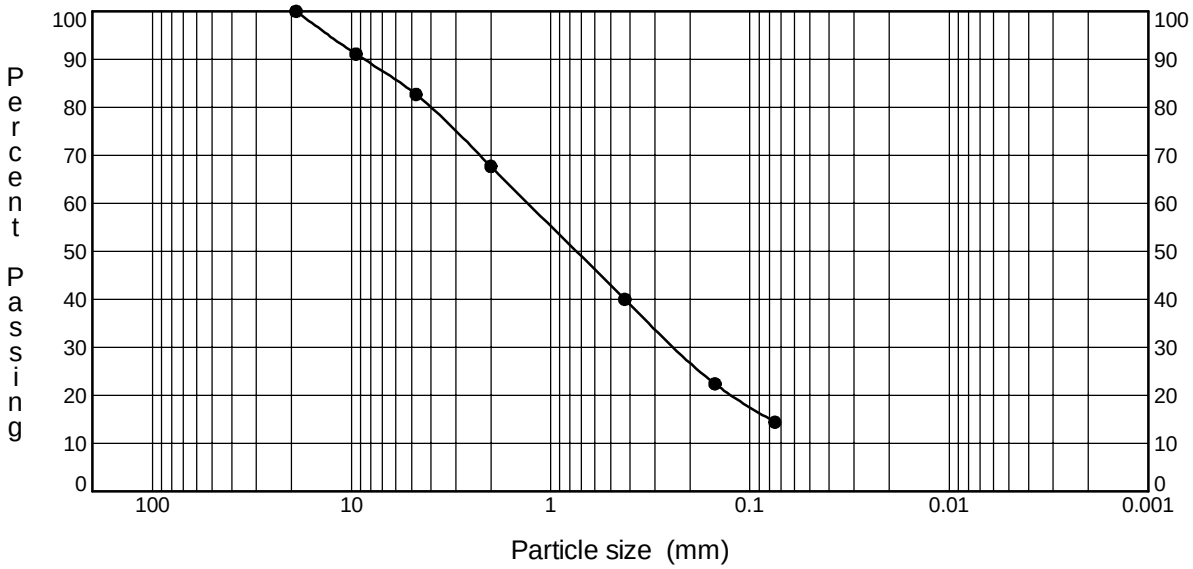
AB Consultants, Inc.
9450 Annapolis Road,
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

RIG TYPE:	CME-45B	AUGER TYPE:	CME#8
HAMMER TYPE:	Automatic	AUGER ID/OD:	3.25 in / NA
HAMMER WT.:	140 lb	CASING ID/OD:	5 in / NA
HAMMER DROP:	30 in	DRILL BY:	PS
LOG BY:	FG		

BORING LOG (SOIL) 2017091.042 ELLICOTT CITY TUNNEL.GPJ AB_CONS.GDT 5/14/20

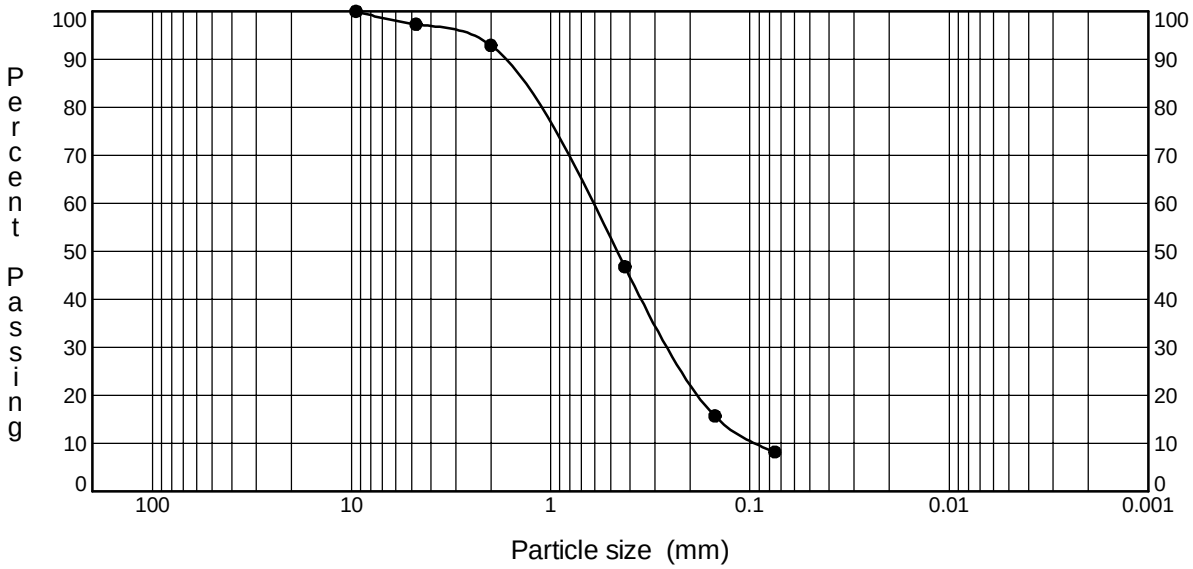
E. LAB TEST RESULTS

BOREHOLE No. **EB-8** DEPTH **5.0**



Cobbles	coarse	fine	coarse	medium	fine	Silt	Clay
	Gravel		Sand				

BOREHOLE No. **EB-8** DEPTH **8.0**



Cobbles	coarse	fine	coarse	medium	fine	Silt	Clay
	Gravel		Sand				

AB Consultants Inc.
9450 Annapolis Road
Lanham, MD 20706
Phone 301-306-3091
Fax: 301-306-3092

GRAIN SIZE DISTRIBUTION

Client: McCormick Taylor
Project: Ellicott city Flood Relief North Tunnel
Number: 2017091.042
Site:
Howard County, Maryland

F. LAB TEST RESULTS FROM GEOTESTING

GeoTesting EXPRESS

Technologies to manage risk for infrastructure

Boston
Atlanta
Chicago
Los Angeles
New York
www.geotesting.com

Transmittal

TO:

Fu Guo

AB Consultants, Inc.

9450 Annapolis Rd

Lanham, MD 20706

DATE: 2/25/2020	GTX NO: 311328
RE: Ellicott City Flood Relief N. Tunnel	

COPIES	DATE	DESCRIPTION
	2/25/2020	**February 2020 Laboratory Test Report**

REMARKS:

SIGNED: Sarah Delaney

Sarah Delaney, Assistant Laboratory Manager

CC:

APPROVED BY : Jonathan Campbell

Jonathan Campbell, Laboratory Manager

GeoTesting EXPRESS
Technologies to manage risk for infrastructure

Atlanta
Chicago
Los Angeles
New York
www.geotesting.com

February 25, 2020

Fu Guo
AB Consultants, Inc.
9450 Annapolis Rd
Lanham, MD 20706

RE: Ellicott City Flood Relief N. Tunnel, Ellicott City, MD (GTX-311328)

Dear Fu Guo:

Enclosed are the test results you requested for the above referenced project. GeoTesting Express, Inc. (GTX) received 11 samples from you on 2/11/2020. These samples were labeled as follows:

Boring Number	Sample Number	Depth	Elevation
EB-1	EB-1 #1	23.5-24.5	117.5 to 118.5
EB-1	EB-1 #2	9-10	132.0 to 133.0
EB-2	EB-2 #1	15.5-16.5	125.5 to 126.5
EB-2	EB-2 #2	25-26	116.0 to 117.0
EB-3	EB-3 #1	105-106	134.0 to 135.0
EB-4	EB-4 #1	101-102	156.0 to 157.0
EB-4	EB-4 #2	114.5-115.5	142.5 to 143.5
EB-5	EB-5 #1	79-80	152.0 to 153.0
EB-5	EB-5 #2	90-91	141.0 to 142.0
EB-7	EB-7 #1	31-32	151.0 to 152.0
EB-7	EB-7 #2	30.5-31	152.0 to 152.5

GTX performed the following tests on these samples:

10 ASTM D3967 - Splitting Tensile Test (Brazilian) - one specimen
10 ASTM D7012 Method C- Uniaxial Compressive Strength of Rock

A copy of your test request is attached.

The results presented in this report apply only to the items tested. This report shall not be reproduced except in full, without written approval from GeoTesting Express. The remainder of these samples will be retained for a period of sixty (60) days and will then be discarded unless otherwise notified by you. Please call me if you have any questions or require additional information. Thank you for allowing GeoTesting Express the opportunity of providing you with testing services. We look forward to working with you again in the future.

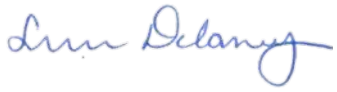
GeoTesting EXPRESS

Technologies to manage risk for infrastructure

Atlanta
Chicago
Los Angeles
New York

www.geotesting.com

Respectfully yours,



Sarah Delaney
Assistant Laboratory Manager

GeoTesting EXPRESS
Technologies to manage risk for infrastructure

Boston
Atlanta
Chicago
Los Angeles
New York
www.geotesting.com

Geotechnical Test Report **2/25/2020**

GTX-311328

Ellicott City Flood Relief N. Tunnel

Ellicott City, MD

Client Project No.: 2017091.042

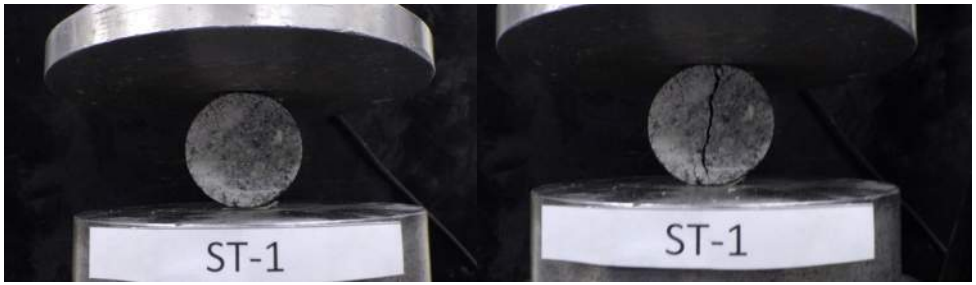
Prepared for:

AB Consultants, Inc.

Client:	AB Consultants, Inc.				
Project:	Ellicott City Flood Relief N. Tunnel				
Location:	Ellicott City, MD			Project No:	GTX-311328
Boring ID:	EB-1	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	EB-1 #1	Test Date:	02/13/20	Checked By:	smd
Depth :	23.5-24.5	Test Id:	544518		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Splitting Tensile Strength of Intact Rock Core Specimens by ASTM D3967

Specimen Depth	Test No	Thickness (L), in	Diameter (D), in	Thickness to Diameter Ratio (L/D)	Failure Load (P), lbs	Splitting Tensile Strength, psi	Failure Type
23.5-24.5 ft	ST-1	1.08	1.99	0.54	3,441	1,010	1



Notes: Strain rate: 2.5%/min.

ASTM requires the thickness-to-diameter ratio (L/D) of each test specimen to be between 0.2 and 0.75.

The reported thickness (L) is the average of three measurements.

The reported diameter(D) is the average of three measurements.

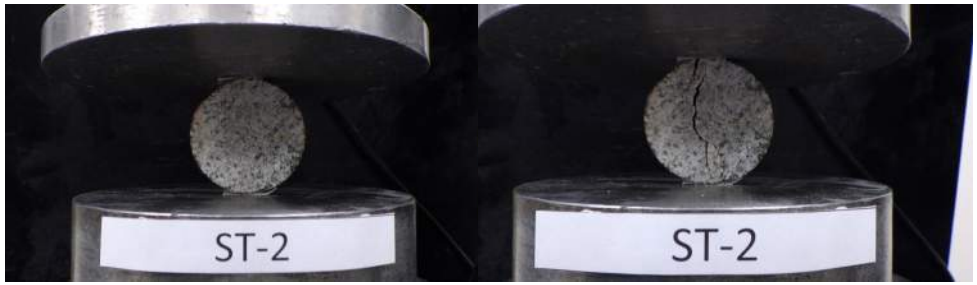
Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

GeoTesting EXPRESS

Client:	AB Consultants, Inc.				
Project:	Ellicott City Flood Relief N. Tunnel				
Location:	Ellicott City, MD			Project No:	GTX-311328
Boring ID:	EB-1	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	EB-1 #2	Test Date:	02/13/20	Checked By:	smd
Depth :	9-10	Test Id:	544519		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Splitting Tensile Strength of Intact Rock Core Specimens by ASTM D3967

Specimen Depth	Test No	Thickness (L), in	Diameter (D), in	Thickness to Diameter Ratio (L/D)	Failure Load (P), lbs	Splitting Tensile Strength, psi	Failure Type
9-10 ft	ST-2	1.03	2.00	0.51	1,629	506	1



Notes: Strain rate: 2.5%/min.

ASTM requires the thickness-to-diameter ratio (L/D) of each test specimen to be between 0.2 and 0.75.

The reported thickness (L) is the average of three measurements.

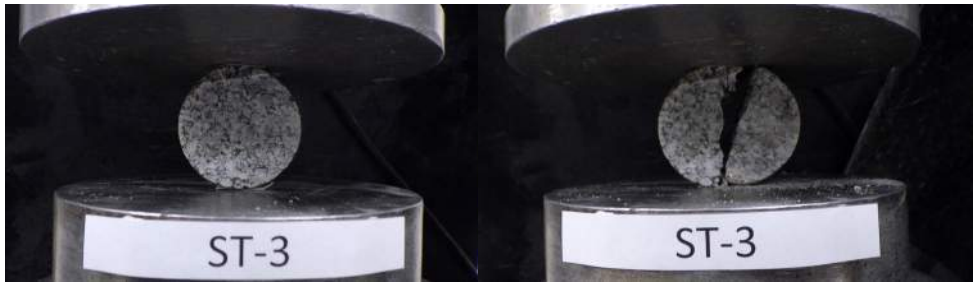
The reported diameter(D) is the average of three measurements.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

Client:	AB Consultants, Inc.				
Project:	Ellicott City Flood Relief N. Tunnel				
Location:	Ellicott City, MD			Project No:	GTX-311328
Boring ID:	EB-2	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	EB-2 #1	Test Date:	02/13/20	Checked By:	smd
Depth :	15.5-16.5	Test Id:	544520		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Splitting Tensile Strength of Intact Rock Core Specimens by ASTM D3967

Specimen Depth	Test No	Thickness (L), in	Diameter (D), in	Thickness to Diameter Ratio (L/D)	Failure Load (P), lbs	Splitting Tensile Strength, psi	Failure Type
15.5-16.5 ft	ST-3	1.11	1.99	0.56	3,176	915	1



Notes: Strain rate: 2.5%/min.

ASTM requires the thickness-to-diameter ratio (L/D) of each test specimen to be between 0.2 and 0.75.

The reported thickness (L) is the average of three measurements.

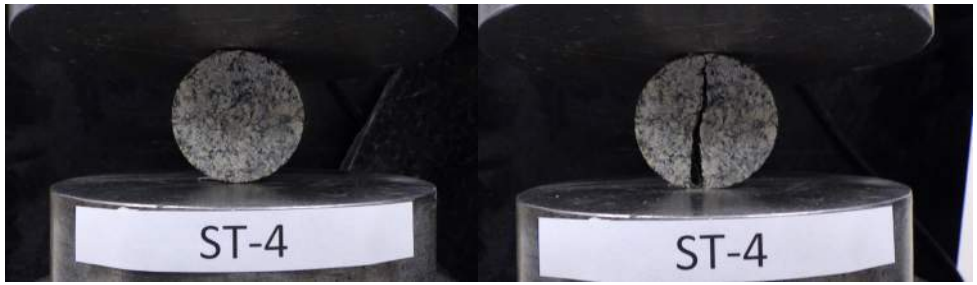
The reported diameter(D) is the average of three measurements.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

Client:	AB Consultants, Inc.				
Project:	Ellicott City Flood Relief N. Tunnel				
Location:	Ellicott City, MD			Project No:	GTX-311328
Boring ID:	EB-2	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	EB-2 #2	Test Date:	02/13/20	Checked By:	smd
Depth :	25-26	Test Id:	544521		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Splitting Tensile Strength of Intact Rock Core Specimens by ASTM D3967

Specimen Depth	Test No	Thickness (L), in	Diameter (D), in	Thickness to Diameter Ratio (L/D)	Failure Load (P), lbs	Splitting Tensile Strength, psi	Failure Type
25-26 ft	ST-4	1.17	1.99	0.59	2,603	711	1



Notes: Strain rate: 2.5%/min.

ASTM requires the thickness-to-diameter ratio (L/D) of each test specimen to be between 0.2 and 0.75.

The reported thickness (L) is the average of three measurements.

The reported diameter(D) is the average of three measurements.

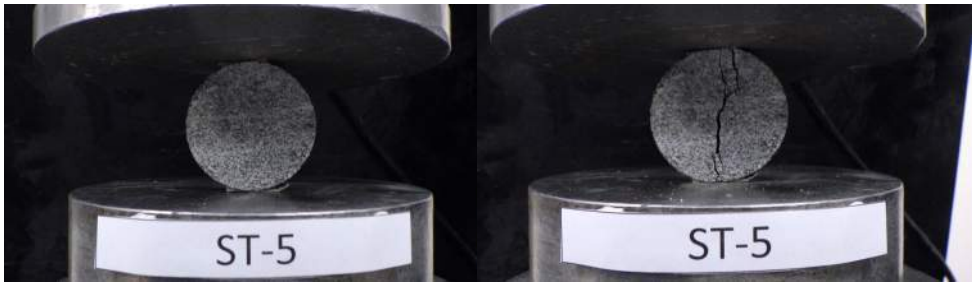
Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

GeoTesting EXPRESS

Client:	AB Consultants, Inc.				
Project:	Ellicott City Flood Relief N. Tunnel				
Location:	Ellicott City, MD			Project No:	GTX-311328
Boring ID:	EB-3	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	EB-3 #1	Test Date:	02/13/20	Checked By:	smd
Depth :	105-106	Test Id:	544522		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Splitting Tensile Strength of Intact Rock Core Specimens by ASTM D3967

Specimen Depth	Test No	Thickness (L), in	Diameter (D), in	Thickness to Diameter Ratio (L/D)	Failure Load (P), lbs	Splitting Tensile Strength, psi	Failure Type
105-106 ft	ST-5	1.11	1.99	0.56	4,194	1,210	1



Notes: Strain rate: 2.5%/min.

ASTM requires the thickness-to-diameter ratio (L/D) of each test specimen to be between 0.2 and 0.75.

The reported thickness (L) is the average of three measurements.

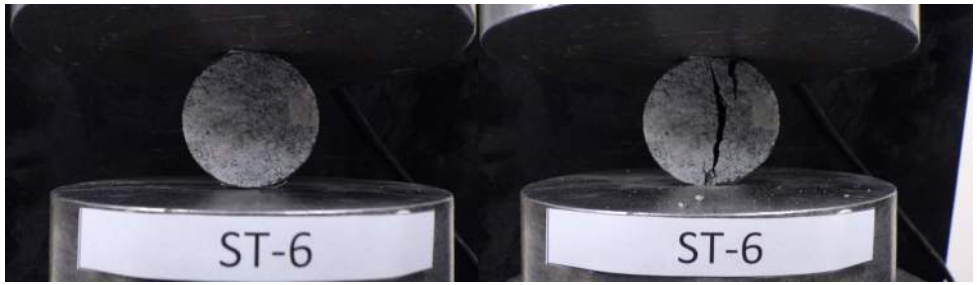
The reported diameter(D) is the average of three measurements.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

Client:	AB Consultants, Inc.				
Project:	Ellicott City Flood Relief N. Tunnel				
Location:	Ellicott City, MD			Project No:	GTX-311328
Boring ID:	EB-4	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	EB-4 #1	Test Date:	02/13/20	Checked By:	smd
Depth :	101-102	Test Id:	544523		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Splitting Tensile Strength of Intact Rock Core Specimens by ASTM D3967

Specimen Depth	Test No	Thickness (L), in	Diameter (D), in	Thickness to Diameter Ratio (L/D)	Failure Load (P), lbs	Splitting Tensile Strength, psi	Failure Type
101-102 ft	ST-6	1.21	1.99	0.61	4,459	1,180	1



Notes: Strain rate: 2.5%/min.

ASTM requires the thickness-to-diameter ratio (L/D) of each test specimen to be between 0.2 and 0.75.

The reported thickness (L) is the average of three measurements.

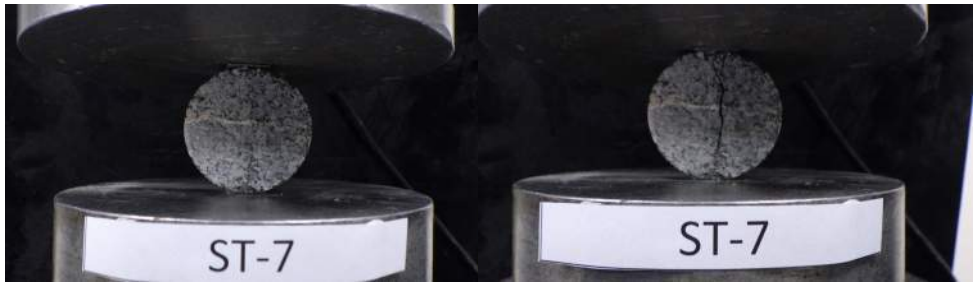
The reported diameter(D) is the average of three measurements.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

Client:	AB Consultants, Inc.				
Project:	Ellicott City Flood Relief N. Tunnel				
Location:	Ellicott City, MD			Project No:	GTX-311328
Boring ID:	EB-4	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	EB-4 #2	Test Date:	02/13/20	Checked By:	smd
Depth :	114.5-115.5	Test Id:	544524		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Splitting Tensile Strength of Intact Rock Core Specimens by ASTM D3967

Specimen Depth	Test No	Thickness (L), in	Diameter (D), in	Thickness to Diameter Ratio (L/D)	Failure Load (P), lbs	Splitting Tensile Strength, psi	Failure Type
114.5-115.5 ft	ST-7	1.14	1.99	0.57	3,997	1,120	1



Notes: Strain rate: 2.5%/min.

ASTM requires the thickness-to-diameter ratio (L/D) of each test specimen to be between 0.2 and 0.75.

The reported thickness (L) is the average of three measurements.

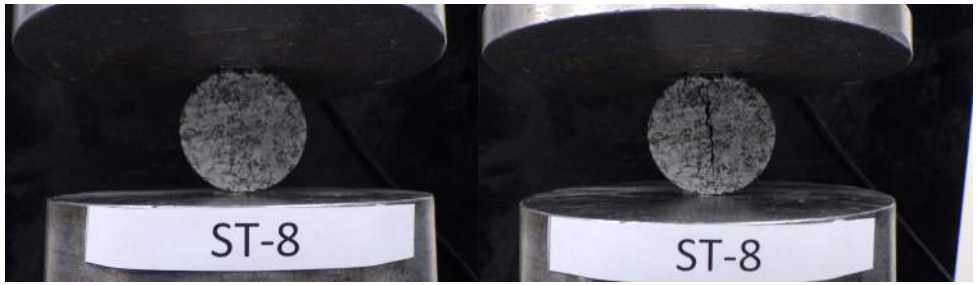
The reported diameter(D) is the average of three measurements.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

Client:	AB Consultants, Inc.				
Project:	Ellicott City Flood Relief N. Tunnel				
Location:	Ellicott City, MD			Project No:	GTX-311328
Boring ID:	EB-5	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	EB-5 #1	Test Date:	02/13/20	Checked By:	smd
Depth :	79-80	Test Id:	544525		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Splitting Tensile Strength of Intact Rock Core Specimens by ASTM D3967

Specimen Depth	Test No	Thickness (L), in	Diameter (D), in	Thickness to Diameter Ratio (L/D)	Failure Load (P), lbs	Splitting Tensile Strength, psi	Failure Type
79-80 ft	ST-8	1.10	1.99	0.55	2,284	663	1



Notes: Strain rate: 2.5%/min.

ASTM requires the thickness-to-diameter ratio (L/D) of each test specimen to be between 0.2 and 0.75.

The reported thickness (L) is the average of three measurements.

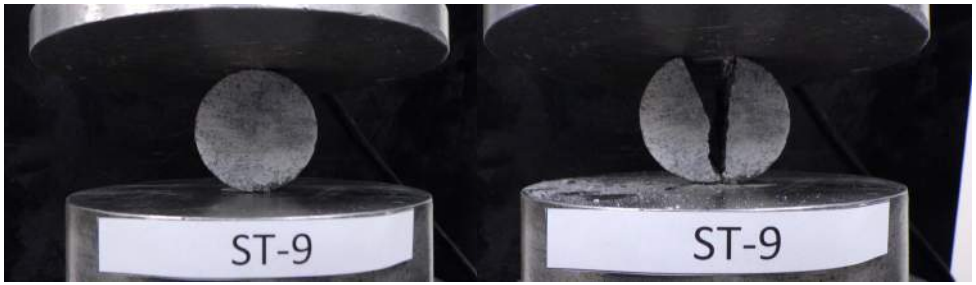
The reported diameter(D) is the average of three measurements.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

Client:	AB Consultants, Inc.				
Project:	Ellicott City Flood Relief N. Tunnel				
Location:	Ellicott City, MD			Project No:	GTX-311328
Boring ID:	EB-5	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	EB-5 #2	Test Date:	02/13/20	Checked By:	smd
Depth :	90-91	Test Id:	544526		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Splitting Tensile Strength of Intact Rock Core Specimens by ASTM D3967

Specimen Depth	Test No	Thickness (L), in	Diameter (D), in	Thickness to Diameter Ratio (L/D)	Failure Load (P), lbs	Splitting Tensile Strength, psi	Failure Type
90-91 ft	ST-9	1.00	1.99	0.50	4,452	1,420	1



Notes: Strain rate: 2.5%/min.

ASTM requires the thickness-to-diameter ratio (L/D) of each test specimen to be between 0.2 and 0.75.

The reported thickness (L) is the average of three measurements.

The reported diameter(D) is the average of three measurements.

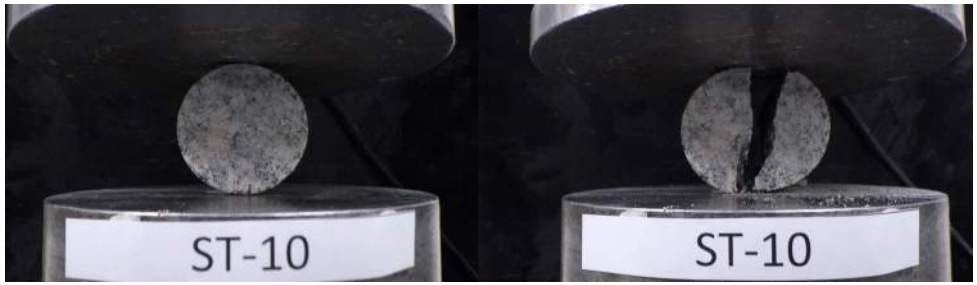
Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

GeoTesting EXPRESS

Client:	AB Consultants, Inc.				
Project:	Ellicott City Flood Relief N. Tunnel				
Location:	Ellicott City, MD			Project No:	GTX-311328
Boring ID:	EB-7	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	EB-7 #2	Test Date:	02/13/20	Checked By:	smd
Depth :	30.5-31	Test Id:	544527		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Splitting Tensile Strength of Intact Rock Core Specimens by ASTM D3967

Specimen Depth	Test No	Thickness (L), in	Diameter (D), in	Thickness to Diameter Ratio (L/D)	Failure Load (P), lbs	Splitting Tensile Strength, psi	Failure Type
30.5-31 ft	ST-10	1.12	1.99	0.56	4,039	1,160	1



Notes: Strain rate: 2.5%/min.

ASTM requires the thickness-to-diameter ratio (L/D) of each test specimen to be between 0.2 and 0.75.

The reported thickness (L) is the average of three measurements.

