Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Purchase Order

Order Date: 02-20-2026

CORRECT ORDER NUMBER MUST APPEAR ON ALL PACKAGES, INVOICES, AND SHIPPING PAPERS. QUESTIONS CONCERNING THIS ORDER SHOULD BE DIRECTED TO THE DEPARTMENT CONTACT.

Order Number:	CPO 1400 4902 AGR2600000017 1	**Change Order No:**	**Procurement Folder:** 1793301
Document Name:	Brush Creek 15 Dam Rehabilitation-Construction		**Reason for Modification:**
Document Description:	Brush Creek 15 Dam Rehabilitation-Construction		
Procurement Type:	Central Purchase Order		
Buyer Name:	Larry D McDonnell		
Telephone:	304-558-2063		
Email:	larry.d.mcdonnell@wv.gov		
Shipping Method:	Best Way		**Effective Start Date:**
Free on Board:	FOB Dest, Freight Prepaid		**Effective End Date:**

VENDOR

Vendor Customer Code: VS0000047922
SEQUOIA SERVICES LLC
3300 BATTLEGROUND AVE STE 102

GREENSBORO NC 27410
US
Vendor Contact Phone: 7046342954 **Extension:**

Discount Details:

	Discount Allowed	Discount Percentage	Discount Days
#1	No	0.0000	0
#2	Not Entered		
#3	Not Entered		
#4	Not Entered		

DEPARTMENT CONTACT

Requestor Name: Christopher J Martin
Requestor Phone: (304) 558-2204
Requestor Email: cmartin@wvca.us

2026
FILE LOCATION _____

INVOICE TO

PROCUREMENT OFFICER 304-558-2221
AGRICULTURE DEPARTMENT OF
ADMINISTRATIVE SERVICES
1900 KANAWHA BLVD E
CHARLESTON WV 25305-0173
US

SHIP TO

ADMINISTRATIVE SERVICES 304-558-2204
WEST VIRGINIA CONSERVATION AGENCY
WEST VIRGINIA CONSERVATION AGENCY
255 GUS R DOUGLASS LN
CHARLESTON WV 25305-0193
US

CR 2-26-26

Total Order Amount:	$17,284,010.00

Purchasing Division's File Copy

PURCHASING DIVISION AUTHORIZATION	**ATTORNEY GENERAL APPROVAL AS TO FORM**	**ENCUMBRANCE CERTIFICATION**
DATE: 2/25/26	**DATE:** 3/2/2026	**DATE:** 3-2-26
ELECTRONIC SIGNATURE ON FILE	**ELECTRONIC SIGNATURE ON FILE**	**ELECTRONIC SIGNATURE ON FILE**

Extended Description:

The Vendor, Sequoia Services, LLC, agrees to enter into a contract with the West Virginia Conservation Agency, to provide rehabilitation of Brush Creek Site 15 dan structure, per the bid requirements, terms, conditions, specifications, Addendum No. 1 issued 10/20/2025, Addendum No. 2 issued 11/18/2025, Addendum No. 3 issued 11/19/2025, Addendum No. 4 issued 12/23/2025, Addendum No. 5 issued 12/31/2025 and the vendor's bid dated 01/14/2026 all incorporated herein by reference and made apart of hereof.

Line	Commodity Code	Quantity	Unit	Unit Price	Total Price
1	72141203	0.00000		0.000000	17284010.00
Service From	**Service To**	**Manufacturer**		**Model No**	

Commodity Line Description: Brush Creek Site 15 Dam Rehab Construction Services

Extended Description:
Dam Rehabilitation services for Brush Creek 15.

See all attached documentation for further details.

PLEASE READ INSTRUCTIONS IN THEIR ENTIRETY. THE AMOUNT ENTERED ON THIS COMMODITY LINE SHOULD BE THE TOTAL COST FOR SITE 15 - SEE EXHIBIT A PRICING PAGE.

GENERAL TERMS AND CONDITIONS:

1. CONTRACTUAL AGREEMENT: Issuance of an Award Document signed by the Purchasing Division Director, or his designee, and approved as to form by the Attorney General's office constitutes acceptance by the State of this Contract made by and between the State of West Virginia and the Vendor. Vendor's signature on its bid, or on the Contract if the Contract is not the result of a bid solicitation, signifies Vendor's agreement to be bound by and accept the terms and conditions contained in this Contract.

2. DEFINITIONS: As used in this Solicitation/Contract, the following terms shall have the meanings attributed to them below. Additional definitions may be found in the specifications included with this Solicitation/Contract.

2.1. "Agency" or **"Agencies"** means the agency, board, commission, or other entity of the State of West Virginia that is identified on the first page of the Solicitation or any other public entity seeking to procure goods or services under this Contract.

2.2. "Bid" or **"Proposal"** means the vendors submitted response to this solicitation.

2.3. "Contract" means the binding agreement that is entered into between the State and the Vendor to provide the goods or services requested in the Solicitation.

2.4. "Director" means the Director of the West Virginia Department of Administration, Purchasing Division.

2.5. "Purchasing Division" means the West Virginia Department of Administration, Purchasing Division.

2.6. "Award Document" means the document signed by the Agency and the Purchasing Division, and approved as to form by the Attorney General, that identifies the Vendor as the contract holder.

2.7. "Solicitation" means the official notice of an opportunity to supply the State with goods or services that is published by the Purchasing Division.

2.8. "State" means the State of West Virginia and/or any of its agencies, commissions, boards, etc. as context requires.

2.9. "Vendor" or **"Vendors"** means any entity submitting a bid in response to the Solicitation, the entity that has been selected as the lowest responsible bidder, or the entity that has been awarded the Contract as context requires.

3. CONTRACT TERM; RENEWAL; EXTENSION: The term of this Contract shall be determined in accordance with the category that has been identified as applicable to this Contract below:

☐ **Term Contract**

Initial Contract Term: The Initial Contract Term will be for a period of _____ _____. The Initial Contract Term becomes effective on the effective start date listed on the first page of this Contract, identified as the State of West Virginia contract cover page containing the signatures of the Purchasing Division, Attorney General, and Encumbrance clerk (or another page identified as _____), and the Initial Contract Term ends on the effective end date also shown on the first page of this Contract.

Renewal Term: This Contract may be renewed upon the mutual written consent of the Agency, and the Vendor, with approval of the Purchasing Division and the Attorney General's office (Attorney General approval is as to form only). Any request for renewal should be delivered to the Agency and then submitted to the Purchasing Division thirty (30) days prior to the expiration date of the initial contract term or appropriate renewal term. A Contract renewal shall be in accordance with the terms and conditions of the original contract. Unless otherwise specified below, renewal of this Contract is limited to _____ successive one (1) year periods or multiple renewal periods of less than one year, provided that the multiple renewal periods do not exceed the total number of months available in all renewal years combined. Automatic renewal of this Contract is prohibited. Renewals must be approved by the Vendor, Agency, Purchasing Division and Attorney General's office (Attorney General approval is as to form only)

☐ **Alternate Renewal Term** – This contract may be renewed for _____ successive _____ year periods or shorter periods provided that they do not exceed the total number of months contained in all available renewals. Automatic renewal of this Contract is prohibited. Renewals must be approved by the Vendor, Agency, Purchasing Division and Attorney General's office (Attorney General approval is as to form only)

Delivery Order Limitations: In the event that this contract permits delivery orders, a delivery order may only be issued during the time this Contract is in effect. Any delivery order issued within one year of the expiration of this Contract shall be effective for one year from the date the delivery order is issued. No delivery order may be extended beyond one year after this Contract has expired.

☐ **Fixed Period Contract:** This Contract becomes effective upon Vendor's receipt of the notice to proceed and must be completed within _____days.

☐ **Fixed Period Contract with Renewals:** This Contract becomes effective upon Vendor's receipt of the notice to proceed and part of the Contract more fully described in the attached specifications must be completed within _____ days. Upon completion of the work covered by the preceding sentence, the vendor agrees that:

☐ the contract will continue for _____ years;

☐ the contract may be renewed for _____ successive _____ year periods or shorter periods provided that they do not exceed the total number of months contained in all available renewals. Automatic renewal of this Contract is prohibited. Renewals must be approved by the Vendor, Agency, Purchasing Division and Attorney General's Office (Attorney General approval is as to form only).

☐ **One-Time Purchase:** The term of this Contract shall run from the issuance of the Award Document until all of the goods contracted for have been delivered, but in no event will this Contract extend for more than one fiscal year.

☑ **Construction/Project Oversight:** This Contract becomes effective on the effective start date listed on the first page of this Contract, identified as the State of West Virginia contract cover page containing the signatures of the Purchasing Division, Attorney General, and Encumbrance clerk (or another page identified as _____), and continues until the project for which the vendor is providing oversight is complete.

☐ **Other:** Contract Term specified in _____

4. AUTHORITY TO PROCEED: Vendor is authorized to begin performance of this contract on the date of encumbrance listed on the front page of the Award Document unless either the box for "Fixed Period Contract" or "Fixed Period Contract with Renewals" has been checked in Section 3 above. If either "Fixed Period Contract" or "Fixed Period Contract with Renewals" has been checked, Vendor must not begin work until it receives a separate notice to proceed from the State. The notice to proceed will then be incorporated into the Contract via change order to memorialize the official date that work commenced.

5. QUANTITIES: The quantities required under this Contract shall be determined in accordance with the category that has been identified as applicable to this Contract below.

☐ **Open End Contract:** Quantities listed in this Solicitation/Award Document are approximations only, based on estimates supplied by the Agency. It is understood and agreed that the Contract shall cover the quantities actually ordered for delivery during the term of the Contract, whether more or less than the quantities shown.

☐ **Service:** The scope of the service to be provided will be more clearly defined in the specifications included herewith.

☐ **Combined Service and Goods:** The scope of the service and deliverable goods to be provided will be more clearly defined in the specifications included herewith.

☐ **One-Time Purchase:** This Contract is for the purchase of a set quantity of goods that are identified in the specifications included herewith. Once those items have been delivered, no additional goods may be procured under this Contract without an appropriate change order approved by the Vendor, Agency, Purchasing Division, and Attorney General's office.

☑ **Construction:** This Contract is for construction activity more fully defined in the specifications.

6. EMERGENCY PURCHASES: The Purchasing Division Director may authorize the Agency to purchase goods or services in the open market that Vendor would otherwise provide under this Contract if those goods or services are for immediate or expedited delivery in an emergency. Emergencies shall include, but are not limited to, delays in transportation or an unanticipated increase in the volume of work. An emergency purchase in the open market, approved by the Purchasing Division Director, shall not constitute of breach of this Contract and shall not entitle the Vendor to any form of compensation or damages. This provision does not excuse the State from fulfilling its obligations under a One-Time Purchase contract.

7. REQUIRED DOCUMENTS: All of the items checked in this section must be provided to the Purchasing Division by the Vendor as specified:

☑ **LICENSE(S) / CERTIFICATIONS / PERMITS:** In addition to anything required under the Section of the General Terms and Conditions entitled Licensing, the apparent successful Vendor shall furnish proof of the following licenses, certifications, and/or permits upon request and in a form acceptable to the State. The request may be prior to or after contract award at the State's sole discretion.

☑ West Virginia Contractors License Classification: C - General Engineering

☑ See Construction Specifications RFQ Brush Creek 14 & 15, Section 10.

☐

☐

The apparent successful Vendor shall also furnish proof of any additional licenses or certifications contained in the specifications regardless of whether or not that requirement is listed above.

8. INSURANCE: The apparent successful Vendor shall furnish proof of the insurance identified by a checkmark below prior to Contract award. The insurance coverages identified below must be maintained throughout the life of this contract. Thirty (30) days prior to the expiration of the insurance policies, Vendor shall provide the Agency with proof that the insurance mandated herein has been continued. Vendor must also provide Agency with immediate notice of any changes in its insurance policies, including but not limited to, policy cancelation, policy reduction, or change in insurers. The apparent successful Vendor shall also furnish proof of any additional insurance requirements contained in the specifications prior to Contract award regardless of whether that insurance requirement is listed in this section.

Vendor must maintain:

☑ **Commercial General Liability Insurance** in at least an amount of: _$1,000,000.00_ per occurrence.

☑ **Automobile Liability Insurance** in at least an amount of: _$1,000,000.00___per occurrence.

☐ **Professional/Malpractice/Errors and Omission Insurance** in at least an amount of: _____per occurrence. Notwithstanding the forgoing, Vendor's are not required to list the State as an additional insured for this type of policy.

☐ **Commercial Crime and Third Party Fidelity Insurance** in an amount of: _____ per occurrence.

☐ **Cyber Liability Insurance** in an amount of: _____ per occurrence.

☑ **Builders Risk Insurance** in an amount equal to 100% of the amount of the Contract.

☐ **Pollution Insurance** in an amount of: _____ per occurrence.

☐ **Aircraft Liability** in an amount of: _____ per occurrence.

☐

☐

☐

☐

9. WORKERS' COMPENSATION INSURANCE: Vendor shall comply with laws relating to workers compensation, shall maintain workers' compensation insurance when required, and shall furnish proof of workers' compensation insurance upon request.

10. VENUE: All legal actions for damages brought by Vendor against the State shall be brought in the West Virginia Claims Commission. Other causes of action must be brought in the West Virginia court authorized by statute to exercise jurisdiction over it.

11. LIQUIDATED DAMAGES: This clause shall in no way be considered exclusive and shall not limit the State or Agency's right to pursue any other available remedy. Vendor shall pay liquidated damages in the amount specified below or as described in the specifications:

☐ _____ for _____.

☑ Liquidated Damages Contained in the Specifications.

☐ Liquidated Damages Are Not Included in this Contract.

12. ACCEPTANCE: Vendor's signature on its bid, or on the certification and signature page, constitutes an offer to the State that cannot be unilaterally withdrawn, signifies that the product or service proposed by vendor meets the mandatory requirements contained in the Solicitation for that product or service, unless otherwise indicated, and signifies acceptance of the terms and conditions contained in the Solicitation unless otherwise indicated.

13. PRICING: The pricing set forth herein is firm for the life of the Contract, unless specified elsewhere within this Solicitation/Contract by the State. A Vendor's inclusion of price adjustment provisions in its bid, without an express authorization from the State in the Solicitation to do so, may result in bid disqualification. Notwithstanding the foregoing, Vendor must extend any publicly advertised sale price to the State and invoice at the lower of the contract price or the publicly advertised sale price.

14. PAYMENT IN ARREARS: Payments for goods/services will be made in arrears only upon receipt of a proper invoice, detailing the goods/services provided or receipt of the goods/services, whichever is later. Notwithstanding the foregoing, payments for software maintenance, licenses, or subscriptions may be paid annually in advance.

15. PAYMENT METHODS: Vendor must accept payment by electronic funds transfer and P-Card. (The State of West Virginia's Purchasing Card program, administered under contract by a banking institution, processes payment for goods and services through state designated credit cards.)

16. TAXES: The Vendor shall pay any applicable sales, use, personal property or any other taxes arising out of this Contract and the transactions contemplated thereby. The State of West Virginia is exempt from federal and state taxes and will not pay or reimburse such taxes.

17. ADDITIONAL FEES: Vendor is not permitted to charge additional fees or assess additional charges that were not either expressly provided for in the solicitation published by the State of West Virginia, included in the Contract, or included in the unit price or lump sum bid amount that Vendor is required by the solicitation to provide. Including such fees or charges as notes to the solicitation may result in rejection of vendor's bid. Requesting such fees or charges be paid after the contract has been awarded may result in cancellation of the contract.

18. FUNDING: This Contract shall continue for the term stated herein, contingent upon funds being appropriated by the Legislature or otherwise being made available. In the event funds are not appropriated or otherwise made available, this Contract becomes void and of no effect beginning on July 1 of the fiscal year for which funding has not been appropriated or otherwise made available. If that occurs, the State may notify the Vendor that an alternative source of funding has been obtained and thereby avoid the automatic termination. Non-appropriation or non-funding shall not be considered an event of default.

19. CANCELLATION: The Purchasing Division Director reserves the right to cancel this Contract immediately upon written notice to the vendor if the materials or workmanship supplied do not conform to the specifications contained in the Contract. The Purchasing Division Director may also cancel any purchase or Contract upon 30 days written notice to the Vendor in accordance with West Virginia Code of State Rules § 148-1-5.2.b.

20. TIME: Time is of the essence regarding all matters of time and performance in this Contract.

21. APPLICABLE LAW: This Contract is governed by and interpreted under West Virginia law without giving effect to its choice of law principles. Any information provided in specification manuals, or any other source, verbal or written, which contradicts or violates the West Virginia Constitution, West Virginia Code, or West Virginia Code of State Rules is void and of no effect.

22. COMPLIANCE WITH LAWS: Vendor shall comply with all applicable federal, state, and local laws, regulations and ordinances. By submitting a bid, Vendor acknowledges that it has reviewed, understands, and will comply with all applicable laws, regulations, and ordinances.

> **SUBCONTRACTOR COMPLIANCE:** Vendor shall notify all subcontractors providing commodities or services related to this Contract that as subcontractors, they too are required to comply with all applicable laws, regulations, and ordinances. Notification under this provision must occur prior to the performance of any work under the contract by the subcontractor.

23. ARBITRATION: Any references made to arbitration contained in this Contract, Vendor's bid, or in any American Institute of Architects documents pertaining to this Contract are hereby deleted, void, and of no effect.

24. MODIFICATIONS: This writing is the parties' final expression of intent. Notwithstanding anything contained in this Contract to the contrary no modification of this Contract shall be binding without mutual written consent of the Agency, and the Vendor, with approval of the Purchasing Division and the Attorney General's office (Attorney General approval is as to form only). Any change to existing contracts that adds work or changes contract cost, and were not included in the original contract, must be approved by the Purchasing Division and the Attorney General's Office (as to form) prior to the implementation of the change or commencement of work affected by the change.

25. WAIVER: The failure of either party to insist upon a strict performance of any of the terms or provision of this Contract, or to exercise any option, right, or remedy herein contained, shall not be construed as a waiver or a relinquishment for the future of such term, provision, option, right, or remedy, but the same shall continue in full force and effect. Any waiver must be expressly stated in writing and signed by the waiving party.

26. SUBSEQUENT FORMS: The terms and conditions contained in this Contract shall supersede any and all subsequent terms and conditions which may appear on any form documents submitted by Vendor to the Agency or Purchasing Division such as price lists, order forms, invoices, sales agreements, or maintenance agreements, and includes internet websites or other electronic documents. Acceptance or use of Vendor's forms does not constitute acceptance of the terms and conditions contained thereon.

27. ASSIGNMENT: Neither this Contract nor any monies due, or to become due hereunder, may be assigned by the Vendor without the express written consent of the Agency, the Purchasing Division, the Attorney General's office (as to form only), and any other government agency or office that may be required to approve such assignments.

28. WARRANTY: The Vendor expressly warrants that the goods and/or services covered by this Contract will: (a) conform to the specifications, drawings, samples, or other description furnished or specified by the Agency; (b) be merchantable and fit for the purpose intended; and (c) be free from defect in material and workmanship.

29. STATE EMPLOYEES: State employees are not permitted to utilize this Contract for personal use and the Vendor is prohibited from permitting or facilitating the same.

30. PRIVACY, SECURITY, AND CONFIDENTIALITY: The Vendor agrees that it will not disclose to anyone, directly or indirectly, any such personally identifiable information or other confidential information gained from the Agency, unless the individual who is the subject of the information consents to the disclosure in writing or the disclosure is made pursuant to the Agency's policies, procedures, and rules. Vendor further agrees to comply with the Confidentiality Policies and Information Security Accountability Requirements, set forth in www.state.wv.us/admin/purchase/privacy.

31. YOUR SUBMISSION IS A PUBLIC DOCUMENT: Vendor's entire response to the Solicitation and the resulting Contract are public documents. As public documents, they will be disclosed to the public following the bid/proposal opening or award of the contract, as required by the competitive bidding laws of West Virginia Code §§ 5A-3-1 et seq., 5-22-1 et seq., and 5G-1-1 et seq. and the Freedom of Information Act West Virginia Code §§ 29B-1-1 et seq.

DO NOT SUBMIT MATERIAL YOU CONSIDER TO BE CONFIDENTIAL, A TRADE SECRET, OR OTHERWISE NOT SUBJECT TO PUBLIC DISCLOSURE.

Submission of any bid, proposal, or other document to the Purchasing Division constitutes your explicit consent to the subsequent public disclosure of the bid, proposal, or document. The Purchasing Division will disclose any document labeled "confidential," "proprietary," "trade secret," "private," or labeled with any other claim against public disclosure of the documents, to include any "trade secrets" as defined by West Virginia Code § 47-22-1 et seq. All submissions are subject to public disclosure without notice.

32. LICENSING: In accordance with West Virginia Code of State Rules § 148-1-6.1.e, Vendor must be licensed and in good standing in accordance with any and all state and local laws and requirements by any state or local agency of West Virginia, including, but not limited to, the West Virginia Secretary of State's Office, the West Virginia Tax Department, West Virginia Insurance Commission, or any other state agency or political subdivision. Obligations related to political subdivisions may include, but are not limited to, business licensing, business and occupation taxes, inspection compliance, permitting, etc. Upon request, the Vendor must provide all necessary releases to obtain information to enable the Purchasing Division Director or the Agency to verify that the Vendor is licensed and in good standing with the above entities.

SUBCONTRACTOR COMPLIANCE: Vendor shall notify all subcontractors providing commodities or services related to this Contract that as subcontractors, they too are required to be licensed, in good standing, and up-to-date on all state and local obligations as described in this section. Obligations related to political subdivisions may include, but are not limited to, business licensing, business and occupation taxes, inspection compliance, permitting, etc. Notification under this provision must occur prior to the performance of any work under the contract by the subcontractor.

33. ANTITRUST: In submitting a bid to, signing a contract with, or accepting a Award Document from any agency of the State of West Virginia, the Vendor agrees to convey, sell, assign, or transfer to the State of West Virginia all rights, title, and interest in and to all causes of action it may now or hereafter acquire under the antitrust laws of the United States and the State of West Virginia for price fixing and/or unreasonable restraints of trade relating to the particular commodities or services purchased or acquired by the State of West Virginia. Such assignment shall be made and become effective at the time the purchasing agency tenders the initial payment to Vendor.

34. VENDOR NON-CONFLICT: Neither Vendor nor its representatives are permitted to have any interest, nor shall they acquire any interest, direct or indirect, which would compromise the performance of its services hereunder. Any such interests shall be promptly presented in detail to the Agency.

35. VENDOR RELATIONSHIP: The relationship of the Vendor to the State shall be that of an independent contractor and no principal-agent relationship or employer-employee relationship is contemplated or created by this Contract. The Vendor as an independent contractor is solely liable for the acts and omissions of its employees and agents. Vendor shall be responsible for selecting, supervising, and compensating any and all individuals employed pursuant to the terms of this Solicitation and resulting contract. Neither the Vendor, nor any employees or subcontractors of the Vendor, shall be deemed to be employees of the State for any purpose whatsoever. Vendor shall be exclusively responsible for payment of employees and contractors for all wages and salaries, taxes, withholding payments, penalties, fees, fringe benefits, professional liability insurance premiums, contributions to insurance and pension, or other deferred compensation plans, including but not limited to, Workers' Compensation and Social Security obligations, licensing fees, etc. and the filing of all necessary documents, forms, and returns pertinent to all of the foregoing.

Vendor shall hold harmless the State, and shall provide the State and Agency with a defense against any and all claims including, but not limited to, the foregoing payments, withholdings, contributions, taxes, Social Security taxes, and employer income tax returns.

36. INDEMNIFICATION: The Vendor agrees to indemnify, defend, and hold harmless the State and the Agency, their officers, and employees from and against: (1) Any claims or losses for services rendered by any subcontractor, person, or firm performing or supplying services, materials, or supplies in connection with the performance of the Contract; (2) Any claims or losses resulting to any person or entity injured or damaged by the Vendor, its officers, employees, or subcontractors by the publication, translation, reproduction, delivery, performance, use, or disposition of any data used under the Contract in a manner not authorized by the Contract, or by Federal or State statutes or regulations; and (3) Any failure of the Vendor, its officers, employees, or subcontractors to observe State and Federal laws including, but not limited to, labor and wage and hour laws.

37. NO DEBT CERTIFICATION: In accordance with West Virginia Code §§ 5A-3-10a and 5-22-1(i), the State is prohibited from awarding a contract to any bidder that owes a debt to the State or a political subdivision of the State. By submitting a bid, or entering into a contract with the State, Vendor is affirming that (1) for construction contracts, the Vendor is not in default on any monetary obligation owed to the state or a political subdivision of the state, and (2) for all other contracts, neither the Vendor nor any related party owe a debt as defined above, and neither the Vendor nor any related party are in employer default as defined in the statute cited above unless the debt or employer default is permitted under the statute.

38. CONFLICT OF INTEREST: Vendor, its officers or members or employees, shall not presently have or acquire an interest, direct or indirect, which would conflict with or compromise the performance of its obligations hereunder. Vendor shall periodically inquire of its officers, members and employees to ensure that a conflict of interest does not arise. Any conflict of interest discovered shall be promptly presented in detail to the Agency.

39. REPORTS: Vendor shall provide the Agency and/or the Purchasing Division with the following reports identified by a checked box below:

☑ Such reports as the Agency and/or the Purchasing Division may request. Requested reports may include, but are not limited to, quantities purchased, agencies utilizing the contract, total contract expenditures by agency, etc.

☐ Quarterly reports detailing the total quantity of purchases in units and dollars, along with a listing of purchases by agency. Quarterly reports should be delivered to the Purchasing Division via email at purchasing.division@wv.gov.

40. BACKGROUND CHECK: In accordance with W. Va. Code § 15-2D-3, the State reserves the right to prohibit a service provider's employees from accessing sensitive or critical information or to be present at the Capitol complex based upon results addressed from a criminal background check. Service providers should contact the West Virginia Division of Protective Services by phone at (304) 558-9911 for more information.

41. PREFERENCE FOR USE OF DOMESTIC STEEL PRODUCTS: Except when authorized by the Director of the Purchasing Division pursuant to W. Va. Code § 5A-3-56, no contractor may use or supply steel products for a State Contract Project other than those steel products made in the United States. A contractor who uses steel products in violation of this section may be subject to civil penalties pursuant to W. Va. Code § 5A-3-56. As used in this section:

a. "State Contract Project" means any erection or construction of, or any addition to, alteration of or other improvement to any building or structure, including, but not limited to, roads or highways, or the installation of any heating or cooling or ventilating plants or other equipment, or the supply of and materials for such projects, pursuant to a contract with the State of West Virginia for which bids were solicited on or after June 6, 2001.

b. "Steel Products" means products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated or otherwise similarly processed, or processed by a combination of two or more or such operations, from steel made by the open heath, basic oxygen, electric furnace, Bessemer or other steel making process.

c. The Purchasing Division Director may, in writing, authorize the use of foreign steel products if:

    1. The cost for each contract item used does not exceed one tenth of one percent (.1%) of the total contract cost or two thousand five hundred dollars ($2,500.00), whichever is greater. For the purposes of this section, the cost is the value of the steel product as delivered to the project; or

    2. The Director of the Purchasing Division determines that specified steel materials are not produced in the United States in sufficient quantity or otherwise are not reasonably available to meet contract requirements.

42. PREFERENCE FOR USE OF DOMESTIC ALUMINUM, GLASS, AND STEEL: In Accordance with W. Va. Code § 5-19-1 et seq., and W. Va. CSR § 148-10-1 et seq., for every contract or subcontract, subject to the limitations contained herein, for the construction, reconstruction, alteration, repair, improvement or maintenance of public works or for the purchase of any item of machinery or equipment to be used at sites of public works, only domestic aluminum, glass or steel products shall be supplied unless the spending officer determines, in writing, after the receipt of offers or bids, (1) that the cost of domestic aluminum, glass or steel products is unreasonable or inconsistent with the public interest of the State of West Virginia, (2) that domestic aluminum, glass or steel products are not produced in sufficient quantities to meet the contract requirements, or (3) the available domestic aluminum, glass, or steel do not meet the contract specifications. This provision only applies to public works contracts awarded in an amount more than fifty thousand dollars ($50,000) or public works contracts that require more than ten thousand pounds of steel products.

The cost of domestic aluminum, glass, or steel products may be unreasonable if the cost is more than twenty percent (20%) of the bid or offered price for foreign made aluminum, glass, or steel products. If the domestic aluminum, glass or steel products to be supplied or produced in a "substantial labor surplus area", as defined by the United States Department of Labor, the cost of domestic aluminum, glass, or steel products may be unreasonable if the cost is more than thirty percent (30%) of the bid or offered price for foreign made aluminum, glass, or steel products. This preference shall be applied to an item of machinery or equipment, as indicated above, when the item is a single unit of equipment or machinery manufactured primarily of aluminum, glass or steel, is part of a public works contract and has the sole purpose or of being a permanent part of a single public works project. This provision does not apply to equipment or machinery purchased by a spending unit for use by that spending unit and not as part of a single public works project.

All bids and offers including domestic aluminum, glass or steel products that exceed bid or offer prices including foreign aluminum, glass or steel products after application of the preferences provided in this provision may be reduced to a price equal to or lower than the lowest bid or offer price for foreign aluminum, glass or steel products plus the applicable preference. If the reduced bid or offer prices are made in writing and supersede the prior bid or offer prices, all bids or offers, including the reduced bid or offer prices, will be reevaluated in accordance with this rule.

43. INTERESTED PARTY SUPPLEMENTAL DISCLOSURE: W. Va. Code § 6D-1-2 requires that for contracts with an actual or estimated value of at least $1 million, the Vendor must submit to the Agency a disclosure of interested parties prior to beginning work under this Contract. Additionally, the Vendor must submit a supplemental disclosure of interested parties reflecting any new or differing interested parties to the contract, which were not included in the original pre-work interested party disclosure, within 30 days following the completion or termination of the contract. A copy of that form is included with this solicitation or can be obtained from the WV Ethics Commission. This requirement does not apply to publicly traded companies listed on a national or international stock exchange. A more detailed definition of interested parties can be obtained from the form referenced above.

44. PROHIBITION AGAINST USED OR REFURBISHED: Unless expressly permitted in the solicitation published by the State, Vendor must provide new, unused commodities, and is prohibited from supplying used or refurbished commodities, in fulfilling its responsibilities under this Contract.

45. VOID CONTRACT CLAUSES: This Contract is subject to the provisions of West Virginia Code § 5A-3-62, which automatically voids certain contract clauses that violate State law.

46. ISRAEL BOYCOTT: Bidder understands and agrees that, pursuant to W. Va. Code § 5A-3-63, it is prohibited from engaging in a boycott of Israel during the term of this contract.

ADDITIONAL TERMS AND CONDITIONS (Construction Contracts Only)

1. CONTRACTOR'S LICENSE: Until June 15, 2021, West Virginia Code § 21-11-2, and after that date, § 30-42-2, requires that all persons desiring to perform contracting work in this state be licensed. The West Virginia Contractors Licensing Board is empowered to issue the contractor's license. Applications for a contractor's license may be made by contacting the West Virginia Contractor Licensing Board.

The apparent successful Vendor must furnish a copy of its contractor's license prior to the issuance of a contract award document.

2. BONDS: The following bonds must be submitted:

☑ **BID BOND:** Pursuant to the requirements contained in W. Va. Code § 5-22-1(c), All Vendors submitting a bid on a construction project shall furnish a valid bid bond in the amount of five percent (5%) of the total amount of the bid protecting the State of West Virginia. **THE BID BOND MUST BE SUBMITTED WITH THE BID OR VENDOR'S BID WILL BE DISQUALIFIED.**

☑ **PERFORMANCE BOND:** The apparent successful Vendor shall provide a performance bond in the amount of 100% of the contract. The performance bond must be received by the Purchasing Division prior to Contract award. (Attorney General requires use of the State approved bond forms found at: www.state.wv.us/admin/purchase/forms2.html)

☑ **LABOR/MATERIAL PAYMENT BOND**: The apparent successful Vendor shall provide a labor/material payment bond in the amount of 100% of the Contract value. The labor/material payment bond must be delivered to the Purchasing Division prior to Contract award. (Attorney General requires use of the State approved bond forms found at: www.state.wv.us/admin/purchase/forms2.html)

☐ **MAINTENANCE BOND:** The apparent successful Vendor shall provide a two (2) year maintenance bond covering the roofing system if the work impacts an existing roof. The amount of the bond must be equal to the price associated with the percentage of the project impacting the roof. The maintenance bond must be issued and delivered to the Purchasing Division prior to Contract award. (Attorney General requires use of the State approved bond forms found at: www.state.wv.us/admin/purchase/forms2.html)

At a minimum, all construction projects require a bid bond, performance bond, and labor/material payment bond. Failure on the part of the state of West Virginia to checkmark the required bonds above does not relieve the vendor from the legal requirement of providing these bonds.

In lieu of the Bid Bond, the Vendor may provide certified checks, cashier's checks, or irrevocable letters of credit. Any certified check, cashier's check, or irrevocable letter of credit provided in lieu of the bid bond must be of the same amount required of the Bid Bond and delivered with the bid.

3. DRUG-FREE WORKPLACE AFFIDAVIT: W. Va. Code § 21-1D-5 provides that any solicitation for a public improvement contract requires each Vendor that submits a bid for the work to submit an affidavit that the Vendor has a written plan for a drug-free workplace policy. If the affidavit is not submitted with the bid submission, the Purchasing Division shall promptly request by telephone and electronic mail that the low bidder and second low bidder provide the affidavit within one business day of the request. Failure to submit the affidavit within one business day of receiving the request shall result in disqualification of the bid. To comply with this law, Vendor should complete the enclosed drug-free workplace affidavit and submit the same with its bid. Failure to submit the signed and notarized drugfree workplace affidavit or a similar affidavit that fully complies with the requirements of the applicable code, within one business day of being requested to do so shall result in disqualification of Vendor's bid. Pursuant to W. Va. Code 21-1D-2(b) and (k), this provision does not apply to public improvement contracts the value of which is $100,000 or less or temporary or emergency repairs.

3.1. DRUG-FREE WORKPLACE POLICY: Pursuant to W. Va. Code § 21-1D-4, Vendor and its subcontractors must implement and maintain a written drug-free workplace policy that complies with said article. The awarding public authority shall cancel this contract if: (1) Vendor fails to implement and maintain a written drug-free workplace policy described in the preceding paragraph, (2) Vendor fails to provide information regarding implementation of its drug-free workplace policy at the request of the public authority; or (3) Vendor provides to the public authority false information regarding the contractor's drug-free workplace policy.

Pursuant to W. Va. Code 21-1D-2(b) and (k), this provision does not apply to public improvement contracts the value of which is $100,000 or less or temporary or emergency repairs.

4. DRUG FREE WORKPLACE REPORT: Pursuant to W. Va. Code § 21-1D-7b, no less than once per year, or upon completion of the project, every contractor shall provide a certified report to the public authority which let the contract. For contracts over $25,000, the public authority shall be the West Virginia Purchasing Division. For contracts of $25,000 or less, the public authority shall be the agency issuing the contract. The report shall include:

(1) Information to show that the education and training service to the requirements of West Virginia Code § 21-1D-5 was provided;

(2) The name of the laboratory certified by the United States Department of Health and Human Services or its successor that performs the drug tests;

(3) The average number of employees in connection with the construction on the public improvement;

(4) Drug test results for the following categories including the number of positive tests and the number of negative tests: (A) Pre-employment and new hires; (B) Reasonable suspicion; (C) Post-accident; and (D) Random.

Vendor should utilize the attached Certified Drug Free Workplace Report Coversheet when submitting the report required hereunder. Pursuant to W. Va. Code 21-1D-2(b) and (k), this provision does not apply to public improvement contracts the value of which is $100,000 or less or temporary or emergency repairs.

5. AIA DOCUMENTS: All construction contracts that will be completed in conjunction with architectural services procured under Chapter 5G of the West Virginia Code will be governed by the attached AIA documents, as amended by the Supplementary Conditions for the State of West Virginia, in addition to the terms and conditions contained herein.

6. PROHIBITION AGAINST GENERAL CONDITIONS: Notwithstanding anything contained in the AIA Documents or the Supplementary Conditions, the State of West Virginia will not pay for general conditions, or winter conditions, or any other condition representing a delay in the contracts. The Vendor is expected to mitigate delay costs to the greatest extent possible and any costs associated with Delays must be specifically and concretely identified. The state will not consider an average daily rate multiplied by the number of days extended to be an acceptable charge.

7. GREEN BUILDINGS MINIMUM ENERGY STANDARDS: In accordance with § 22-29-4, all new building construction projects of public agencies that have not entered the schematic design phase prior to July 1, 2012, or any building construction project receiving state grant funds and appropriations, including public schools, that have not entered the schematic design phase prior to July 1, 2012, shall be designed and constructed complying with the ICC International Energy Conservation Code, adopted by the State Fire Commission, and the ANSI/ASHRAE/IESNA Standard 90.1-2007: Provided, That if any construction project has a commitment of federal funds to pay for a portion of such project, this provision shall only apply to the extent such standards are consistent with the federal standards.

8. LOCAL LABOR MARKET HIRING REQUIREMENT: Pursuant to West Virginia Code §21-1C-1 et seq., Employers shall hire at least seventy-five percent of employees for public improvement construction projects from the local labor market, to be rounded off, with at least two employees from outside the local labor market permissible for each employer per project.

Any employer unable to employ the minimum number of employees from the local labor market shall inform the nearest office of Workforce West Virginia of the number of qualified employees needed and provide a job description of the positions to be filled.

If, within three business days following the placing of a job order, Workforce West Virginia is unable to refer any qualified job applicants to the employer or refers less qualified job applicants than the number requested, then Workforce West Virginia shall issue a waiver to the employer stating the unavailability of applicant and shall permit the employer to fill any positions covered by the waiver from outside the local labor market. The waiver shall be in writing and shall be issued within the prescribed three days. A waiver certificate shall be sent to both the employer for its permanent project records and to the public authority.

Any employer who violates this requirement is subject to a civil penalty of $250 per each employee less than the required threshold of seventy-five percent per day of violation after receipt of a notice of violation.

Any employer that continues to violate any provision of this article more than fourteen calendar days after receipt of a notice of violation is subject to a civil penalty of $500 per each employee less than the required threshold of seventy-five percent per day of violation.

The following terms used in this section have the meaning shown below.

(1) The term "construction project" means any construction, reconstruction, improvement, enlargement, painting, decorating or repair of any public improvement let to contract in an amount equal to or greater than $500,000. The term "construction project" does not include temporary or emergency repairs;

(2) The term "employee" means any person hired or permitted to perform hourly work for wages by a person, firm or corporation in the construction industry; The term "employee" does not include:(i) Bona fide employees of a public authority or individuals engaged in making temporary or emergency repairs;(ii) Bona fide independent contractors; or(iii) Salaried supervisory personnel necessary to assure efficient execution of the employee's work;

(3) The term "employer" means any person, firm or corporation employing one or more employees on any public improvement and includes all contractors and subcontractors;

(4) The term "local labor market" means every county in West Virginia and any county outside of West Virginia if any portion of that county is within fifty miles of the border of West Virginia;

(5) The term "public improvement" includes the construction of all buildings, roads, highways, bridges, streets, alleys, sewers, ditches, sewage disposal plants, waterworks, airports and all other structures that may be let to contract by a public authority, excluding improvements funded, in whole or in part, by federal funds.

9. DAVIS-BACON AND RELATED ACT WAGE RATES:

☐ The work performed under this contract is federally funded in whole, or in part. Pursuant to _____, Vendors are required to pay applicable Davis-Bacon wage rates.

☑ The work performed under this contract is not subject to Davis-Bacon wage rates.

10. SUBCONTRACTOR LIST SUBMISSION: In accordance with W. Va. Code § 5-22-1, the apparent low bidder on a contract valued at more than $250,000.00 for the construction, alteration, decoration, painting or improvement of a new or existing building or structure shall submit a list of all subcontractors who will perform more than $25,000.00 of work on the project including labor and materials. (This section does not apply to any other construction projects, such as highway, mine reclamation, water or sewer projects.) The subcontractor list shall be provided to the Purchasing Division within one business day of the opening of bids for review.
If the apparent low bidder fails to submit the subcontractor list, the Purchasing Division shall promptly request by telephone and electronic mail that the low bidder and second low bidder provide the subcontractor list within one business day of the request. Failure to submit the subcontractor list within one business day of receiving the request shall result in disqualification of the bid.

If no subcontractors who will perform more than $25,000.00 of work are to be used to complete the project, the apparent low bidder must make this clear on the subcontractor list, in the bid itself, or in response to the Purchasing Division's request for the subcontractor list.

a. Required Information. The subcontractor list must contain the following information:

i. Bidder's name

ii. Name of each subcontractor performing more than $25,000 of work on the project.

iii. The license number of each subcontractor, as required by W. Va. Code § 21-11-1 et. seq.

iv. If applicable, a notation that no subcontractor will be used to perform more than $25,000.00 of work. (This item iv. is not required if the vendor makes this clear in the bid itself or in documentation following the request for the subcontractor list.)

b. Subcontractor List Submission Form: The subcontractor list may be submitted in any form, including the attached form, as long as the required information noted above is included. If any information is missing from the bidder's subcontractor list submission, it may be obtained from other documents such as bids, emails, letters, etc. that accompany the subcontractor list submission.

c. Substitution of Subcontractor. Written approval must be obtained from the State Spending Unit before any subcontractor substitution is permitted. Substitutions are not permitted unless:

i. The subcontractor listed in the original bid has filed for bankruptcy;

ii. The subcontractor in the original bid has been debarred or suspended; or

iii. The contractor certifies in writing that the subcontractor listed in the original bid fails, is unable, or refuses to perform his subcontract.

Subcontractor List Submission (Construction Contracts Only)

Bidder's Name: _____

☐ Check this box if no subcontractors will perform more than $25,000.00 of work to complete the project.

Subcontractor Name	License Number if Required by W. Va. Code § 21-11-1 et. seq.

Attach additional pages if necessary

Revised 8/24/2023

DESIGNATED CONTACT: Vendor appoints the individual identified in this Section as the Contract Administrator and the initial point of contact for matters relating to this Contract.

(Printed Name and Title) _____

(Address) _____

(Phone Number) / (Fax Number) _____

(email address) _____

CERTIFICATION AND SIGNATURE: By signing below, or submitting documentation through *wv*OASIS, I certify that: I have reviewed this Solicitation/Contract in its entirety; that I understand the requirements, terms and conditions, and other information contained herein; that this bid, offer or proposal constitutes an offer to the State that cannot be unilaterally withdrawn; that the product or service proposed meets the mandatory requirements contained in the Solicitation/Contract for that product or service, unless otherwise stated herein; that the Vendor accepts the terms and conditions contained in the Solicitation, unless otherwise stated herein; that I am submitting this bid, offer or proposal for review and consideration; that this bid or offer was made without prior understanding, agreement, or connection with any entity submitting a bid or offer for the same material, supplies, equipment or services; that this bid or offer is in all respects fair and without collusion or fraud; that this Contract is accepted or entered into without any prior understanding, agreement, or connection to any other entity that could be considered a violation of law; that I am authorized by the Vendor to execute and submit this bid, offer, or proposal, or any documents related thereto on Vendor's behalf; that I am authorized to bind the vendor in a contractual relationship; and that to the best of my knowledge, the vendor has properly registered with any State agency that may require registration.

By signing below, I further certify that I understand this Contract is subject to the provisions of West Virginia Code § 5A-3-62, which automatically voids certain contract clauses that violate State law; and that pursuant to W. Va. Code 5A-3-63, the entity entering into this contract is prohibited from engaging in a boycott against Israel.

_____

(Company)

_____

(Signature of Authorized Representative)

_____

(Printed Name and Title of Authorized Representative) (Date)

_____

(Phone Number) (Fax Number)

_____

(Email Address)

GENERAL CONSTRUCTION SPECIFICATIONS (No AIA Documents)

1. **PURPOSE AND SCOPE:** The West Virginia Purchasing Division is soliciting bids on behalf of WV Conservation Agency to establish a contract for the following:

   To complete the rehabilitation of dam structure that is classified as high hazard potential. The dam structure is Brush Creek Site 15. This dam provides a combination of flood protection, water supply, and recreation benefits to the surrounding communities. Brush Creek Site 15 is located on the North Fork of Brush Creek in Mercer County, West Virginia

   The Vendor shall furnish all materials, labor, and equipment necessary to complete all Construction Services. The Vendor shall furnish any incidental work, materials, labor, and equipment that are necessary to complete the Construction Services, even if such incidental work is not explicitly included in the Project Plans.

   Site 15 description: The dam is an approximately 690-feet-long zoned earthen embankment with a crest width of 22 feet, and a maximum height of 76 feet measured from the invert of the principal spillway conduit to the low point on the crest of the dam. The upstream slope of the embankment ranges from about 2H: 1 V to 2.5H: 1 V and the downstream slope is approximately 2.5H: 1 V.

   Site 15 rehabilitation measures: These measures include the installation of an upstream riprap stability berm, riser structure improvements, installation of a new downstream filter drainage system, flattening of the downstream embankment slope, extension of the 24-inch diameter principal spillway pipe, and installation of a new impact basin. The existing grass-lined auxiliary spillway will be improved with a roller compacted concrete (RCC) stepped chute spillway.

   These items are to be accomplished by following the construction and material specifications, design drawings, Oversight Engineer, and as identified during the Job Showing.

   The contractor will perform post-construction site reclamation on all disturbed areas of the construction site.

   Final approval will be given by the Contracting Officer Representative.

2. **DEFINITIONS:** The terms listed below shall have the meanings assigned to them below. Additional definitions can be found in section 2 of the General Terms and Conditions and in the Project Plans as defined below.

   2.1 "Construction Services" means the work will consist of supplying all equipment, labor, and materials required for the rehabilitation efforts of Brush Creek Site 15 dam structure as more fully described in the Project Plans.

   2.2 "Pricing Page" means the pages contained in wvOASIS, attached hereto as Exhibit A. Exhibit A is included in this documentation upon which Vendor should list its proposed price for the Construction Services.

2.3 **"Solicitation"** means the official notice of an opportunity to supply the State with Construction Services that is published by the Purchasing Division.

2.4 **"Project Plans"** means documents developed by an architect, an engineer, the Agency, or another design professional, which are attached hereto exhibits, that provide detailed instructions on how the Construction Services are to be performed. Project Plans are documents developed by an architect, an engineer, the Agency, or another design professional, which are attached hereto as exhibits (See exhibit "B"), that provide detailed instructions on how the Construction Services are to be performed. If Project Plans contain drawings or other documents too large to attach in the exhibits. Vendors can obtain copies in accordance with West Virginia Purchasing Division guidelines.

2.5 **"United States Department of Agriculture – Natural Resources Conservation Services (NRCS)"** means a federal agency of the United States government. NRCS works hand-in-hand with landowners, local conservation districts, and state and federal government agencies to provide federal assistance through programs, initiatives, and resources. One of those programs is the Watershed Rehabilitation Program (REHAB). The REHAB program is authorized by Public Law 83-566 which helps project sponsors rehabilitate aging dams that are reaching the end of their design life and/or no longer meet federal or state safety criteria or performance standards. This contract is derived from an agreement between NRCS and the WVCA for Rehab of Brush Creek site 15.

2.6 **"West Virginia State Conservation Committee (SCC)"** means a key body overseeing conservation efforts across the state. The SCC comprises various members, including representatives from federal and state agriculture and environmental agencies, agricultural producers, and nonprofit organizations. The SCC may employ an administrative officer (Executive Director), technical experts, and other agents and employees, permanent and temporary, as required. The administrative officer (Executive Director) and support staff shall be known as the West Virginia Conservation Agency (WVCA). The SCC approves policy and provides guidance to the WVCA. The SCC can direct the WVCA to partner and coordinate with conservation districts to implement programs through one or several conservations districts on several different programs. The SCC can also direct the WVCA to implement its programs at the state government level through a state contract utilizing the West Virginia State Purchasing Division.

2.7 **"West Virginia Conservation Agency (WVCA)"** means a state agency that provides conservation activities to the State of West Virginia and provides administrative support and technical support to the fourteen (14) conservation districts in the State of West Virginia. The WVCA is tasked with providing conservation activities that include implementation of agricultural enhancement, conservation services water quality projects, and watershed projects to include Emergency Watershed Protection; The Operations, Maintenance, and Repair (OMR) of Flood Control Structures (Dams); and Rehabilitation of Flood Control Structures (Dams). The West Virginia Conservation Agency shall be called by its full name or the "WVCA" in this document.

2.8 **"WVCA Contracting Officer (CO)"** means an appointed staff member of the WVCA whose signature will be on all official contract decisions on behalf of the government. The WVCA will direct the CO as to the proper agency response before the CO places a signature. The CO's signed documents shall be the official response of the government, and no other responses are binding. Federal, State, and County entities will take their issues to the WVCA Contracting Officer. The CO will take all issues to the WVCA for guidance and approval. Upon approval, the CO will issue a statement as to how the issue is to be addressed or sign off on documents related to determinations, findings, and any administrative or technical aspects of the contract as the official responses. The WVCA Contracting Officer has the signatory authority to request through West Virginia Purchasing Division to establish, administer, modify and/or terminate this contract. The CO will utilize the WVCA Procurement Officer to take any action on the construction contract. The WVCA Procurement Officer will forward the contract request to the WV Purchasing Division. Following WV Purchasing Division approval, the CO will share the decisions with the COR who will then share decisions with the contractor. All changes to the contract documents require a Change Order. When required, the COR sends a request to the CO. The CO, with approval of the WVCA, will have the WVCA Procurement Officer send the change order request to the WV Purchasing Division as stated above. If approved, a construction change order will be issued.

2.9 **"WVCA Contracting Officer Representative (COR)"** means an appointed staff member of the WVCA whose responsibility is to assist the Contracting Officer (CO) in managing and overseeing a specific contract, acting as the CO's representative at the project site.

2.10 **"Quality Assurance Firm / Oversight Engineer (Oversight Engineer)"** means a firm (and engineers working for that firm) that is responsible for construction oversight by providing technical guidance and quality assurance to the contractor on implementation of the construction project. Ensuring the work on the ground adherence to standards of all construction documents and to the highest standards of quality, safety, and efficiency.

2.11 **"Sponsoring Local Organizations (SLO)"** means organizations below the state level which include, but not limited to, county commissions, municipalities, public service districts, and grassroots organizations providing financial and administrative support to a project.

2.12 **"Subcontractor"** means a person/business/company who performs a portion of a project undertaken by a principal or general contractor or another subcontractor. During bid submission, the bidder shall submit a list of all subcontractors who will perform more than $25,000 worth of work on the project including labor and materials.

2.13 **"Substantially Complete"** means the work shall be deemed "substantially complete" if and only if the Contractor has completed the work and related contract obligations in accordance with the contract documents, such that the Government may enjoy the intended access, occupancy, possession, and use of the entire work without impairment due to incomplete or deficient work, and without interference from the Contractor's completion of remaining work or correction of deficiencies in completed work.

2.14 "Gantt Chart" means a visual project management tool, usually bar chart, used to illustrate a project schedule, showing tasks along a timeline.

3. **ORDER OF PRECEDENCE:** This General Construction Specifications document will have priority over, and supersede, anything contained in the Project Plans.

4. **QUALIFICATIONS:** Vendor, or Vendor's staff if requirements are inherently limited to individuals rather than corporate entities, shall have qualifications in experience through number of projects; experience with Dam-Rehabilitation, Construction, and/or Repair; and experience with Roller Compacted Concrete (RCC) for Dam Rehabilitation, Construction, and/or Repair projects. Compliance with this experience requirement will be evaluated by the State prior to the contract award. The vendor must provide in their bid packet documentation of experience through past projects, documents demonstrating evidence that the vendor has successfully completed the requested type of work listed in the specifications and drawings, and references. The vendor must provide any documentation requested by the State to assist in confirmation of compliance with this provision. References, documentation, or other information to confirm compliance with this experience requirement may be requested after bid opening and prior to contract award.

   Contractors must have the following minimum qualifications:

   a. The vendor, or vendor's supervisory staff assigned to this project, must have successfully completed at least two (2) projects within the last ten (10) years that involved work similar in nature to that described in these specifications or the Project Plans.

   b. Vendor must have experience with Dam Construction, Repair, or Rehabilitation projects.

   c. Vendor must have experience with Roller Compacted Concrete (RCC) for Dam Rehabilitation projects.

   Submission of Qualifications:

   d. A list of projects similar in scope and size during the past ten (10) years. The bidder shall submit a list of projects that are similar in scope and size to the proposed Brush Creek site 15 Rehabilitation Construction Project. These projects must have been completed during the past ten (10) years. The list shall contain the contractee/owner of the project and shall contain a POC for that contractee/owner of the project.

   e. Documentation that details a minimum of two (2) projects similar in scope and size during the past ten (10) years. The bidder shall submit a minimum of two (2) projects that are similar in scope and size to the proposed Brush Creek site 15 Rehabilitation Construction Project (each project shall be submitted on a separate document). These projects must have been completed during the past ten (10) years.

   f. Each document shall include but not limited to project description, scope, major items of work, contractee/owner, inspection company, and references.

Projects examples shall be provided exhibiting dam construction, rehabilitation, or repair, particularly those requiring similar construction practices to those required for this contract.

Project Examples and project information should be included to allow the WVCA to contact the contractees who were served in previous contracts (owners/agencies served).
This will give the WVCA the ability to assess the quality of the services provided. Examples of contractor's past performance on NRCS construction projects (or projects of similar nature may be substituted) should exhibit construction practices aligning with the work to be performed for the Brush Creek site 15 Rehabilitation Construction Project.
Examples should highlight measures implemented to meet construction milestones on schedule, as well as management techniques to meet or exceed the deliverables and requirements of the contract specifications.

g. Resume-style format of Qualifications. In addition to the contractor's licensing and qualifications set forth is this document, the contractor/subcontractor qualifications provided should identify key personnel in a resume-style format that have demonstrated expertise in past projects related to earthwork, concrete, project management, and other components necessary to meet the construction requirements.

   When the contractor utilizes subcontractors by choice or as the construction specifications require, the contractor is responsible for ensuring all subcontractors meet the professional licensing requirements as detailed in the construction specifications.

   A qualified contractor or subcontractor must meet the required experience to submit an eligible bid.

h. Documented experience of previous project requiring placement of roller compacted concrete (RCC). The contractor must be experienced in high hazard potential classified dam construction and/or rehabilitation. The contractor must provide documented experience provide documented experience of a previous project requiring mixing and placing of roller compacted concrete (RCC).

   If the contractor is choosing to subcontract the roller compacted concrete work, the documents submission must include separate qualifications, experience, and past performance of the subcontractor identified to complete the RCC work.
   The requirements of the construction personnel according to the construction specifications are as follows:

The Roller Compacted Concrete (RCC) Plant Operator shall be experienced in production of RCC with at least 1 project of similar quantity and scope within the past 3 years, or 2 jobs of similar quantity and scope within the past 5 years.

The contractor shall engage an independent third party to serve as RCC Quality Control Supervisor. The RCC Quality Control Supervisor shall be experienced in production and placement of RCC with at least 1 project of similar quantity and scope within the past 3 years, or 2 jobs of similar quantity and scope within the past 5 years.

The RCC Placement Foreman/Superintendent shall have at least one RCC project of similar quantity and scope in the last 5 years with at least 10 years of experience in earthwork.

The contractor is responsible for ensuring all subcontractors meet the minimum requirements of experience as detailed in the construction specifications.

The contractor may be disqualified from bidding if contractor fails to provide a project example of a previous dam construction, rehabilitation, or repair project with a large component of roller compacted concrete installation.

Where experience in NRCS assisted dam construction, rehabilitation, or repair projects is not available, projects of similar nature may be substituted.

5. **CONTRACT AWARD:** The Contract is intended to provide Agency with a purchase price for the Construction Services. The Contract will be awarded to the lowest qualified responsible bidder meeting the required specifications. If the Pricing Pages contain alternates/add-ons, the Contract will be awarded based on the grand total of the base bid and any alternates/add-ons selected.

6. **SELECTION OF ALTERNATES:** Pursuant to W. Va. Code § 5-22-1(f), any solicitation of bids shall include no more than five alternates. Alternates, if accepted, shall be accepted in the order in which they are listed on the bid form. Any unaccepted alternate contained within a bid shall expire 90 days after the date of the opening of bids for review. Determination of the lowest qualified responsible bidder shall be based on the sum of the base bid and any alternates accepted.

7. **PERFORMANCE:** Vendor shall perform the Construction Services in accordance with this document and the Project Plans, Exhibit B.

8. **SUBSTITUTIONS:** Any substitution requests must be submitted in accordance with the official question and answer period described in the INSTRUCTIONS TO VENDORS SUBMITTING BIDS, Paragraph 4. Vendor Question Deadline. Vendors submitting substitution requests should submit product brochures and product specifications during the official question and answer period.

9. **PROJECT PLANS:** The checked box will apply to Project Plans for this solicitation.

   ☐ **No Additional Project Plan Documents:** There are no additional Project Plans other than those attached hereto as Exhibit B or any subsequent addenda modifying Exhibit B.

   X **Additional Project Plan Documents:** There are additional Project Plan documents other than those attached as Exhibit B. The documents listed on Exhibit B are attached to the solicitation via wvOASIS Vendor Self Service portal. If you have any issues downloading the attachments, contact Larry McDonnell at Larry.D.McDonnell@wv.gov.

10. **FEDERAL ACQUISITION REGULATIONS – 52.211-18 VARIATION IN ESTIMATED QUANTITY:** As prescribed in Federal Acquisition Regulations (FAR) 11.703, Contract clauses, Variation in Estimated Quantity (Apr 1984), when a fixed-price construction contract is contemplated that authorizes a variation in the estimated quantity of unit priced items:

    If the quantity of a unit-priced item in this contract is an estimated quantity and the actual quantity of the unit-priced item varies more than 15 percent above or below the estimated quantity, an equitable adjustment in the contract price shall be made upon demand of either party. The equitable adjustment shall be based upon any increase or decrease in costs due solely to the variation above 115 percent or below 85 percent of the estimated quantity.

    If the quantity variation is such as to cause an increase in the time necessary for completion, the Contractor may request, in writing, an extension of time, to be received by the WVCA Contracting Officer within 10 days from the beginning of the delay (or within such further period as may be granted by the WVCA before the date of final settlement of the contract).

    Upon receipt of a written request for an extension, the WVCA Contracting Officer shall submit to WVCA to ascertain the facts and to decide if adjustment to extend the completion date is valid. The judgement of the WVCA shall be given to the WVCA Contracting Officer to place an official response.

11. CONDITIONS OF THE WORK

a. **Permits:** The Vendor shall procure all necessary permits and licenses to comply with all applicable Federal, State, or Local laws, regulations and ordinances of any regulating body.

   The contractor is responsible for any additional necessary permits and associated fees. The contractor shall, without additional expense to the West Virginia Purchasing Division, be responsible for codes, any necessary licenses/permits, and for complying with any applicable federal, state, and municipal laws, and regulations applicable to the performance of the work.

   The WVCA shall be responsible for obtaining all work rights of entry for the project. The contractor is permitted only to do the work outlined by the Oversight Engineer while completing work on-site under this contract. Any additional work requested by the landowner will occur only after the final inspection is completed by the WVCA and all

necessary permits and rights of entry for additional work must be obtained by the contractor or landowner.

The following permits have been obtained for Brush Creek Site 15:

I. WV DEP Dam Safety Certificate of Approval
II. USACOE Section 404 General Permit - Clean Water Act
III. WV DEP Section 401 Water Quality Certification
IV. WV DEP NPDES Construction Stormwater
V. WV DNR Public Lands Corp Stream Activity Application

b. **Land Rights:** Adequate land rights needed to perform the work under this contract have been acquired by, or on behalf of, the WVCA. The right to enter, remove, or otherwise make use of adjacent property, roads, utility lines, fences, and other improvements not included within the land rights provided shall be the sole responsibility of the contractor.

c. **Ingress and Egress:** The WVCA shall be responsible for obtaining all work rights-of-entry for the project. Where ingress and egress are not defined by the drawings, the vendor shall review the drawings and determine their recommendation for Ingress and Egress into a particular area of the project site and determine whether the ingress/egress should be used together or separately for entrance and exit purposes. The Oversight Engineer will review the vendor's proposal and provide a recommendation to the COR. The COR will designate the right-of-way to be used. The COR shall inform the CO who will provide an official response in writing as to the location and traffic pattern.

12. **PROJECT SITE:** The contractor is permitted only to do the work outlined in the drawings and in the specifications while completing work on-site under this contract. Any variations by the contractor in implementing the specifications or drawings without a modification will cause the work to be suspended. Upon identifying any variations, the Oversight Engineer will contact the Contracting Officer Representative (COR) to request that all work be halted at the project site. The Oversight Engineer will identify the variations made by the contractor to the drawings or specifications and inform the COR of the changes. The COR will meet with the contractor and inform them of the corrections needed before work continues.

    Any additional work requested by the partnership of this project (to include but not limited to State and Federal entities, the Mercer County Commission, and the Green Valley-Glenwood PSD) will only occur through an approved modification to the contract. Without modification, no work will be conducted outside the perimeters of the drawings and specifications.

    The State of West Virginia, the Purchasing Division, the State Conservation Committee, the WVCA, the Oversight Engineer, the Mercer County Commission, the Green Valley-Glenwood PSD, and the NRCS will not be held responsible or liable for any work or any resulting damage from work performed outside of the contract or work limits.

13. **Utility Identification:** It is the responsibility of the contractor before any ground-disturbing activities to place a telephone call to Miss Utility of West Virginia to ensure that utilities are

identified at the project site. You can also get additional information at their website at www.WV811.com. **To make contact, dial 811 or 1-800-245-4848.**

14. **Existing Conditions**: If discrepancies are discovered between the existing conditions and those noted in the specifications, Vendor must immediately notify the Agency's representative. Vendor must also immediately notify the Agency if suspected hazardous materials are encountered.

15. **Construction Schedule:** The construction contractor shall submit a construction schedule within 21 days following the contract award. Schedule should identify milestones that show a projected start date, substantial completion date, final completion date, and duration of critical activities that demonstrate an understanding of the timeline specified within this document and is consistent with the Brush Creek site 15 construction contract sequencing criteria. Major work areas such as the upstream embankment, downstream embankment, & auxiliary spillway at each site must be identified.

    The schedule shall be presented in a chart and graphical form. and a digital copy of the schedule shall be provided with each submission or update.

    The Gantt chart schedule shall be prepared in construction scheduling software that includes work activities linked together with logic between tasks. The start, finish, duration, and interdependent tasks shall be shown for each construction task.

    All liquidated damage milestones shall be shown in the schedule.

    The schedule shall also include the status of reservoir the pools (pool operating normally, being drained, drained, refilling, pool lowered, etc.) throughout the timeline of the construction period.

    The forty-six (46) bid line-items for Brush Creek Site 15 shall be included as scheduled tasks at a minimum (contractor can choose to include more items) to sufficiently detail the work to be performed. The schedule should assume a notice to proceed with field work of March 2, 2026.

    Preconstruction work activities such as preparation of submittals, work plans, continuous video monitoring set-up, and shop drawings are anticipated to occur between the contract award and notice to proceed dates.

    Following approval of the contractor initial schedule submission, the contractor shall expand the schedule to include the contractor and subcontractor resources and requirements for each task, identify and track bid schedule costs within tasks, and track the progress of all tasks. The schedule shall be updated and resubmitted with each monthly request for payment and as requested by the WVCA.

16. **Project Closeout**: Project Closeout shall include the following:

    a. The construction contractor shall participate in a "Substantial Completion Inspection" and a "Final Completion Inspection" prior to release from the contract. In each of these inspections, the COR, Oversight Engineer, and/or any additional subject matter expert(s)

designated by West Virginia Conservation Agency will participate as inspectors to identify any deficiencies.

b. Substantial Completion Inspection: The purpose of this inspection will be to identify deficiencies that need to be remedy prior to the Agency's final completion inspection. During this period the contractor is still obligated to perform in accordance with the contract and must take all actions necessary to ensure that work complies with the requirements of the contract prior to final acceptance.

c. Prior to the final completion inspection, the contractor shall complete a final clean-up of the project site. The contractor is responsible for removing and disposing of all unused and/or unnecessary materials and/or debris, off site and at the contractor's expense.

d. Final Completion Inspection: the purpose of this inspection will be to inspect those deficiencies found in the substantial completion inspection and verify that all deficiencies have been addressed. If all deficiencies have been corrected, final acceptance of the work will be given. The vendor shall submit any warranty documents to the Agency project manager at final inspection.

17. Mobilization and Demobilization:

The work shall consist of the mobilization and demobilization of the equipment and personnel necessary for performing the work required for the contract.

During mobilization, the construction of all temporary access roads will be completed as necessary to begin work on a substantial phase of the contract, when applicable. The cost for this will be included in the bid for mobilization and demobilization.

Mobilization may include additional buildings and other facilities (upon written approval of the WVCA Contracting Officer).

Also, during the mobilization process, the contractor shall include the establishment of the contractor's field office (field office is bid as a separate line item from the mobilization and demobilization line item. For Brush Creek site 15 is line item #45).

Demobilization shall include all activities involving removal from the sites of equipment, supplies, and personnel after completion of the work including cleanup of all rubbish and waste materials generated during the construction of this project; and restoration of any damage to existing site improvements resulting from the contractor's activities at the site.

Measurement and Basis of Payment for Mobilization and Demobilization: The line item shall be bid as a Lump Sum amount. Line-item number seven (7) on the Bid Schedule Sheet contains Mobilization and Demobilization.

Payment of Mobilization and Demobilization: Payment criteria is established in the technical specification CS8. It provides for a mobilization payment of 75% of the lump sum amount and a demobilization payment of 25% of the lump sum amount upon completion.

18. FACILITIES ACCESS: Performance of Contract Services may require access cards and/or keys to gain entrance to Agency's facilities. In the event that access cards and/or keys are required:

a. Vendor must identify principal service personnel which will be issued access cards and/or keys to perform service.

b. Vendor will be responsible for controlling cards and keys and will pay replacement fee, if the cards or keys become lost or stolen.

c. Vendor shall notify Agency immediately of any lost, stolen, or missing card or key.

d. Anyone performing under this Contract will be subject to Agency's security protocol and procedures.

e. Vendor shall inform all staff of Agency's security protocol and procedures.

19. GENERAL CONSTRUCTION SITE OPERATIONS:

a. START OF CONSTRUCTION:
The WVCA will issue a "Notice to Proceed" to the awarded contractor which provides for the start of work. Upon the contractor's receipt of the "Notice to Proceed", the awarded contractor will follow the Sequencing Document/construction schedule and begin work.

b. WORK TIMEFRAME:
The Pre-construction activities can begin following the receipt of the "Notice to Proceed". The on-site construction will start **March 02, 2026**, and conclude on the established "substantial completion date" of **December 30, 2027**.

An additional 30 days will be given to complete the rest of the work for final completion.

To assist the vendor, we have calculated the number of Total Available Workdays and the Total Available Non-Restricted Workdays between the two dates given above.

The total available workdays in 2026 are 206 workdays.
The total available workdays in 2027 are 246 workdays.