The reported diameter(D) is the average of three measurements.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

GeoTesting EXPRESS

Client:	AB Consultants, Inc.				
Project:	Ellicott City Flood Relief N. Tunnel				
Location:	Ellicott City, MD			Project No:	GTX-311328
Boring ID:	---	Sample Type:	---	Tested By:	tlm
Sample ID:	---	Test Date:	02/13/20	Checked By:	smd
Depth :	---	Test Id:	544534		

Bulk Density and Compressive Strength of Rock Core Specimens by ASTM D7012 Method C

Boring ID	Sample Number	Depth	Bulk Density, pcf	Compressive strength, psi	Failure Type	Meets ASTM D4543	Note(s)
EB-1	EB-1 #1	23.5-24.5 ft	167	13392	1	Yes	---
EB-1	EB-1 #2	9-10 ft	162	5048	2	Yes	---
EB-2	EB-2 #1	15.5-16.5 ft	166	14435	1	Yes	---
EB-2	EB-2 #2	25-26 ft	166	12923	1	Yes	---
EB-3	EB-3 #1	105-106 ft	171	12553	1	Yes	---
EB-4	EB-4 #1	101-102 ft	168	14614	1	Yes	---
EB-4	EB-4 #2	114.5-115.5 ft	167	9410	1	Yes	---

Notes: Density determined on core samples by measuring dimensions and weight and then calculating.

All specimens tested at the approximate as-received moisture content and at standard laboratory temperature.

The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

Client:	AB Consultants, Inc.				
Project:	Ellicott City Flood Relief N. Tunnel				
Location:	Ellicott City, MD			Project No:	GTX-311328
Boring ID:	---	Sample Type:	---	Tested By:	tlm
Sample ID:	---	Test Date:	02/13/20	Checked By:	smd
Depth :	---	Test Id:	544537		

Bulk Density and Compressive Strength of Rock Core Specimens by ASTM D7012 Method C

Boring ID	Sample Number	Depth	Bulk Density, pcf	Compressive strength, psi	Failure Type	Meets ASTM D4543	Note(s)
EB-5	EB-5 #1	79-80 ft	168	9003	1	Yes	---
EB-5	EB-5 #2	90-91 ft	168	17650	1	Yes	---
EB-7	EB-7 #1	31-32 ft	164	11808	1	Yes	---

Notes: Density determined on core samples by measuring dimensions and weight and then calculating.

All specimens tested at the approximate as-received moisture content and at standard laboratory temperature.

The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

Client:	AB Consultants, Inc.	Test Date:	2/12/2020
Project Name:	Ellicott City Flood Relief N. Tunnel	Tested By:	cmh
Project Location:	Ellicott City, MD	Checked By:	smd
GTX #:	311328		
Boring ID:	EB-1		
Sample ID:	EB-1 #1		
Depth:	23.5-24.5 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.50	4.50	4.50
Specimen Diameter, in:	1.99	1.99	1.99
Specimen Mass, g:	614.28		
Bulk Density, lb/ft^3	167	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.3	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

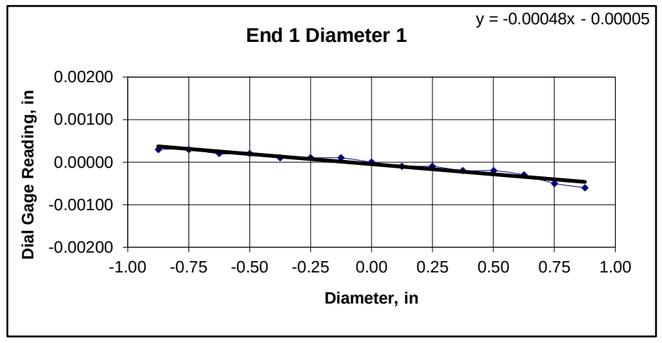
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00030	0.00030	0.00020	0.00020	0.00010	0.00010	0.00010	0.00000	-0.00010	-0.00010	-0.00020	-0.00020	-0.00030	-0.00050	-0.00060
Diameter 2, in (rotated 90°)	-0.00080	-0.00070	-0.00060	-0.00060	-0.00040	-0.00020	-0.00010	0.00000	0.00010	0.00020	0.00020	0.00020	0.00030	0.00030	0.00040

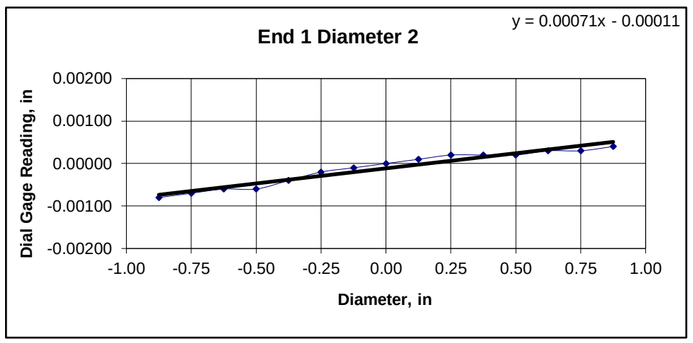
Difference between max and min readings, in:
0° = 0.00090 90° = 0.00120

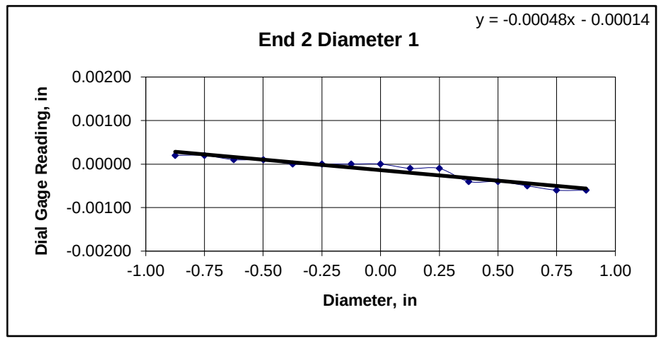
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00020	0.00020	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00040	-0.00040	-0.00050	-0.00060	-0.00060
Diameter 2, in (rotated 90°)	-0.00080	-0.00080	-0.00060	-0.00040	-0.00040	-0.00030	-0.00020	0.00000	0.00000	0.00000	0.00000	0.00020	0.00020	0.00030	0.00030

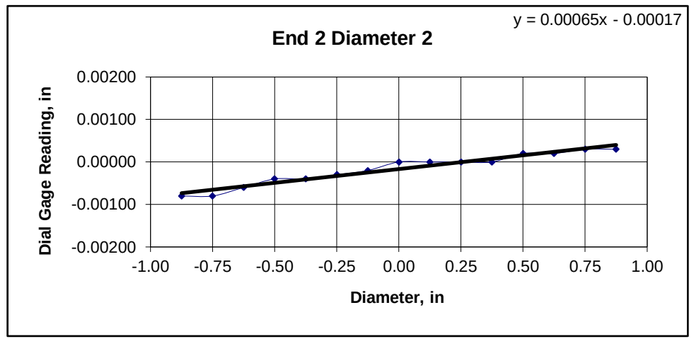
Difference between max and min readings, in:
0° = 0.0008 90° = 0.0011

Maximum difference must be < 0.0020 in. Difference = ± 0.00060
Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00048
Angle of Best Fit Line: 0.02734

End 2:
Slope of Best Fit Line 0.00048
Angle of Best Fit Line: 0.02767

Maximum Angular Difference: 0.00033

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00071
Angle of Best Fit Line: 0.04076

End 2:
Slope of Best Fit Line 0.00065
Angle of Best Fit Line: 0.03716

Maximum Angular Difference: 0.00360

Parallelism Tolerance Met? **YES**
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00090	1.990	0.00045	0.026	YES
Diameter 2, in (rotated 90°)	0.00120	1.990	0.00060	0.035	YES
END 2					
Diameter 1, in	0.00080	1.990	0.00040	0.023	YES
Diameter 2, in (rotated 90°)	0.00110	1.990	0.00055	0.032	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? **YES**

GeoTesting EXPRESS

Client:	AB Consultants, Inc.
Project Name:	Ellicott City Flood Relief N. Tunnel
Project Location:	Ellicott City, MD
GTX #:	311328
Test Date:	2/13/2020
Tested By:	cmh
Checked By:	smd
Boring ID:	EB-1
Sample ID:	EB-1 #1
Depth, ft:	23.5-24.5

After cutting and grinding

After break

Client:	AB Consultants, Inc.	Test Date:	2/12/2020
Project Name:	Ellicott City Flood Relief N. Tunnel	Tested By:	cmh
Project Location:	Ellicott City, MD	Checked By:	smd
GTX #:	311328		
Boring ID:	EB-1		
Sample ID:	EB-1 #2		
Depth:	9-10 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.45	4.45	4.45
Specimen Diameter, in:	1.99	1.99	1.99
Specimen Mass, g:	588.4		
Bulk Density, lb/ft^3	162	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

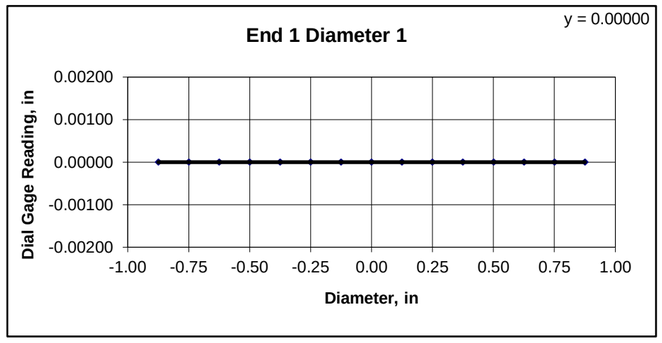
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	-0.00060	-0.00060	-0.00050	-0.00030	-0.00020	-0.00020	-0.00010	0.00000	0.00010	0.00020	0.00020	0.00020	0.00030	0.00040	0.00040

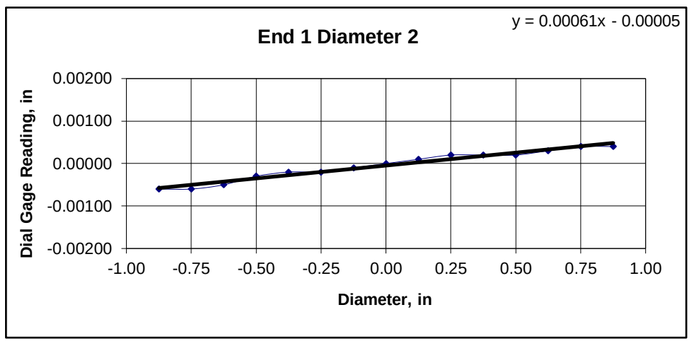
Difference between max and min readings, in:
0° = 0.00000 90° = 0.00100

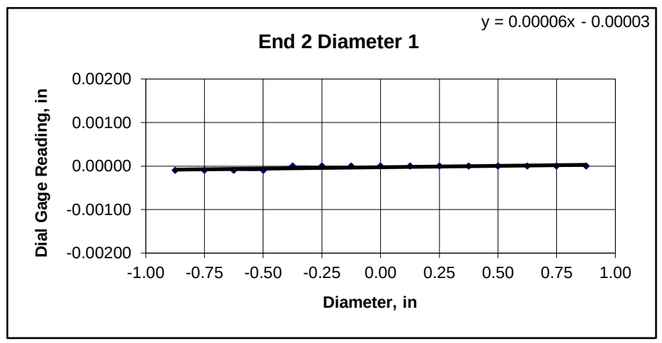
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00010	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	-0.00080	-0.00070	-0.00060	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00010	0.00010	0.00020	0.00030	0.00040

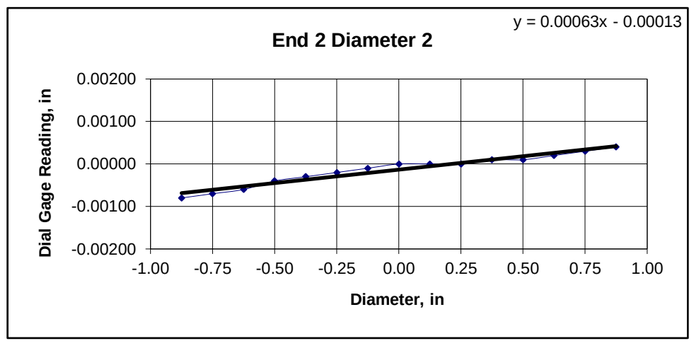
Difference between max and min readings, in:
0° = 0.0001 90° = 0.0012

Maximum difference must be < 0.0020 in. Difference = ± 0.00060
Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00000
Angle of Best Fit Line: 0.00000

End 2:
Slope of Best Fit Line 0.00006
Angle of Best Fit Line: 0.00360

Maximum Angular Difference: 0.00360

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00061
Angle of Best Fit Line: 0.03470

End 2:
Slope of Best Fit Line 0.00063
Angle of Best Fit Line: 0.03618

Maximum Angular Difference: 0.00147

Parallelism Tolerance Met? **YES**
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00000	1.990	0.00000	0.000	YES
Diameter 2, in (rotated 90°)	0.00100	1.990	0.00050	0.029	YES
END 2					
Diameter 1, in	0.00010	1.990	0.00005	0.003	YES
Diameter 2, in (rotated 90°)	0.00120	1.990	0.00060	0.035	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? **YES**

GeoTesting EXPRESS

Client:	AB Consultants, Inc.
Project Name:	Ellicott City Flood Relief N. Tunnel
Project Location:	Ellicott City, MD
GTX #:	311328
Test Date:	2/13/2020
Tested By:	cmh
Checked By:	smd
Boring ID:	EB-1
Sample ID:	EB-1 #2
Depth, ft:	9-10

After cutting and grinding

After break

Client:	AB Consultants, Inc.	Test Date:	2/12/2020
Project Name:	Ellicott City Flood Relief N. Tunnel	Tested By:	cmh
Project Location:	Ellicott City, MD	Checked By:	smd
GTX #:	311328		
Boring ID:	EB-2		
Sample ID:	EB-2 #1		
Depth:	15.5-16.5 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.44	4.44	4.44
Specimen Diameter, in:	1.99	1.99	1.99
Specimen Mass, g:	601.29		
Bulk Density, lb/ft^3	166	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

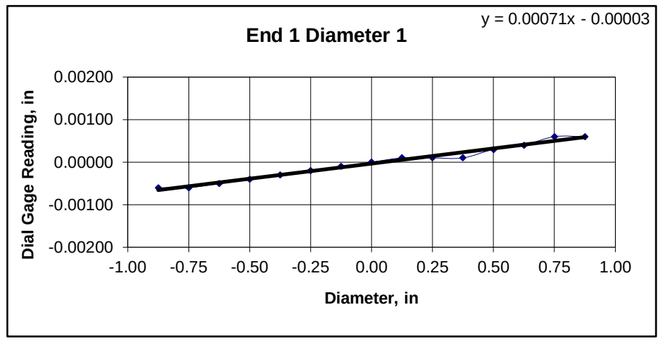
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00060	-0.00060	-0.00050	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00010	0.00010	0.00010	0.00030	0.00040	0.00060	0.00060
Diameter 2, in (rotated 90°)	0.00040	0.00030	0.00030	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010	-0.00030	-0.00030

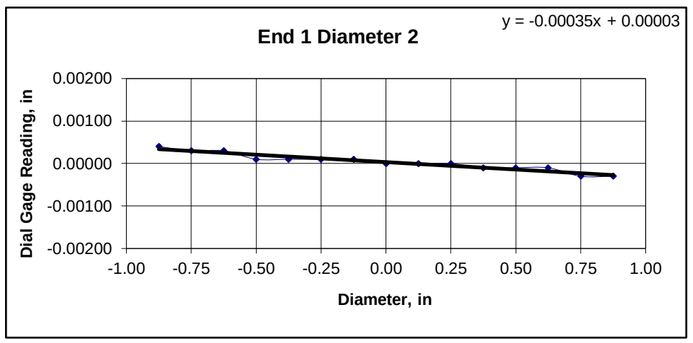
Difference between max and min readings, in:
0° = 0.00120 90° = 0.00070

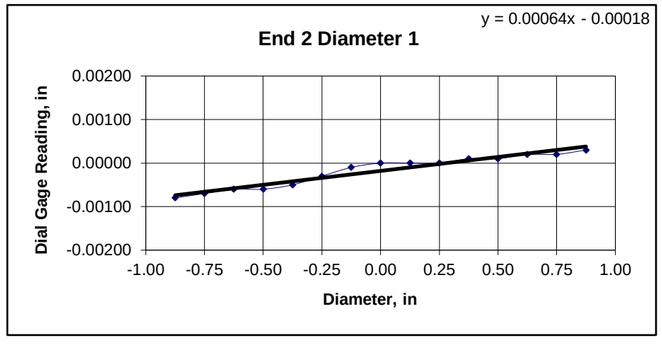
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00080	-0.00070	-0.00060	-0.00060	-0.00050	-0.00030	-0.00010	0.00000	0.00000	0.00000	0.00010	0.00010	0.00020	0.00020	0.00030
Diameter 2, in (rotated 90°)	0.00020	0.00020	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00030	-0.00040	-0.00040	-0.00060

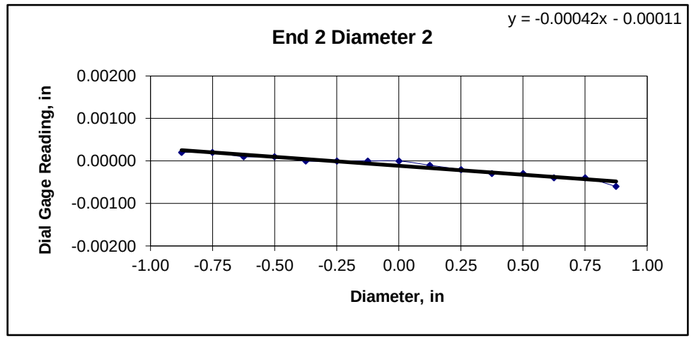
Difference between max and min readings, in:
0° = 0.0011 90° = 0.0008

Maximum difference must be < 0.0020 in. Difference = ± 0.00060
Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00071
Angle of Best Fit Line: 0.04076

End 2:
Slope of Best Fit Line 0.00064
Angle of Best Fit Line: 0.03667

Maximum Angular Difference: 0.00409

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00035
Angle of Best Fit Line: 0.01997

End 2:
Slope of Best Fit Line 0.00042
Angle of Best Fit Line: 0.02406

Maximum Angular Difference: 0.00409

Parallelism Tolerance Met? **YES**
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00120	1.990	0.00060	0.035	YES
Diameter 2, in (rotated 90°)	0.00070	1.990	0.00035	0.020	YES
END 2					
Diameter 1, in	0.00110	1.990	0.00055	0.032	YES
Diameter 2, in (rotated 90°)	0.00080	1.990	0.00040	0.023	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? **YES**

GeoTesting EXPRESS

Client:	AB Consultants, Inc.
Project Name:	Ellicott City Flood Relief N. Tunnel
Project Location:	Ellicott City, MD
GTX #:	311328
Test Date:	2/13/2020
Tested By:	cmh
Checked By:	smd
Boring ID:	EB-2
Sample ID:	EB-2 #2
Depth, ft:	15.5-16.5

After cutting and grinding

After break

Client:	AB Consultants, Inc.	Test Date:	2/12/2020
Project Name:	Ellicott City Flood Relief N. Tunnel	Tested By:	cmh
Project Location:	Ellicott City, MD	Checked By:	smd
GTX #:	311328		
Boring ID:	EB-2		
Sample ID:	EB-2 #2		
Depth:	25-26 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.50	4.50	4.50
Specimen Diameter, in:	1.99	1.99	1.99
Specimen Mass, g:	610.38		
Bulk Density, lb/ft^3	166	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.3	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

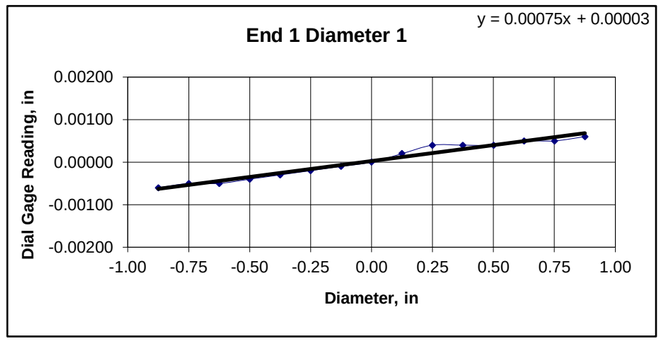
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00060	-0.00050	-0.00050	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00020	0.00040	0.00040	0.00040	0.00050	0.00050	0.00060
Diameter 2, in (rotated 90°)	0.00040	0.00030	0.00030	0.00030	0.00010	0.00010	0.00010	0.00000	-0.00020	-0.00020	-0.00040	-0.00050	-0.00050	-0.00060	-0.00080

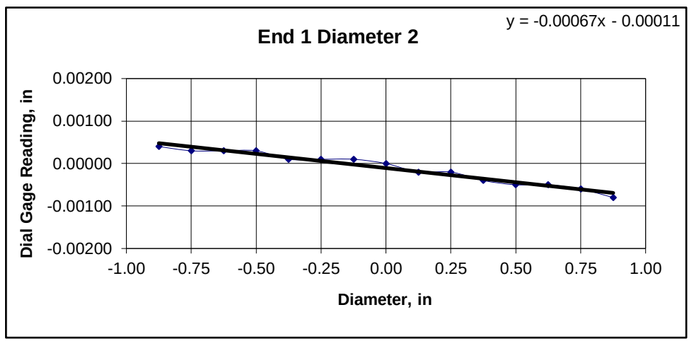
Difference between max and min readings, in:
0° = 0.00120 90° = 0.00120

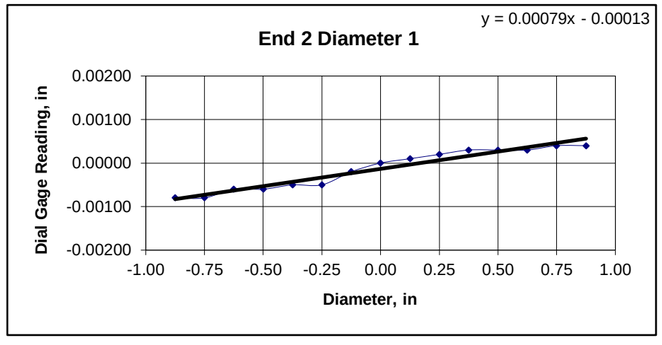
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00080	-0.00080	-0.00060	-0.00060	-0.00050	-0.00050	-0.00020	0.00000	0.00010	0.00020	0.00030	0.00030	0.00030	0.00040	0.00040
Diameter 2, in (rotated 90°)	0.00040	0.00040	0.00040	0.00030	0.00030	0.00020	0.00010	0.00000	-0.00010	-0.00020	-0.00040	-0.00050	-0.00050	-0.00060	-0.00070

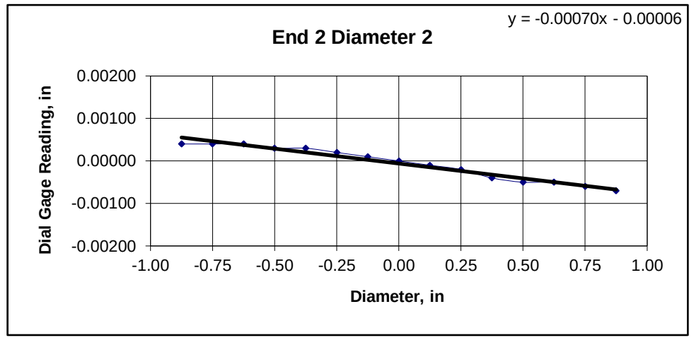
Difference between max and min readings, in:
0° = 0.0012 90° = 0.0011

Maximum difference must be < 0.0020 in. Difference = ± 0.00060
Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00075
Angle of Best Fit Line: 0.04289

End 2:
Slope of Best Fit Line 0.00079
Angle of Best Fit Line: 0.04551

Maximum Angular Difference: 0.00262

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00067
Angle of Best Fit Line: 0.03831

End 2:
Slope of Best Fit Line 0.00070
Angle of Best Fit Line: 0.04011

Maximum Angular Difference: 0.00180

Parallelism Tolerance Met? **YES**
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00120	1.990	0.00060	0.035	YES
Diameter 2, in (rotated 90°)	0.00120	1.990	0.00060	0.035	YES
END 2					
Diameter 1, in	0.00120	1.990	0.00060	0.035	YES
Diameter 2, in (rotated 90°)	0.00110	1.990	0.00055	0.032	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? **YES**

GeoTesting EXPRESS

Client:	AB Consultants, Inc.
Project Name:	Ellicott City Flood Relief N. Tunnel
Project Location:	Ellicott City, MD
GTX #:	311328
Test Date:	2/13/2020
Tested By:	cmh
Checked By:	smd
Boring ID:	EB-2
Sample ID:	EB-2 #2
Depth, ft:	25-26

After cutting and grinding

After break

Client:	AB Consultants, Inc.	Test Date:	2/12/2020
Project Name:	Ellicott City Flood Relief N. Tunnel	Tested By:	cmh
Project Location:	Ellicott City, MD	Checked By:	smd
GTX #:	311328		
Boring ID:	EB-3		
Sample ID:	EB-3 #1		
Depth:	105-106 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.48	4.48	4.48
Specimen Diameter, in:	1.99	1.99	1.99
Specimen Mass, g:	625.07		
Bulk Density, lb/ft^3	171	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.3	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

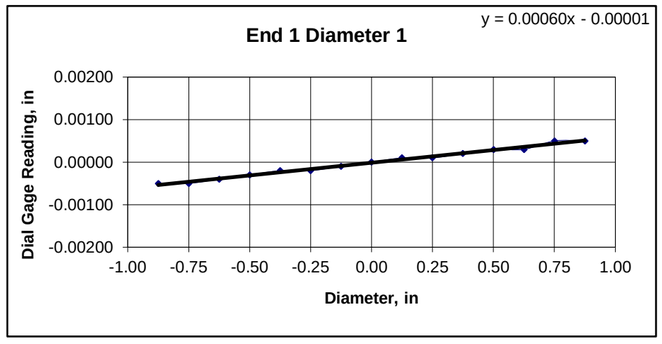
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00050	-0.00050	-0.00040	-0.00030	-0.00020	-0.00020	-0.00010	0.00000	0.00010	0.00010	0.00020	0.00030	0.00030	0.00050	0.00050
Diameter 2, in (rotated 90°)	-0.00040	-0.00040	-0.00010	-0.00020	-0.00020	-0.00020	-0.00010	0.00000	0.00000	0.00010	0.00010	0.00010	0.00010	0.00010	0.00020

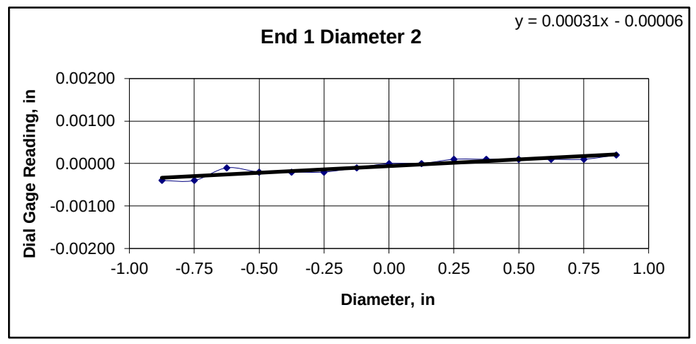
Difference between max and min readings, in:
0° = 0.00100 90° = 0.00060

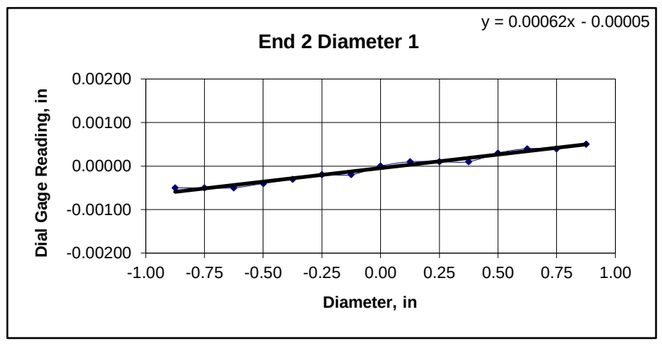
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00050	-0.00050	-0.00050	-0.00040	-0.00030	-0.00020	-0.00020	0.00000	0.00010	0.00010	0.00010	0.00030	0.00040	0.00040	0.00050
Diameter 2, in (rotated 90°)	-0.00040	-0.00040	-0.00040	-0.00040	-0.00020	-0.00020	-0.00020	0.00000	0.00000	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010

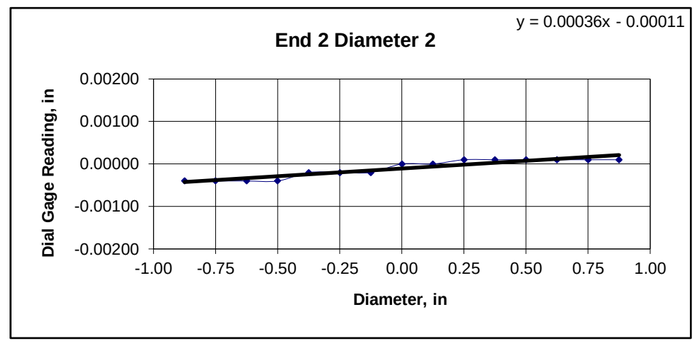
Difference between max and min readings, in:
0° = 0.001 90° = 0.0005

Maximum difference must be < 0.0020 in. Difference = ± 0.00050
Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00060
Angle of Best Fit Line: 0.03421

End 2:
Slope of Best Fit Line 0.00062
Angle of Best Fit Line: 0.03569

Maximum Angular Difference: 0.00147

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00031
Angle of Best Fit Line: 0.01801

End 2:
Slope of Best Fit Line 0.00036
Angle of Best Fit Line: 0.02079

Maximum Angular Difference: 0.00278

Parallelism Tolerance Met? **YES**
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

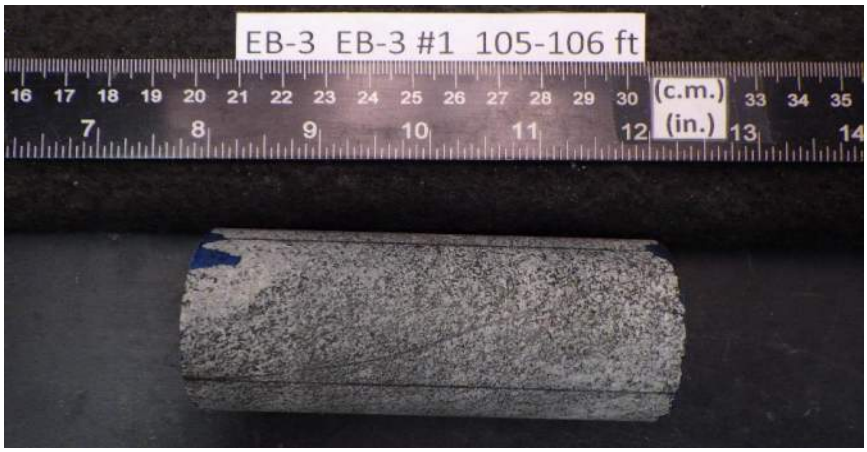
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00100	1.990	0.00050	0.029	YES
Diameter 2, in (rotated 90°)	0.00060	1.990	0.00030	0.017	YES
END 2					
Diameter 1, in	0.00100	1.990	0.00050	0.029	YES
Diameter 2, in (rotated 90°)	0.00050	1.990	0.00025	0.014	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

GeoTesting EXPRESS

Client:	AB Consultants, Inc.
Project Name:	Ellicott City Flood Relief N. Tunnel
Project Location:	Ellicott City, MD
GTX #:	311328
Test Date:	2/13/2020
Tested By:	cmh
Checked By:	smd
Boring ID:	EB-3
Sample ID:	EB-3 #1
Depth, ft:	105-106



After cutting and grinding

After break

Client:	AB Consultants, Inc.	Test Date:	2/12/2020
Project Name:	Ellicott City Flood Relief N. Tunnel	Tested By:	cmh/kdp
Project Location:	Ellicott City, MD	Checked By:	smd
GTX #:	311328		
Boring ID:	EB-4		
Sample ID:	EB-4 #1		
Depth:	101-102 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.48	4.48	4.48
Specimen Diameter, in:	1.98	1.99	1.99
Specimen Mass, g:	612.82		
Bulk Density, lb/ft^3	168	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.3	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

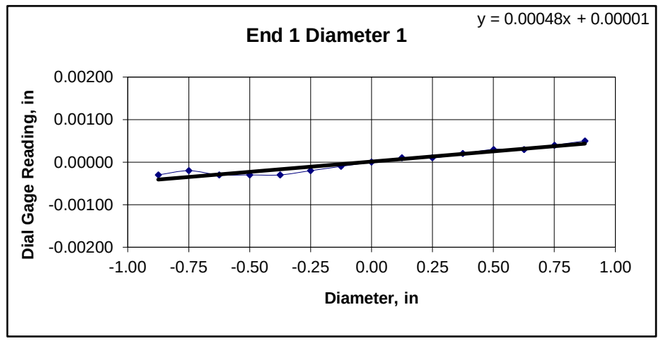
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00030	-0.00020	-0.00030	-0.00030	-0.00030	-0.00020	-0.00010	0.00000	0.00010	0.00010	0.00020	0.00030	0.00030	0.00040	0.00050
Diameter 2, in (rotated 90°)	0.00030	0.00020	0.00020	0.00020	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010	-0.00020

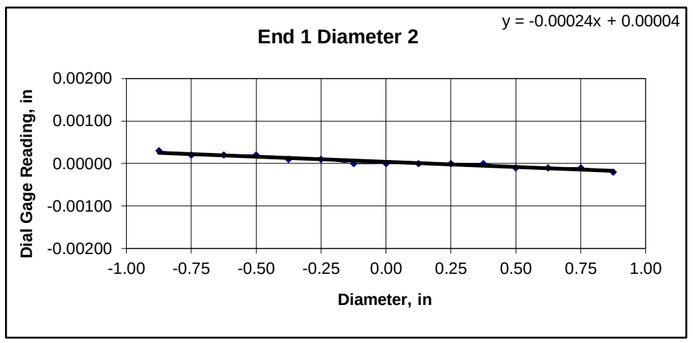
Difference between max and min readings, in:
0° = 0.00080 90° = 0.00050

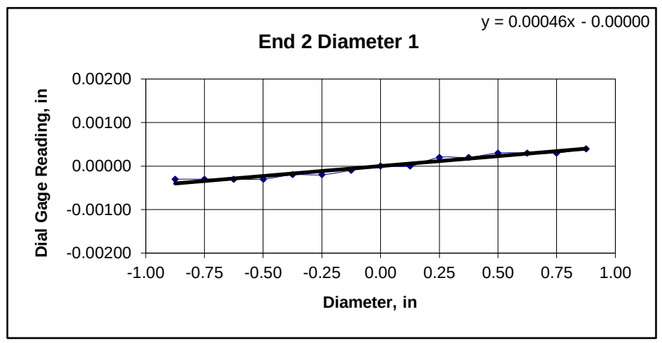
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00030	-0.00030	-0.00030	-0.00030	-0.00020	-0.00020	-0.00010	0.00000	0.00000	0.00020	0.00020	0.00030	0.00030	0.00030	0.00040
Diameter 2, in (rotated 90°)	-0.00020	-0.00030	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00010	0.00010	0.00020

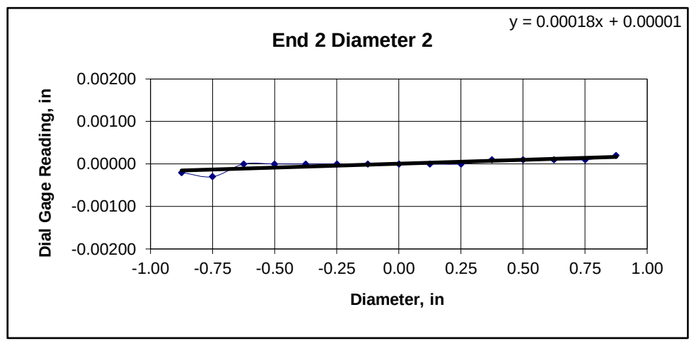
Difference between max and min readings, in:
0° = 0.0007 90° = 0.0005

Maximum difference must be < 0.0020 in. Difference = ± 0.00040
Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00048
Angle of Best Fit Line: 0.02767

End 2:
Slope of Best Fit Line 0.00046
Angle of Best Fit Line: 0.02619

Maximum Angular Difference: 0.00147

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00024
Angle of Best Fit Line: 0.01391

End 2:
Slope of Best Fit Line 0.00018
Angle of Best Fit Line: 0.01048

Maximum Angular Difference: 0.00344

Parallelism Tolerance Met? **YES**
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00080	1.985	0.00040	0.023	YES
Diameter 2, in (rotated 90°)	0.00050	1.985	0.00025	0.014	YES
END 2					
Diameter 1, in	0.00070	1.985	0.00035	0.020	YES
Diameter 2, in (rotated 90°)	0.00050	1.985	0.00025	0.014	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? **YES**

GeoTesting EXPRESS

Client:	AB Consultants, Inc.
Project Name:	Ellicott City Flood Relief N. Tunnel
Project Location:	Ellicott City, MD
GTX #:	311328
Test Date:	2/13/2020
Tested By:	cmh
Checked By:	smd
Boring ID:	EB-4
Sample ID:	EB-4 #1
Depth, ft:	101-102

After cutting and grinding

After break

Client:	AB Consutants, Inc.	Test Date:	2/12/2020
Project Name:	Ellicott City Flood Relief N Tunnel	Tested By:	cmh/kdp
Project Location:	Ellicott City, MD	Checked By:	smd
GTX #:	311328		
Boring ID:	EB-4		
Sample ID:	EB-4 #2		
Depth:	114.5-115.5 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.48	4.48	4.48
Specimen Diameter, in:	1.99	1.99	1.99
Specimen Mass, g:	613.23		
Bulk Density, lb/ft^3	167	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.3	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

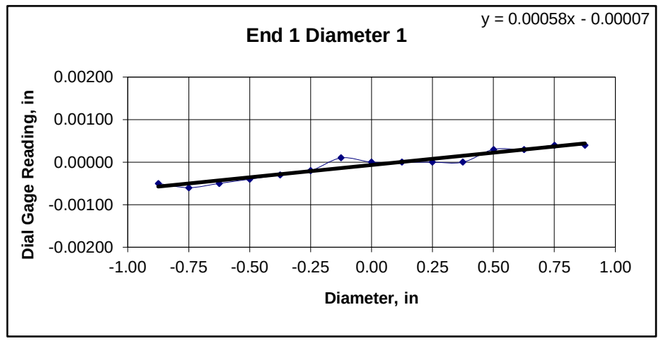
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00050	-0.00060	-0.00050	-0.00040	-0.00030	-0.00020	0.00010	0.00000	0.00000	0.00000	0.00000	0.00030	0.00030	0.00040	0.00040
Diameter 2, in (rotated 90°)	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

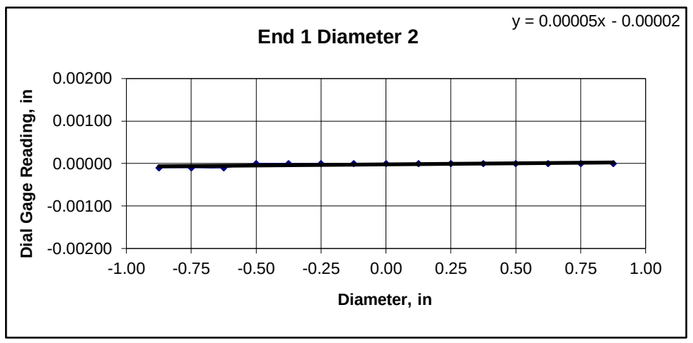
Difference between max and min readings, in:
0° = 0.00100 90° = 0.00010

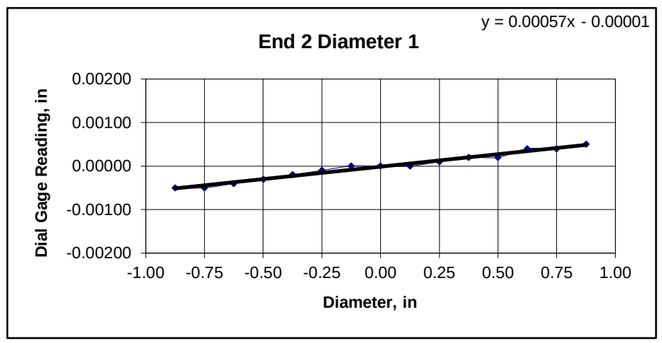
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00050	-0.00050	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00010	0.00020	0.00020	0.00040	0.00040	0.00050
Diameter 2, in (rotated 90°)	0.00010	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

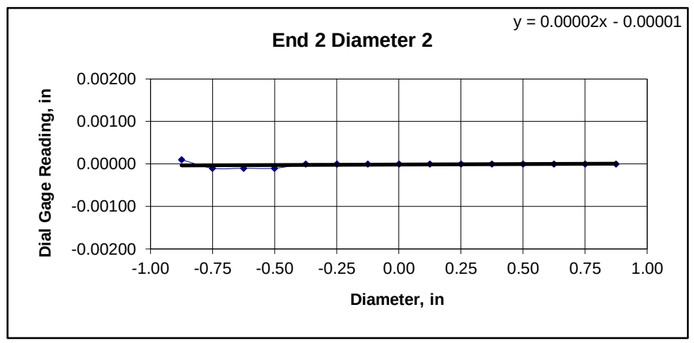
Difference between max and min readings, in:
0° = 0.001 90° = 0.0002

Maximum difference must be < 0.0020 in. Difference = ± 0.00050
Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00058
Angle of Best Fit Line: 0.03323

End 2:
Slope of Best Fit Line 0.00057
Angle of Best Fit Line: 0.03274

Maximum Angular Difference: 0.00049

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00005
Angle of Best Fit Line: 0.00295

End 2:
Slope of Best Fit Line 0.00002
Angle of Best Fit Line: 0.00131

Maximum Angular Difference: 0.00164

Parallelism Tolerance Met? **YES**
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00100	1.990	0.00050	0.029	YES
Diameter 2, in (rotated 90°)	0.00010	1.990	0.00005	0.003	YES
END 2					
Diameter 1, in	0.00100	1.990	0.00050	0.029	YES
Diameter 2, in (rotated 90°)	0.00020	1.990	0.00010	0.006	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? **YES**

GeoTesting EXPRESS

Client:	AB Consultants, Inc.
Project Name:	Ellicott City Flood Relief N. Tunnel
Project Location:	Ellicott City, MD
GTX #:	311328
Test Date:	2/13/2020
Tested By:	cmh
Checked By:	smd
Boring ID:	EB-4
Sample ID:	EB-4 #2
Depth, ft:	114.5-115.5

After cutting and grinding

After break

Client:	AB Consultants, Inc.	Test Date:	2/12/2020
Project Name:	Ellicott City Flood Relief N Tunnel	Tested By:	cmh/kdp
Project Location:	Ellicott City, MD	Checked By:	smd
GTX #:	311328		
Boring ID:	EB-5		
Sample ID:	EB-5 #1		
Depth:	79-80 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.52	4.52	4.52
Specimen Diameter, in:	1.99	1.98	1.99
Specimen Mass, g:	616.77		
Bulk Density, lb/ft^3	168	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.3	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

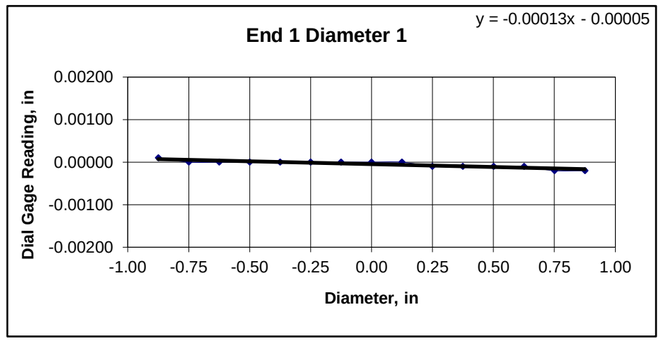
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010	-0.00010	-0.00020	-0.00020
Diameter 2, in (rotated 90°)	0.00020	0.00020	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00020	-0.00020	-0.00030

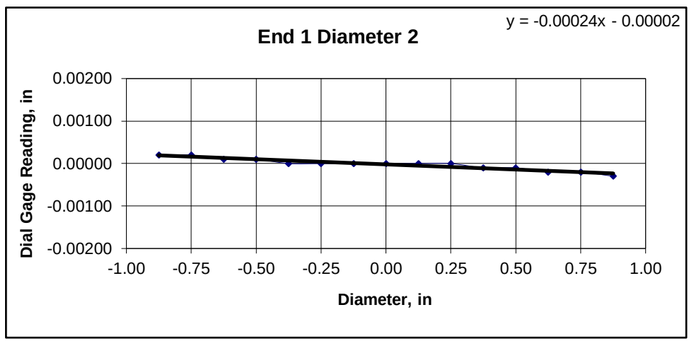
Difference between max and min readings, in:
0° = 0.00030 90° = 0.00050

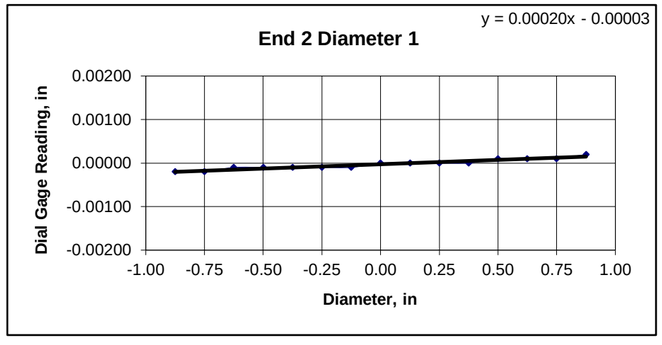
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00020	-0.00020	-0.00010	-0.00010	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00010	0.00020
Diameter 2, in (rotated 90°)	0.00030	0.00030	0.00030	0.00020	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00030

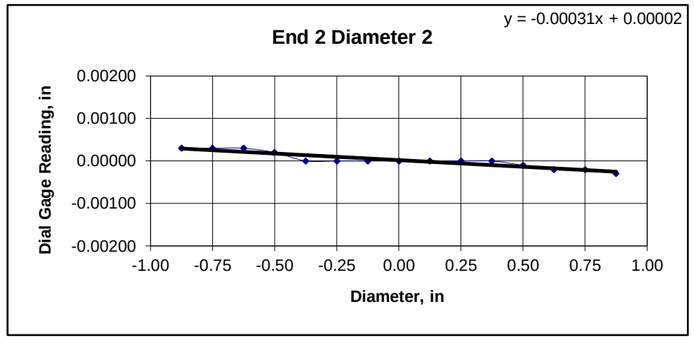
Difference between max and min readings, in:
0° = 0.0004 90° = 0.0006

Maximum difference must be < 0.0020 in. Difference = ± 0.00030
Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00013
Angle of Best Fit Line: 0.00769

End 2:
Slope of Best Fit Line 0.00020
Angle of Best Fit Line: 0.01146

Maximum Angular Difference: 0.00377

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00024
Angle of Best Fit Line: 0.01391

End 2:
Slope of Best Fit Line 0.00031
Angle of Best Fit Line: 0.01784

Maximum Angular Difference: 0.00393

Parallelism Tolerance Met? **YES**
Spherically Seated

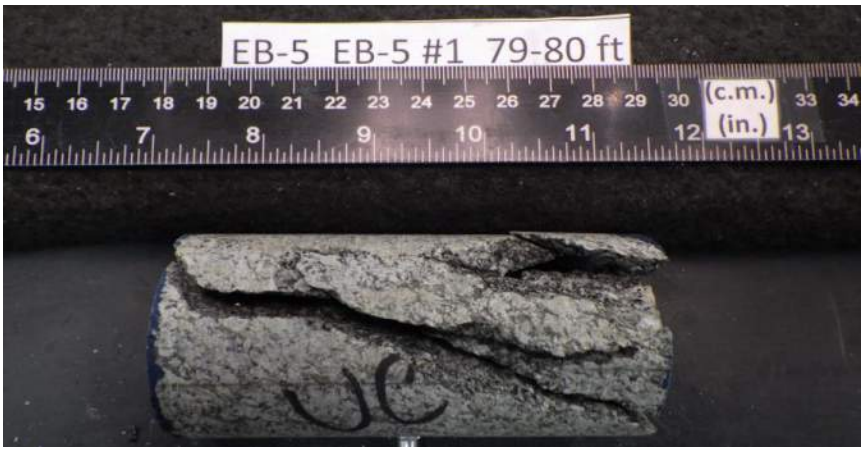
PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00030	1.985	0.00015	0.009	YES
Diameter 2, in (rotated 90°)	0.00050	1.985	0.00025	0.014	YES
END 2					
Diameter 1, in	0.00040	1.985	0.00020	0.012	YES
Diameter 2, in (rotated 90°)	0.00060	1.985	0.00030	0.017	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? **YES**

Client:	AB Consultants, Inc.
Project Name:	Ellicott City Flood Relief N. Tunnel
Project Location:	Ellicott City, MD
GTX #:	311328
Test Date:	2/13/2020
Tested By:	cmh
Checked By:	smd
Boring ID:	EB-5
Sample ID:	EB-5 #1
Depth, ft:	79-80

After cutting and grinding



After break

Client:	AB Consultans, Inc.	Test Date:	2/12/2020
Project Name:	Ellicott City Flood Relief N. Tunnel	Tested By:	cmh/kdp
Project Location:	Ellicott City, MD	Checked By:	smd
GTX #:	311328		
Boring ID:	EB-5		
Sample ID:	EB-5 #2		
Depth:	90-91 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.52	4.52	4.52
Specimen Diameter, in:	1.99	1.99	1.99
Specimen Mass, g:	621.09		
Bulk Density, lb/ft^3	168	**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.3	**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

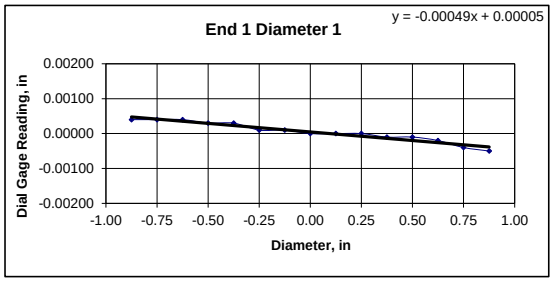
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00040	0.00040	0.00040	0.00030	0.00030	0.00010	0.00010	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00020	-0.00040	-0.00050
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010

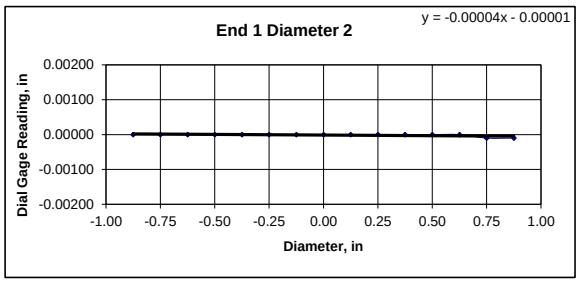
Difference between max and min readings, in:
0° = 0.00090 90° = 0.00010

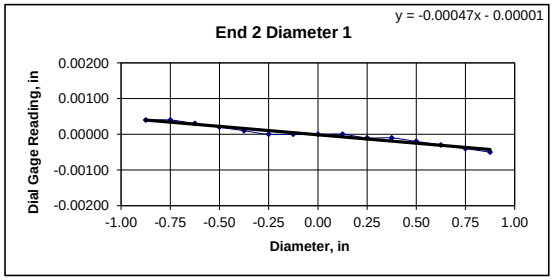
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00040	0.00040	0.00030	0.00020	0.00010	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00020	-0.00030	-0.00040	-0.00050
Diameter 2, in (rotated 90°)	-0.00010	-0.00020	-0.00010	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

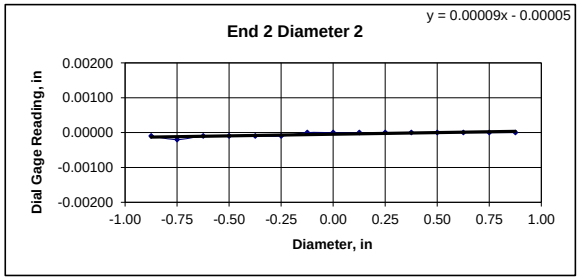
Difference between max and min readings, in:
0° = 0.0009 90° = 0.0002

Maximum difference must be < 0.0020 in. Difference = ± 0.00045
Flatness Tolerance Met? YES









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00049
Angle of Best Fit Line: 0.02816

End 2:
Slope of Best Fit Line 0.00047
Angle of Best Fit Line: 0.02701

Maximum Angular Difference: 0.00115

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00004
Angle of Best Fit Line: 0.00213

End 2:
Slope of Best Fit Line 0.00009
Angle of Best Fit Line: 0.00540

Maximum Angular Difference: 0.00327

Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00090	1.990	0.00045	0.026	YES
Diameter 2, in (rotated 90°)	0.00010	1.990	0.00005	0.003	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? YES

END 2					
Diameter 1, in	0.00090	1.990	0.00045	0.026	YES
Diameter 2, in (rotated 90°)	0.00020	1.990	0.00010	0.006	YES

GeoTesting EXPRESS

Client:	AB Consultants, Inc.
Project Name:	Ellicott City Flood Relief N. Tunnel
Project Location:	Ellicott City, MD
GTX #:	311328
Test Date:	2/13/2020
Tested By:	cmh
Checked By:	smd
Boring ID:	EB-5
Sample ID:	EB-5 #2
Depth, ft:	90-91

After cutting and grinding

After break

Client:	AB Consultans, Inc.	Test Date:	2/13/2020
Project Name:	Ellicott City Flood Relief N. Tunnel	Tested By:	cmh
Project Location:	Ellicott City, MD	Checked By:	smd
GTX #:	311328		
Boring ID:	EB-7		
Sample ID:	EB-7 #1		
Depth:	31-32 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.42	4.43	4.43
Specimen Diameter, in:	1.99	1.99	1.99
Specimen Mass, g:	594.33		
Bulk Density, lb/ft^3	164	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

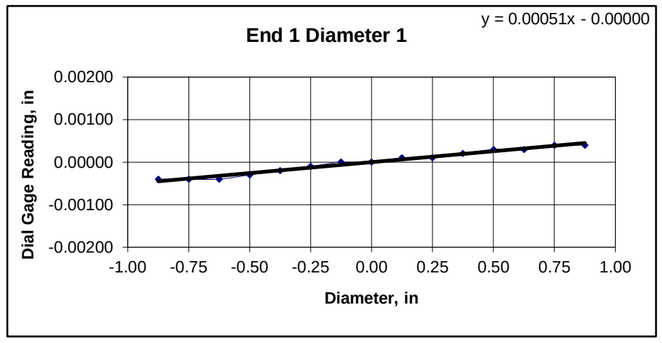
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00040	-0.00040	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00010	0.00010	0.00020	0.00030	0.00030	0.00040	0.00040
Diameter 2, in (rotated 90°)	-0.00030	-0.00030	-0.00020	-0.00020	-0.00020	-0.00020	-0.00010	0.00000	0.00000	0.00010	0.00010	0.00010	0.00020	0.00020	0.00030

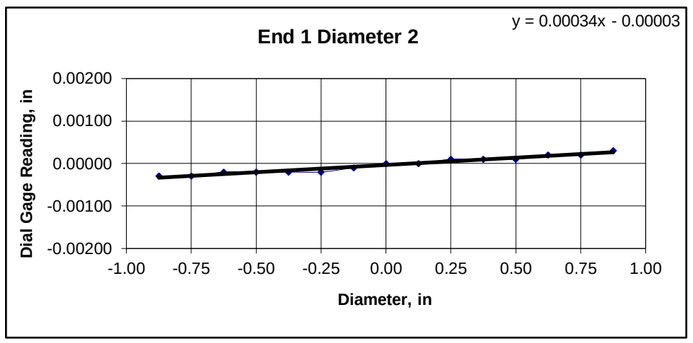
Difference between max and min readings, in:
0° = 0.00080 90° = 0.00060