The non-restricted workdays in 2026 are 188 workdays.
The non-restricted workdays in 2027 are 174 workdays.

To derive at those numbers, the WVCA identified the **Total Number of Days** and then subtracted the total number of days in (a) **Non-Available Days** (Saturday, Sunday, Holidays) and then broke down further by calculating the number of days in (b) **Limited Construction Work Period**.

Total Number of Days: There are 669 days between the two dates with 305 days in 2026 and 364 days in 2027.

Non-Available Days: Days the WVCA has determined that the contractor will be off from work as a standard routine is Saturdays, Sundays, and Holidays. If during the construction season, the contractor wishes to work on these days, the contractor will need to seek approval from the WVCA and if approved a contract modification will be written.

Saturdays, Sundays Off: There are a total of forty-three (43) Saturdays off from work and forty-three (43) Sundays off from work in the calendar year 2026. There are a total of fifty-two (52) Saturdays off from work and fifty-two (52) Sundays off from work in the calendar year 2027.

Holidays Off: The holidays that will be observed in 2026 and 2027 are provided below for each of the two construction seasons. There is a total of thirteen (13) observed holidays in calendar year 2026. There is a total of fourteen (14) observed holidays in calendar year 2027. Additional mandated State and Federal holidays may be observed in addition to those listed below.

2026		2027
Primary Election Day* – May 12, 2026		**New Years Day** – January 01, 2027
Memorial Day – May 25, 2026		**Martin Luther King Jr. Day** – January 18, 2027
Juneteenth Day – June 19, 2026		**Presidents' Day** – February 15, 2027
Independence Day – July 3, 2026		**Memorial Day** – May 31, 2027
Labor Day – September 07, 2026		**Juneteenth Day** – June 18, 2027
Columbus Day – October 12, 2026		**West Virginia Day*** – June 21, 2027
General Election Day – November 3, 2026		**Independence Day** – July 5, 2027
Veterans' Day – November 11, 2026		**Labor Day** – September 6, 2027
Thanksgiving Day – November 26, 2026		**Columbus Day** – October 11, 2027
Day After Thanksgiving* – November 27, 2026		**Veterans' Day** – November 11, 2027
Christmas Eve* – December 24, 2026		**Thanksgiving Day** – November 25, 2027.
Christmas Day – December 25, 2026		**Day After Thanksgiving*** – November 26, 2027
New Years Eve* – December 31, 2026		**Christmas Eve*** (observed) – December 23, 2027
		Christmas Day (observed) – December 24, 2027

* West Virginia State Holidays.

Limited Construction Work Period: A winter shutdown is not required for the project; however, contractors should anticipate that winter weather conditions will impact the ability to perform work activities. In this contract, the limited construction work period is from December 14, 2026, through March 12, 2027.

During this timeframe the contractor must notify the Contracting Officer Representative (COR) to seek approval for any work activities they plan to complete during the limited construction work period. The COR, in consultation with the Oversight Engineer, will determine if that work can be completed based on the restrictions in the specifications and quality control requirements. The specifications and the quality control requirements will be strictly adhered to and may limit the work that can be performed during this period.

From December 14, 2026, through March 12, 2027, the WVCA has an estimated sixty-one (61) limited workdays (minus weekends and Holidays) in the "Limited Construction Work Period" for this contract.

Adverse Weather Days: Are not calculated into the total number of days available (As shown above in number 2). The design has an estimated sixty-five (65) days per construction season and should be assumed lost due to adverse weather conditions. This estimate is based on adverse weather conditions when rainfall **exceeded 0.1 - inches** of rain per day.

Contractors should plan for this amount of lost work time. Time extension for adverse weather conditions would only be considered by the WVCA if the contractor experiences delay that exceed the 65 days and is adequately supported by construction diaries, entries and site weather conditions.

c. **TIMEFRAME SUCCESS THROUGH STRICK ADHERENCE TO THE CONSTRUCTION SCHEDULE:** The WVCA has concluded that this contract can be completed during this timeframe that has been presented. Contractors should schedule the work in accordance with the Construction Sequencing Criteria and provide a workforce to complete the work within the identified timeframe.

Workweek: The WVCA expects that the standard for a workweek shall be at a minimum Monday through Friday.

Variations may be made to the Workweek schedule: Any variation to the work week (requesting to work weekends or holidays) shall be requested by the contractor. The contractor will make a request to the COR. The COR, in consultation with the Oversight Engineer, will decide on the proposal. If approved, the WVCA Contracting Officer (CO) will issue a change order.

Workday: The WVCA expects that the standard workday shall be at a minimum from 7:00 a.m. to 5:30 p.m. A mandatory lunch break of a minimum of 30 minutes will be taken by the contractor and crew each day.

Variations may be made to the Workday schedule: Any variation to the workday shall be requested by the contractor. One such variation would be the adjustment of the workday start time and end time based upon the time of year concerning Eastern Standard Time or Daylight Savings Time. Another such variation would be the use of Multiple Shifts.

The contractor may contemplate this option for multiple tasks to include, but not limited to, the Site 15 upstream berm work and the Roller Compacted Concrete (RCC) work.

The contractor will make a request to the COR. The COR, in consultation with the Oversight Engineer, will decide on the proposal. If approved, the WVCA Contracting Officer (CO) will issue a change order.

Multiple Shifts: To implement multiple shifts, the contractor will make a request to the Contracting Officer Representative (COR). The COR, in consultation with the Oversight Engineer, will decide on the proposal. If approved, the WVCA Contracting Officer (CO) will issue a change order.

When multiple shifts are approved by the WVCA, the number of shifts and the number of hours per shift will be determined and placed into a change order.

The contractor will have an experienced and acceptable workforce on-site during this time.

Also, the contractor will have equipment in serviceable and operating condition on-site during this time.

d. **AUTHORITY OF THE CONTRACTING OFFICER REPRESENTATIVE (COR):** Is responsible for assisting the Contracting Officer (CO) in managing and overseeing a specific contract, acting as the CO's representative at the project site. The COR serves as the primary point of contact on the project site. The COR will direct discussions between the government and the contractor at the project site. The COR will facilitate communications from the project site which includes communications from the contractor to the CO and from the Oversight Engineer to the CO.

The COR will monitor the performance of all personnel at the project site, ensure quality standards are met. The COR ensures the contractor fulfills the contract's technical and performance requirements by comparing the contractor's work to the construction specification, drawings, permits, and construction timeline. To ensure this the COR will implement the following:

(a) Communicate daily with the Oversight Engineer on implementation of the construction specification, drawings by the contractor.
(b) Discuss the implementation of the Quality Assurance Plan with the Oversight Engineer.
(c) Ensure all operations continue to move forward each day.
(d) Elevate issues and concerns to the Contracting Officer.
(e) Monitor work on the ground versus the Construction Timeline and any variance needs to be elevated.
(f) Call for the removal of any individual interfering with project operations.

(h) Document daily construction activities, including daily job diary entries, photos, and videos.
(i) Is the lead representative for the WVCA during the update meetings with the contractor, oversight engineer, and project stakeholders.

e. **AUTHORITY OF THE OVERSIGHT ENGINEER:** Is responsible for construction oversight by providing technical guidance and quality assurance to the WVCA on implementation of all construction related activities. Ensuring work on the ground adherence to standards of all construction documents and to the highest standards of quality, safety, and efficiency as follows:

(a) Implement the Quality Assurance Plan, including, but not limited to surveying, material testing, construction observation, inspections, and record keeping.
(b) Ensure all tasks follow the drawings and specifications. Any variation is to be reported to the COR.
(c) Oversee quality control inspections and tests performed by the vendor.
(d) Prepare (as-built) drawings.
(e) Review vendor submittals and coordinate the submittal review responses with project stakeholders.
(f) Review and verifying vendor survey notes for compliance with contract documents.
(g) Document daily construction activities, including daily job diary entries, photos, and videos.
(h) Monitor pollution control measures for compliance with the NPDES permit, state and local regulations.
(i) Monitor safety plan and construction schedule.
(j) Processing the pay estimates, as required by WVCA, and assist with pay-roll-related contract requirements.
(k) Provide independent cost estimates for contract modifications and changes.
(l) Coordinates and leads updating meetings with the contractor and project stakeholders.

Dispute Management: Any disagreements between the Contractor and the Oversight Engineer on interpretation of the drawings and specifications made by the Oversight Engineer will be elevated to the COR. The decision of the COR with a written response from the WVCA Contracting Officer will be final.

Obligating the State: The Oversight Engineer is not authorized to increase the obligation of the State of West Virginia, the State Conservation Committee, the WVCA, the Oversight Engineer, the Mercer County Commission, and the Green Valley-Glenwood PSD in this contract unless a Change Order is issued changing the obligations.

20. PROJECT OVERSIGHT: The contractor shall contact the WVCA and coordinate prior to mobilization to the site. The contractor shall meet with the COR and the Oversight Engineer at the site prior to the start of work.

Performance: Work shall be performed by the contractor as shown in the work drawings and as stated in the work specifications. The COR will provide oversight with consultation from the Oversight Engineer, to ensure drawings and specifications are followed.

Safety: Safety is a top priority, and any unsafe condition or act shall immediately shut down operations at the project site. This action can be announced by the WVCA, COR, or the Oversight Engineer. Work will resume when the COR determines the condition, or act has been corrected and gives the order for work to restart.

Suspension of Work: The COR, with consultation from the Oversight Engineer, may suspend the work, in whole or in part, for such time as the COR deems it necessary to prevent unsafe conditions for the employees or the public, or for any other condition or reason deemed to be of public interest.

All such suspension orders will be verbally stated to the contractor by the COR and work will cease immediately. A written suspension order from the CO to the contractor will follow the verbal order.

The COR may suspend the work, in whole or in part, for such time as the COR deems it necessary because of contractor shortfalls (inefficient operation, equipment not in good operating condition, or any condition or circumstance that is considered unsatisfactory for the performance of the work), unsatisfactory work performance, or failure of the contractor to comply with any of the requirements of this contract. Work suspension due to contractor shortfalls will not extend the end date established in this contract.

The COR may suspend the work, in whole or in part, for such time as the COR deems it necessary because of adverse weather conditions (the weather that places the contractor's staff and agency staff in harm's way or conditions that will cause equipment to do damage to the structure during operations). Adverse weather conditions exceeding the stated 65 days will cause the creation of a change order to adjust schedule and Liquidated damages.

Extension of Contract beyond Established End Date: If in order to complete the project it requires the contract end date is extended, a determination will be made as to if it was a result of Contractor Shortfall or Adverse Weather/ "Act of God".

If it is determined to be Contractor Shortfall based on COR/Oversight Engineer documentation (daily work log showing no work when work could have been completed), the contractor will not be additionally monetarily compensated for expenses incurred by the contractor for work beyond the established end date.

If it is determined to be Adverse Weather/"Act of God" based on COR/Oversight Engineer documentation (daily work log showing that work could not proceed for more than the allotted adverse weather/"Act of God" days [65 days]) or the contractor can provide evidence that the delay was due to conditions outside the control of the contractor, the contractor shall be entitled to seek additional monetarily compensated for expenses incurred by the contractor for work beyond the established end date. This action will cause the creation of a change order to adjust compensation.

Increase Cost over the life of the Project: If, during the course of the project, the contractor can show valid justification for increased costs due to unforeseen events in the World, the contractor shall be entitled to seek additional monetarily compensated for expenses incurred by the contractor for increased costs of more than 15% above the original bid on materials. Also, if the Oversight Engineer determines during the course of work that additional work must be added to complete the project, the contractor shall be entitled to seek additional monetarily compensated for expenses incurred by the contractor for increased costs Thess actions will cause the creation of a change order to adjust compensation.

21. **THE WEST VIRGINIA CONSERVATION AGENCY INSPECTIONS AND TESTING:** All work (which term includes but is not restricted to materials, workmanship, and manufacture and fabrication of components) shall be subject to inspection and testing by the WVCA at all reasonable times and at places before acceptance. Any such inspection and testing are for the sole benefit of the WVCA and shall not relieve the contractor of the responsibility of providing quality control measures to ensure that the work strictly complies with the contract requirements.

    No inspections or tests by the WVCA shall be construed as constituting or implying acceptance. Inspections or tests shall not relieve the contractor of responsibility for damage to or loss of the material before acceptance, nor in any way affect the continuing rights of the WVCA after acceptance of the completed work.

22. **INSPECTIONS OF CONSTRUCTION:** The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. The Contractor shall maintain complete inspection records and make them available to the Oversight Engineer and the WVCA. All work shall be conducted under the general observation of the Oversight Engineer and is subject to inspections and tests by the Oversight Engineer and the WVCA at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract.

    Such inspections and tests are for the sole benefit of the WVCA and do not:
    (a) Relieve the contractor's responsibility for providing adequate quality control measures.
    (b) Relieve the contractor's responsibility for damage to or loss of the material before acceptance.
    (c) Constitute or imply acceptance.
    (d) Affect the continuing rights of the State and Federal Government after acceptance of the completed work under the last paragraph of this section.

    The presence or absence of an inspector does not relieve the contractor from any contract requirement. No inspector is authorized to change any term or condition of the contract, specification, or drawings without written authorization (modification/change order).

    The WVCA may charge the contractor any additional cost of inspection or test when work is not ready at the time specified by the contractor for inspection or test, or when prior rejection makes re-inspection or retest necessary.

The Oversight Engineer and the COR shall perform all inspections and tests in a manner that will not unnecessarily delay the work. All special, full-size, and performance tests shall be performed as described in the contract.

The contractor shall, without charge, replace or correct work found by the COR and/or Oversight Engineer which does not conform to contract requirements, unless, in the public interest, the WVCA consents to accept the work with an appropriate adjustment in the contract price. The contractor shall promptly segregate and remove rejected material from the premises.

If the contractor does not promptly replace or correct rejected work, the WVCA may:

(a) By contract or otherwise, replace or correct the work and charge the cost to the contractor.
(b) Terminate for default the contractor's right to proceed.

If, before acceptance of the entire work, the COR and the Oversight Engineer decide to examine already completed work by removing it or tearing it out, the contractor, on request, shall promptly furnish all necessary facilities, labor, and material.

If the work is found to be defective or nonconforming in any material respect due to the fault of the contractor or its subcontractors, the contractor shall defray the expenses of the examination and of satisfactory reconstruction.

However, if the work is found to meet contract requirements, the WVCA shall make an equitable adjustment for the additional services involved in the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

Unless otherwise specified in the contract, the Oversight Engineer and the WVCA shall accept, as promptly as practicable after completion and inspection, all work required by the contract or that portion of the work the WVCA determines to be accepted separately.

Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the State of West Virginia, the State Conservation Committee, the WVCA, the Oversight Engineer, the Mercer County Commission, and the Green Valley-Glenwood PSD' rights under any warranty or guarantee.

23. **CONTRACTOR'S RESPONSIBILITIES:** The contractor is responsible for ensuring the safe and efficient execution of the project and its supervisors overseeing the entire construction process. The contractor will accomplish this through adhering to the contract documents, project management, maintaining high standards of quality and safety throughout the construction process, planning, executing, overseeing, and inspecting the project from start to finish, coordinating subcontractors, and providing materials and labor, and managing budgets and timelines. This encompasses various tasks, from initial planning and coordination to final completion and closeout.

Key Responsibilities of a Contractor: In 9.1.2 through 9.1.14 are some of the items of responsibility the contractor has in this project and include, but not limited to, the following:

Project Management: This includes planning, scheduling, and overseeing all aspects of the construction project, ensuring it stays on track and within budget.

Safety: Implementing and maintaining a safe working environment for all personnel, adhering to safety regulations, conducting regular safety inspections, and that all workers are properly trained and equipped.

Planning and Coordination: Integrating erosion and sediment control practices into the project plan, coordinating with relevant authorities (state, local, and federal), and ensuring all work aligns with the contract documents.

Quality Control: Upholding the highest quality standards throughout the project, from material selection to construction methods. This involves close observation of construction activities, adherence to specifications, and timely reporting of any deviations.

Communication: Contractors need to effectively communicate with all stakeholders, including clients, subcontractors, and suppliers, to keep everyone informed and address any issues that arise.

Schedule Management: Developing and maintaining a construction schedule and monitoring progress to ensure the project stays on track.

Materials and Equipment: Providing the necessary materials and equipment for the project and managing their delivery and storage on the job site.

Legal and Regulatory Compliance: Ensuring all work complies with relevant laws, regulations, and building codes.

Budget Management: Contractors are responsible for managing project costs, tracking expenses, and ensuring the project stays within the allocated budget.

Hiring and Procurement: Contractors may be responsible for hiring employees, as well as procuring necessary materials and equipment from vendors.

Subcontractor Management: Contractors hire and manage subcontractors, ensuring their work is completed to the required specifications and the quality of work performed by subcontractors achieves the required standards. All within the agreed-upon timeframe.

Change Orders: Managing any changes to the original project scope, including documenting requests, negotiating costs, and ensuring the changes are properly incorporated into the project plan.

Project Construction Site: The contractor will take all reasonable actions to observe and understand the project site. This includes site conditions throughout the life of the project.

Site Investigation and Conditions Affecting the Work: The contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions that can affect the work or its cost, including but not limited to (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, electric power, and roads; (3) uncertainties of weather, groundwater levels, stream stages, river stages, or similar physical conditions at the site; (4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance.

The contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the government, as well as from the drawings and specifications made a part of this contract. Any failure of the contractor to take the actions described and acknowledged in this paragraph will not relieve the contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the State of West Virginia, the State Conservation Committee, the WVCA, the Oversight Engineer, the Mercer County Commission, and the Green Valley-Glenwood PSD.

The State of West Virginia, the Purchasing Division, the State Conservation Committee, the WVCA, the Oversight Engineer, the Mercer County Commission, and the Green Valley-Glenwood PSD assume no responsibility for any conclusions or interpretations made by the contractor based on the information made available by this group. Nor does this group assume responsibility for any understanding reached or representation made concerning conditions, which can affect the work by any of its officers or employees before the execution of this contract, unless that understanding, or representation is expressly stated in this contract.

Differing Site Conditions Pre-Construction: The contractor shall promptly, and before the conditions are disturbed (start of work), give written notice to the Oversight Engineer and the COR that site conditions have so dramatically changed since the job showing that the site now differs from those indicated in this contract.

The Oversight Engineer shall investigate the site conditions promptly after receiving the notice and provide a written report to the COR.

If, in the opinion of the Oversight Engineer, site conditions have so dramatically changed since the job showing that the site now differs from those indicated in this contract and causes an increase or decrease in the contractor's cost of, or the time required for, performing any part of the work under this contract, the Oversight Engineer will indicate any additional cost or additional time required to complete the project.

If, in the opinion of the Oversight Engineer, site conditions have not changed since the job showing, the Oversight Engineer will report what was found during the site investigation.

Based upon the Oversight Engineer's report, the WVCA will decide on whether differing site conditions exist or not. If differing site conditions exist, the WVCA will determine if the equitable adjustment is justified under this clause and will decide if a contract modification/change order is needed. Also, the WVCA will decide if a financial change to the contract is needed and incorporate it into the modification/change order.

The Change Order will be signed by the WVCA Contracting Officer and sent out for implementation.

If it is determined that the site changes identified do not pose a threat or change to the outcome if work continues, the WVCA Contracting Officer will provide a statement in writing that the conditions are safe to continue. The contractor will continue to work with no modification/change order.

If differing site conditions do not exist in the opinion of the WVCA, the WVCA Contracting Officer will provide a written statement that no differing site conditions could be found, and no modification will be written.

No request by the contractor for an equitable adjustment to the contract for the differing site conditions shall be allowed if done after the work is completed in the area of suspected differing site conditions and after the final inspection is completed.

Differing Site Conditions During Construction: If the contractor comes across conditions that are so different from those presented in the construction design reports, specifications and drawings, the contractor shall stop work and promptly give written notice to the Oversight Engineer and the COR that these differing site conditions exist, and the design can no longer be followed.

The Oversight Engineer shall investigate the site conditions promptly after receiving the notice and provide a written report to the COR.

If, in the opinion of the Oversight Engineer, site conditions have so dramatically changed from the design reports, specifications, or drawings, that the site now differs from those indicated in the design documents and will cause an increase or decrease in the contractor's cost of, or the time required for, performing any part of the work under this contract, the Oversight Engineer will indicate any additional cost or additional time required to complete the project.

If, in the opinion of the Oversight Engineer, site conditions have not changed in comparison to the design documents, the Oversight Engineer will report what was found during the site investigation.

Based upon the Oversight Engineer's report, the WVCA will decide on whether differing site conditions exist or not. If differing site conditions exist, the WVCA will determine if the equitable adjustment is justified under this clause and will decide if a contract modification/change order is needed. Also, the WVCA will decide if a financial change to the contract is needed and incorporate it into the modification/change order.

The Change Order will be signed by the WVCA Contracting Officer and sent out for implementation.

If it is determined that the site changes identified do not pose a threat or change to the outcome if work continues, the WVCA Contracting Officer will provide a statement in writing that the conditions are safe to continue. The contractor will continue to work with no modification/change order.

If differing site conditions do not exist in the opinion of the WVCA, the WVCA Contracting Officer will provide a written statement that no differing site conditions could be found, and no modification will be written.

No request by the contractor for an equitable adjustment to the contract for the differing site conditions shall be allowed if done after the work is completed in the area of suspected differing site conditions and after the final inspection is completed.

24. CONTRACTOR'S PERFORMANCE OF WORK: The contractor is responsible for the means, methods, techniques, sequences, or procedures of work. It is contemplated that the contractor will furnish the necessary personnel/skilled labor, material, equipment, services, and facilities (except as otherwise specified) to perform the Statement of Work/Specifications, and all other items necessary for the successful completion of work. The contractor shall give the work the constant attention necessary to facilitate progress.

Contractor Management: The contractor shall always have on the work site a competent superintendent capable of reading and thoroughly understanding the plans and specifications. One who is thoroughly experienced in the type of work being performed and who will effectively communicate and consult with the Contracting Officer Representative (COR) and the Oversight Engineer.

On contractual matters, the contractor shall go through the COR who shall elevate it to the CO. The CO, in consultation with the WVCA Procurement Officer and the West Virginia Purchasing Division, provide a response to all contract questions.

The contractor shall provide a list of addresses and telephone numbers of their personnel who may be reached in case of emergency during hours when no work is to be performed to the COR.

On weekends, holidays, suspensions of work, and the occurrence of storms, the contractor shall alert certain members of their personnel to stand by and inform the COR of arrangements made.

Workforce: The contractor shall perform work on the site (the contractor and his or her employees) equivalent to at least 15 percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement to this contract if, during the performance of the work, the contractor requests a reduction, and the WVCA determines that the reduction would be to the advantage of the government.

An employee of the contractor is an individual for whom the contractor withholds, and pays, employment taxes (FICA). All others will be considered Subcontractors. The West Virginia Purchasing Division or the WVCA reserves the right to require successful contractors to produce evidence showing the payment of employment taxes for all onsite workers.

Equipment Operators: The contractor shall at all times employ sufficient equipment operators to prosecute the several classes of work to full completion in the manner and time required by these specifications.

Qualified Operator: The contractor shall provide qualified operators. Unqualified or inefficient operators shall immediately be replaced at the discretion of the COR in consultation with the Oversight Engineer. Should a contractor fail to remove such a person, or people as required above or fail to furnish suitable and sufficient personnel for the proper prosecution of the work, the WVCA may suspend the work by written notice until such order is complied with.

Laborers: The contractor shall always employ sufficient labor for prosecuting the several classes of work to full completion in the manner and time required by these Specifications. All employees will have sufficient skill and experience to perform the work assigned to them

properly. Employees engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform all work properly and satisfactorily.

Disorderly or Threating Laborer: Any person who, in the opinion of the COR and in consultation with the Oversight Engineer, is disorderly or deemed a threat to another employee of the contractor, an employee of NRCS, an employee of the State of West Virginia, a member of the State Conservation Committee, an employee of the WVCA, an employee of the Oversight Engineer, a member of the Mercer County Commission, an employee of Green Valley-Glenwood PSD, or to the general public shall, at the request of the COR, be removed forthwith.

Any contractor employing such a person shall not reemploy such person on the project without the written approval of the WVCA Contracting Officer. Should a contractor fail to remove such a person, or people as required above or fail to furnish suitable and sufficient personnel for the proper prosecution of the work, the WVCA may suspend the work by written notice until such order is complied with.

Equipment: The contractor shall always provide enough equipment for prosecuting the several classes of work to full completion in the manner and time required by these specifications. Equipment will be of sufficient size and in such a mechanical condition as to meet the requirements of the work and to produce a satisfactory quality of work.

Mounted or attached equipment shall be customarily manufactured for the respective size of the tractor being offered. Backhoe(s) and excavator(s) shall have mounted or attached equipment that is customarily manufactured for the respective size of the backhoe or excavator being offered.

Horsepower shall be flywheel horsepower rating. Horsepower and bucket capacities shall be listed in the current edition of Rental Rate Blue Book for Construction Equipment (Published by Dataquest) or similar reliable reference approved by the WVCA. The equipment should not deviate from the minimum and/or maximum horsepower specified in the Bid Schedule of this invitation to be considered as being acceptable to the terms of the contract. Equipment used on any portion of the project shall be such that no injury to the adjacent property will result from its use.

All equipment shall be maintained in a proper working condition and shall be free of any fluid leaks. Equipment in need of repair that prohibits work to its full potential shall be immediately replaced. The contractor shall provide all the oil and lubricants and perform the required maintenance promptly.

Personal Protective Equipment (PPE): At a minimum, all workers and contractor management on the project site shall have Hard Hats, Safety shirts/vests, Steel-toe boots, and safety goggles/glasses.

Hard Hat Areas: The entire job site, except for offices, shall be considered a Hard Hat Area. All people entering this area, without exception, are required to wear hard hats. This is a safety issue and all personnel on site shall ensure all visitors entering hard hat areas are wearing hard hats. This will be supervised by the contractor and the COR. If someone enters the hard hat

area without wearing a hard hat, work will cease, and the individual will be escorted outside the hard hat area before work can continue.

Labels for hard hats shall bear a manufacturer's label indicating design compliance with the appropriate ANSI (American National Standards Institute) standard.

Safety Shirt/Vest: Safety shirts or vests shall be worn, at all times, on the entire job site. Any person entering the designed work area is, without exception, required to wear a safety shirt or vest. The contractor and the Oversight Engineer shall ensure all visitors entering the work area comply. If someone enters the identified work area without wearing a safety shirt or vest, work will cease, and the individual will be escorted outside the work area before work can continue.

Steel-toe boots: Steel-toe boots should be worn, at all times, on the entire job site. All people entering the area are, without exception, required to wear Steel-toe boots.

Safety Goggles/Glasses: Safety glasses should be worn at all times unless operating equipment with an enclosed cab. A face shield should be used, in addition to safety glasses, when operating a string/brush trimmer and other times when your face could be hit by debris. All personnel involved in or within 100 feet (33 yards) diameter around the working area of brush removal and tree removal must wear protective safety goggles/glasses.

Chainsaw Chaps: Chainsaw chaps refer to a type of personal protective equipment (PPE) that is to be worn by anyone using a chainsaw on the project site.

25. **CONTINUOUS VIDEO MONITORING:** The contractor will be required to supply and provide maintenance services on two (2) trailer mounted cameras to be placed at locations at the discretion of the Oversight Engineer. Each camera must meet the requirements set forth in the CONSTRUCTION SPECIFICATION 96-FIELD OFFICE.

In this specification - The Contractor shall provide cameras for real-time remote monitoring of construction activities.

Brush Creek Site 15 Cameras: The specification requirement will be connected to Bid Schedule Sheet Site 15, bid line-item number 45 (Field Office) to provide two (2) trailer mounted cameras at this site.

26. MISCELLANEOUS:

26.1 Contract Manager: During its performance of this Contract, Vendor must designate and maintain a primary contract manager responsible for overseeing Vendor's responsibilities under this Contract. The Contract manager must be available during normal business hours to address any customer service or other issues related to this Contract. Vendor should list its Contract manager and his or her contact information below.

EXHIBIT B – PROJECT PLANS

Exhibit B – Project Plans – PDF files attached to solicitation include:

1. BC15 Drawings
2. BC15 Specifications
3. BC15 Construction Sequencing Criteria
4. BC15 As-Built Drawings
5. BC15 Geotechnical Investigation Report
6. BC 9-14-15 Geophysical Report
7. BC15 Piezometer Data Summary
8. NRCS Supplement to OSHA Parts 1910 and 1926
9. 2024-09-27 BC15 Operation and Maintenance Plan
10. 2024-09-27 BC15 Quality Assurance and Inspection Staffing Plan

EXHIBIT C – LIQUIDATED DAMAGES

LIQUIDATED DAMAGES:

Liquidated damages are not punitive and are not negative performance incentives. Liquidated damages are used to compensate the WVCA for calculable damages. Therefore, the liquidated damages rate will be based upon those identified costs that the State of West Virginia, the State Conservation Committee, the WVCA, the Oversight Engineer, Mercer County Commission, and Green Valley-Glenwood PSD acquire because the contractor failed to work within the time specified in the contract to meet milestones and to complete all aspects of the contract by the established date. **Liquidated Damages have been calculated at the following rates for milestones and completion of project:**

Project Completion

- **Site 15** – If all work is not completed within four or less consecutive construction seasons, ending December 30, 2027, the rate of LD will be **$ 4,183.^{33} per day**.

Milestones

- **Site 15** – If the Site 15 reservoir draining, upstream riprap berm installation, and riser work is not completed by December 30, 2026, of the current construction season, the rate of LD will be **$ 2,500.00 per day**.

FEDERAL FUNDS ADDENDUM

2 C.F.R. §§ 200.317 – 200.327

Purpose: This addendum is intended to modify the solicitation in an attempt to make the contract compliant with the requirements of 2 C.F.R. §§ 200.317 through 200.327 relating to the expenditure of certain federal funds. This solicitation will allow the State to obtain one or more contracts that satisfy standard state procurement, state federal funds procurement, and county/local federal funds procurement requirements.

Instructions: Vendors who are willing to extend their contract to procurements with federal funds and the requirements that go along with doing so, should sign the attached document identified as: "REQUIRED CONTRACT PROVISIONS FOR NON-FEDERAL ENTITY CONTRACTS UNDER FEDERAL AWARDS (2 C.F.R. § 200.317)"

Should the awarded vendor be unwilling to extend the contract to federal funds procurement, the State reserves the right to award additional contracts to vendors that can and are willing to meet federal funds procurement requirements.

Changes to Specifications: Vendors should consider this solicitation as containing two separate solicitations, one for state level procurement and one for county/local procurement.

State Level: In the first solicitation, bid responses will be evaluated with applicable preferences identified in sections 15, 15A, and 16 of the "Instructions to Vendors Submitting Bids" to establish a contract for both standard state procurements and state federal funds procurements.

County Level: In the second solicitation, bid responses will be evaluated with applicable preferences identified in Sections 15, 15A, and 16 of the "Instructions to Vendors Submitting Bids" omitted to establish a contract for County/Local federal funds procurement.

Award: If the two evaluations result in the same vendor being identified as the winning bidder, the two solicitations will be combined into a single contract award. If the evaluations result in a different bidder being identified as the winning bidder, multiple contracts may be awarded. The State reserves the right to award to multiple different entities should it be required to satisfy standard state procurement, state federal funds procurement, and county/local federal funds procurement requirements.

State Government Use Caution: State agencies planning to utilize this contract for procurements subject to the above identified federal regulations should first consult with the federal agency providing the applicable funding to ensure the contract is complaint.

County/Local Government Use Caution: County and Local government entities planning to utilize this contract for procurements subject to the above identified federal regulation should first consult with the federal agency providing the applicable funding to ensure the contract is complaint. For purposes of County/Local government use, the solicitation resulting in this contract was conducted in accordance with the procurement laws, rules, and procedures governing the West Virginia Department of Administration, Purchasing Division, except that vendor preference has been omitted for County/Local use purposes and the contract terms contained in the document entitled "REQUIRED CONTRACT PROVISIONS FOR NON-FEDERAL ENTITY CONTRACTS UNDER FEDERAL AWARDS (2 C.F.R. § 200.317)" have been added.

FEDERAL FUNDS ADDENDUM

REQUIRED CONTRACT PROVISIONS FOR NON-FEDERAL ENTITY CONTRACTS UNDER FEDERAL AWARDS (2 C.F.R. § 200.317):

The State of West Virginia Department of Administration, Purchasing Division, and the Vendor awarded this Contract intend that this Contract be compliant with the requirements of the Procurement Standards contained in the Uniform Administrative Requirements, Cost Principles, and Audit Requirements found in 2 C.F.R. § 200.317, et seq. for procurements conducted by a Non-Federal Entity. Accordingly, the Parties agree that the following provisions are included in the Contract.

1. **MINORITY BUSINESSES, WOMEN'S BUSINESS ENTERPRISES, AND LABOR SURPLUS AREA FIRMS:**
(2 C.F.R. § 200.321)

    a. The State confirms that it has taken all necessary affirmative steps to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible. Those affirmative steps include:

        (1) Placing qualified small and minority businesses and women's business enterprises on solicitation lists;
        (2) Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources;
        (3) Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses, and women's business enterprises;
        (4) Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority businesses, and women's business enterprises;
        (5) Using the services and assistance, as appropriate, of such organizations as the Small Business Administration and the Minority Business Development Agency of the Department of Commerce; and
        (6) Requiring the prime contractor, if subcontracts are to be let, to take the affirmative steps listed in paragraphs (1) through (5) above.

    b. Vendor confirms that if it utilizes subcontractors, it will take the same affirmative steps to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible.

2. **DOMESTIC PREFERENCES:**
(2 C.F.R. § 200.322)

    a. The State confirms that as appropriate and to the extent consistent with law, it has, to the greatest extent practicable under a Federal award, provided a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United

States (including but not limited to iron, aluminum, steel, cement, and other manufactured products).

b. Vendor confirms that will include the requirements of this Section 2. Domestic Preference in all subawards including all contracts and purchase orders for work or products under this award.

c. Definitions: For purposes of this section:

(1) "Produced in the United States" means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.
(2) "Manufactured products" means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.

3. **BREACH OF CONTRACT REMEDIES AND PENALTIES:**
(2 C.F.R. § 200.327 and Appendix II)

(a) The provisions of West Virginia Code of State Rules § 148-1-5 provide for breach of contract remedies, and penalties. A copy of that rule is attached hereto as Exhibit A and expressly incorporated herein by reference.

4. **TERMINATION FOR CAUSE AND CONVENIENCE:**
(2 C.F.R. § 200.327 and Appendix II)

(a) The provisions of West Virginia Code of State Rules § 148-1-5 govern Contract termination. A copy of that rule is attached hereto as Exhibit A and expressly incorporated herein by reference.

5. **EQUAL EMPLOYMENT OPPORTUNITY:**
(2 C.F.R. § 200.327 and Appendix II)

Except as otherwise provided under 41 CFR Part 60, and if this contract meets the definition of "federally assisted construction contract" in 41 CFR Part 60–1.3, this contract includes the equal opportunity clause provided under 41 CFR 60–1.4(b), in accordance with Executive Order 11246, "Equal Employment Opportunity" (30 FR 12319, 12935, 3 CFR Part, 1964–1965 Comp., p. 339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

6. **DAVIS-BACON WAGE RATES:**
(2 C.F.R. § 200.327 and Appendix II)

Vendor agrees that if this Contract includes construction, all construction work in excess of $2,000 will be completed and paid for in compliance with the Davis–Bacon Act (40 U.S.C. 3141–3144, and 3146–3148) as supplemented by Department of Labor regulations (29 CFR Part 5, "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction"). In accordance with the statute, contractors must:

(a) pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor.
(b) pay wages not less than once a week.

A copy of the current prevailing wage determination issued by the Department of Labor is attached hereto as Exhibit B. The decision to award a contract or subcontract is conditioned upon the acceptance of the wage determination. The State will report all suspected or reported violations to the Federal awarding agency.

7. **ANTI-KICKBACK ACT:**
(2 C.F.R. § 200.327 and Appendix II)

Vendor agrees that it will comply with the Copeland Anti-KickBack Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). Accordingly, Vendor, Subcontractors, and anyone performing under this contract are prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The State must report all suspected or reported violations to the Federal awarding agency.

8. **CONTRACT WORK HOURS AND SAFETY STANDARDS ACT**
(2 C.F.R. § 200.327 and Appendix II)

Where applicable, and only for contracts awarded by the State in excess of $100,000 that involve the employment of mechanics or laborers, Vendor agrees to comply with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, Vendor is required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

9. **RIGHTS TO INVENTIONS MADE UNDER A CONTRACT OR AGREEMENT.**
(2 C.F.R. § 200.327 and Appendix II)

If the Federal award meets the definition of "funding agreement" under 37 CFR § 401.2 (a) and the recipient or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that "funding agreement," the recipient or subrecipient must comply with the requirements of 37 CFR Part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the awarding agency.

10. **CLEAN AIR ACT**
(2 C.F.R. § 200.327 and Appendix II)

Vendor agrees that if this contract exceeds $150,000, Vendor is to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401–7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251–1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

11. **DEBARMENT AND SUSPENSION**
(2 C.F.R. § 200.327 and Appendix II)

The State will not award to any vendor that is listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), "Debarment and Suspension." SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.

12. **BYRD ANTI–LOBBYING AMENDMENT**
(2 C.F.R. § 200.327 and Appendix II)

Vendors that apply or bid for an award exceeding $100,000 must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Each tier must also disclose any lobbying with non–Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non–Federal award.

13. PROCUREMENT OF RECOVERED MATERIALS
(2 C.F.R. § 200.327 and Appendix II; 2 C.F.R. § 200.323)

Vendor agrees that it and the State must comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act. The requirements of Section 6002 include procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds $10,000 or the value of the quantity acquired during the preceding fiscal year exceeded $10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.

14. PROHIBITION ON CERTAIN TELECOMMUNICATIONS AND VIDEO SURVEILLANCE SERVICES OR EQUIPMENT.
(2 C.F.R. § 200.327 and Appendix II; 2 CFR § 200.216)

Vendor and State agree that both are prohibited from obligating or expending funds under this Contract to:

(1) Procure or obtain;
(2) Extend or renew a contract to procure or obtain; or
(3) Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Public Law 115–232, section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

(i) For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).
(ii) Telecommunications or video surveillance services provided by such entities or using such equipment.
(iii) Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

In implementing the prohibition under Public Law 115–232, section 889, subsection (f), paragraph (1), heads of executive agencies administering loan, grant, or subsidy programs shall prioritize available funding and technical support to assist affected businesses, institutions and organizations as is reasonably necessary for those affected entities to transition from covered communications equipment and services, to procure replacement equipment and services, and to ensure that communications service to users and customers is sustained.

State of West Virginia Purchasing Division	Vendor Name:
By: _____	By: _____
Printed Name: _____	Printed Name: _____
Title: _____	Title: _____
Date: _____	Date: _____

EXHIBIT A To:
REQUIRED CONTRACT PROVISIONS FOR NON-FEDERAL ENTITY CONTRACTS UNDER FEDERAL AWARDS (2 C.F.R. § 200.317):

W. Va. CSR § 148-1-5

West Virginia Code of State Rules
Title 148. Department of Administration
Legislative Rule (Ser. 1)
Series 1. Purchasing

W. Va. Code St. R. § 148-1-5
§ 148-1-5. Remedies.
Currentness

5.1. The Director may require that the spending unit attempt to resolve any issues that it may have with the vendor prior to pursuing a remedy contained herein. The spending unit must document any resolution efforts and provide copies of those documents to the Purchasing Division.

5.2. Contract Cancellation.

5.2.1. Cancellation. The Director may cancel a purchase or contract immediately under any one of the following conditions including, but not limited to:

5.2.1.a. The vendor agrees to the cancellation;

5.2.1.b. The vendor has obtained the contract by fraud, collusion, conspiracy, or is in conflict with any statutory or constitutional provision of the State of West Virginia;

5.2.1.c. Failure to honor any contractual term or condition or to honor standard commercial practices;

5.2.1.d. The existence of an organizational conflict of interest is identified;

5.2.1.e. Funds are not appropriated or an appropriation is discontinued by the legislature for the acquisition;

5.2.1.f. Violation of any federal, state, or local law, regulation, or ordinance, and

5.2.1.g. The contract was awarded in error.

5.2.2. The Director may cancel a purchase or contract for any reason or no reason, upon providing

the vendor with 30 days' notice of the cancellation.

5.2.3. Opportunity to Cure. In the event that a vendor fails to honor any contractual term or condition, or violates any provision of federal, state, or local law, regulation, or ordinance, the Director may request that the vendor remedy the contract breach or legal violation within a time frame the Director determines to be appropriate. If the vendor fails to remedy the contract breach or legal violation or the Director determines, at his or her sole discretion, that such a request is unlikely to yield a satisfactory result, then he or she may cancel immediately without providing the vendor an opportunity to perform a remedy.

5.2.4. Re-Award. The Director may award the cancelled contract to the next lowest responsible bidder (or next highest scoring bidder if best value procurement) without a subsequent solicitation if the following conditions are met:

5.2.4.a. The next lowest responsible bidder (or next highest scoring bidder if best value procurement) is able to perform at the price contained in its original bid submission, and

5.2.4.b. The contract is an open-end contract, a one-time purchase contract, or a contract for work which has not yet commenced.

Award to the next lowest responsible bidder (or next highest scoring bidder if best value procurement) will not be an option if the vendor's failure has in any way increased or significantly changed the scope of the original contract. The vendor failing to honor contractual and legal obligations is responsible for any increase in cost the state incurs as a result of the re-award.

5.3. Non-Responsible. If the Director believes that a vendor may be non-responsible, the Director may request that a vendor or spending unit provide evidence that the vendor either does or does not have the capability to fully perform the contract requirements, and the integrity and reliability necessary to assure good faith performance. If the Director determines that the vendor is non-responsible, the Director shall reject that vendor's bid and shall not award the contract to that vendor. A determination of non-responsibility must be evaluated on a case-by-case basis and can only be made after the vendor in question has submitted a bid. A determination of non-responsibility will only extend to the contract for which the vendor has submitted a bid and does not operate as a bar against submitting future bids.

5.4. Suspension.

5.4.1. The Director may suspend, for a period not to exceed 1 year, the right of a vendor to bid on

procurements issued by the Purchasing Division or any state spending unit under its authority if:

5.4.1.a. The vendor has submitted a bid and then requested that its bid be withdrawn after bids have been publicly opened.

5.4.1.b. The vendor has exhibited poor performance in fulfilling his or her contractual obligations to the State. Poor performance includes, but is not limited to any of the following: violations of law, regulation, or ordinance; failure to deliver timely; failure to deliver quantities ordered; poor performance reports; or failure to deliver commodities, services, or printing at the quality level required by the contract.

5.4.1.c. The vendor has breached a contract issued by the Purchasing Division or any state spending unit under its authority and refuses to remedy that breach.

5.4.1.d. The vendor's actions have given rise to one or more of the grounds for debarment listed in W. Va. Code § 5A-3-33d.

5.4.2. Vendor suspension for the reasons listed in section 5.4 above shall occur as follows:

5.4.2.a. Upon a determination by the Director that a suspension is warranted, the Director will serve a notice of suspension to the vendor.

5.4.2.b. A notice of suspension must inform the vendor:

5.4.2.b.1. Of the grounds for the suspension;

5.4.2.b.2. Of the duration of the suspension;

5.4.2.b.3. Of the right to request a hearing contesting the suspension;

5.4.2.b.4. That a request for a hearing must be served on the Director no later than 5 working days of the vendor's receipt of the notice of suspension;

5.4.2.b.5. That the vendor's failure to request a hearing no later than 5 working days of

the receipt of the notice of suspension will be deemed a waiver of the right to a hearing and result in the automatic enforcement of the suspension without further notice or an opportunity to respond; and

5.4.2.b.6. That a request for a hearing must include an explanation of why the vendor believes the Director's asserted grounds for suspension do not apply and why the vendor should not be suspended.

5.4.2.c. A vendor's failure to serve a request for hearing on the Director no later than 5 working days of the vendor's receipt of the notice of suspension will be deemed a waiver of the right to a hearing and may result in the automatic enforcement of the suspension without further notice or an opportunity to respond.

5.4.2.d. A vendor who files a timely request for hearing but nevertheless fails to provide an explanation of why the asserted grounds for suspension are inapplicable or should not result in a suspension, may result in a denial of the vendor's hearing request.

5.4.2.e. Within 5 working days of receiving the vendor's request for a hearing, the Director will serve on the vendor a notice of hearing that includes the date, time and place of the hearing.

5.4.2.f. The hearing will be recorded and an official record prepared. Within 10 working days of the conclusion of the hearing, the Director will issue and serve on the vendor, a written decision either confirming or reversing the suspension.

5.4.3. A vendor may appeal a decision of the Director to the Secretary of the Department of Administration. The appeal must be in writing and served on the Secretary no later than 5 working days of receipt of the Director's decision.

5.4.4. The Secretary, or his or her designee, will schedule an appeal hearing and serve on the vendor, a notice of hearing that includes the date, time and place of the hearing. The appeal hearing will be recorded and an official record prepared. Within 10 working days of the conclusion of the appeal hearing, the Secretary will issue and serve on the vendor a written decision either confirming or reversing the suspension.

5.4.5. Any notice or service related to suspension actions or proceedings must be provided by certified mail, return receipt requested.

5.5. Vendor Debarment. The Director may debar a vendor on the basis of one or more of the grounds for debarment contained in W. Va. Code § 5A-3-33d or if the vendor has been declared ineligible to participate in procurement related activities under federal laws and regulation.

5.5.1. Debarment proceedings shall be conducted in accordance with W. Va. Code § 5A-3-33e and these rules. A vendor that has received notice of the proposed debarment by certified mail, return receipt requested, must respond to the proposed debarment within 30 working days after receipt of notice or the debarment will be instituted without further notice. A vendor is deemed to have received notice, notwithstanding the vendor's failure to accept the certified mail, if the letter is addressed to the vendor at its last known address. After considering the matter and reaching a decision, the Director shall notify the vendor of his or her decision by certified mail, return receipt requested.

5.5.2. Any vendor, other than a vendor prohibited from participating in federal procurement, undergoing debarment proceedings is permitted to continue participating in the state's procurement process until a final debarment decision has been reached. Any contract that a debarred vendor obtains prior to a final debarment decision shall remain in effect for the current term, but may not be extended or renewed. Notwithstanding the foregoing, the Director may cancel a contract held by a debarred vendor if the Director determines, in his or her sole discretion, that doing so is in the best interest of the State. A vendor prohibited from participating in federal procurement will not be permitted to participate in the state's procurement process during debarment proceedings.

5.5.3. If the Director's final debarment decision is that debarment is warranted and notice of the final debarment decision is mailed, the Purchasing Division shall reject any bid submitted by the debarred vendor, including any bid submitted prior to the final debarment decision if that bid has not yet been accepted and a contract consummated.

5.5.4. Pursuant to W.Va. Code § 5A-3-33e(e), the length of the debarment period will be specified in the debarment decision and will be for a period of time that the Director finds necessary and proper to protect the public from an irresponsible vendor.

5.5.5. List of Debarred Vendors. The Director shall maintain and publicly post a list of debarred vendors on the Purchasing Division's website.

5.5.6. Related Party Debarment. The Director may pursue debarment of a related party at the same time that debarment of the original vendor is proceeding or at any time thereafter that the Director determines a related party debarment is warranted. Any entity that fails to provide the Director with full, complete, and accurate information requested by the Director to determine related party

status will be presumed to be a related party subject to debarment.

5.6. Damages.

5.6.1. A vendor who fails to perform as required under a contract shall be liable for actual damages and costs incurred by the state.

5.6.2. If any commodities delivered under a contract have been used or consumed by a spending unit and on testing the commodities are found not to comply with specifications, no payment may be approved by the Spending Unit for the merchandise until the amount of actual damages incurred has been determined.

5.6.3. The Spending Unit shall seek to collect damages by following the procedures established by the Office of the Attorney General for the collection of delinquent obligations.

Credits

History: Filed 4-1-19, eff. 4-1-19; Filed 4-16-21, eff. 5-1-21.

Current through register dated May 7, 2021. Some sections may be more current. See credits for details.
W. Va. C.S.R. § 148-1-5, WV ADC § 148-1-5

End of Document

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EXHIBIT B To:
REQUIRED CONTRACT PROVISIONS FOR NON-FEDERAL ENTITY CONTRACTS UNDER FEDERAL AWARDS (2 C.F.R. § 200.317):

Prevailing Wage Determination

☐ – Not Applicable Because Contract Not for Construction

☐ – Federal Prevailing Wage Determination on Next Page

APPENDIX A, 2 C.F.R. § 418 – CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure

   Form to Report Lobbying," (Appendix B to 2 C.F.R. § 418) in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

   This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

   The Contractor,_____, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. Chap.

   38, Administrative Remedies for False Claims and Statements, apply to this certification and disclosure, if any.

_____

Name and Title of Contractor's Authorized Official

_____

Signature of Contractor's Authorized Official

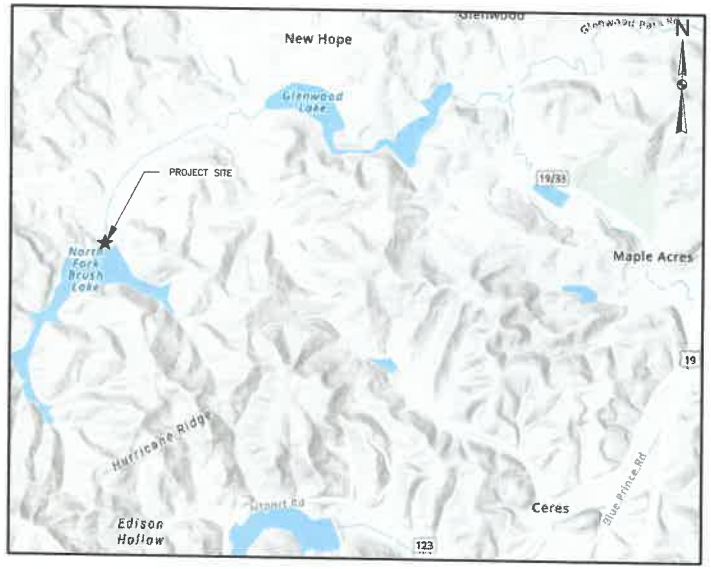
_____

Date

BRUSH CREEK WATERSHED SITE 15
REHABILITATION PROJECT (NID ID: WV05511)
MERCER COUNTY, WEST VIRGINIA

DRAINAGE AREA	2.7 SQUARE MILES
FLOOD STORAGE (TO AUXILIARY SPILLWAY CREST)	2,079 ACRE-FEET
WATER SUPPLY STORAGE	1,516 ACRE-FEET
WATER SURFACE AREA (AT WATER SUPPLY POOL)	75 ACRES
HEIGHT OF DAM	76 FEET

PREPARED FOR THE U.S. DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICE
IN COOPERATION WITH THE WEST VIRGINIA CONSERVATION AGENCY, THE MERCER COUNTY COMMISSION, THE CITY OF PRINCETON, AND THE GREEN VALLEY-GLENWOOD PUBLIC SERVICE DISTRICT
SEPTEMBER 27, 2024



VICINITY MAP

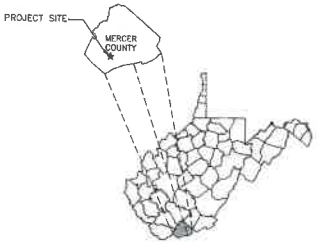
I, Jonathan Pittman, do hereby certify pursuant to the penalties of W.Va. Code, Chapter 30, Article 13 to the best of my knowledge, information and belief, that the information contained in the accompanying plans, specifications, and reports has been prepared in accordance with accepted engineering practice, is true and correct.
To the best of my professional knowledge, judgement, and belief, these plans meet applicable NRCS standards.

JONATHAN W PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

DATE: 09-27-2024

I, _____, do hereby certify pursuant to the penalties of W.Va. Code, Chapter 30, Article 13 to the best of my knowledge, information and belief, that the information contained in the accompanying plans, specifications, and reports has been installed in accordance with accepted engineering practice, is true and correct.
To the best of my professional knowledge, judgement, and belief, this practice is installed in accordance with the plans and specifications and meets applicable NRCS standards.

DATE: _____



KEY MAP

CALL BEFORE YOU DIG!
WEST VIRGINIA LAW REQUIRES 2 WORKING DAYS NOTICE PRIOR TO EXCAVATION

JOB CLASS VIII

SHEET INDEX OF DRAWINGS

SHEET NUMBER	DRAWING NUMBER	SHEET TITLE
1	15-G-01	COVER SHEET
2	15-G-02	SYMBOL LEGEND AND GENERAL NOTES
3	15-C-01	EXISTING SITE PLAN
4	15-C-02	EXISTING EMBANKMENT DETAILS
5	15-C-03	EXISTING TRENCH DRAIN AND IMPACT BASIN DETAILS
6	15-C-04	PROPOSED SITE PLAN
7	15-C-05	SUBSURFACE EXPLORATION PLAN AND PROJECT LAYOUT AND CONTROL PLAN
8	15-C-06	GEOLOGIC PROFILES AND SECTIONS - SHEET 1 OF 3
9	15-C-07	GEOLOGIC PROFILES AND SECTIONS - SHEET 2 OF 3
10	15-C-08	GEOLOGIC PROFILES AND SECTIONS - SHEET 3 OF 3
11	15-C-09	SITE ACCESS AND STAGING PLAN
12	15-C-10	DEMOLITION PLAN
13	15-C-11	TOE DRAIN EXCAVATION PLAN
14	15-C-12	PROPOSED TOE DRAIN PLAN
15	15-C-13	EMBANKMENT SECTIONS
16	15-C-14	TOE DRAIN PROFILE
17	15-C-15	TOE DRAIN DETAILS - SHEET 1 OF 2
18	15-C-16	TOE DRAIN DETAILS - SHEET 2 OF 2
19	15-C-17	PROPOSED PRINCIPAL SPILLWAY OUTLET PLAN, PROFILE, AND ELEVATION
20	15-C-18	AUXILIARY SPILLWAY EXCAVATION PLAN
21	15-C-19	AUXILIARY SPILLWAY FOUNDATION PLAN
22	15-C-20	PROPOSED AUXILIARY SPILLWAY PLAN- SHEET 1 OF 2
23	15-C-21	PROPOSED AUXILIARY SPILLWAY PLAN- SHEET 2 OF 2
24	15-C-22	AUXILIARY SPILLWAY SECTIONS - SHEET 1 OF 4
25	15-C-23	AUXILIARY SPILLWAY SECTIONS - SHEET 2 OF 4
26	15-C-24	AUXILIARY SPILLWAY SECTIONS - SHEET 3 OF 4
27	15-C-25	AUXILIARY SPILLWAY SECTIONS - SHEET 4 OF 4
28	15-C-26	AUXILIARY SPILLWAY LAYOUT PLAN
29	15-C-27	AUXILIARY SPILLWAY 3D MODEL
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31	15-C-29	RCC TEST SECTION DETAILS
32	15-C-30	PROJECT MONUMENT DETAILS
33	15-C-31	UPSTREAM RIPRAP BERM DETAILS
34	15-C-32	MISCELLANEOUS CIVIL DETAILS
35	15-S-01	STRUCTURAL NOTES AND TYPICAL DETAILS
36	15-S-02	IMPACT BASIN PLAN, SECTION, AND DETAILS
37	15-S-03	IMPACT BASIN STEEL PLACEMENT - SHEET 1 OF 6
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57	15-S-23	TAILWATER WEIR WALL STEEL SCHEDULE
58	15-S-24	STARTERWALL AND BAFFLE BLOCK DETAILS
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EROSION AND SEDIMENT CONTROL SHEET INDEX

	DRAWING NUMBER	SHEET TITLE
1	15-ES-01	OVERALL SITE MAP
2	15-ES-02	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 1A SHT 1
3	15-ES-03	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 1A SHT 2
4	15-ES-04	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 1A SHT 3
5	15-ES-05	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 1A SHT 4
6	15-ES-06	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 1B SHT 1
7	15-ES-07	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 1B SHT 2
8	15-ES-08	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 1B SHT 3
9	15-ES-09	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 1B SHT 4
10	15-ES-10	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 2 SHT 1
11	15-ES-11	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 2 SHT 2
12	15-ES-12	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 2 SHT 3
13	15-ES-13	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 2 SHT 4
14	15-ES-14	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 3 SHT 1
15	15-ES-15	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 3 SHT 2
16	15-ES-16	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 3 SHT 3
17	15-ES-17	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 3 SHT 4
18	15-ES-18	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 4 SHT 1
19	15-ES-19	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 4 SHT 2
20	15-ES-20	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 4 SHT 3
21	15-ES-21	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 4 SHT 4
22	15-ES-22	EROSION AND SEDIMENT CONTROL PLAN DETAILS
23	15-ES-23	EROSION AND SEDIMENT CONTROL PLAN DETAILS
24	15-ES-24	EROSION AND SEDIMENT CONTROL PLAN DETAILS AND NOTES
25	15-ES-25	EROSION AND SEDIMENT CONTROL PLAN NOTES

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

		Date
Designed	CDS	SEP 24
Drawn	CBP	SEP 24
Checked	EBB	SEP 24
Approved	JMP	SEP 24
Approved	ANDY DEICHERT	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION
COVER SHEET
Brush Creek Watershed — Mercer County, WV

Atterra-Schnabel JV
300 Brookside Ave., Bldg. 1B, Suite 160, Ambler, PA 19002
Phone: 267-468-4156
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-G-01

SEPTEMBER 2024

SHEET 1 OF 61

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Last Saved By: CPATSON3 SaveDate: 10/2/2024 1:05 PM PlotDate: 10/2/2024 2:57 PM
N:\Projects\Mercer County\WV05511_Brush_Creek\Site 15\Preliminary\Drawings\Plans\15-G-01-COVER.dwg Layout: COVER SHEET

ABBREVIATIONS

AB	ANCHOR BOLTS
ABC	AGGREGATE BASE COURSE
AC	ACRE
ACB	ARTICULATED CONCRETE BLOCK
ADH	ADHESIVE
ALT	ALTERNATIVE, ALTERNATE
ANC	ANCHOR
APPROX	APPROXIMATE
ASW	AUXILIARY SPILLWAY
AWS	AMERICAN WELDING SOCIETY
AWWA	AMERICAN WATER WORKS ASSOCIATION
BM	BENCH MARK
BOM	BILL OF MATERIALS
BOT	BOTTOM
BF	BOTTOM FACE
C-C	CENTER TO CENTER
CHK	CHECK
CG	CENTER OF GRAVITY
CJ	CONSTRUCTION JOINT
CPA	CONCRETE PLACEMENT AREA
CTR	CENTER, CENTERS
CM/SEC	CENTIMETERS PER SECOND
CMP	CORRUGATED METAL PIPE
CNTR	CENTER
CONC	CONCRETE
COR	CONTRACTING OFFICER'S REPRESENTATIVE
CS	CONSTRUCTION SPECIFICATION
DBA	DEFORMED BAR ANCHOR
DEG	DEGREES
DET	DETAIL
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
D/S	DOWNSTREAM
DWG	DRAWING
DWL	DOWEL
EA	EACH
EF	EACH FACE
EL	ELEVATION
EMB	EMBEDMENT
EQ	EQUAL
ES	EQUAL SPACE
EW	EACH WAY
EXP ANC	EXPANSION ANCHOR
FF	FAR FACE
FPS	FEET PER SECOND
FS	FAR SIDE
FT	FEET
FUI	FUTURE UNIT INTAKE
GPM	GALLONS PER MINUTE
HDPE	HIGH DENSITY POLYETHYLENE
HK	HOOK
HORIZ	HORIZONTAL
HS	HIGH STRENGTH
HSS	HOLLOW STRUCTURAL SECTION
HW	HEADWATER
HYDRO	HYDROPHILIC
ID	INSIDE DIAMETER
IN	INCHES
INJ	INJECTION
INV	INVERT
LB	POUND
LT	LEFT
LG	LONG, LENGTH
MAX	MAXIMUM
MIN	MINIMUM
NF	NEAR FACE
NOM	NOMINAL
NS	NEAR SIDE
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
PL	PLATE
PT ANC	POST TENSION ANCHOR
PROJ	PROJECT
PSW	PRINCIPAL SPILLWAY
PVC	POLYVINYL CHLORIDE PIPE
R	RADIUS
RCC	ROLLER COMPACTED CONCRETE
RCP	REINFORCED CONCRETE
REINF	REINFORCING, REINFORCED
REF	REFERENCE
REQD	REQUIRED
RT	RIGHT
RHT	RIGHT HAND THREAD
SF	SILT FENCE
SHT	SHEET
SIM	SIMILAR
SL	STOP LOG
SP	SPACE
SPEC	SPECIFICATION
SS	STAINLESS STEEL
SSF	SUPER SILT FENCE
STD	STANDARD
STL	STEEL
SYM	SYMMETRICAL
TEMP	TEMPORARY
TF	TOP FACE
TR	TRASH RACK
TS	TUBE STEEL
TYP	TYPICAL
TOS	TOP OF STEEL
TW	TAILWATER
UNO	UNLESS NOTED OTHERWISE
U/S	UPSTREAM
UV	UNIFORMLY VARYING
VERT	VERTICAL
VWP	VIBRATING WIRE PIEZOMETER
W/	WITH
W/O	WITHOUT
WP	WORK POINT
WS	WATER STOP
WSTUD	WELDABLE STUD

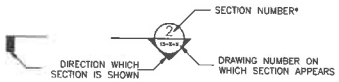
EXISTING FEATURES LEGEND

EXISTING IRON PIN	○ EIP
EXISTING REBAR	○ EIR
NO POINT SET	● NPS
IRON REBAR SET	● IRS
LIGHT POLE	
ELECTRIC MANHOLE	E
ELECTRIC METER	
ELECTRIC TRANSFORMER	
UTILITY POLE	
BOLLARD	
CLEAN OUT	
SEWER MANHOLE	
SIGN	
STORM MANHOLE	
FIRE HYDRANT	
WATER MANHOLE	
WATER METER	
WATER VALVE	WV
WELL	
MANHOLE	OMH
TREE	
RIGHT-OF-WAY	R/W
CONCRETE MONUMENT	CM
CHORD	CH
SIGHT EASEMENT	SE
DEED BOOK	DB
PLAT BOOK	PB
CURB AND GUTTER	C&G
REINFORCED CONC PIPE	RCP
CORRUGATED METAL PIPE	CMP
CORRUGATED PLASTIC PIPE	CPP
MAJOR COUNTOUR	2440
MINOR COUNTOUR	
SANITARY SEWER LINE	SS
UNDERGROUND ELECTRIC LINE	UE
OVERHEARD ELECTRIC LINE	OHE
TREE LINE	
WATER LINE	W
FENCE LINE	
EXISTING RIPRAP LIMITS	
EDGE OF WATER	
LIMITS OF DISTURBANCE	LOD
ASPHALT	
CONCRETE	
FINE DRAINFILL	
COARSE DRAINFILL	
WETLANDS	
GRAVEL	
RIPRAP	
BEDDING STONE	
NONWOVEN GEOTEXTILE	
CLEARING AND GRUBBING	

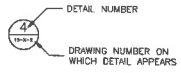
GENERAL NOTES

1. THE CONTRACTOR IS RESPONSIBLE FOR CHECKING AND VERIFYING THE EXISTING INFORMATION PRESENTED ON THESE DRAWINGS. ANY DISCREPANCIES SHALL BE ADDRESSED TO THE CONTRACTOR OFFICER'S REPRESENTATIVE (COR) IN WRITING.
2. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO PERFORM ALL WORK IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS CONCERNING THE DISTURBANCE OF WETLANDS AND STREAMS.
3. ALL PUBLIC ROADWAYS SHALL REMAIN OPEN AT ALL TIMES. IT IS THE CONTRACTOR'S RESPONSIBILITY TO MAINTAIN ROAD SURFACES CLEAN AND FREE OF CONSTRUCTION SEDIMENT AND DEBRIS AT ALL TIMES.
4. ALL WORK SHALL BE IN ACCORDANCE WITH APPLICABLE LOCAL, COUNTY, STATE, AND FEDERAL REGULATIONS AND PERMIT REQUIREMENTS. THE CONTRACTOR IS RESPONSIBLE FOR NOTIFYING AND COORDINATING ALL WORK WITH THE AFFECTED UTILITY COMPANIES.
5. THE CONTRACTOR SHALL ESTABLISH PERMANENT BENCHMARKS. THE LOCATIONS OF THESE BENCHMARKS SHALL BE APPROVED BY THE COR PRIOR TO INSTALLATION.
6. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING THE EXISTING UTILITY INFORMATION PRESENTED ON THESE DRAWINGS. ANY DISCREPANCIES SHALL BE ADDRESSED TO THE ENGINEER AND CONTRACTING OFFICER'S REPRESENTATIVE (COR) IN WRITING. THE CONTRACTOR IS RESPONSIBLE FOR NOTIFYING AND COORDINATING WORK WITH THE AFFECTED UTILITY COMPANIES.
7. TOPOGRAPHIC AND BATHYMETRIC DATA WAS PROVIDED BY NRCS ON MAY 15, 2019. TOPOGRAPHIC DATA AND EXISTING SITE FEATURES ARE BASED ON THE GANNETT FLEMING SURVEY PERFORMED IN MARCH 2016. BATHYMETRIC DATA IS BASED ON THE GANNETT FLEMING SURVEY PERFORMED IN MAY 2016.
8. THE REFERENCED COORDINATE SYSTEM FOR ALL DRAWINGS ARE THE NAVD88 VERTICAL DATUM AND NAD83 (2011) HORIZONTAL DATUM, WEST VIRGINIA STATE PLANE SOUTH COORDINATE SYSTEM.
9. LIMITS OF DISTURBANCE: 23.41 ACRES
10. CALL BEFORE YOU DIG! CONTRACTOR SHALL CONTACT WEST VIRGINIA 811 CALL SYSTEM AT LEAST TWO WORKING DAYS PRIOR TO ANY EXCAVATION.
11. REFERENCES TO "LEFT" AND "RIGHT" WITHIN THESE PLANS ASSUME ONE IS LOOKING DOWNSTREAM.
12. THE CONTRACTOR SHALL PROVIDE ADEQUATE MEANS OF CLEANING TRUCKS AND/OR OTHER EQUIPMENT OF MUD PRIOR TO ENTERING THE WVDOT AND LOCAL RIGHT-OF-WAY. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CLEAN ALL STREETS, TO ALLAY DUST AND TO TAKE WHATEVER MEASURES NECESSARY TO ENSURE THE ROAD(S) ARE MAINTAINED IN A CLEAN, MUD AND DUST FREE CONDITION AT ALL TIMES.
13. WHERE EXISTING NATURAL DRAINAGE DITCHES OR STREAM BANKS ARE DISTURBED DURING CONSTRUCTION THE CONTRACTOR SHALL RESTORE THESE AREAS TO ORIGINAL ALIGNMENT, GRADE, AND INVERT UNLESS OTHERWISE SHOWN ON THE DRAWINGS.
14. THE CONTRACTOR SHALL RESTORE ALL DISTURBED AREAS WITH SEED AND MULCH OR SOD UNLESS OTHERWISE SHOWN ON THE DRAWINGS.
15. THE CONTRACTOR SHALL CONFORM WITH NRCS SUPPLEMENT TO OSHA PARTS 1910 AND 1926 AS FOUND IN NEH 845, APPENDIX F.