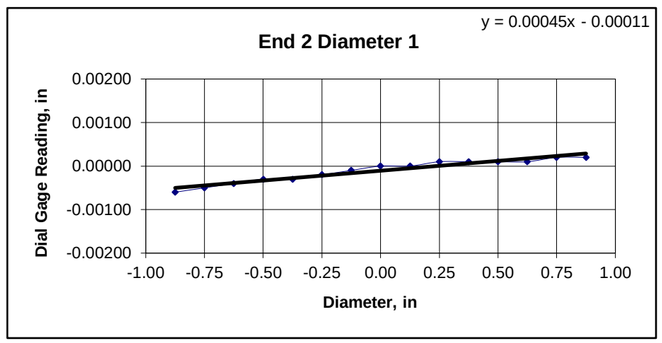
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00060	-0.00050	-0.00040	-0.00030	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00010	0.00010	0.00010	0.00010	0.00020	0.00020
Diameter 2, in (rotated 90°)	-0.00040	-0.00040	-0.00030	-0.00030	-0.00020	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00010	0.00020	0.00020	0.00020	0.00030

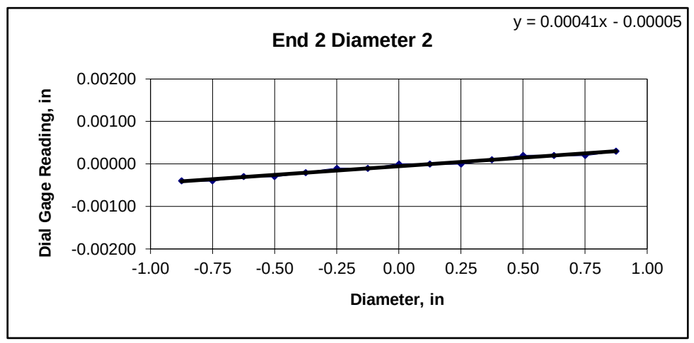
Difference between max and min readings, in:
0° = 0.0008 90° = 0.0007

Maximum difference must be < 0.0020 in. Difference = ± 0.00040
Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00051
Angle of Best Fit Line: 0.02947

End 2:
Slope of Best Fit Line 0.00045
Angle of Best Fit Line: 0.02586

Maximum Angular Difference: 0.00360

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00034
Angle of Best Fit Line: 0.01964

End 2:
Slope of Best Fit Line 0.00041
Angle of Best Fit Line: 0.02325

Maximum Angular Difference: 0.00360

Parallelism Tolerance Met? **YES**
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00080	1.990	0.00040	0.023	YES
Diameter 2, in (rotated 90°)	0.00060	1.990	0.00030	0.017	YES
END 2					
Diameter 1, in	0.00080	1.990	0.00040	0.023	YES
Diameter 2, in (rotated 90°)	0.00070	1.990	0.00035	0.020	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? **YES**

Client:	AB Consultants, Inc.
Project Name:	Ellicott City Flood Relief N. Tunnel
Project Location:	Ellicott City, MD
GTX #:	311328
Test Date:	2/13/2020
Tested By:	cmh
Checked By:	smd
Boring ID:	EB-7
Sample ID:	EB-7 #1
Depth, ft:	31-32

After cutting and grinding

After break

GeoTesting EXPRESS

ROCK CHAIN OF CUSTODY & TEST REQUEST

GeoTesting Express, Inc.
125 Nagog Park
Acton, MA 01720
800 434 1062 Toll Free
978 635 0266 Fax

2358 Perimeter Park Drive, Suite 320
Atlanta, GA 30341
770 645 6575 Tel
770 645 6570 Fax

www.geotesting.com

EQI.01-2021

CLIENT		INVOICE (complete if different from Client)	
Company: AB Consultants Inc.		Company:	
Address: 9450 Annapolis Road		Address:	
City, State, Zip: Lanham, Maryland, 20706		City, State, Zip:	
Contact: Fu Guo	Phone: 3013063091	Contact:	Phone:
E-mail: fu.guo@abconsultantsinc.com	Cell: 2406783088	E-mail:	Cell:

PROJECT		
Project Name: Ellicott City Flood Relief North Tunnel	Client Project #: 2017091.042	Purchase Order#:
Project Location: Ellicott City	GTX Sales Order #:	Requested Turnaround: 2 weeks
On-site Contact: Fu Guo	E-mail: fu.guo@abconsultantsinc.com	Phone: 2406783088

ROCK			CERCHAR Abrasivity (ASTM D 7625) * 55HRC/40HRC	Direct Shear (ASTM D5607)*	Direct Tensile Strength (ASTM D 2936)	Elastic Moduli in Triaxial Compression (ASTM D 7012B)	Elastic Moduli in Uniaxial Compression (ASTM D 7012D)	Unit Weight (ISRM)	Petrographic Analysis (ISRM)	Point Load Index (ASTM D 5731)* Diametral, Axial, Lump/Block	Punch Penetration (Handewith)	Slake Durability (ASTM D 4644)	Splitting (Brazilian) Tensile Strength (ASTM D 3967)	Schmidt Hammer (ASTM D 5873)	Total Hardness (Schmidt Hammer and Taber Abrasion)	Triaxial Compression (ASTM D 7012A)	Unconfined Compression (ASTM D 7012C)	Other:_____	Other:_____
Boring ID	Sample ID	Depth																		
EB-1	EB-1 #1	23.5-24.5											X				X			
EB-1	EB-1 #2	9-10											X				X			
EB-2	EB-2 #1	15.5-16.5											X				X			
EB-2	EB-2 #2	25-26											X				X			
EB-3	EB-3 #1	105-106											X				X			
EB-4	EB-4 #1	101-102											X				X			
EB-4	EB-4 #2	114.5-115.5											X				X			
EB-5	EB-5 #1	79-80											X				X			
EB-5	EB-5 #2	90-91											X				X			
EB-7	EB-7 #1	31-32															X			
EB-7	EB-7 #2	30.5-31											X							

*Specify Test Conditions (Undisturbed or Remolded, Density and Moisture, Test Normal Loads, Test Confining Stresses, etc.):

AUTHORIZE BY SIGNING AND DATING:

SIGNATURE: _____ PRINT NAME: Fu Guo DATE: 2/6/20

For GTX Use Only
Incoming Sample Inspection Performed ☐
Adverse conditions:

Relinquished By:	DATE:	Received By:	DATE: 2/11/2020
	TIME:		TIME: 10:55
Relinquished By:	DATE:	Received By:	DATE:
	TIME:		TIME:

ATTACHMENT B - GEOTECH

GeoTesting EXPRESS

WARRANTY and LIABILITY

GeoTesting Express (GTX) warrants that all tests it performs are run in general accordance with the specified test procedures and accepted industry practice. GTX will correct or repeat any test that does not comply with this warranty. GTX has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

GTX may report engineering parameters that require us to interpret the test data. Such parameters are determined using accepted engineering procedures. However, GTX does not warrant that these parameters accurately reflect the true engineering properties of the *in situ* material. Responsibility for interpretation and use of the test data and these parameters for engineering and/or construction purposes rests solely with the user and not with GTX or any of its employees.

GTX's liability will be limited to correcting or repeating a test which fails our warranty. GTX's liability for damages to the Purchaser of testing services for any cause whatsoever shall be limited to the amount GTX received for the testing services. GTX will not be liable for any damages, or for any lost benefits or other consequential damages resulting from the use of these test results, even if GTX has been advised of the possibility of such damages. GTX will not be responsible for any liability of the Purchaser to any third party.

Commonly Used Symbols

A	pore pressure parameter for $\Delta\sigma_1 - \Delta\sigma_3$
B	pore pressure parameter for $\Delta\sigma_3$
CAI	CERCHAR Abrasiveness Index
CIU	isotropically consolidated undrained triaxial shear test
CR	compression ratio for one dimensional consolidation
CSR	cyclic stress ratio
C_c	coefficient of curvature, $(D_{30})^2 / (D_{10} \times D_{60})$
C_u	coefficient of uniformity, D_{60}/D_{10}
C_c	compression index for one dimensional consolidation
C_α	coefficient of secondary compression
c_v	coefficient of consolidation
c	cohesion intercept for total stresses
c'	cohesion intercept for effective stresses
D	diameter of specimen
D	damping ratio
D_{10}	diameter at which 10% of soil is finer
D_{15}	diameter at which 15% of soil is finer
D_{30}	diameter at which 30% of soil is finer
D_{50}	diameter at which 50% of soil is finer
D_{60}	diameter at which 60% of soil is finer
D_{85}	diameter at which 85% of soil is finer
d_{50}	displacement for 50% consolidation
d_{90}	displacement for 90% consolidation
d_{100}	displacement for 100% consolidation
E	Young's modulus
e	void ratio
e_c	void ratio after consolidation
e_o	initial void ratio
G	shear modulus
G_s	specific gravity of soil particles
H	height of specimen
H_R	Rebound Hardness number
i	gradient
I_S	Uncorrected point load strength
$I_{S(50)}$	Size corrected point load strength index
H_A	Modified Taber Abrasion
H_T	Total hardness
K_o	lateral stress ratio for one dimensional strain
k	permeability
LI	Liquidity Index
m_v	coefficient of volume change
n	porosity
PI	plasticity index
P_c	preconsolidation pressure
p	$(\sigma_1 + \sigma_3) / 2$, $(\sigma_v + \sigma_h) / 2$
p'	$(\sigma'_1 + \sigma'_3) / 2$, $(\sigma'_v + \sigma'_h) / 2$
p'_c	p' at consolidation
Q	quantity of flow
q	$(\sigma_1 - \sigma_3) / 2$
q_f	q at failure
q_o, q_i	initial q
q_c	q at consolidation
S_r	Post cyclic undrained shear strength
T	temperature
t	time
U, UC	unconfined compression test
UU, Q	unconsolidated undrained triaxial test
u_a	pore gas pressure
u_e	excess pore water pressure
u, u_w	pore water pressure
V	total volume
V_g	volume of gas
V_s	volume of solids
V_s	shear wave velocity
V_v	volume of voids
V_w	volume of water
V_o	initial volume
v	velocity
W	total weight
W_s	weight of solids
W_w	weight of water
w	water content
w_c	water content at consolidation
w_f	final water content
w_l	liquid limit
w_n	natural water content
w_p	plastic limit
w_s	shrinkage limit
w_o, w_i	initial water content
α	slope of q_f versus p_f
α'	slope of q_f versus p_f'
γ_t	total unit weight
γ_d	dry unit weight
γ_s	unit weight of solids
γ_w	unit weight of water
ε	strain
ε_{vol}	volume strain
ε_h, ε_v	horizontal strain, vertical strain
μ	Poisson's ratio, also viscosity
σ	normal stress
σ'	effective normal stress
σ_c, σ'_c	consolidation stress in isotropic stress system
σ_h, σ'_h	horizontal normal stress
σ_v, σ'_v	vertical normal stress
σ'_{vc}	Effective vertical consolidation stress
σ_1	major principal stress
σ_2	intermediate principal stress
σ_3	minor principal stress
τ	shear stress
φ	friction angle based on total stresses
φ'	friction angle based on effective stresses
φ'_r	residual friction angle
φ_{ult}	φ for ultimate strength

GeoTesting EXPRESS

Technologies to manage risk for infrastructure

Boston
Atlanta
Chicago
Los Angeles
New York
www.geotesting.com

Transmittal

TO:

Fu Guo

AB Consultants, Inc.

9450 Annapolis Rd

Lanham, MD 20706

DATE: 5/12/2020	GTX NO: 311328
RE: Ellicott City Flood Relief N. Tunnel	

COPIES	DATE	DESCRIPTION
	5/12/2020	**May 2020 Laboratory Test Report**

REMARKS:

SIGNED: Sarah Delaney

Sarah Delaney, Assistant Laboratory Manager

CC:

APPROVED BY : Jonathan Campbell

Jonathan Campbell, Laboratory Manager

GeoTesting EXPRESS
Technologies to manage risk for infrastructure

Atlanta
Chicago
Los Angeles
New York
www.geotesting.com

May 12, 2020

Fu Guo
AB Consultants, Inc.
9450 Annapolis Rd
Lanham, MD 20706

RE: Ellicott City Flood Relief N. Tunnel, Ellicott City, MD (GTX-311328)

Dear Fu Guo:

Enclosed are the test results you requested for the above referenced project. GeoTesting Express, Inc. (GTX) received three samples from you on 5/5/2020. These samples were labeled as follows:

Boring Number	Sample Number	Depth	Elevation
EB-6	EB-6 #1	74.5-75	175.5 to 175.0
EB-6	EB-6 #2	87-87.6	163.0 to 162.5
EB-6	EB-6 #3	89.5-90.5	160.5 to 159.5

GTX performed the following tests on these samples:

2 ASTM D3967 - Splitting Tensile Test (Brazilian) - one specimen
3 ASTM D7012 Method C- Uniaxial Compressive Strength of Rock

A copy of your test request is attached.

The results presented in this report apply only to the items tested. This report shall not be reproduced except in full, without written approval from GeoTesting Express. The remainder of these samples will be retained for a period of sixty (60) days and will then be discarded unless otherwise notified by you. Please call me if you have any questions or require additional information. Thank you for allowing GeoTesting Express the opportunity of providing you with testing services. We look forward to working with you again in the future.

Respectfully yours,

Sarah Delaney
Assistant Laboratory Manager

GeoTesting EXPRESS
Technologies to manage risk for infrastructure

Boston
Atlanta
Chicago
Los Angeles
New York
www.geotesting.com

Geotechnical Test Report **5/12/2020**

GTX-311328

Ellicott City Flood Relief N. Tunnel

Ellicott City, MD

Client Project No.: 2017091.042

Prepared for:

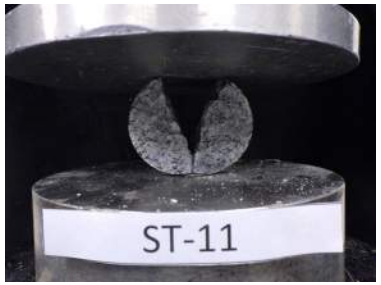
AB Consultants, Inc.

GeoTesting EXPRESS

Client:	AB Consultants, Inc.				
Project:	Ellicott City Flood Relief N. Tunnel				
Location:	Ellicott City, MD			Project No:	GTX-311328
Boring ID:	EB-6	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	EB-6 #2	Test Date:	05/08/20	Checked By:	smd
Depth :	87-87.6	Test Id:	556691		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Splitting Tensile Strength of Intact Rock Core Specimens by ASTM D3967

Specimen Depth	Test No	Thickness (L), in	Diameter (D), in	Thickness to Diameter Ratio (L/D)	Failure Load (P), lbs	Splitting Tensile Strength, psi	Failure Type
87.47-87.56 ft	ST-11	1.07	1.99	0.54	5,206	1,550	1



Notes: Strain rate: 2.5%/min.

ASTM requires the thickness-to-diameter ratio (L/D) of each test specimen to be between 0.2 and 0.75.

The reported thickness (L) is the average of three measurements.

The reported diameter(D) is the average of three measurements.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

GeoTesting EXPRESS

Client:	AB Consultants, Inc.				
Project:	Ellicott City Flood Relief N. Tunnel				
Location:	Ellicott City, MD			Project No:	GTX-311328
Boring ID:	EB-6	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	EB-6 #3	Test Date:	05/08/20	Checked By:	smd
Depth :	89.5-90.5	Test Id:	556692		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Splitting Tensile Strength of Intact Rock Core Specimens by ASTM D3967

Specimen Depth	Test No	Thickness (L), in	Diameter (D), in	Thickness to Diameter Ratio (L/D)	Failure Load (P), lbs	Splitting Tensile Strength, psi	Failure Type
89.96-90.05 ft	ST-12	1.09	1.99	0.55	5,348	1,560	1

Notes: Strain rate: 2.5%/min.

ASTM requires the thickness-to-diameter ratio (L/D) of each test specimen to be between 0.2 and 0.75.

The reported thickness (L) is the average of three measurements.

The reported diameter(D) is the average of three measurements.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

Client:	AB Consultants, Inc.				
Project:	Ellicott City Flood Relief N. Tunnel				
Location:	Ellicott City, MD			Project No:	GTX-311328
Boring ID:	---	Sample Type:	---	Tested By:	tlm
Sample ID:	---	Test Date:	05/08/20	Checked By:	smd
Depth :	---	Test Id:	556690		

Bulk Density and Compressive Strength of Rock Core Specimens by ASTM D7012 Method C

Boring ID	Sample Number	Depth	Bulk Density, pcf	Compressive strength, psi	Failure Type	Meets ASTM D4543	Note(s)
EB-6	EB-6 #1	74.62-75.0 ft	166	9276	1	Yes	---
EB-6	EB-6 #2	87.07-87.45 ft	166	18030	1	Yes	---
EB-6	EB-6 #3	89.57-89.95 ft	167	18088	1	Yes	---

Notes: Density determined on core samples by measuring dimensions and weight and then calculating.

All specimens tested at the approximate as-received moisture content and at standard laboratory temperature.

The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

Client:	AB Consultants, Inc.	Test Date:	5/8/2020
Project Name:	Ellicott City Flood Relief N. Tunnel	Tested By:	cmh/kdp
Project Location:	Ellicott City, MD	Checked By:	smd
GTX #:	311328		
Boring ID:	EB-6		
Sample ID:	EB-6 #1		
Depth:	74.62-75.0 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.47	4.47	4.47
Specimen Diameter, in:	2.00	2.00	2.00
Specimen Mass, g:	611.47		
Bulk Density, lb/ft^3	166	**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

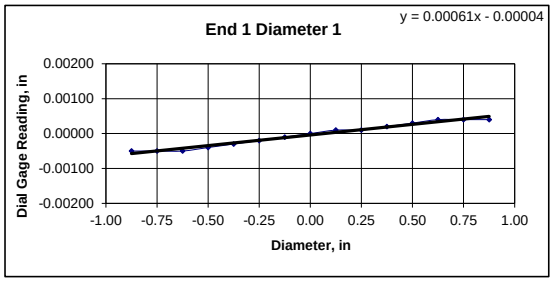
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00050	-0.00050	-0.00050	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00010	0.00010	0.00020	0.00030	0.00040	0.00040	0.00040
Diameter 2, in (rotated 90°)	0.00020	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010	-0.00020	-0.00020

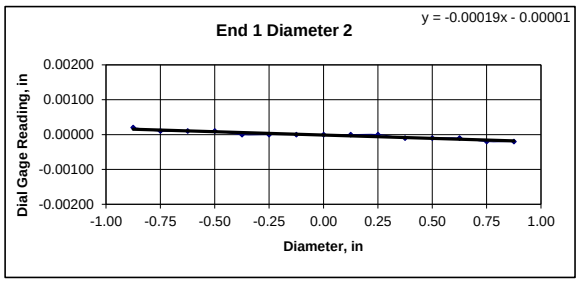
Difference between max and min readings, in:
0° = 0.00090 90° = 0.00040

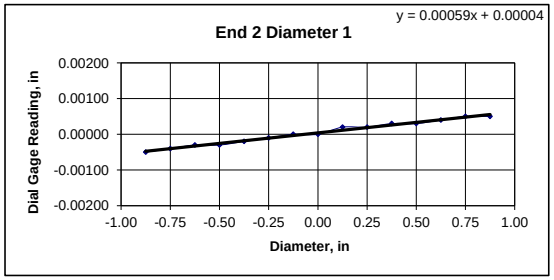
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00050	-0.00040	-0.00030	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00020	0.00020	0.00030	0.00030	0.00040	0.00050	0.00050
Diameter 2, in (rotated 90°)	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010

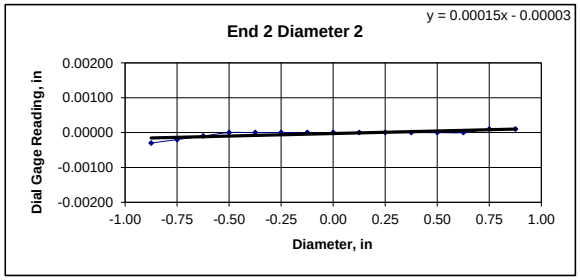
Difference between max and min readings, in:
0° = 0.001 90° = 0.0004

Maximum difference must be < 0.0020 in. Difference = ± 0.00050
Flatness Tolerance Met? YES









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00061
Angle of Best Fit Line: 0.03487

End 2:
Slope of Best Fit Line 0.00059
Angle of Best Fit Line: 0.03372

Maximum Angular Difference: 0.00115

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00019
Angle of Best Fit Line: 0.01097

End 2:
Slope of Best Fit Line 0.00015
Angle of Best Fit Line: 0.00835

Maximum Angular Difference: 0.00262

Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00090	2.000	0.00045	0.026	YES
Diameter 2, in (rotated 90°)	0.00040	2.000	0.00020	0.011	YES
END 2					
Diameter 1, in	0.00100	2.000	0.00050	0.029	YES
Diameter 2, in (rotated 90°)	0.00040	2.000	0.00020	0.011	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? YES

GeoTesting EXPRESS

Client:	AB Consultants, Inc.
Project Name:	Ellicott City Flood Relief N. Tunnel
Project Location:	Ellicott City, MD
GTX #:	311328
Test Date:	5/8/2020
Tested By:	cmh
Checked By:	smd
Boring ID:	EB-6
Sample ID:	EB-6 #1
Depth, ft:	74.62-75.0

After cutting and grinding

After break

Client:	AB Consultants, Inc.	Test Date:	5/8/2020
Project Name:	Ellicott City Flood Relief N. Tunnel	Tested By:	cmh/kdp
Project Location:	Ellicott City, MD	Checked By:	smd
GTX #:	311328		
Boring ID:	EB-6		
Sample ID:	EB-6 #2		
Depth:	87.07-87.45 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.56	4.56	4.56
Specimen Diameter, in:	1.99	1.99	1.99
Specimen Mass, g:	621.05		
Bulk Density, lb/ft^3	166	**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.3	**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

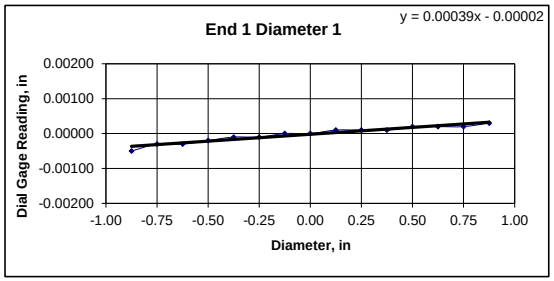
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00050	-0.00030	-0.00030	-0.00020	-0.00010	-0.00010	0.00000	0.00000	0.00010	0.00010	0.00010	0.00020	0.00020	0.00020	0.00030
Diameter 2, in (rotated 90°)	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

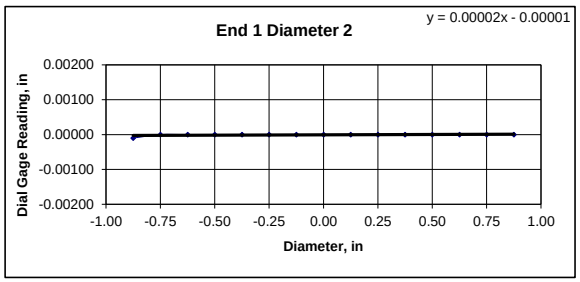
Difference between max and min readings, in:
0° = 0.00080 90° = 0.00010

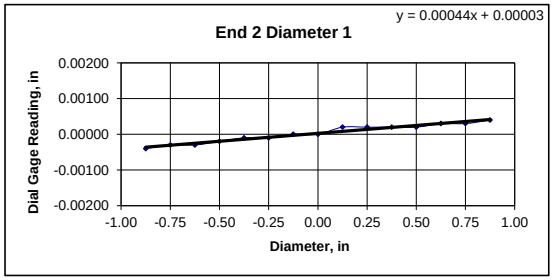
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00040	-0.00030	-0.00030	-0.00020	-0.00010	-0.00010	0.00000	0.00000	0.00020	0.00020	0.00020	0.00020	0.00030	0.00030	0.00040
Diameter 2, in (rotated 90°)	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

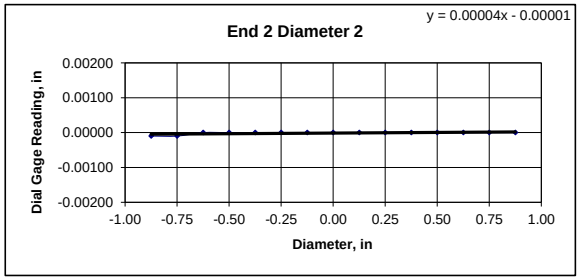
Difference between max and min readings, in:
0° = 0.0008 90° = 0.0001

Maximum difference must be < 0.0020 in. Difference = ± 0.00040
Flatness Tolerance Met? YES









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00039
Angle of Best Fit Line: 0.02259

End 2:
Slope of Best Fit Line 0.00044
Angle of Best Fit Line: 0.02537

Maximum Angular Difference: 0.00278

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00002
Angle of Best Fit Line: 0.00115

End 2:
Slope of Best Fit Line 0.00004
Angle of Best Fit Line: 0.00213

Maximum Angular Difference: 0.00098

Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00080	1.990	0.00040	0.023	YES
Diameter 2, in (rotated 90°)	0.00010	1.990	0.00005	0.003	YES
END 2					
Diameter 1, in	0.00080	1.990	0.00040	0.023	YES
Diameter 2, in (rotated 90°)	0.00010	1.990	0.00005	0.003	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? YES

GeoTesting EXPRESS

Client:	AB Consultants, Inc.
Project Name:	Ellicott City Flood Relief N. Tunnel
Project Location:	Ellicott City, MD
GTX #:	311328
Test Date:	5/8/2020
Tested By:	cmh
Checked By:	smd
Boring ID:	EB-6
Sample ID:	EB-6 #2
Depth, ft:	87.07-87.45

After cutting and grinding

After break

Client:	AB Consultants, Inc.	Test Date:	5/8/2020
Project Name:	Ellicott City Flood Relief N. Tunnel	Tested By:	cmh/kdp
Project Location:	Ellicott City, MD	Checked By:	smd
GTX #:	311328		
Boring ID:	EB-6		
Sample ID:	EB-6 #3		
Depth:	89.57-89.95 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.45	4.45	4.45
Specimen Diameter, in:	1.99	1.99	1.99
Specimen Mass, g:	608.95		
Bulk Density, lb/ft^3	167	**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

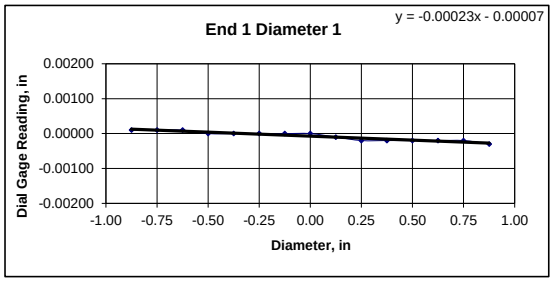
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00020	-0.00020	-0.00020	-0.00030
Diameter 2, in (rotated 90°)	0.00040	0.00030	0.00020	0.00020	0.00020	0.00020	0.00010	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00020	-0.00020	-0.00050

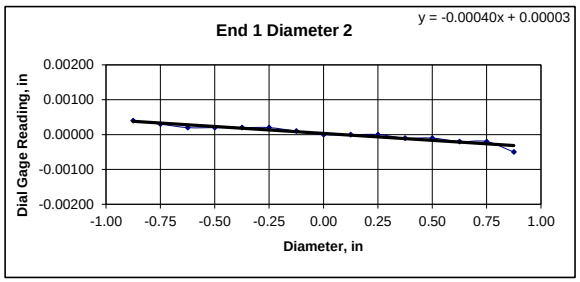
Difference between max and min readings, in:
0° = 0.00040 90° = 0.00090

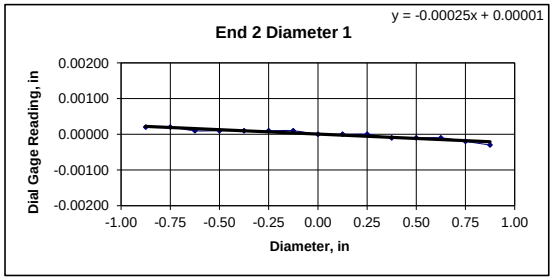
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00020	0.00020	0.00010	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010	-0.00020	-0.00030
Diameter 2, in (rotated 90°)	-0.00040	-0.00030	-0.00020	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00020	0.00020	0.00020	0.00030

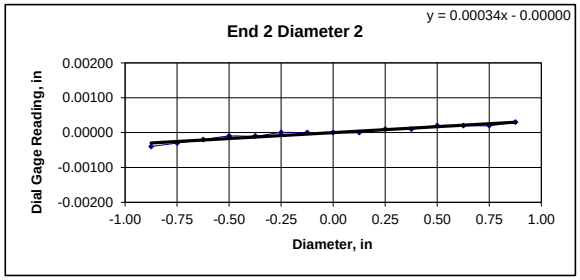
Difference between max and min readings, in:
0° = 0.0005 90° = 0.0007

Maximum difference must be < 0.0020 in. Difference = ± 0.00045
Flatness Tolerance Met? YES









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00023
Angle of Best Fit Line: 0.01310

End 2:
Slope of Best Fit Line 0.00025
Angle of Best Fit Line: 0.01408

Maximum Angular Difference: 0.00098

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00040
Angle of Best Fit Line: 0.02275

End 2:
Slope of Best Fit Line 0.00034
Angle of Best Fit Line: 0.01948

Maximum Angular Difference: 0.00327

Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00040	1.990	0.00020	0.012	YES
Diameter 2, in (rotated 90°)	0.00090	1.990	0.00045	0.026	YES
END 2					
Diameter 1, in	0.00050	1.990	0.00025	0.014	YES
Diameter 2, in (rotated 90°)	0.00070	1.990	0.00035	0.020	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? YES

GeoTesting EXPRESS

Client:	AB Consultants, Inc.
Project Name:	Ellicott City Flood Relief N. Tunnel
Project Location:	Ellicott City, MD
GTX #:	311328
Test Date:	5/8/2020
Tested By:	cmh
Checked By:	smd
Boring ID:	EB-6
Sample ID:	EB-6 #3
Depth, ft:	89.57-89.95

After cutting and grinding

After break

GeoTesting EXPRESS

ROCK CHAIN OF CUSTODY & TEST REQUEST

GeoTesting Express, Inc.
125 Nagog Park
Acton, MA 01720
800 434 1062 Toll Free
978 635 0266 Fax

2358 Perimeter Park Drive, Suite 320
Atlanta, GA 30341
770 645 6575 Tel
770 645 6570 Fax

www.geotesting.com

EOI 01-2021

CLIENT		INVOICE (complete if different from Client)	
Company: AB Consultants Inc.		Company:	
Address: 9450 Annapolis Road		Address:	
City, State, Zip: Lanham, Maryland, 20706		City, State, Zip:	
Contact: Fu Guo	Phone: 3013063091	Contact:	Phone:
E-mail: fu.guo@abconsultantsinc.com	Cell: 2406783088	E-mail:	Cell:

PROJECT		
Project Name: Ellicott City Flood Relief North Tunnel	Client Project #: 2017091.042	Purchase Order#:
Project Location: Ellicott City	GTX Sales Order #:	Requested Turnaround: 2 weeks
On-site Contact: Fu Guo	E-mail: fu.guo@abconsultantsinc.com	Phone: 2406783088

ROCK

Boring ID	Sample ID	Depth	CERCHAR Abrasivity (ASTM D 7625) * 55HRC/40HRC	Direct Shear (ASTM D5607)*	Direct Tensile Strength (ASTM D 2936)	Elastic Moduli in Triaxial Compression (ASTM D 7012B)	Elastic Moduli in Unlaxial Compression (ASTM D 7012D)	Unit Weight (ISRM)	Petrographic Analysis (ISRM)	Point Load Index (ASTM D 5731)* Diametral, Axial, Lump/Block	Punch Penetration (Handewith)	Slake Durability (ASTM D 4644)	Splitting (Brazilian) Tensile Strength (ASTM D 3967)	Schmidt Hammer (ASTM D 5873)	Total Hardness (Schmidt Hammer and Taber Abrasion)	Triaxial Compression (ASTM D 7012A)	Unconfined Compression (ASTM D 7012C)	Other:	Other:
EB-6	EB-6 #1	74.5-75															X		
EB-6	EB-6 #2	87-87.6											X				X		
EB-6	EB-6 #3	89.5-90.5											X				X		

*Specify Test Conditions (Undisturbed or Remolded, Density and Moisture, Test Normal Loads, Test Confining Stresses, etc.):

AUTHORIZE BY SIGNING AND DATING:

SIGNATURE:_____ **PRINT NAME:** _____ **DATE:** _____

For GTX Use Only
Incoming Sample Inspection Performed ☐
Adverse conditions:

Relinquished By:	**DATE:**	**Received By:**	**DATE:** 5/5/20
	TIME:		**TIME:** 2:30pm
Relinquished By:	**DATE:**	**Received By:**	**DATE:**
	TIME:		**TIME:**

ATTACHMENT B - GEOTECH

GeoTesting EXPRESS

WARRANTY and LIABILITY

GeoTesting Express (GTX) warrants that all tests it performs are run in general accordance with the specified test procedures and accepted industry practice. GTX will correct or repeat any test that does not comply with this warranty. GTX has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

GTX may report engineering parameters that require us to interpret the test data. Such parameters are determined using accepted engineering procedures. However, GTX does not warrant that these parameters accurately reflect the true engineering properties of the *in situ* material. Responsibility for interpretation and use of the test data and these parameters for engineering and/or construction purposes rests solely with the user and not with GTX or any of its employees.

GTX's liability will be limited to correcting or repeating a test which fails our warranty. GTX's liability for damages to the Purchaser of testing services for any cause whatsoever shall be limited to the amount GTX received for the testing services. GTX will not be liable for any damages, or for any lost benefits or other consequential damages resulting from the use of these test results, even if GTX has been advised of the possibility of such damages. GTX will not be responsible for any liability of the Purchaser to any third party.

Commonly Used Symbols

A	pore pressure parameter for $\Delta\sigma_1 - \Delta\sigma_3$
B	pore pressure parameter for $\Delta\sigma_3$
CAI	CERCHAR Abrasiveness Index
CIU	isotropically consolidated undrained triaxial shear test
CR	compression ratio for one dimensional consolidation
CSR	cyclic stress ratio
C_c	coefficient of curvature, $(D_{30})^2 / (D_{10} \times D_{60})$
C_u	coefficient of uniformity, D_{60}/D_{10}
C_c	compression index for one dimensional consolidation
C_α	coefficient of secondary compression
c_v	coefficient of consolidation
c	cohesion intercept for total stresses
c'	cohesion intercept for effective stresses
D	diameter of specimen
D	damping ratio
D_{10}	diameter at which 10% of soil is finer
D_{15}	diameter at which 15% of soil is finer
D_{30}	diameter at which 30% of soil is finer
D_{50}	diameter at which 50% of soil is finer
D_{60}	diameter at which 60% of soil is finer
D_{85}	diameter at which 85% of soil is finer
d_{50}	displacement for 50% consolidation
d_{90}	displacement for 90% consolidation
d_{100}	displacement for 100% consolidation
E	Young's modulus
e	void ratio
e_c	void ratio after consolidation
e_o	initial void ratio
G	shear modulus
G_s	specific gravity of soil particles
H	height of specimen
H_R	Rebound Hardness number
i	gradient
I_S	Uncorrected point load strength
$I_{S(50)}$	Size corrected point load strength index
H_A	Modified Taber Abrasion
H_T	Total hardness
K_o	lateral stress ratio for one dimensional strain
k	permeability
LI	Liquidity Index
m_v	coefficient of volume change
n	porosity
PI	plasticity index
P_c	preconsolidation pressure
p	$(\sigma_1 + \sigma_3) / 2$, $(\sigma_v + \sigma_h) / 2$
p'	$(\sigma'_1 + \sigma'_3) / 2$, $(\sigma'_v + \sigma'_h) / 2$
p'_c	p' at consolidation
Q	quantity of flow
q	$(\sigma_1 - \sigma_3) / 2$
q_f	q at failure
q_o, q_i	initial q
q_c	q at consolidation
S_r	Post cyclic undrained shear strength
T	temperature
t	time
U, UC	unconfined compression test
UU, Q	unconsolidated undrained triaxial test
u_a	pore gas pressure
u_e	excess pore water pressure
u, u_w	pore water pressure
V	total volume
V_g	volume of gas
V_s	volume of solids
V_s	shear wave velocity
V_v	volume of voids
V_w	volume of water
V_o	initial volume
v	velocity
W	total weight
W_s	weight of solids
W_w	weight of water
w	water content
w_c	water content at consolidation
w_f	final water content
w_l	liquid limit
w_n	natural water content
w_p	plastic limit
w_s	shrinkage limit
w_o, w_i	initial water content
α	slope of q_f versus p_f
α'	slope of q_f versus p_f'
γ_t	total unit weight
γ_d	dry unit weight
γ_s	unit weight of solids
γ_w	unit weight of water
ε	strain
ε_{vol}	volume strain
ε_h, ε_v	horizontal strain, vertical strain
μ	Poisson's ratio, also viscosity
σ	normal stress
σ'	effective normal stress
σ_c, σ'_c	consolidation stress in isotropic stress system
σ_h, σ'_h	horizontal normal stress
σ_v, σ'_v	vertical normal stress
σ'_{vc}	Effective vertical consolidation stress
σ_1	major principal stress
σ_2	intermediate principal stress
σ_3	minor principal stress
τ	shear stress
φ	friction angle based on total stresses
φ'	friction angle based on effective stresses
φ'_r	residual friction angle
φ_{ult}	φ for ultimate strength

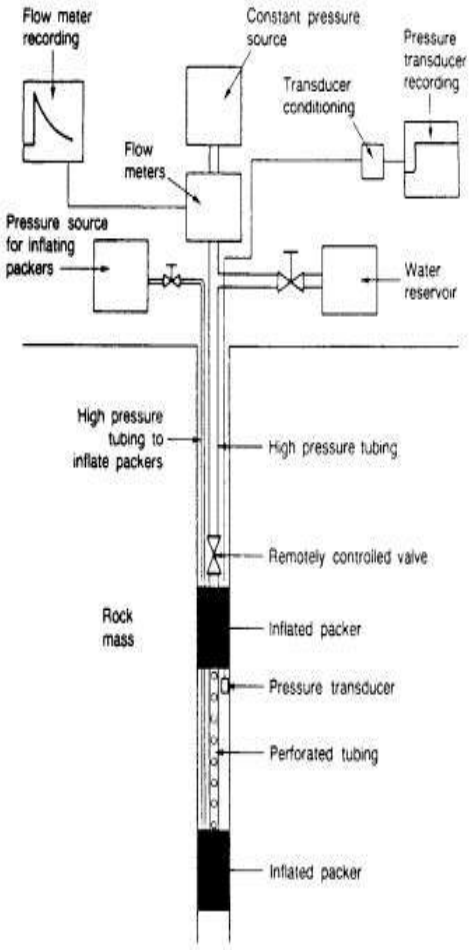
G. PACKER TEST RESULTS

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 1	Page	1 of 2
Project Number:	2017091.042	Northing:	583704.2	Easting:	1370447.8	Elevation	142
Drill Hole Diamet	2.75"	Date Started:	1/13/2020	Date Finished:	1/14/2020		
						Log By:	FG/AT

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
7'	10:27 AM				
to	10:37 AM	10	5	2	
12'	10:47 AM	10	7	3	
1/13/2020	10:57 AM	10	10	5	
	11:07 AM	10	7	2	
	11:17 AM	10	5	2	
12'	11:33 AM				
to	11:43 AM	10	7	~0	
17'	11:53 AM	10	9	~0	
1/13/2020	12:03 PM	10	15	~0	
	12:13 PM	10	9	~0	
	12:23 PM	10	7	~0	
17'	12:38 PM				
to	12:48 PM	10	10	~0	
22'	12:58 PM	10	13	~0	
1/13/2020	1:08 PM	10	20	~0	
	1:18 PM	10	13	~0	
	1:28 PM	10	10	~0	
22'	1:35 PM				
to	1:45 PM	10	12	~0	
27'	1:55 PM	10	18	~0	
1/13/2020	2:05 PM	10	25	~0	
	2:15 PM	10	18	~0	
	2:25 PM	10	12	~0	



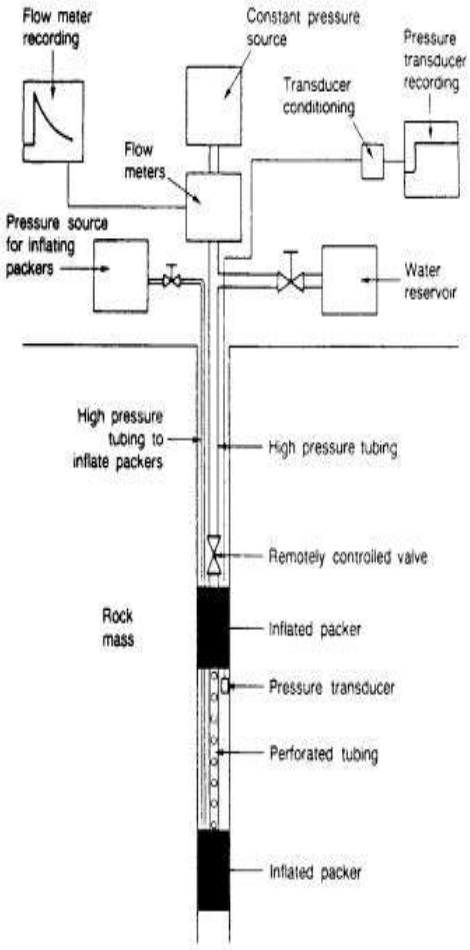
A: Total Length of Test Section (FT)	=	4'11"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	75-120	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 1	Page	2 of 2
Project Number:	2017091.042	Northing:	583704.2	Easting:	1370447.8	Elevation	142
Drill Hole Diamet	2.75"	Date Started:	1/13/2020	Date Finished:	1/14/2020		
						Log By:	FG/AT

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
27'	8:02 AM				
to	8:12 AM	10	15	~0	
32'	8:22 AM	10	20	~0	
1/14/2020	8:32 AM	10	30	~0	
	8:42 AM	10	20	~0	
	8:52 AM	10	15	~0	
32'	8:54 AM				
to	9:04 AM	10	17	~0	
37'	9:14 AM	10	25	~0	
1/14/2020	9:24 AM	10	35	~0	
	9:34 AM	10	25	~0	
	9:44 AM	10	17	~0	
37'	9:50 AM				
to	10:00 AM	10	20	~0	
42'	10:10 AM	10	30	~0	
1/14/2020	10:20 AM	10	40	~0	
	10:30 AM	10	30	~0	
	10:40 AM	10	20	~0	
42'	10:48 AM				
to	10:58 AM	10	20	~0	
47'	11:08 AM	10	30	~0	
1/14/2020	11:18 AM	10	45	~0	
	11:28 AM	10	30	~0	
	11:38 AM	10	20	~0	



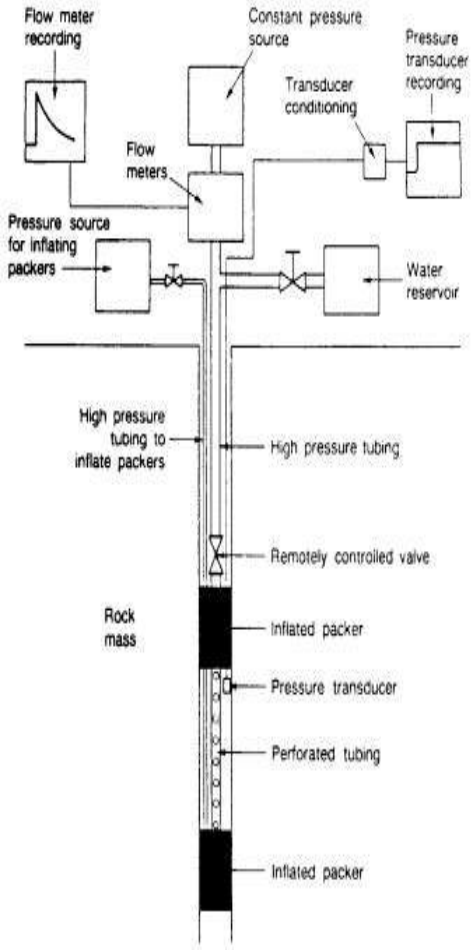
A: Total Length of Test Section (FT)	=	4'11"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	120	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 2	Page	1 of 2
Project Number:	2017091.042	Northing:	583748.4	Easting:	1370400.2	Elevation	141
Drill Hole Diamet	2.75"	Date Started:	1/17/2020	Date Finished:	1/21/2020		
						Log By:	FG

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
7	9:45 AM				
to	9:55 AM	10	~10	7	
12	10:05 AM	10	20	7	
1/17/2020	10:15 AM	10	30	7	
	10:25 AM	10	20	7	
	10:35 AM	10	~10	7	
12	10:55 AM				
to	11:05 AM	10	10	4	
17	11:15 AM	10	13	5	
1/17/2020	11:25 AM	10	15	4	
	11:35 AM	10	13	5	
	11:45 AM	10	10	4	
17	11:52 AM				
to	12:02 PM	10	10	~0	
22	12:12 PM	10	20	~0	
1/17/2020	12:22 PM	10	30	~0	
	12:32 PM	10	20	~0	
	12:42 PM	10	10	~0	
22	12:30 PM				
to	12:40 PM	10	15	2	
27	12:50 PM	10	20	3	
1/17/2020	1:00 PM	10	25	4	
	1:10 PM	10	20	3	
	1:20 PM	10	15	2	



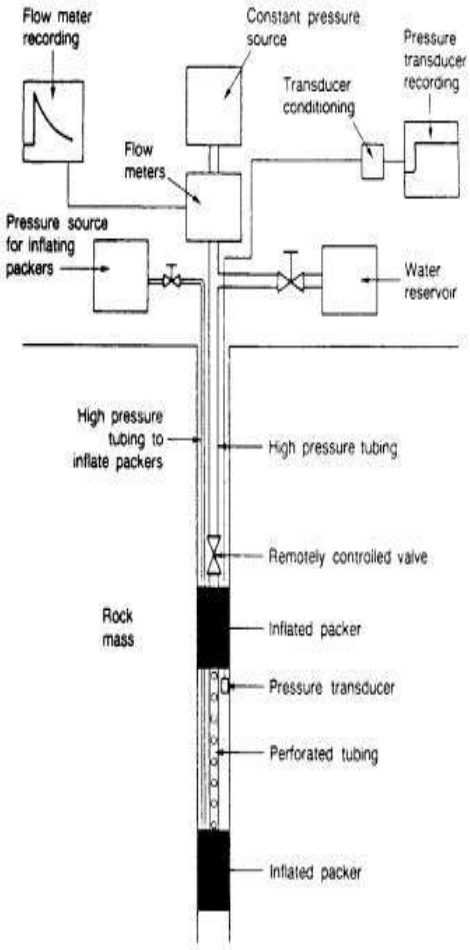
A: Total Length of Test Section (FT)	=	4'11"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	120	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 2	Page	2 of 2
Project Number:	2017091.042	Northing:	583748.4	Easting:	1370400.2	Elevation	141
Drill Hole Diamet	2.75"	Date Started:	1/17/2020	Date Finished:	1/20/2020		
I.D of Drilling Road						Log By:	FG

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
27	1:26 PM				
to	1:36 PM	10	15	1	
32	1:46 PM	10	23	1	
1/17/2020	1:56 PM	10	30	1	
	2:06 PM	10	23	~0	
	2:16 PM	10	15	~0	
32	10:09 AM				
to	10:19 AM	10	20	2	
37	10:29 AM	10	30	2	
1/20/2020	10:39 AM	10	35	2	
	10:49 AM	10	30	2	
	10:59 AM	10	20	2	
37	11:02 AM				
to	11:12 AM	10	20	~0	
42	11:22 AM	10	30	~0	
1/20/2020	11:32 AM	10	40	~0	
	11:42 AM	10	30	~0	
	11:52 AM	10	20	~0	
38.5	11:54 AM				
to	12:04 PM	10	20	~0	
43.5	12:14 PM	10	30	~0	
1/20/2020	12:24 PM	10	40	~0	
	12:34 PM	10	30	~0	
	12:44 PM	10	20	~0	



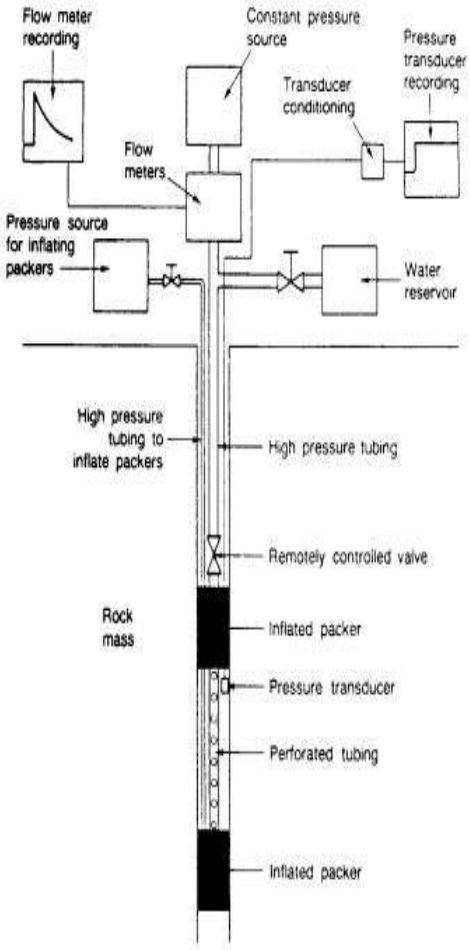
A: Total Length of Test Section (FT)	=	4'11"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	120	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 3	Page	1 of 4
Project Number:	2017091.042	Northing:	583689.5	Easting:	1370222.4	Elevation	242
Drill Hole Diamet	2.75"	Date Started:	1/2/2020	Date Finished:	1/6/2020		
						Log By:	FG

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
63'	2:21 PM				
to	2:31 PM	10	30	~0	
68'	2:41 PM	10	48	~0	
1/2/2020	2:51 PM	10	65	~0	
	3:01 PM	15	48	~0	
	3:11 PM	4	30	~0	
68'	8:08 AM				
to	8:18 AM	10	45	~0	
73'	8:28 AM	10	52	~0	
1/3/2020	8:38 AM	10	70	~0	
	8:48 AM	10	52	~0	
	8:58 AM	10	45	~0	
73'	9:05 AM				
to	9:15 AM	10	40	~0	
78'	9:25 AM	10	55	~0	
1/3/2020	9:35 AM	10	75	~0	
	9:45 AM	10	55	~0	
	9:55 AM	10	40	~0	
78'	10:00 AM				
to	10:10 AM	10	40	1	
83'	10:20 AM	10	60	~0	
1/3/2020	10:30 AM	10	80	~0	
	10:40 AM	10	60	~0	
	10:50 AM	10	40	~0	



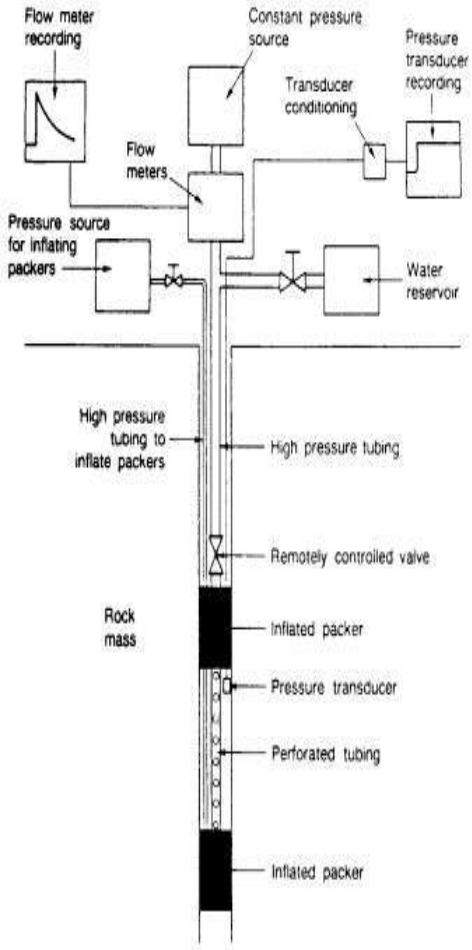
A: Total Length of Test Section (FT)	=	4'11"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	100 - 210	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 3	Page	2 of 4
Project Number:	2017091.042	Northing:	583689.5	Easting:	1370222.4	Elevation	242
Drill Hole Diamet	2.75"	Date Started:	1/2/2020	Date Finished:	1/6/2020		
						Log By:	FG

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
83'	10:56 AM				
to	11:06 AM	10	45	~0	
88'	11:16 AM	10	65	~0	
1/3/2020	11:26 AM	10	85	~0	
	11:36 AM	10	65	~0	
	11:46 AM	10	45	~0	
88'	11:57 AM				
to	12:07 PM	10	45	~0	
93'	12:17 PM	10	70	~0	
1/3/2020	12:27 PM	10	90	~0	
	12:37 PM	10	70	~0	
	12:47 PM	10	45	~0	
93'	12:56 PM				
to	1:06 PM	10	50	~0	
98'	1:16 PM	10	75	~0	
1/3/2020	1:26 PM	10	95	~0	
	1:36 PM	10	75	~0	
	1:46 PM	10	50	~0	
98'	1:55 PM				
to	2:05 PM	10	50	~0	
103'	2:15 PM	10	75	~0	
1/3/2020	2:25 PM	10	100	~0	
	2:35 PM	10	75	~0	
	2:45 PM	10	50	~0	



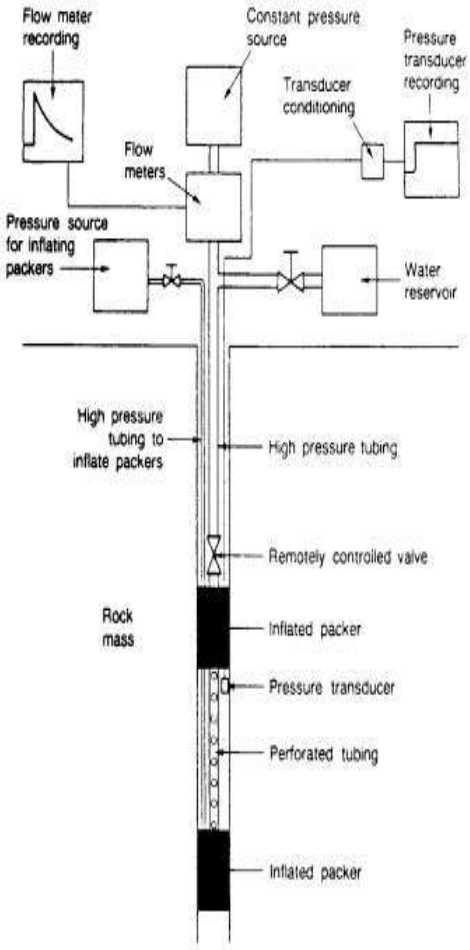
A: Total Length of Test Section (FT)	=	4'11"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	100 - 210	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 3	Page	3 of 4
Project Number:	2017091.042	Northing:	583689.5	Easting:	1370222.4	Elevation	242
Drill Hole Diamet	2.75"	Date Started:	1/2/2020	Date Finished:	1/6/2020		
						Log By:	FG

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
103'	2:52 PM				
to	3:02 PM	10	50	~0	
108'	3:12 PM	10	78	~0	
1/3/2020	3:22 PM	10	105	~0	
	3:32 PM	10	78	~0	
	3:42 PM	10	50	~0	
108'	8:17 AM				
to	8:27 AM	10	55	~0	
113'	8:37 AM	10	80	~0	
1/6/2020	8:47 AM	10	110	~0	
	8:57 AM	10	80	~0	
	9:07 AM	10	55	~0	
113'	9:38 AM				
to	9:48 AM	10	55	~0	
118'	9:58 AM	10	85	~0	
1/6/2020	10:08 AM	10	115	~0	
	10:18 AM	10	85	~0	
	10:28 AM	10	55	~0	
118'	10:38 AM				
to	10:48 AM	10	60	~0	
123'	10:58 AM	10	90	~0	
1/6/2020	11:08 AM	10	120	~0	
	11:18 AM	10	90	~0	
	11:28 AM	10	60	~0	