DRAWING SYMBOLS LEGEND

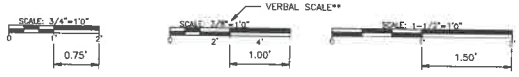


SECTION INDICATOR



DETAIL INDICATOR

PLAN, SECTION OR DETAIL LABEL



SCALE INDICATOR

* SECTION AND ELEVATION INDICATORS ARE SIMILAR. SECTION AND ELEVATION NUMBERS ARE COMBINED AND SEQUENTIAL ON EACH DRAWING.

** VERBAL SCALE IS SHOWN FOR CONVENIENCE ONLY AND IS APPLICABLE TO ANSI D 22"X34" SHEETS ONLY. THE VERBAL SCALE IS NOT ACCURATE WHEN DRAWINGS ARE NOT PLOTTED AT THE INTENDED SIZE OF ANSI D 22"X34". ALL DRAWINGS SHOULD BE CHECKED TO ENSURE THAT THE SCALE BAR IS SHOWN CORRECTLY AT THE PLOTTED SHEET SIZE.

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

SYMBOL LEGEND AND GENERAL NOTES

Brush Creek Watershed *Mercer County, WV*

Aterra-Schnabel JV
300 Brookside Ave, Bldg 15, Suite 160, Ambler, PA 19002
Phone: 336-274-8406

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-0-02

SEPTEMBER 2024

SHEET 2 OF 61

REVISIONS			
#	DATE	APPROVED	TITLE	DESCRIPTION

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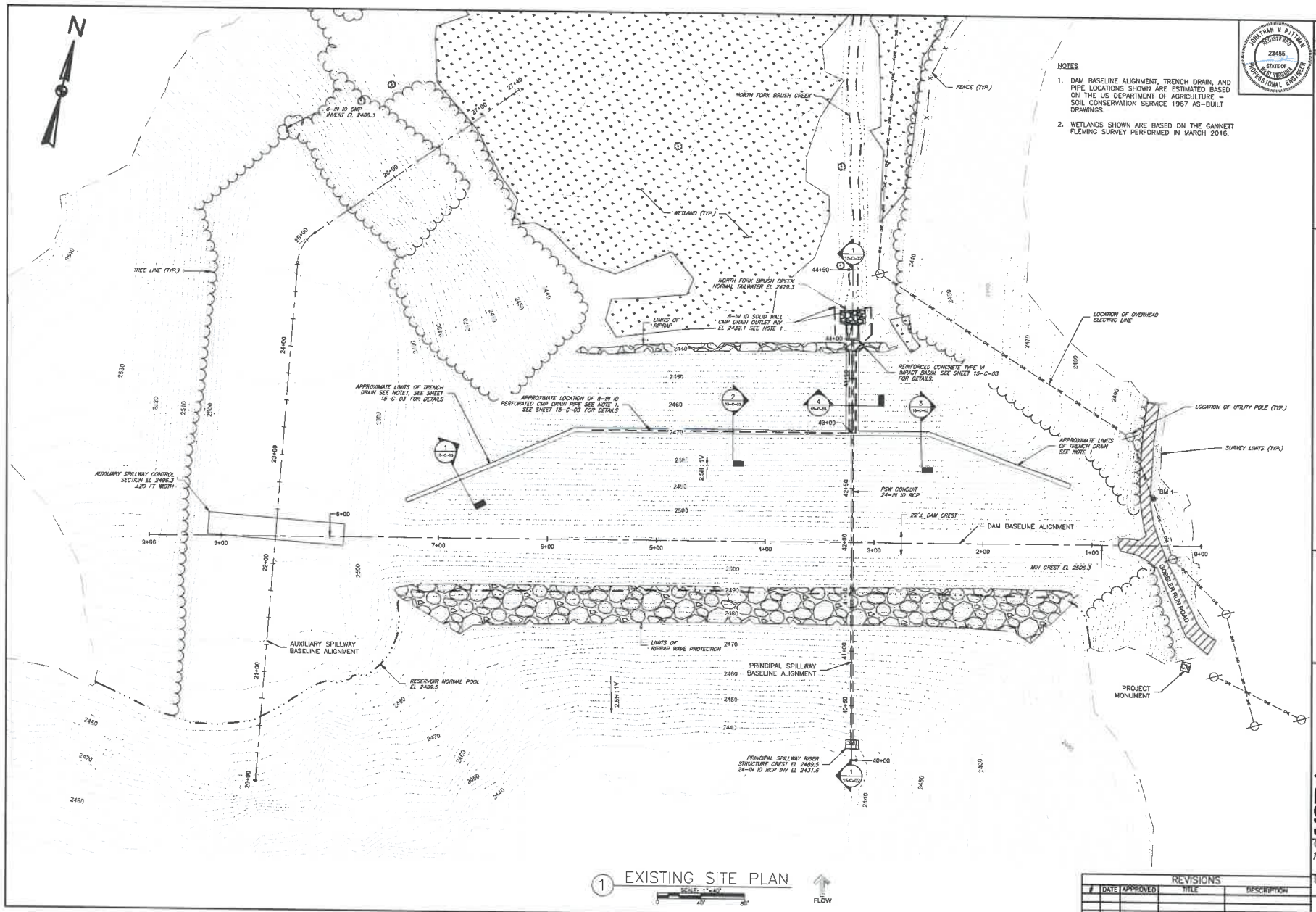

1 EXISTING SITE PLAN

SCALE: 1" = 40'

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

JONATHAN M. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

EXISTING SITE PLAN

Brush Creek Watershed Mercer County, WV

USDA United States Department of Agriculture
Natural Resources Conservation Service

ATERRA SCHNABEL JV
350 Brookside Ave., Bldg. 18, Suite 160, Amston, PA 18002
Phone: 330-274-2158

Contract No. 12SPEC18D0023

Drawing No. 15-C-01

SEPTEMBER 2024

SHEET 3 OF 61

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Last Saved By: CPARSONS SaveDate: 10/2/2024 11:02 AM PlotDate: 10/2/2024 3:39 PM
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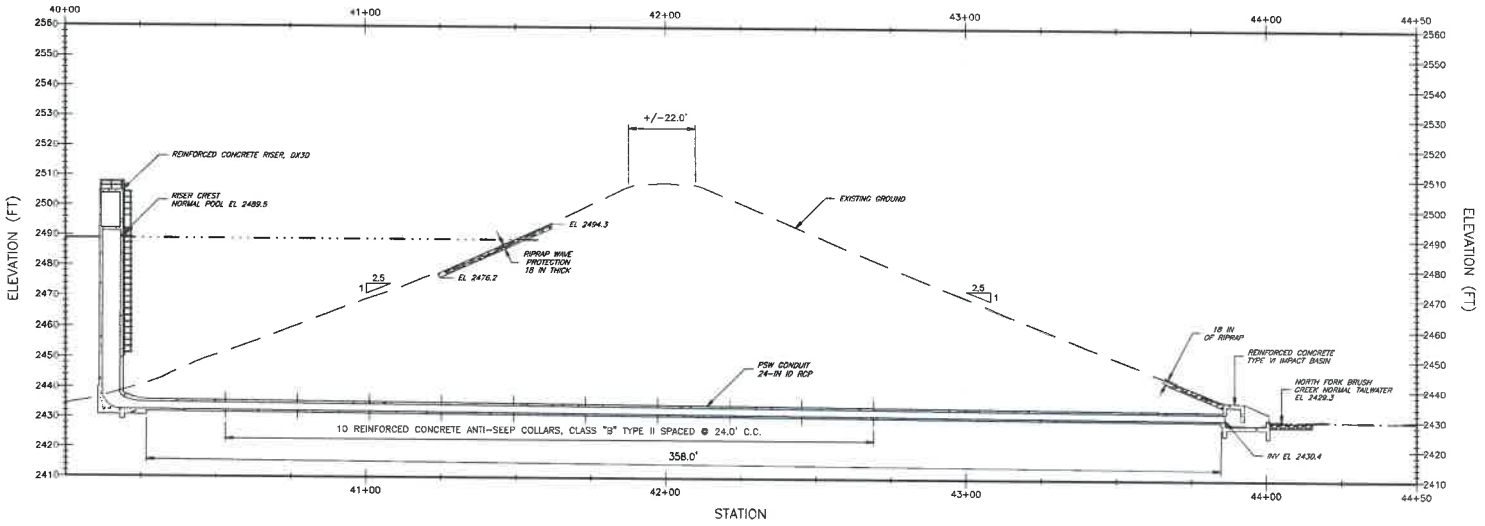
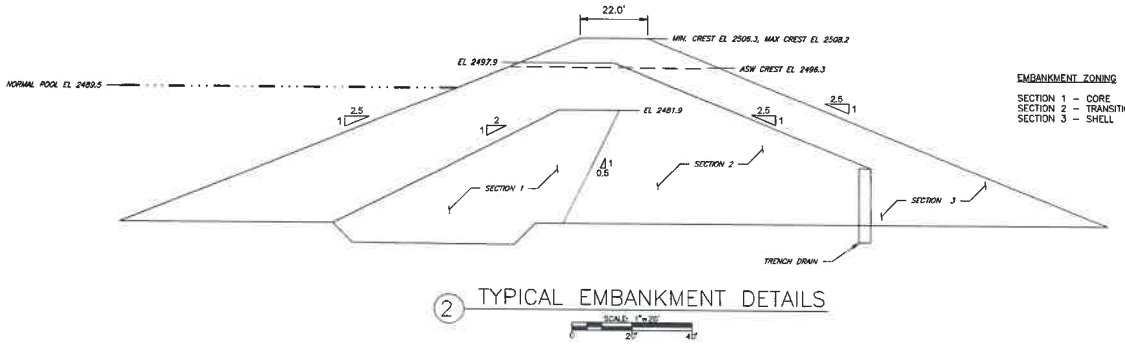


1 PRINCIPAL SPILLWAY PROFILE



EMBANKMENT ZONING

SECTION 1 – CORE
SECTION 2 – TRANSITION
SECTION 3 – SHELL

2 TYPICAL EMBANKMENT DETAILS

SCALE: 1"= 20'

NOTES

1. TYPICAL EMBANKMENT DETAILS SHOWN ARE BASED ON US DEPARTMENT OF AGRICULTURE – SOIL CONSERVATION SERVICE 1967 AS-BUILT DRAWINGS.

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked ERB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

EXISTING EMBANKMENT DETAILS

Brush Creek Watershed *Mercer County, WV*

Aterra Schnabel JV
300 Brookside Ave., Bldg. 19, Suite 160, Ambler, PA 19002
Phone: 336-274-2048
schnabel-eng.com

USDA United States Department of Agriculture Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-02

SEPTEMBER 2024

SHEET 4 OF 61

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

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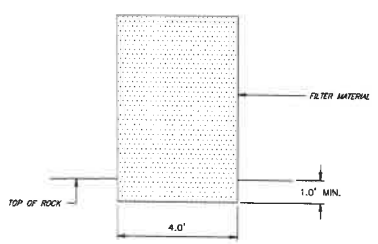
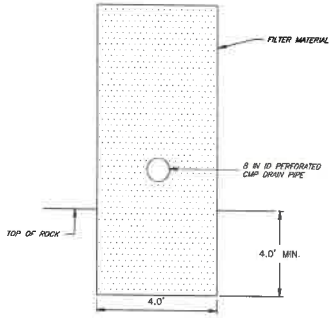


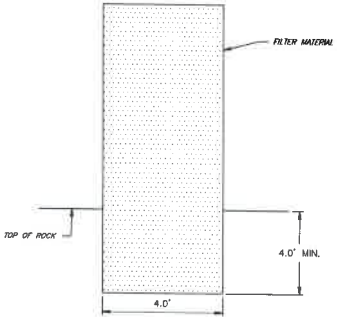
1 TRENCH DRAIN STA 6+80

SCALE: 1"=2'



2 TRENCH DRAIN STA 4+30

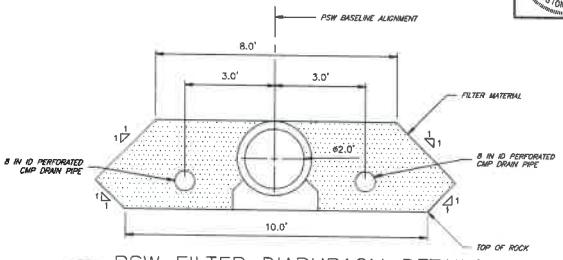
SCALE: 1"=2'



3 TRENCH DRAIN STA 2+60

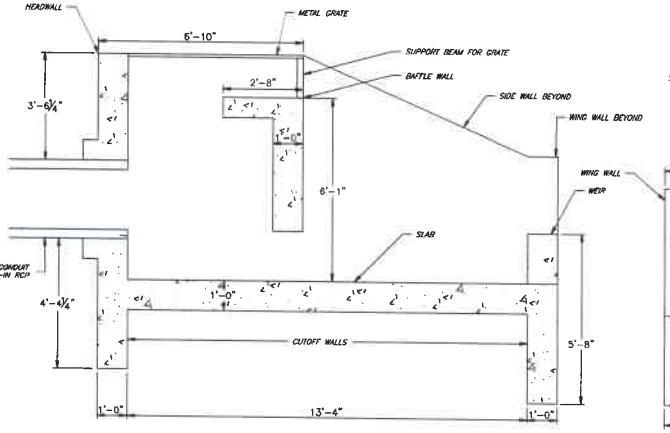
SCALE: 1"=2'

NOTE: DETAILS 1–3 STATIONING ARE BASED ON THE DAM BASELINE ALIGNMENT.



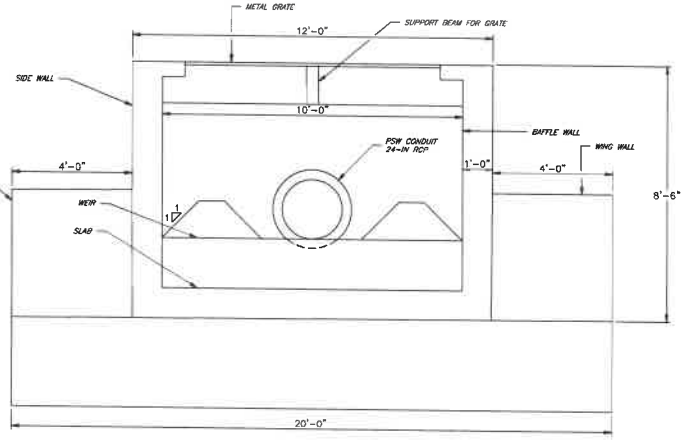
4 PSW FILTER DIAPHRAGM DETAILS

SCALE: 1"=3'



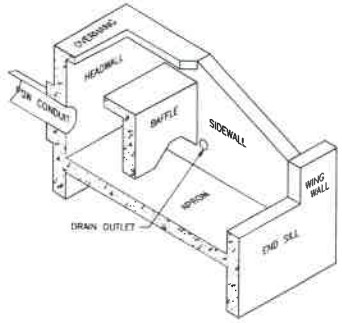
5 IMPACT BASIN SECTION

SCALE: 1"=2'



6 IMPACT BASIN ELEVATION

SCALE: 1"=2'



7 IMPACT BASIN HALF ISOMETRIC

NTS

NOTES

1. EXISTING DETAILS SHOWN ARE BASED ON US DEPARTMENT OF AGRICULTURE – SOIL CONSERVATION SERVICE 1967 AS-BUILT DRAWINGS

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

EXSTING TRENCH DRAIN AND IMPACT BASIN DETAILS

Brush Creek Watershed *Mercer County, WV*

Schnabel Engineering
ATERRA Solutions
550 Broadcast Ave., Bldg. 18, Suite 1400, Ambler, PA 19002
Phone: 336-274-0406

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-03

SEPTEMBER 2024

SHEET 5 OF 61

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Last Saved By: CPARSONS SaveDate: 10/2/2024 11:02 AM PlotDate: 10/2/2024 2:56 PM
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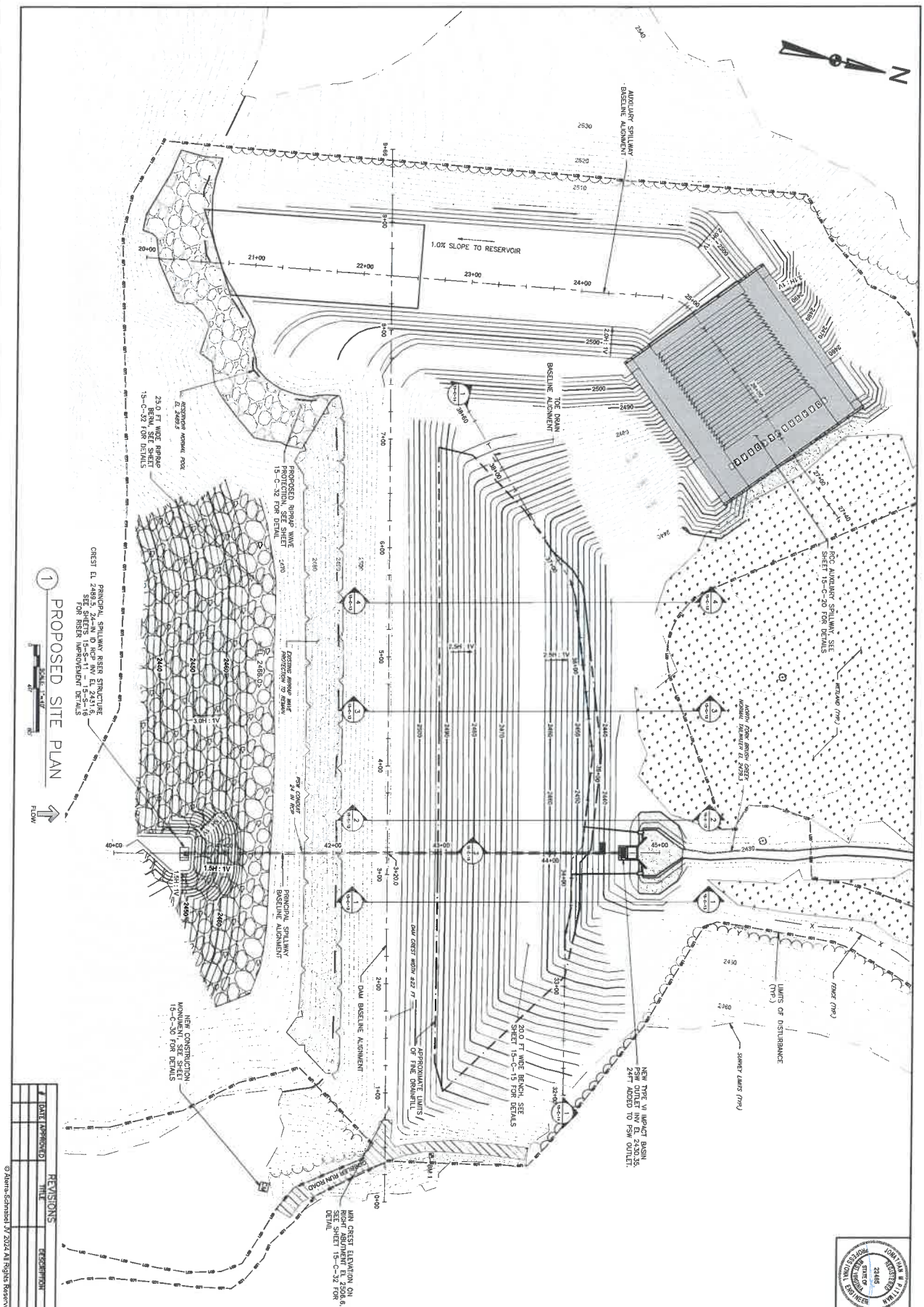

NO.	DATE APPROVED	TITLE	DESCRIPTION
		REVISIONS	

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Contract No. 12SPEC18D0023

Drawing No. 15-C-04

SEPTEMBER 2024

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USDA United States Department of Agriculture
Natural Resources Conservation Service

ALTERRA SOLUTIONS | Schnabel ENGINEERING

300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 336-274-9456
schnabel-eng.com

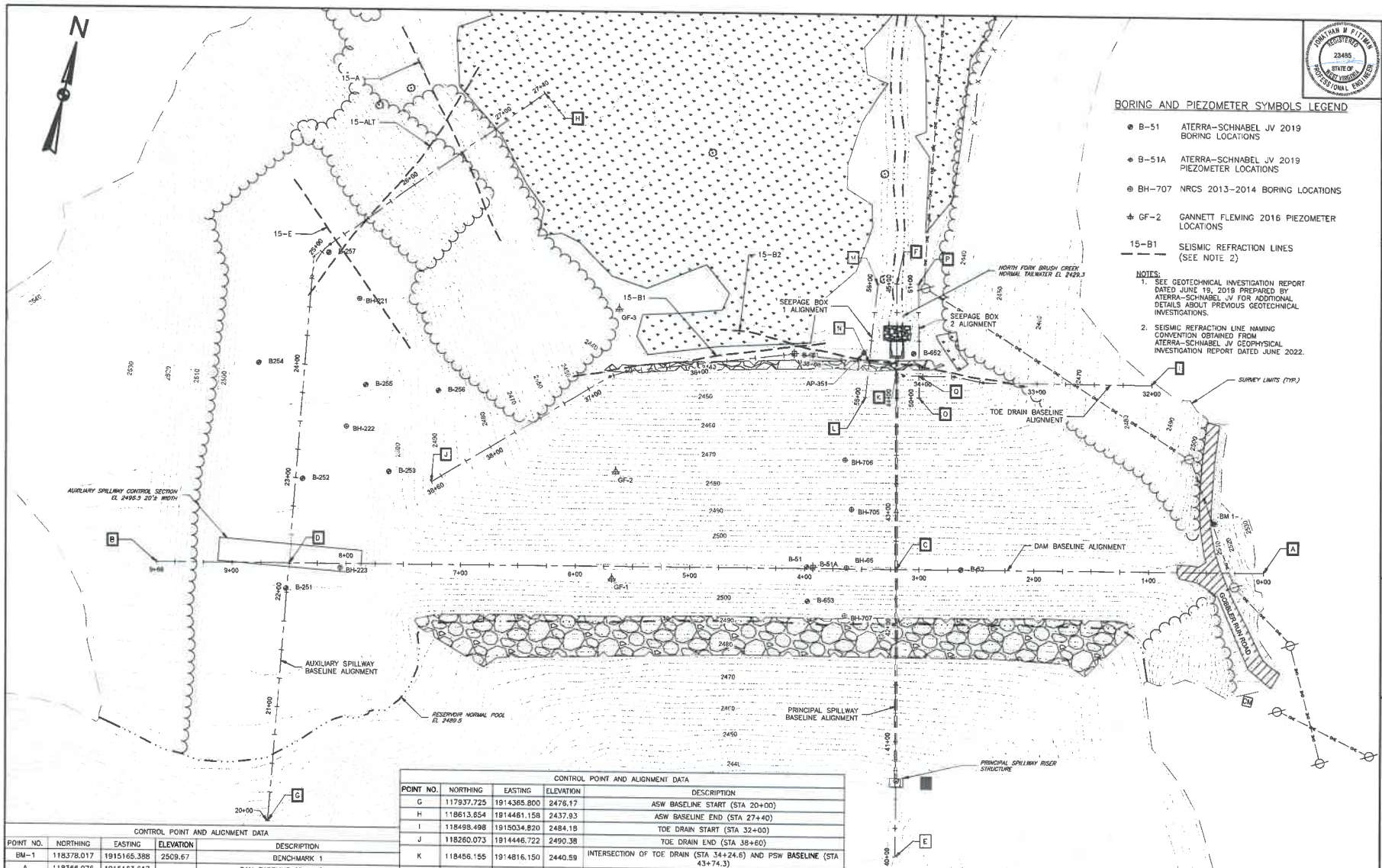
BRUSH CREEK SITE 15 DAM REHABILITATION

PROPOSED SITE PLAN

Brush Creek Watershed — *Mercer County, WV*

		Date
Designed	CDS	SEP 24
Drawn	CRP	SEP 24
Checked	EBB	SEP 24
Approved	JMP	SEP 24

COMMONWEALTH OF VIRGINIA — 22465 — REGISTERED PROFESSIONAL ENGINEER — JAMES M. PYLE



BORING AND PIEZOMETER SYMBOLS LEGEND

- B-51 — ATERRA-SCHNABEL JV 2019 BORING LOCATIONS
- B-51A — ATERRA-SCHNABEL JV 2019 PIEZOMETER LOCATIONS
- BH-707 — NRCS 2013-2014 BORING LOCATIONS
- GF-2 — GANNETT FLEMING 2016 PIEZOMETER LOCATIONS
- 15-B1 — SEISMIC REFRACTION LINES (SEE NOTE 2)

NOTES:
1. SEE GEOTECHNICAL INVESTIGATION REPORT DATED JUNE 19, 2019 PREPARED BY ATERRA-SCHNABEL JV FOR ADDITIONAL DETAILS ABOUT PREVIOUS GEOTECHNICAL INVESTIGATIONS.
2. SEISMIC REFRACTION LINE NAMING CONVENTION OBTAINED FROM ATERRA-SCHNABEL JV GEOPHYSICAL INVESTIGATION REPORT DATED JUNE 2022.

CONTROL POINT AND ALIGNMENT DATA

POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION
BM-1	118378.017	1915165.388	2509.67	BENCHMARK 1
A	118366.076	1915163.617	---	DAM BASELINE START (STA 0+00)
B	118132.310	1914230.705	2515.08	DAM BASELINE END (STA 9+68)
C	118286.975	1914857.932	2508.11	INTERSECTION OF DAM BASELINE (STA 3+20) AND PSW BASELINE (STA 42+00)
D	118160.086	1914343.346	2496.47	INTERSECTION OF DAM BASELINE (STA 8+50) AND ASW BASELINE (STA 22+25)
E	118044.724	1914917.688	2434.36	PSW BASELINE START (STA 40+00)
F	118529.660	1914797.844	2429.70	PSW BASELINE END (STA 45+00)

CONTROL POINT AND ALIGNMENT DATA

POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION
G	117937.725	1914365.800	2476.17	ASW BASELINE START (STA 20+00)
H	118613.654	1914481.158	2437.93	ASW BASELINE END (STA 27+40)
I	118498.498	1915034.820	2484.18	TOE DRAIN START (STA 32+00)
J	118260.073	1914446.722	2490.38	TOE DRAIN END (STA 38+60)
K	118456.155	1914816.150	2440.59	INTERSECTION OF TOE DRAIN (STA 34+24.6) AND PSW BASELINE (STA 43+74.3)
L	118426.295	1914795.702	2450.41	SEEPAGE BOX 1 ALIGNMENT START (STA 55+00)
M	118525.323	1914781.796	2435.44	SEEPAGE BOX 1 ALIGNMENT END (STA 56+00)
N	118456.844	1914791.412	2438.42	INTERSECTION OF SB1 ALIGNMENT (STA 55+30.9) AND TOE DRAIN ALIGNMENT (STA 34+50.3)
O	118438.222	1914840.940	2450.34	SEEPAGE BOX 2 ALIGNMENT START (STA 50+00)
P	118534.240	1914816.176	2435.64	SEEPAGE BOX 2 ALIGNMENT END (STA 51+00)
Q	118456.093	1914836.331	2442.80	INTERSECTION OF SB2 ALIGNMENT (STA 50+19.3) AND TOE DRAIN ALIGNMENT (STA 34+03.4)

1 SUBSURFACE EXPLORATION AND PROJECT LAYOUT PLAN

Scale: 1"=40'

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

Designed CDS SEP 24
Drawn CRP SEP 24
Checked ESB SEP 24
Approved JMP SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION
SUBSURFACE EXPLORATION PLAN AND PROJECT LAYOUT AND CONTROL PLAN
Brush Creek Watershed — Mercer County, WV

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-05

SEPTEMBER 2024

SHEET 7 OF 61

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Last Saved By: CPARSONS SavaDate: 10/2/2024 11:59 AM PlotDate: 10/2/2024 5:10 PM
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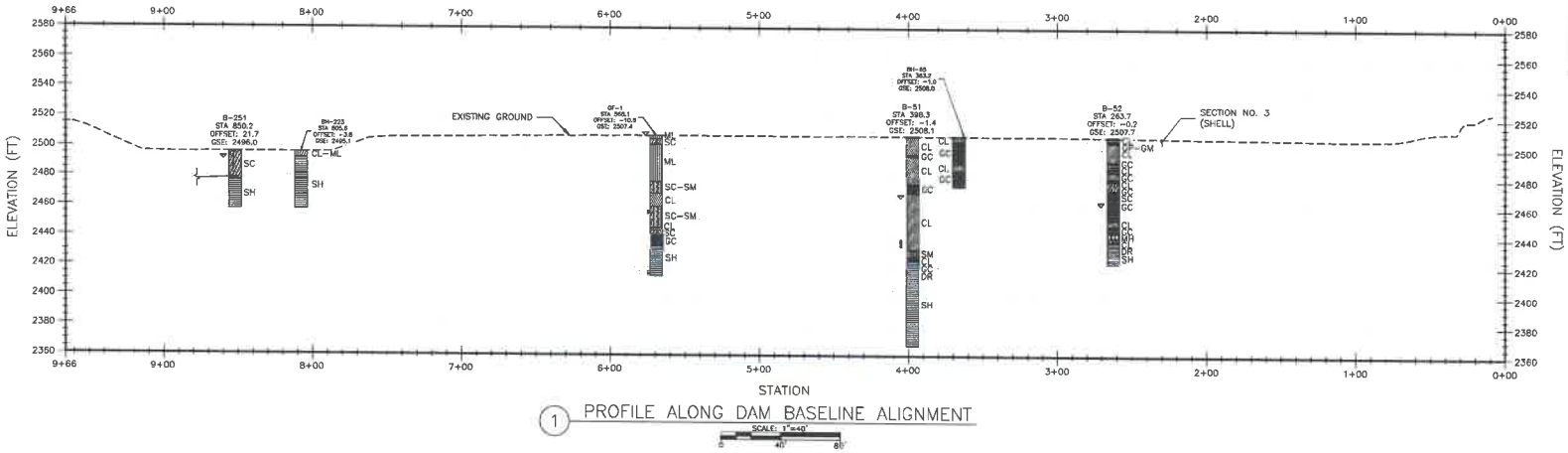
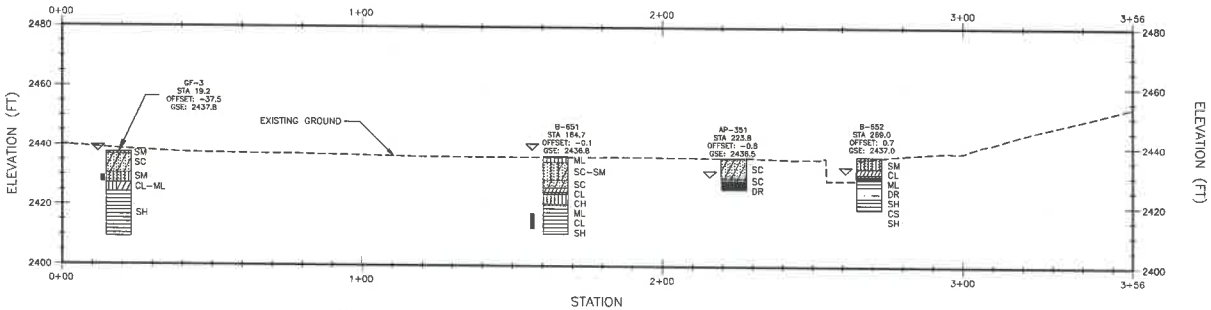


1 PROFILE ALONG DAM BASELINE ALIGNMENT

SCALE: 1"=40'



2 PROFILE ALONG DOWNSTREAM EMBANKMENT TOE

SCALE: 1"=20'

LEGEND

CH	SC-SM
CL	SM
CL-ML	SP
GC	SP-SM
GM	DISINTEGRATED ROCK (DR)
GP	CLAYSTONE (CS)
GP-GM	SHALE (SH)
GW-GC	LIMESTONE W/ SHALE (LS/SH)
MH	OBSERVED WATER LEVEL
ML	PIEZOMETER SCREEN LOCATION
SC	

NOTES:

1. BORING DATA OBTAINED BY ATERRA-SCHNABEL JV IS PRESENTED IN THE FINAL GEOTECHNICAL INVESTIGATION REPORT, REVISION 1, DATED OCTOBER 28 2021
2. STRATIGRAPHY AND WATER LEVELS OBSERVED IN THE BORINGS MAY NOT BE REPRESENTATIVE OF SUBSURFACE CONDITIONS BETWEEN BORINGS. GROUNDWATER LEVELS SHOWN ARE THE LAST READING BEFORE GROUTING OR WERE MEASURED IN PIEZOMETERS, IF INSTALLED.
3. BORING DATA OBTAINED BY OTHERS IS BASED ON DATA PRESENTED IN THE SUPPLEMENTAL WATERSHED PLAN – ENVIRONMENTAL ASSESSMENT FOR THE REHABILITATION OF BRUSH CREEK SITE 15 WATERSHED DAM DATED FEBRUARY 2017.

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

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JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

		Date
Designed	CDS	SEP 24
Drawn	CRP	SEP 24
Checked	EBB	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

GEOLOGIC PROFILES AND SECTIONS – SHEET 1 OF 3

Brush Creek Watershed *Mercer County, WV*

ATERRA | Schnabel
300 Brookside Ave., Bldg. 15, Suite 166, Ambler, PA 19002
Phone: 330-224-3466
adimidjian@aterra-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-06

SEPTEMBER 2024

SHEET 8 OF 61

Last Saved by: CPRADHAN S SaveDate: 10/2/2024 11:08 AM PlotDate: 10/2/2024 2:28 PM
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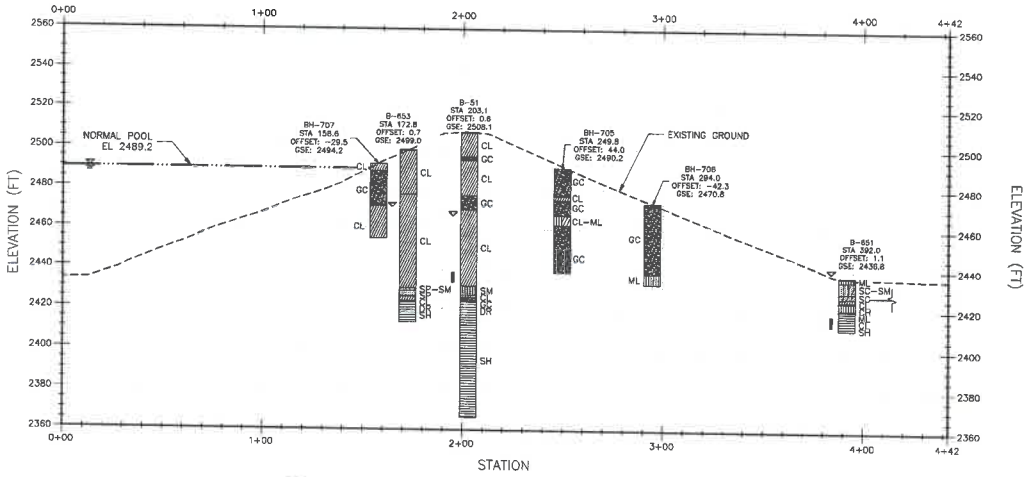
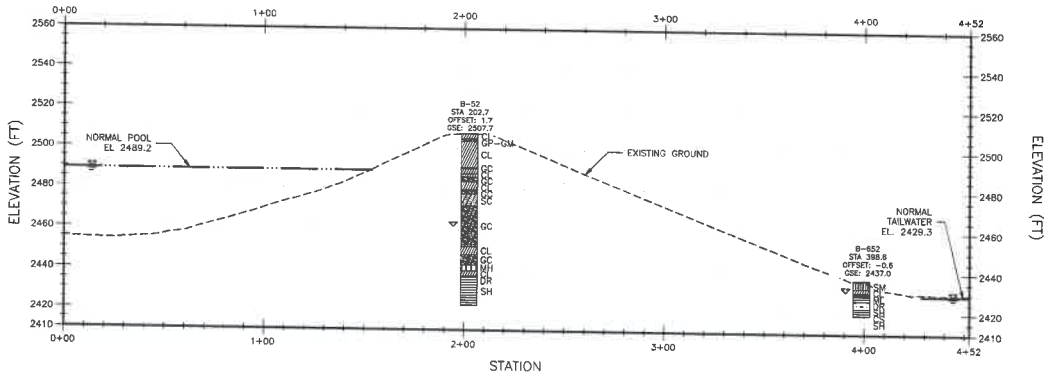


3 EMBANKMENT SECTION AT STATION 4+00

SCALE: 1"=30'



4 EMBANKMENT SECTION AT STATION 2+65

SCALE: 1"=30'

LEGEND

CH	SC-SM
CL	SM
CL-ML	SP
GC	SP-SM
GM	DISINTEGRATED ROCK (DR)
GP	CLAYSTONE (CS)
GP-GM	SHALE (SH)
GW-GC	LIMESTONE W/ SHALE (LS/SH)
MH	OBSERVED WATER LEVEL
ML	PIEZOMETER SCREEN LOCATION
SC	

NOTES:

1. BORING DATA OBTAINED BY ATERRA-SCHNABEL JV IS PRESENTED IN THE FINAL GEOTECHNICAL INVESTIGATION REPORT, REVISION 1, DATED OCTOBER 28, 2021
2. STRATIGRAPHY AND WATER LEVELS OBSERVED IN THE BORINGS MAY NOT BE REPRESENTATIVE OF SUBSURFACE CONDITIONS BETWEEN BORINGS. GROUNDWATER LEVELS SHOWN ARE THE LAST READING BEFORE GROUTING OR WERE MEASURED IN PIEZOMETERS, IF INSTALLED.
3. BORING DATA OBTAINED BY OTHERS IS BASED ON DATA PRESENTED IN THE SUPPLEMENTAL WATERSHED PLAN - ENVIRONMENTAL ASSESSMENT FOR THE REHABILITATION OF BRUSH CREEK SITE 15 WATERSHED DAM DATED FEBRUARY 2017.

JONATHAN W. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Designed	Drawn	Checked	Approved
Date	SEP 24	SEP 24	SEP 24	SEP 24
	CDS	CRP	EBB	JMP

BRUSH CREEK SITE 15 DAM REHABILITATION

GEOLOGIC PROFILES AND SECTIONS - SHEET 2 OF 3

Brush Creek Watershed *Mercer County, WV*

USDA United States Department of Agriculture
Natural Resources Conservation Service

ATERRA SOLUTIONS | Schnabel Engineering

300 Brookside Ave., Bldg. 15, Suite 160, Ambler, PA 19002
Phone: 336-274-4456
COA#: C-4902

Contract No.
12SPEC18D0023

Drawing No.
15-C-07

SEPTEMBER 2024

SHEET 9 OF 81

REVISIONS

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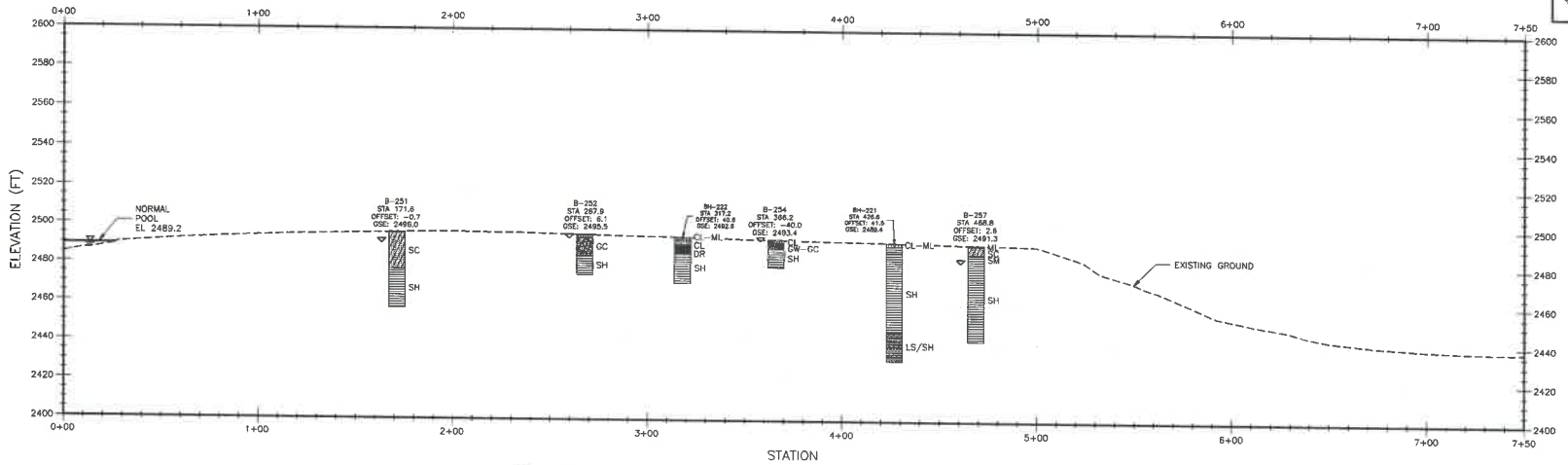
Xrefs: 15-C-07-Cover-SHEET 1.DWG



FLOW

5 PROFILE ALONG AUXILIARY SPILLWAY BASELINE ALIGNMENT

SCALE: 1" = 30'

LEGEND

CH	SC-SM
CL	SM
CL-ML	SP
GC	SP-SM
GM	DISINTEGRATED ROCK (DR)
GP	CLAYSTONE (CS)
GP-GM	SHALE (SH)
GW-GC	LIMESTONE W/ SHALE (LS/SH)
MH	OBSERVED WATER LEVEL
ML	PIEZOMETER SCREEN LOCATION
SC	

NOTES:

1. BORING DATA OBTAINED BY ATERRA-SCHNABEL JV IS PRESENTED IN THE FINAL GEOTECHNICAL INVESTIGATION REPORT, REVISION 1. DATED OCTOBER 28, 2021.
2. STRATIGRAPHY AND WATER LEVELS OBSERVED IN THE BORINGS MAY NOT BE REPRESENTATIVE OF SUBSURFACE CONDITIONS BETWEEN BORINGS. GROUNDWATER LEVELS SHOWN ARE THE LAST READING BEFORE GROUTING OR WERE MEASURED IN PIEZOMETERS, IF INSTALLED.
3. BORING DATA OBTAINED BY OTHERS IS BASED ON DATA PRESENTED IN THE SUPPLEMENTAL WATERSHED PLAN – ENVIRONMENTAL ASSESSMENT FOR THE REHABILITATION OF BRUSH CREEK SITE 15 WATERSHED DAM DATED FEBRUARY 2017.

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

GEOLOGIC PROFILES AND SECTIONS – SHEET 3 OF 3

Mercer County, WV

Brush Creek Watershed

Aterra Schnabel JV
300 Brookside Ave., Bldg. 15, Suite 160, Ambler, PA 19002
Phone: 336-274-8456
contact@aterra.com

USDA United States Department of Agriculture Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-08

SEPTEMBER 2024

SHEET 10 OF 61

REVISIONS			
#	DATE APPROVED	TITLE	DESCRIPTION

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Last Saved By: CPARSONS SheetDate: 10/02/2024 11:08 AM PltDate: 10/2/2024 2:59 PM
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MID: 26276965 - SHEET 3 OF 3

1 SITE ACCESS AND STAGING AREA PLAN

SCALE: 1" = 100'

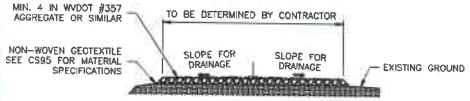
NOTES:

1. SEE SHEETS ES-01 – ES-15 FOR EROSION AND SEDIMENT CONTROL DETAILS.
2. AUXILIARY SPILLWAY MAY BE USED AS A STAGING/STOCKPILING AREA DURING THE EMBANKMENT WORK PROVIDED THE REQUIREMENTS IN THE SPECIAL CONDITIONS ARE MET
3. AREAS USED FOR SITE ACCESS, STAGING, AND STOCKPILING SHALL BE REPAIRED TO PRE-WORK CONDITIONS OR BETTER TO THE SATISFACTION OF THE COR UNLESS OTHERWISE SHOWN ON THE DRAWINGS.
4. EXISTING ROADWAY TO DAM CREST AND BOAT RAMP SHALL BE ACCESSIBLE BY THE SPONSORS AND FSD AT ALL TIMES. THE CONTRACTOR IS RESPONSIBLE FOR COSTS ASSOCIATED WITH IMPROVEMENTS TO ACCOMMODATE CONTRACTOR'S MEANS/METHODS TO THIS EXISTING ROADWAY. THE CONTRACTOR SHALL REPAIR THE ROADWAY TO PRE-CONSTRUCTION CONDITIONS AND TO THE SATISFACTION OF THE COR.

LEGEND

- EXISTING ROAD
- TEMPORARY ROAD/ CONSTRUCTION STAGING/ STOCKPILE AREA
- CLEARING AND GRUBBING LIMITS
- WETLANDS

SITE IMPACTS	
DESCRIPTION	AREA (AC)
LIMITS OF DISTURBANCE	20.16
CONSTRUCTION STAGING/STOCKPILING	5.87
CLEARING AND GRUBBING	2.22
PERMANENT WETLAND IMPACTS	0.15
TEMPORARY WETLAND IMPACTS	2.75



2 TYPICAL ACCESS ROAD DETAIL

NTS

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Designed	Drawn	Checked	Approved
Date	SEP 24	SEP 24	SEP 24	SEP 24
	CDS	CRP	EBB	JMP

BRUSH CREEK SITE 15 DAM REHABILITATION

SITE ACCESS AND STAGING PLAN

Brush Creek Watershed *Mercer County, WV*

USDA United States Department of Agriculture Natural Resources Conservation Service

ATERRA | Schnabel Solutions

300 Brookside Ave, Bldg 18, Suite 160, Ambler, PA 19002 Phone: 336-279-4408 www.aterra-schnabel.com

Contract No. 12SPEC18D0023

Drawing No. 15-C-09

SEPTEMBER 2024

SHEET 11 OF 61

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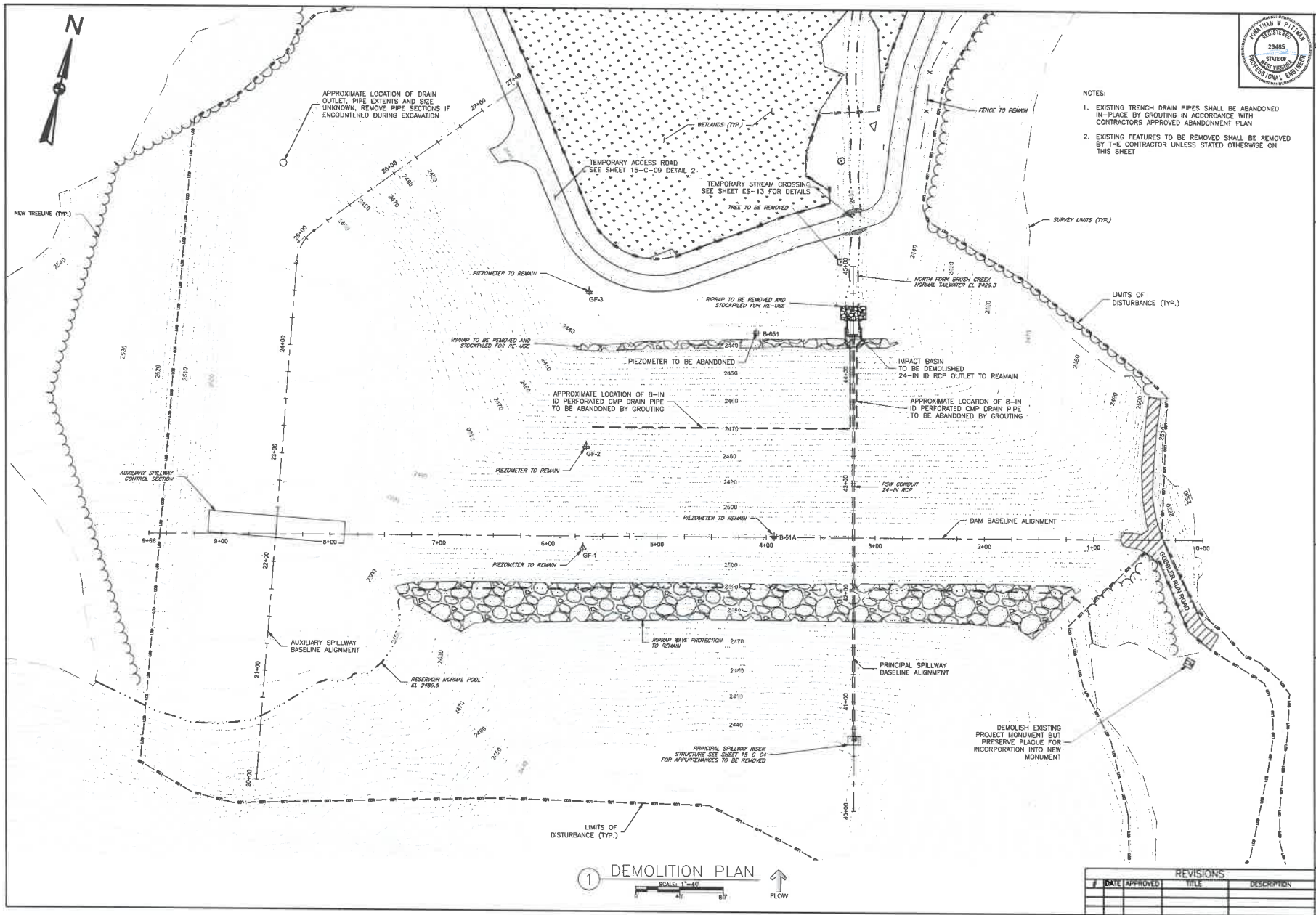
Last Saved By: CPARSONS SavedDate: 2/10/2025 3:21 PM PlotDate: 2/10/2025 1:22 PM
P:\Reviews\CK\Deeds Fork\2018\18C7043_DR_LMRCS_NE_Brush_Creek\GIS-SE Products\GIS-CAD\DRAWINGS\GIS-FINAL_DESIGN\SITE 15\C-15-SCAST.dwg Layout: SITE ACCESS AND STAGING PLAN



NOTES:

1. EXISTING TRENCH DRAIN PIPES SHALL BE ABANDONED IN-PLACE BY GROUTING IN ACCORDANCE WITH CONTRACTORS APPROVED ABANDONMENT PLAN
2. EXISTING FEATURES TO BE REMOVED SHALL BE REMOVED BY THE CONTRACTOR UNLESS STATED OTHERWISE ON THIS SHEET

JONATHAN W. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

DEMOLITION PLAN

Brush Creek Watershed — Mercer County, WV

Schnabel Engineering | ATERRA SOLUTIONS
300 Broadside Ave., Bldg. 1B, Suite 160, Mechanicsburg, PA 17055
Phone: 336-274-9456
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-10

SEPTEMBER 2024

SHEET 12 OF 61

REVISIONS

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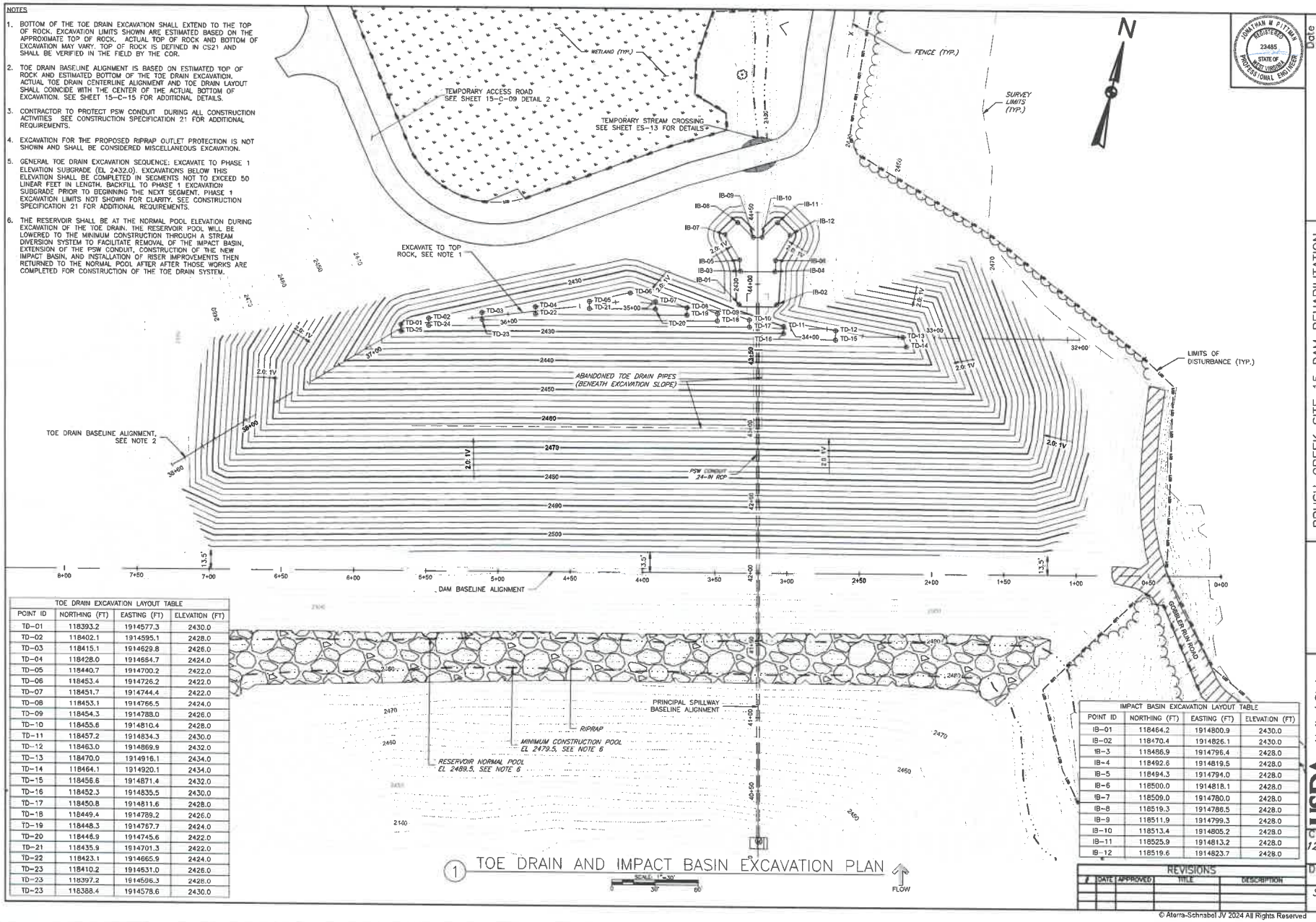
Plotted By: Christopher Hedore (chedore@schnabel-eng.com) File Name: C:\Projects\Brush Creek\Design\Sheets\Cad\Drawings\SS05-FINAL_DESIGN\SITE 15\0-15-06-DEMO.dwg Layout: DEMOLITION PLAN

NOTES

1. BOTTOM OF THE TOE DRAIN EXCAVATION SHALL EXTEND TO THE TOP OF ROCK. EXCAVATION LIMITS SHOWN ARE ESTIMATED BASED ON THE APPROXIMATE TOP OF ROCK. ACTUAL TOP OF ROCK AND BOTTOM OF EXCAVATION MAY VARY. TOP OF ROCK IS DEFINED IN CS21 AND SHALL BE VERIFIED IN THE FIELD BY THE COR.
2. TOE DRAIN BASELINE ALIGNMENT IS BASED ON ESTIMATED TOP OF ROCK AND ESTIMATED BOTTOM OF THE TOE DRAIN EXCAVATION. ACTUAL TOE DRAIN CENTERLINE ALIGNMENT AND TOE DRAIN LAYOUT SHALL COINCIDE WITH THE CENTER OF THE ACTUAL BOTTOM OF EXCAVATION. SEE SHEET 15-C-15 FOR ADDITIONAL DETAILS.
3. CONTRACTOR TO PROTECT PSW CONDUIT DURING ALL CONSTRUCTION ACTIVITIES. SEE CONSTRUCTION SPECIFICATION 21 FOR ADDITIONAL REQUIREMENTS.
4. EXCAVATION FOR THE PROPOSED RIPRAP OUTLET PROTECTION IS NOT SHOWN AND SHALL BE CONSIDERED MISCELLANEOUS EXCAVATION.
5. GENERAL TOE DRAIN EXCAVATION SEQUENCE: EXCAVATE TO PHASE 1 ELEVATION SUBGRADE (EL 2432.0). EXCAVATIONS BELOW THIS ELEVATION SHALL BE COMPLETED IN SEGMENTS NOT TO EXCEED 50 LINEAR FEET IN LENGTH. BACKFILL TO PHASE 1 EXCAVATION SUBGRADE PRIOR TO BEGINNING THE NEXT SEGMENT. PHASE 1 EXCAVATION LIMITS NOT SHOWN FOR CLARITY. SEE CONSTRUCTION SPECIFICATION 21 FOR ADDITIONAL REQUIREMENTS.
6. THE RESERVOIR SHALL BE AT THE NORMAL POOL ELEVATION DURING EXCAVATION OF THE TOE DRAIN. THE RESERVOIR POOL WILL BE LOWERED TO THE MINIMUM CONSTRUCTION THROUGH A STREAM DIVERSION SYSTEM TO FACILITATE REMOVAL OF THE IMPACT BASIN, EXTENSION OF THE PSW CONDUIT, CONSTRUCTION OF THE NEW IMPACT BASIN, AND INSTALLATION OF RISER IMPROVEMENTS THEN RETURNED TO THE NORMAL POOL AFTER AFTER THOSE WORKS ARE COMPLETED FOR CONSTRUCTION OF THE TOE DRAIN SYSTEM.



1 TOE DRAIN AND IMPACT BASIN EXCAVATION PLAN

SCALE: 1" = 30'

TOE DRAIN EXCAVATION LAYOUT TABLE

POINT ID	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)
TD-01	118393.2	1914577.3	2430.0
TD-02	118402.1	1914595.1	2428.0
TD-03	118415.1	1914629.8	2426.0
TD-04	118428.0	1914664.7	2424.0
TD-05	118440.7	1914700.2	2422.0
TD-06	118453.4	1914726.2	2422.0
TD-07	118451.7	1914744.4	2422.0
TD-08	118453.1	1914766.5	2424.0
TD-09	118454.3	1914788.0	2426.0
TD-10	118455.6	1914810.4	2428.0
TD-11	118457.2	1914834.3	2430.0
TD-12	118463.0	1914869.9	2432.0
TD-13	118470.0	1914916.1	2434.0
TD-14	118464.1	1914920.1	2434.0
TD-15	118456.6	1914871.4	2432.0
TD-16	118452.3	1914835.5	2430.0
TD-17	118450.8	1914811.6	2428.0
TD-18	118449.4	1914789.2	2426.0
TD-19	118448.3	1914767.7	2424.0
TD-20	118446.9	1914745.6	2422.0
TD-21	118435.9	1914701.3	2422.0
TD-22	118423.1	1914665.9	2424.0
TD-23	118410.2	1914631.0	2426.0
TD-23	118397.2	1914596.3	2428.0
TD-23	118388.4	1914578.6	2430.0

IMPACT BASIN EXCAVATION LAYOUT TABLE

POINT ID	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)
IB-01	118464.2	1914800.9	2430.0
IB-02	118470.4	1914826.1	2430.0
IB-3	118486.9	1914796.4	2428.0
IB-4	118492.6	1914819.5	2428.0
IB-5	118494.3	1914794.0	2428.0
IB-6	118500.0	1914818.1	2428.0
IB-7	118509.0	1914780.0	2428.0
IB-8	118519.3	1914786.5	2428.0
IB-9	118511.9	1914799.3	2428.0
IB-10	118513.4	1914805.2	2428.0
IB-11	118525.9	1914813.2	2428.0
IB-12	118519.6	1914823.7	2428.0

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

JONATHAN M. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

		Date
Designed	CDS	SEP 24
Drawn	CRP	SEP 24
Checked	EBB	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

TOE DRAIN EXCAVATION PLAN

Brush Creek Watershed *Mercer County, WV*

Schnabel Engineering
ATERRA SOLUTION
300 Brookside Ave., Bldg. 18, Suite 160, Beckley, WV 25801
Phone: 336-274-4456
jpittman@atl-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. *12SPEC18D0023*

Drawing No. 15-C-11

SEPTEMBER 2024

SHEET 13 OF 61

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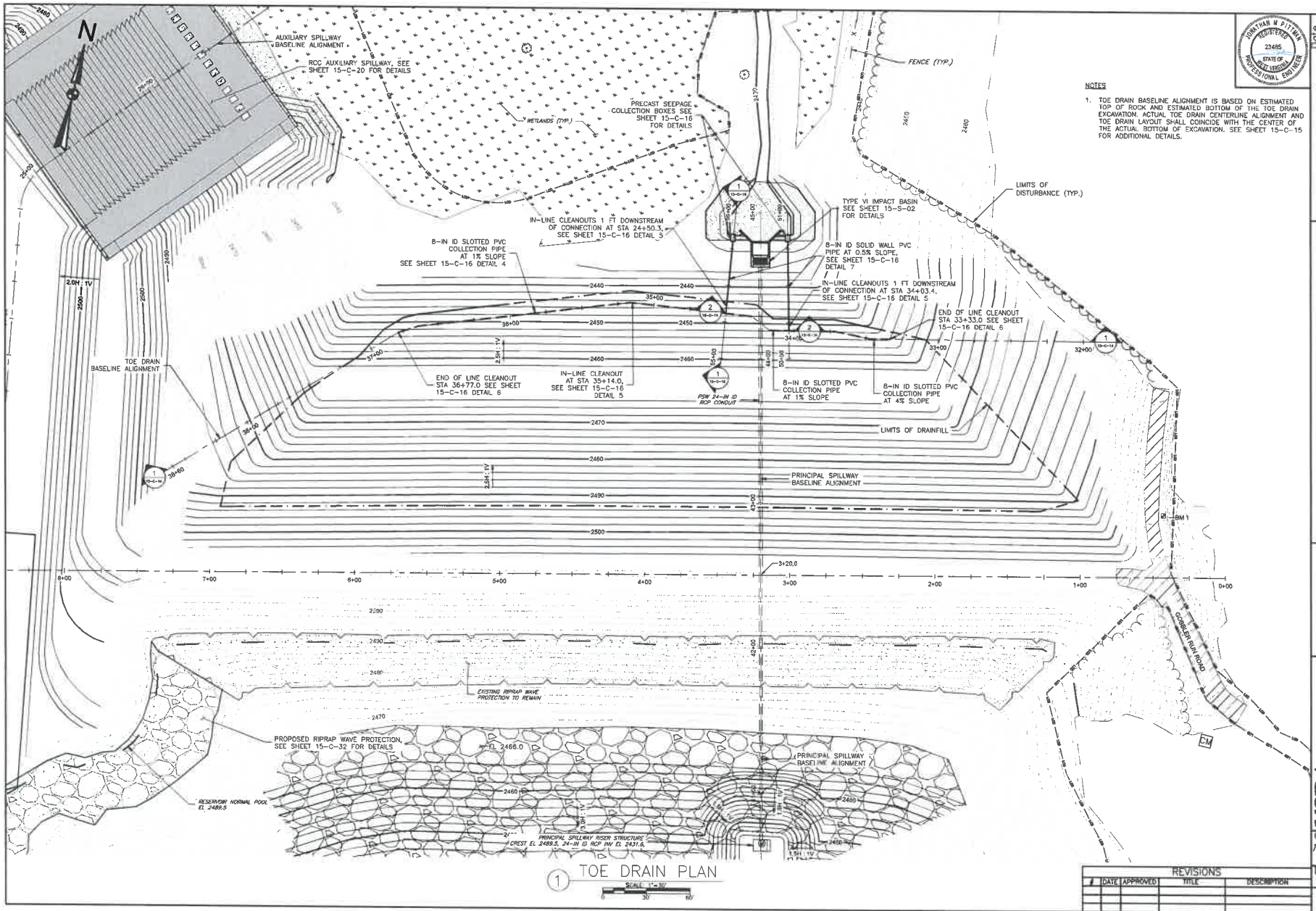

1 TOE DRAIN PLAN

SCALE 1"=30'

NOTES

1. TOE DRAIN BASELINE ALIGNMENT IS BASED ON ESTIMATED TOP OF ROCK AND ESTIMATED BOTTOM OF THE TOE DRAIN EXCAVATION. ACTUAL TOE DRAIN CENTERLINE ALIGNMENT AND TOE DRAIN LAYOUT SHALL COINCIDE WITH THE CENTER OF THE ACTUAL BOTTOM OF EXCAVATION. SEE SHEET 15-C-15 FOR ADDITIONAL DETAILS.