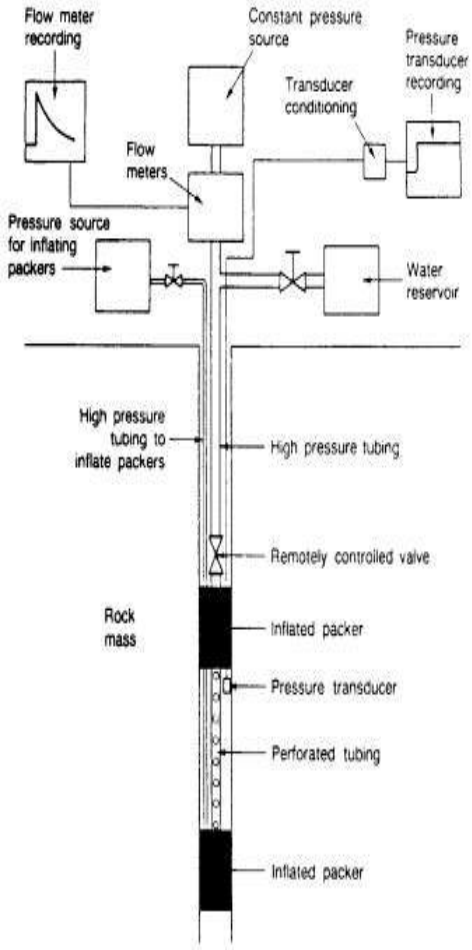
A: Total Length of Test Section (FT)	=	4'11"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	100 - 210	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 3	Page	4 of 4
Project Number:	2017091.042	Northing:	583689.5	Easting:	1370222.4	Elevation	242
Drill Hole Diamet	2.75"	Date Started:	1/2/2020	Date Finished:	1/6/2020		
						Log By:	FG

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
123'	11:33 AM				
to	11:43 AM	10	65	~0	
128'	11:53 AM	10	95	~0	
1/6/2020	12:03 PM	10	125	~0	
	12:13 PM	10	95	~0	
	12:23 PM	10	65	~0	
128'	12:28 PM				
to	12:38 PM	10	65	~0	
133'	12:48 PM	10	95	~0	
1/6/2020	12:58 PM	10	135	~0	
	1:08 PM	10	95	~0	
	1:18 PM	10	65	~0	
131'	1:20 PM				
to	1:30 PM	10	65	~0	
136'	1:40 PM	10	95	~0	
1/6/2020	1:50 PM	10	130	~0	
	2:00 PM	10	95	~0	
	2:10 PM	10	90	~0	



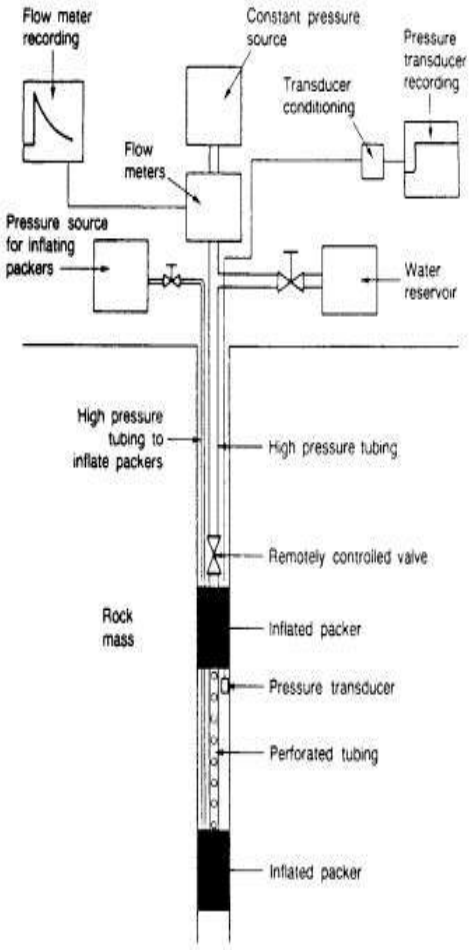
A: Total Length of Test Section (FT)	=	4'11"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	100 - 210	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 3B	Page	1 of 4
Project Number:	2017091.042	Northing:	583560	Easting:	1369845.9	Elevation	256
Drill Hole Diamet	2.75"	Date Started:	4/20/2020	Date Finished:	4/22/2020		
						Log By:	FG

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
78'	10:13 AM				
to	10:23 AM	10	40	0	
83'	10:33 AM	10	60	0	
4/20/2020	10:43 AM	10	80	~0	
	10:53 AM	10	60	0	
	11:03 AM	10	40	0	
83'	11:10 AM				
to	11:20 AM	10	45	0	
88'	11:30 AM	10	65	~0	
4/20/2020	11:40 AM	10	85	~0	
	11:50 AM	10	65	0	
	12:00 PM	10	45	0	
88'	12:18 PM				
to	12:28 PM	10	45	0	
93'	12:38 PM	10	70	~0	
4/20/2020	12:48 PM	10	90	~0	
	12:58 PM	10	70	0	
	1:08 PM	10	45	0	
93'	9:22AM				
to	9:32AM	10	50	0	
98'	9:42AM	10	75	0	
4/21/2020	9:52AM	10	95	0	
	10:02AM	10	75	0	
	10:12AM	10	50	0	



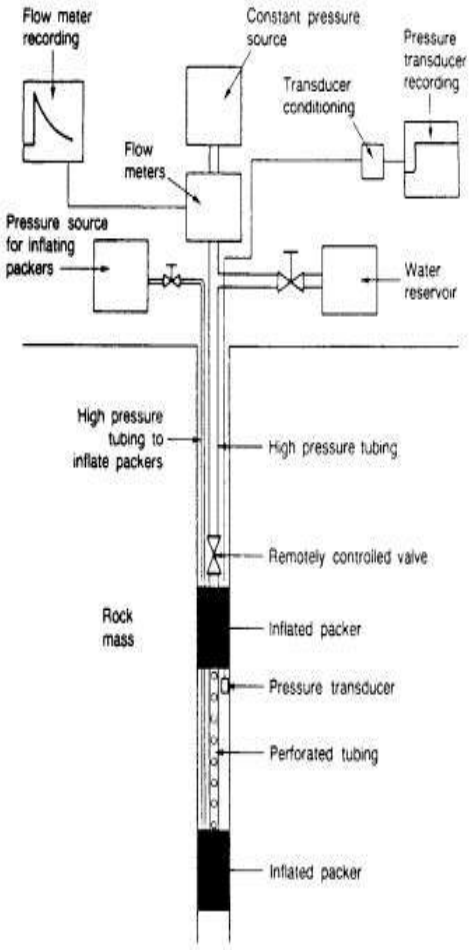
A: Total Length of Test Section (FT)	=	4'7"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	120 - 200	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 3B	Page	2 of 4
Project Number:	2017091.042	Northing:	583560	Easting:	1369845.9	Elevation	256
Drill Hole Diamet	2.75"	Date Started:	4/20/2020	Date Finished:	4/22/2020		
						Logd By:	FG

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
98'	10:14AM				
to	10:24AM	10	50	0	
103'	10:34AM	10	75	0	
4/21/2020	10:44AM	10	100	0	
	10:54AM	10	75	0	
	11:04AM	10	50	0	
103'	11:06AM				
to	11:16AM	10	55	0	
108'	11:26AM	10	80	~0	
4/21/2020	11:36AM	10	105	~0	
	11:46AM	10	80	~0	
	11:56AM	10	55	0	
108'	11:58AM				
to	12:08PM	10	55	0	
113'	12:18PM	10	80	~0	
4/21/2020	12:28PM	10	110	~0	
	12:38PM	10	80	~0	
	12:48PM	10	55	0	
113'	12:50PM				
to	1:00PM	10	60	0	
118'	1:10PM	10	90	0	
4/21/2020	1:20PM	10	115	0	
	1:30PM	10	90	0	
	1:40PM	10	60	0	



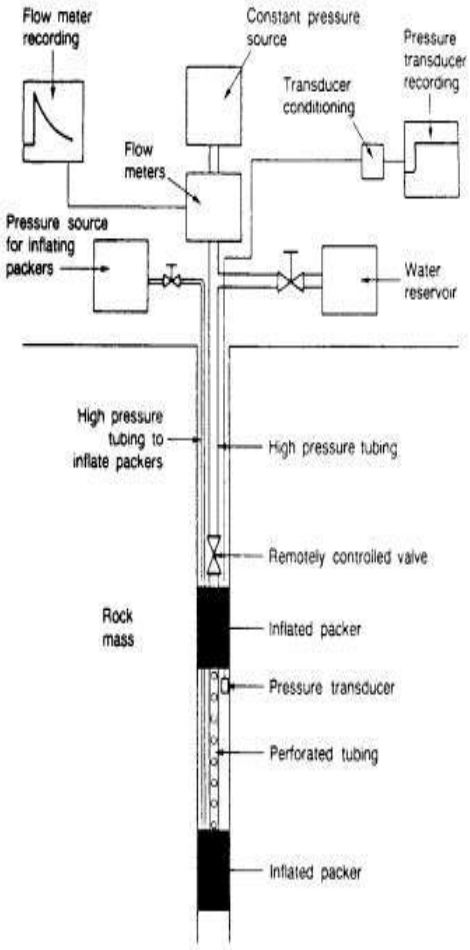
A: Total Length of Test Section (FT)	=	4'7"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	200	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 3B	Page	3 of 4
Project Number:	2017091.042	Northing:	583560	Easting:	1369845.9	Elevation	256
Drill Hole Diamet	2.75"	Date Started:	4/20/2020	Date Finished:	4/22/2020		
						Logd By:	FG

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
118'	1:41PM				
to	1:51PM	10	60	0	
123'	2:01PM	10	90	0	
4/21/2020	2:11PM	10	120	0	
	2:21PM	10	90	0	
	2:31PM	10	60	0	
123'	8:18 AM				
to	8:28 AM	10	65	~0	
128'	8:38 AM	10	95	~0	
4/22/2020	8:48 AM	10	125	~0	
	8:58 AM	10	95	~0	
	9:08 AM	10	65	~0	
128'	9:17 AM				
to	9:27 AM	10	65	~0	
133'	9:37 AM	10	100	~0	
4/22/2020	9:47 AM	10	130	~0	
	9:57 AM	10	100	~0	
	10:07 AM	10	65	~0	
133'	10:14 AM				
to	10:24 AM	10	70	0	
138'	10:34 AM	10	105	0	
4/22/2020	10:44 AM	10	135	0	
	10:54 AM	10	105	0	
	11:04 AM	10	70	0	



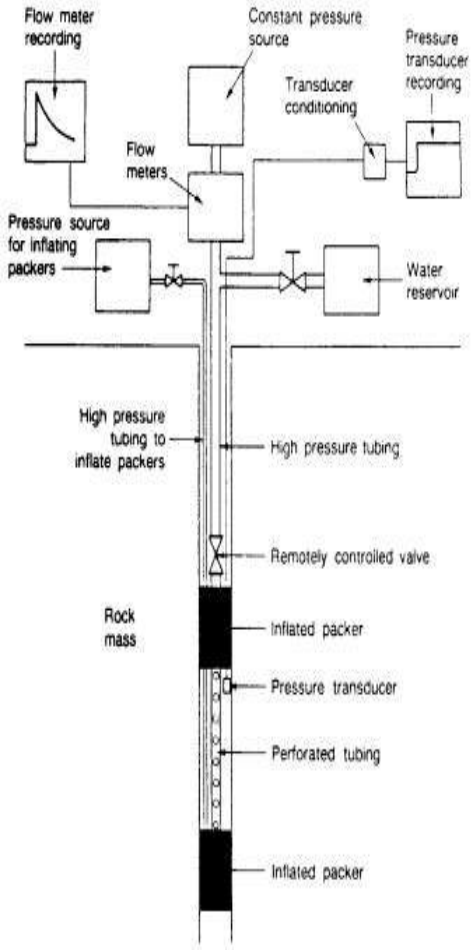
A: Total Length of Test Section (FT)	=	4'7"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	200	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 3B	Page	4 of 4
Project Number:	2017091.042	Northing:	583560	Easting:	1369845.9	Elevation	256
Drill Hole Diamet	2.75"	Date Started:	4/20/2020	Date Finished:	4/22/2020		
						Log By:	FG

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
138'	11:09 AM				
to	11:19 AM	10	70	~0	
143'	11:29 AM	10	105	~0	
4/22/2020	11:39 AM	10	140	~0	
	11:49 AM	10	105	~0	
	11:59 AM	10	70	~0	
143'	12:04 PM				
to	12:14 PM	10	75	~0	
148'	12:24 PM	10	110	~0	
4/22/2020	12:34 PM	10	145	~0	
	12:44 PM	10	110	~0	
	12:54 PM	10	75	~0	



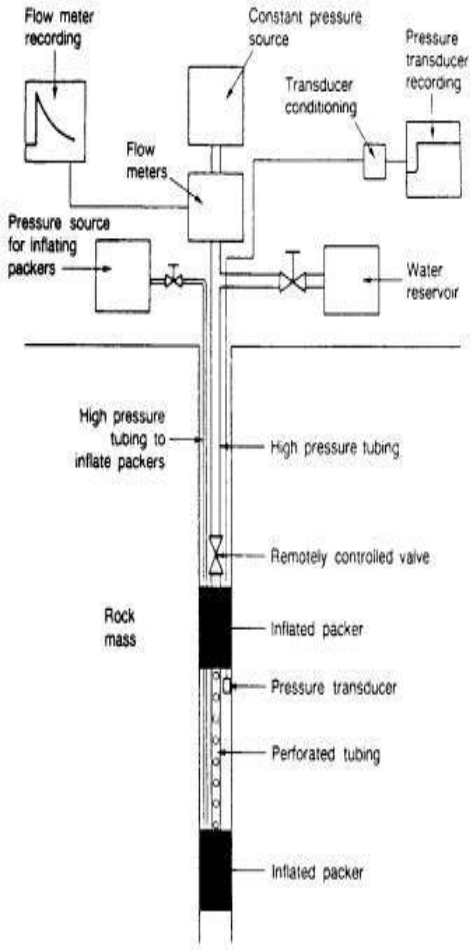
A: Total Length of Test Section (FT)	=	3'7"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	200	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 4	Page:	1 of 1
Project Number:	2017091.042	Northing:	583818.5	Easting:	1369584.9	Elevation	257
Drill Hole Diamet	2.75"	Date Started:	12/5/2019	Date Finished:	12/5/2019		
						Log by:	AT

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
131'	1:04 PM				
to	1:14 PM	10	65	~0	
136'	1:24 PM	10	100	~0	
12/5/2019	1:34 PM	10	130	~0	
	1:44 PM	10	100	~0	
	1:54 PM	10	65	~0	
136'	11:25 AM				
to	11:35 AM	10	70	~0	
141'	11:45 AM	10	100	~0	
12/5/2019	11:55 AM	10	135	~0	
	12:05 PM	10	100	~0	
	12:15 PM	10	70	~0	



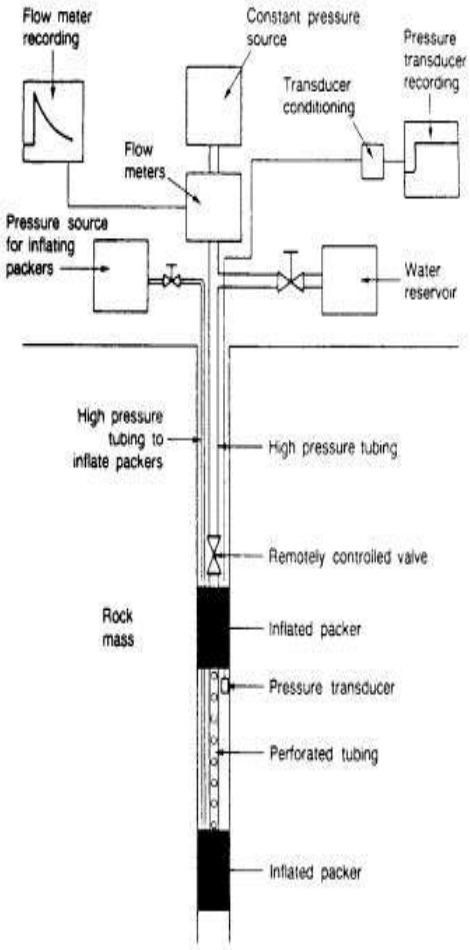
A: Total Length of Test Section (FT)	=	4'11"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	200	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 5	Page	1 of 3
Project Number:	2017091.042	Northing:	583615.4	Easting:	1369547.8	Elevation	233
Drill Hole Diamet	2.75"	Date Started:	2/6/2020	Date Finished:	2/12/2020		
						Log By:	FG

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
53'	9:42 AM				
to	9:52 AM	10	27	~0	
58'	10:02 AM	10	41	~0	
2/6/2020	10:12 AM	10	55	~0	
	10:22 AM	10	41	0	
	10:32 AM	10	27	0	
58'	10:42 AM				
to	10:52 AM	10	30	~0	
63'	11:02 AM	10	45	~0	
2/6/2020	11:12 AM	10	60	~0	
	11:22 AM	10	45	~0	
	11:32 AM	10	30	~0	
63'	11:42 AM				
to	11:52 AM	10	32	~0	
68'	12:02 PM	10	50	~0	
2/6/2020	12:12 PM	10	65	~0	
	12:22 PM	10	50	~0	
	12:32 PM	10	32	~0	
68'	8:10 AM				
to	8:20 AM	10	35	0	
73'	8:30 AM	10	52	~0	
2/7/2020	8:40 AM	10	70	~0	
	8:50 AM	10	52	0	
	9:00 AM	10	35	0	



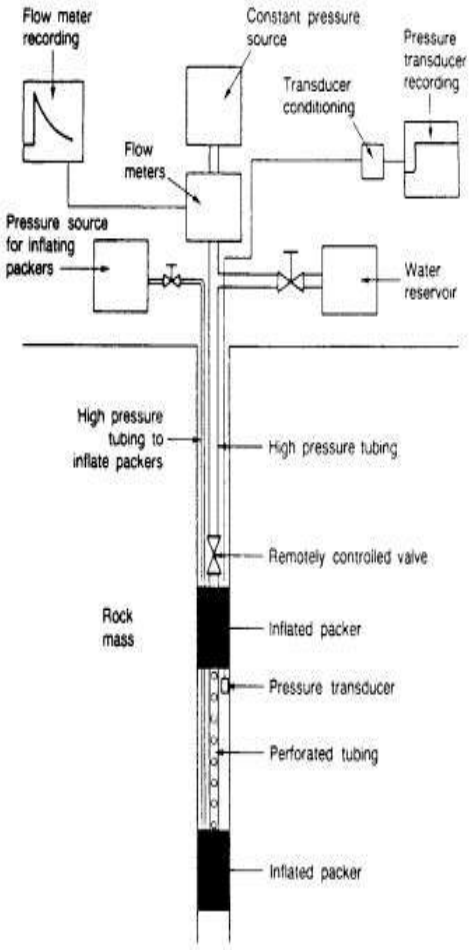
A: Total Length of Test Section (FT)	=	4'11"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	120-180	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 5	Page	2 of 3
Project Number:	2017091.042	Northing:	583615.4	Easting:	1369547.8	Elevation	233
Drill Hole Diamet	2.75"	Date Started:	2/6/2020	Date Finished:	2/12/2020		
						Log By:	FG

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
73'	9:05 AM				
to	9:15 AM	10	38	0	
78'	9:25 AM	10	56	0	
2/7/2020	9:35 AM	10	75	0	
	9:45 AM	10	56	0	
	9:55 AM	10	38	0	
78'	10:00 AM				
to	10:10 AM	10	40	0	
83'	10:20 AM	10	60	~0	
2/7/2020	10:30 AM	10	80	~0	
	10:40 AM	10	60	~0	
	10:50 AM	10	40	0	
83'	10:55 AM				
to	11:05 AM	10	42	0	
88'	11:15 AM	10	65	~0	
2/7/2020	11:25 AM	10	85	0	
	11:35 AM	10	65	0	
	11:45 AM	10	42	0	
88'	11:50 AM				
to	12:00 PM	10	45	0	
93'	12:10 PM	10	68	~0	
2/7/2020	12:20 PM	10	90	~0	
	12:30 PM	10	68	0	
	12:40 PM	10	45	0	



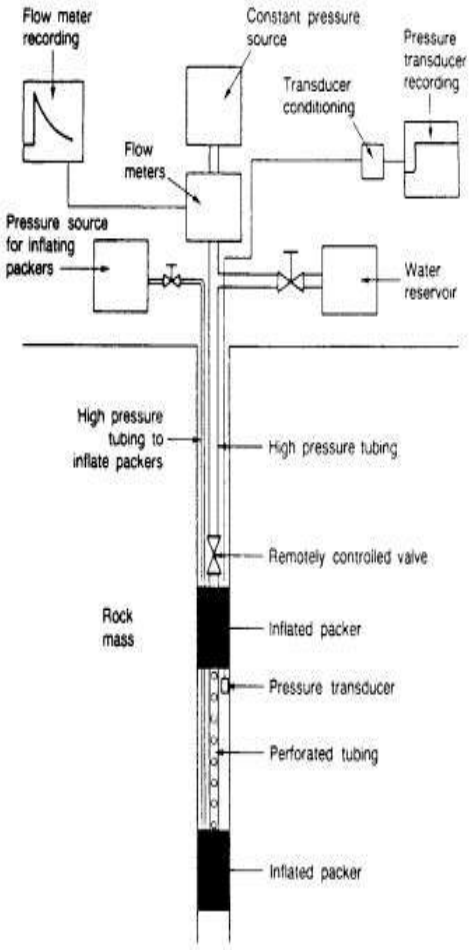
A: Total Length of Test Section (FT)	=	4'11"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	120 -180	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 5	Page	3 of 3
Project Number:	2017091.042	Northing:	583615.4	Easting:	1369547.8	Elevation	233
Drill Hole Diamet	2.75"	Date Started:	2/6/2020	Date Finished:	2/12/2020		
						Log By:	FG

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
93'	12:45 PM				
to	12:55 PM	10	48	0	
98'	1:05 PM	10	70	0	
2/7/2020	1:15 PM	10	95	0	
	1:25 PM	10	70	0	
	1:35 PM	10	48	0	
98'	1:40 PM				
to	1:50 PM	10	50	0	
103'	2:00 PM	10	75	0	
2/7/2020	2:10 PM	10	100	0	
	2:20 PM	10	75	0	
	2:30 PM	10	50	0	
103'	2:35 PM				
to	2:45 PM	10	50	0	
108'	2:55 PM	10	75	0	
2/7/2020	3:05 PM	10	105	0	
	3:15 PM	10	75	0	
	3:25 PM	10	50	0	
108'	8:13 AM				
to	8:23 AM	10	55	~0	
113'	8:33 AM	10	80	~0	
2/12/2020	8:43 AM	10	110	~0	
	8:53 AM	10	80	~0	
	9:03 AM	10	55	~0	



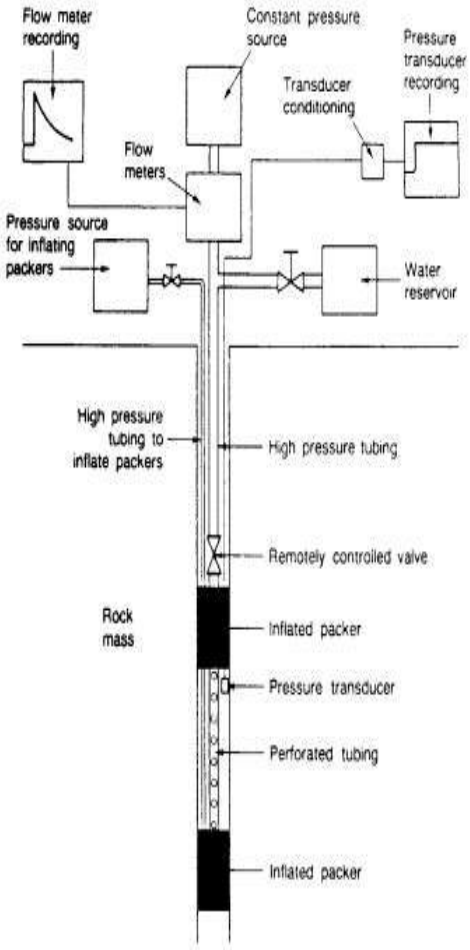
A: Total Length of Test Section (FT)	=	4'11"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	120 - 180	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 6	Page	1 of 3
Project Number:	2017091.042	Northing:	583779.2	Easting:	1369199.8	Elevation	250
Drill Hole Diamet	2.75"	Date Started:	3/17/2020	Date Finished:	2/12/2020		
						Log By:	FG

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
53'	10:11 AM				
to	10:21 AM	10	25	0	
58'	10:31 AM	10	30	0	
3/17/2020	10:41 AM	10	55	0	
	10:51 AM	10	30	0	
	11:01 AM	10	20	0	
58'	11:07 AM				
to	11:17 AM	10	30	0	
63'	11:27 AM	10	45	0	
3/17/2020	11:37 AM	10	60	~0	
	11:47 AM	10	45	0	
	11:57 AM	10	30	0	
63'	12:00 PM				
to	12:10 PM	10	32	0	
68'	12:20 PM	10	50	~0	
3/17/2020	12:30 PM	10	65	~0	
	12:40 PM	10	50	~0	
	12:50 PM	10	32	~0	
68'	12:52 PM				
to	1:02 PM	10	35	0	
73'	1:12 PM	10	52	~0	
3/17/2020	1:22 PM	10	70	~0	
	1:32 PM	10	52	0	
	1:42 PM	10	35	0	



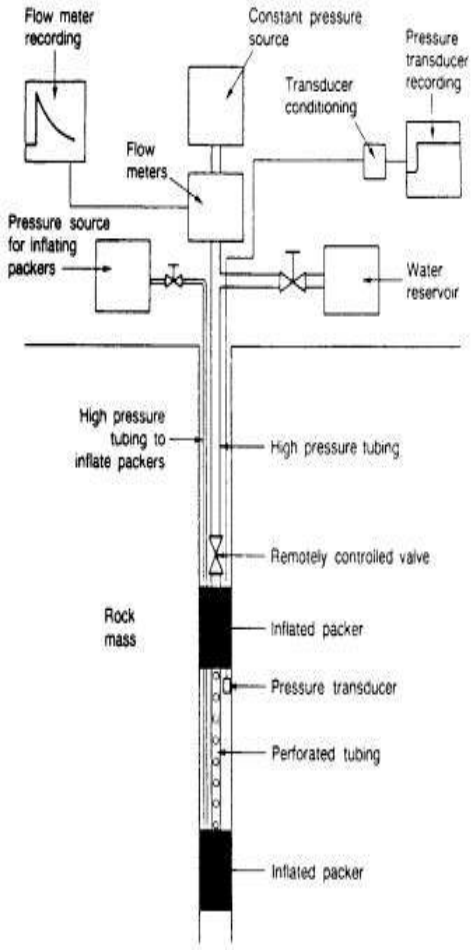
A: Total Length of Test Section (FT)	=	4'11"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	120-180	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 6	Page	2 of 3
Project Number:	2017091.042	Northing:	583779.2	Easting:	1369199.8	Elevation	250
Drill Hole Diamet	2.75"	Date Started:	2/6/2020	Date Finished:	2/12/2020		
						Log By:	FG

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
73'	1:48 PM				
to	1:58 PM	10	40	~0	
78'	2:08 PM	10	55	~0	
3/17/2020	2:18 PM	10	75	~0	
	2:28 PM	10	55	~0	
	2:38 PM	10	40	~0	
78'	7:52 AM				
to	8:02 AM	10	40	0	
83'	8:12 AM	10	60	0	
3/18/2020	8:22 AM	10	80	~0	
	8:32 AM	10	60	0	
	8:42 AM	10	40	0	
83'	8:47 AM				
to	8:57 AM	10	45	0	
88'	9:07 AM	10	65	0	
3/18/2020	9:17 AM	10	85	~0	
	9:27 AM	10	65	0	
	9:37 AM	10	45	0	
88'	9:49 AM				
to	9:59 AM	10	45	0	
93'	10:09 AM	10	65	~0	
3/18/2020	10:19 AM	10	90	~0	
	10:29 AM	10	65	~0	
	10:37 AM	10	45	~0	