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Designed	Drawn	Checked	Approved
Date	SEP 24	SEP 24	SEP 24	SEP 24
	CDS	CRP	EBB	JMP

BRUSH CREEK SITE 15 DAM REHABILITATION

PROPOSED TOE DRAIN PLAN

Brush Creek Watershed *Mercer County, WV*

Schnabel Engineering
Aterra Solutions
300 Brookside Ave., Bldg 16, Suite 160, Morgantown, WV 26501
Phone: 336-274-0168
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-12

SEPTEMBER 2024

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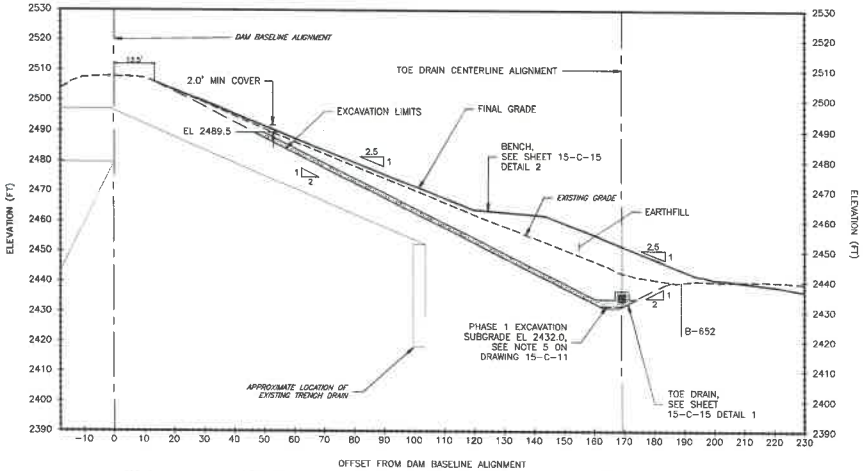
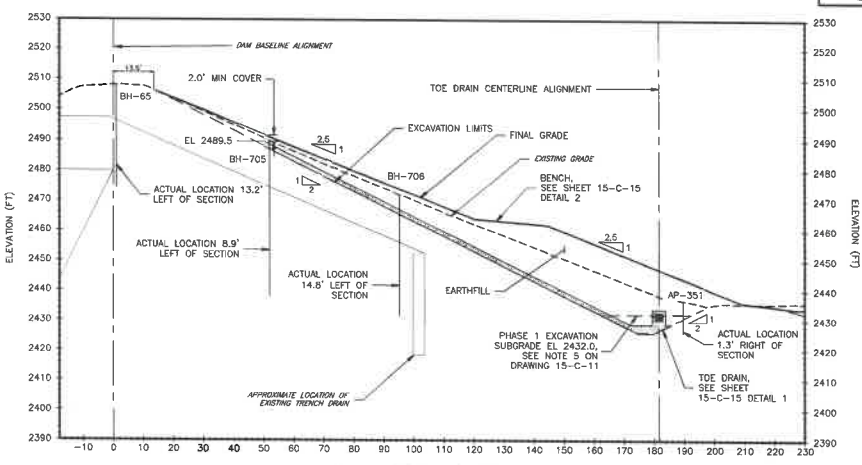


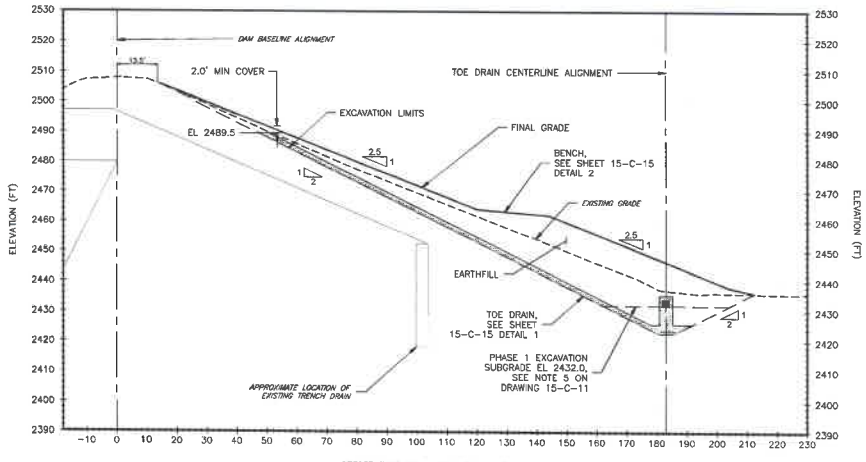
1 15-C-04 EMBANKMENT SECTION AT DAM BASELINE STA 2+75

SCALE: 1"=20'



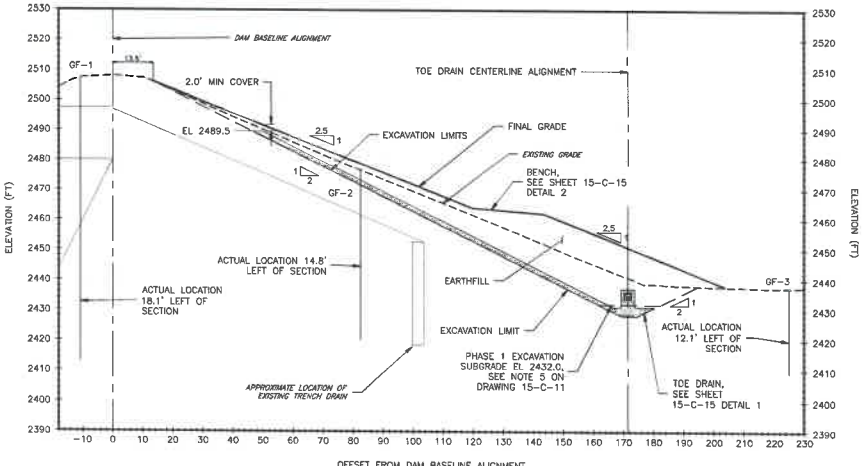
2 15-C-04 EMBANKMENT SECTION AT DAM BASELINE STA 3+50

SCALE: 1"=20'



3 15-C-04 EMBANKMENT SECTION AT DAM BASLINE STA 4+50

SCALE: 1"=20'



4 15-C-04 EMBANKMENT SECTION AT DAM BASLINE STA 5+50

SCALE: 1"=20'

NOTES

1. SEE SHEET 15-C-02 FOR TYPICAL EMBANKMENT ZONING DETAILS

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JONATHAN N. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Date	
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JNP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

EMBANKMENT SECTIONS

Brush Creek Watershed *Mercer County, WV*

Schnabel Engineering | ATERRA SOLUTIONS
300 Brockside Ave., Bldg 18, Suite 160, Columbus, OH 43228
Phone: 330-274-8406
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

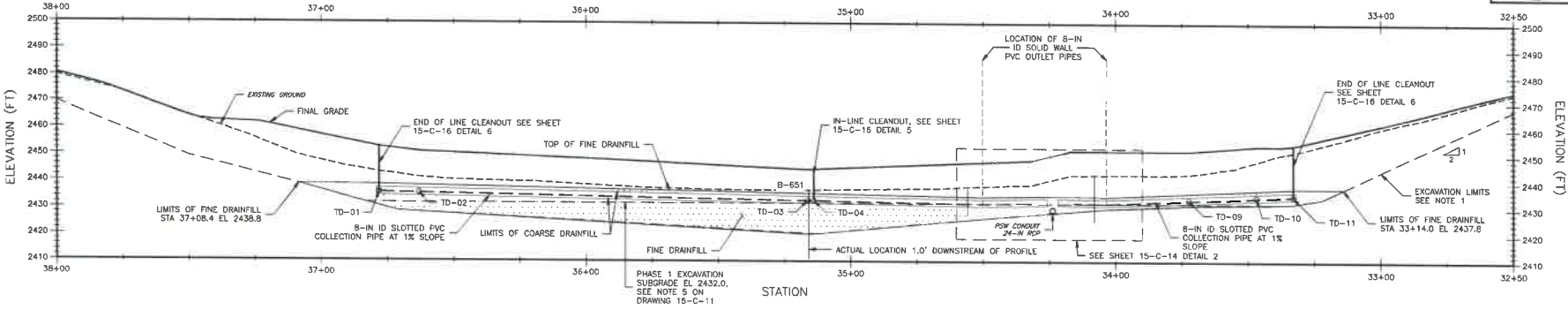
Contract No. 12SPEC18D0023

Drawing No. 15-C-13

SEPTEMBER 2024

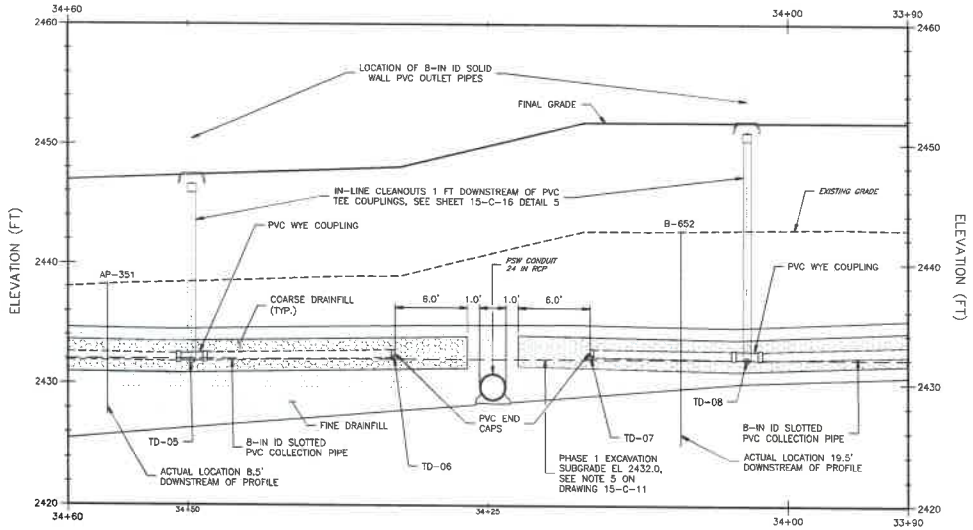
SHEET 15 OF 61

Last Saved By: CPARSONS SendDate: 10/2/2024 11:23 AM PlotDate: 10/2/2024 3:09 PM
File Name: C:\Users\cparsons\Aterra-Schnabel JV\Brush Creek Watershed - CAD\BRANWB\SDS\15-FINAL_DESIGN\SITE 15\C-15-03-PRSP-Avg Layout EMBANKMENT SECTIONS



1 PROFILE ALONG TOE DRAIN BASELINE ALIGNMENT

SCALE: 1"=20'



2 TOE DRAIN PROFILE AT PSW CONDUIT

SCALE: 1"=5'

TOE DRAIN LAYOUT			
POINT	STATION	INV. EL	DESCRIPTION
TD-01	36+28.25	2435.8	END OF LINE CLEANOUT
TD-02	36+63.22	2435.6	11.25° BEND
TD-03	35+16.24	2433.0	11.25° BEND
TD-04	35+14.00	2432.9	IN-LINE CLEANOUT
TD-05	34+50.26	2431.8	PVC WYE COUPLING TO OUTLET PIPE
TD-06	34+32.80	2432.1	END OF LINE END CAPS
TD-07	34+16.43	2432.2	END OF LINE END CAPS
TD-08	34+03.41	2432.0	PVC WYE COUPLING TO OUTLET PIPE
TD-09	33+72.45	2433.2	11.25° BEND
TD-10	33+46.89	2433.3	11.25° BEND
TD-11	33+33.00	2434.8	END OF LINE CLEANOUT

NOTES

1. BOTTOM OF THE TOE DRAIN EXCAVATION SHALL EXTEND TO THE TOP OF ROCK. EXCAVATION LIMITS SHOWN ARE ESTIMATED BASED ON THE APPROXIMATE TOP OF ROCK. ACTUAL TOP OF ROCK AND BOTTOM OF EXCAVATION MAY VARY. TOP OF ROCK IS DEFINED IN CS21 AND WILL BE VERIFIED IN THE FIELD BY THE ENGINEER.
2. TOE DRAIN BASELINE ALIGNMENT IS BASED ON ESTIMATED TOP OF ROCK AND ESTIMATED BOTTOM OF THE TOE DRAIN EXCAVATION. ACTUAL TOE DRAIN BASELINE ALIGNMENT WILL BE IN LINE WITH THE INVERT OF THE PIPE IF TOP OF ROCK IS DETERMINED TO BE AT A LOWER OR HIGHER ELEVATION IN THE FIELD. SEE SHEET 15-C-15 FOR ADDITIONAL DETAILS.

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Date		
Designed	CDS	SEP 24
Drawn	CRP	SEP 24
Checked	EBB	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

TOE DRAIN PROFILE

Brush Creek Watershed *Mercer County, WV*

Schnabel ENGINEERING | ATERRA SOLUTIONS
300 Brookside Ave., Bldg. 15, Suite 160, Ambler, PA 19002
Phone: 336-274-4548
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-14

SEPTEMBER 2024

SHEET 16 OF 61

REVISIONS				
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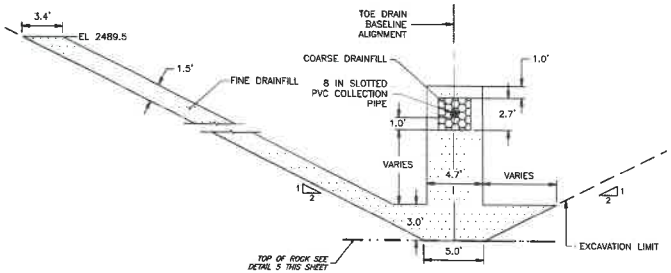
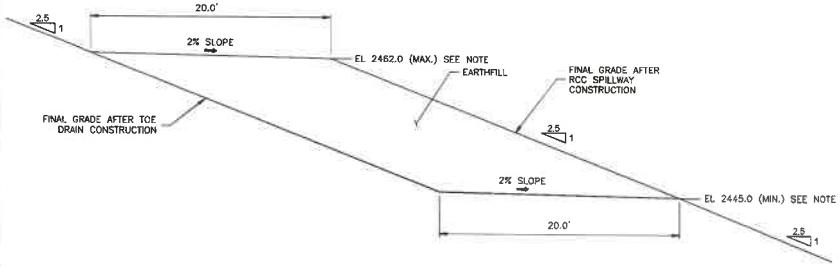
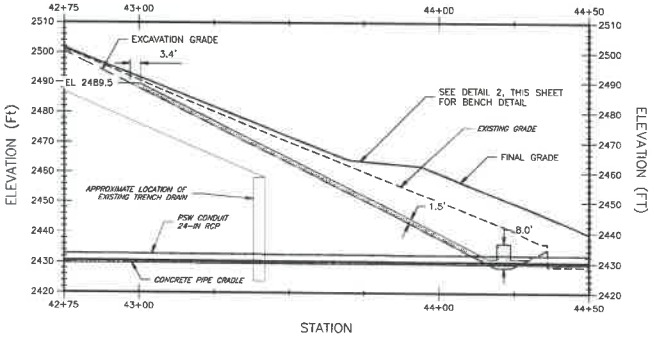


1 TYPICAL TOE DRAIN DETAIL
NTS

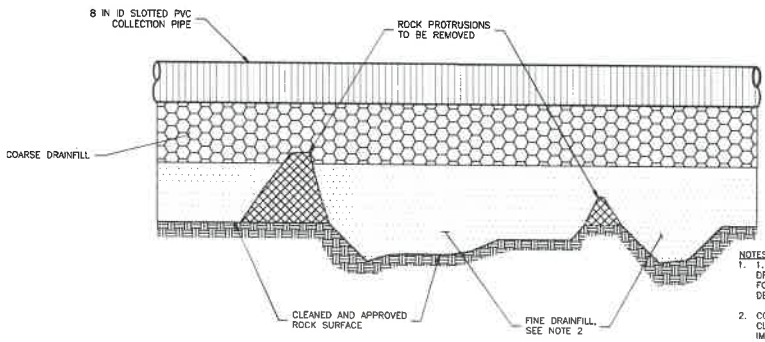


2 TYPICAL DOWNSTREAM SLOPE BENCH DETAIL
SCALE: 1"=5'

NOTE: ELEVATION OF TOP OF BENCH MAY VARY BASED ON ACTUAL VOLUME OF EXCESS EARTHFILL MATERIALS.

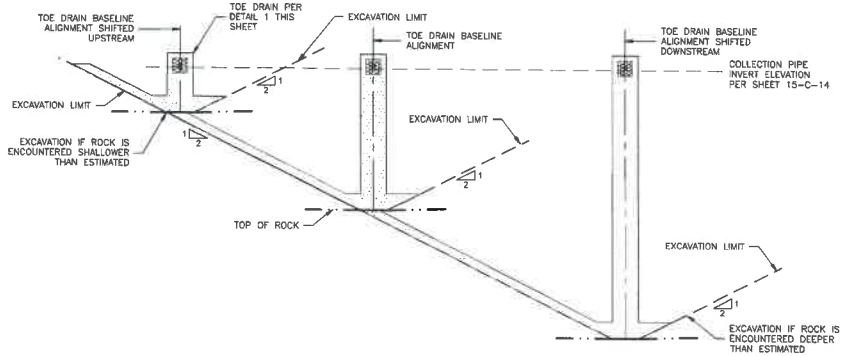


3 TOE DRAIN SECTION AT PSW CONDUIT
15-C-04
SCALE: 1"=20'



4 REMOVAL OF ROCK PROTRUSION AND PLACEMENT OF DRAINFILL IN DEPRESSIONS
SCALE: 1"=1'

NOTES:
1. 1. THIS DETAIL APPLIES TO TOE DRAIN ONLY. SEE SHEET 15-C-28, FOR RCC FOUNDATION PREPARATION DETAILS.
2. CONTRACTOR SHALL COVER THE CLEANED APPROVED ROCK SURFACE IMMEDIATELY AFTER FINAL CLEANING. SEE CONSTRUCTION SPECIFICATION 63 FOR ADDITIONAL DETAILS.
3. FOUNDATION GRADE SHALL HAVE NO VERTICAL SURFACES. VERTICAL SURFACES FOUND IN ROCK SHALL BE TRIMMED TO A MINIMUM SLOPE OF 1H:1V OR AS DIRECTED BY COR



5 TOE DRAIN DETAIL FOR TOP OF ROCK VARIABILITY
NTS

JONATHAN W. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Designed	Drawn	Checked	Approved
Date	CDS SEP 24	CRP SEP 24	FBB SEP 24	JMP SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

TOE DRAIN DETAILS - SHEET 1 OF 2

Brush Creek Watershed *Mercer County, WV*

Schnabel Engineering | ATERRA Solutions
300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 336-274-9456
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-15

SEPTEMBER 2024

SHEET 17 OF 61

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

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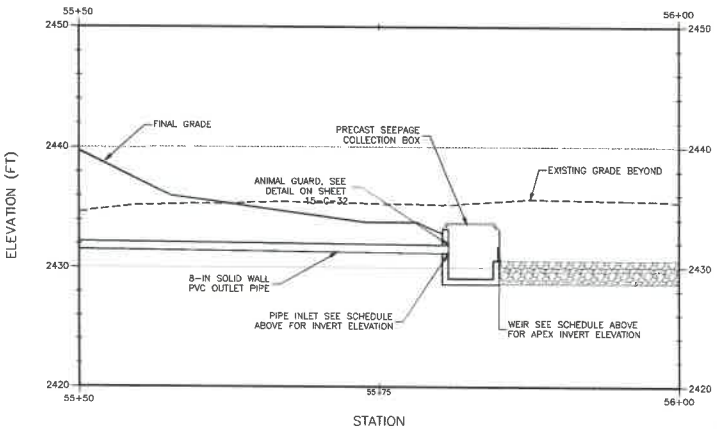
File Name: P:\Projects\WV\Mercer\15_Brush_Creek\CAD\Plan Sheets\15-C_Toe_Drain\15-C-15_TOE DRAIN DETAILS.dgn
Active Sheet: 1 OF 2

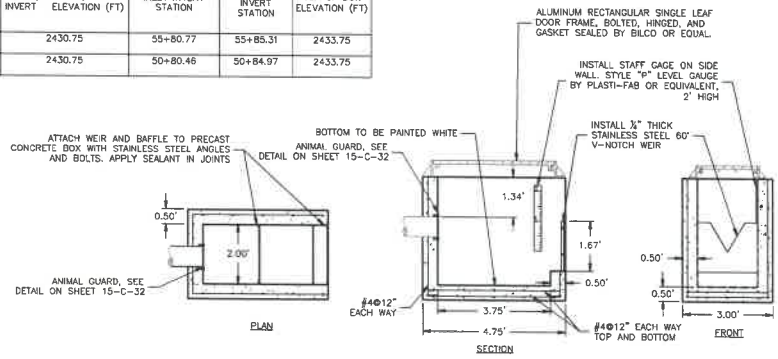
PRECAST SEEPAGE COLLECTION BOX SCHEDULE

SEEPAGE BOX	INLET PIPE INVERT ELEVATION (FT)	WEIR (V-NOTCH) APEX INVERT ELEVATION (FT)	INLET INVERT STATION	OUTLET INVERT STATION	TOP OF BOX ELEVATION (FT)
1	2431.20	2430.75	55+80.77	55+85.31	2433.75
2	2431.20	2430.75	50+80.46	50+84.97	2433.75

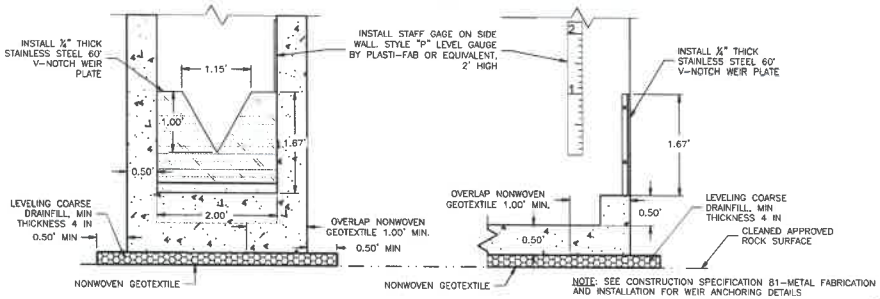


1 (15-C-13) LEFT PRECAST SEEPAGE COLLECTION BOX PROFILE

NOTE: SEE SCHEDULE ABOVE FOR RIGHT PRECAST SEEPAGE COLLECTION BOX STATIONING AND ELEVATIONS

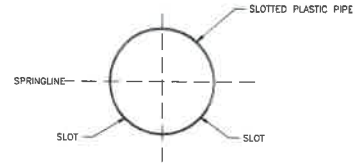


2 TYPICAL PRECAST SEEPAGE COLLECTION BOX DETAILS NTS



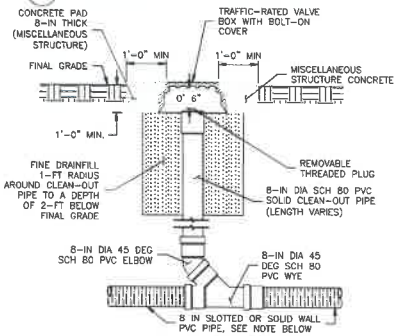
NOTE: SEE CONSTRUCTION SPECIFICATION 81-METAL FABRICATION AND INSTALLATION FOR WEIR ANCHORING DETAILS

3 PRECAST SEEPAGE COLLECTION BOX WEIR PLATE DETAIL



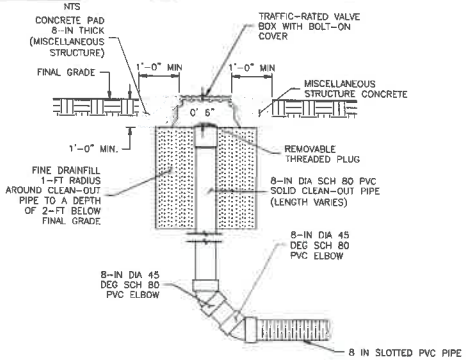
NOTE: SEE CS45 FOR SLOT SIZING AND PLACEMENT REQUIREMENTS

4 SLOTTED COLLECTION PIPE DETAIL NTS



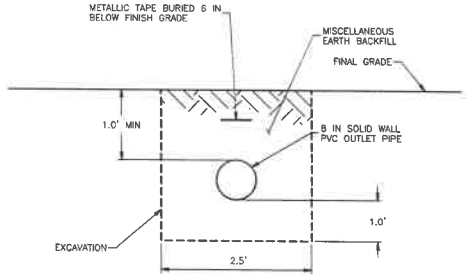
NOTE: PIPES CONNECTED BY CLEANOUTS LOCATED ALONG THE TOE DRAIN BASELINE ALIGNMENT TO BE SLOTTED, ALL OTHER CONNECTED TO CLEANOUT TO BE SLOTTED

5 TYPICAL IN-LINE CLEANOUT DETAIL NTS



NOTE: DRAINFILL ENCAPSULATES COLLECTION PIPE NOT SHOWN FOR CLARITY

6 TYPICAL END-OF-LINE CLEANOUT DETAIL NTS



7 (15-C-13) TYPICAL SOLID WALL PIPE BEDDING DETAIL NTS

JONATHAN N. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Designed	CDS	Date	SEP 24
Drawn	CRP		SEP 24
Checked	EBB		SEP 24
Approved	JMP		SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

TOE DRAIN DETAILS - SHEET 2 OF 2

Brush Creek Watershed *Mercer County, WV*

Schnabel Engineering | AECOM Solutions

300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
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schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-16

SEPTEMBER 2024

SHEET 18 OF 61

REVISIONS			
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Last Saved By: CPARSONS SaveDate: 10/2/2024 11:19 AM PltDate: 10/2/2024 3:39 PM
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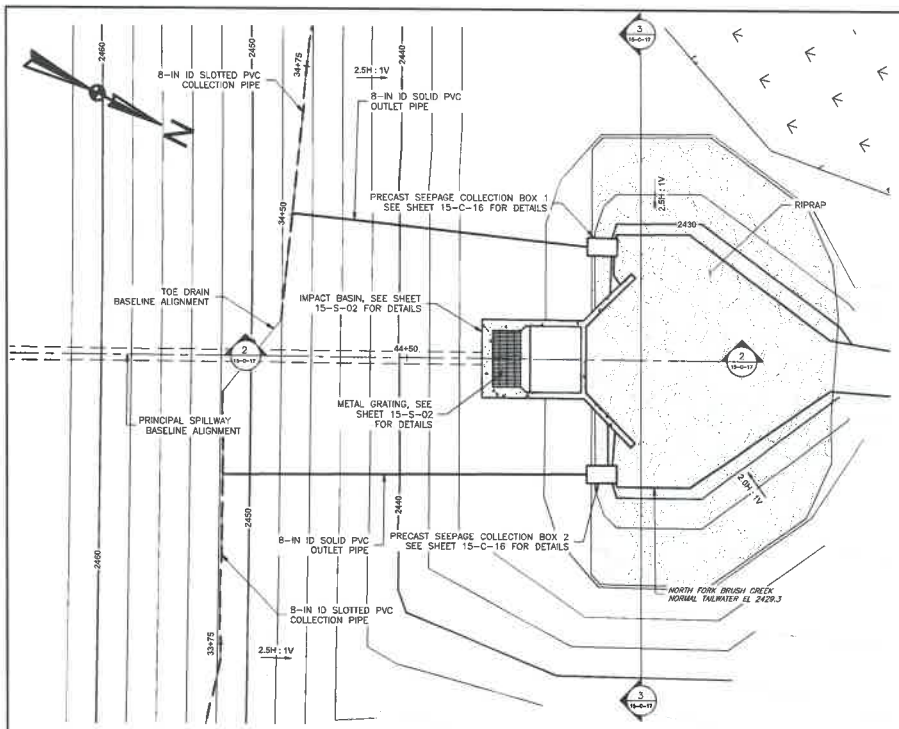
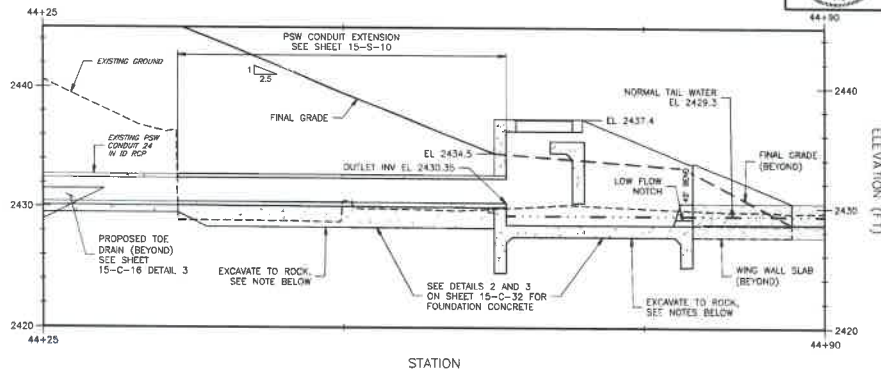
SHEET 2 OF 2



1 PRINCIPAL SPILLWAY OUTLET PLAN

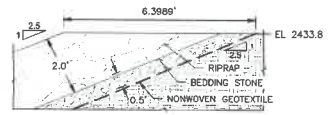
NOTE: EXCAVATION FOR PSW SPILLWAY EXTENSION AND IMPACT BASIN OUTLET IS CLASSIFIED AS MISCELLANEOUS EXCAVATION SUBSIDIARY TO THE IMPACT BASIN OUTLET WORK.



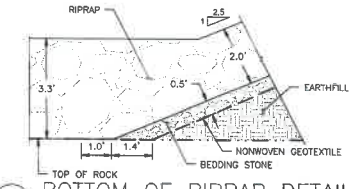
2 PRINCIPAL SPILLWAY OUTLET PROFILE

NOTES

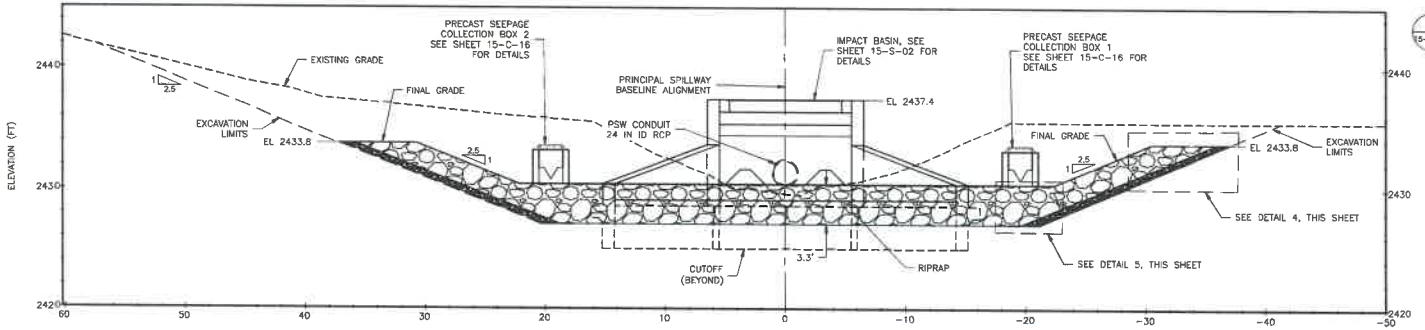
1. EXCAVATION FOR PSW SPILLWAY EXTENSION AND IMPACT BASIN OUTLET IS CLASSIFIED AS MISCELLANEOUS EXCAVATION SUBSIDIARY TO THE IMPACT BASIN OUTLET WORK. NECESSARY EXCAVATION FOR THE REMOVAL OF THE EXISTING IMPACT BASIN WILL BE PERFORMED BEFORE CONSTRUCTION OF NEW IMPACT BASIN.
2. CONTRACTOR SHALL COVER THE CLEANED, APPROVED ROCK SURFACE IMMEDIATELY AFTER FINAL CLEANING. SEE CONSTRUCTION SPECIFICATION 63 FOR ADDITIONAL DETAILS.
3. GUARDRAIL NOT SHOWN FOR CLARITY, SEE SHEET 15-S-02 FOR DETAILS



4 TOP OF RIPRAP DETAIL



5 BOTTOM OF RIPRAP DETAIL



3 PRINCIPAL SPILLWAY OUTLET ELEVATION VIEW

NOTE: GUARDRAIL NOT SHOWN FOR CLARITY, SEE SHEET 15-S-02 FOR DETAILS

REVISIONS			
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Checked	EBB	SEP 24
Approved	MJP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

PROPOSED PRINCIPAL SPILLWAY OUTLET PLAN, PROFILE, AND ELEVATION

Brush Creek Watershed — *Mercer County, WV*

Schnabel Engineering | ATERRA Solutions
300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 267-274-2456
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-17

SEPTEMBER 2024

SHEET 19 OF 61

Last Saved By: CPARSONS SaveDate: 10/2/2024 11:22 AM PltDate= 10/2/2024 3:13 PM
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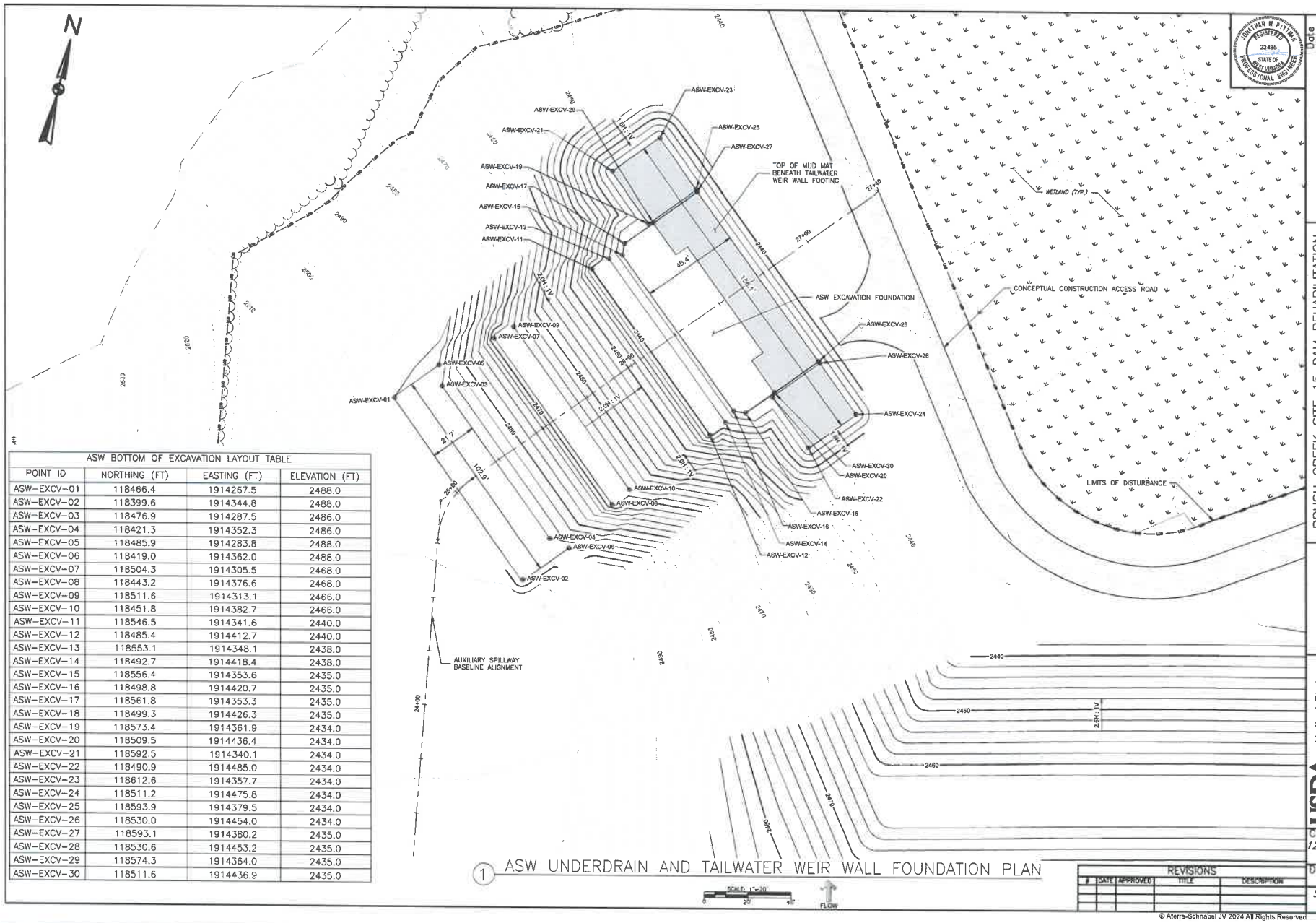

ASW BOTTOM OF EXCAVATION LAYOUT TABLE			
POINT ID	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)
ASW-EXCV-01	118466.4	1914267.5	2488.0
ASW-EXCV-02	118399.6	1914344.8	2488.0
ASW-EXCV-03	118476.9	1914287.5	2486.0
ASW-EXCV-04	118421.3	1914352.3	2486.0
ASW-EXCV-05	118485.9	1914283.8	2488.0
ASW-EXCV-06	118419.0	1914362.0	2488.0
ASW-EXCV-07	118504.3	1914305.5	2468.0
ASW-EXCV-08	118443.2	1914376.6	2468.0
ASW-EXCV-09	118511.6	1914313.1	2466.0
ASW-EXCV-10	118451.8	1914382.7	2466.0
ASW-EXCV-11	118546.5	1914341.6	2440.0
ASW-EXCV-12	118485.4	1914412.7	2440.0
ASW-EXCV-13	118553.1	1914348.1	2438.0
ASW-EXCV-14	118492.7	1914418.4	2438.0
ASW-EXCV-15	118556.4	1914353.6	2435.0
ASW-EXCV-16	118498.8	1914420.7	2435.0
ASW-EXCV-17	118561.8	1914353.3	2435.0
ASW-EXCV-18	118499.3	1914426.3	2435.0
ASW-EXCV-19	118573.4	1914361.9	2434.0
ASW-EXCV-20	118509.5	1914436.4	2434.0
ASW-EXCV-21	118592.5	1914340.1	2434.0
ASW-EXCV-22	118490.9	1914485.0	2434.0
ASW-EXCV-23	118612.6	1914357.7	2434.0
ASW-EXCV-24	118511.2	1914475.8	2434.0
ASW-EXCV-25	118593.9	1914379.5	2434.0
ASW-EXCV-26	118530.0	1914454.0	2434.0
ASW-EXCV-27	118593.1	1914380.2	2435.0
ASW-EXCV-28	118530.6	1914453.2	2435.0
ASW-EXCV-29	118574.3	1914364.0	2435.0
ASW-EXCV-30	118511.6	1914436.9	2435.0

1 ASW UNDERDRAIN AND TAILWATER WEIR WALL FOUNDATION PLAN

SCALE: 1"=20'

FLOW

JONATHAN N. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Date	
Designed	CDS SEP 24
Drawn	CRP SEP 24
Checked	EBB SEP 24
Approved	JMP SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

ASW UNDERDRAIN AND TAILWATER WEIR WALL FOUNDATION PLAN

Brush Creek Watershed *Mercer County, WV*

Schnabel Engineering | ATERRA SOLUTIONS
300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 336-274-9456
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Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-18

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SHEET 20 OF 61

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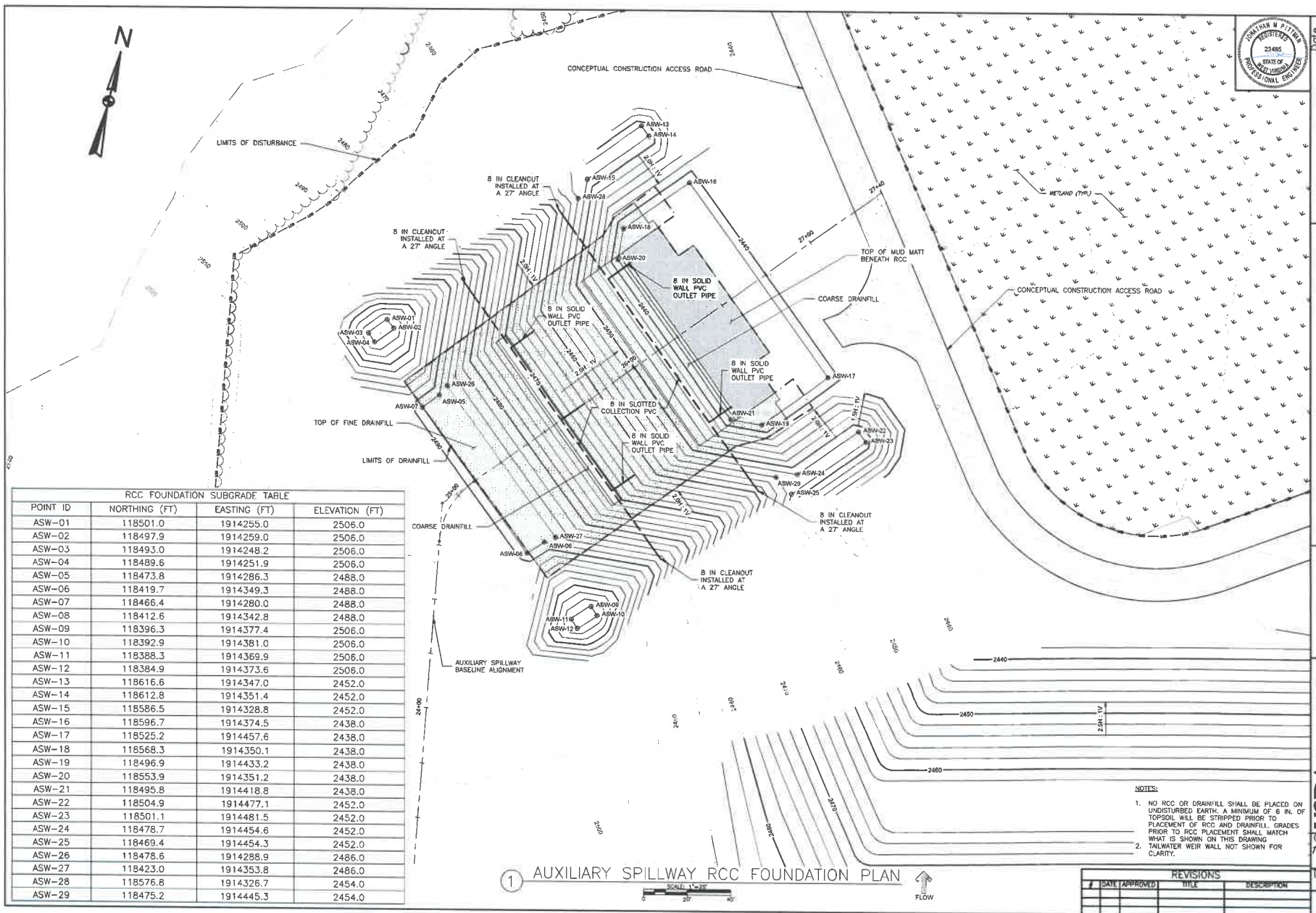

RCC FOUNDATION SUBGRADE TABLE			
POINT ID	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)
ASW-01	118501.0	1914255.0	2506.0
ASW-02	118497.9	1914259.0	2506.0
ASW-03	118493.0	1914248.2	2506.0
ASW-04	118489.6	1914251.9	2506.0
ASW-05	118473.8	1914286.3	2488.0
ASW-06	118419.7	1914349.3	2488.0
ASW-07	118466.4	1914280.0	2488.0
ASW-08	118412.6	1914342.8	2488.0
ASW-09	118396.3	1914377.4	2506.0
ASW-10	118392.9	1914381.0	2506.0
ASW-11	118388.3	1914369.9	2506.0
ASW-12	118384.9	1914373.6	2506.0
ASW-13	118616.6	1914347.0	2452.0
ASW-14	118612.8	1914351.4	2452.0
ASW-15	118586.5	1914328.8	2452.0
ASW-16	118596.7	1914374.5	2438.0
ASW-17	118525.2	1914457.6	2438.0
ASW-18	118568.3	1914350.1	2438.0
ASW-19	118496.9	1914433.2	2438.0
ASW-20	118553.9	1914351.2	2438.0
ASW-21	118495.8	1914418.8	2438.0
ASW-22	118504.9	1914477.1	2452.0
ASW-23	118501.1	1914481.5	2452.0
ASW-24	118478.7	1914454.6	2452.0
ASW-25	118469.4	1914454.3	2452.0
ASW-26	118478.6	1914288.9	2486.0
ASW-27	118423.0	1914353.8	2486.0
ASW-28	118576.8	1914326.7	2454.0
ASW-29	118475.2	1914445.3	2454.0

1 AUXILIARY SPILLWAY RCC FOUNDATION PLAN
SCALE: 1"=20'

NOTES:
1. NO RCC OR DRAINFILL SHALL BE PLACED ON UNDISTURBED EARTH. A MINIMUM OF 6 IN. OF TOPSOIL WILL BE STRIPPED PRIOR TO PLACEMENT OF RCC AND DRAINFILL. GRADES PRIOR TO RCC PLACEMENT SHALL MATCH WHAT IS SHOWN ON THIS DRAWING
2. TAILWATER WEIR WALL NOT SHOWN FOR CLARITY.

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Date	
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION
AUXILIARY SPILLWAY RCC FOUNDATION PLAN
Brush Creek Watershed *Mercer County, WV*

Schnabel Engineering / ATERRA SOLUTIONS
300 Brookside Ave., Bldg. 15, Suite 160, Beckley, WV 25801
Phone: 336-274-9458
schnabel-eng.com

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SHEET 21 OF 61

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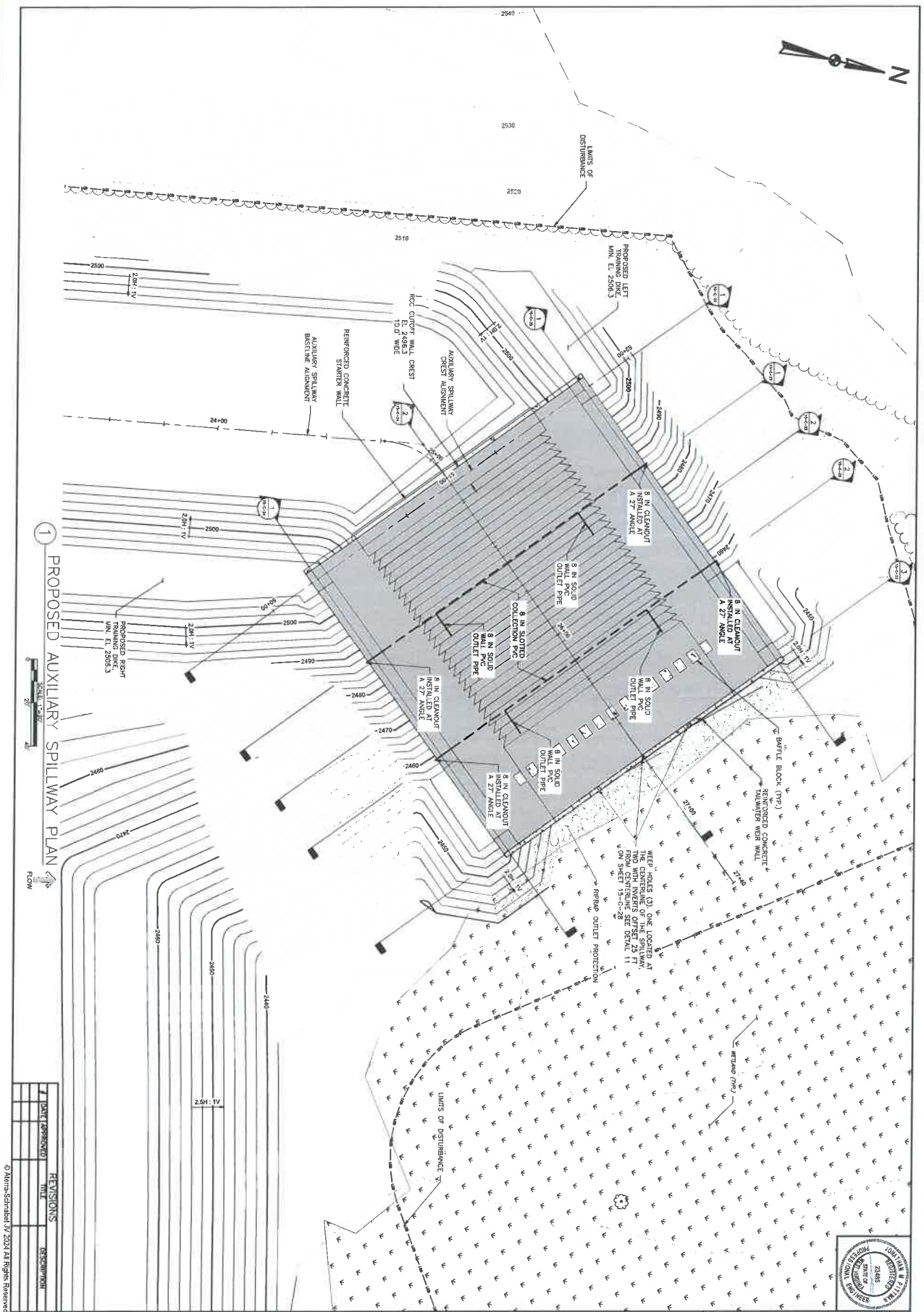

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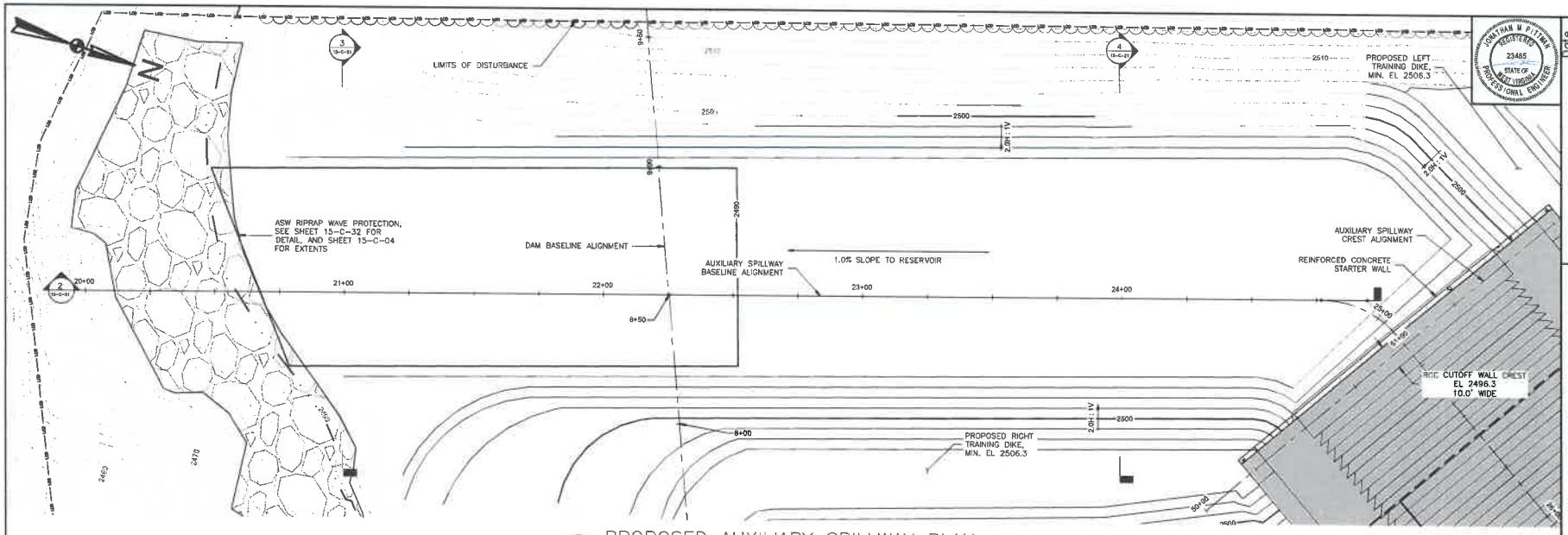
BRUSH CREEK SITE 15 DAM REHABILITATION

PROPOSED AUXILIARY SPILLWAY PLAN– SHEET 1 OF 2

Brush Creek Watershed *Mercer County, WV*

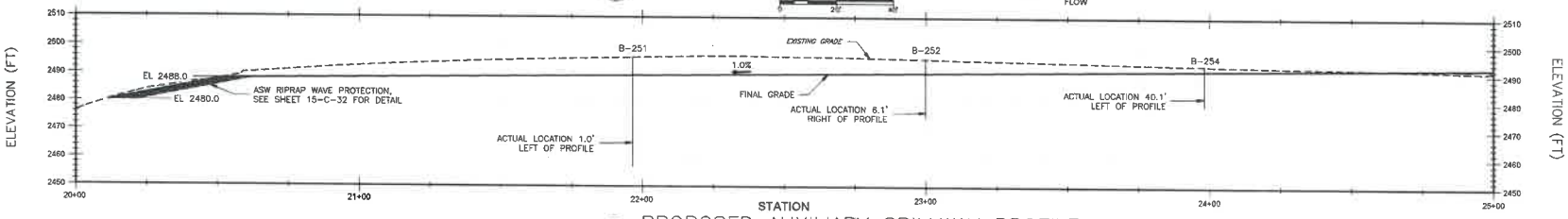
JONATHAN M. PITTMAN LICENSED PROFESSIONAL ENGINEER 23485 STATE OF WEST VIRGINIA

		Date
Designed	CDS	SEP 24
Drawn	CRP	SEP 24
Checked	EBB	SEP 24
Approved	JMP	SEP 24



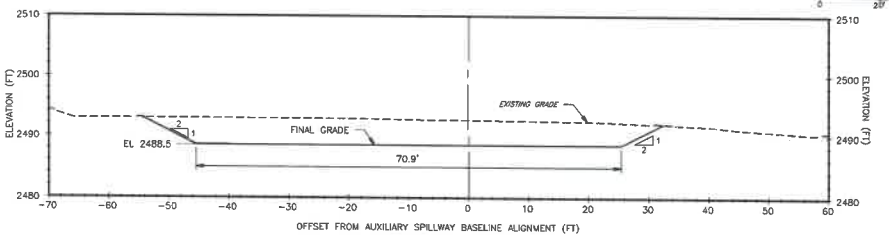
1 PROPOSED AUXILIARY SPILLWAY PLAN

SCALE: 1"=30'



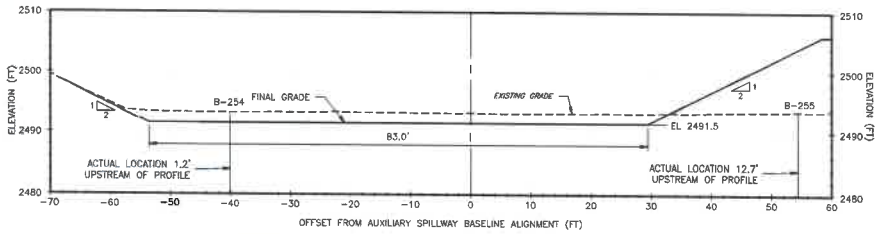
2 PROPOSED AUXILIARY SPILLWAY PROFILE

SCALE: 1"=30'



3 AUXILIARY SPILLWAY SECTION AT STA 21+00

SCALE: 1"=10'



4 AUXILIARY SPILLWAY SECTION AT STA 24+00

SCALE: 1"=10'

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Drawn	CRP	SEP 24
Checked	EBB	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

PROPOSED AUXILIARY SPILLWAY PLAN–SHEET 2 OF 2

Brush Creek Watershed *Mercer County, WV*

Schnabel Engineering
ATERRA SOLUTIONS
300 Brookside Ave., Bldg 15, Suite 160, Morgantown, WV 26501
Phone: 336-271-9456
schnabel-eng.com

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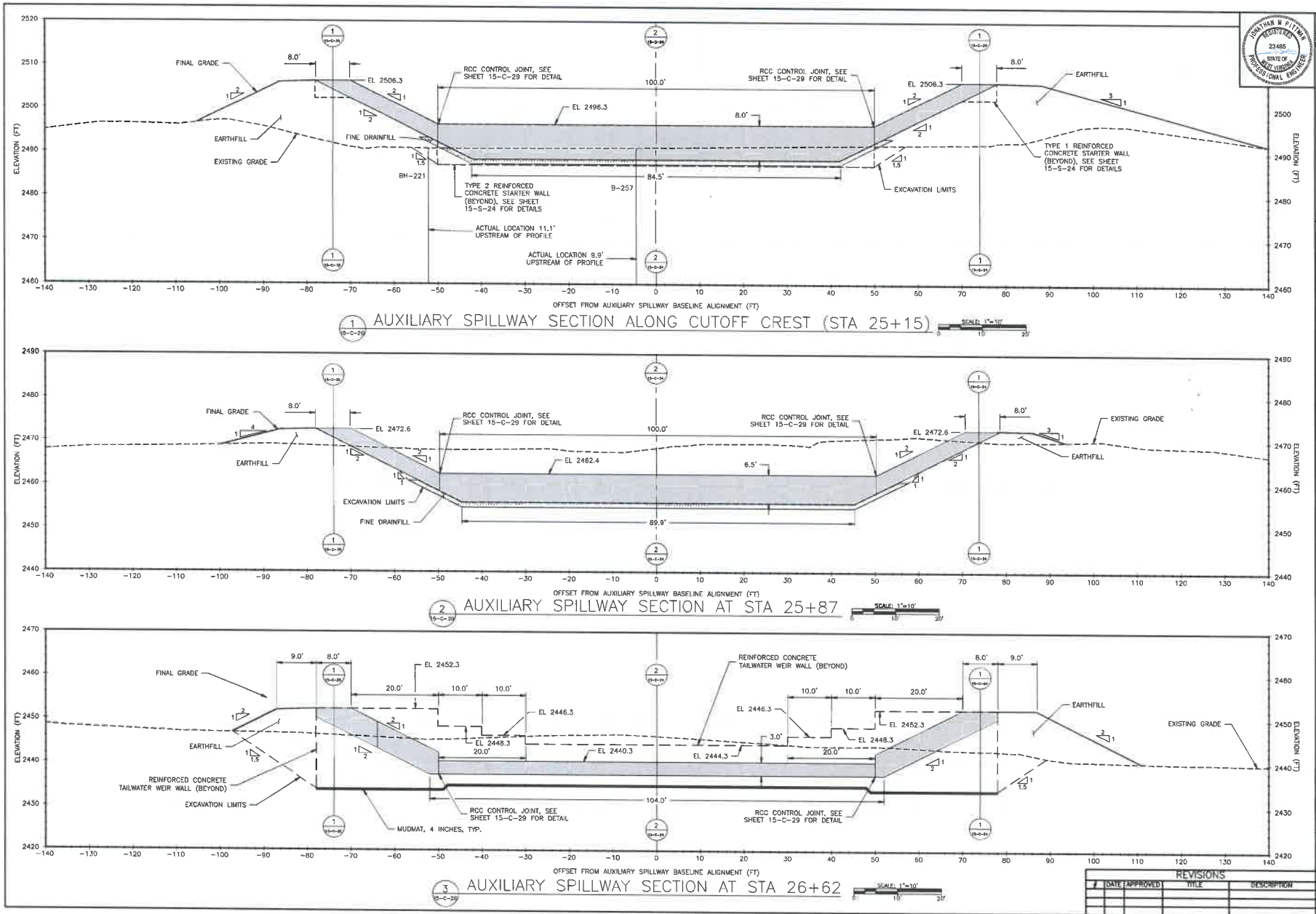
SEPTEMBER 2024

SHEET 23 OF 61

Last Saved By: CDAVIDSON Date/Time: 10/2/2024 11:27 AM File/Path: I:\2023\61\SITE 15\C-Sheets\CDS\Sheets\15-C-21 AUXILIARY SPILLWAY PLAN- SHEET 2 OF 2.dgn



JONATHAN M. FITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Designed	Drawn	Checked	Approved
	CDS	CRP	EBB	JMP
Date	SEP 24	SEP 24	SEP 24	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

AUXILIARY SPILLWAY SECTIONS - SHEET 1 OF 4

Brush Creek Watershed *Mercer County, WV*

Aterra Solution | Schnabel Engineering

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USDA Natural Resources Conservation Service

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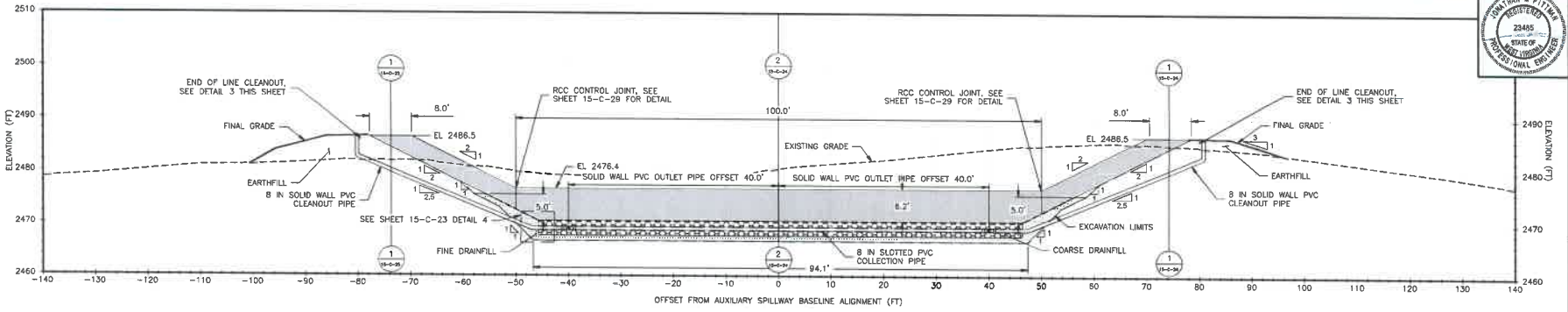
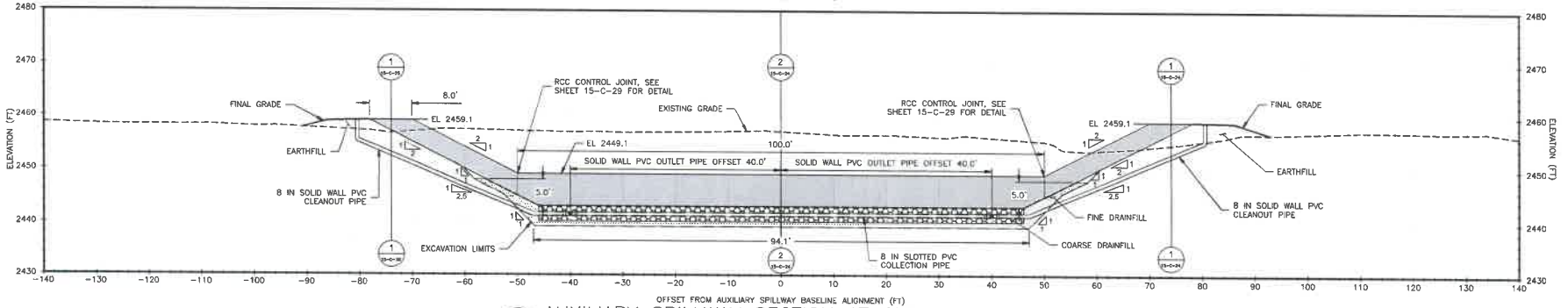
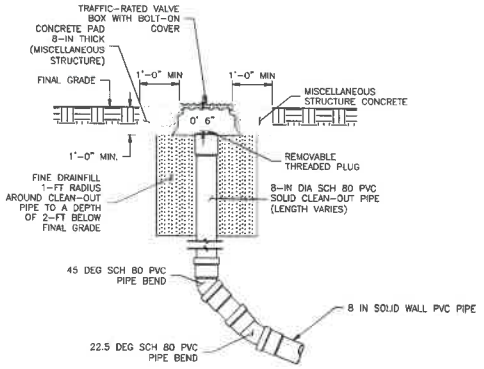


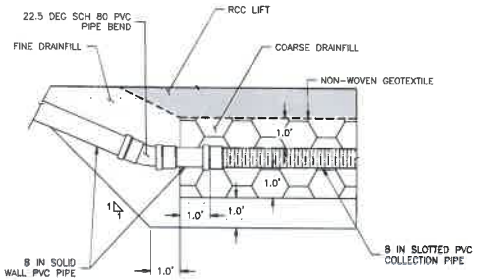
1 AUXILIARY SPILLWAY SECTION AT STA 25+59



2 AUXILIARY SPILLWAY SECTION AT STA 26+14



3 TYPICAL END OF LINE 27 DEGREE CLEANOUT
NTS



4 TRANSITION FROM SOLID TO PERFORATED PIPE
NTS

REVISIONS

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	Designed	Drawn	Checked	Approved
	CDS	CRP	EBB	JMP
Date	SEP 24	SEP 24	SEP 24	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION
AUXILIARY SPILLWAY SECTIONS - SHEET 2 OF 4
Brush Creek Watershed Mercer County, WV

Schnabel Engineering | ATERRA SOLUTIONS
300 Brookside Ave., Bldg. 16, Suite 160, Beckley, WV 25801
Phone: 336-274-9406
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-23

SEPTEMBER 2024

SHEET 25 OF 61

Last Saved By: CPATERSONS StreetSide: 10/2/2024 11:21 AM PM Date: 10/2/2024 1:01 PM
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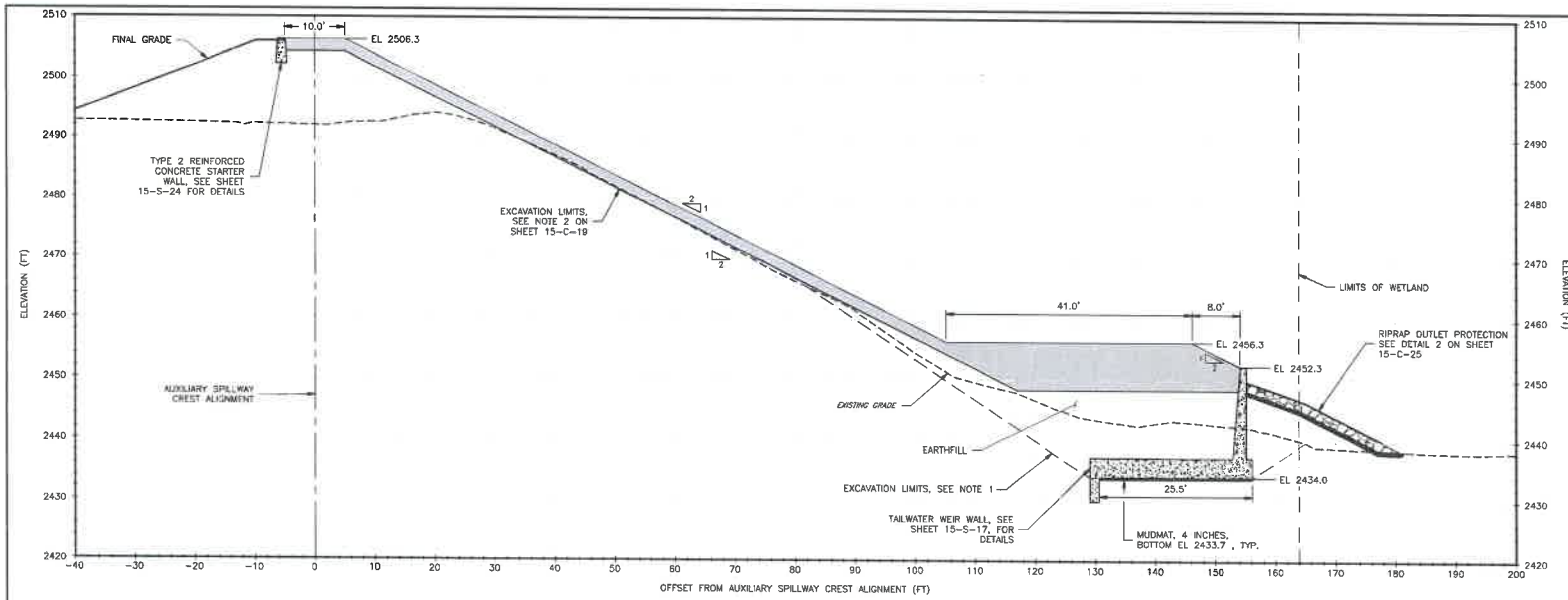
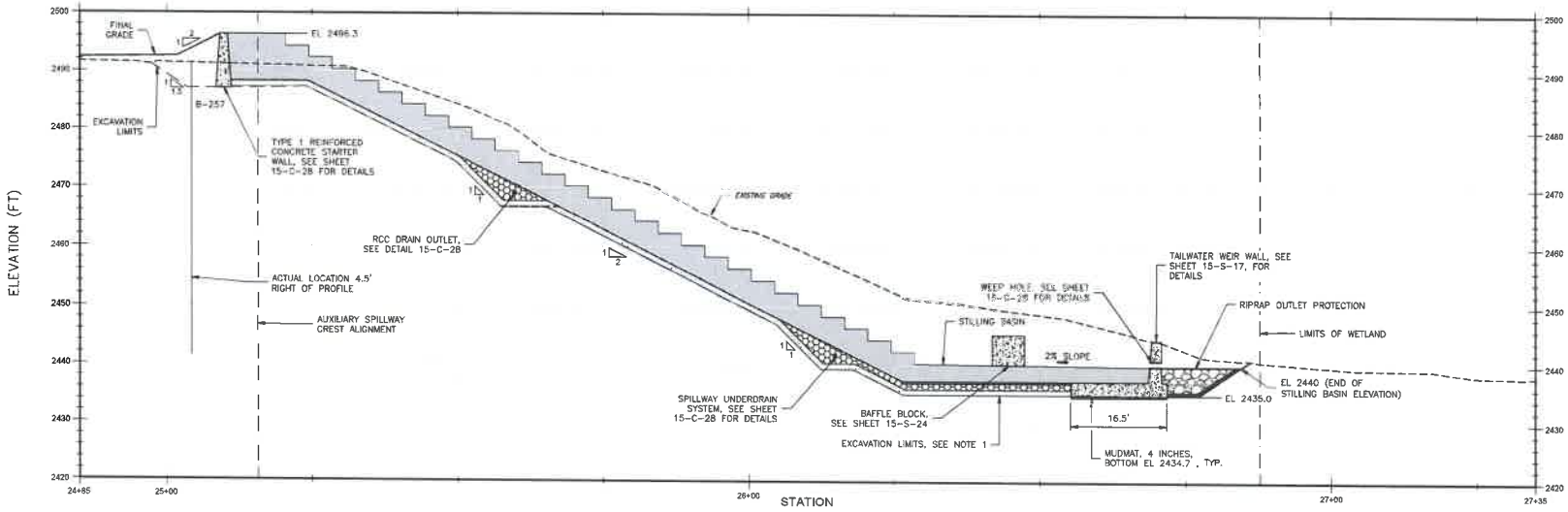


1 15-C-24 RCC CUTOFF WALL SECTION AT RIGHT TRAINING DIKE

SCALE: 1"=10'



2 15-C-29 PROFILE ALONG AUXILIARY SPILLWAY BASELINE ALIGNMENT

SCALE: 1"=10'

NOTES

1. TAILWATER WEIR WALL SUBGRADE SHALL BE THE TOP OF ROCK UNLESS OTHERWISE APPROVED BY THE COR. EXCAVATION LIMITS SHOWN ARE ESTIMATED BASED ON THE APPROXIMATE TOP OF ROCK. ACTUAL TOP OF ROCK AND BOTTOM OF EXCAVATION MAY VARY. TOP OF ROCK SHALL BE DEFINED IN THE FIELD BY THE COR.

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Designed	Drawn	Checked	Approved
	CDS	CRP	EBB	JMP
Date	SEP 24	SEP 24	SEP 24	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

AUXILIARY SPILLWAY SECTIONS - SHEET 3 OF 4

Brush Creek Watershed *Mercer County, WV*

Aterra-Schnabel JV | 300 Brookside Ave., Bldg. 15, Suite 160, Morgantown, WV 26501 Phone: 304-276-9166 aterraschnabel.com

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Contract No. 12SPEC18D0023

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SHEET 26 OF 61

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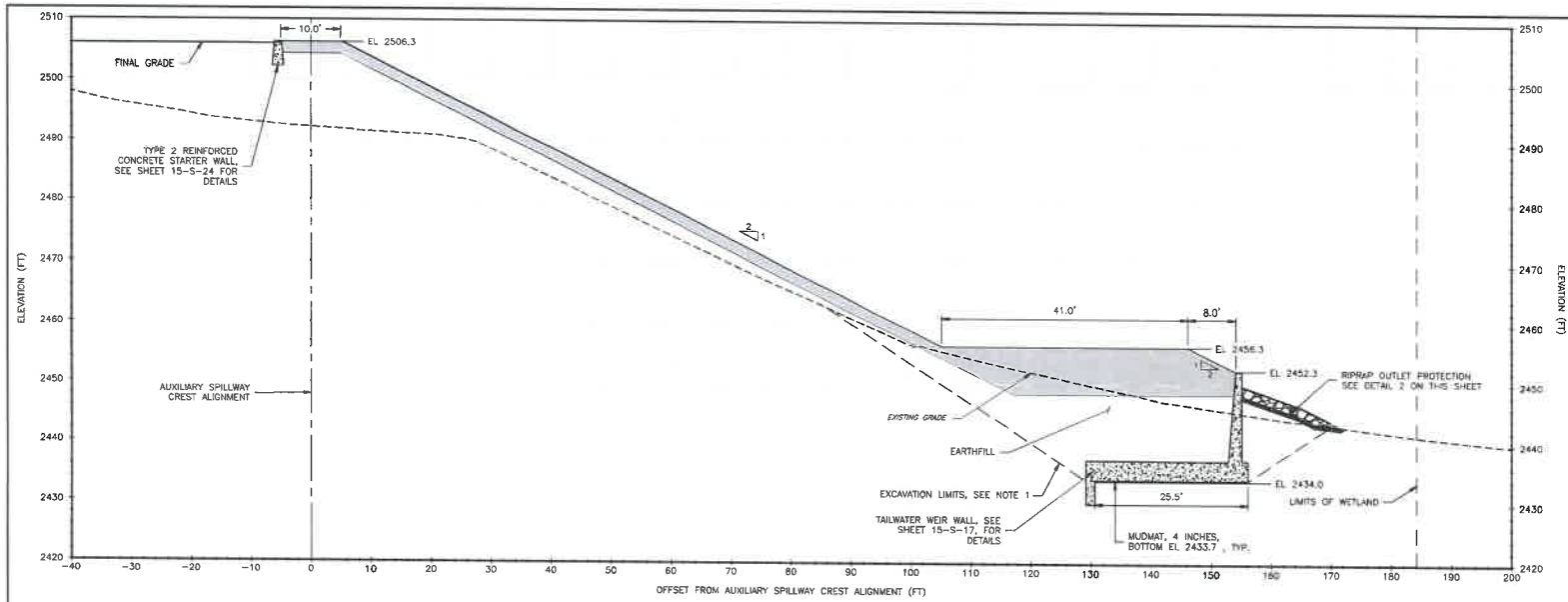
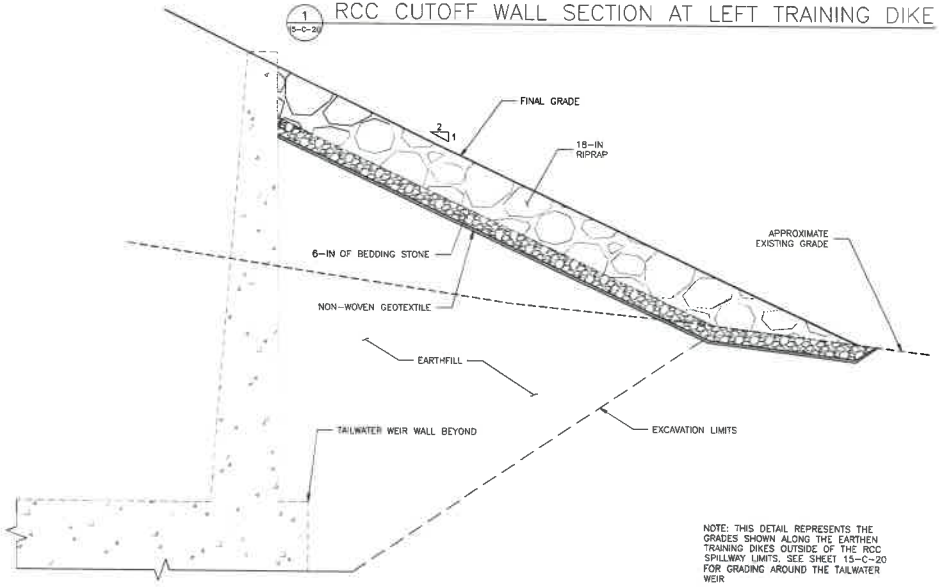
Last Saved By: CDS/SCHN Save Date: 10/2/2024 11:21 PM File Name: C:\Schnabel Proj\SHP\BRC0015_01_NRCS_NE_Brush_Creek\15-SE Proj\Issue\04-CAD\DRAWING\SVG\FINAL_DESIGN\SITE 15\C-15-C24.DWG Layout: AUXILIARY SPILLWAY SECTIONS - SHEET 3 OF 4



1 15-C-20 RCC CUTOFF WALL SECTION AT LEFT TRAINING DIKE

SCALE: 1"=10'



NOTE: THIS DETAIL REPRESENTS THE GRADES SHOWN ALONG THE EARTHEN TRAINING DIKES OUTSIDE OF THE RCC SPILLWAY LIMITS. SEE SHEET 15-C-20 FOR GRADING AROUND THE TAILWATER WEIR

2 15-C-21 RIPRAP OUTLET PROTECTION TYPICAL DETAIL DOWNSTREAM OF TRAINING DIKE

SCALE: 1"=5'

NOTES

1. TAILWATER WEIR WALL SUBGRADE SHALL BE THE TOP OF ROCK UNLESS OTHERWISE APPROVED BY THE COR. EXCAVATION LIMITS SHOWN ARE ESTIMATED BASED ON THE APPROXIMATE TOP OF ROCK. ACTUAL TOP OF ROCK AND BOTTOM OF EXCAVATION MAY VARY. TOP OF ROCK SHALL BE DEFINED IN THE FIELD BY THE COR.

REVISIONS

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Drawn	CRP	SEP 24
Checked	EBB	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

AUXILIARY SPILLWAY SECTIONS - SHEET 4 OF 4

Brush Creek Watershed Mercer County, WV

Alterra | Schnabel

300 Broadside Ave., Bldg. 10, Suite 160, Akron, OH 44333
Phone: 330-374-9456
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USDA United States Department of Agriculture

Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-25

SEPTEMBER 2024

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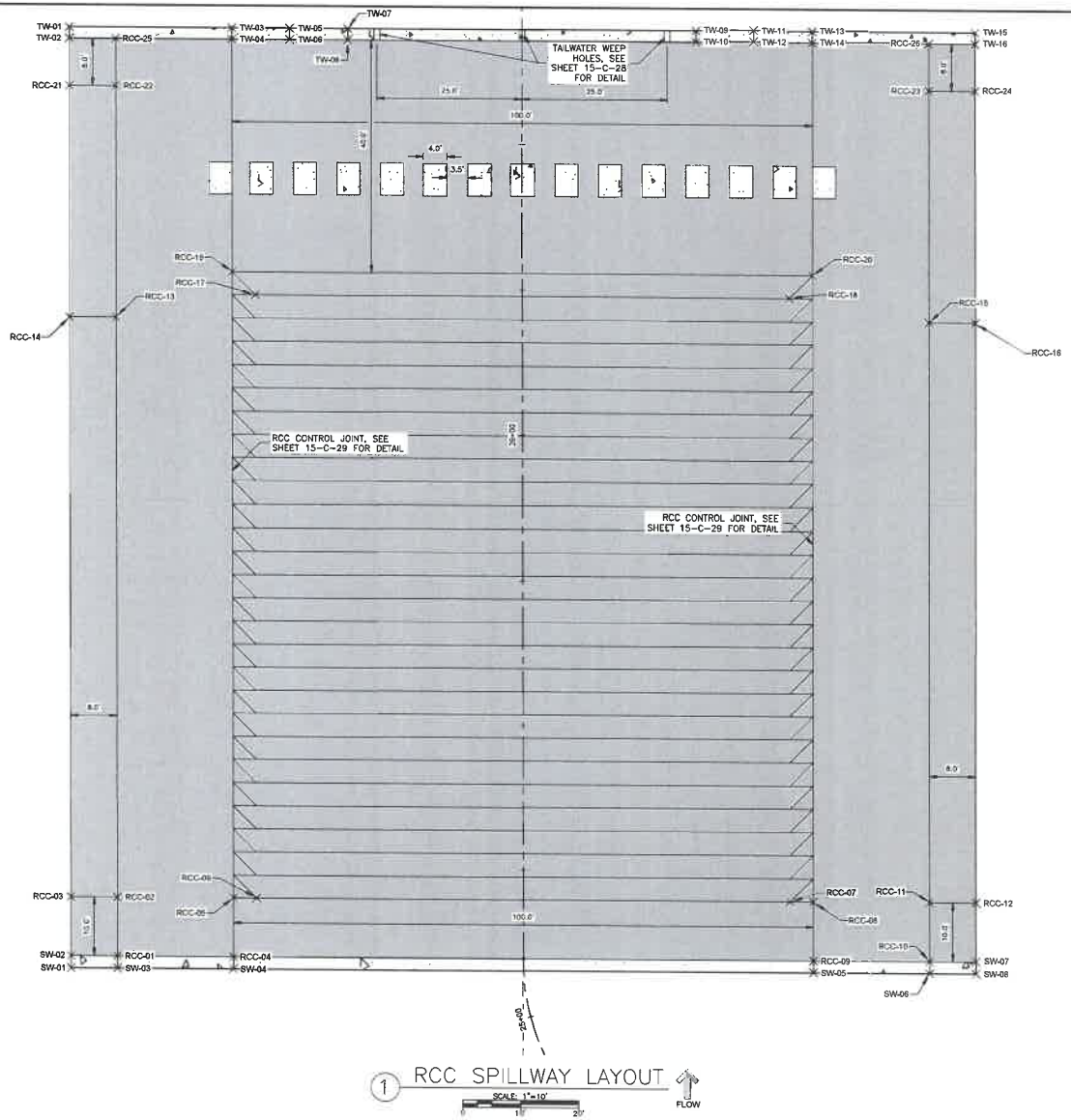
SPILLWAY SECTIONS - SHEET 4 OF 4



1 RCC SPILLWAY LAYOUT

SCALE: 1"=10'

ASW AUXILIARY SPILLWAY CHANNEL LAYOUT			
POINT ID	NOTHING (FT)	EASTING (FT)	TOP OF LIFT/ WALL ELEVATION (FT)
RCC-01	118484.62	1914258.1265	2506.30
RCC-02	118492.21	1914264.6435	2506.30
RCC-03	118497.42	1914258.5671	2506.30
RCC-04	118471.60	1914273.3021	2496.30
RCC-05	118479.18	1914279.8146	2496.30
RCC-06	118476.56	1914282.8334	2494.30
RCC-07	118416.62	1914352.6346	2494.30
RCC-08	118414.01	1914355.6675	2496.30
RCC-09	118406.45	1914349.1685	2496.30
RCC-10	118393.41	1914364.3432	2506.30
RCC-11	118401.00	1914370.8599	2506.30
RCC-12	118395.79	1914376.9239	2506.30
RCC-13	118568.11	1914329.7473	2456.30
RCC-14	118573.32	1914323.6768	2456.30
RCC-15	118476.83	1914438.0397	2456.30
RCC-16	118471.62	1914442.1080	2456.30
RCC-17	118555.47	1914350.5721	2442.30
RCC-18	118495.50	1914420.4055	2442.30
RCC-19	118561.11	1914350.1411	2440.30
RCC-20	118495.96	1914426.0277	2440.30
RCC-21	118603.66	1914349.7728	2456.30
RCC-22	118598.46	1914355.8283	2456.30
RCC-23	118507.21	1914462.1145	2456.30
RCC-24	118502.00	1914468.1844	2456.30
RCC-25	118604.53	1914361.0440	2452.30
RCC-26	118513.28	1914467.3245	2452.30
SW-01	118488.32	1914250.7528	2506.30
SW-02	118489.83	1914252.0535	2506.30
SW-03	118483.10	1914256.8183	2506.30
SW-04	118470.08	1914271.9988	2496.30
SW-05	118404.94	1914347.8706	2496.30
SW-06	118391.91	1914363.0521	2506.30
SW-07	118388.20	1914370.4022	2506.30
SW-08	118386.70	1914369.1157	2506.30
TW-01	118611.26	1914356.2772	2452.30
TW-02	118609.77	1914355.0010	2452.30
TW-03	118593.00	1914377.5244	2448.30
TW-04	118591.49	1914376.2265	2448.30
TW-05	118586.48	1914385.1117	2446.30
TW-06	118584.98	1914383.8195	2446.30
TW-07	118579.97	1914392.6991	2444.30
TW-08	118578.46	1914391.4069	2444.30
TW-09	118540.88	1914438.2205	2444.30
TW-10	118539.38	1914436.9312	2444.30
TW-11	118534.37	1914445.8081	2446.30
TW-12	118532.86	1914444.5186	2446.30
TW-13	118527.85	1914453.3947	2448.30
TW-14	118526.35	1914452.1051	2448.30
TW-15	118509.58	1914474.6996	2452.30
TW-16	118508.07	1914473.3954	2452.30

NOTE: RCC – AUXILIARY SPILLWAY
SW – STARTER WALL
TW – TAILWATER WEIR

JONATHAN M PITTMAN
REGISTERED
23485
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

	Date
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

AUXILIARY SPILLWAY LAYOUT PLAN

Brush Creek Watershed *Mercer County, WV*

ATERRA | Schnabel
300 Brookside Ave., Bldg. 15, Suite 160, Beckley, WV 25801
Phone: 336-274-9456
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-26

SEPTEMBER 2024

SHEET 28 OF 61

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Last Saved By: CDS[CDS] SaveDate: 10/2/2024 11:19 AM PlotDate: 10/2/2024 3:02 PM
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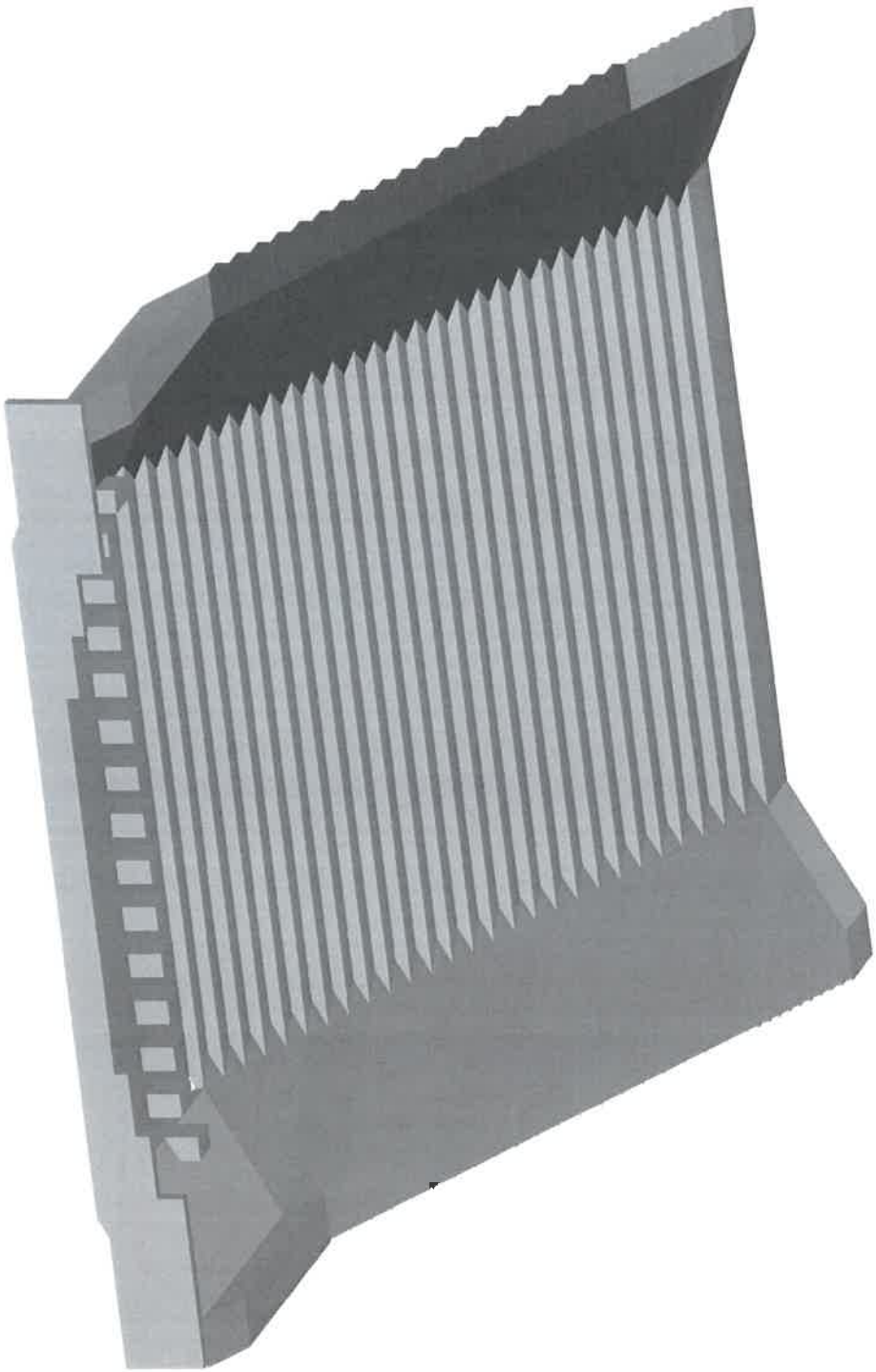

1 RCC SPILLWAY 3D ISOMETRIC VIEW
NTS

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DESCRIPTION	TITLE	DATE APPROVED	

JONATHAN M. PITTMAN REGISTERED PROFESSIONAL ENGINEER 23495

Contract No. 12SPEC1800023	USDA United States Department of Agriculture Natural Resources Conservation Service	ATERRA SOLUTIONS | Schnabel engineering 300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002 Phone: 336-274-9456 schnabel-eng.com	BRUSH CREEK SITE 15 DAM REHABILITATION AUXILIARY SPILLWAY 3D MODEL Brush Creek Watershed — Mercer County, WV

		Date
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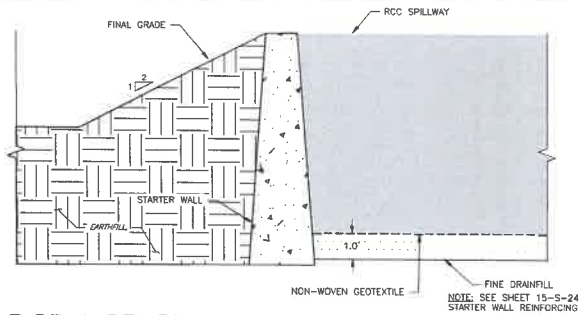
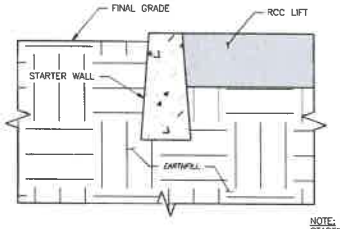
Drawn	CRP	SEP 24
Checked	JMP	SEP 24
Approved	----	SEP 24

Drawing No. 15-C-27
SEPTEMBER 2024
SHEET 28 OF 61



NOTE: SEE SHEET 15-S-24 FOR STARTER WALL REINFORCING DETAILS

1 TYPE 1 REINFORCED CONCRETE STARTER WALL
NTS



NOTE: SEE SHEET 15-S-24 FOR STARTER WALL REINFORCING DETAILS

2 TYPE 2 REINFORCED CONCRETE STARTER WALL
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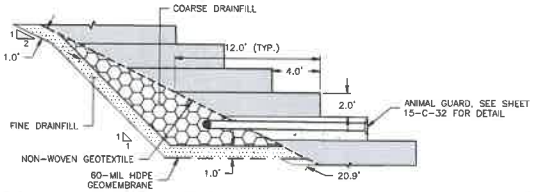
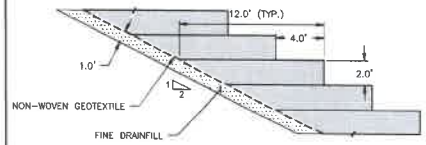
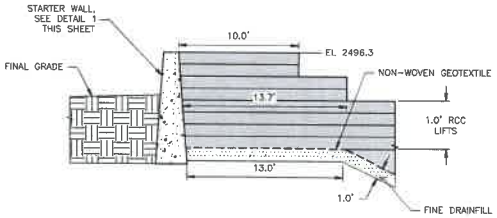


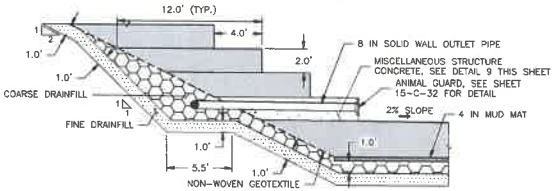
3 TOP RCC DRAIN OUTLET DETAIL – SECTION
SCALE: 1"=5'



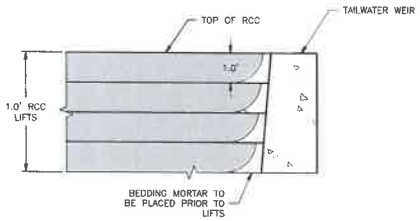
4 TYPICAL RCC STEP DETAIL
SCALE: 1"=5'



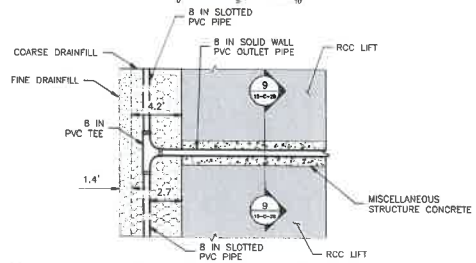
5 TYPICAL STARTER WALL–RCC PLACEMENT DETAIL
SCALE: 1"=5'



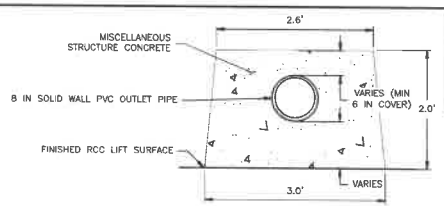
6 BOTTOM RCC DRAIN OUTLET DETAIL – SECTION
SCALE: 1"=5'



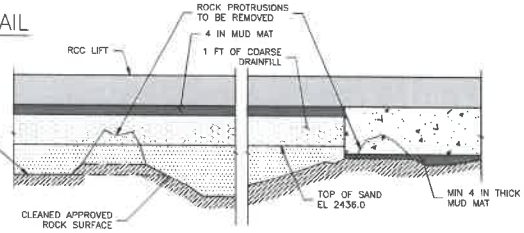
7 RCC–TAILWATER WEIR CONTACT DETAIL
SCALE: 1"=5'



8 RCC DRAIN OUTLET DETAIL – PLAN
SCALE: 1"=5'



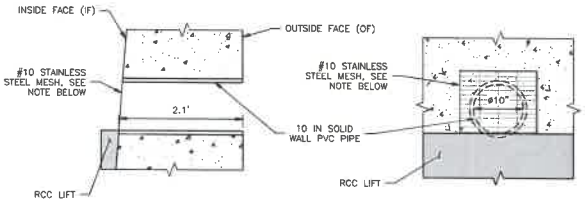
9 PIPE ENCASEMENT DETAIL
SCALE: 1"=1'0"



NOTES:

1. THIS DETAIL ONLY APPLIES TO THE RCC SUBGRADE. SEE SHEET 15-C-15 FOR TOE DRAIN FOUNDATION PREPARATION DETAILS.
2. CONTRACTOR SHALL COVER THE CLEANED, APPROVED ROCK SURFACE IMMEDIATELY AFTER FINAL CLEANING. SEE CONSTRUCTION SPECIFICATION 63 FOR ADDITIONAL DETAILS.
3. FOUNDATION GRADE SHALL HAVE NO VERTICAL SURFACES. VERTICAL SURFACES FOUND IN ROCK SHALL BE TRIMMED TO A MINIMUM SLOPE OF 1H:1V OR AS DIRECTED BY COR

10 ASW FOUNDATION PREPARATION DETAILS
NTS



SECTION ELEVATION

NOTE: MOUNT #10 MESH TO THE INSIDE FACE OF THE WALL TO COVER AT LEAST 2 INCHES BEYOND THE EXTENTS OF THE PVC OUTLET ON TOP, LEFT, AND RIGHT SIDES. ATTACH THE MESH TO THE WALL USING STAINLESS STEEL FASTENERS. FOLLOW MANUFACTURES INSTRUCTIONS FOR INSTALLATION.

11 TAILWATER WEIR WEEP HOLE
SCALE: 1"=1'0"

NOTES:
1. ALL COLD JOINTS SHALL BE TREATED IN ACCORDANCE WITH CS 36. COLD JOINT TREATMENT INCLUDING PLACEMENT OF BONDING MORTAR.

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JONATHAN M. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CDS	SEP 24
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Checked EBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

AUXILIARY SPILLWAY DETAILS

Brush Creek Watershed — Mercer County, WV

Schnabel Engineering | ATERRA SCHNABEL
300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 267-468-8405
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USDA United States Department of Agriculture
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SHEET 30 OF 61

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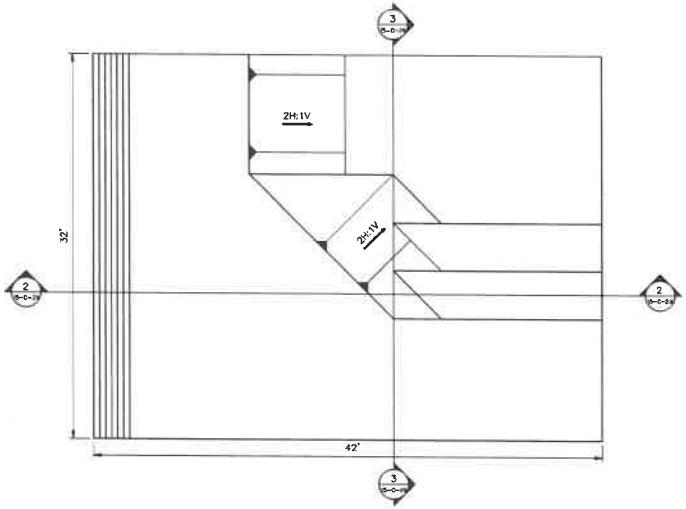
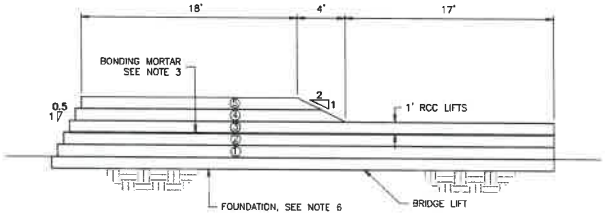


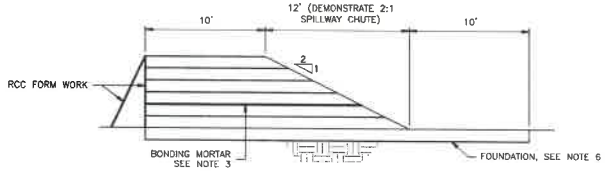
1 RCC TEST SECTION PLAN

SCALE 1"=5'



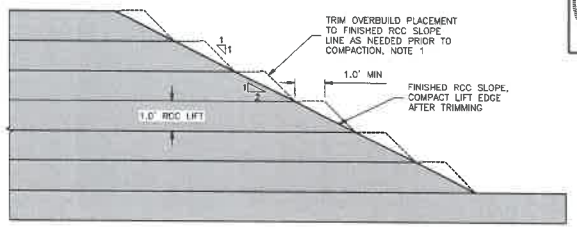
2 RCC TEST SECTON – PROFILE VIEW

SCALE 1"=5'



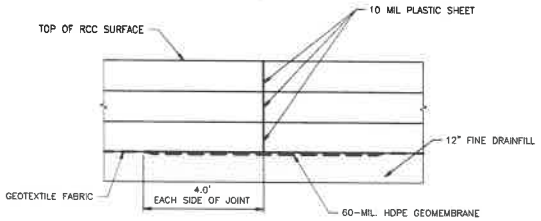
3 RCC TEST SECTION – SECTION VIEW

SCALE 1"=5'



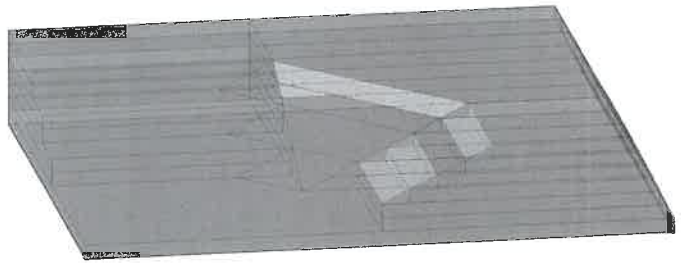
4 UNFORMED SLOPED TRAINING WALL EDGE FINISHING DETAIL

SCALE 1"=2'



5 RCC CONTROL JOINT TYPICAL DETAIL

SCALE 1"=2'



6 RCC TEST SECTION 3D ISOMETRIC VIEW

NTS

NOTES:

1. PRIOR TO RCC PRODUCTION, THE CONTRACTOR MUST CONSTRUCT A TEST SECTION IN ACCORDANCE WITH CS 36.
2. ALL EQUIPMENT PROPOSED FOR USE IN THE PERMANENT WORK SHALL BE DEMONSTRATED AT THE RCC TEST SECTION.
3. ALL COLD JOINTS OCCURRING DURING THE TEST SECTION SHALL BE TREATED IN ACCORDANCE WITH CS 36. COLD JOINT TREATMENT INCLUDING PLACEMENT OF BONDING MORTAR SHALL BE DEMONSTRATED AT ONE FULL LIFT PRIOR TO PLACEMENT OF LIFT 3.
4. ALL PROCEDURES SPECIFIED FOR CONSTRUCTION OF THE RCC SHALL BE INCORPORATED IN ALL LIFTS PLACED INCLUDING JOINTS, CURING, LIFT SURFACE PREPARATION AND QUALITY CONTROL.
5. IF DIRECTED BY THE COR, HEIGHT OF TEST SECTION MAY BE INCREASED TO FURTHER DEMONSTRATE PLACING TECHNIQUES PRIOR TO INITIATION OF PERMANENT WORK.
6. LIFT 1 SHALL BE PLACED WITHIN 24 HOURS OF PLACING BRIDGE LIFT.
7. DETERMINE THE AMD ON LIFT 2 IN ACCORDANCE WITH CS 36. REPEAT THE PROCEDURE ON LIFT 3 IF DEEMED NECESSARY BY THE ENGINEER.

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

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JONATHAN W. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed COS	SEP. 24
Drawn CRP	SEP. 24
Checked EBB	SEP. 24
Approved JMP	SEP. 24

BRUSH CREEK SITE 15 DAM REHABILITATION

RCC TEST SECTION DETAILS

Brush Creek Watershed *Mercer County, WV*

Schnabel Engineering | ATERRA Solutions
300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 267-279-4456
www.schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-29

SEPTEMBER 2024

SHEET 31 OF 61

Last Saved By: CPARSONS StartDate: 10/2/2024 11:21 AM PlotDate: 10/2/2024 3:33 PM
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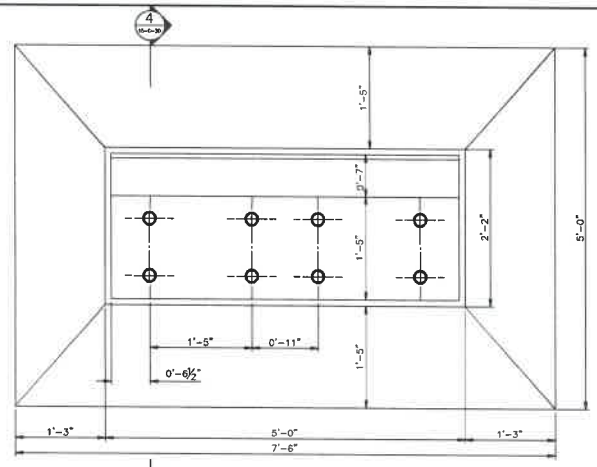
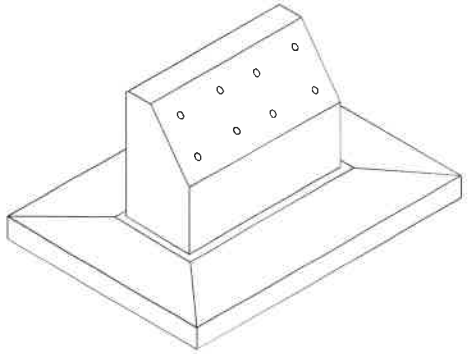


1 PROJECT MONUMENT – PLAN

SCALE 1"=10'

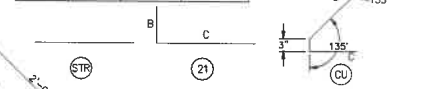


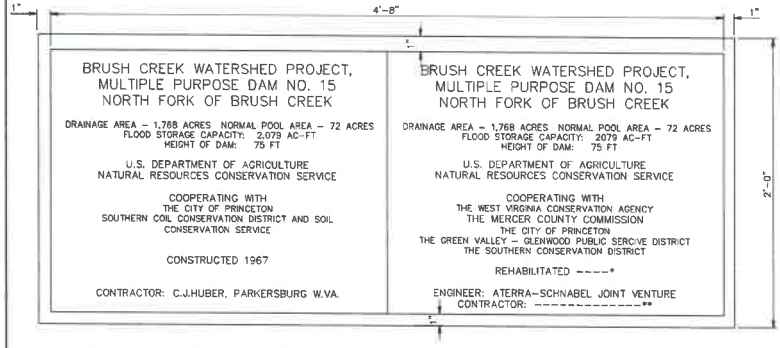
2 PROJECT MONUMENT – ISOMETRIC

NTS

PROJECT MONUMENT STEEL SCHEDULE							
MARK	SIZE	QUAN.	LENGTH	TYPE	B	C	TOTAL LENGTH
701	4	5	6' 10"	STR			34' 2"
702	4	8	4' 6"	STR			36' 0"
703	4	7	2' 7"	21	1' 0"	1' 7"	18' 1"
704	4	7	3' 11"	21	1' 0"	2' 11"	27' 5"
705	4	2	4' 6"	STR			9' 0"
706	4	7	2' 11"	CU	1' 11"	1' 0"	20' 5"

	BAR SIZE	LINEAR FT	WEIGHT LBS
TOTAL	4	145.08	74.09

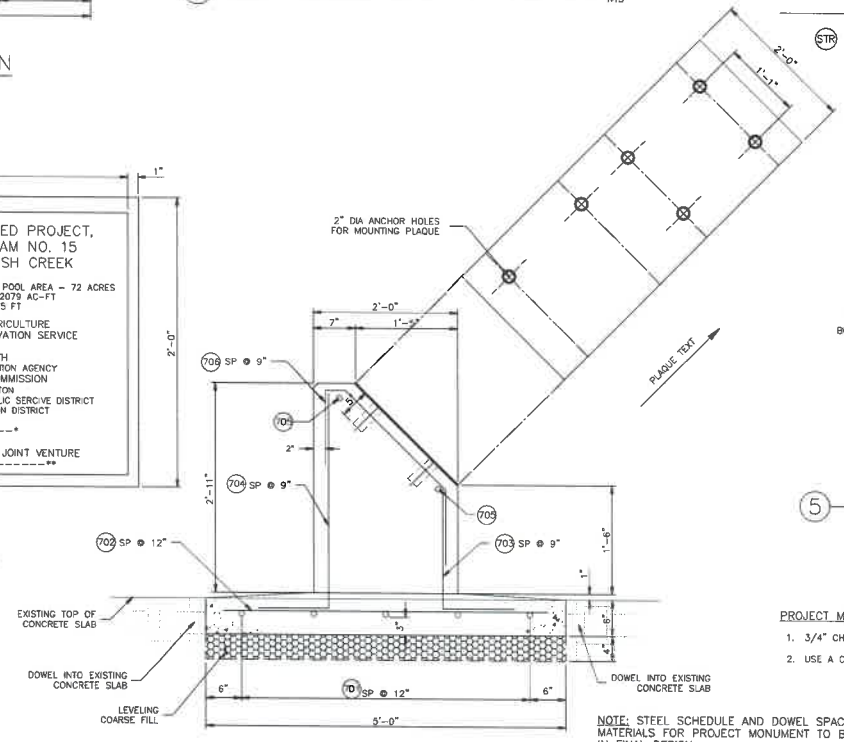




*REHABILITATION YEAR SHALL BE YEAR CONSTRUCTION IS COMPLETE.
**CONTRACTOR IS TO BE DETERMINED

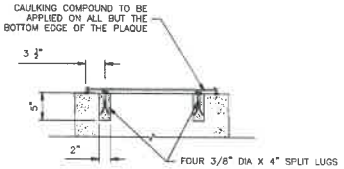
3 PROJECT MONUMENT – PLAQUE

SCALE 1"=5'



4 PROJECT MONUMENT – ELEVATION

SCALE 1"=10'



5 PLAQUE MOUNTING DETAIL

NTS

PROJECT MONUMENT NOTES:

1. 3/4" CHAMFER ALL EXPOSED EDGES OF MONUMENT.
2. USE A CARBORRUNDUM RUBBED FINISH ON MONUMENT.

NOTE: STEEL SCHEDULE AND DOWEL SPACING AND MATERIALS FOR PROJECT MONUMENT TO BE ADDED IN FINAL DESIGN

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

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JONATHAN M. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Date	
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

PROJECT MONUMENT DETAILS

Brush Creek Watershed *Mercer County, WV*

Schnabel | ATERRA SOLUTIONS
300 Brookside Ave., Bldg. 15, Suite 100, Morgantown, WV 26501
Phone: 336-274-8458
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-30

SEPTEMBER 2024

SHEET 32 OF 61

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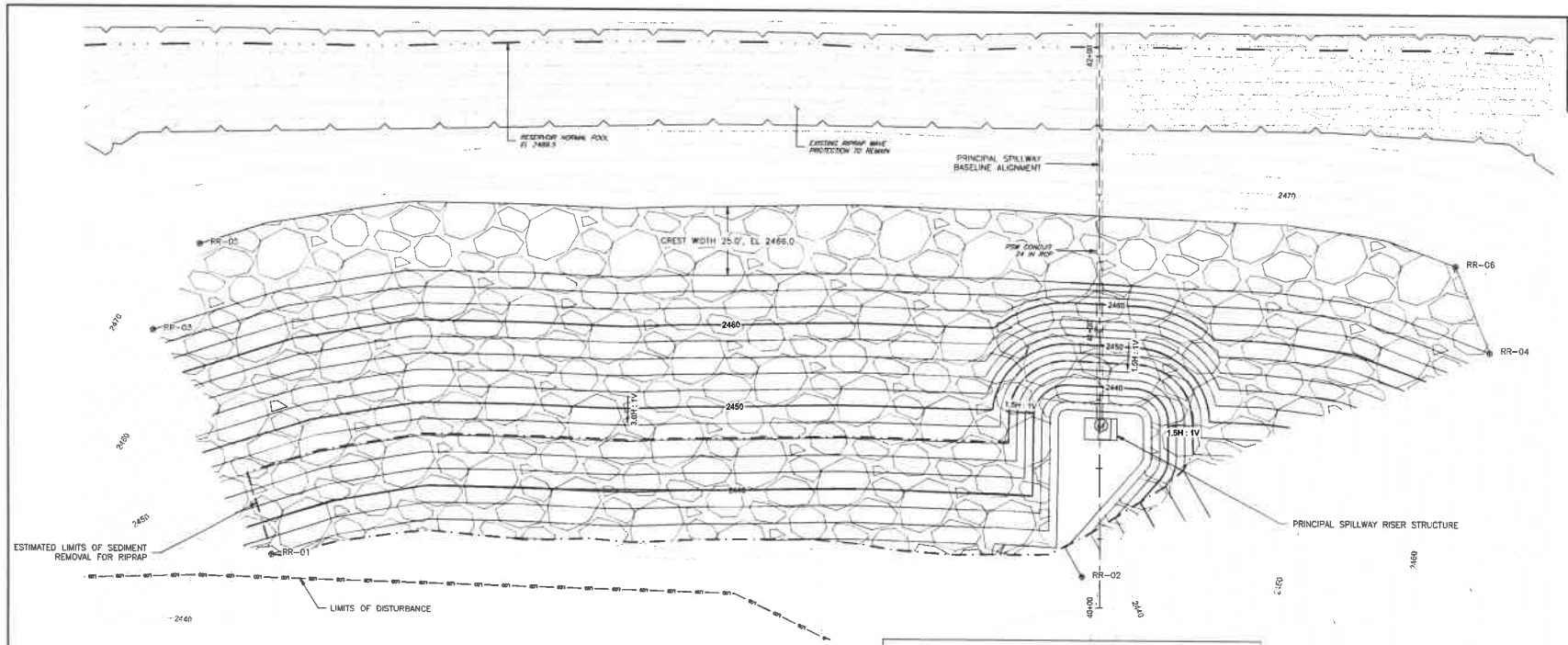
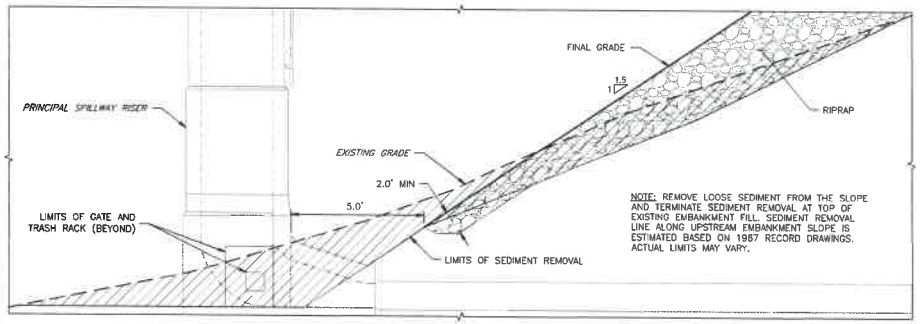


1 RIPRAP BERM PLAN

SCALE 1"=20'

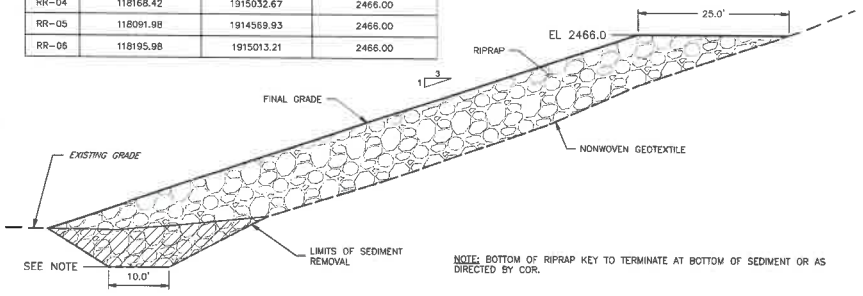
RIPRAP BERM POINT TABLE			
POINT	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)
RR-01	117989.16	1914622.30	2434.00
RR-02	118053.53	1914908.86	2434.00
RR-03	118057.25	1914560.99	2466.00
RR-04	118168.42	1915032.67	2466.00
RR-05	118091.98	1914569.93	2466.00
RR-06	118195.98	1915013.21	2466.00



2 RIPRAP NEAR RISER TYPICAL SECTION

NTS

FLOW



3 RIPRAP BERM TYPICAL SECTION

SCALE 1"=10'

FLOW

NOTES:

1. REMOVE SEDIMENT WITHIN THE FOOTPRINT OF RIPRAP. CONTRACTOR TO VERIFY SEDIMENT ELEVATIONS PRIOR TO STARTING EXCAVATION.

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Date	
Designed	CDS SEP 24
Drawn	CRP SEP 24
Checked	EBB SEP 24
Approved	JMP SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

UPSTREAM RIPRAP BERM DETAILS

Brush Creek Watershed *Mercer County, WV*

Schnabel ENGINEERING | ATERRA JV

300 Brookside Ave, Bldg 18, Suite 160, Ambler, PA 19002
Phone: 336-274-5486
pittsburgh.org/jmp

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-31

SEPTEMBER 2024

SHEET 33 OF 61

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Last Saved By: CPARSONS SavaDate: 10/2/2024 11:33 AM PlotDate: 10/2/2024 1:14 PM
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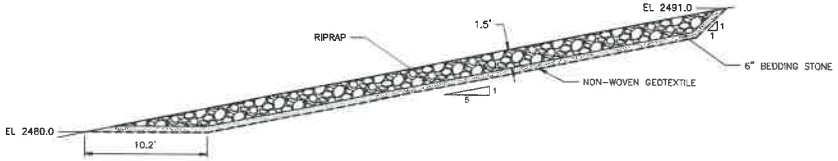
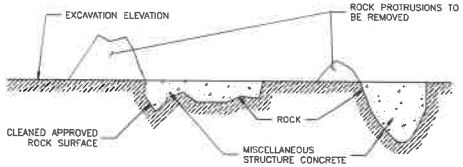


1 PROPOSED ASW ENTRANCE RIPRAP WAVE PROTECTION

SCALE 1"=5'

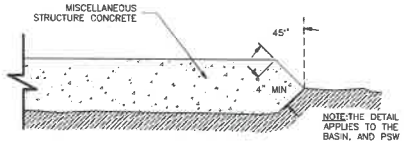
NOTE: SLOPE SHOWN IS TYPICAL VARIES ACROSS ENTRACE OF ALIXILIARY SPILLWAY CHANNEL



NOTE:THE DETAIL ALSO APPLIES TO THE IMPACT BASIN, AND PSW CRADLE

2 ROCK REMOVAL AND BACKFILL CONCRETE

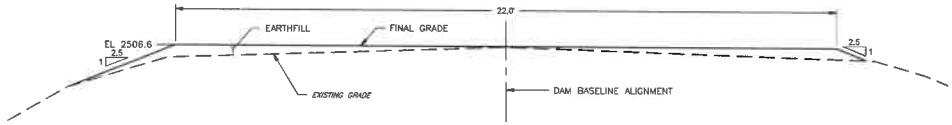
SCALE 1"=10'



NOTE:THE DETAIL ALSO APPLIES TO THE IMPACT BASIN, AND PSW CRADLE

3 BACKFILL CONCRETE FINISHING DETAIL

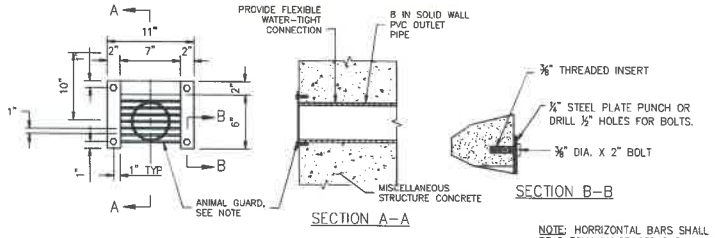
SCALE 1"=10'



NOTE: THIS DETAIL SHALL APPLY TO THE ENTIRETY OF THE EMBANKMENT CREST AND TRAINING DIKES OR WHERE DETERMINED AS NEEDED BY THE COR.

5 CREST IMPROVEMENTS TYPICAL DETAIL

SCALE 1"=2'



NOTE: HORRIZONTAL BARS SHALL BE 5 EQUALLY SPACED BARS FOR GIVEN PIPE DIAMETERS

4 ANIMAL GUARD DETAIL

NTS

JONATHAN W PITTMAN REGISTERED 23465 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Designed	Drawn	Checked	Approved
Date	SEP 24	SEP 24	SEP 24	SEP 24
	CDS	CRP	EBB	JWP

BRUSH CREEK SITE 15 DAM REHABILITATION

MISCELLANEOUS CIVIL DETAILS

Brush Creek Watershed *Mercer County, WV*

Aterra-Schnabel JV
300 Brookside Ave., Bldg. 19, Suite 160, Ambler, PA 19002
Phone: 336-274-1068

USDA United States Department of Agriculture

Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-32

SEPTEMBER 2024

SHEET 34 OF 61

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Last Saved By: CPARSONS SaveDate: 10/2/2024 11:33 AM PlotDate:10/2/2024 3:03 PM
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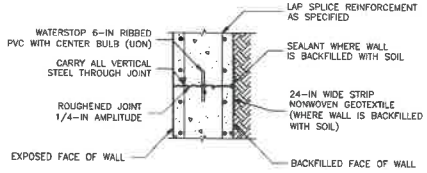
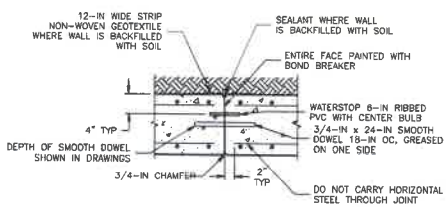
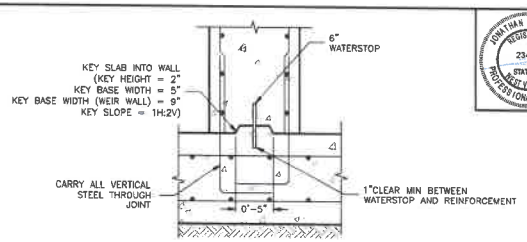
CSVE DRTA&S



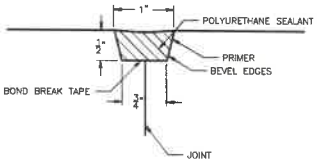
1 HORIZONTAL CONSTRUCTION JOINT (CJ) IN WALLS



2 CONTRACTION JOINT IN WALLS (PLAN)
NTS

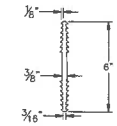


3 CONSTRUCTION JOINT AT BASE OF WALLS
NTS

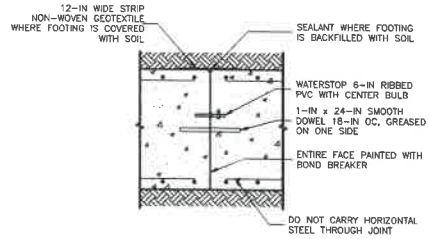


4 JOINT SEALANT DETAIL
NTS

NOTE: EXPANSION JOINT MATERIAL NOT SHOWN FOR CLARITY.



5 TYPICAL PVC WATERSTOP
SCALE: 3"=1'0"



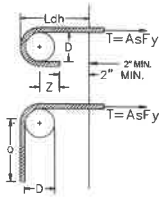
6 CONTRACTION JOINT IN WEIR WALL SLABS
NTS

MINIMUM REINF. BAR DEVELOPMENT LENGTH (IN)		
BAR SIZE	TOP	OTHER
#3	12	12
#4	14	12
#5	18	14
#6	21	17
#7	31	24
#8	35	27
#9	45	34
#10	55	42
#11	66	51

MINIMUM REINF. BAR LAP SPLICE LENGTH (IN)		
BAR SIZE	TOP	OTHER
#3	16	16
#4	19	16
#5	24	19
#6	28	23
#7	41	32
#8	46	36
#9	59	45
#10	72	55
#11	86	67

MINIMUM END HOOK DEVELOPMENT LENGTH (IN)*				
BAR SIZE	Ldh	O	Z	D
#3	6	4.5	2.5	2.25
#4	7	6	2.5	3
#5	8	7.5	2.5	3.75
#6	10	9	3	4.5
#7	11	10.5	3.5	5.25
#8	13	12	4	6
#9	15	13.5	4.5	9
#10	16	15	5	10
#11	18	16.5	5.5	11

** SIDE COVER MUST BE ≥ 2.5"
** END COVER MUST BE ≥ 2"



NOTES:

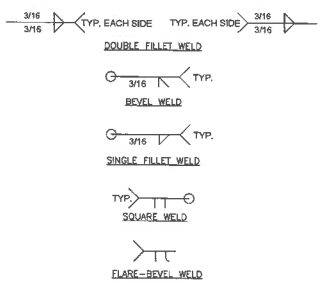
1. TABULATED VALUES ARE BASED ON UNCOATED GRADE 60 REBAR AND CONCRETE WITH f'c=4500 PSI AND 2.5" COVER.
2. TENSION DEVELOPMENT LENGTHS AND TENSION LAP SPLICE LENGTHS ARE CALCULATED IN ACCORDANCE WITH ACI 12.2.3 AND 12.15, RESPECTIVELY.
3. LAP SPLICE LENGTHS ARE MULTIPLES OF TENSION DEVELOPMENT LENGTHS; CLASS A=1.0*ld AND CLASS B=1.3*ld (ACI 12.15.1).
4. BAR CENTER-TO-CENTER SPACING WAS ASSUMED TO BE GREATER THAN TWICE THE CONCRETE COVER PLUS ONE BAR DIAMETER, SO THAT "c" WAS GOVERNED BY CONCRETE COVER RATHER THAN BY BAR SPACING. THEREFORE TABULATED VALUES ARE NOT APPLICABLE FOR CENTER-TO-CENTER BAR SPACING LESS THAN 6".
5. TOP BARS ARE HORIZONTAL BARS WITH MORE THAN 12 INCHES OF CONCRETE CAST BELOW THE BARS.

GENERAL CONCRETE NOTES:

1. ALL STRUCTURAL CONCRETE SHALL BE f'c=4500 PSI. ALL CONCRETE SHALL ALSO BE AIR ENTRAINED (4.5 TO 7.5%) AND HAVE A MAXIMUM SLUMP OF 5 INCHES WITHOUT WATER REDUCING ADMIXTURE AND 6.5 INCHES MAXIMUM WITH WATER REDUCING ADMIXTURE.
2. CONCRETE SHALL BE PREPARED, PLACED, AND CURED IN ACCORDANCE WITH THE REQUIREMENTS ADOPTED BY THE AMERICAN CONCRETE INSTITUTE (ACI) AND LOCAL CODES.
3. MAINTAIN MINIMUM CONCRETE COVER AROUND REINFORCING STEEL AS FOLLOWS, UNLESS OTHERWISE INDICATED ON THE DRAWINGS:
   WALLS EXPOSED TO WEATHER OR BACKFILL – 2 INCHES
   WALLS CONTINUALLY EXPOSED TO WATER – 2.5 INCHES
   FOOTINGS AND CONCRETE FORMED AGAINST EARTH – 3 INCHES
4. ALL REINFORCING STEEL SHALL BE DEFORMED BILLET STEEL BARS CONFORMING TO ASTM 615, 60 KSI YIELD GRADE.
5. REINFORCING STEEL SPLICES NOT SHOWN ON THESE DRAWINGS SHALL BE SHOWN ON THE SHOP DRAWINGS AND APPROVED BY THE ENGINEER IN ACCORDANCE WITH THE SPECIFICATIONS. LOCATE SPLICES AT POINT OF MINIMUM STRESS.
6. CHAMFER ALL EXPOSED EDGES, HORIZONTAL, TOP, AND VERTICAL JOINTS IN WALLS 3/4" UNLESS INDICATED ON THE DRAWINGS.
7. PROVIDE CONSTRUCTION, AND CONTRACTION JOINTS AS INDICATED ON THE DRAWINGS, OR AS DIRECTED BY THE ENGINEER. CONTRACTION JOINTS HAVE NO REINFORCING THROUGH THE JOINTS AND THE CONCRETE SURFACES ARE UNBONDED. 6" RIBBED WATERSTOPS ARE REQUIRED ON ALL CONTRACTION AND CONSTRUCTION JOINTS, UNLESS NOTED OTHERWISE. ONLY STRAIGHT BUTT SPLICES MAY BE PERFORMED IN THE FIELD. ALL OTHER SPLICES SHALL BE FACTORY MADE.
8. END VERTICAL WATERSTOP 3" FROM TOP OF WALLS.
9. WATERSTOP SHALL EXTEND FROM SLAB INTO WALLS. MINIMUM RADIUS OF BEND AROUND CORNERS SHALL BE 9"
10. THE FOLLOWING ABBREVIATIONS APPLY

CJ	=	CONSTRUCTION JOINT	JT	=	JOINT
OCJ	=	OPTIONAL CONSTRUCTION JOINT	EJ	=	EXPANSION JOINT
BF	=	BOTTOM FACE	WP	=	WORKING POINT
NF	=	NEAR FACE	EL	=	ELEVATION
EF	=	EACH FACE	WS	=	WATER SURFACE
TF	=	TOP FACE	TW	=	TAILWATER
FF	=	FAR FACE	HW	=	HEADWATER
NS	=	NEAR SIDE	SPC	=	SPACE OR SPACES
FS	=	FAR SIDE	CTR	=	CENTER OR CENTERS
ES	=	EQUALLY SPACED	OC	=	ON CENTER
EW	=	EACH WAY	HSS	=	HOLLOW STRUCTURAL SECTION
UV	=	UNIFORMLY VARYING			

WELD SYMBOLS LEGEND



JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

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BRUSH CREEK SITE 15 DAM REHABILITATION
STRUCTURAL NOTES AND TYPICAL DETAILS
Brush Creek Watershed — Mercer County, WV

Aterra Schnabel JV
300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 267-419-2365
aschnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-01

SEPTEMBER 2024

SHEET 35 OF 61

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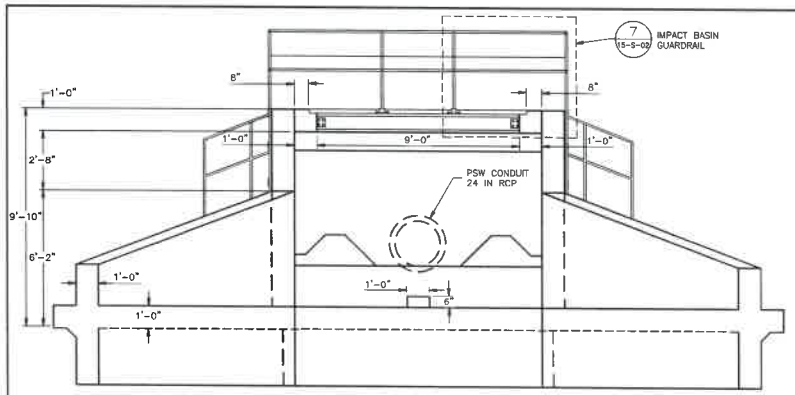
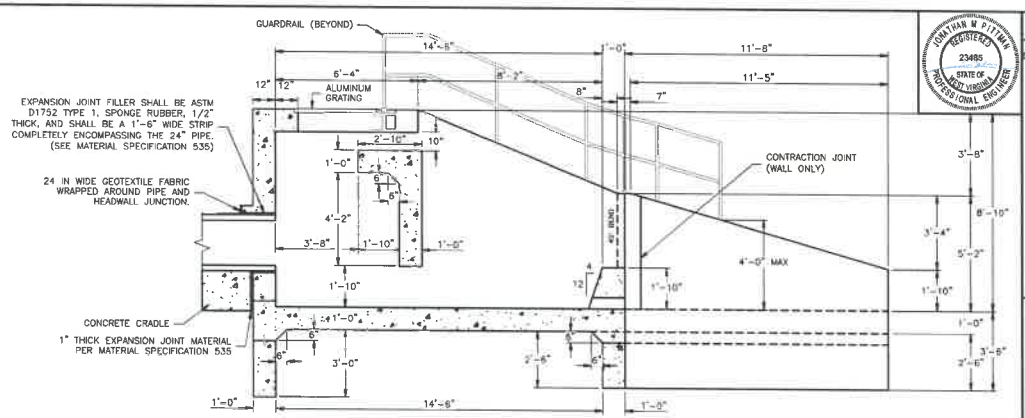


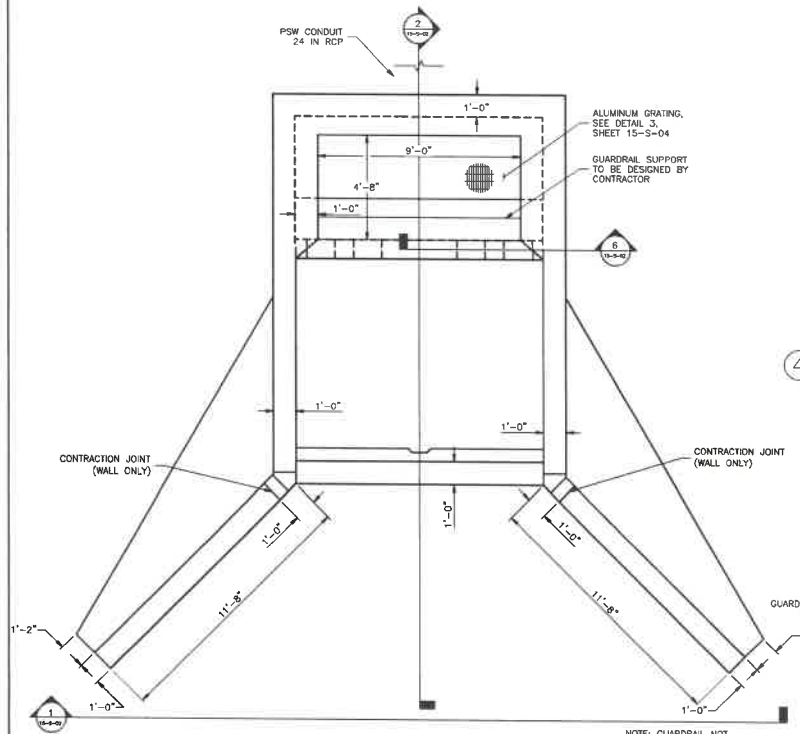
1 IMPACT BASIN ELEVATION

SCALE: 3/8"=1'0"



2 IMPACT BASIN SECTION

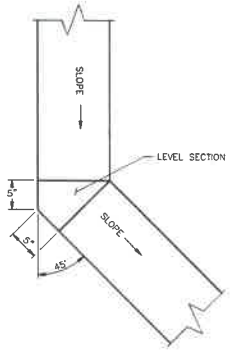
SCALE: 3/8"=1'0"



3 IMPACT BASIN PLAN

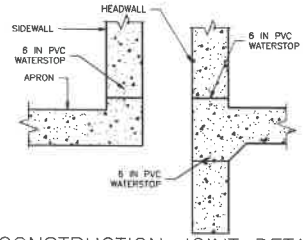
SCALE: 3/8"=1'0"

NOTE: GUARDRAIL NOT SHOWN FOR CLARITY



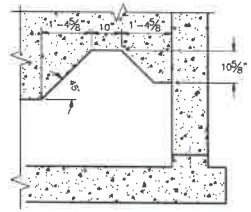
4 JUNCTION PLAN DETAIL

SCALE: 1"=10'



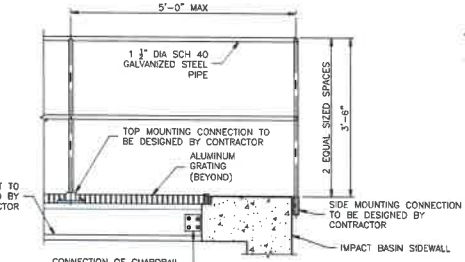
5 CONSTRUCTION JOINT DETAILS

SCALE: 1"=20'



6 BAFFLE SECTION

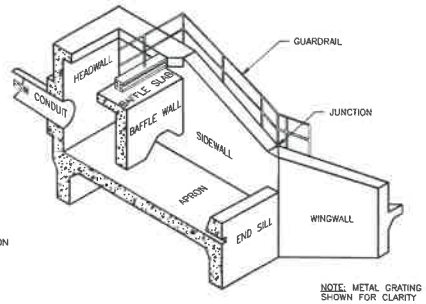
SCALE: 1"=20'



7 IMPACT BASIN GUARDRAIL DETAIL

SCALE: 3/4"=1'0"

NOTE: TOE BOARDS FOR GUARDRAIL NOT SHOW, BUT SHALL BE PROVIDED IN DESIGN FROM CONTRACTOR



8 IMPACT BASIN HALF ISOMETRIC

NTS

NOTE: METAL GRATING NOT SHOWN FOR CLARITY

REVISIONS			
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Designed CRP Date SEP 24
Drawn CRP SEP 24
Checked CDS SEP 24
Approved JMP SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

IMPACT BASIN PLAN, SECTION, AND DETAILS

Brush Creek Watershed Mercer County, WV

Schnabel Engineering | ATERRA SOLUTIONS
300 Brookside Ave., Bldg 18, Suite 160, Ambler, PA 19002
Phone: 336-274-4466

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-02

SEPTEMBER 2024

SHEET 36 OF 61

Last Saved By: CPATSONS SavaDate: 10/2/2024 11:29 AM PlotDate: 10/2/2024 3:04 PM
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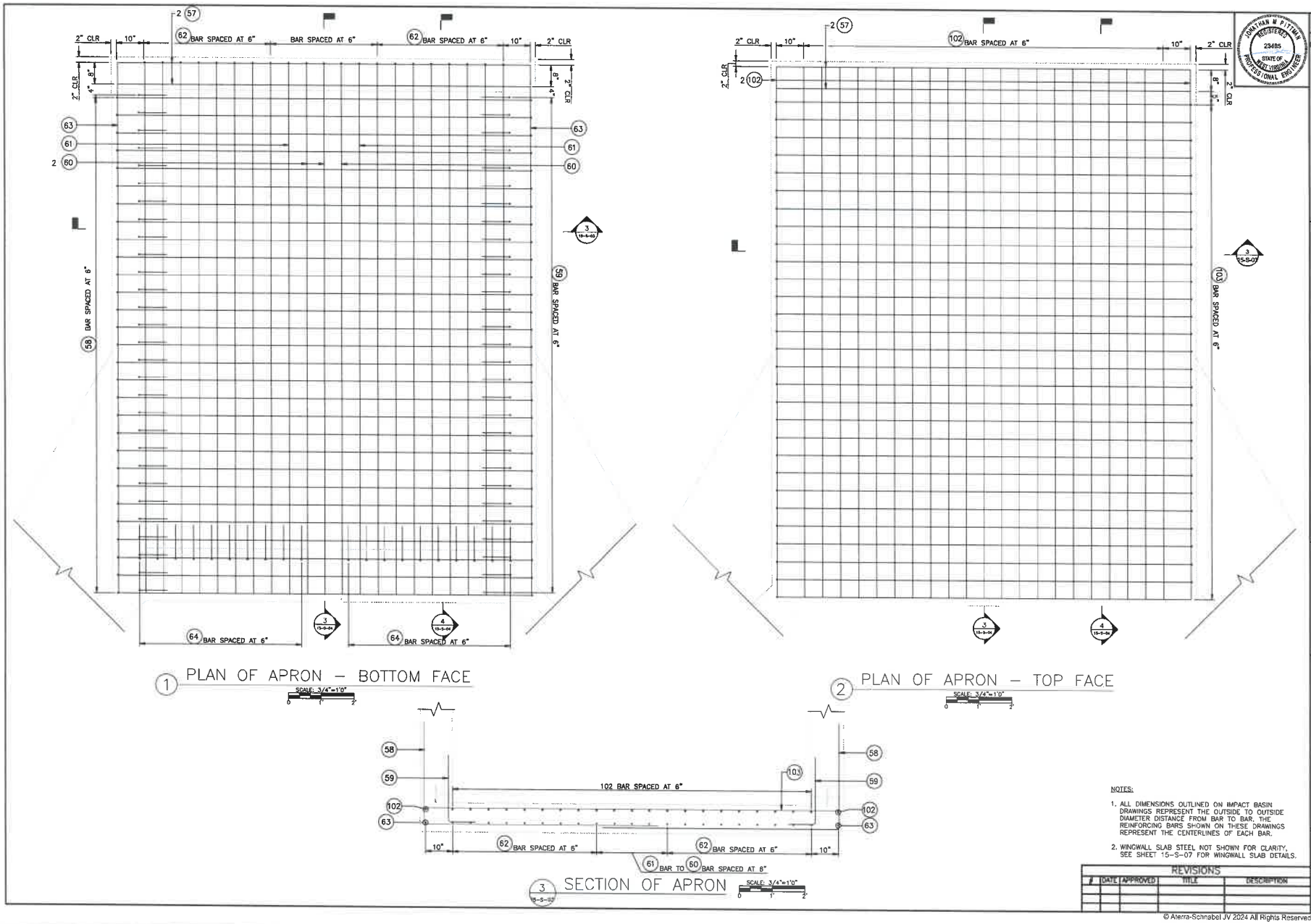

1 PLAN OF APRON – BOTTOM FACE
SCALE: 3/4"=1'0"

2 PLAN OF APRON – TOP FACE
SCALE: 3/4"=1'0"

3 SECTION OF APRON
SCALE: 3/4"=1'0"

NOTES:

1. ALL DIMENSIONS OUTLINED ON IMPACT BASIN DRAWINGS REPRESENT THE OUTSIDE TO OUTSIDE DIAMETER DISTANCE FROM BAR TO BAR. THE REINFORCING BARS SHOWN ON THESE DRAWINGS REPRESENT THE CENTERLINES OF EACH BAR.
2. WINGWALL SLAB STEEL NOT SHOWN FOR CLARITY, SEE SHEET 15-S-07 FOR WINGWALL SLAB DETAILS.