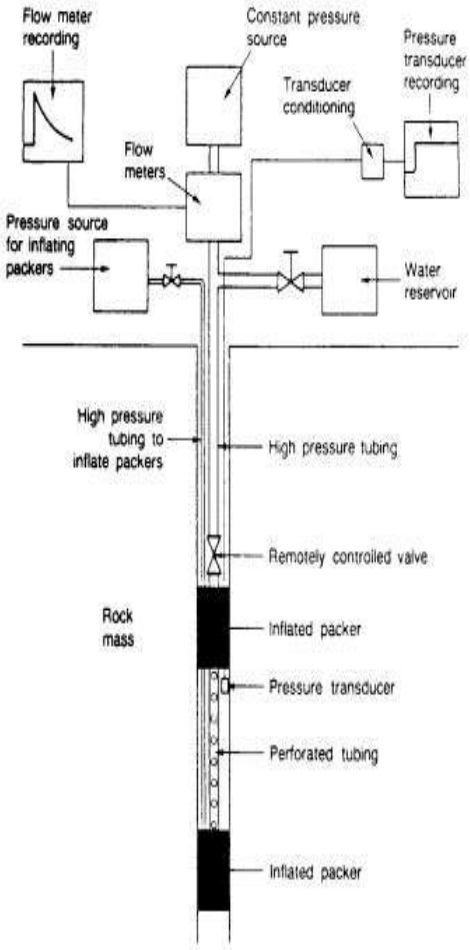
A: Total Length of Test Section (FT)	=	4'11"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	120 -180	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 6	Page	3 of 3
Project Number:	2017091.042	Northing:	583779.2	Easting:	1369199.8	Elevation	250
Drill Hole Diamet	2.75"	Date Started:	3/17/2020	Date Finished:	3/19/2020		
						Log By:	FG

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
93'	10:43 AM				
to	10:53 AM	10	50	0	
98'	11:03 AM	10	70	~0	
3/18/2020	11:13 AM	10	95	~0	
	11:23 AM	10	70	~0	
	11:33 AM	10	50	0	
98'	1:40 PM				
to	1:50 PM	10	50	0	
103'	2:00 PM	10	75	0	
3/18/2020	2:10 PM	10	100	~0	
	2:20 PM	10	75	0	
	2:30 PM	10	50	0	
103'	10:21 PM				
to	10:31 PM	10	55	~0	
108'	10:41 PM	10	75	~0	
3/19/2020	10:51 PM	10	105	~0	
	11:01 PM	10	75	~0	
	11:11 PM	10	55	~0	
108'	11:20 AM				
to	11:30 AM	10	55	0	
113'	11:40 AM	10	80	~0	
3/19/2020	11:50 AM	10	110	~0	
	12:00 PM	10	80	0	
	12:10 PM	10	55	0	



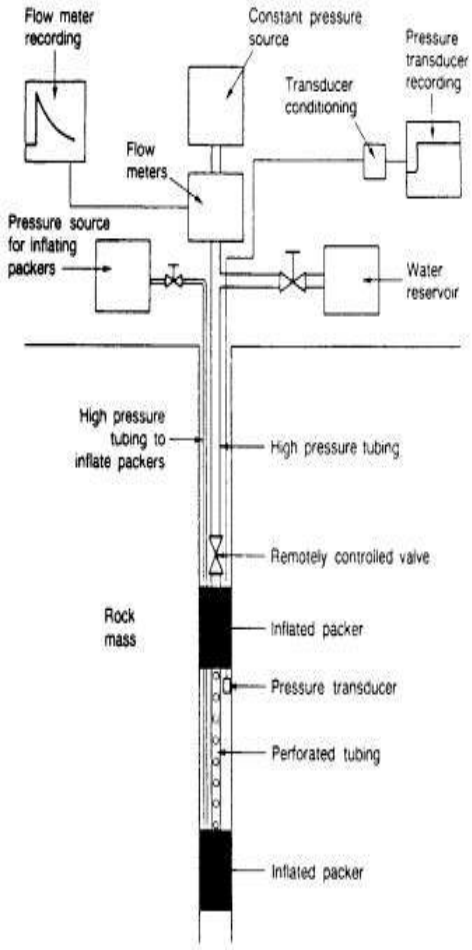
A: Total Length of Test Section (FT)	=	4'11"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	180-200	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 7	Page	1 of 2
Project Number:	2017091.042	Northing:	583477.2	Easting:	1369098.9	Elevation	183
Drill Hole Diamet	2.75"	Date Started:	1/27/2020	Date Finished:	1/28/2020		
						Log By:	FG

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
33'	9:30 AM				
to	9:40 AM	10	20	~0	
38'	9:50 AM	10	25	1	
1/27/2020	10:00 AM	10	35	~0	
	10:10 AM	10	25	~0	
	10:20 AM	10	30	~0	
38'	10:23 AM				
to	10:33 AM	10	20	~0	
43'	10:34 AM	10	30	~0	
1/27/2020	10:53 AM	10	40	~0	
	11:03 AM	10	30	~0	
	11:13 AM	10	20	~0	
43'	11:15 AM				
to	11:25 AM	10	20	~0	
48'	11:35 AM	10	30	~0	
1/27/2020	11:45 AM	10	45	~0	
	11:55 AM	10	30	~0	
	12:05 PM	10	20	~0	
48'	12:10 PM				
to	12:20 PM	10	25	~0	
53'	12:30 PM	10	40	~0	
1/27/2020	12:40 PM	10	50	1	
	12:50 PM	10	40	~0	
	1:00 PM	10	25	~0	



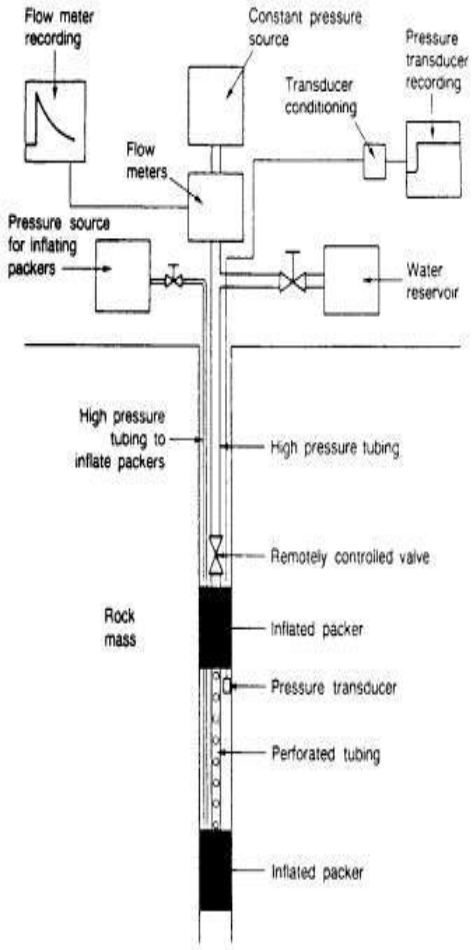
A: Total Length of Test Section (FT)	=	4'11"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	120	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

PACKER TEST LOG

AB CONSULTANTS, INC
9450 Annapois Road
Lanham, Maryland 20706

Project Name:	Ellicott City Flood Relief North Tunnel			Boring #:	EB - 7	Page	2 of 2
Project Number:	2017091.042	Northing:	583477.2	Easting:	1369098.9	Elevation	183
Drill Hole Diamet	2.75"	Date Started:	1/27/2020	Date Finished:	1/28/2020		
						Log By:	FG

Test Interval From/To (ft)	Time (Hr:MIN:SEC	Elapsed Time(Δt Min)	Pressure (Psi)	Flow Rate (Gal/Min)	Remark
53'	1:05 PM				
to	1:15 PM	10	25	~0	
58'	1:25 PM	10	40	1	
1/27/2020	1:35 PM	10	55	1	
	1:45 PM	10	40	~0	
	1:55 PM	10	25	~0	
58'	8:20 AM				
to	8:30 AM	10	30	~0	
63'	8:40 AM	10	45	~0	
1/28/2020	8:50 AM	10	60	~0	
	9:00 AM	10	45	~0	
	9:10 AM	10	30	~0	
63'	9:18 AM				
to	9:28 AM	10	30	~0	
68'	9:38 AM	10	45	~0	
1/28/2020	9:48 AM	10	65	1	
	9:58 AM	10	45	~0	
	10:08 AM	10	30	~0	
68'	10:14 AM				
to	10:24 AM	10	35	~0	
73'	10:34 AM	10	55	~0	
1/28/2020	10:44 AM	10	70	~0	
	10:54 AM	10	55	1	
	11:04 AM	10	35	~0	



A: Total Length of Test Section (FT)	=	4'11"	FT
TP: Total Length of Top Packer and Assembly	=	2'5"	FT
BP: Total Lenth of Bottom Backer and Assembely	=	3'	FT
D: Distance Between Ground Surface and Top of The Test Zone	=		FT
PIP: Packer Inflation Pressure (D Psi+50Psi	=	120	Psi
H1: Distance Between Water Pressure Gauge and Ground Surface	=		FT
H2: Distance Between Ground Surface and Ground Water Table	=		FT
Q: VOL/TIME = (ΔHΔ/t)	=		Gal/Min

H. MONITORING WELL RESULTS

OBSERVATION WELL INSTALLATION REPORT

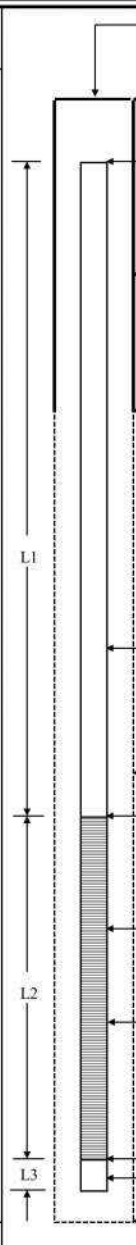
Well No. EB-3
Boring No. EB-3

PROJECT	Ellicott City Flood Relief North Tunnel		
LOCATION	Ellicott City, Maryland	PROJECT MGR.	Andinet Tolla
CLIENT	McCormick Taylor	FIELD REP.	Fu Guo
CONTRACTOR	AB Consultants Inc.	DATE INSTALLED	1/9/2020
DRILLER	Palmer Stephens	WATER LEVEL	Dry

Ground El.	240 ft	Location	Near house 3727 Church Rd
El. Datum	NAVD 1988		

☐ Guard Pipe
☒ Roadway Box

SOIL/ROCK CONDITIONS	BOREHOLE BACKFILL
0-23': Brown and gray silty sands	0-9': Grout



(Bottom of Exploration)
(Numbers refer to depth from ground surface in feet)

(Not to Scale)

Type of protective cover/lock	8-in Roadway Box
Height of top of guard pipe above the ground surface	- ft
Height of top of riser pipe above the ground surface	0 ft
Type of protective casing:	-
Length	- ft
Inside Diameter	- in
Depth of bottom of guard pipe/roadway box	- ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Bentonite/Concrete	0.0	1.0
Bentonite Seal	1.0	8.0

Type of riser pipe:	Solid PVC
Inside diameter of riser pipe	2.0 in
Type of backfill around riser	Silica Sand
Diameter of borehole	6.0 in
Depth to top of well screen	11.0 ft
Type of screen	Sotted PVC Schedule 80
Screen gauge or size of openings	0.02 in
Diameter of screen	2.0 in
Type of backfill around screen	Silica Sand
Depth of bottom of well screen	21.0 ft
Bottom of Silt trap	23.0 ft
Depth of bottom of borehole	23.0 ft

ft	+	ft	+	ft	=	ft	
Riser Pay Length (L1)		Length of screen (L2)		Length of silt trap (L3)		Pay length	

COMMENTS:

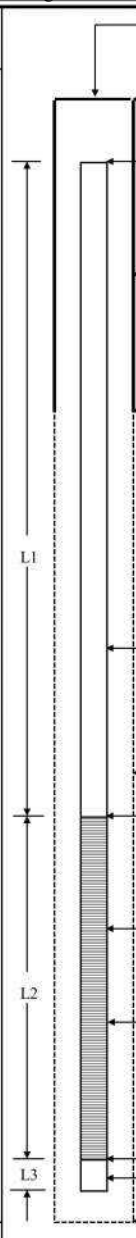
OBSERVATION WELL INSTALLATION REPORT

Well No. EB-4
Boring No. EB-4

PROJECT	Ellicott City Flood Relief North Tunnel		
LOCATION	Ellicott City, Maryland	PROJECT MGR.	Andinet Tolla
CLIENT	McCormick Taylor	FIELD REP.	Fu Guo
CONTRACTOR	AB Consultants Inc.	DATE INSTALLED	1/10/2020
DRILLER	Palmer Stephens	WATER LEVEL	Dry

Ground El. 258 ft
El. Datum NAVD 1988
Location In the middle of the Circuit Courthouse Parking Lot on Court House Drive
☐ Guard Pipe
☒ Roadway Box

SOIL/ROCK CONDITIONS	BOREHOLE BACKFILL
0-19': Brown and gray silty sands	0-5': Grout



Type of protective cover/lock: 8-in Roadway Box
Height of top of guard pipe above the ground surface: - ft
Height of top of riser pipe above the ground surface: 0 ft
Type of protective casing: -
Length: - ft
Inside Diameter: - in
Depth of bottom of guard pipe/roadway box: - ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Bentonite/Concrete	0.0	1.0
Bentonite Seal	1.0	4.0

Type of riser pipe: Solid PVC
Inside diameter of riser pipe: 2.0 in
Type of backfill around riser: Silica Sand
Diameter of borehole: 6.0 in
Depth to top of well screen: 7.0 ft
Type of screen: Sotted PVC Schedule 80
Screen gauge or size of openings: 0.02 in
Diameter of screen: 2.0 in
Type of backfill around screen: Silica Sand
Depth of bottom of well screen: 17.0 ft
Bottom of Silt trap: 19.0 ft
Depth of bottom of borehole: 19.0 ft

(Bottom of Exploration)
(Numbers refer to depth from ground surface in feet)
(Not to Scale)

Riser Pay Length (L1)	+	Length of screen (L2)	+	Length of silt trap (L3)	=	Pay length
ft		ft		ft		ft

COMMENTS:

OBSERVATION WELL INSTALLATION REPORT

Well No. EB-8
Boring No. EB-8

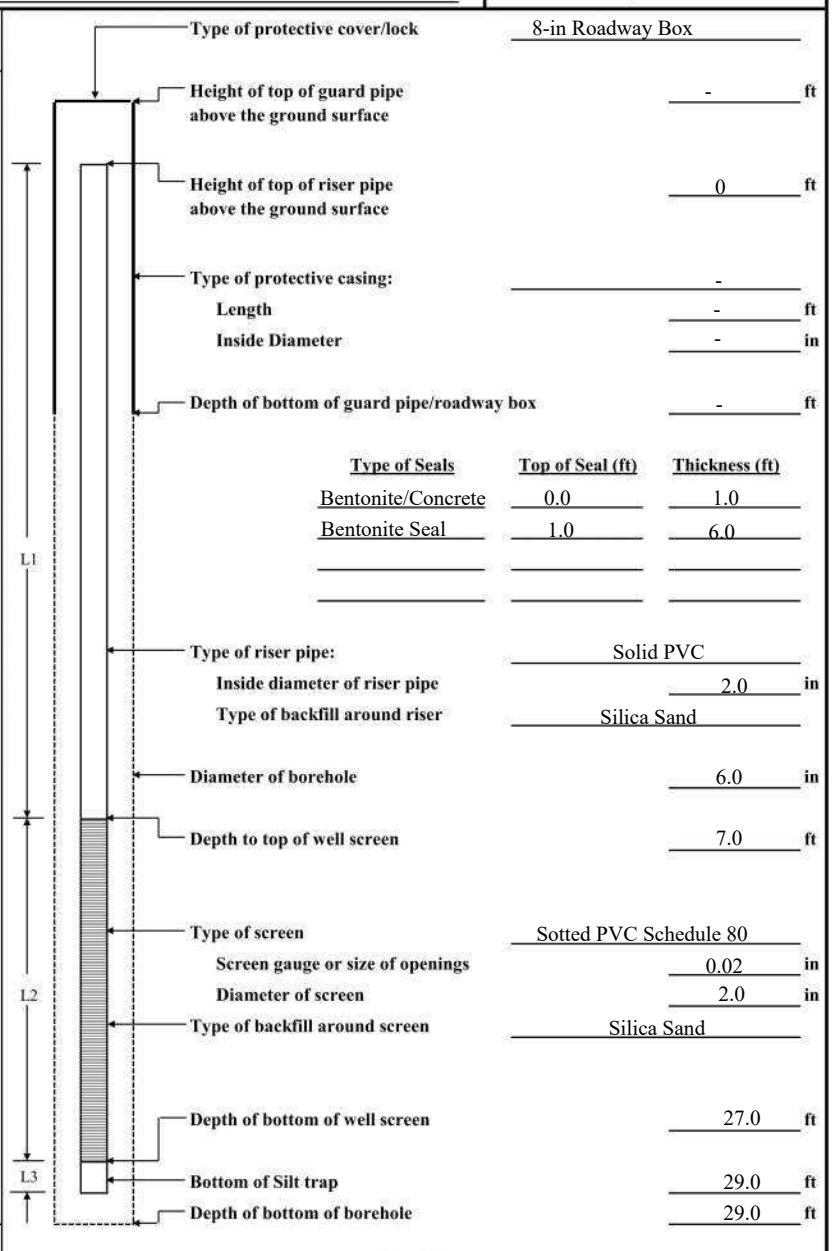
PROJECT	Ellicott City Flood Relief North Tunnel		
LOCATION	Ellicott City, Maryland	PROJECT MGR.	Andinet Tolla
CLIENT	McCormick Taylor	FIELD REP.	Fu Guo
CONTRACTOR	AB Consultants Inc.	DATE INSTALLED	1/10/2020
DRILLER	Palmer Stephens	WATER LEVEL	8.0

Ground El. 258 ft
El. Datum NAVD 1988

Location In the southeast corner of the parking lot near Main St and Ellicott Mills Dr

☐ Guard Pipe
☒ Roadway Box

SOIL/ROCK CONDITIONS	BOREHOLE BACKFILL
0-29': Brown, gray, red silty sands	0-7': Grout



Type of protective cover/lock	8-in Roadway Box
Height of top of guard pipe above the ground surface	- ft
Height of top of riser pipe above the ground surface	0 ft
Type of protective casing:	-
Length	- ft
Inside Diameter	- in
Depth of bottom of guard pipe/roadway box	- ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Bentonite/Concrete	0.0	1.0
Bentonite Seal	1.0	6.0

Type of riser pipe:	Solid PVC
Inside diameter of riser pipe	2.0 in
Type of backfill around riser	Silica Sand
Diameter of borehole	6.0 in
Depth to top of well screen	7.0 ft
Type of screen	Sotted PVC Schedule 80
Screen gauge or size of openings	0.02 in
Diameter of screen	2.0 in
Type of backfill around screen	Silica Sand
Depth of bottom of well screen	27.0 ft
Bottom of Silt trap	29.0 ft
Depth of bottom of borehole	29.0 ft

Riser Pay Length (L1)	+	Length of screen (L2)	+	Length of silt trap (L3)	=	Pay length
ft		ft		ft		ft

COMMENTS:

GEOTECHNICAL SUBSURFACE INVESTIGATION REPORT

Ellicott City Additional Boring
Howard County, Maryland

PREPARED FOR:

McCormick Taylor
905 South Exeter Street, 4th Floor
Baltimore, Maryland 21202

PREPARED BY:

AB CONSULTANTS, INC.
9450 ANNAPOLIS ROAD
LANHAM, MARYLAND 20706

January 5, 2021

AB CONSULTANTS, INC.
9450 Annapolis Road
Lanham, Maryland 20706
Ph: (301) 306-3091
Fax: (301) 306-3092
www.abconsultantsinc.com

January 5, 2021

Attn: Mr. Chris Brooks, PE
McCormick Taylor, Inc.
509 South Exeter Street, 4th floor
Baltimore, MD 21202

REF: Report of Subsurface Investigation and Studies for
Ellicott City Additional Boring
Howard County, Maryland
AB Job No. 2017091.042.02

Dear Mr. Brooks,

AB Consultants, Inc. (AB) is pleased to submit this report containing the results of geotechnical investigation for the above referenced project. The project site is located in Ellicott City, Maryland. The purpose of this study was to explore the subsurface conditions for the newly proposed extended north tunnel preliminary design project in Ellicott City, Maryland.

Field Investigation

For the subsurface studies, a total of Seven (7) 17.5 to 86 feet deep soil borings and rock coring were performed from November 16 to 19 and December 7 to 15, 2020. Field drilling operations are managed and supervised by AB. Soil borings were staked out in the field by engineers from AB and McCormick Taylor. Site locations and boring plans are included in the Appendix.

Borings were drilled using an All-Terrain Vehicle (ATV) D-50 and CME550 drilling rigs. Soil borings were advanced to core-able rock and soil sample collection was not needed for this project.

Rock coring was performed at all borings where boulder/rock was encountered before the termination depths. Core sample was obtained using a 5-ft-long, NQWL-size double-tube core barrel with a diamond bit. Each core run is shown at the appropriate depth on the log with the percent recovery and Rock Quality Designation (RQD). The percent of recovery was determined as the ratio of recovery to the total length of the run. RQD, expressed in percent, was determined as the sum of intact, sound rock core greater than 4-inch length divided by the total length of the run. Rock core was removed from the core barrel and placed in wooden box and transported to our laboratory. Rock core sample boxes are included in the Appendix.

All boreholes were backfilled with auger cuttings upon completion of the field study or 24 hour later. Samples obtained from the borings were inspected by a geotechnical engineer and the field log was edited accordingly. The final logs indicating the subsurface conditions encountered are included in the Appendix.

AB CONSULTANTS, INC.
9450 Annapolis Road
Lanham, Maryland 20706
Ph: (301) 306-3091
Fax: (301) 306-3092
www.abconsultantsinc.com
Engineers Planners Surveyors Support Services

Subsurface Soil Conditions and Groundwater Observations

Based on the subsurface information revealed from soil boring, encountered soils are grouped in major zones as presented below:

Topsoil	Topsoil was encountered in most borings. Topsoil is defined as the more high-organic, weathered surficial soils horizon capable of supporting vegetation.
Pavement	Asphalt pavement of thickness ranging from 3 to 4 inches was encountered in borings B-3 and B-7.
Type a	*Silty Sand:* Underneath Pavement and Topsoil, brown silty sand were encountered in most borings and extended to 8 to 76 ft below existing ground.
Type b	*Bedrock:* Underneath Type a, mostly gray, pink, and white, medium to coarse grained, very close to wide fracture spacing, heavily weathered to fresh, hard GRANITE was encountered in all borings and extended to completion depth of the boring.

Groundwater observations were made in boring during drilling operations. As noted on boring logs, groundwater was observed in most soil borings. Fluctuations in the level and quantity of ground water will occur due to variations in rainfall, temperature, soil permeability and other factors not evident at the time of the water level measurements recorded on boring logs.

General Limitations

This report is based upon the data obtained from the test holes performed at indicated location and from any other information discussed in this report. This report does not reflect any variations that may occur across the site. If variations appear evident, the summary of this report should then be reviewed by ABC geotechnical engineer in light of the new information.

* * * * *

All samples obtained from soil test borings and rock coring will be retained in our laboratory for a period of thirty (30) days from the date of this report. They will be available for inspection during this period. After that time, the samples will be discarded.

It has been a pleasure serving you on this project. If you have any questions regarding this report, or if we can be of further service in any way, please contact us.

Very truly yours,
AB Consultants, Inc.

Fu Guo, P.E.
Project Engineer

APPENDIX

A. General Notes

B. Vicinity Map

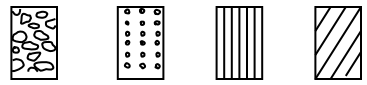
C. Boring Plans

D. Boring Logs

E. Rock Core Sample Box

A. GENERAL NOTES

Drilling and Sampling Symbols



Gravel Sand Silt Clay

Split Spoon (SS) Auger Cutting (AU) Shelby Tube (ST) Rock Core (RC)

N = Standard penetration, blows per foot of a 140 lbs hammer for 30" drop
RQD = Rock Quality Designation
LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index

Cohesionless Soils

If the sand or silt content of a soil is great enough, the soil becomes non-cohesive or semi-cohesive. The soil classification becomes SAND or SILT with the other soil constituents being modifying.

Based on N-Value

0 to 4 Blows…….Very Loose	30 to 59 Blows…….Dense
5 to 9 Blows…….Loose	Over 60 Blows…….Very Dense
10 to 29 Blows…….Medium Dense	

Cohesive Soils

If clay content is sufficient so that clay dominates soil properties, then CLAY becomes the major soil constituent as modifier. Other minor soil constituents may be added according to classification breakdown for cohesion less soils: i.e. silty clay, trace of some sand, trace of gravel.