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

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JONATHAN M PITTMAN
REGISTERED
23485
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

Date	
Designed CRP	SEP 24
Drawn CRP	SEP 24
Checked CDS	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

IMPACT BASIN STEEL PLACEMENT – SHEET 1 OF 6

Brush Creek Watershed *Mercer County, WV*

Alterra Schnabel
300 Brookside Ave., Bldg. 18, Suite 180, Ambler, PA 19002
Phone: 336-274-8456
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-03

SEPTEMBER 2024

SHEET 37 OF 61

Last Saved By: CHAWKINS StrawDate: 10/2/2024 11:29 AM PlotDate: 10/2/2024 3:04 PM
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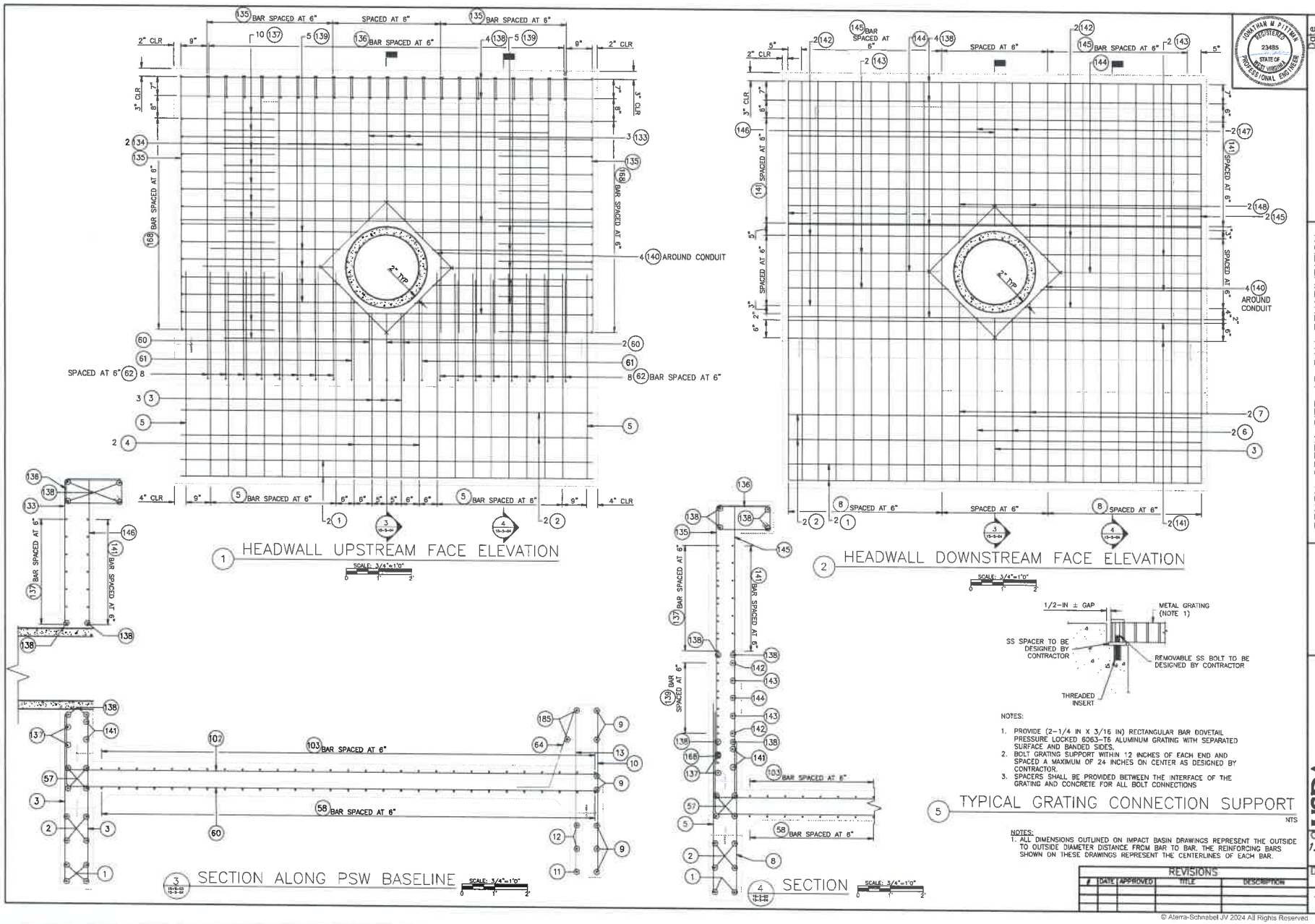

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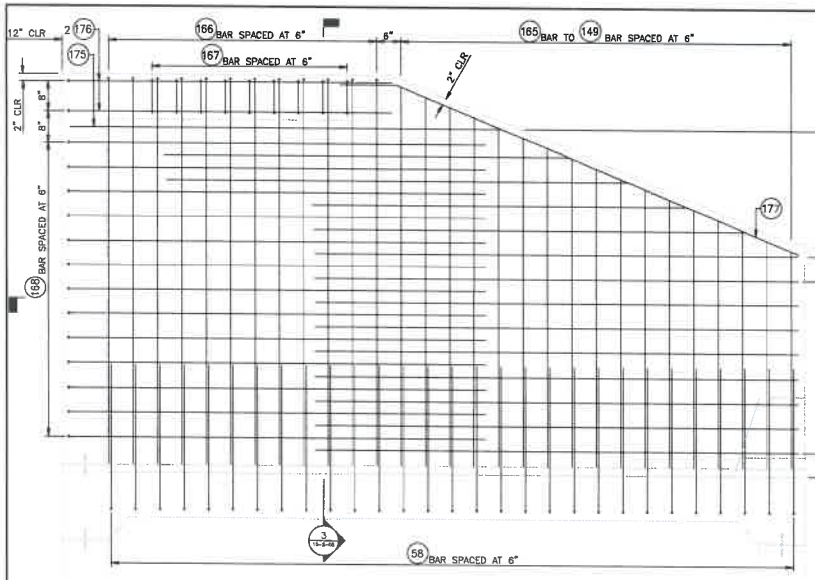
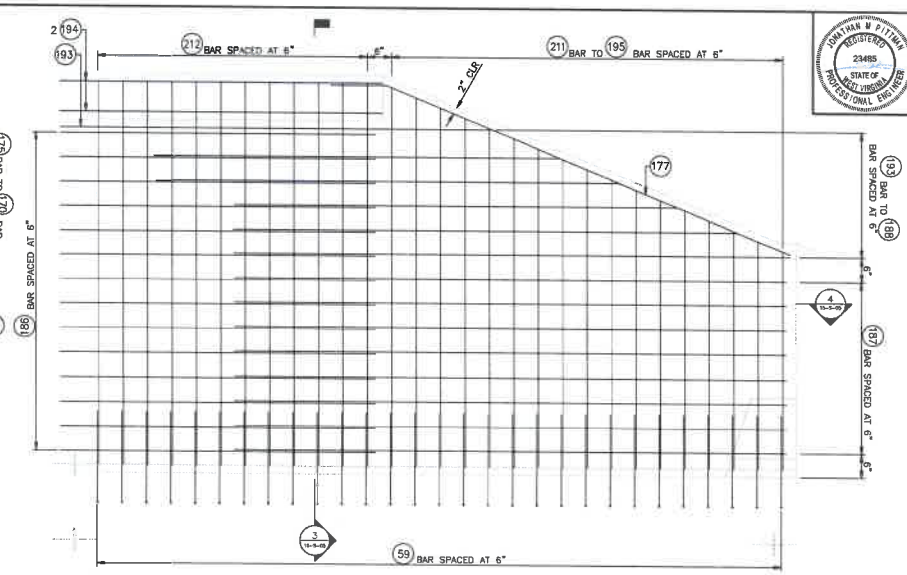


1 SIDEWALL ELEVATION–UNEXPOSED FACE

SCALE: 3/4"=1'0"

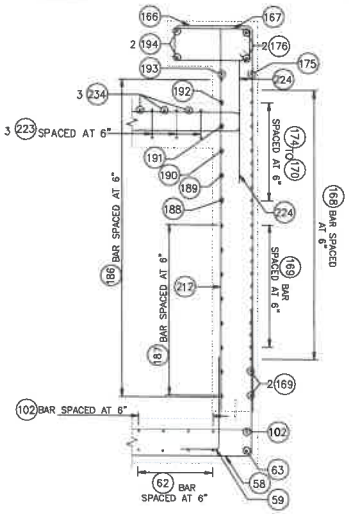
NOTE: GUARDRAIL NOT SHOWN FOR CLARITY, SEE DRAWING 15-S-10 FOR DETAILS



2 SIDEWALL ELEVATION–EXPOSED FACE

SCALE: 3/4"=1'0"

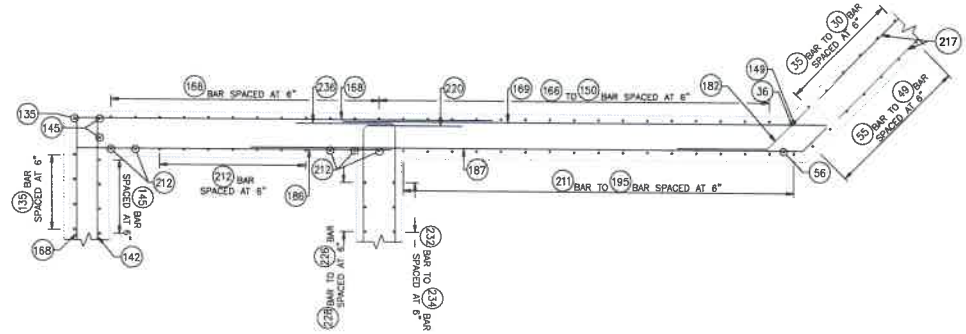
NOTE: GUARDRAIL NOT SHOWN FOR CLARITY, SEE DRAWING 15-S-10 FOR DETAILS



3 15-S-05 BAFFLE SLAB TO SIDEWALL CONECTION

SCALE: 3/4"=1'0"

NOTE: GUARDRAIL NOT SHOWN FOR CLARITY, SEE DRAWING 15-S-10 FOR DETAILS



4 15-S-05 SIDEWALL PLAN VIEW SECTION

SCALE: 3/4"=1'0"

NOTES:

1. ALL DIMENSIONS OUTLINED ON IMPACT BASIN DRAWINGS REPRESENT THE OUTSIDE TO OUTSIDE DIAMETER DISTANCE FROM BAR TO BAR. THE REINFORCING BARS SHOWN ON THESE DRAWINGS REPRESENT THE CENTERLINES OF EACH BAR.

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

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JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CRP	SEP 24
Drawn CRP	SEP 24
Checked CDS	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

IMPACT BASIN STEEL PLACEMENT - SHEET 3 OF 6

Brush Creek Watershed *Mercer County, WV*

ATERRA | Schnabel JOINT VENTURE
300 Brookside Ave., Bldg. 15, Suite 160, Ambler, PA 19002
Phone: 215-283-6460
www.aterra-sjv.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-05

SEPTEMBER 2024

SHEET 39 OF 61

Last Saved By: CPHERSONS SaveDate: 10/2/2024 11:29 AM FileDate: 09/2/2024 3:04 PM
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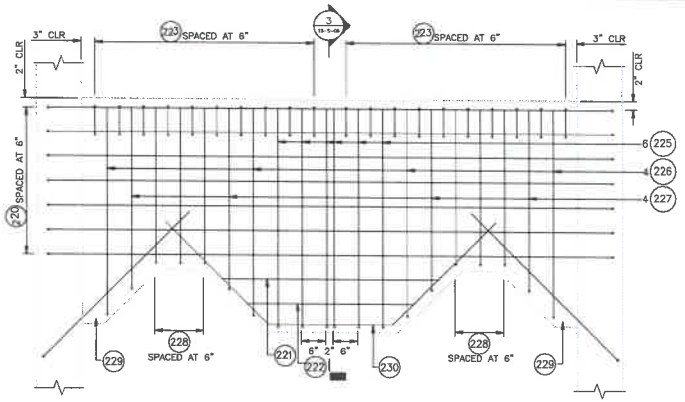
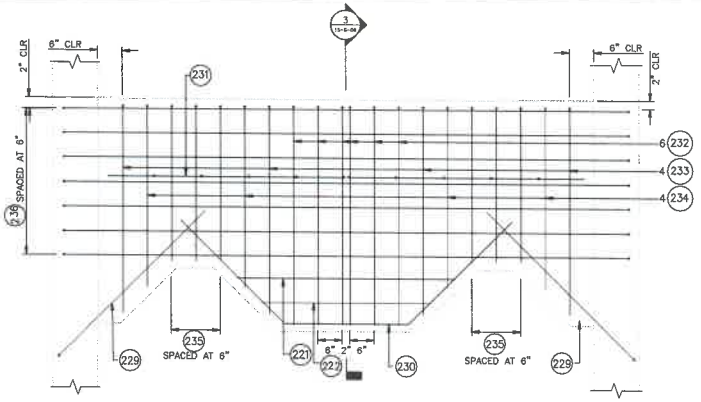
STEEL PLACEMENT - SHEET 3 OF 6



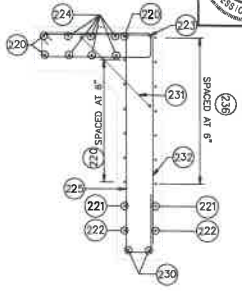
1 BAFFLE ELEVATION – UPSTREAM FACE

SCALE: 3/4"=1'0"



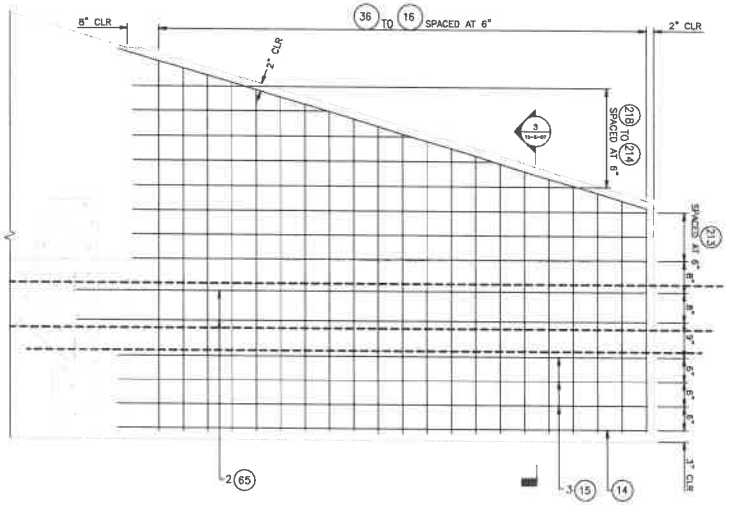
2 BAFFLE ELEVATION – DOWNSTREAM FACE

SCALE: 3/4"=1'0"



3 BAFFLE SECTION

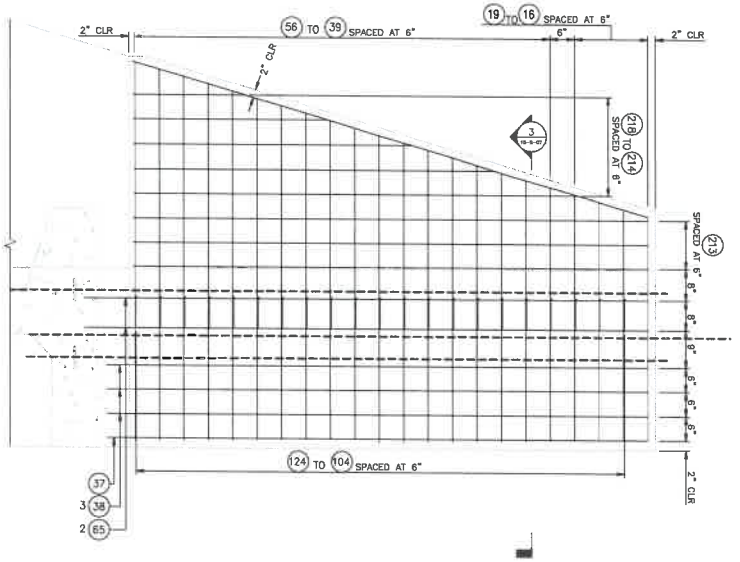
SCALE: 3/4"=1'0"



4 WINGWALL ELEVATION – UNEXPOSED FACE

SCALE: 3/4"=1'0"

NOTE: GUARDRAIL NOT SHOWN FOR CLARITY, SEE DRAWING 15-S-10 FOR DETAILS



5 WINGWALL ELEVATION – EXPOSED FACE

SCALE: 3/4"=1'0"

NOTE: GUARDRAIL NOT SHOWN FOR CLARITY, SEE DRAWING 15-S-10 FOR DETAILS

NOTES:

1. ALL DIMENSIONS OUTLINED ON IMPACT BASIN DRAWINGS REPRESENT THE OUTSIDE TO OUTSIDE DIAMETER DISTANCE FROM BAR TO BAR. THE REINFORCING BARS SHOWN ON THESE DRAWINGS REPRESENT THE CENTERLINES OF EACH BAR.

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

		Date
Designed	CRP	SEP 24
Drawn	CRP	SEP 24
Checked	CDS	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

IMPACT BASIN STEEL PLACEMENT – SHEET 4 OF 6

Brush Creek Watershed *Mercer County, WV*

ATERRA SCHNABEL JV

300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002 Phone: 267-314-4456 www.aterra-schnabel.com

USDA United States Department of Agriculture

Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-06

SEPTEMBER 2024

SHEET 40 OF 61

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File name: O:\Seattle Fwd\D0181\RCRS\15_DL\NRCS_IHE_Brush_Creek\405-SE Products\dgn\CAD\DRAWINGS\05-PRM_DESIGN\SITE 15\S-15-02-BASE (Avg Layout IMPACT BASIN STEEL PLACEMENT - SHEET 4 OF 6

1 PLAN WINGWALL FOOTING – BOTTOM FACE

SCALE: 3/4"=1'0"

2 PLAN WINGWALL FOOTING – TOP FACE

SCALE: 3/4"=1'0"

3 WINGWALL SECTION

SCALE: 3/4"=1'0"

VIEW 1

VIEW 2

4 PLAN WINGWALL SECTIONS

SCALE: 3/4"=1'0"

NOTE: VIEW 1 AND VIEW 2 FOR THE PLAN WINGWALL SECTIONS ARE CUT AT THE SAME LOCATION, SECOND VIEW ADDED FOR ANNOTATION CLARITY

NOTES:

1. ALL DIMENSIONS OUTLINED ON IMPACT BASIN DRAWINGS REPRESENT THE OUTSIDE TO OUTSIDE DIAMETER DISTANCE FROM BAR TO BAR. THE REINFORCING BARS SHOWN ON THESE DRAWINGS REPRESENT THE CENTERLINES OF EACH BAR.

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

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JONATHAN M. PITTMAN
REGISTERED
23485
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

	Date
Designed CRP	SEP 24
Drawn CRP	SEP 24
Checked CDS	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

IMPACT BASIN STEEL PLACEMENT – SHEET 5 OF 6

Brush Creek Watershed *Mercer County, WV*

ATERRA SCHNABEL

300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 267-238-3045
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-07

SEPTEMBER 2024

SHEET 41 OF 61

Last Saved By: CPARSONS SaveDate: 10/2/2024 11:29 AM PlotDate: 10/2/2024 3:54 PM
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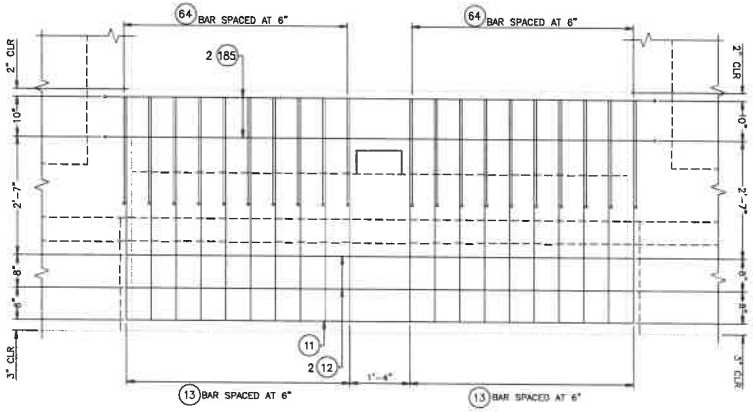
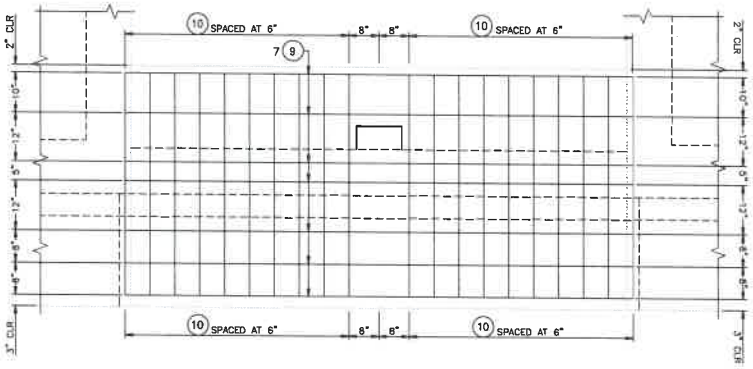
SITE15_FLAG1SBM01 - SHEET 1 OF 6



1 ELEVATION OF ENDSILL AND TOEWALL – UPSTREAM FACE

SCALE: 3/4"=1'0"



2 ELEVATION OF ENDSILL AND TOEWALL – DOWNSTREAM FACE

SCALE: 3/4"=1'0"

NOTES:

1. ALL DIMENSIONS OUTLINED ON IMPACT BASIN DRAWINGS REPRESENT THE OUTSIDE TO OUTSIDE DIAMETER DISTANCE FROM BAR TO BAR. THE REINFORCING BARS SHOWN ON THESE DRAWINGS REPRESENT THE CENTERLINES OF EACH BAR.

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

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JONATHAN M. FITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

		Date
Designed	CRP	SEP 24
Drawn	CRP	SEP 24
Checked	CDS	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

IMPACT BASIN STEEL PLACEMENT – SHEET 6 OF 6

Brush Creek Watershed *Mercer County, WV*

ATERRA SOLUTIONS | Schnabel ENGINEERING
300 Brookside Ave., Bldg. 15, Suite 160, Ambler, PA 19002
Phone: 330-221-4436
email: ...@aterra.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-08

SEPTEMBER 2024

SHEET 42 OF 61

Last Saved By: CPHERSONS SaveDate: 10/2/2024 11:28 AM PlotDate: 10/2/2024 3:04 PM
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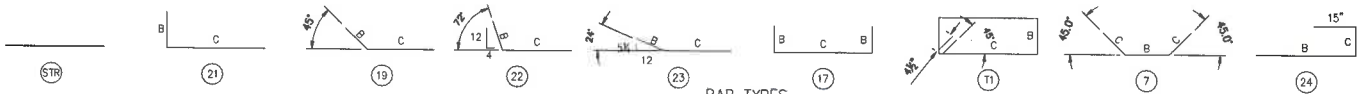
LOCATION	MARK	SIZE	QUAN.	LENGTH	TYPE	B	C	TOTAL LENGTH
HEADWALL	1	5	4	12' 8"	STR			50' 8"
"	2	5	4	12' 8"	STR			50' 8"
"	3	4	4	5' 0"	STR			20' 0"
"	4	4	2	5' 5"	STR			10' 10"
"	5	4	18	6' 3"	STR			112' 6"
"	6	4	2	5' 0"	STR			10' 0"
"	7	4	2	5' 6"	STR			11' 0"
"	8	4	20	5' 1"	STR			101' 8"
ENDSILL	9	5	7	11' 3"	STR			78' 9"
"	10	5	20	4' 11"	STR			98' 4"
"	11	5	1	11' 3"	STR			11' 3"
"	12	5	2	11' 3"	STR			22' 6"
"	13	5	20	4' 11"	STR			98' 4"
W'GWALL	14	5	2	13' 0"	19	1' 3"	11' 9"	26' 0"
"	15	4	6	12' 9"	19	1' 0"	11' 9"	76' 6"
"	16	5	4	5' 0"	STR			20' 0"
"	17	4	4	5' 2"	STR			20' 8"
"	18	4	4	5' 4"	STR			21' 4"
"	19	4	4	5' 6"	STR			22' 0"
"	20	4	2	5' 8"	STR			11' 4"
"	21	4	2	5' 10"	STR			11' 8"
"	22	4	2	6' - 0"	STR			12' 0"
"	23	4	2	6' 2"	STR			12' 4"
"	24	4	2	6' 4"	STR			12' 8"
"	25	4	2	6' 6"	STR			13' 0"
"	26	4	2	6' 8"	STR			13' 4"
"	27	4	2	6' 10"	STR			13' 8"
"	28	4	2	6' 11"	STR			13' 10"
"	29	4	2	7' 1"	STR			14' 2"
"	30	4	2	7' 3"	STR			14' 6"
"	31	4	2	7' 5"	STR			14' 10"
"	32	4	2	7' 7"	STR			15' 2"
"	33	4	2	7' 9"	STR			15' 6"
"	34	4	2	7' 11"	STR			15' 10"
"	35	4	2	8' 1"	STR			16' 2"
"	36	4	2	8' 3"	STR			16' 6"
"	37	5	2	13' 3"	19	1' 3"	12' 0"	26' 6"
"	38	4	6	13' 0"	19	1' 0"	12' 0"	78' 0"
"	39	4	2	5' 6"	STR			11' 4"
"	40	4	2	5' 10"	STR			11' 8"
"	41	4	2	6' 0"	STR			12' 0"
"	42	4	2	6' 2"	STR			12' 4"
"	43	4	2	6' 4"	STR			12' 8"
"	44	4	2	6' 6"	STR			13' 0"
"	45	4	2	6' 8"	STR			13' 4"
"	46	4	2	6' 10"	STR			13' 8"
"	47	4	2	6' 11"	STR			13' 10"
"	48	4	2	7' 1"	STR			14' 2"
"	49	4	2	7' 3"	STR			14' 6"
"	50	4	2	7' 5"	STR			14' 10"
"	51	4	2	7' 7"	STR			15' 2"
"	52	4	2	7' 9"	STR			15' 6"
"	53	4	2	7' 11"	STR			15' 10"
"	54	4	2	8' 1"	STR			16' 2"
"	55	4	2	8' 3"	STR			16' 6"
"	56	4	2	8' 5"	STR			16' 10"
APRON	57	5	4	12' 8"	STR			50' 8"
"	58	4	58	9' 10"	21	3' 2"	7' 2"	570' 4"
"	59	4	58	2' 10"	21	2' 0"	0' 10"	164' 4"
"	60	4	3	18' 3"	21	2' 0"	16' 3"	54' 9"
"	61	4	2	18' 9"	21	2' 6"	16' 3"	37' 6"

LOCATION	MARK	SIZE	QUAN.	LENGTH	TYPE	B	C	TOTAL LENGTH
"	62	4	16	19' 4"	21	3' 1"	16' 3"	309' 4"
"	63	5	2	16' 3"	STR			32' 6"
"	64	5	20	3' 2"	22	0' 10"	2' 4"	63' 4"
W'GWALL	65	4	8	12' 6"	STR			100' 0"
"	66	4	4	20' 0"	STR			80' 0"
"	67	4	4	19' 3"	STR			77' 0"
"	68	4	4	18' 6"	STR			74' 0"
"	69	4	4	17' 9"	STR			71' 0"
"	70	4	4	15' 6"	STR			62' 0"
"	71	4	4	12' 6"	STR			50' 0"
"	72	4	4	9' 7"	STR			38' 4"
"	73	4	2	1' 11"	STR			3' 10"
"	74	4	2	2' 1"	STR			4' 2"
"	75	4	2	2' 2"	STR			4' 4"
"	76	4	2	2' 4"	STR			4' 8"
"	77	4	2	2' 6"	STR			5' 0"
"	78	4	2	2' 7"	STR			5' 2"
"	79	4	2	2' 9"	STR			5' 6"
"	80	4	2	2' 11"	STR			5' 10"
"	81	4	2	3' 1"	STR			6' 2"
"	82	4	2	3' 2"	STR			6' 4"
"	83	4	2	3' 4"	STR			6' 8"
"	84	4	2	3' 6"	STR			7' 0"
"	85	4	2	3' 7"	STR			7' 2"
"	86	4	2	3' 9"	STR			7' 6"
"	87	4	2	3' 11"	STR			7' 10"
"	88	4	2	4' 1"	STR			8' 2"
"	89	4	2	4' 2"	STR			8' 4"
"	90	4	2	4' 4"	STR			8' 8"
"	91	4	2	4' 6"	STR			9' 0"
"	92	4	2	4' 7"	STR			9' 2"
"	93	4	2	4' 9"	STR			9' 6"
"	94	4	2	4' 11"	STR			9' 10"
"	95	4	2	5' 0"	STR			10' 0"
"	96	4	2	5' 0"	STR			10' 0"
"	97	4	2	4' 10"	STR			9' 8"
"	98	4	2	4' 8"	STR			9' 4"
"	99	4	2	4' 2"	STR			8' 4"
"	100	4	2	3' 8"	STR			7' 4"
"	101	4	2	3' 2"	STR			6' 4"
APRON	102	5	23	16' 3"	STR			373' 9"
"	103	5	29	12' 8"	STR			367' 4"
W'GWALL	104	4	2	2' 7"	21	0' 8"	1' 11"	5' 2"
"	105	4	2	2' 9"	21	0' 8"	2' 1"	5' 6"
"	106	4	2	2' 10"	21	0' 8"	2' 2"	5' 8"
"	107	4	2	3' 0"	21	0' 8"	2' 4"	6' 0"
"	108	4	2	3' 2"	21	0' 8"	2' 6"	6' 4"
"	109	4	2	3' 3"	21	0' 8"	2' 7"	6' 6"
"	110	4	2	3' 5"	21	0' 8"	2' 9"	6' 10"
"	111	4	2	3' 7"	21	0' 8"	2' 11"	7' 2"
"	112	4	2	3' 9"	21	0' 8"	3' 1"	7' 6"
"	113	4	2	3' 10"	21	0' 8"	3' 2"	7' 8"
"	114	4	2	4' 0"	21	0' 8"	3' 4"	8' 0"
"	115	4	2	4' 2"	21	0' 8"	3' 6"	8' 4"
"	116	4	2	4' 3"	21	0' 8"	3' 7"	8' 6"
"	117	4	2	4' 5"	21	0' 8"	3' 9"	8' 10"
"	118	4	2	4' 7"	21	0' 8"	3' 11"	9' 2"
"	119	4	2	4' 9"	21	0' 6"	4' 1"	9' 6"
"	120	4	2	5' 0"	21	0' 6"	4' 4"	10' 0"
"	121	4	2	5' 0"	21	0' 8"	4' 4"	10' 0"
"	122	4	2	5' 2"	21	0' 8"	4' 6"	10' 4"

LOCATION	MARK	SIZE	QUAN.	LENGTH	TYPE	B	C	TOTAL LENGTH
"	123	4	2	5' 3"	21	0' 8"	4' 7"	10' 6"
"	124	4	2	5' 7"	21	0' 8"	4' 11"	11' 2"
"	125	4	2	4' 11"	STR			9' 10"
"	126	4	2	5' 0"	STR			10' 0"
"	127	4	2	5' 0"	STR			10' 0"
"	128	4	2	4' 10"	STR			9' 8"
"	129	4	2	4' 6"	STR			9' 4"
"	130	4	2	4' 2"	STR			8' 4"
"	131	4	2	3' 8"	STR			7' 4"
"	132	4	2	3' 2"	STR			6' 4"
HEADWALL	133	5	3	6' 1"	21	4' 5"	1' 6"	18' 3"
"	134	5	2	6' 7"	21	4' 11"	1' 6"	13' 2"
"	135	5	18	9' 6"	21	7' 10"	1' 6"	171' 0"
"	136	4	21	4' 4"	TI	0' 8"	1' 6"	91' 0"
"	137	4	9	10' 0"	STR			90' 0"
"	138	5	8	12' 8"	STR			101' 4"
"	139	4	10	4' 0"	STR			40' 0"
"	140	5	8	3' 0"	STR			24' 0"
"	141	4	9	12' 8"	STR			114' 0"
"	142	4	4	5' 5"	STR			21' 8"
"	143	4	4	4' 11"	STR			19' 8"
"	144	4	2	4' 6"	STR			9' 4"
"	145	4	20	8' 4"	STR			166' 8"
"	146	4	1	4' 5"	STR			4' 5"
"	147	4	2	4' 5"	STR			8' 10"
"	148	4	2	4' 11"	STR			9' 10"
SIDEWALL	149	4	2	4' 9"	STR			9' 6"
"	150	4	2	5' 0"	STR			10' 0"
"	151	4	2	5' 3"	STR			10' 6"
"	152	4	2	5' 5"	STR			10' 10"
"	153	4	2	5' 7"	STR			11' 2"
"	154	4	2	5' 10"	STR			11' 8"
"	155	4	2	6' 0"	STR			12' 0"
"	156	4	2	6' 3"	STR			12' 6"
"	157	4	2	6' 6"	STR			13' 0"
"	158	4	2	6' 9"	STR			13' 6"
"	159	4	2	6' 11"	STR			13' 10"
"	160	4	2	7' 2"	STR			14' 4"
"	161	4	2	7' 5"	STR			14' 10"
"	162	4	2	7' 7"	STR			15' 2"
"	163	4	2	7' 10"	STR			15' 6"
"	164	4	2	8' 1"	STR			16' 2"
"	165	4	2	8' 4"	STR			16' 8"
"	166	4	24	9' 10"	21	8' 6"	1' 4"	236' 0"
"	167	4	18	4' 4"	TI	0' 8"	1' 6"	78' 0"
"	168	4	26	12' 1"	21	2' 10"	9' 3"	314' 2"
"	169	4	16	10' 9"	STR			172' 0"
"	170	4	2	10' 7"	STR			21' 2"
"	171	4	2	9' 7"	STR			19' 2"
"	172	4	2	8' 4"	STR			16' 8"
"	173	4	2	10' 3"	STR			20' 6"
"	174	4	2	9' 0"	STR			18' 0"
"	175	4	2	9' 7"	STR			19' 2"
"	176	5	4	8' 5"	21	1' 3"	7' 2"	33' 8"
"	177	5	4	10' 9"	STR	1' 3"	9' 6"	43' 0"
"	178	4	2	3' 3"	19	1' 3"	2' 0"	6' 6"
"	179	4	2	3' 3"	19	1' 3"	2' 0"	6' 6"
"	180	4	2	3' 3"	19	1' 3"	2' 0"	6' 6"
"	181	4	2	3' 3"	19	1' 3"	2' 0"	6' 6"
"	182	4	2	3' 3"	19	1' 3"	2' 0"	6' 6"
"	183	4	2	3' 11"	19	1' 0"	2' 11"	7' 10"

LOCATION	MARK	SIZE	QUAN.	LENGTH	TYPE	B	C	TOTAL LENGTH
"	184	5	2	13' 6"	19	1' 3"	12' 3"	27' 0"
ENDSILL	185	5	2	14' 8"	17	1' 3"	12' 2"	29' 4"
SIDEWALL	186	4	28	7' 0"	STR			196' 0"
"	187	4	16	13' 0"	19	0' 9"	12' 3"	208' 0"
"	188	4	2	12' 2"	STR			24' 4"
"	189	4	2	11' 2"	STR			22' 4"
"	190	4	2	9' 10"	STR			19' 8"
"	191	4	2	10' 3"	STR			20' 6"
"	192	4	2	9' 0"	STR			18' 0"
"	193	4	2	9' 7"	STR			19' 2"
"	194	5	4	9' 0"	19	1' 10"	7' 2"	36' 0"
"	195	4	2	4' 9"	STR			9' 6"
"	196	4	2	5' 0"	STR			10' 0"
"	197	4	2	5' 3"	STR			10' 6"
"	198	4	2	5' 5"	STR			10' 10"
"	199	4	2	5' 7"	STR			11' 2"
"	200	4	2	5' 10"	STR			11' 8"
"	201	4	2	6' 0"	STR			12' 0"
"	202	4	2	6' 3"	STR			12' 6"
"	203	4	2	6' 6"	STR			13' 0"
"	204	4	2	6' 9"	STR			13' 6"
"	205	4	2	6' 11"	STR			13' 10"
"	206	4	2	7' 2"	STR			14' 4"
"	207	4	2	7' 5"	STR			14' 10"
"	208	4	2	7' 7"	STR			15' 2"
"	209	4	2	7' 10"	STR			15' 8"
"	210	4	2	8' 1"	STR			16' 2"
"	211	4	2	8' 4"	STR			16' 8"
SIDEWALL	212	4	24	8' 6"	STR			204' 0"
W'GWALL	213	4	12	11' 5"	STR			137' 0"
"	214	4	4	9' 10"	STR			39' 4"
"	215	4	4	8' 0"	STR			32' 0"
"	216	4	4	6' 2"	STR			24' 8"
"	217	4	4	4' 4"	STR			17' 4"
"	218	4	4	2' 6"	STR			10' 0"
"	219	5	2	13' 2"	19	1' 3"	11' 11"	26' 4"
BAFFLE	220	4	7	16' 8"	17	2' 1"	12' 6"	116' 8"
"	221	4	2	4' 10"	STR			9' 8"
"	222	4	2	3' 9"	STR			7' 6"
"	223	4	20	6' 2"	T1	0' 6"	2' 5"	123' 4"
"	224	4	6	15' 6"	17	1' 6"	12' 6"	93' 0"
"	225	4	6	6' 6"	24	4' 10"	0' 5"	39' 0"
"	226	4	4	6' 3"	24	4' 7"	0' 5"	25' 0"
"	227	4	4	5' 1"	24	3' 5"	0' 5"	20' 4"
"	228	4	6	5' 1"	24	3' 5"	0' 5"	30' 6"
"	229	5	4	5' 7"	21	1' 0"	4' 7"	22' 4"
"	230	5	2	9' 3"	7	2' 9"	3' 3"	18' 6"
"	231	5	10	4' 1"	17	1' 0"	2' 1"	40' 10"
"	232	4	6	7' 2"	21	2' 4"	4' 10"	43' 0"
"	233	4	4	6' 11"	21	2' 3"	4' 8"	27' 8"
"	234	4	4	8' 3"	21	2' 3"	4' 0"	25' 0"
"	235	4	6	5' 8"	21	2' 3"	3' 5"	34' 0"
"	236	4	7	16' 8"	17	2' 1"	12' 6"	116' 8"

	BAR SIZE	LINEAR FT	WEIGHT LBS
	4	6027.00	4026.04
	5	1879.50	1960.32
TOTAL		7906.50	5985.35



BAR TYPES

JONATHAN M PITTMAN
REGISTERED
23485
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

BRUSH CREEK SITE 15 DAM REHABILITATION

IMPACT BASIN STEEL SCHEDULE

Brush Creek Watershed *Mercer County, WV*

		Date
Designed	CRP	SEP 24
Drawn	CRP	SEP 24
Checked	CDS	SEP 24
Approved	JMP	SEP 24

Schnabel Engineering
ALERRA SOLUTIONS
300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 336-274-9466
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-09

SEPTEMBER 2024

SHEET 43 OF 61

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

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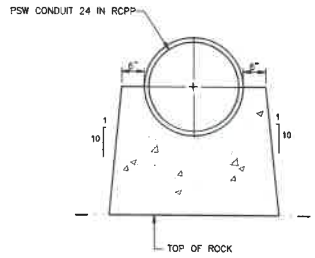
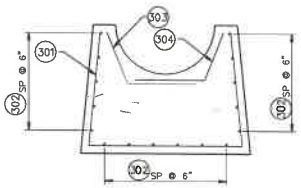


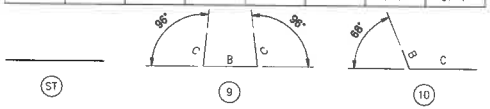


CONCRETE CRADLE PIPE EXTENSION STEEL SCHEDULE

MARK	SIZE	QUAN.	LENGTH	TYPE	B	C	TOTAL LENGTH
301	5	23	8'-5"	9	3'-4"	2'-6"	193' 7"
302	5	32	12'-11"	ST			413' 4"
303	5	23	2'-9"	10	1'-2"	1'-7"	63' 3"
304	5	23	2'-8"	10	1'-1"	1'-7"	61' 4"

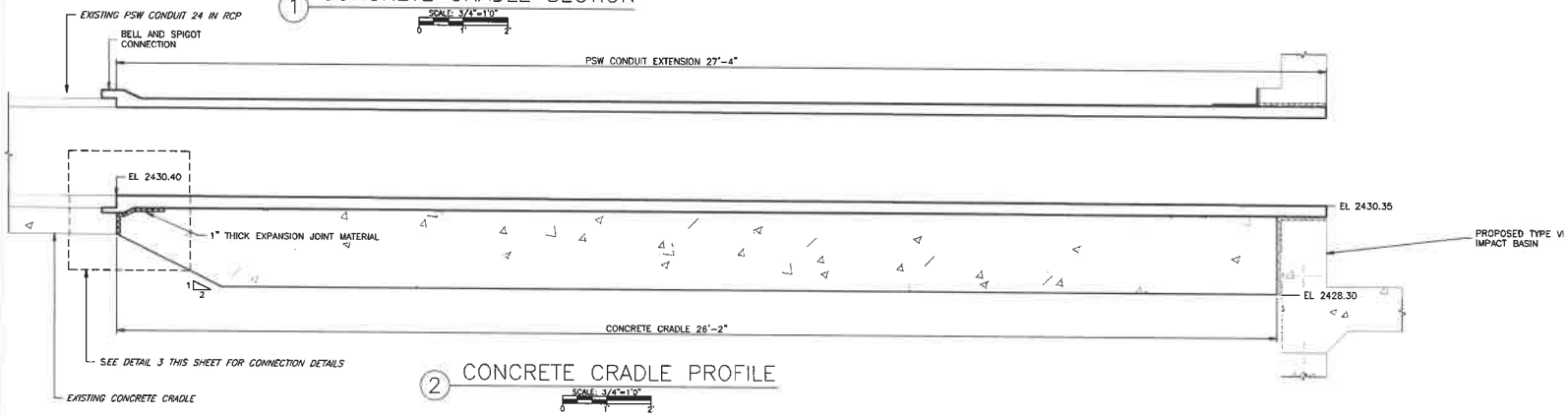
CONCRETE CRADLE BAR LENGTH AND WEIGHT TOTALS

BAR SIZE	LINEAR FT	WEIGHT LBS
5	731.50	762.43



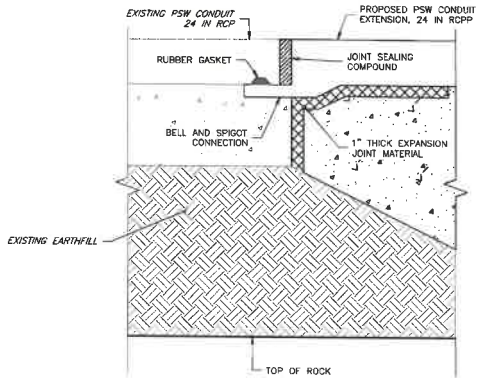
1 CONCRETE CRADLE SECTION

SCALE: 3/4"=1'0"



2 CONCRETE CRADLE PROFILE

SCALE: 3/4"=1'0"



3 EXISTING TO PROPOSED CRADLE JOINT DETAIL

NTS

NOTE: JOINT LENGTH EQUALS WATERTIGHT JOINT EXTENSIBILITY PLUS JOINT GAP. THE PIPE SHALL BE DRAWN TOGETHER SO THAT THE MAXIMUM JOINT GAP DOES NOT EXCEED ½" FOR PIPE LAID ON A STRAIGHT LINE.

NOTE: CONTRACTOR IS RESPONSIBLE FOR PERFORMING FIELD MEASUREMENTS AND VERIFYING THE COMPATIBILITY BETWEEN THE EXISTING PSW CONDUIT AND THE PROPOSED PIPE EXTENSION PRIOR TO ORDERING THE PIPE AND ACCESSORIES.

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

JONATHAN M. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CRP	SEP 24
Drawn CRP	SEP 24
Checked CDS	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

PRINCIPAL SPILLWAY CONDUIT EXTENTION DETAILS

Brush Creek Watershed *Mercer County, WV*

Schnabel Engineering
ATERRA SOLUTIONS
300 Brookside Ave., Bldg. 10, Suite 160, Ambler, PA 19002
Phone: 336-274-9456

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-10

SEPTEMBER 2024

SHEET 44 OF 61

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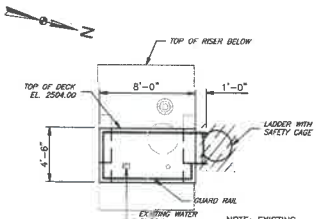
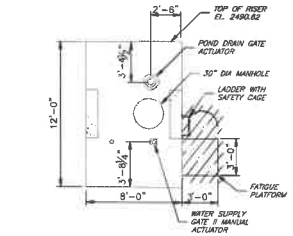


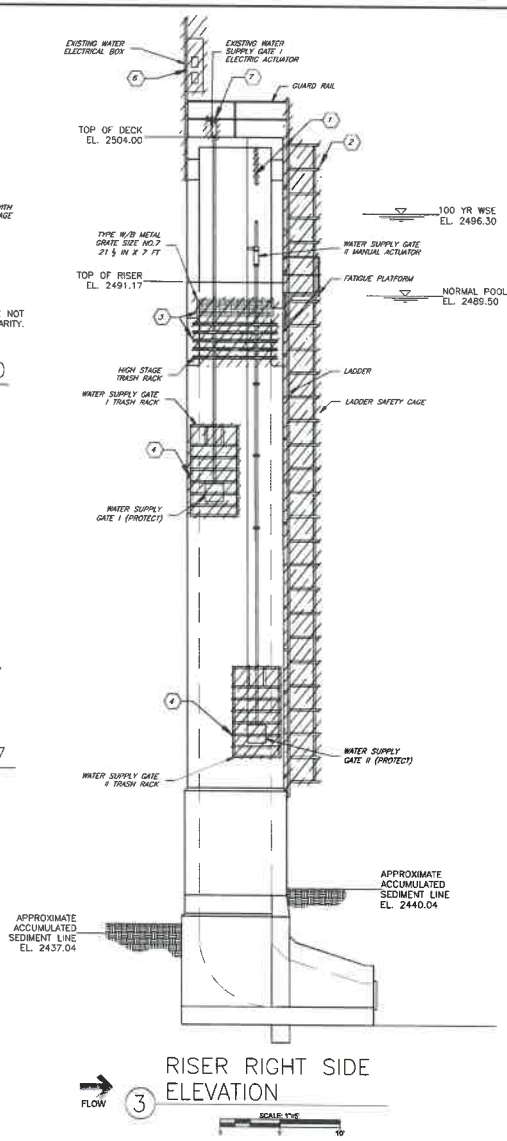
TOP OF DECK PLAN EL. 2504.00

FLOW 1 SCALE: 1"=5'



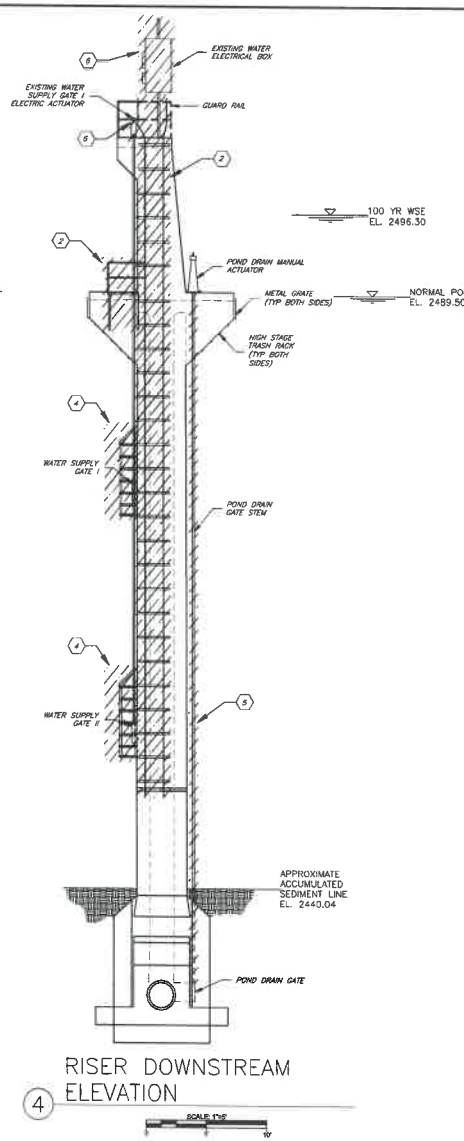
TOP OF RISER PLAN EL. 2491.17

FLOW 2 SCALE: 1"=5'



RISER RIGHT SIDE ELEVATION

FLOW 3 SCALE: 1"=5'



RISER DOWNSTREAM ELEVATION

4 SCALE: 1"=5'

(#) KEY NOTES:

1. REMOVE AND DISPOSE OF EXISTING STEM COVER.
2. REMOVE AND REPLACE EXISTING LADDER, LADDER SAFETY CAGE AND FATIGUE PLATFORM.
3. REMOVE AND REPLACE EXISTING HIGH STAGE TRASH RACKS, AND HIGH STAGE GRATING.
4. REMOVE AND REPLACE BOTH EXISTING WATER SUPPLY TRASH RACKS.
5. REMOVE AND REPLACE POND DRAIN GATE, STEM, AND STEM GUIDES. PROTECT AND REINSTALL EXISTING MANUAL ACTUATOR.
6. REMOVE AND DISPOSE OF EXISTING ELECTRICAL BOX.
7. REMOVE WATER SUPPLY GATE I ELECTRICAL ACTUATOR.

POND DRAIN GATE NOTES:

1. REMOVE EXISTING 18" X 18" SQUARE CAST IRON SLIDE GATE FROM RISER.
2. PROVIDE SURFACE PREPARATION OF EXISTING CAST IRON GATE IN ACCORDANCE WITH SSPC-SP10.
3. VISUALLY INSPECT ALL MEMBERS AND WELDS AND CHECK MEMBER THICKNESSES. SEE CONSTRUCTION SPECIFICATION 71 FOR MORE DETAILS.
4. REPLACEMENT GATE SHALL BE HYDRO GATE HG560 OR APPROVED EQUAL. REPLACEMENT GATE SHALL MATCH EXISTING OPENING AND BOLT PATTERN FOR WALL THIMBLE.
5. SLIDE GATE SHALL BE SUITABLE FOR 57 FT OF SEATING HEAD, AND 0 FT OF UNSEATING HEAD.

GENERAL DEMOLITION NOTES:

1. PRESERVE AND PROTECT WATER SUPPLY GATES I & II AND THEIR STEMS AND STEM GUIDES. CUT WITH GRINDER OR EQUIVALENT.
2. CUT EXISTING CONCRETE ANCHORS NOT PLANNED FOR REUSE FLUSH TO CONCRETE FACE WITH GRINDER OR EQUIVALENT. NO TORCH CUTTING CAN BE USED.
3. REMOVE SEDIMENT AROUND RISER STRUCTURE & POND DRAIN GATE. CONTRACTOR TO VERIFY SEDIMENT ELEVATIONS PRIOR TO STARTING EXCAVATION.
4. SALVAGEABLE MATERIALS SHALL BE PROPERTY OF OWNER. OTHER MATERIALS SHALL BE DISPOSED OF OFF-SITE IN ACCORDANCE WITH LOCAL REGULATIONS, AT CONTRACTOR EXPENSE.

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Date	
Designed	SMD SEP 24
Drawn	BAY SEP 24
Checked	KLS SEP 24
Approved	JMP SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

RISER HARDWARE AND REMOVAL PLAN

Brush Creek Watershed — Mercer County, WV

Aterra Schnabel Solutions

300 Brookside Ave., Bldg. 15, Suite 160, Ambler, PA 19002
Phone: 267-219-3456
www.aterra-pa.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-11

SEPTEMBER 2024

SHEET 45 OF 61

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

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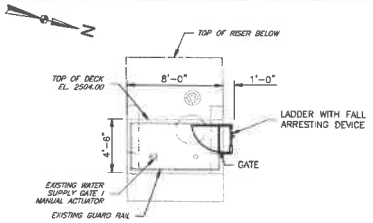
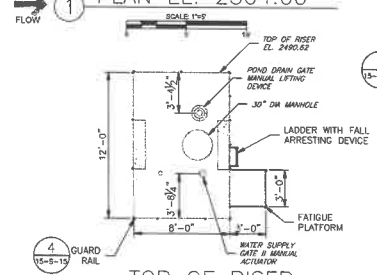


TOP OF DECK PLAN EL. 2504.00

FLOW

1

SCALE 1"=5'



FLOW

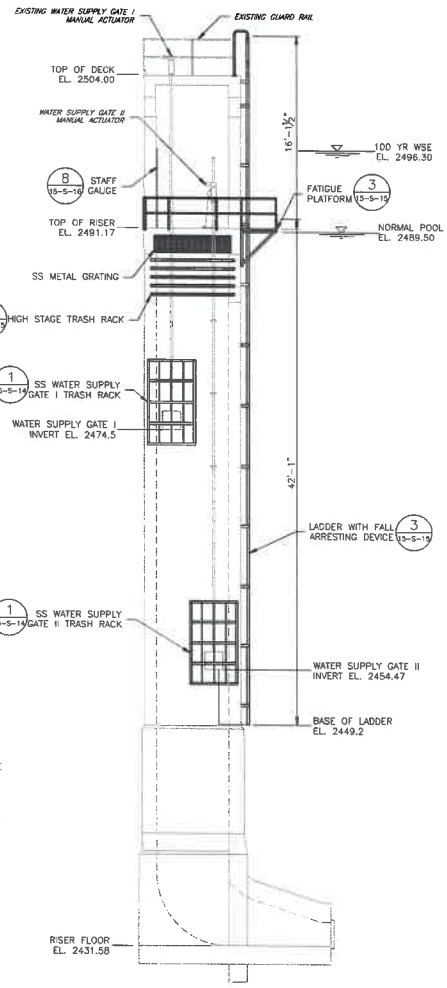
TOP OF RISER PLAN EL. 2491.17

2

SCALE 1"=5'

RISER IMPROVEMENTS GENERAL NOTES:

1. THESE NOTES ARE GENERAL AND APPLY TO ALL PARTS OF THE IMPROVEMENTS TO THE RISER UNLESS NOTED OTHERWISE.
2. ALL STRUCTURAL MEMBERS SHALL BE TYPE 304 STAINLESS STEEL OR GALVANIZED STEEL AS SHOWN.
3. CONTRACTOR SHALL VERIFY ALL ELEVATIONS, DIMENSIONS AND CONDITIONS OF EXISTING INFRASTRUCTURE PRIOR TO ORDERING REPLACEMENT PARTS OR BEGINNING CONSTRUCTION ACTIVITIES.
4. ALL FASTENERS & ANCHORS SHALL BE 316 STAINLESS STEEL. USE SS ANCHORS IN WET AREAS. USE C651 SILICONE BRONZE NUTS FOR ALL SS BOLTS AND EMBEDDED ANCHORS.
5. USE ANTI-SEIZE LUBRICANT FOR ALL STAINLESS STEEL FASTENERS.
6. ALL WELDING SHALL BE IN ACCORDANCE WITH AWS D1.6 FOR STAINLESS STEEL AND AWS D1.1 FOR CARBON STEEL.
7. ALL WELDS SHALL BE FULL PENETRATION WELDS UNLESS NOTED OTHERWISE.
8. WELD CONNECTIONS AND GRIND SMOOTH.
9. PRESERVE AND PROTECT ALL GATE ACTUATORS DURING CONSTRUCTION. STORE AS DIRECTED BY ENGINEER IF EQUIPMENT IS UNINSTALLED DURING CONSTRUCTION.
10. ANCHORS EMBEDDED IN CONCRETE SHALL BE ADHESIVE ANCHORS. ADHESIVE SHALL BE HILTI HIT-RE 500V 3 OR EQUIVALENT. ANCHOR HOLES SHALL BE HAMMER DRILLED.
11. WELD A CAP TO THE ENDS OF ALL EXPOSED HSS.
12. REPAIR CONCRETE INSIDE OF THE RISER WITH XYPEX MEGAMIX II OR APPROVED EQUAL. APPLY PER MANUFACTURERS RECOMMENDATION.
13. AFTER REPAIRING THE CONCRETE, COAT CONCRETE WITH XYPEX CONCENTRATE PER MANUFACTURERS RECOMMENDATION.

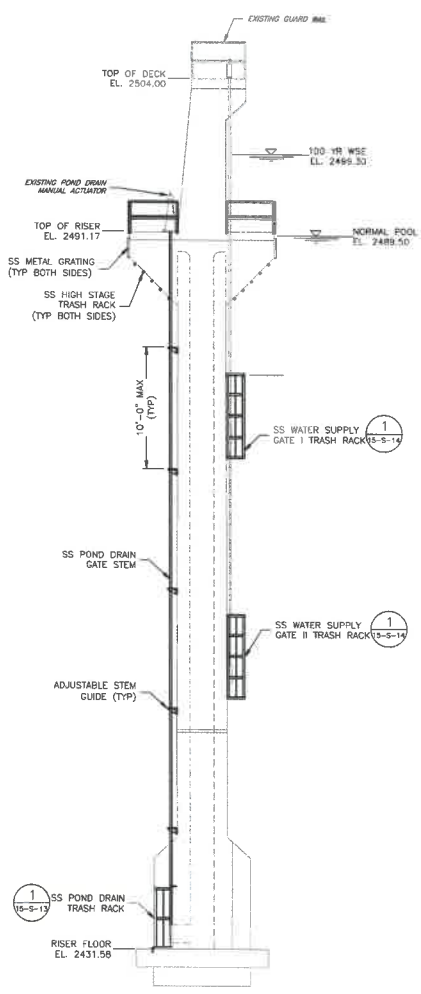


FLOW

RISER RIGHT ELEVATION

3

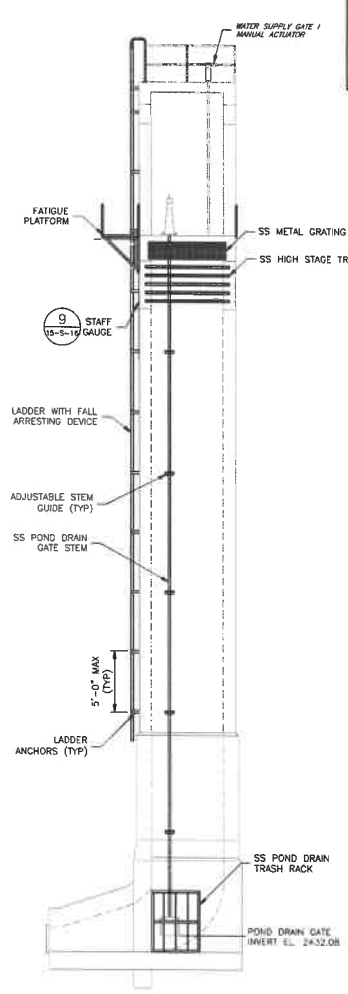
SCALE 1"=5'



RISER UPSTREAM ELEVATION

4

SCALE 1"=5'



FLOW

RISER LEFT ELEVATION

5

SCALE 1"=5'

JONATHAN W PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed SND	SEP 24
Drawn BSY	SEP 24
Checked KLS	SEP 24
Approved JWP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

PROPOSED RISER PLAN AND ELEVATION

Brush Creek Watershed *Mercer County, WV*

ATERRA Schnabel JV SOLUTION
300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 330-274-2450

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-12

SEPTEMBER 2024

SHEET 46 OF 61

REVISIONS			
#	DATE APPROVED	TITLE	DESCRIPTION

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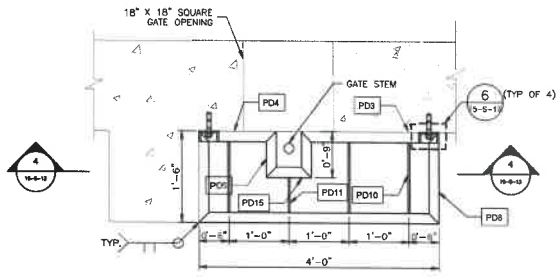
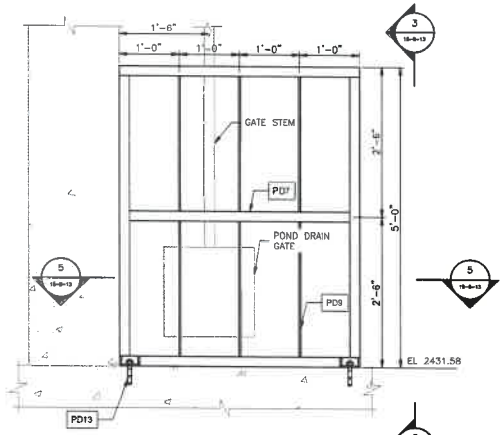
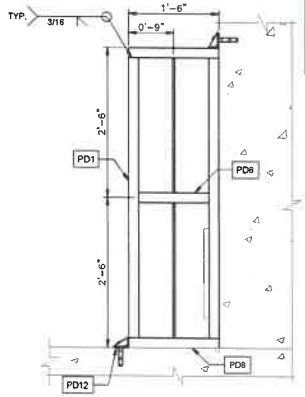


POND DRAIN GATE TRASH RACK PLAN



POND DRAIN GATE TRASH RACK ELEVATION



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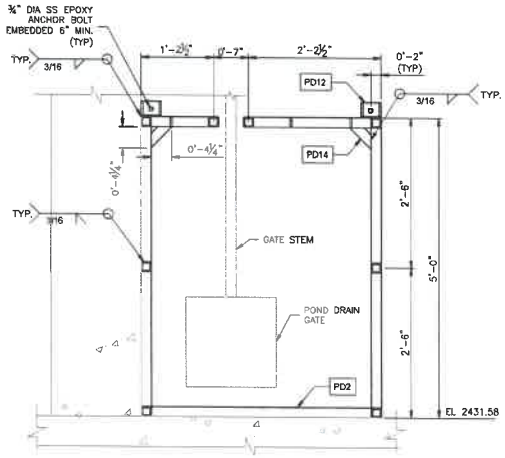

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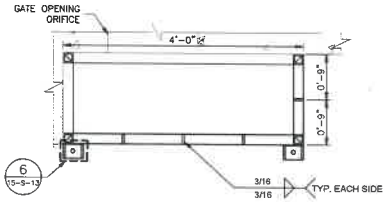

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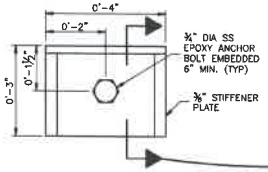
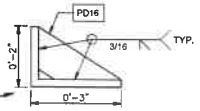


ANCHOR BRACKET PLAN



ANCHOR BRACKET SECTION

POND DRAIN TRASH RACK BILL OF MATERIALS

MARK	QTY	DESCRIPTION	LENGTHS	MATERIAL
PD1	4	HSS 2x2x¼"	4'-8"	TYPE 304 SS
PD2	3	HSS 2x2x¼"	4'-0"	TYPE 304 SS
PD3	1	HSS 2x2x¼"	2'-3½"	TYPE 304 SS
PD4	1	HSS 2x2x¼"	1'-3½"	TYPE 304 SS
PD5	2	HSS 2x2x¼"	0'-9"	TYPE 304 SS
PD6	2	HSS 2x2x¼"	1'-2"	TYPE 304 SS
PD7	1	HSS 2x2x¼"	3'-8"	TYPE 304 SS
PD8	4	HSS 2x2x¼"	1'-6"	TYPE 304 SS
PD9	8	2x⅜" BAR	2'-3"	TYPE 304 SS
PD10	3	2x⅜" BAR	1'-2"	TYPE 304 SS
PD11	1	2x⅜" BAR	0'-7"	TYPE 304 SS
PD12	4	L 3x2x¼"	0'-4"	TYPE 304 SS
PD13	4	⅝" SS ANCHOR	EMBED 6" MIN	TYPE 304 SS
PD14	2	⅜" GUSSET PLATE	SEE SECTION 4 SHEET 15-S-13	TYPE 304 SS
PD15	1	HSS 2x2x¼"	0'-9"	TYPE 304 SS
PD16	8	⅜" STIFFENER PLATE	0'-3½"	TYPE 304 SS

NOTES:

1. ALL STEEL SHALL BE TYPE 304 STAINLESS STEEL.
2. ALL WELDS SHALL BE IN ACCORDANCE WITH AWS D1.6 STANDARDS.
3. ANCHORS BOLTS SHALL BE TYPE 316 SS EPOXY ANCHORS.