Based on N-Value

0 to 3 Blows…….Very Soft	16 to 30 Blows……..Stiff
4 to 5 Blows…….Soft	30 to 60 Blows……..Very Stiff
6 to 16 Blows……...Firm	Over 61 Blows……..Hard

Based on Penetrometer Value

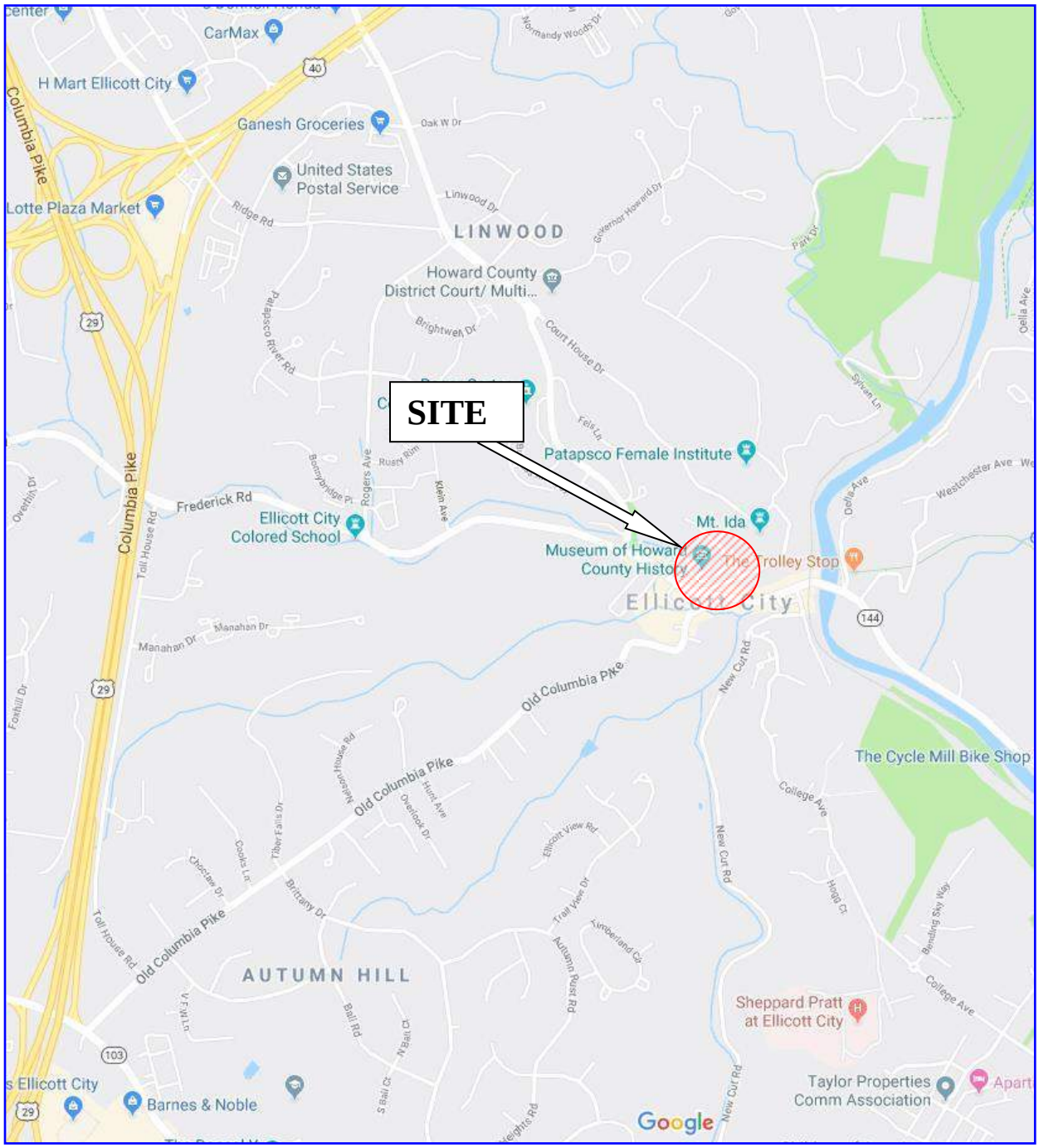
Below 0.25……...Very Soft	1.00 to 1.99……..Stiff
0.25 to 0.49……..Soft	2.00 to 3.99……..Very Stiff
0.50 to 0.99……..Firm	Over 4.00…….Hard

Quantity Modifiers

Term	% of Dry Weight
trace	0 to 10
little	11 to 20
some	21 to 35
and/with	36 to 50

Particle Size Identifications

Boulder ……..Over 8 inch diameter
Cobbles……...3 inch to 8 inch
Gravel……..Coarse……1 inch to 3 inch
Medium…….1/2 inch to 1 inch
Fine……....4.75 mm to 1/2 inch
Sand……....Coarse……....2 mm to 4.75 mm
Medium……..0.425 mm to 2 mm
Fine……....0.075 mm to 0.425 mm
Silt/Clay…….....Below 0.075 mm

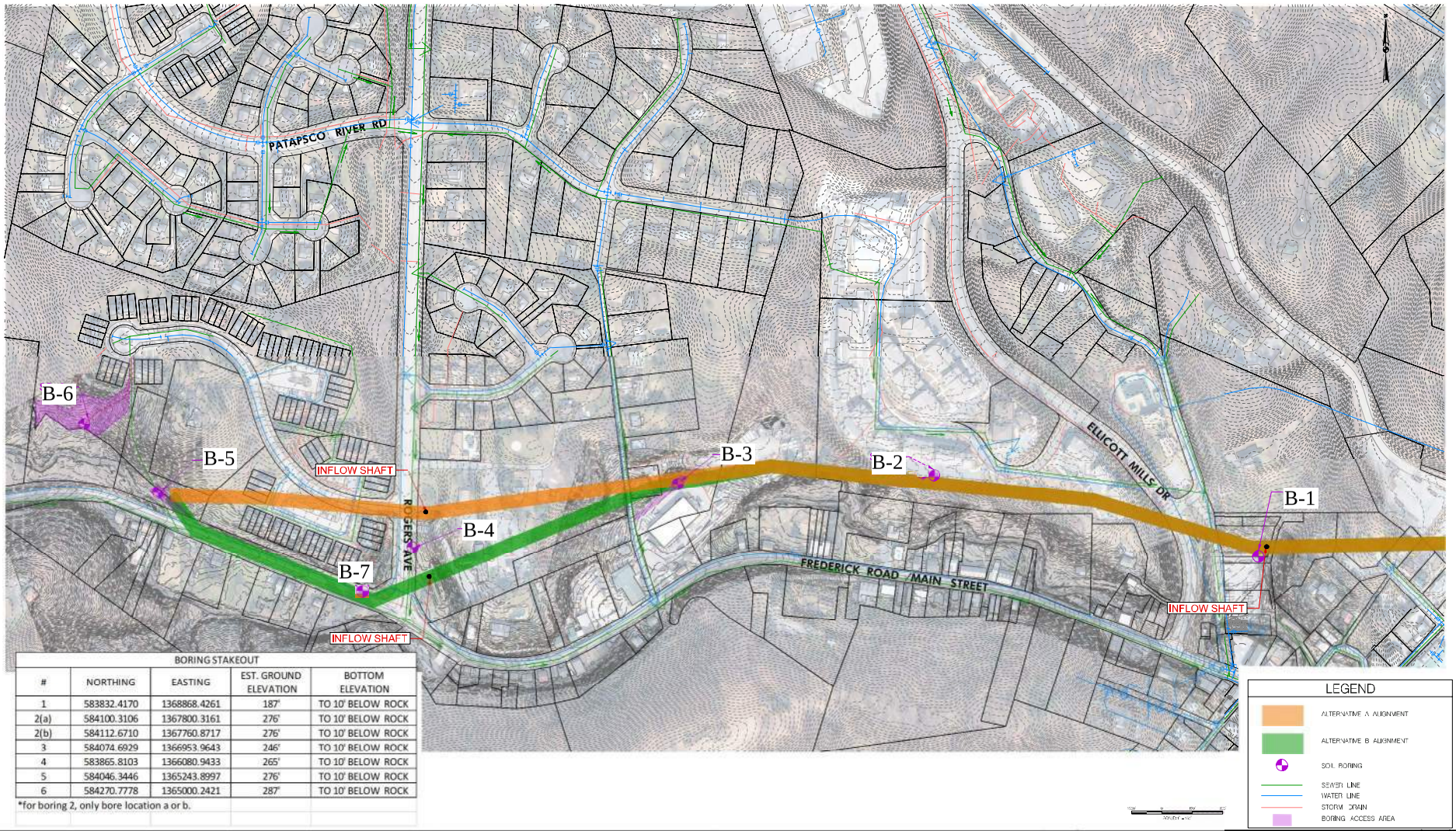


B. VICINITY MAP

Ellicott City Additional Boring
Howard County, Maryland

JOB NO: 2017091.042.02
SCALE: N.T.S.
DATE: 1/5/21

C. BORING PLAN



BORING STAKEOUT

#	NORTHING	EASTING	EST. GROUND ELEVATION	BOTTOM ELEVATION
1	583832.4170	1368868.4261	187'	TO 10' BELOW ROCK
2(a)	584100.3106	1367800.3161	276'	TO 10' BELOW ROCK
2(b)	584112.6710	1367760.8717	276'	TO 10' BELOW ROCK
3	584074.6929	1366953.9643	246'	TO 10' BELOW ROCK
4	583865.8103	1366080.9433	265'	TO 10' BELOW ROCK
5	584046.3446	1365243.8997	276'	TO 10' BELOW ROCK
6	584270.7778	1365000.2421	287'	TO 10' BELOW ROCK

*for boring 2, only bore location a or b.

DEPARTMENT OF PUBLIC WORKS
HOWARD COUNTY, MARYLAND

CHIEF, STORMWATER MANAGEMENT DIVISION DATE

McCORMICK TAYLOR
509 South Exeter Street
4th Floor
Baltimore, Maryland 21202
(410) 662-7400

Howard County MARYLAND
Storm Water Management Division
Bureau of Environmental Services
9801 Broken Land Parkway
Columbia, Maryland 21046
(410) 313-6444

DES: HBH				
DRN: MER				
CHK:				
DATE: 10/27/20	BY	NO.	REVISION	DATE

NORTH TUNNEL
PRELIMINARY DESIGN
CAPITAL PROJECT #C-0337
HOWARD COUNTY
HSCD# TBD

PRELIMINARY EXT. TUNNEL BORING LAYOUT

SCALE 1" = 150'

SHEET 1 OF 1

D. BORING LOGS

Project No. 2017091.042.02

LOG OF BOREHOLE B-1

Sheet 1 of 1

CLIENT: McCormick Taylor

PROJECT: **Ellicott City Additional Boring**

ARCHITECT/ENGINEER:

SITE: **Howard County, Maryland**

SURFACE ELEV.: **180.0** ft.

DEPTH (FT)	GRAPHIC LOG	SAMPLES: BLOWS/6" N - VALUE RQD	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: IN. RECOVERED IN. DRIVEN	TESTS: MOISTURE (%)	TESTS: DRY DENSITY (PCF)	TESTS: Qu (TSF)	TESTS: % PASSING #200 SIEVE	REMARKS/ ADDITIONAL DATA
0.3	179.8	3" Topsoil Brown SILTY SAND (SM)								
32.0	148.0	Mostly gray, white and pink GRANITE, medium to coarse grained, predominantly close to moderately close fracture spacing, slightly weathered to fresh, hard, minerals mainly	RQD= 97%	1	RC	60/60 100%				
37.0	143.0	quartz, fractures dip at 15-60 degrees								
		Mostly gray, white, and pink GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, slightly weathered to fresh, hard, minerals mainly	RQD= 70%	2	RC	60/60 100%				
42.0	138.0	quartz, fractures dip at 0-60 degrees Coring Setup @ 32 ft End of Boring @ 42 ft Borehole was backfilled upon completion								

WATER LEVEL OBSERVATIONS

WL	▽	10	@ Drilling

AB Consultants, Inc.
9450 Annapolis Road
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

STARTED:	11/16/20	FINISHED:	11/16/20
DRILL CO.:	ABC	DRILL RIG:	CME550
DRILLER:	AG	ASS'T DRILLER:	
LOGGED BY:		APPROVED:	

BORING LOG AB08 2017091.042.02 ELLICOTT CITY.GPJ AB_CONS.GDT 1/6/21

Project No. 2017091.042.02

LOG OF BOREHOLE B-2

Sheet 1 of 2

CLIENT: McCormick Taylor

PROJECT: **Ellicott City Additional Boring**

ARCHITECT/ENGINEER:

SITE: **Howard County, Maryland**

SURFACE ELEV.: **272.0** ft.

DEPTH (FT)	GRAPHIC LOG	SAMPLES: BLOWS/6" N - VALUE RQD	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: IN. RECOVERED IN. DRIVEN	TESTS: MOISTURE (%)	TESTS: DRY DENSITY (PCF)	TESTS: Qu (TSF)	TESTS: % PASSING #200 SIEVE	REMARKS/ ADDITIONAL DATA
0.3	3" Topsoil									
271.8	Brown SILTY SAND (SM)									

Continued Next Page

WATER LEVEL OBSERVATIONS

WL	Dry	@ Drilling

AB Consultants, Inc.
9450 Annapolis Road
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

STARTED:	12/7/20	FINISHED:	12/11/20
DRILL CO.:	ABC	DRILL RIG:	D50
DRILLER:	JA	ASS'T DRILLER:	
LOGGED BY:		APPROVED:	

BORING LOG AB08 2017091.042.02 ELLICOTT CITY.GPJ AB_CONS.GDT 1/6/21

Project No. 2017091.042.02

LOG OF BOREHOLE B-2

Sheet 2 of 2

CLIENT: McCormick Taylor

PROJECT: **Ellicott City Additional Boring**

ARCHITECT/ENGINEER:

SITE: **Howard County, Maryland**

(continued)	GRAPHIC LOG	DEPTH (FT)	SAMPLES: BLOWS/6" N - VALUE RQD	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: IN. RECOVERED IN. DRIVEN	TESTS: MOISTURE (%)	TESTS: DRY DENSITY (PCF)	TESTS: Qu (TSF)	TESTS: % PASSING #200 SIEVE	REMARKS/ ADDITIONAL DATA
Brown SILTY SAND (SM) *(continued)*		55									
61.0 211.0		60									
Gray, pink and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, slightly weathered to fresh, hard, minerals mainly quartz, fractures dip at 0-45 degrees			RQD= 86%	1	RC	60/60 100%					
66.0 206.0		65									
Coring Setup @ 61 ft End of Boring @ 66 ft Borehole was backfilled upon completion											

WATER LEVEL OBSERVATIONS

WL	Dry	@ Drilling

AB Consultants, Inc.
9450 Annapolis Road
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

STARTED:	12/7/20	FINISHED:	12/11/20
DRILL CO.:	ABC	DRILL RIG:	D50
DRILLER:	JA	ASS'T DRILLER:	
LOGGED BY:		APPROVED:	

BORING LOG AB08 2017091.042.02 ELLICOTT CITY.GPJ AB_CONS.GDT 1/6/21

Project No. 2017091.042.02

LOG OF BOREHOLE B-3

Sheet 1 of 1

CLIENT: McCormick Taylor

PROJECT: **Ellicott City Additional Boring**

ARCHITECT/ENGINEER:

SITE: **Howard County, Maryland**

SURFACE ELEV.: **240.0** ft.

			SAMPLES				TESTS				
	GRAPHIC LOG	DEPTH (FT)	BLOWS/6" N - VALUE RQD	NUMBER	TYPE	IN. RECOVERED IN. DRIVEN	MOISTURE (%)	DRY DENSITY (PCF)	Qu (TSF)	% PASSING #200 SIEVE	REMARKS/ ADDITIONAL DATA
0.3 4" Asphalt 239.7 Brown SILTY SAND (SM)		5									
7.5 232.5 Gray, white and pink GRANITE, medium to coarse grained, predominantly close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5-25 degrees		10	RQD= 100%	1	RC	60/60 100%					
12.5 227.5 Gray, white, and pink GRANITE, medium to coarse grained, predominantly moderately close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 5 degree		15	RQD= 100%	2	RC	60/60 100%					
17.5 222.5 Coring Setup @ 7.5 ft End of Boring @ 17.5 ft Borehole was backfilled upon completion											

WATER LEVEL OBSERVATIONS

WL	▽	5	@ Drilling

AB Consultants, Inc.
9450 Annapolis Road
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

STARTED:	11/18/20	FINISHED:	11/18/20
DRILL CO.:	ABC	DRILL RIG:	CME550
DRILLER:	AG	ASS'T DRILLER:	
LOGGED BY:		APPROVED:	

BORING LOG AB08 2017091.042.02 ELLICOTT CITY.GPJ AB_CONS.GDT 1/6/21

Project No. 2017091.042.02

LOG OF BOREHOLE B-4

Sheet 1 of 2

CLIENT: McCormick Taylor

PROJECT: **Ellicott City Additional Boring**

ARCHITECT/ENGINEER:

SITE: **Howard County, Maryland**

SURFACE ELEV.: **259.0** ft.

DEPTH (FT)	GRAPHIC LOG	SAMPLES: BLOWS/6" N - VALUE RQD	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: IN. RECOVERED IN. DRIVEN	TESTS: MOISTURE (%)	TESTS: DRY DENSITY (PCF)	TESTS: Qu (TSF)	TESTS: % PASSING #200 SIEVE	REMARKS/ ADDITIONAL DATA
0.3	3" Topsoil									
	Brown SILTY SAND (SM)									
258.8										

▽

Continued Next Page

WATER LEVEL OBSERVATIONS

WL	▽	15	@ Drilling

AB Consultants, Inc.
9450 Annapolis Road
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

STARTED:	11/16/20	FINISHED:	11/16/20
DRILL CO.:	ABC	DRILL RIG:	CME550
DRILLER:	AG	ASS'T DRILLER:	
LOGGED BY:		APPROVED:	

BORING LOG AB08 2017091.042.02 ELLICOTT CITY.GPJ AB_CONS.GDT 1/6/21

Project No. 2017091.042.02

LOG OF BOREHOLE B-4

Sheet 2 of 2

CLIENT: McCormick Taylor

PROJECT: **Ellicott City Additional Boring**

ARCHITECT/ENGINEER:

SITE: **Howard County, Maryland**

(continued)	GRAPHIC LOG	DEPTH (FT)	SAMPLES: BLOWS/6" N - VALUE RQD	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: IN. RECOVERED IN. DRIVEN	TESTS: MOISTURE (%)	TESTS: DRY DENSITY (PCF)	TESTS: Qu (TSF)	TESTS: % PASSING #200 SIEVE	REMARKS/ ADDITIONAL DATA
Brown SILTY SAND (SM) *(continued)*		55, 60, 65, 70, 75									
76.0		75									
Mostly pink with some white and gray GRANITE, medium to coarse grained, predominantly very close to wide fracture spacing, slightly weathered to fresh, hard, minerals mainly quartz, fractures dip at 0-45 degrees	183.0		RQD= 95%	1	RC	60/60 100%					
81.0	178.0	80									
Mostly pink, gray, and some white GRANITE, medium to coarse grained, predominantly moderately close to wide fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 0-45 degrees			RQD= 82%	2	RC	51/60 85%					
86.0	173.0	85									
Coring Setup @ 76 ft End of Boring @ 86 ft Borehole was backfilled upon completion											

WATER LEVEL OBSERVATIONS			
WL	▽	15	@ Drilling

AB Consultants, Inc.
9450 Annapolis Road
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

STARTED:	11/16/20	FINISHED:	11/16/20
DRILL CO.:	ABC	DRILL RIG:	CME550
DRILLER:	AG	ASS'T DRILLER:	
LOGGED BY:		APPROVED:	

BORING LOG AB08 2017091.042.02 ELLICOTT CITY.GPJ AB_CONS.GDT 1/6/21

Project No. 2017091.042.02

LOG OF BOREHOLE B-5

Sheet 1 of 1

CLIENT: McCormick Taylor

PROJECT: **Ellicott City Additional Boring**

ARCHITECT/ENGINEER:

SITE: **Howard County, Maryland**

SURFACE ELEV.: **305.0** ft.

DEPTH (FT)	GRAPHIC LOG	SAMPLES: BLOWS/6" N - VALUE RQD	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: IN. RECOVERED IN. DRIVEN	TESTS: MOISTURE (%)	TESTS: DRY DENSITY (PCF)	TESTS: Qu (TSF)	TESTS: % PASSING #200 SIEVE	REMARKS/ ADDITIONAL DATA
0.3	3" Topsoil Brown SILTY SAND (SM)									
304.8										
5										
10										
11.0										
294.0	Mostly gray and white GRANITE, medium to coarse grained, predominantly very close to close fracture spacing, slightly weathered to heavy weathered, hard to soft, minerals mainly quartz, fractures dip at 0-45 degrees, with silty sand from 14.5 ft	RQD= 9%	1	RC	39/60 65%					
15										
16.0										
289.0	Mostly gray and white GRANITE, medium to coarse grained, predominantly close to wide fracture spacing, slightly weathered to fresh, hard, minerals mainly quartz, fractures dip at 5-60 degrees	RQD= 90%	2	RC	57/60 95%					
20										
21.0										
284.0	Coring Setup @ 11 ft End of Boring @ 21 ft Borehole was backfilled upon completion									

WATER LEVEL OBSERVATIONS

WL	▽	8	@ Drilling

AB Consultants, Inc.
9450 Annapolis Road
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

STARTED:	11/18/20	FINISHED:	11/18/20
DRILL CO.:	ABC	DRILL RIG:	CME550
DRILLER:	AG	ASS'T DRILLER:	
LOGGED BY:		APPROVED:	

BORING LOG AB08 2017091.042.02 ELLICOTT CITY.GPJ AB_CONS.GDT 1/6/21

Project No. 2017091.042.02

LOG OF BOREHOLE B-6

Sheet 1 of 1

CLIENT: McCormick Taylor

PROJECT: **Ellicott City Additional Boring**

ARCHITECT/ENGINEER:

SITE: **Howard County, Maryland**

SURFACE ELEV.: **282.0** ft.

				SAMPLES				TESTS				
		GRAPHIC LOG	DEPTH (FT)	BLOWS/6" N - VALUE RQD	NUMBER	TYPE	IN. RECOVERED IN. DRIVEN	MOISTURE (%)	DRY DENSITY (PCF)	Qu (TSF)	% PASSING #200 SIEVE	REMARKS/ ADDITIONAL DATA
0.3	3" Topsoil Brown SILTY SAND (SM)	281.8										
8.0	Mostly gray and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 15-45 degrees	274.0	5	RQD= 80%	1	RC	60/60 100%					
13.0	Mostly gray and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, slightly weathered to fresh, hard, minerals mainly quartz, fractures dip at 0-45 degrees	269.0	10	RQD= 85%	2	RC	60/60 100%					
18.0	Coring Setup @ 8 ft End of Boring @ 18 ft Borehole was backfilled upon completion	264.0	15									

WATER LEVEL OBSERVATIONS

WL	▽ 5	@ Drilling	

AB Consultants, Inc.
9450 Annapolis Road
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

STARTED:	11/19/20	FINISHED:	11/19/20
DRILL CO.:	ABC	DRILL RIG:	CME550
DRILLER:	AG	ASS'T DRILLER:	
LOGGED BY:		APPROVED:	

BORING LOG AB08 2017091.042.02 ELLICOTT CITY.GPJ AB_CONS.GDT 1/6/21

Project No. 2017091.042.02

LOG OF BOREHOLE B-7

Sheet 1 of 1

CLIENT: McCormick Taylor

PROJECT: **Ellicott City Additional Boring**

ARCHITECT/ENGINEER:

SITE: **Howard County, Maryland**

SURFACE ELEV.: **256.0** ft.

DEPTH (FT)	GRAPHIC LOG	SAMPLES: BLOWS/6" N - VALUE RQD	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: IN. RECOVERED IN. DRIVEN	TESTS: MOISTURE (%)	TESTS: DRY DENSITY (PCF)	TESTS: Qu (TSF)	TESTS: % PASSING #200 SIEVE	REMARKS/ ADDITIONAL DATA
0.3	3" Asphalt Brown SILTY SAND (SM)									
255.8										
32.5	Mostly gray and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, slightly weathered to fresh, hard, minerals mainly quartz, fractures dip at 5-45 degrees	RQD= 40%	1	RC	36/60 60%					
223.5										
37.5	Mostly gray and white GRANITE, medium to coarse grained, predominantly very close to moderately close fracture spacing, fresh, hard, minerals mainly quartz, fractures dip at 0-45 degrees	RQD= 38%	2	RC	26.5/60 44%					
218.5										
42.5	Coring Setup @ 32.5 ft End of Boring @ 42.5 ft Borehole was backfilled upon completion									
213.5										

WATER LEVEL OBSERVATIONS

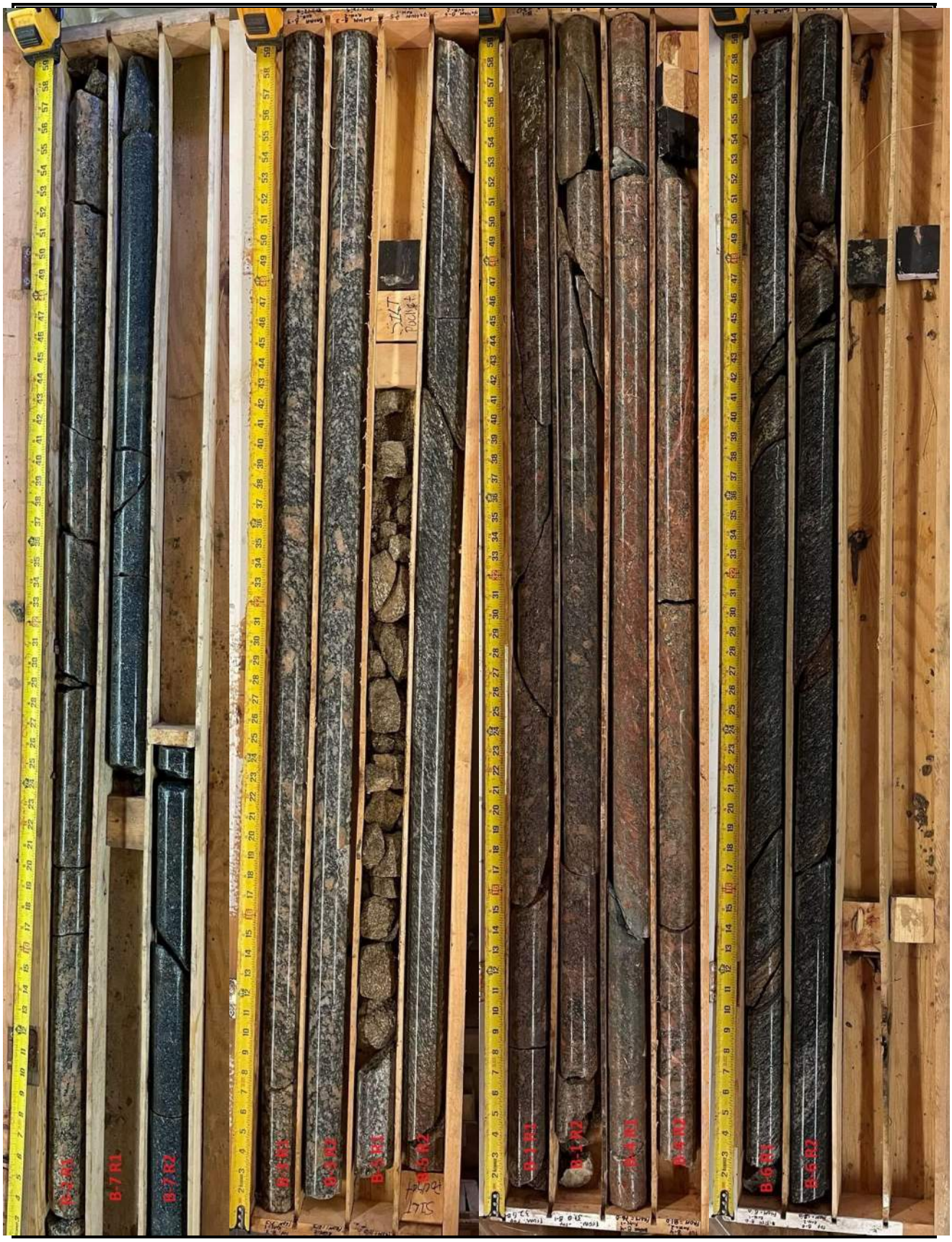
WL	▽	16	@ Drilling

AB Consultants, Inc.
9450 Annapolis Road
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

STARTED:	12/15/20	FINISHED:	12/15/20
DRILL CO.:	ABC	DRILL RIG:	D50
DRILLER:	JA	ASS'T DRILLER:	
LOGGED BY:		APPROVED:	

BORING LOG AB08 2017091.042.02 ELLICOTT CITY.GPJ AB_CONS.GDT 1/6/21

E. ROCK CORE SAMPLE BOX

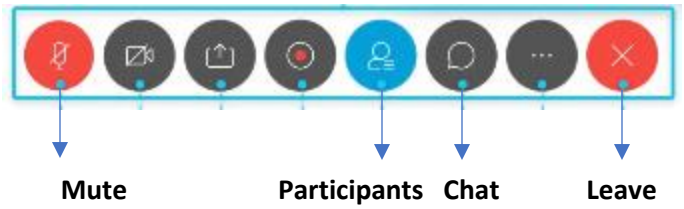

B-7 R1
B-7 R2
B-6 R1
B-6 R2
B-5 R1
B-5 R2
B-4 R1
B-4 R2
B-3 R1
B-3 R2
B-2 R1
B-2 R2
B-1 R1
B-1 R2

Joining a Cisco Webex Event

Joining the event

You will receive an email that contains instructions.
Click the link to join the Event.
Under **Join Event Now**, type your name and email address, then click **Join Now**.

Most of the event's options are in the center of the screen at the bottom and participants and additional panels are on the right.

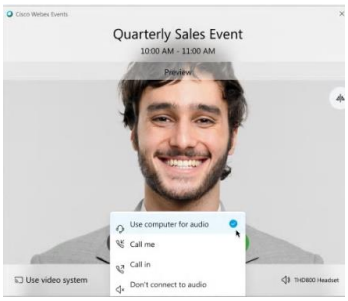


If you wish to speak during the event, please click on the participants icon bottom center. The participants will display on the right. Click the Hand icon. 

Connecting to Audio

First, click the audio connection options in the Webex Events app.

Second, choose how you want to hear the event's audio:



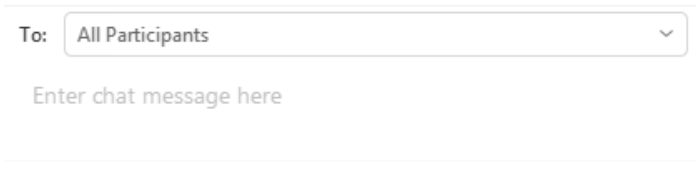
Use computer for audio – Use your computer with a headset or speakers. This is the default. You can change your headset, speakers, microphone.

Call me – Enter or select the home phone number that you'd like the event to call.

Call in – Use your phone to dial in to the event. Enter your attendee number when prompted. The number is displayed on the screen.

Sending Messages

If you need technical assistance, click the Chat button. 



The Chat box will open on the right.

You will be muted. When it's your turn to speak, your name will be announced.