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Date	SEP 24
Designed SND	SEP 24
Drawn BJY	SEP 24
Checked KLS	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

POND DRAIN GATE TRASH RACK DETAILS

Brush Creek Watershed *Mercer County, WV*

Aterra-Schnabel JV
300 Brookside Ave., Bldg. 28, Suite 160, Ambler, PA 19002
Phone: 336-274-5456

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-13

SEPTEMBER 2024

SHEET 47 OF 61

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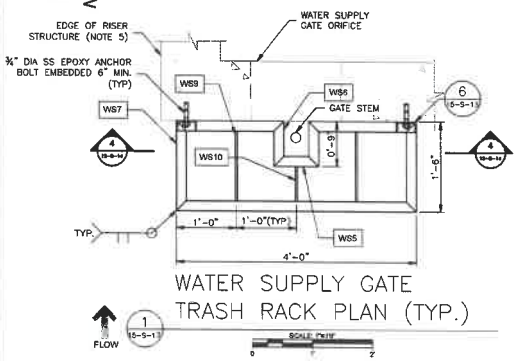
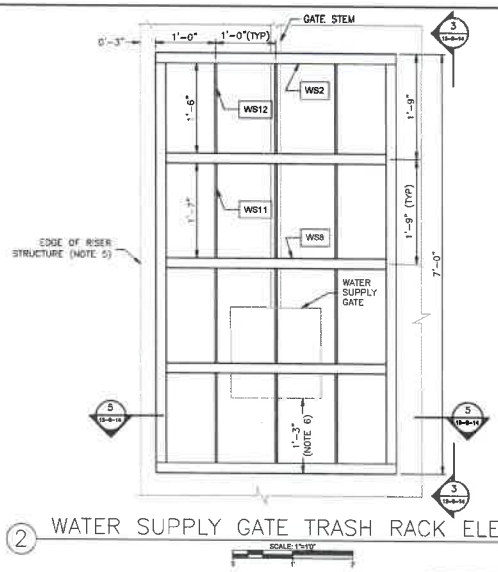
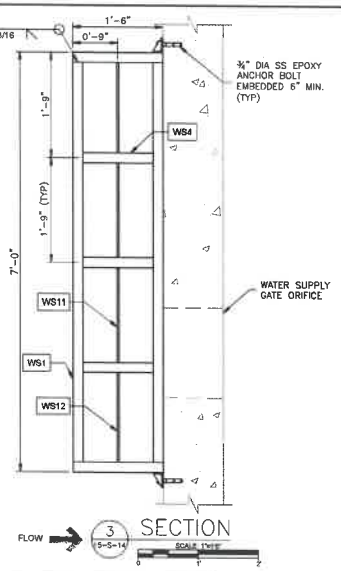


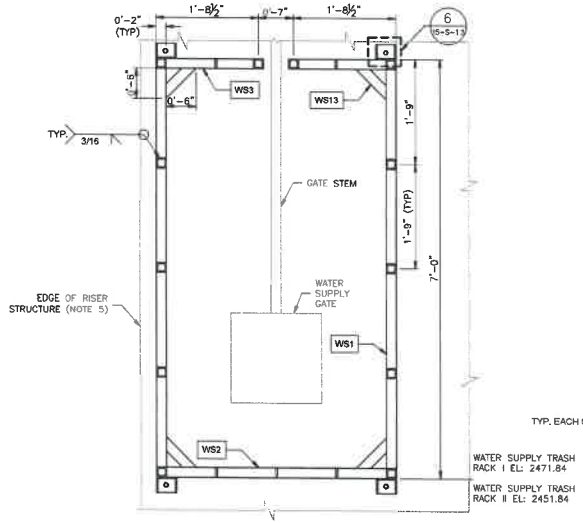
WATER SUPPLY GATE TRASH RACK PLAN (TYP.)



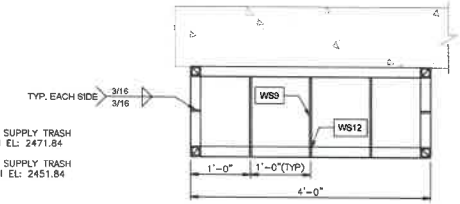
2 WATER SUPPLY GATE TRASH RACK ELEVATION



3 SECTION



4 SECTION



5 SECTION

WATER SUPPLY GATE TRASH RACK BILL OF MATERIALS

MARK	QTY	DESCRIPTION	LENGTHS	MATERIAL
WS1	4	HSS 2x2x⅛"	6'-8"	TYPE 304 SS
WS2	3	HSS 2x2x⅛"	4'-0"	TYPE 304 SS
WS3	2	HSS 2x2x⅛"	1'-0½"	TYPE 304 SS
WS4	6	HSS 2x2x⅛"	1'-2"	TYPE 304 SS
WS5	1	HSS 2x2x⅛"	0'-9"	TYPE 304 SS
WS6	2	HSS 2x2x⅛"	0'-9"	TYPE 304 SS
WS7	4	HSS 2x2x⅛"	1'-6"	TYPE 304 SS
WS8	3	HSS 2x2x⅛"	3'-8"	TYPE 304 SS
WS9	5	2x⅜" BAR	1'-2"	TYPE 304 SS
WS10	1	2x⅜" BAR	0'-7"	TYPE 304 SS
WS11	10	2x⅜" BAR	1'-7"	TYPE 304 SS
WS12	10	2x⅜" BAR	1'-6"	TYPE 304 SS
WS13	4	⅜" GUSSET PL	SEE SECTION 4 SHEET 15-S-14	TYPE 304 SS
WS14	4	L3x2x¼" ANCHOR	SEE DETAIL 6 SHEET 15-S-13	TYPE 304 SS
WS15	8	⅜" STIFFENER PLATE	SEE DETAIL 6 SHEET 15-S-13	TYPE 304 SS

NOTES:

1. ALL STEEL SHALL BE TYPE 304 STAINLESS STEEL.
2. ALL WELDS SHALL BE IN ACCORDANCE WITH AWS D1.6 STANDARDS.
3. ANCHORS SHALL BE TYPE 304 SS EPOXY ANCHORS.
4. PROVIDE 2 IDENTICAL FABRICATIONS OF THE WATER SUPPLY TRASH RACK FOR WATER SUPPLY GATES I AND II. B.O.M. IS COMPLETE FOR A SINGLE TRASH RACK FABRICATION.
5. THE EDGE OF STRUCTURE IS MIRRORED FOR WATER SUPPLY TRASH RACK II.
6. WATER SUPPLY GATE I; INVERT ELEVATION= 2473.09
   WATER SUPPLY GATE II; INVERT ELEVATION= 2453.09

REVISIONS			
#	DATE	APPROVED	TITLE	DESCRIPTION

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JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed SND	SEP 24
Drawn BJY	SEP 24
Checked MLE	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

WATER SUPPLY GATES I & II TRASH RACK DETAILS

Brush Creek Watershed *Mercer County, WV*

Schnabel Engineering | Aterra Solutions
300 Brookside Ave., Bldg. 18, Suite 1600, Ambler, PA 19002
Phone: 336-271-4505
aterra-sch.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC1B00023

Drawing No. 15-S-14

SEPTEMBER 2024

SHEET 48 OF 61

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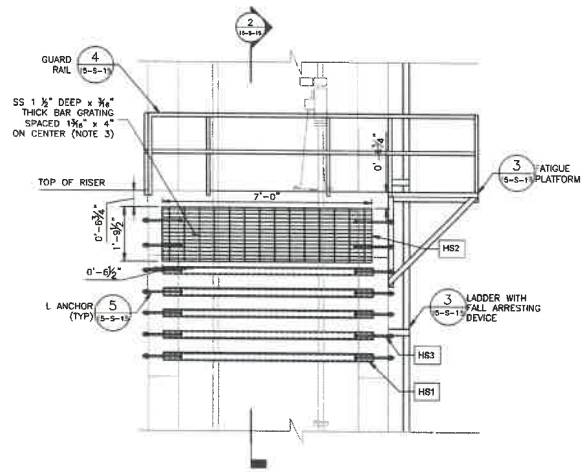
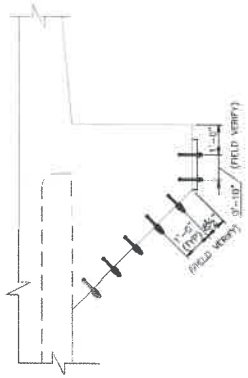


HIGH STAGE TRASH RACK ELEVATION



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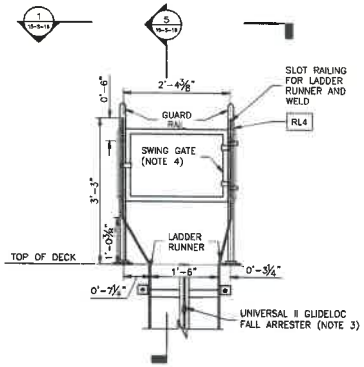
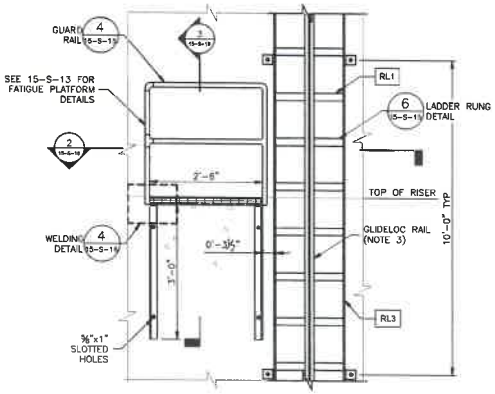
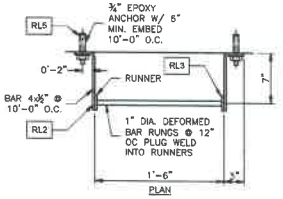
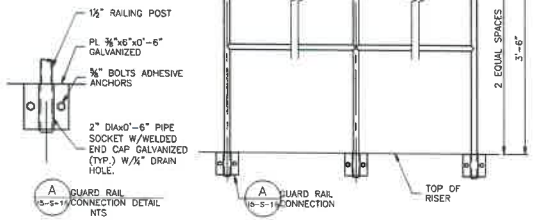




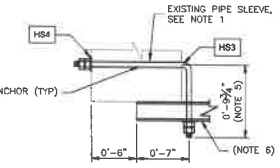
LADDER AND FATIGUE PLATFORM ELEVATION



LADDER RUNG DETAIL



GALVANIZED GUARD RAILS



L ANCHOR BOLT DETAIL

NOTES:

1. REUSE ¾" EXISTING PIPE SLEEVE. CLEAN EXISTING PIPE SLEEVE AND PREPARE SURFACE IN ACCORDANCE WITH SSPC-SP3.
2. GRATING SHALL BE BANDED ALL AROUND.
3. PROVIDE A GLIDELOC VERTICAL HEIGHT ACCESS LADDER SYSTEM KIT. THE VERTICAL RAIL SHALL BE GALVANIZED. ALL OTHER COMPONENTS SHALL BE STAINLESS STEEL. PROVIDE THREE UNIVERSAL II GLIDELOC FALL ARRESTERS OR EQUIVALENT.
4. SWING GATE SHALL BE PS SAFETY ACCESS EDGEHALT LADDER SAFETY GATE OR EQUIVALENT.
5. FIELD VERIFY REQUIRED LENGTH FOR REPLACEMENT L-ANCHORS.
6. WELD A CAP TO THE END OF EXPOSED HSS.
7. NEW GUARD RAIL SHALL ENCOMPASS PERIMETER OF TOP OF RISER.

RISER ACCESS LADDER BILL OF MATERIALS

MARK	QTY	DESCRIPTION	LENGTHS	MATERIAL
RL1	55	1" BAR RUNG	DETAIL 6 SHEET 15-S-15	GALVANIZED STEEL
RL2	12	ATTACHMENT BAR	DETAIL 6 SHEET 15-S-15	GALVANIZED STEEL
RL3	2	RUNNER	58'-3"	GALVANIZED STEEL
RL4	2	LADDER RAIL	DETAIL 5 SHEET 15-S-15	GALVANIZED STEEL
RL5	12	¾" EPOXY ANCHOR	DETAIL 6 SHEET 15-S-15	STAINLESS STEEL

HIGH STAGE TRASH RACK BILL OF MATERIALS

MARK	QTY	DESCRIPTION	LENGTHS	MATERIAL
HS1	10	HSS 2x2x⅜"	7'-0"	TYPE 304 SS
HS2	2	SS 1 -1/2" DEEP x ⅜" THICK BAR GRATING	DETAIL 1 SHEET 15-S-15	TYPE 304 SS
HS3	28	⅝" DIA ANCHOR	DETAIL 5 SHEET 15-S-15	TYPE 304 SS
HS4	28	2x2 WASHER PLATE	N/A	TYPE 304 SS

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

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JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed SND	SEP 24
Drawn BJY	SEP 24
Checked MLS	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

MISCELLANEOUS METAL DETAILS - SHEET 1 OF 2

Brush Creek Watershed — Mercer County, WV

Schnabel Engineering
ATERRA SOLUTIONS
300 Brookside Ave., Bldg 15, Suite 1R01, Ambler, PA 19002
Phone: 336-272-8456
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-15

SEPTEMBER 2024

SHEET 49 OF 61

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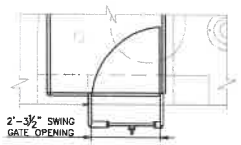
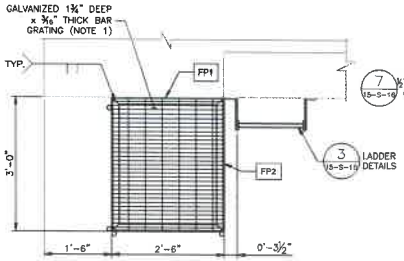


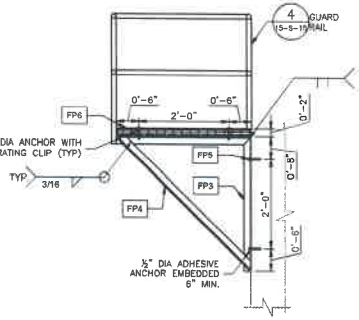
1 15-S-15 SWING GATE PLAN

SCALE: 1/2"=1'-0"



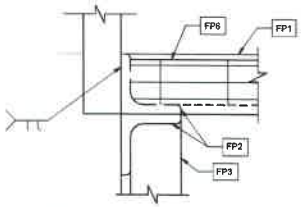
2 15-S-15 FATIGUE PLATFORM PLAN

SCALE: 3/4"=1'-0"



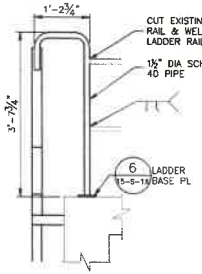
3 15-S-15 FATIGUE PLATFORM SECTION

SCALE: 3/4"=1'-0"



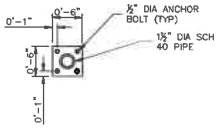
4 15-S-15 WELDING DETAIL

SCALE: 6"=1'-0"



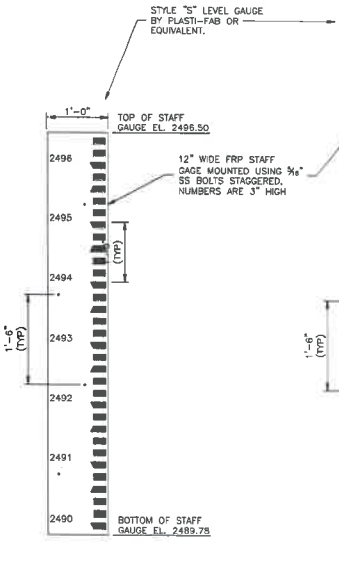
5 15-S-15 LADDER RAIL

SCALE: 3/4"=1'-0"



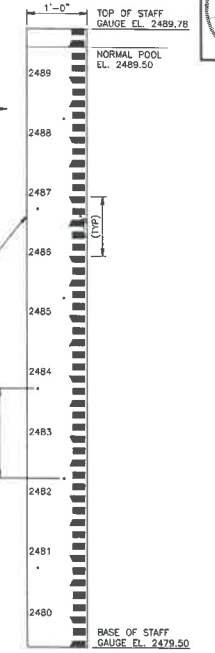
6 15-S-16 LADDER RAIL BASE PLATE

SCALE: 1"=1'-0"



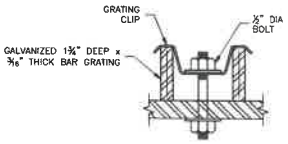
8 15-S-15 UPPER STAFF GAUGE

SCALE: 1"=1'-0"



9 15-S-15 LOWER STAFF GAUGE

SCALE: 1"=1'-0"



7 15-S-16 GRATING CLIP DETAIL

NTS

FATIGUE PLATFORM BILL OF MATERIALS				
MARK	QTY	DESCRIPTION	LENGTHS	MATERIAL
FP1	2	L 2x2x3/16"	2'-6"	GALVANIZED STEEL
FP2	4	L 2x2x3/16"	3'-0"	GALVANIZED STEEL
FP3	2	L 2x2x3/16"	3'-0"	GALVANIZED STEEL
FP4	2	L 2x2x3/16"	4'-10½"	GALVANIZED STEEL
FP5	4	½" ANCHORS	EMBED 6" MIN	GALVANIZED STEEL
FP6	1	GRATING	DETAIL 2 15-S-13	GALVANIZED STEEL

NOTES:

1. GRATING SHALL BE BANDED ALL AROUND.

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Date	
Designed	SND SEP 24
Drawn	BJY SEP 24
Checked	KLS SEP 24
Approved	JMP SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

MISCELLANEOUS METAL DETAILS – SHEET 2 OF 2

Brush Creek Watershed *Mercer County, WV*

Aterra-Schnabel JV
500 Brooktide Ave., Bldg. 18, Suite 160, Moorestown, NJ 08057
Phone: 330-271-8186
ATERRA SCHNABEL JV

United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-16

SEPTEMBER 2024

SHEET 50 OF 61

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

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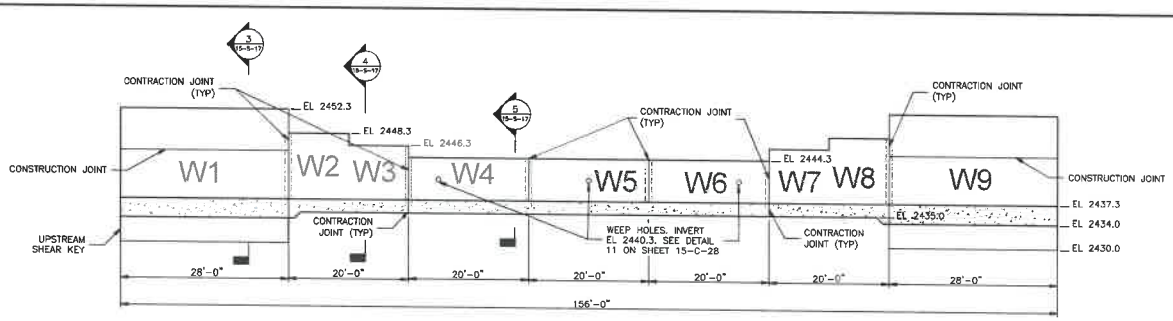
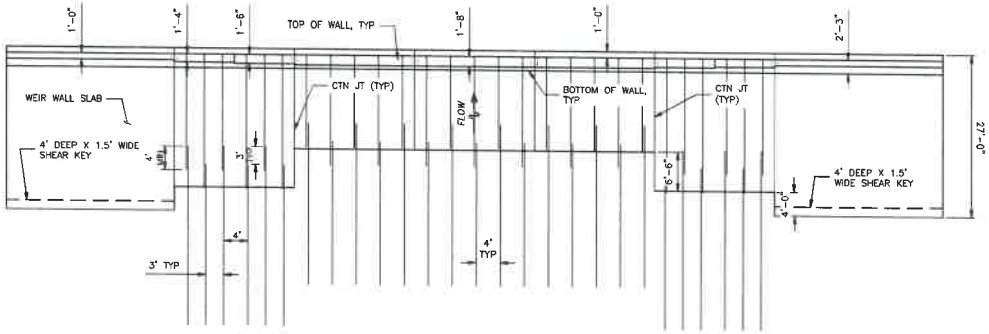
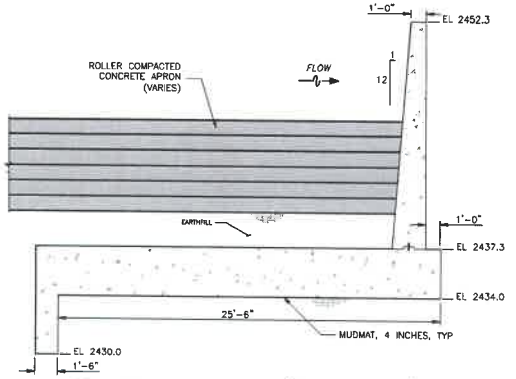


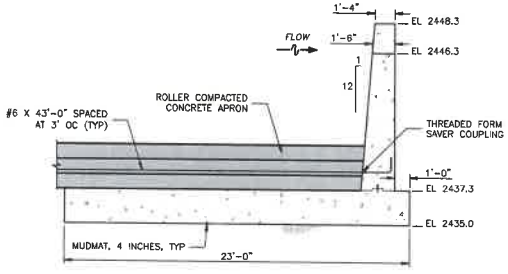
1 TAILWATER WEIR WALL ELEVATION



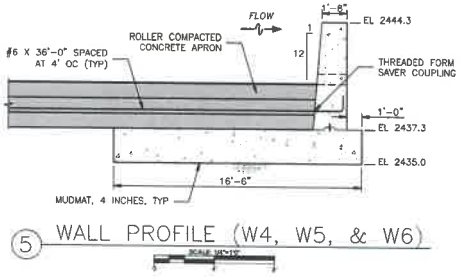
2 TAILWATER WEIR WALL PLAN



3 WALL PROFILE (W1 & W9)



4 WALL PROFILE (W2, W3, W7, & W8)



5 WALL PROFILE (W4, W5, & W6)

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed JTG	SEP 24
Drawn JTG	SEP 24
Checked MLP	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

TAILWATER WEIR WALL PLAN, ELEVATION, AND SECTION

Brush Creek Watershed *Mercer County, WV*

Aterra Schnabel Joint Venture
300 Brookside Ave., Bldg. 10, Suite 160, Ambler, PA 19002
Phone: 336-274-8458

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-17

SEPTEMBER 2024

SHEET 51 OF 61

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

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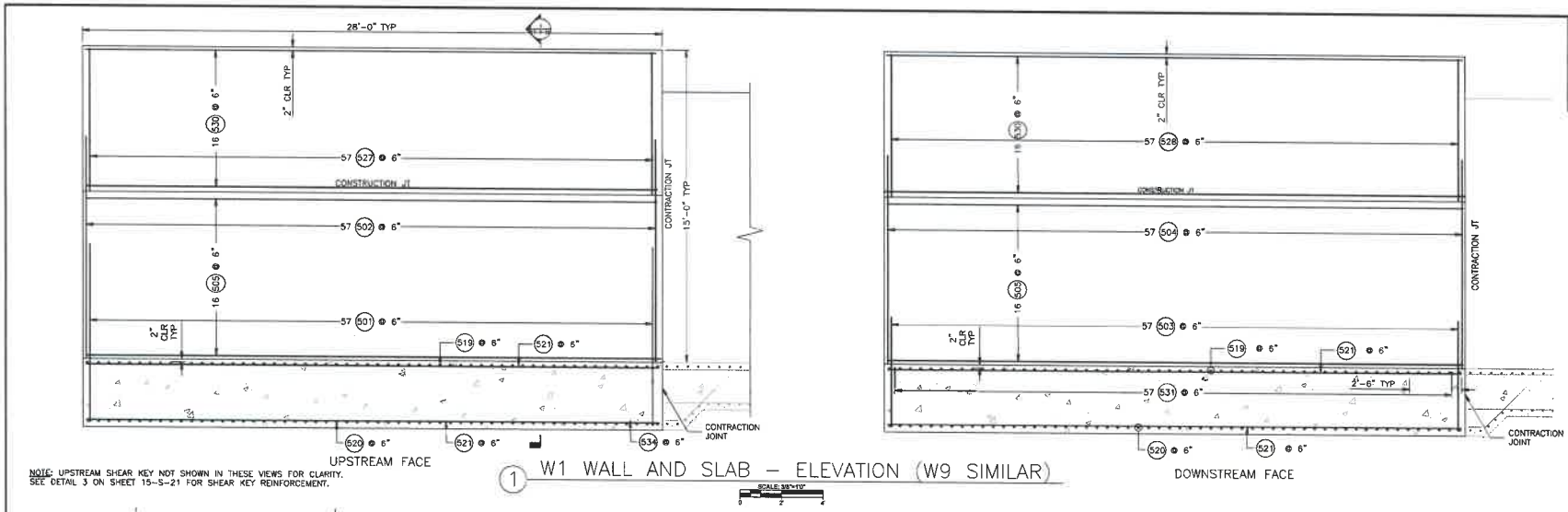
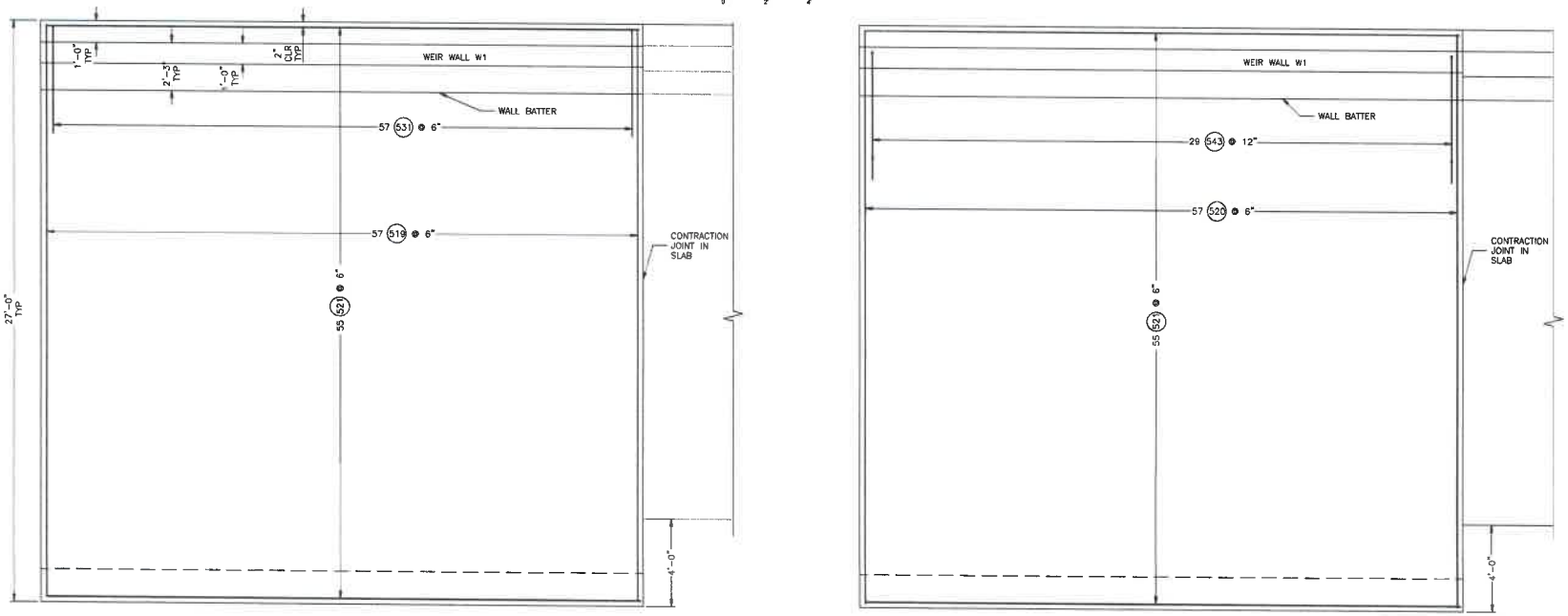


NOTE: UPSTREAM SHEAR KEY NOT SHOWN IN THESE VIEWS FOR CLARITY.
SEE DETAIL 3 ON SHEET 15-S-21 FOR SHEAR KEY REINFORCEMENT.

1 W1 WALL AND SLAB – ELEVATION (W9 SIMILAR)

SCALE: 3/8"=1'-0"



2 W1 SLAB – PLAN (W9 SIMILAR)

SCALE: 1/2"=1'-0"

NOTE: W9 WALL AND SLAB ARE SIMILAR TO W1 AND ARE SYMMETRIC

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Date		
Designed	JTG	SEP 24
Drawn	JTG	SEP 24
Checked	MLD	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

TAILWATER WEIR WALL STEEL PLACEMENT
SHEET 1 OF 5

Brush Creek Watershed *Mercer County, WV*

Schnabel Engineering
ATERRA Solutions
300 Brookside Ave. Bldg 18, Suite 160, Ambler, PA 19002
Phone: 336-274-9456

United States Department of Agriculture
Natural Resources Conservation Service

Contract No.
12SPEC18D0023

Drawing No.
15-S-18

SEPTEMBER 2024

SHEET 52 OF 61

REVISIONS			
#	DATE APPROVED	TITLE	DESCRIPTION

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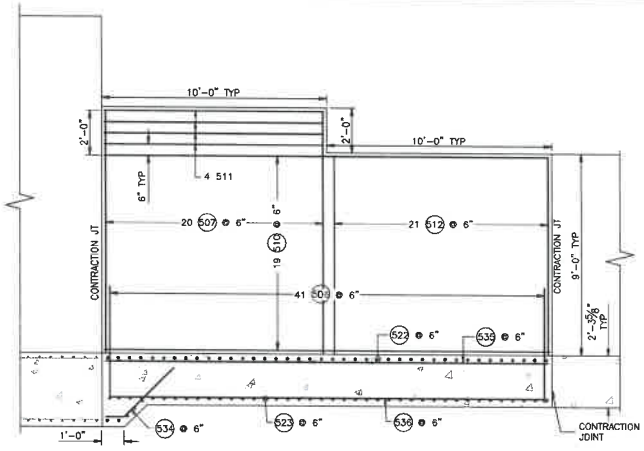
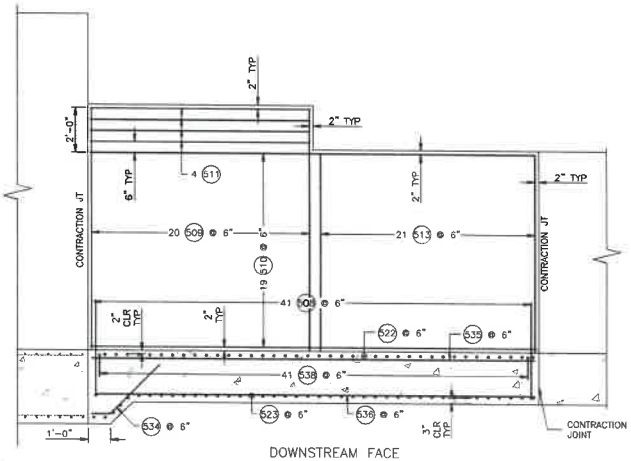


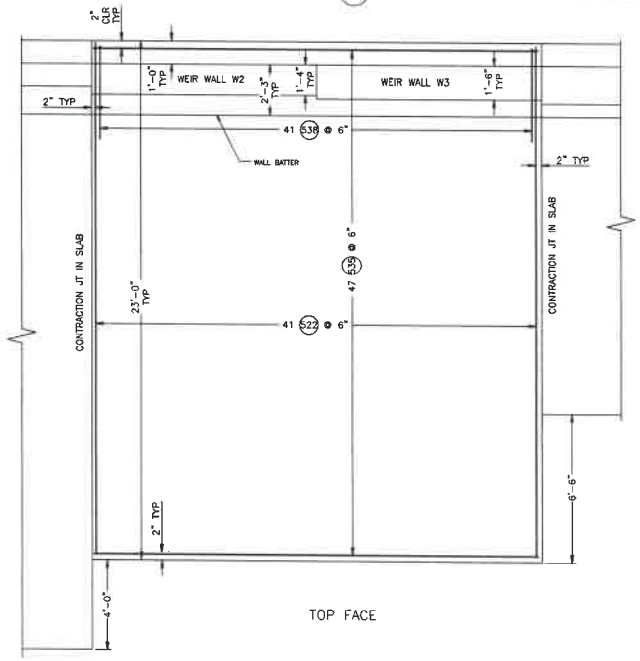
UPSTREAM FACE



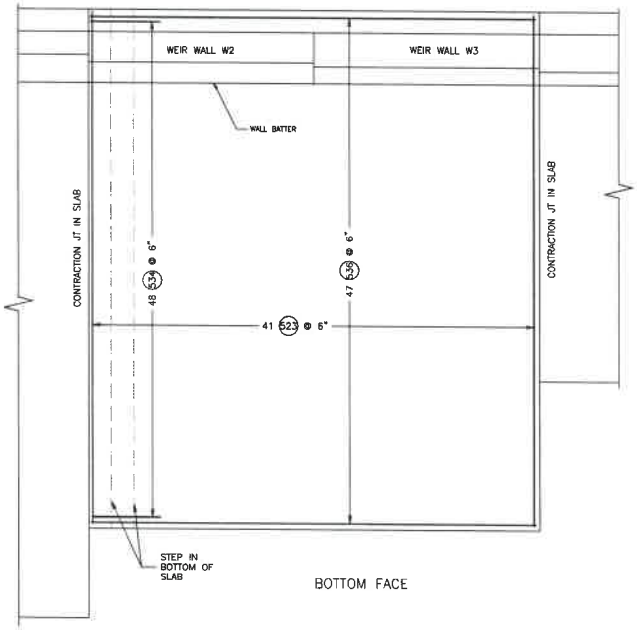
DOWNSTREAM FACE

1 W2 & W3 WALL AND SLAB – ELEVATION (W7 & W8 SIMILAR)

SCALE: 3/8"=1'0"



TOP FACE



BOTTOM FACE

2 W2 & W3 SLAB – PLAN (W7 & W8 SIMILAR)

SCALE: 3/8"=1'0"

NOTE: W7 & W8 WALL AND SLAB ARE SIMILAR TO W2 & W3 AND ARE SYMMETRIC

JONATHAN W PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Designed	Drawn	Checked	Approved
Date	SEP 24	SEP 24	SEP 24	SEP 24
	JTG	JTG	MLD	JNP

BRUSH CREEK SITE 15 DAM REHABILITATION

TAILWATER WEIR WALL STEEL PLACEMENT SHEET 2 OF 5

Brush Creek Watershed *Mercer County, WV*

Aterra-Schnabel JV
300 Brookside Ave., Bldg. 19, Suite 160, Beckley, WV 25801
Phone: 336-274-9456
aterraschnabel.wrgs.com

United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-19

SEPTEMBER 2024

SHEET 53 OF 61

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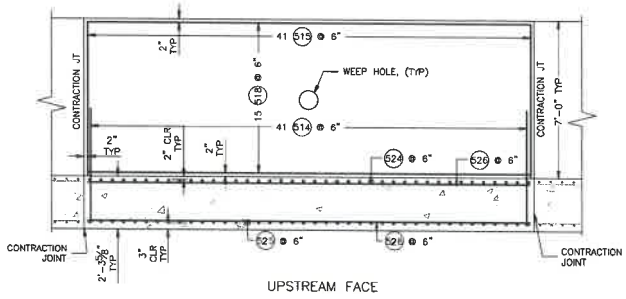
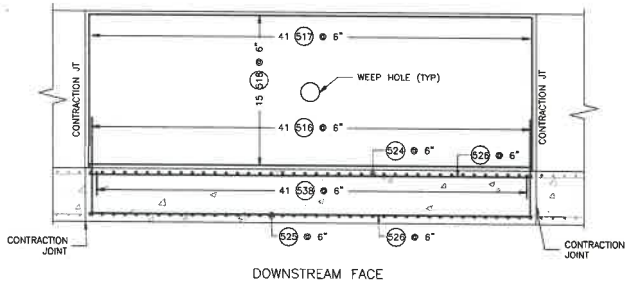
Plotted By: CHRISTOPHER.SMITH Plot Date: 10/2/2024 1:34:37 PM File Name: \\WV\MER\38 Projects\BRUSH CREEK\DRAWINGS\SDC\FINAL_DESIGN\SITE 15\S-15-19 to S-15-22 WEIR WALL.dwg Layout: TAILWATER WEIR WALL STEEL PLACEMENT - SHEET 2 OF 5



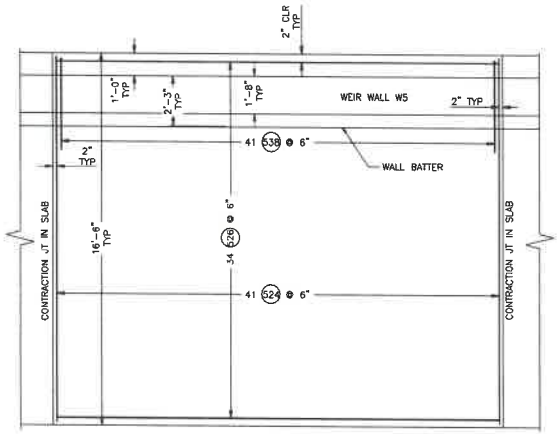
UPSTREAM FACE



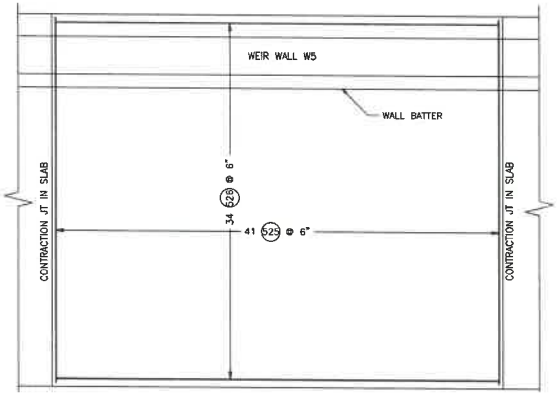
DOWNSTREAM FACE

1 W5 WALL AND SLAB – ELEVATION (W4 & W6 SIMILAR)

SCALE: 3/8"=1'0"



TOP FACE



BOTTOM FACE

2 W5 SLAB – PLAN (W4 & W6 SIMILAR)

SCALE: 1/2"=1'0"

NOTE: W4 & W6 WALL AND SLAB ARE SIMILAR TO W5 AND ARE SYMMETRIC

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Designed	Drawn	Checked	Approved
	JTG	JTG	MLD	JMP
Date	SEP 24	SEP 24	SEP 24	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

TAILWATER WEIR WALL STEEL PLACEMENT
SHEET 3 OF 5

Brush Creek Watershed *Mercer County, WV*

ATERRA | Schnabel ENGINEERING
300 Brookside Ave., Bldg. 18, Suite 160, Morgantown, WV 26501
Phone: 338-274-5456
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-20

SEPTEMBER 2024

SHEET 54 OF 61

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Last Saved By: CHARSONS SaveDate: 10/2/2024 11:01:54 AM PlotDate: 10/2/2024 1:58 PM
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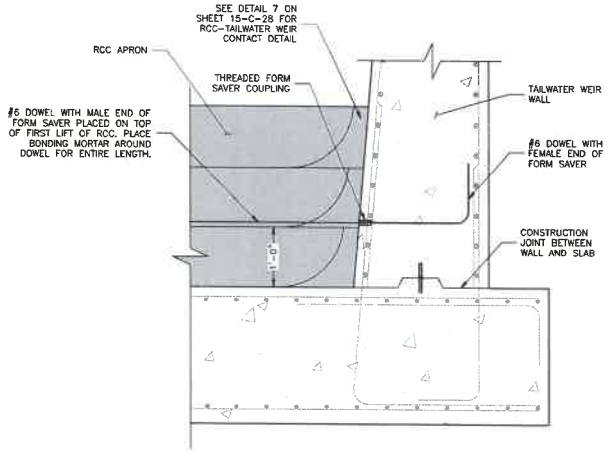
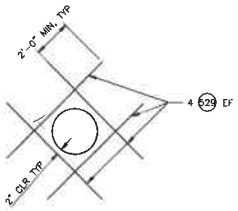


1 DOWEL INTO RCC CONNECTION TO WEIR WALL

SCALE: 1"=1'0"

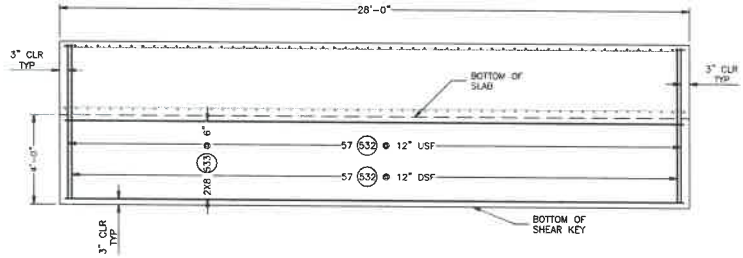


2 WEEP HOLE OPENING DETAIL

NOT TO SCALE

NOTES:

1. PROVIDE ADDITIONAL REINFORCEMENT AT ALL 8" WEEP HOLE PENETRATIONS. ADDITIONAL REINFORCEMENT TO MATCH SIZE OF TYPICAL REINFORCEMENT. PROVIDE ADDITIONAL REINFORCEMENT AT EACH FACE OF WALL.
2. CUT VERTICAL AND HORIZONTAL REINFORCEMENT OR ADJUST SPACING TO FIT AROUND PENETRATION WITH A MINIMUM CLEAR DISTANCE OF 2" BETWEEN THE PIPE AND REINFORCEMENT.



3 W1 & W9 SHEAR KEY REINFORCEMENT PROFILE

SCALE: 3/8"=1'0"

JONATHAN M. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Designed	Drawn	Checked	Approved
Date	SEP 24	SEP 24	SEP 24	SEP 24
	JTG	JTG	MLD	JMP

BRUSH CREEK SITE 15 DAM REHABILITATION

TAILWATER WEIR WALL STEEL PLACEMENT

SHEET 4 OF 5

Brush Creek Watershed *Mercer County, WV*

Aterra | Schnabel

300 Brookside Ave., Bldg. H5, Suite 160, Ambler, PA 19002
Phone: 336-274-9456
schnabel-eng.com

United States Department of Agriculture

USDA Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-21

SEPTEMBER 2024

SHEET 55 OF 61

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Last Saved By: CWatkins Date/Time: 10/2/2024, 11:42 AM PlotDate: 10/2/2024 1:06 PM
Plotted By: Christina Rumbaugh
Plotted On: 24x36 (ARCH_Full_Bleed_Check)
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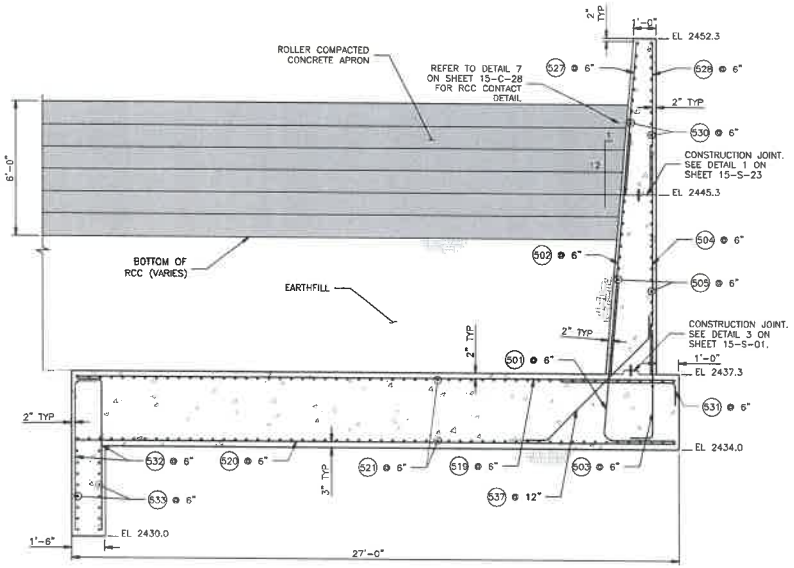
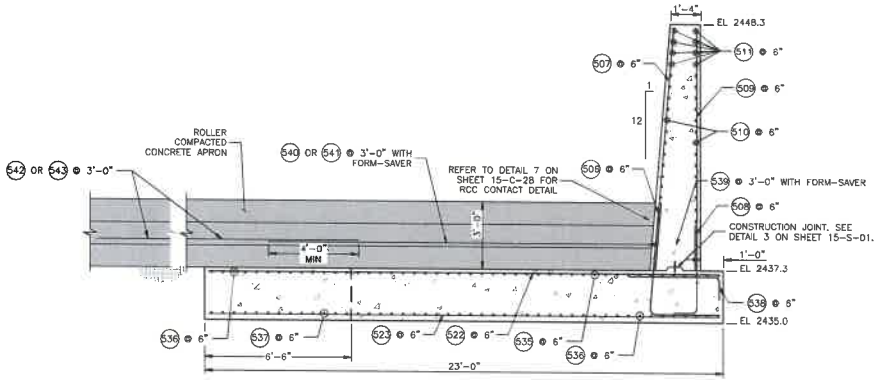


1 W1 WALL AND SLAB – PROFILE (W9 SIMILAR)

SCALE: 3/8"=1'0"

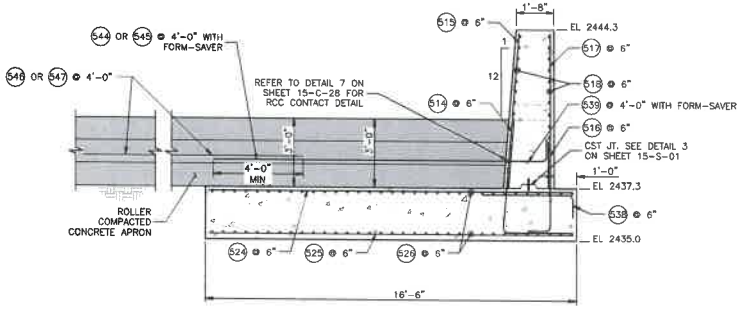


2 W2 WALL AND SLAB – PROFILE (W8 SIMILAR)

SCALE: 3/8"=1'0"

NOTES:

1. FOR DOWELS INTO RCC, EXTEND CONTINOUSLY TO AT LEAST 43'-0" UPSTREAM OF WALL FACE. STAGGER SPLICE LOCATIONS AT LEAST 3 FT AS SHOWN ON DETAIL 2 OF SHEET 15-S-17. PROVIDE A MINIMUM 4' LAP SPLICE OR A MECHANICAL COUPLING PER SPECIFICATIONS.

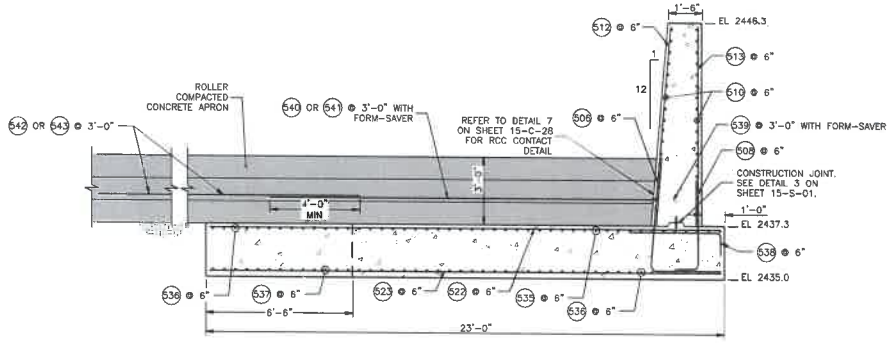


3 W5 WALL AND SLAB – PROFILE (W4 & W6 SIMILAR)

SCALE: 3/8"=1'0"

NOTES:

1. FOR DOWELS INTO RCC, EXTEND CONTINOUSLY TO AT LEAST 36'-0" UPSTREAM OF WALL FACE. STAGGER SPLICE LOCATIONS AT LEAST 3 FT AS SHOWN ON DETAIL 2 OF SHEET 15-S-17. PROVIDE A MINIMUM 4' LAP SPLICE OR A MECHANICAL COUPLING PER SPECIFICATIONS.



4 W3 WALL AND SLAB – PROFILE (W7 SIMILAR)

SCALE: 3/8"=1'0"

NOTES:

1. FOR DOWELS INTO RCC, EXTEND CONTINOUSLY TO AT LEAST 43'-0" UPSTREAM OF WALL FACE. STAGGER SPLICE LOCATIONS AT LEAST 3 FT AS SHOWN ON DETAIL 2 OF SHEET 15-S-17. PROVIDE A MINIMUM 4' LAP SPLICE OR A MECHANICAL COUPLING PER SPECIFICATIONS.

JONATHAN W PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed JTG	SEP 24
Drawn JTG	SEP 24
Checked MJD	SEP 24
Approved JWP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

TAILWATER WEIR WALL STEEL PLACEMENT

SHEET 5 OF 5

Brush Creek Watershed *Mercer County, WV*

Schnabel Engineering

ATERRA Solutions

300 Brodrick Ave., Bldg. 18, Suite 160, Ambler, PA 19002 Phone: 330-274-3488 schnabel-eng.com

United States Department of Agriculture

USDA Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-22

SEPTEMBER 2024

SHEET 56 OF 61

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Last Saved By: CONKSON DrawDate: 9/3/2024 11:10 AM PlotDate: 9/3/2024 3:58 PM
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STEEL SCHEDULE								
LOCATION	MARK	SIZE	QUAN.	LENGTH	TYPE	B	C	TOTAL LENGTH
WEIR WALL	501	9	114	10'3"	22	7' 1"	3' 2"	1168'6"
"	502	7	114	10' 9"	STR			1225' 6"
"	503	5	114	5' 11"	21	5' 1"	0' 10"	674'6"
"	504	5	114	10' 0"	STR			1140'0"
"	505	8	64	27' 8"	STR			1770'8"
"	506	8	82	8' 2"	22	5' 1"	3' 1"	669' 8"
"	507	6	40	10' 11"	STR			436'8"
"	508	5	82	4' 11"	21	4' 1"	0' 10"	403' 2"
"	509	5	40	10' 10"	STR			433' 4"
"	510	6	76	19' 8"	STR			1494' 8"
"	511	6	16	9' 8"	STR			154' 8"
"	512	6	42	8' 11"	STR			374'6"
"	513	5	42	8' 10"	STR			371' 0"
"	514	6	123	8' 2"	22	5' 1"	3' 1"	1004' 6"
"	515	6	123	6' 11"	STR			850' 9"
"	516	5	123	4' 11"	21	4' 1"	0' 10"	604' 9"
"	517	5	123	6' 10"	STR			840' 6"
"	518	6	90	19' 8"	STR			1770' 0"
SLAB	519	9	114	26' 8"	STR			3040' 0"
"	520	6	114	26' 8"	STR			3040' 0"
"	521	6	220	27' 8"	STR			6086' 8"
"	522	8	82	22' 8"	STR			1858'8"
"	523	5	82	22' 8"	STR			1858'8"
"	524	6	123	16' 1"	STR			1978' 3"
"	525	5	123	16' 1"	STR			1978' 3"
"	526	6	204	19' 8"	STR			4012' 0"
WEIR WALL	527	7	114	6' 11"	STR			788' 6"
"	528	5	114	6' 10"	STR			779' 0"
"	529	6	24	5'-0"	STR			120' 0"
"	530	6	56	27' 8"	STR			1549' 4"
SLAB	531	6	114	6' 0"	21	5' 0"	1' 0"	684' 0"
"	532	6	228	8' 1"	21	7' 1"	1' 0"	1843' 0"
"	533	6	32	27' 8"	STR			885' 4"
"	534	6	96	3' 11"	19	3'2"	0' 9"	376' 0"
"	535	6	94	19' 8"	STR			1848' 8"
"	536	6	94	19' 8"	STR			1848' 8"
"	537	6	56	8' 10"	7	6' 10"	1' 0"	494' 8"
"	538	6	145	5' 0"	21	4' 0"	1' 0"	725' 0"
WEIR WALL	539	6	27	3' 0"	21	2' 0"	1' 0"	81' 0"
RCC	540	6	6	17' 0"	STR			102' 0"
"	541	6	6	20' 0"	STR			120' 0"
"	542	6	6	30' 0"	STR			180' 0"
"	543	6	6	27' 0"	STR			162' 0"
"	544	6	9	13' 0"	STR			117' 0"
"	545	6	9	16' 0"	STR			144' 0"
"	546	6	9	27' 0"	STR			243' 0"
"	547	6	9	24' 0"	STR			216' 0"

	BAR SIZE	LINEAR FT	WEIGHT (LBS)
	5	9083.17	9474
	6	32942.33	49479
	7	2014.00	4117
	8	4299.00	11478
	9	4208.50	14309
TOTAL		52547.00	88857

BAR TYPES

JONATHAN M PITTMAN
REGISTERED
23485
STATE OF
PROFESSIONAL ENGINEER

Date	
Designed JTG	SEP 24
Drawn JTG	SEP 24
Checked MLD	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

TAILWATER WEIR WALL STEEL SCHEDULE

Brush Creek Watershed *Mercer County, WV*

Aterra-Schnabel JV
300 Brookside Ave., Bldg. 15, Suite 160, Ambler, PA 19002
Phone: 336-274-5656
aterraschnabel.com

United States Department of Agriculture
Natural Resources Conservation Service

Contract No.
12SPEC18D0023

Drawing No.
15-S-23

SEPTEMBER 2024

SHEET 57 OF 61

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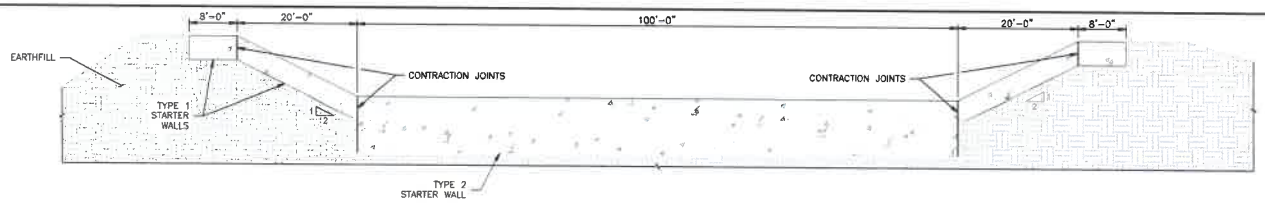
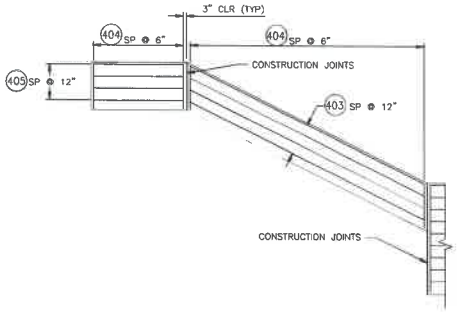
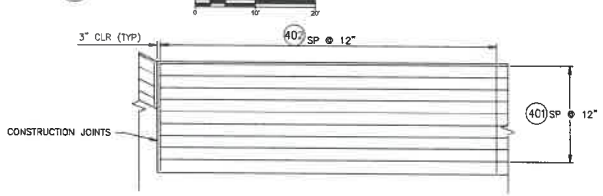
Last Saved By: CPARSONS SavedDate: 10/7/2024 11:34 AM PlotDate: 10/7/2024 2:08 PM
File: C:\Projects\WV\Mercer\Brush Creek\15\Design\Structural\Tailwater\Drawings\TAILWATER WEIR WALL_SHEET_Brush_Creek15-S23_TailwaterWall_DESIGNSITE 150-15-15 to 0+15+22 WEIR WALL.dwg Layout: TAILWATER WEIR WALL STEEL SCHEDULE



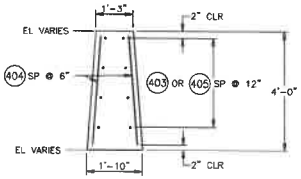
1 STARTER WALL ELEVATION VIEW



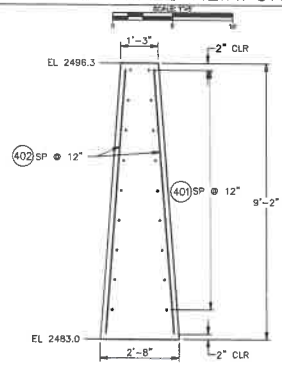
2 TYPE 1 STARTER WALL REINFORCEMENT ELEVATION



4 TYPE 2 STARTER WALL REINFORCEMENT ELEVATION



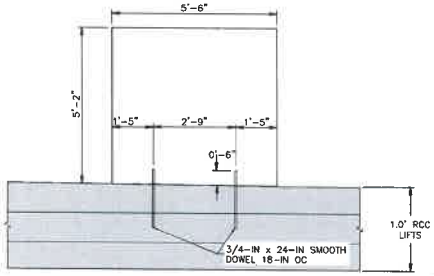
3 TYPE 1 STARTER WALL REINFORCEMENT SECTION



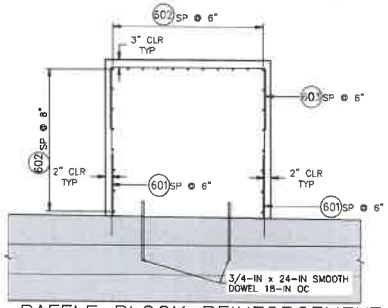
5 TYPE 2 STARTER WALL REINFORCEMENT SECTION

STARTER WALL STEEL SCHEDULE							
MARK	SIZE	QUAN.	LENGTH	TYPE	B	C	TOTAL LENGTH
401	5	180	10'-0"	STR			1800'-0"
402	5	200	8'-10"	STR			1766'-8"
403	5	32	10'-11"	STR			349'-4"
404	5	108	3'-8"	STR			396'-0"
405	5	16	7'-6"	STR			120'-0"

	BAR SIZE	LINEAR FT	WEIGHT LBS
TOTAL	5	6009.00	6267.39



6 SECTION AT BAFFLE BLOCK



7 BAFFLE BLOCK REINFORCEMENT

BAFFLE BLOCK STEEL SCHEDULE							
MARK	SIZE	QUAN.	LENGTH	TYPE	B	C	TOTAL LENGTH
601	6	120	2'-8"	STR			320'-0"
602	5	375	3'-6"	STR			1312'-6"
603	5	120	9'-2"	17	2'-0"	5'-2"	1100'-0"

	BAR SIZE	LINEAR FT	WEIGHT LBS
	5	2412.50	2516.42
	6	320.00	480.64
TOTAL		2732.50	2997.06

BAR TYPES

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

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JONATHAN M. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Date			
Designed	CDS		SEP 24
Drawn	CRP		SEP 24
Checked	EBB		SEP 24
Approved	JMP		SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION
STARTERWALL AND BAFFLE BLOCK DETAILS
Brush Creek Watershed Mercer County, WV

ATERRA SCHNABEL JV
300 Brickside Ave., Bldg. 1B, Suite 160, Ambler, PA 19002
Phone: 267-419-1646
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-24

SEPTEMBER 2024

SHEET 58 OF 61

Last Saved By: CPARSONS SaveDate: 10/2/2024 11:34 AM PlotDate: 10/2/2024 3:09 PM
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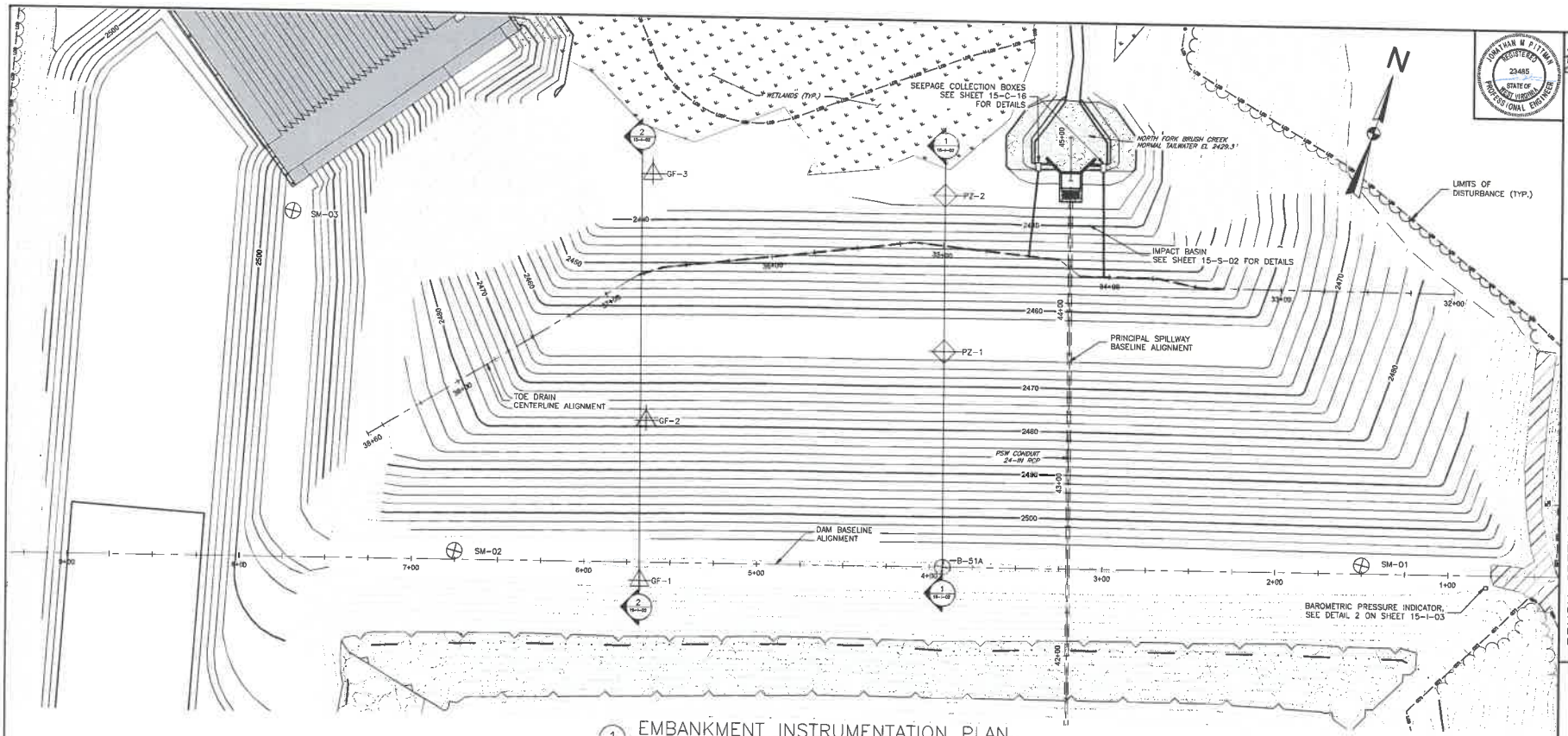

1 EMBANKMENT INSTRUMENTATION PLAN

SCALE: 1"=30'

INSTRUMENTATION SCHEDULE

INSTRUMENT ID	STATION (DAM BASELINE)	OFFSET (FEET FROM DAM BASELINE)	NORTHING (FT)	EASTING (FT)	GROUND SURFACE ELEVATION (FT)	SCREENED INTERVAL ELEVATION (FT)	VIBRATING WIRE PIEZOMETER (VWP) TIP ELEVATION (FT)	NOTES
GF-3	5+61.97	224.82	118447.3	1914569.2	2437.94	EL 2427.8 – EL 2429.8	EL 2428.8	EXISTING OPEN STANDPIPE TO REMAIN
GF-2	5+68.00	82.40	118308.4	1914600.5	2476.65	EL 2444.5 TO EL 2442.5 (S) EL 2423.0 TO EL 2421.0 (D)	EL 2443.5 (S) EL 2422.0 (D)	EXISTING OPEN STANDPIPE TO REMAIN
GF-1	5+64.82	-10.78	118217.1	1914619.7	2507.32	EL 2413.9 – EL 2415.9 (D) EL 2454.4 – EL 2456.4 (S)	EL 2414.9 (D) EL 2455.4 (S)	EXISTING OPEN STANDPIPE TO REMAIN
PZ-2	3+92.50	215.00	118478.4	1914736.1	2435.66	EL 2424.82– EL 2429.82	EL 2427.32	PROPOSED OPEN STANDPIPE TO BE INSTALLED
PZ-1	3+92.50	125.00	118391.0	1914757.6	2465.11	EL 2423.4 – EL 2428.4	EL 2425.9	PROPOSED OPEN STANDPIPE TO BE INSTALLED
B-51A	3+92.50	1.09	118270.7	1914787.3	2508.12	EL 2433.5 – EL 2438.1	EL 2435.8	EXISTING OPEN STANDPIPE TO REMAIN
SM-01	1+50.00	5.00	118332.5	1915021.8	2506.4	N/A	N/A	PROPOSED SURFACE MONUMENT
SM-02	6+75.00	5.00	118206.8	1914512.1	2507.1	N/A	N/A	PROPOSED SURFACE MONUMENT
SM-03	7+70.00	200.00	118373.4	1914373.1	2506.0	N/A	N/A	PROPOSED SURFACE MONUMENT

INSTRUMENTATION LEGEND

- PROPOSED PIEZOMETER TO BE INSTALLED
- GANNETT FLEMING 2016 PIEZOMETERS TO REMAIN
- ATERRA-SCHNABEL JV 2019 PIEZOMETER LOCATIONS TO REMAIN
- SURFACE MONUMENT LOCATION

NOTES:
1. CONTRACTOR SHALL PROTECT ALL EXISTING OPEN STANDPIPE PIEZOMETERS TO REMAIN IN ACCORDANCE WITH THE CONSTRUCTION SPECIFICATIONS
2. NEW VIBRATING WIRE PIEZOMETERS SHALL BE INSTALLED IN ALL OPEN STANDPIPE PIEZOMETERS SEE SHEET 15-I-03 FOR DETAILS

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

		Date
Designed	CDS	SEP 24
Drawn	CRP	SEP 24
Checked	FBB	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

EMBANKMENT INSTRUMENTATION PLAN

Brush Creek Watershed — Mercer County, WV

ATERRA SCHNABEL JV

Schnabel Engineering

300 Brookside Ave., Bldg. 15, Suite 160, Ambler, PA 19002
Phone: 267-403-1850
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-I-01

SEPTEMBER 2024

SHEET 59 OF 61

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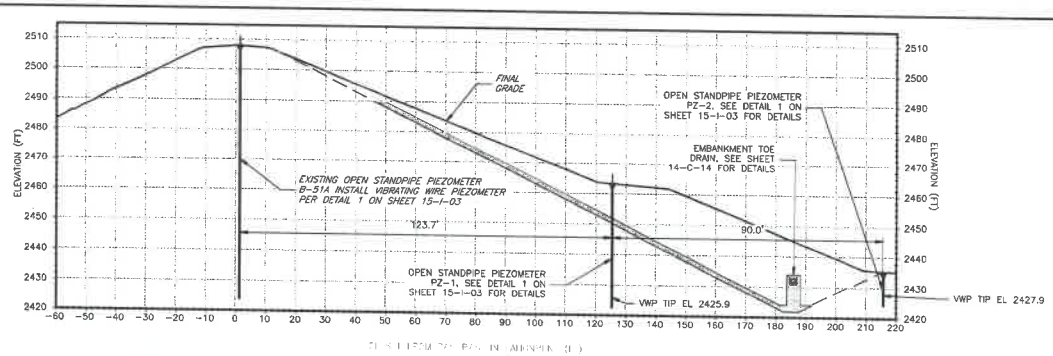
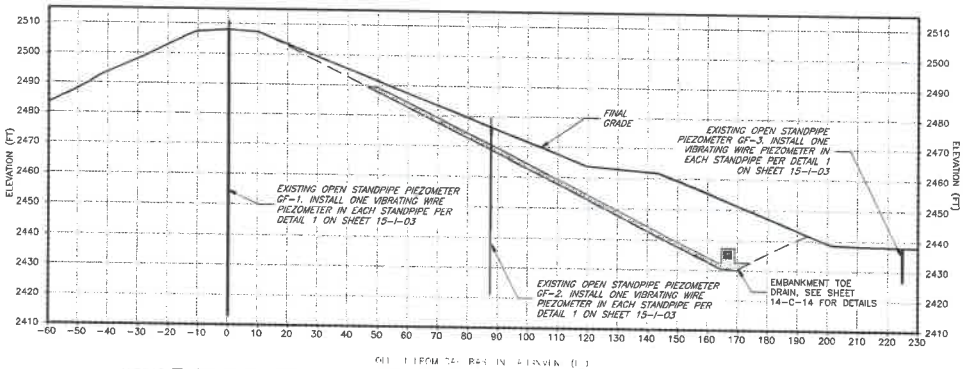
Last Saved By: CDNERONS Savedate: 10/2/2024 11:23 AM Plotdate: 10/2/2024 3:06 PM
File Name: C:\Users\cdneronsa\Aterra-Schnabel JV\BRUSH_WC_Brush_Creek\05-DESIGN\04-CAD\DRAWINGS\05-FINAL_DESIGN\SITE 15\15-I-01-EMBANKMENT INSTRUMENTATION PLAN.dwg Layout: EMBANKMENT INSTRUMENTATION PLAN



1 15-401 EMBANKMENT SECTION AT DAM BASELINE STA 3+92.50



2 15-401 EMBANKEMENT SECTION AT DAM BASELINE STA 5+68

NOTES:
1. EXISTING OPEN STANDPIPE PIEZOMETER GF-3 IS NOT SHOWN. SEE SHEET 15-I-01 FOR LOCATION. INSTALL ONE VIBRATING WIRE PIEZOMETER IN GF-3 PER DETAIL 1 ON SHEET 15-I-03.

REVISIONS			
#	DATE	APPROVED	TITLE	DESCRIPTION

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

		Date
Designed	CDS	SEP 24
Drawn	CRP	SEP 24
Checked	EBB	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION
EMBANKMENT INSTRUMENTATION SECTIONS
Mercer County, WV
Brush Creek Watershed

USDA United States Department of Agriculture
Natural Resources Conservation Service

Aterra | Schnabel

300 Brookside Ave, Bldg 15, Suite 180, Ambler, PA 19002
Phone: 336-274-9458
jschnabel@aterra.com

Contract No. 12SPEC18D0023

Drawing No. 15-I-02

SEPTEMBER 2024

SHEET 60 OF 61

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Last Saved By: CPARSONS SaveDate: 10/2/2024 11:33 AM PlotDate: 10/2/2024 3:26 PM
File Name: C:\Users\cparsons\Aterra-Schnabel JV\Brush Creek Rehabilitation - Documents\Design\Drawings\Sheets\15-I_Sheets_Combined.dgn Model: 15-I-SHEET-FINAL_DESIGNSITE 15\ 15-I-SHEET Layout: EMBANKMENT INSTRUMENTATION SECTIONS

	Department of Administration **Purchasing Division** **2019 Washington Street East** **Post Office Box 50130** **Charleston, WV 25305-0130**	**State of West Virginia** # Purchase Order **Order Date:** 02-20-2026	CORRECT ORDER NUMBER MUST APPEAR ON ALL PACKAGES, INVOICES, AND SHIPPING PAPERS. QUESTIONS CONCERNING THIS ORDER SHOULD BE DIRECTED TO THE DEPARTMENT CONTACT.

Order Number:	CPO 1400 4902 AGR2600000017 1	**Change Order No:**	**Procurement Folder:** 1793301
Document Name:	Brush Creek 15 Dam Rehabilitation-Construction		**Reason for Modification:**
Document Description:	Brush Creek 15 Dam Rehabilitation-Construction		
Procurement Type:	Central Purchase Order		
Buyer Name:	Larry D McDonnell		
Telephone:	304-558-2063		
Email:	larry.d.mcdonnell@wv.gov		
Shipping Method:	Best Way		**Effective Start Date:**
Free on Board:	FOB Dest, Freight Prepaid		**Effective End Date:**

VENDOR	**DEPARTMENT CONTACT**
Vendor Customer Code: VS0000047922 SEQUOIA SERVICES LLC 3300 BATTLEGROUND AVE STE 102 GREENSBORO NC 27410 US **Vendor Contact Phone:** 7046342954 **Extension:**	**Requestor Name:** Christopher J Martin **Requestor Phone:** (304) 558-2204 **Requestor Email:** cmartin@wvca.us

Discount Details:

	Discount Allowed	Discount Percentage	Discount Days
#1	No	0.0000	0
#2	Not Entered		
#3	Not Entered		
#4	Not Entered		

INVOICE TO	**SHIP TO**
PROCUREMENT OFFICER 304-558-2221 AGRICULTURE DEPARTMENT OF ADMINISTRATIVE SERVICES 1900 KANAWHA BLVD E CHARLESTON WV 25305-0173 US	ADMINISTRATIVE SERVICES 304-558-2204 WEST VIRGINIA CONSERVATION AGENCY WEST VIRGINIA CONSERVATION AGENCY 255 GUS R DOUGLASS LN CHARLESTON WV 25305-0193 US

Total Order Amount:	$17,284,010.00

PURCHASING DIVISION AUTHORIZATION	**ATTORNEY GENERAL APPROVAL AS TO FORM**	**ENCUMBRANCE CERTIFICATION**
DATE:	**DATE:**	**DATE:**
ELECTRONIC SIGNATURE ON FILE	**ELECTRONIC SIGNATURE ON FILE**	**ELECTRONIC SIGNATURE ON FILE**

Extended Description:

The Vendor, Sequoia Services, LLC, agrees to enter into a contract with the West Virginia Conservation Agency, to provide rehabilitation of Brush Creek Site 15 dam structure, per the bid requirements, terms, conditions, specifications, Addendum No. 1 issued 10/20/2025, Addendum No. 2 issued 11/18/2025, Addendum No. 3 issued 11/19/2025, Addendum No. 4 issued 12/23/2025, Addendum No. 5 issued 12/31/2025 and the vendor's bid dated 01/14/2026 all incorporated herein by reference and made apart of hereof.

Line	Commodity Code	Quantity	Unit	Unit Price	Total Price
1	72141203	0.00000		0.000000	17284010.00
Service From	**Service To**	**Manufacturer**		**Model No**	

Commodity Line Description: Brush Creek Site 15 Dam Rehab Construction Services

Extended Description:
Dam Rehabilitation services for Brush Creek 15.

See all attached documentation for further details.

PLEASE READ INSTRUCTIONS IN THEIR ENTIRETY. THE AMOUNT ENTERED ON THIS COMMODITY LINE SHOULD BE THE TOTAL COST FOR SITE 15 - SEE EXHIBIT A PRICING PAGE.

GENERAL TERMS AND CONDITIONS:

1. CONTRACTUAL AGREEMENT: Issuance of an Award Document signed by the Purchasing Division Director, or his designee, and approved as to form by the Attorney General's office constitutes acceptance by the State of this Contract made by and between the State of West Virginia and the Vendor. Vendor's signature on its bid, or on the Contract if the Contract is not the result of a bid solicitation, signifies Vendor's agreement to be bound by and accept the terms and conditions contained in this Contract.

2. DEFINITIONS: As used in this Solicitation/Contract, the following terms shall have the meanings attributed to them below. Additional definitions may be found in the specifications included with this Solicitation/Contract.

2.1. "Agency" or **"Agencies"** means the agency, board, commission, or other entity of the State of West Virginia that is identified on the first page of the Solicitation or any other public entity seeking to procure goods or services under this Contract.

2.2. "Bid" or **"Proposal"** means the vendors submitted response to this solicitation.

2.3. "Contract" means the binding agreement that is entered into between the State and the Vendor to provide the goods or services requested in the Solicitation.

2.4. "Director" means the Director of the West Virginia Department of Administration, Purchasing Division.

2.5. "Purchasing Division" means the West Virginia Department of Administration, Purchasing Division.

2.6. "Award Document" means the document signed by the Agency and the Purchasing Division, and approved as to form by the Attorney General, that identifies the Vendor as the contract holder.

2.7. "Solicitation" means the official notice of an opportunity to supply the State with goods or services that is published by the Purchasing Division.

2.8. "State" means the State of West Virginia and/or any of its agencies, commissions, boards, etc. as context requires.

2.9. "Vendor" or **"Vendors"** means any entity submitting a bid in response to the Solicitation, the entity that has been selected as the lowest responsible bidder, or the entity that has been awarded the Contract as context requires.

3. CONTRACT TERM; RENEWAL; EXTENSION: The term of this Contract shall be determined in accordance with the category that has been identified as applicable to this Contract below:

☐ **Term Contract**

Initial Contract Term: The Initial Contract Term will be for a period of _____ _____. The Initial Contract Term becomes effective on the effective start date listed on the first page of this Contract, identified as the State of West Virginia contract cover page containing the signatures of the Purchasing Division, Attorney General, and Encumbrance clerk (or another page identified as _____), and the Initial Contract Term ends on the effective end date also shown on the first page of this Contract.

Renewal Term: This Contract may be renewed upon the mutual written consent of the Agency, and the Vendor, with approval of the Purchasing Division and the Attorney General's office (Attorney General approval is as to form only). Any request for renewal should be delivered to the Agency and then submitted to the Purchasing Division thirty (30) days prior to the expiration date of the initial contract term or appropriate renewal term. A Contract renewal shall be in accordance with the terms and conditions of the original contract. Unless otherwise specified below, renewal of this Contract is limited to _____ successive one (1) year periods or multiple renewal periods of less than one year, provided that the multiple renewal periods do not exceed the total number of months available in all renewal years combined. Automatic renewal of this Contract is prohibited. Renewals must be approved by the Vendor, Agency, Purchasing Division and Attorney General's office (Attorney General approval is as to form only)

☐ **Alternate Renewal Term** – This contract may be renewed for _____ successive _____ year periods or shorter periods provided that they do not exceed the total number of months contained in all available renewals. Automatic renewal of this Contract is prohibited. Renewals must be approved by the Vendor, Agency, Purchasing Division and Attorney General's office (Attorney General approval is as to form only)

Delivery Order Limitations: In the event that this contract permits delivery orders, a delivery order may only be issued during the time this Contract is in effect. Any delivery order issued within one year of the expiration of this Contract shall be effective for one year from the date the delivery order is issued. No delivery order may be extended beyond one year after this Contract has expired.

☐ **Fixed Period Contract:** This Contract becomes effective upon Vendor's receipt of the notice to proceed and must be completed within _____days.

☐ **Fixed Period Contract with Renewals:** This Contract becomes effective upon Vendor's receipt of the notice to proceed and part of the Contract more fully described in the attached specifications must be completed within _____ days. Upon completion of the work covered by the preceding sentence, the vendor agrees that:

☐ the contract will continue for _____ years;

☐ the contract may be renewed for _____ successive _____ year periods or shorter periods provided that they do not exceed the total number of months contained in all available renewals. Automatic renewal of this Contract is prohibited. Renewals must be approved by the Vendor, Agency, Purchasing Division and Attorney General's Office (Attorney General approval is as to form only).

☐ **One-Time Purchase:** The term of this Contract shall run from the issuance of the Award Document until all of the goods contracted for have been delivered, but in no event will this Contract extend for more than one fiscal year.

☑ **Construction/Project Oversight:** This Contract becomes effective on the effective start date listed on the first page of this Contract, identified as the State of West Virginia contract cover page containing the signatures of the Purchasing Division, Attorney General, and Encumbrance clerk (or another page identified as _____), and continues until the project for which the vendor is providing oversight is complete.

☐ **Other:** Contract Term specified in _____

4. AUTHORITY TO PROCEED: Vendor is authorized to begin performance of this contract on the date of encumbrance listed on the front page of the Award Document unless either the box for "Fixed Period Contract" or "Fixed Period Contract with Renewals" has been checked in Section 3 above. If either "Fixed Period Contract" or "Fixed Period Contract with Renewals" has been checked, Vendor must not begin work until it receives a separate notice to proceed from the State. The notice to proceed will then be incorporated into the Contract via change order to memorialize the official date that work commenced.

5. QUANTITIES: The quantities required under this Contract shall be determined in accordance with the category that has been identified as applicable to this Contract below.

☐ **Open End Contract:** Quantities listed in this Solicitation/Award Document are approximations only, based on estimates supplied by the Agency. It is understood and agreed that the Contract shall cover the quantities actually ordered for delivery during the term of the Contract, whether more or less than the quantities shown.

☐ **Service:** The scope of the service to be provided will be more clearly defined in the specifications included herewith.

☐ **Combined Service and Goods:** The scope of the service and deliverable goods to be provided will be more clearly defined in the specifications included herewith.

☐ **One-Time Purchase:** This Contract is for the purchase of a set quantity of goods that are identified in the specifications included herewith. Once those items have been delivered, no additional goods may be procured under this Contract without an appropriate change order approved by the Vendor, Agency, Purchasing Division, and Attorney General's office.

☑ **Construction:** This Contract is for construction activity more fully defined in the specifications.

6. EMERGENCY PURCHASES: The Purchasing Division Director may authorize the Agency to purchase goods or services in the open market that Vendor would otherwise provide under this Contract if those goods or services are for immediate or expedited delivery in an emergency. Emergencies shall include, but are not limited to, delays in transportation or an unanticipated increase in the volume of work. An emergency purchase in the open market, approved by the Purchasing Division Director, shall not constitute of breach of this Contract and shall not entitle the Vendor to any form of compensation or damages. This provision does not excuse the State from fulfilling its obligations under a One-Time Purchase contract.

7. REQUIRED DOCUMENTS: All of the items checked in this section must be provided to the Purchasing Division by the Vendor as specified:

☑ **LICENSE(S) / CERTIFICATIONS / PERMITS:** In addition to anything required under the Section of the General Terms and Conditions entitled Licensing, the apparent successful Vendor shall furnish proof of the following licenses, certifications, and/or permits upon request and in a form acceptable to the State. The request may be prior to or after contract award at the State's sole discretion.

☑ West Virginia Contractors License Classification: C - General Engineering

☑ See Construction Specifications RFQ Brush Creek 14 & 15, Section 10.

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The apparent successful Vendor shall also furnish proof of any additional licenses or certifications contained in the specifications regardless of whether or not that requirement is listed above.

8. INSURANCE: The apparent successful Vendor shall furnish proof of the insurance identified by a checkmark below prior to Contract award. The insurance coverages identified below must be maintained throughout the life of this contract. Thirty (30) days prior to the expiration of the insurance policies, Vendor shall provide the Agency with proof that the insurance mandated herein has been continued. Vendor must also provide Agency with immediate notice of any changes in its insurance policies, including but not limited to, policy cancelation, policy reduction, or change in insurers. The apparent successful Vendor shall also furnish proof of any additional insurance requirements contained in the specifications prior to Contract award regardless of whether that insurance requirement is listed in this section.

Vendor must maintain:

☑ **Commercial General Liability Insurance** in at least an amount of: _$1,000,000.00_ per occurrence.

☑ **Automobile Liability Insurance** in at least an amount of: _$1,000,000.00___per occurrence.

☐ **Professional/Malpractice/Errors and Omission Insurance** in at least an amount of: _____per occurrence. Notwithstanding the forgoing, Vendor's are not required to list the State as an additional insured for this type of policy.

☐ **Commercial Crime and Third Party Fidelity Insurance** in an amount of: _____ per occurrence.

☐ **Cyber Liability Insurance** in an amount of: _____ per occurrence.

☑ **Builders Risk Insurance** in an amount equal to 100% of the amount of the Contract.

☐ **Pollution Insurance** in an amount of: _____ per occurrence.

☐ **Aircraft Liability** in an amount of: _____ per occurrence.

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9. WORKERS' COMPENSATION INSURANCE: Vendor shall comply with laws relating to workers compensation, shall maintain workers' compensation insurance when required, and shall furnish proof of workers' compensation insurance upon request.

10. VENUE: All legal actions for damages brought by Vendor against the State shall be brought in the West Virginia Claims Commission. Other causes of action must be brought in the West Virginia court authorized by statute to exercise jurisdiction over it.

11. LIQUIDATED DAMAGES: This clause shall in no way be considered exclusive and shall not limit the State or Agency's right to pursue any other available remedy. Vendor shall pay liquidated damages in the amount specified below or as described in the specifications:

☐ _____ for _____.

☑ Liquidated Damages Contained in the Specifications.

☐ Liquidated Damages Are Not Included in this Contract.

12. ACCEPTANCE: Vendor's signature on its bid, or on the certification and signature page, constitutes an offer to the State that cannot be unilaterally withdrawn, signifies that the product or service proposed by vendor meets the mandatory requirements contained in the Solicitation for that product or service, unless otherwise indicated, and signifies acceptance of the terms and conditions contained in the Solicitation unless otherwise indicated.

13. PRICING: The pricing set forth herein is firm for the life of the Contract, unless specified elsewhere within this Solicitation/Contract by the State. A Vendor's inclusion of price adjustment provisions in its bid, without an express authorization from the State in the Solicitation to do so, may result in bid disqualification. Notwithstanding the foregoing, Vendor must extend any publicly advertised sale price to the State and invoice at the lower of the contract price or the publicly advertised sale price.

14. PAYMENT IN ARREARS: Payments for goods/services will be made in arrears only upon receipt of a proper invoice, detailing the goods/services provided or receipt of the goods/services, whichever is later. Notwithstanding the foregoing, payments for software maintenance, licenses, or subscriptions may be paid annually in advance.

15. PAYMENT METHODS: Vendor must accept payment by electronic funds transfer and P-Card. (The State of West Virginia's Purchasing Card program, administered under contract by a banking institution, processes payment for goods and services through state designated credit cards.)

16. TAXES: The Vendor shall pay any applicable sales, use, personal property or any other taxes arising out of this Contract and the transactions contemplated thereby. The State of West Virginia is exempt from federal and state taxes and will not pay or reimburse such taxes.

17. ADDITIONAL FEES: Vendor is not permitted to charge additional fees or assess additional charges that were not either expressly provided for in the solicitation published by the State of West Virginia, included in the Contract, or included in the unit price or lump sum bid amount that Vendor is required by the solicitation to provide. Including such fees or charges as notes to the solicitation may result in rejection of vendor's bid. Requesting such fees or charges be paid after the contract has been awarded may result in cancellation of the contract.

18. FUNDING: This Contract shall continue for the term stated herein, contingent upon funds being appropriated by the Legislature or otherwise being made available. In the event funds are not appropriated or otherwise made available, this Contract becomes void and of no effect beginning on July 1 of the fiscal year for which funding has not been appropriated or otherwise made available. If that occurs, the State may notify the Vendor that an alternative source of funding has been obtained and thereby avoid the automatic termination. Non-appropriation or non-funding shall not be considered an event of default.

19. CANCELLATION: The Purchasing Division Director reserves the right to cancel this Contract immediately upon written notice to the vendor if the materials or workmanship supplied do not conform to the specifications contained in the Contract. The Purchasing Division Director may also cancel any purchase or Contract upon 30 days written notice to the Vendor in accordance with West Virginia Code of State Rules § 148-1-5.2.b.

20. TIME: Time is of the essence regarding all matters of time and performance in this Contract.

21. APPLICABLE LAW: This Contract is governed by and interpreted under West Virginia law without giving effect to its choice of law principles. Any information provided in specification manuals, or any other source, verbal or written, which contradicts or violates the West Virginia Constitution, West Virginia Code, or West Virginia Code of State Rules is void and of no effect.

22. COMPLIANCE WITH LAWS: Vendor shall comply with all applicable federal, state, and local laws, regulations and ordinances. By submitting a bid, Vendor acknowledges that it has reviewed, understands, and will comply with all applicable laws, regulations, and ordinances.

> **SUBCONTRACTOR COMPLIANCE:** Vendor shall notify all subcontractors providing commodities or services related to this Contract that as subcontractors, they too are required to comply with all applicable laws, regulations, and ordinances. Notification under this provision must occur prior to the performance of any work under the contract by the subcontractor.

23. ARBITRATION: Any references made to arbitration contained in this Contract, Vendor's bid, or in any American Institute of Architects documents pertaining to this Contract are hereby deleted, void, and of no effect.

24. MODIFICATIONS: This writing is the parties' final expression of intent. Notwithstanding anything contained in this Contract to the contrary no modification of this Contract shall be binding without mutual written consent of the Agency, and the Vendor, with approval of the Purchasing Division and the Attorney General's office (Attorney General approval is as to form only). Any change to existing contracts that adds work or changes contract cost, and were not included in the original contract, must be approved by the Purchasing Division and the Attorney General's Office (as to form) prior to the implementation of the change or commencement of work affected by the change.

25. WAIVER: The failure of either party to insist upon a strict performance of any of the terms or provision of this Contract, or to exercise any option, right, or remedy herein contained, shall not be construed as a waiver or a relinquishment for the future of such term, provision, option, right, or remedy, but the same shall continue in full force and effect. Any waiver must be expressly stated in writing and signed by the waiving party.

26. SUBSEQUENT FORMS: The terms and conditions contained in this Contract shall supersede any and all subsequent terms and conditions which may appear on any form documents submitted by Vendor to the Agency or Purchasing Division such as price lists, order forms, invoices, sales agreements, or maintenance agreements, and includes internet websites or other electronic documents. Acceptance or use of Vendor's forms does not constitute acceptance of the terms and conditions contained thereon.

27. ASSIGNMENT: Neither this Contract nor any monies due, or to become due hereunder, may be assigned by the Vendor without the express written consent of the Agency, the Purchasing Division, the Attorney General's office (as to form only), and any other government agency or office that may be required to approve such assignments.

28. WARRANTY: The Vendor expressly warrants that the goods and/or services covered by this Contract will: (a) conform to the specifications, drawings, samples, or other description furnished or specified by the Agency; (b) be merchantable and fit for the purpose intended; and (c) be free from defect in material and workmanship.

29. STATE EMPLOYEES: State employees are not permitted to utilize this Contract for personal use and the Vendor is prohibited from permitting or facilitating the same.

30. PRIVACY, SECURITY, AND CONFIDENTIALITY: The Vendor agrees that it will not disclose to anyone, directly or indirectly, any such personally identifiable information or other confidential information gained from the Agency, unless the individual who is the subject of the information consents to the disclosure in writing or the disclosure is made pursuant to the Agency's policies, procedures, and rules. Vendor further agrees to comply with the Confidentiality Policies and Information Security Accountability Requirements, set forth in www.state.wv.us/admin/purchase/privacy.

31. YOUR SUBMISSION IS A PUBLIC DOCUMENT: Vendor's entire response to the Solicitation and the resulting Contract are public documents. As public documents, they will be disclosed to the public following the bid/proposal opening or award of the contract, as required by the competitive bidding laws of West Virginia Code §§ 5A-3-1 et seq., 5-22-1 et seq., and 5G-1-1 et seq. and the Freedom of Information Act West Virginia Code §§ 29B-1-1 et seq.

DO NOT SUBMIT MATERIAL YOU CONSIDER TO BE CONFIDENTIAL, A TRADE SECRET, OR OTHERWISE NOT SUBJECT TO PUBLIC DISCLOSURE.

Submission of any bid, proposal, or other document to the Purchasing Division constitutes your explicit consent to the subsequent public disclosure of the bid, proposal, or document. The Purchasing Division will disclose any document labeled "confidential," "proprietary," "trade secret," "private," or labeled with any other claim against public disclosure of the documents, to include any "trade secrets" as defined by West Virginia Code § 47-22-1 et seq. All submissions are subject to public disclosure without notice.

32. LICENSING: In accordance with West Virginia Code of State Rules § 148-1-6.1.e, Vendor must be licensed and in good standing in accordance with any and all state and local laws and requirements by any state or local agency of West Virginia, including, but not limited to, the West Virginia Secretary of State's Office, the West Virginia Tax Department, West Virginia Insurance Commission, or any other state agency or political subdivision. Obligations related to political subdivisions may include, but are not limited to, business licensing, business and occupation taxes, inspection compliance, permitting, etc. Upon request, the Vendor must provide all necessary releases to obtain information to enable the Purchasing Division Director or the Agency to verify that the Vendor is licensed and in good standing with the above entities.

SUBCONTRACTOR COMPLIANCE: Vendor shall notify all subcontractors providing commodities or services related to this Contract that as subcontractors, they too are required to be licensed, in good standing, and up-to-date on all state and local obligations as described in this section. Obligations related to political subdivisions may include, but are not limited to, business licensing, business and occupation taxes, inspection compliance, permitting, etc. Notification under this provision must occur prior to the performance of any work under the contract by the subcontractor.

33. ANTITRUST: In submitting a bid to, signing a contract with, or accepting a Award Document from any agency of the State of West Virginia, the Vendor agrees to convey, sell, assign, or transfer to the State of West Virginia all rights, title, and interest in and to all causes of action it may now or hereafter acquire under the antitrust laws of the United States and the State of West Virginia for price fixing and/or unreasonable restraints of trade relating to the particular commodities or services purchased or acquired by the State of West Virginia. Such assignment shall be made and become effective at the time the purchasing agency tenders the initial payment to Vendor.

34. VENDOR NON-CONFLICT: Neither Vendor nor its representatives are permitted to have any interest, nor shall they acquire any interest, direct or indirect, which would compromise the performance of its services hereunder. Any such interests shall be promptly presented in detail to the Agency.

35. VENDOR RELATIONSHIP: The relationship of the Vendor to the State shall be that of an independent contractor and no principal-agent relationship or employer-employee relationship is contemplated or created by this Contract. The Vendor as an independent contractor is solely liable for the acts and omissions of its employees and agents. Vendor shall be responsible for selecting, supervising, and compensating any and all individuals employed pursuant to the terms of this Solicitation and resulting contract. Neither the Vendor, nor any employees or subcontractors of the Vendor, shall be deemed to be employees of the State for any purpose whatsoever. Vendor shall be exclusively responsible for payment of employees and contractors for all wages and salaries, taxes, withholding payments, penalties, fees, fringe benefits, professional liability insurance premiums, contributions to insurance and pension, or other deferred compensation plans, including but not limited to, Workers' Compensation and Social Security obligations, licensing fees, etc. and the filing of all necessary documents, forms, and returns pertinent to all of the foregoing.

Vendor shall hold harmless the State, and shall provide the State and Agency with a defense against any and all claims including, but not limited to, the foregoing payments, withholdings, contributions, taxes, Social Security taxes, and employer income tax returns.

36. INDEMNIFICATION: The Vendor agrees to indemnify, defend, and hold harmless the State and the Agency, their officers, and employees from and against: (1) Any claims or losses for services rendered by any subcontractor, person, or firm performing or supplying services, materials, or supplies in connection with the performance of the Contract; (2) Any claims or losses resulting to any person or entity injured or damaged by the Vendor, its officers, employees, or subcontractors by the publication, translation, reproduction, delivery, performance, use, or disposition of any data used under the Contract in a manner not authorized by the Contract, or by Federal or State statutes or regulations; and (3) Any failure of the Vendor, its officers, employees, or subcontractors to observe State and Federal laws including, but not limited to, labor and wage and hour laws.

37. NO DEBT CERTIFICATION: In accordance with West Virginia Code §§ 5A-3-10a and 5-22-1(i), the State is prohibited from awarding a contract to any bidder that owes a debt to the State or a political subdivision of the State. By submitting a bid, or entering into a contract with the State, Vendor is affirming that (1) for construction contracts, the Vendor is not in default on any monetary obligation owed to the state or a political subdivision of the state, and (2) for all other contracts, neither the Vendor nor any related party owe a debt as defined above, and neither the Vendor nor any related party are in employer default as defined in the statute cited above unless the debt or employer default is permitted under the statute.

38. CONFLICT OF INTEREST: Vendor, its officers or members or employees, shall not presently have or acquire an interest, direct or indirect, which would conflict with or compromise the performance of its obligations hereunder. Vendor shall periodically inquire of its officers, members and employees to ensure that a conflict of interest does not arise. Any conflict of interest discovered shall be promptly presented in detail to the Agency.

39. REPORTS: Vendor shall provide the Agency and/or the Purchasing Division with the following reports identified by a checked box below:

☑ Such reports as the Agency and/or the Purchasing Division may request. Requested reports may include, but are not limited to, quantities purchased, agencies utilizing the contract, total contract expenditures by agency, etc.

☐ Quarterly reports detailing the total quantity of purchases in units and dollars, along with a listing of purchases by agency. Quarterly reports should be delivered to the Purchasing Division via email at purchasing.division@wv.gov.

40. BACKGROUND CHECK: In accordance with W. Va. Code § 15-2D-3, the State reserves the right to prohibit a service provider's employees from accessing sensitive or critical information or to be present at the Capitol complex based upon results addressed from a criminal background check. Service providers should contact the West Virginia Division of Protective Services by phone at (304) 558-9911 for more information.

41. PREFERENCE FOR USE OF DOMESTIC STEEL PRODUCTS: Except when authorized by the Director of the Purchasing Division pursuant to W. Va. Code § 5A-3-56, no contractor may use or supply steel products for a State Contract Project other than those steel products made in the United States. A contractor who uses steel products in violation of this section may be subject to civil penalties pursuant to W. Va. Code § 5A-3-56. As used in this section:

a. "State Contract Project" means any erection or construction of, or any addition to, alteration of or other improvement to any building or structure, including, but not limited to, roads or highways, or the installation of any heating or cooling or ventilating plants or other equipment, or the supply of and materials for such projects, pursuant to a contract with the State of West Virginia for which bids were solicited on or after June 6, 2001.

b. "Steel Products" means products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated or otherwise similarly processed, or processed by a combination of two or more or such operations, from steel made by the open heath, basic oxygen, electric furnace, Bessemer or other steel making process.

c. The Purchasing Division Director may, in writing, authorize the use of foreign steel products if:

    1. The cost for each contract item used does not exceed one tenth of one percent (.1%) of the total contract cost or two thousand five hundred dollars ($2,500.00), whichever is greater. For the purposes of this section, the cost is the value of the steel product as delivered to the project; or

    2. The Director of the Purchasing Division determines that specified steel materials are not produced in the United States in sufficient quantity or otherwise are not reasonably available to meet contract requirements.

42. PREFERENCE FOR USE OF DOMESTIC ALUMINUM, GLASS, AND STEEL: In Accordance with W. Va. Code § 5-19-1 et seq., and W. Va. CSR § 148-10-1 et seq., for every contract or subcontract, subject to the limitations contained herein, for the construction, reconstruction, alteration, repair, improvement or maintenance of public works or for the purchase of any item of machinery or equipment to be used at sites of public works, only domestic aluminum, glass or steel products shall be supplied unless the spending officer determines, in writing, after the receipt of offers or bids, (1) that the cost of domestic aluminum, glass or steel products is unreasonable or inconsistent with the public interest of the State of West Virginia, (2) that domestic aluminum, glass or steel products are not produced in sufficient quantities to meet the contract requirements, or (3) the available domestic aluminum, glass, or steel do not meet the contract specifications. This provision only applies to public works contracts awarded in an amount more than fifty thousand dollars ($50,000) or public works contracts that require more than ten thousand pounds of steel products.

The cost of domestic aluminum, glass, or steel products may be unreasonable if the cost is more than twenty percent (20%) of the bid or offered price for foreign made aluminum, glass, or steel products. If the domestic aluminum, glass or steel products to be supplied or produced in a "substantial labor surplus area", as defined by the United States Department of Labor, the cost of domestic aluminum, glass, or steel products may be unreasonable if the cost is more than thirty percent (30%) of the bid or offered price for foreign made aluminum, glass, or steel products. This preference shall be applied to an item of machinery or equipment, as indicated above, when the item is a single unit of equipment or machinery manufactured primarily of aluminum, glass or steel, is part of a public works contract and has the sole purpose or of being a permanent part of a single public works project. This provision does not apply to equipment or machinery purchased by a spending unit for use by that spending unit and not as part of a single public works project.

All bids and offers including domestic aluminum, glass or steel products that exceed bid or offer prices including foreign aluminum, glass or steel products after application of the preferences provided in this provision may be reduced to a price equal to or lower than the lowest bid or offer price for foreign aluminum, glass or steel products plus the applicable preference. If the reduced bid or offer prices are made in writing and supersede the prior bid or offer prices, all bids or offers, including the reduced bid or offer prices, will be reevaluated in accordance with this rule.

43. INTERESTED PARTY SUPPLEMENTAL DISCLOSURE: W. Va. Code § 6D-1-2 requires that for contracts with an actual or estimated value of at least $1 million, the Vendor must submit to the Agency a disclosure of interested parties prior to beginning work under this Contract. Additionally, the Vendor must submit a supplemental disclosure of interested parties reflecting any new or differing interested parties to the contract, which were not included in the original pre-work interested party disclosure, within 30 days following the completion or termination of the contract. A copy of that form is included with this solicitation or can be obtained from the WV Ethics Commission. This requirement does not apply to publicly traded companies listed on a national or international stock exchange. A more detailed definition of interested parties can be obtained from the form referenced above.

44. PROHIBITION AGAINST USED OR REFURBISHED: Unless expressly permitted in the solicitation published by the State, Vendor must provide new, unused commodities, and is prohibited from supplying used or refurbished commodities, in fulfilling its responsibilities under this Contract.

45. VOID CONTRACT CLAUSES: This Contract is subject to the provisions of West Virginia Code § 5A-3-62, which automatically voids certain contract clauses that violate State law.

46. ISRAEL BOYCOTT: Bidder understands and agrees that, pursuant to W. Va. Code § 5A-3-63, it is prohibited from engaging in a boycott of Israel during the term of this contract.

ADDITIONAL TERMS AND CONDITIONS (Construction Contracts Only)

1. CONTRACTOR'S LICENSE: Until June 15, 2021, West Virginia Code § 21-11-2, and after that date, § 30-42-2, requires that all persons desiring to perform contracting work in this state be licensed. The West Virginia Contractors Licensing Board is empowered to issue the contractor's license. Applications for a contractor's license may be made by contacting the West Virginia Contractor Licensing Board.

The apparent successful Vendor must furnish a copy of its contractor's license prior to the issuance of a contract award document.

2. BONDS: The following bonds must be submitted:

☑ **BID BOND:** Pursuant to the requirements contained in W. Va. Code § 5-22-1(c), All Vendors submitting a bid on a construction project shall furnish a valid bid bond in the amount of five percent (5%) of the total amount of the bid protecting the State of West Virginia. **THE BID BOND MUST BE SUBMITTED WITH THE BID OR VENDOR'S BID WILL BE DISQUALIFIED.**

☑ **PERFORMANCE BOND:** The apparent successful Vendor shall provide a performance bond in the amount of 100% of the contract. The performance bond must be received by the Purchasing Division prior to Contract award. (Attorney General requires use of the State approved bond forms found at: www.state.wv.us/admin/purchase/forms2.html)

☑ **LABOR/MATERIAL PAYMENT BOND**: The apparent successful Vendor shall provide a labor/material payment bond in the amount of 100% of the Contract value. The labor/material payment bond must be delivered to the Purchasing Division prior to Contract award. (Attorney General requires use of the State approved bond forms found at: www.state.wv.us/admin/purchase/forms2.html)

☐ **MAINTENANCE BOND:** The apparent successful Vendor shall provide a two (2) year maintenance bond covering the roofing system if the work impacts an existing roof. The amount of the bond must be equal to the price associated with the percentage of the project impacting the roof. The maintenance bond must be issued and delivered to the Purchasing Division prior to Contract award. (Attorney General requires use of the State approved bond forms found at: www.state.wv.us/admin/purchase/forms2.html)

At a minimum, all construction projects require a bid bond, performance bond, and labor/material payment bond. Failure on the part of the state of West Virginia to checkmark the required bonds above does not relieve the vendor from the legal requirement of providing these bonds.

In lieu of the Bid Bond, the Vendor may provide certified checks, cashier's checks, or irrevocable letters of credit. Any certified check, cashier's check, or irrevocable letter of credit provided in lieu of the bid bond must be of the same amount required of the Bid Bond and delivered with the bid.

3. DRUG-FREE WORKPLACE AFFIDAVIT: W. Va. Code § 21-1D-5 provides that any solicitation for a public improvement contract requires each Vendor that submits a bid for the work to submit an affidavit that the Vendor has a written plan for a drug-free workplace policy. If the affidavit is not submitted with the bid submission, the Purchasing Division shall promptly request by telephone and electronic mail that the low bidder and second low bidder provide the affidavit within one business day of the request. Failure to submit the affidavit within one business day of receiving the request shall result in disqualification of the bid. To comply with this law, Vendor should complete the enclosed drug-free workplace affidavit and submit the same with its bid. Failure to submit the signed and notarized drugfree workplace affidavit or a similar affidavit that fully complies with the requirements of the applicable code, within one business day of being requested to do so shall result in disqualification of Vendor's bid. Pursuant to W. Va. Code 21-1D-2(b) and (k), this provision does not apply to public improvement contracts the value of which is $100,000 or less or temporary or emergency repairs.

3.1. DRUG-FREE WORKPLACE POLICY: Pursuant to W. Va. Code § 21-1D-4, Vendor and its subcontractors must implement and maintain a written drug-free workplace policy that complies with said article. The awarding public authority shall cancel this contract if: (1) Vendor fails to implement and maintain a written drug-free workplace policy described in the preceding paragraph, (2) Vendor fails to provide information regarding implementation of its drug-free workplace policy at the request of the public authority; or (3) Vendor provides to the public authority false information regarding the contractor's drug-free workplace policy.

Pursuant to W. Va. Code 21-1D-2(b) and (k), this provision does not apply to public improvement contracts the value of which is $100,000 or less or temporary or emergency repairs.

4. DRUG FREE WORKPLACE REPORT: Pursuant to W. Va. Code § 21-1D-7b, no less than once per year, or upon completion of the project, every contractor shall provide a certified report to the public authority which let the contract. For contracts over $25,000, the public authority shall be the West Virginia Purchasing Division. For contracts of $25,000 or less, the public authority shall be the agency issuing the contract. The report shall include:

(1) Information to show that the education and training service to the requirements of West Virginia Code § 21-1D-5 was provided;

(2) The name of the laboratory certified by the United States Department of Health and Human Services or its successor that performs the drug tests;

(3) The average number of employees in connection with the construction on the public improvement;

(4) Drug test results for the following categories including the number of positive tests and the number of negative tests: (A) Pre-employment and new hires; (B) Reasonable suspicion; (C) Post-accident; and (D) Random.

Vendor should utilize the attached Certified Drug Free Workplace Report Coversheet when submitting the report required hereunder. Pursuant to W. Va. Code 21-1D-2(b) and (k), this provision does not apply to public improvement contracts the value of which is $100,000 or less or temporary or emergency repairs.

5. AIA DOCUMENTS: All construction contracts that will be completed in conjunction with architectural services procured under Chapter 5G of the West Virginia Code will be governed by the attached AIA documents, as amended by the Supplementary Conditions for the State of West Virginia, in addition to the terms and conditions contained herein.

6. PROHIBITION AGAINST GENERAL CONDITIONS: Notwithstanding anything contained in the AIA Documents or the Supplementary Conditions, the State of West Virginia will not pay for general conditions, or winter conditions, or any other condition representing a delay in the contracts. The Vendor is expected to mitigate delay costs to the greatest extent possible and any costs associated with Delays must be specifically and concretely identified. The state will not consider an average daily rate multiplied by the number of days extended to be an acceptable charge.

7. GREEN BUILDINGS MINIMUM ENERGY STANDARDS: In accordance with § 22-29-4, all new building construction projects of public agencies that have not entered the schematic design phase prior to July 1, 2012, or any building construction project receiving state grant funds and appropriations, including public schools, that have not entered the schematic design phase prior to July 1, 2012, shall be designed and constructed complying with the ICC International Energy Conservation Code, adopted by the State Fire Commission, and the ANSI/ASHRAE/IESNA Standard 90.1-2007: Provided, That if any construction project has a commitment of federal funds to pay for a portion of such project, this provision shall only apply to the extent such standards are consistent with the federal standards.

8. LOCAL LABOR MARKET HIRING REQUIREMENT: Pursuant to West Virginia Code §21-1C-1 et seq., Employers shall hire at least seventy-five percent of employees for public improvement construction projects from the local labor market, to be rounded off, with at least two employees from outside the local labor market permissible for each employer per project.

Any employer unable to employ the minimum number of employees from the local labor market shall inform the nearest office of Workforce West Virginia of the number of qualified employees needed and provide a job description of the positions to be filled.

If, within three business days following the placing of a job order, Workforce West Virginia is unable to refer any qualified job applicants to the employer or refers less qualified job applicants than the number requested, then Workforce West Virginia shall issue a waiver to the employer stating the unavailability of applicant and shall permit the employer to fill any positions covered by the waiver from outside the local labor market. The waiver shall be in writing and shall be issued within the prescribed three days. A waiver certificate shall be sent to both the employer for its permanent project records and to the public authority.

Any employer who violates this requirement is subject to a civil penalty of $250 per each employee less than the required threshold of seventy-five percent per day of violation after receipt of a notice of violation.

Any employer that continues to violate any provision of this article more than fourteen calendar days after receipt of a notice of violation is subject to a civil penalty of $500 per each employee less than the required threshold of seventy-five percent per day of violation.

The following terms used in this section have the meaning shown below.

(1) The term "construction project" means any construction, reconstruction, improvement, enlargement, painting, decorating or repair of any public improvement let to contract in an amount equal to or greater than $500,000. The term "construction project" does not include temporary or emergency repairs;

(2) The term "employee" means any person hired or permitted to perform hourly work for wages by a person, firm or corporation in the construction industry; The term "employee" does not include:(i) Bona fide employees of a public authority or individuals engaged in making temporary or emergency repairs;(ii) Bona fide independent contractors; or(iii) Salaried supervisory personnel necessary to assure efficient execution of the employee's work;

(3) The term "employer" means any person, firm or corporation employing one or more employees on any public improvement and includes all contractors and subcontractors;

(4) The term "local labor market" means every county in West Virginia and any county outside of West Virginia if any portion of that county is within fifty miles of the border of West Virginia;

(5) The term "public improvement" includes the construction of all buildings, roads, highways, bridges, streets, alleys, sewers, ditches, sewage disposal plants, waterworks, airports and all other structures that may be let to contract by a public authority, excluding improvements funded, in whole or in part, by federal funds.

9. DAVIS-BACON AND RELATED ACT WAGE RATES:

☐ The work performed under this contract is federally funded in whole, or in part. Pursuant to _____, Vendors are required to pay applicable Davis-Bacon wage rates.

☑ The work performed under this contract is not subject to Davis-Bacon wage rates.

10. SUBCONTRACTOR LIST SUBMISSION: In accordance with W. Va. Code § 5-22-1, the apparent low bidder on a contract valued at more than $250,000.00 for the construction, alteration, decoration, painting or improvement of a new or existing building or structure shall submit a list of all subcontractors who will perform more than $25,000.00 of work on the project including labor and materials. (This section does not apply to any other construction projects, such as highway, mine reclamation, water or sewer projects.) The subcontractor list shall be provided to the Purchasing Division within one business day of the opening of bids for review.
If the apparent low bidder fails to submit the subcontractor list, the Purchasing Division shall promptly request by telephone and electronic mail that the low bidder and second low bidder provide the subcontractor list within one business day of the request. Failure to submit the subcontractor list within one business day of receiving the request shall result in disqualification of the bid.

If no subcontractors who will perform more than $25,000.00 of work are to be used to complete the project, the apparent low bidder must make this clear on the subcontractor list, in the bid itself, or in response to the Purchasing Division's request for the subcontractor list.

a. Required Information. The subcontractor list must contain the following information:

i. Bidder's name

ii. Name of each subcontractor performing more than $25,000 of work on the project.

iii. The license number of each subcontractor, as required by W. Va. Code § 21-11-1 et. seq.

iv. If applicable, a notation that no subcontractor will be used to perform more than $25,000.00 of work. (This item iv. is not required if the vendor makes this clear in the bid itself or in documentation following the request for the subcontractor list.)

b. Subcontractor List Submission Form: The subcontractor list may be submitted in any form, including the attached form, as long as the required information noted above is included. If any information is missing from the bidder's subcontractor list submission, it may be obtained from other documents such as bids, emails, letters, etc. that accompany the subcontractor list submission.

c. Substitution of Subcontractor. Written approval must be obtained from the State Spending Unit before any subcontractor substitution is permitted. Substitutions are not permitted unless:

i. The subcontractor listed in the original bid has filed for bankruptcy;

ii. The subcontractor in the original bid has been debarred or suspended; or

iii. The contractor certifies in writing that the subcontractor listed in the original bid fails, is unable, or refuses to perform his subcontract.

Subcontractor List Submission (Construction Contracts Only)

Bidder's Name: _____

☐ Check this box if no subcontractors will perform more than $25,000.00 of work to complete the project.

Subcontractor Name	License Number if Required by W. Va. Code § 21-11-1 et. seq.

Attach additional pages if necessary

Revised 8/24/2023

DESIGNATED CONTACT: Vendor appoints the individual identified in this Section as the Contract Administrator and the initial point of contact for matters relating to this Contract.

(Printed Name and Title) _____

(Address) _____

(Phone Number) / (Fax Number) _____

(email address) _____

CERTIFICATION AND SIGNATURE: By signing below, or submitting documentation through *wv*OASIS, I certify that: I have reviewed this Solicitation/Contract in its entirety; that I understand the requirements, terms and conditions, and other information contained herein; that this bid, offer or proposal constitutes an offer to the State that cannot be unilaterally withdrawn; that the product or service proposed meets the mandatory requirements contained in the Solicitation/Contract for that product or service, unless otherwise stated herein; that the Vendor accepts the terms and conditions contained in the Solicitation, unless otherwise stated herein; that I am submitting this bid, offer or proposal for review and consideration; that this bid or offer was made without prior understanding, agreement, or connection with any entity submitting a bid or offer for the same material, supplies, equipment or services; that this bid or offer is in all respects fair and without collusion or fraud; that this Contract is accepted or entered into without any prior understanding, agreement, or connection to any other entity that could be considered a violation of law; that I am authorized by the Vendor to execute and submit this bid, offer, or proposal, or any documents related thereto on Vendor's behalf; that I am authorized to bind the vendor in a contractual relationship; and that to the best of my knowledge, the vendor has properly registered with any State agency that may require registration.

By signing below, I further certify that I understand this Contract is subject to the provisions of West Virginia Code § 5A-3-62, which automatically voids certain contract clauses that violate State law; and that pursuant to W. Va. Code 5A-3-63, the entity entering into this contract is prohibited from engaging in a boycott against Israel.

_____

(Company)

_____

(Signature of Authorized Representative)

_____

(Printed Name and Title of Authorized Representative) (Date)

_____

(Phone Number) (Fax Number)

_____

(Email Address)

REQUEST FOR QUOTATION
Brush Creek 15 Dam Rehabilitation
CRFQ AGR26*16

GENERAL CONSTRUCTION SPECIFICATIONS (No AIA Documents)

1. **PURPOSE AND SCOPE:** The West Virginia Purchasing Division is soliciting bids on behalf of WV Conservation Agency to establish a contract for the following:

   To complete the rehabilitation of dam structure that is classified as high hazard potential. The dam structure is Brush Creek Site 15. This dam provides a combination of flood protection, water supply, and recreation benefits to the surrounding communities. Brush Creek Site 15 is located on the North Fork of Brush Creek in Mercer County, West Virginia

   The Vendor shall furnish all materials, labor, and equipment necessary to complete all Construction Services. The Vendor shall furnish any incidental work, materials, labor, and equipment that are necessary to complete the Construction Services, even if such incidental work is not explicitly included in the Project Plans.

   Site 15 description: The dam is an approximately 690-feet-long zoned earthen embankment with a crest width of 22 feet, and a maximum height of 76 feet measured from the invert of the principal spillway conduit to the low point on the crest of the dam. The upstream slope of the embankment ranges from about 2H: 1 V to 2.5H: 1 V and the downstream slope is approximately 2.5H: 1 V.

   Site 15 rehabilitation measures: These measures include the installation of an upstream riprap stability berm, riser structure improvements, installation of a new downstream filter drainage system, flattening of the downstream embankment slope, extension of the 24-inch diameter principal spillway pipe, and installation of a new impact basin. The existing grass-lined auxiliary spillway will be improved with a roller compacted concrete (RCC) stepped chute spillway.

   These items are to be accomplished by following the construction and material specifications, design drawings, Oversight Engineer, and as identified during the Job Showing.

   The contractor will perform post-construction site reclamation on all disturbed areas of the construction site.

   Final approval will be given by the Contracting Officer Representative.

2. **DEFINITIONS:** The terms listed below shall have the meanings assigned to them below. Additional definitions can be found in section 2 of the General Terms and Conditions and in the Project Plans as defined below.

   2.1 **"Construction Services"** means the work will consist of supplying all equipment, labor, and materials required for the rehabilitation efforts of Brush Creek Site 15 dam structure as more fully described in the Project Plans.

   2.2 **"Pricing Page"** means the pages contained in wvOASIS, attached hereto as Exhibit A. Exhibit A is included in this documentation upon which Vendor should list its proposed price for the Construction Services.

2.3 **"Solicitation"** means the official notice of an opportunity to supply the State with Construction Services that is published by the Purchasing Division.

2.4 **"Project Plans"** means documents developed by an architect, an engineer, the Agency, or another design professional, which are attached hereto exhibits, that provide detailed instructions on how the Construction Services are to be performed. Project Plans are documents developed by an architect, an engineer, the Agency, or another design professional, which are attached hereto as exhibits (See exhibit "B"), that provide detailed instructions on how the Construction Services are to be performed. If Project Plans contain drawings or other documents too large to attach in the exhibits. Vendors can obtain copies in accordance with West Virginia Purchasing Division guidelines.

2.5 **"United States Department of Agriculture – Natural Resources Conservation Services (NRCS)"** means a federal agency of the United States government. NRCS works hand-in-hand with landowners, local conservation districts, and state and federal government agencies to provide federal assistance through programs, initiatives, and resources. One of those programs is the Watershed Rehabilitation Program (REHAB). The REHAB program is authorized by Public Law 83-566 which helps project sponsors rehabilitate aging dams that are reaching the end of their design life and/or no longer meet federal or state safety criteria or performance standards. This contract is derived from an agreement between NRCS and the WVCA for Rehab of Brush Creek site 15.

2.6 **"West Virginia State Conservation Committee (SCC)"** means a key body overseeing conservation efforts across the state. The SCC comprises various members, including representatives from federal and state agriculture and environmental agencies, agricultural producers, and nonprofit organizations. The SCC may employ an administrative officer (Executive Director), technical experts, and other agents and employees, permanent and temporary, as required. The administrative officer (Executive Director) and support staff shall be known as the West Virginia Conservation Agency (WVCA). The SCC approves policy and provides guidance to the WVCA. The SCC can direct the WVCA to partner and coordinate with conservation districts to implement programs through one or several conservations districts on several different programs. The SCC can also direct the WVCA to implement its programs at the state government level through a state contract utilizing the West Virginia State Purchasing Division.

2.7 **"West Virginia Conservation Agency (WVCA)"** means a state agency that provides conservation activities to the State of West Virginia and provides administrative support and technical support to the fourteen (14) conservation districts in the State of West Virginia. The WVCA is tasked with providing conservation activities that include implementation of agricultural enhancement, conservation services water quality projects, and watershed projects to include Emergency Watershed Protection; The Operations, Maintenance, and Repair (OMR) of Flood Control Structures (Dams); and Rehabilitation of Flood Control Structures (Dams). The West Virginia Conservation Agency shall be called by its full name or the "WVCA" in this document.

2.8 "**WVCA Contracting Officer (CO)**" means an appointed staff member of the WVCA whose signature will be on all official contract decisions on behalf of the government. The WVCA will direct the CO as to the proper agency response before the CO places a signature. The CO's signed documents shall be the official response of the government, and no other responses are binding. Federal, State, and County entities will take their issues to the WVCA Contracting Officer. The CO will take all issues to the WVCA for guidance and approval. Upon approval, the CO will issue a statement as to how the issue is to be addressed or sign off on documents related to determinations, findings, and any administrative or technical aspects of the contract as the official responses. The WVCA Contracting Officer has the signatory authority to request through West Virginia Purchasing Division to establish, administer, modify and/or terminate this contract. The CO will utilize the WVCA Procurement Officer to take any action on the construction contract. The WVCA Procurement Officer will forward the contract request to the WV Purchasing Division. Following WV Purchasing Division approval, the CO will share the decisions with the COR who will then share decisions with the contractor. All changes to the contract documents require a Change Order. When required, the COR sends a request to the CO. The CO, with approval of the WVCA, will have the WVCA Procurement Officer send the change order request to the WV Purchasing Division as stated above. If approved, a construction change order will be issued.

2.9 "**WVCA Contracting Officer Representative (COR)**" means an appointed staff member of the WVCA whose responsibility is to assist the Contracting Officer (CO) in managing and overseeing a specific contract, acting as the CO's representative at the project site.

2.10 "**Quality Assurance Firm / Oversight Engineer (Oversight Engineer)**" means a firm (and engineers working for that firm) that is responsible for construction oversight by providing technical guidance and quality assurance to the contractor on implementation of the construction project. Ensuring the work on the ground adherence to standards of all construction documents and to the highest standards of quality, safety, and efficiency.

2.11 "**Sponsoring Local Organizations (SLO)**" means organizations below the state level which include, but not limited to, county commissions, municipalities, public service districts, and grassroots organizations providing financial and administrative support to a project.

2.12 "**Subcontractor**" means a person/business/company who performs a portion of a project undertaken by a principal or general contractor or another subcontractor. During bid submission, the bidder shall submit a list of all subcontractors who will perform more than $25,000 worth of work on the project including labor and materials.

2.13 "**Substantially Complete**" means the work shall be deemed "substantially complete" if and only if the Contractor has completed the work and related contract obligations in accordance with the contract documents, such that the Government may enjoy the intended access, occupancy, possession, and use of the entire work without impairment due to incomplete or deficient work, and without interference from the Contractor's completion of remaining work or correction of deficiencies in completed work.

2.14 "Gantt Chart" means a visual project management tool, usually bar chart, used to illustrate a project schedule, showing tasks along a timeline.

3. **ORDER OF PRECEDENCE:** This General Construction Specifications document will have priority over, and supersede, anything contained in the Project Plans.

4. **QUALIFICATIONS:** Vendor, or Vendor's staff if requirements are inherently limited to individuals rather than corporate entities, shall have qualifications in experience through number of projects; experience with Dam-Rehabilitation, Construction, and/or Repair; and experience with Roller Compacted Concrete (RCC) for Dam Rehabilitation, Construction, and/or Repair projects. Compliance with this experience requirement will be evaluated by the State prior to the contract award. The vendor must provide in their bid packet documentation of experience through past projects, documents demonstrating evidence that the vendor has successfully completed the requested type of work listed in the specifications and drawings, and references. The vendor must provide any documentation requested by the State to assist in confirmation of compliance with this provision. References, documentation, or other information to confirm compliance with this experience requirement may be requested after bid opening and prior to contract award.

   Contractors must have the following minimum qualifications:

   a. The vendor, or vendor's supervisory staff assigned to this project, must have successfully completed at least two (2) projects within the last ten (10) years that involved work similar in nature to that described in these specifications or the Project Plans.

   b. Vendor must have experience with Dam Construction, Repair, or Rehabilitation projects.

   c. Vendor must have experience with Roller Compacted Concrete (RCC) for Dam Rehabilitation projects.

   Submission of Qualifications:

   d. A list of projects similar in scope and size during the past ten (10) years. The bidder shall submit a list of projects that are similar in scope and size to the proposed Brush Creek site 15 Rehabilitation Construction Project. These projects must have been completed during the past ten (10) years. The list shall contain the contractee/owner of the project and shall contain a POC for that contractee/owner of the project.

   e. Documentation that details a minimum of two (2) projects similar in scope and size during the past ten (10) years. The bidder shall submit a minimum of two (2) projects that are similar in scope and size to the proposed Brush Creek site 15 Rehabilitation Construction Project (each project shall be submitted on a separate document). These projects must have been completed during the past ten (10) years.

   f. Each document shall include but not limited to project description, scope, major items of work, contractee/owner, inspection company, and references.

Projects examples shall be provided exhibiting dam construction, rehabilitation, or repair, particularly those requiring similar construction practices to those required for this contract.

Project Examples and project information should be included to allow the WVCA to contact the contractees who were served in previous contracts (owners/agencies served).
This will give the WVCA the ability to assess the quality of the services provided. Examples of contractor's past performance on NRCS construction projects (or projects of similar nature may be substituted) should exhibit construction practices aligning with the work to be performed for the Brush Creek site 15 Rehabilitation Construction Project.
Examples should highlight measures implemented to meet construction milestones on schedule, as well as management techniques to meet or exceed the deliverables and requirements of the contract specifications.

g. Resume-style format of Qualifications. In addition to the contractor's licensing and qualifications set forth is this document, the contractor/subcontractor qualifications provided should identify key personnel in a resume-style format that have demonstrated expertise in past projects related to earthwork, concrete, project management, and other components necessary to meet the construction requirements.

   When the contractor utilizes subcontractors by choice or as the construction specifications require, the contractor is responsible for ensuring all subcontractors meet the professional licensing requirements as detailed in the construction specifications.

   A qualified contractor or subcontractor must meet the required experience to submit an eligible bid.

h. Documented experience of previous project requiring placement of roller compacted concrete (RCC). The contractor must be experienced in high hazard potential classified dam construction and/or rehabilitation. The contractor must provide documented experience provide documented experience of a previous project requiring mixing and placing of roller compacted concrete (RCC).

   If the contractor is choosing to subcontract the roller compacted concrete work, the documents submission must include separate qualifications, experience, and past performance of the subcontractor identified to complete the RCC work.
   The requirements of the construction personnel according to the construction specifications are as follows:

The Roller Compacted Concrete (RCC) Plant Operator shall be experienced in production of RCC with at least 1 project of similar quantity and scope within the past 3 years, or 2 jobs of similar quantity and scope within the past 5 years.

The contractor shall engage an independent third party to serve as RCC Quality Control Supervisor. The RCC Quality Control Supervisor shall be experienced in production and placement of RCC with at least 1 project of similar quantity and scope within the past 3 years, or 2 jobs of similar quantity and scope within the past 5 years.

The RCC Placement Foreman/Superintendent shall have at least one RCC project of similar quantity and scope in the last 5 years with at least 10 years of experience in earthwork.

The contractor is responsible for ensuring all subcontractors meet the minimum requirements of experience as detailed in the construction specifications.

The contractor may be disqualified from bidding if contractor fails to provide a project example of a previous dam construction, rehabilitation, or repair project with a large component of roller compacted concrete installation.

Where experience in NRCS assisted dam construction, rehabilitation, or repair projects is not available, projects of similar nature may be substituted.

5. **CONTRACT AWARD:** The Contract is intended to provide Agency with a purchase price for the Construction Services. The Contract will be awarded to the lowest qualified responsible bidder meeting the required specifications. If the Pricing Pages contain alternates/add-ons, the Contract will be awarded based on the grand total of the base bid and any alternates/add-ons selected.

6. **SELECTION OF ALTERNATES:** Pursuant to W. Va. Code § 5-22-1(f), any solicitation of bids shall include no more than five alternates. Alternates, if accepted, shall be accepted in the order in which they are listed on the bid form. Any unaccepted alternate contained within a bid shall expire 90 days after the date of the opening of bids for review. Determination of the lowest qualified responsible bidder shall be based on the sum of the base bid and any alternates accepted.

7. **PERFORMANCE:** Vendor shall perform the Construction Services in accordance with this document and the Project Plans, Exhibit B.

8. **SUBSTITUTIONS:** Any substitution requests must be submitted in accordance with the official question and answer period described in the INSTRUCTIONS TO VENDORS SUBMITTING BIDS, Paragraph 4. Vendor Question Deadline. Vendors submitting substitution requests should submit product brochures and product specifications during the official question and answer period.

9. **PROJECT PLANS:** The checked box will apply to Project Plans for this solicitation.

   ☐ **No Additional Project Plan Documents:** There are no additional Project Plans other than those attached hereto as Exhibit B or any subsequent addenda modifying Exhibit B.

   X **Additional Project Plan Documents:** There are additional Project Plan documents other than those attached as Exhibit B. The documents listed on Exhibit B are attached to the solicitation via wvOASIS Vendor Self Service portal. If you have any issues downloading the attachments, contact Larry McDonnell at Larry.D.McDonnell@wv.gov.

10. **FEDERAL ACQUISITION REGULATIONS – 52.211-18 VARIATION IN ESTIMATED QUANTITY:** As prescribed in Federal Acquisition Regulations (FAR) 11.703, Contract clauses, Variation in Estimated Quantity (Apr 1984), when a fixed-price construction contract is contemplated that authorizes a variation in the estimated quantity of unit priced items:

    If the quantity of a unit-priced item in this contract is an estimated quantity and the actual quantity of the unit-priced item varies more than 15 percent above or below the estimated quantity, an equitable adjustment in the contract price shall be made upon demand of either party. The equitable adjustment shall be based upon any increase or decrease in costs due solely to the variation above 115 percent or below 85 percent of the estimated quantity.

    If the quantity variation is such as to cause an increase in the time necessary for completion, the Contractor may request, in writing, an extension of time, to be received by the WVCA Contracting Officer within 10 days from the beginning of the delay (or within such further period as may be granted by the WVCA before the date of final settlement of the contract).

    Upon receipt of a written request for an extension, the WVCA Contracting Officer shall submit to WVCA to ascertain the facts and to decide if adjustment to extend the completion date is valid. The judgement of the WVCA shall be given to the WVCA Contracting Officer to place an official response.

11. CONDITIONS OF THE WORK

a. **Permits:** The Vendor shall procure all necessary permits and licenses to comply with all applicable Federal, State, or Local laws, regulations and ordinances of any regulating body.

   The contractor is responsible for any additional necessary permits and associated fees. The contractor shall, without additional expense to the West Virginia Purchasing Division, be responsible for codes, any necessary licenses/permits, and for complying with any applicable federal, state, and municipal laws, and regulations applicable to the performance of the work.

   The WVCA shall be responsible for obtaining all work rights of entry for the project. The contractor is permitted only to do the work outlined by the Oversight Engineer while completing work on-site under this contract. Any additional work requested by the landowner will occur only after the final inspection is completed by the WVCA and all

necessary permits and rights of entry for additional work must be obtained by the contractor or landowner.

The following permits have been obtained for Brush Creek Site 15:

I. WV DEP Dam Safety Certificate of Approval
II. USACOE Section 404 General Permit - Clean Water Act
III. WV DEP Section 401 Water Quality Certification
IV. WV DEP NPDES Construction Stormwater
V. WV DNR Public Lands Corp Stream Activity Application

b. **Land Rights:** Adequate land rights needed to perform the work under this contract have been acquired by, or on behalf of, the WVCA. The right to enter, remove, or otherwise make use of adjacent property, roads, utility lines, fences, and other improvements not included within the land rights provided shall be the sole responsibility of the contractor.

c. **Ingress and Egress:** The WVCA shall be responsible for obtaining all work rights-of-entry for the project. Where ingress and egress are not defined by the drawings, the vendor shall review the drawings and determine their recommendation for Ingress and Egress into a particular area of the project site and determine whether the ingress/egress should be used together or separately for entrance and exit purposes. The Oversight Engineer will review the vendor's proposal and provide a recommendation to the COR. The COR will designate the right-of-way to be used. The COR shall inform the CO who will provide an official response in writing as to the location and traffic pattern.

12. **PROJECT SITE:** The contractor is permitted only to do the work outlined in the drawings and in the specifications while completing work on-site under this contract. Any variations by the contractor in implementing the specifications or drawings without a modification will cause the work to be suspended. Upon identifying any variations, the Oversight Engineer will contact the Contracting Officer Representative (COR) to request that all work be halted at the project site. The Oversight Engineer will identify the variations made by the contractor to the drawings or specifications and inform the COR of the changes. The COR will meet with the contractor and inform them of the corrections needed before work continues.

    Any additional work requested by the partnership of this project (to include but not limited to State and Federal entities, the Mercer County Commission, and the Green Valley-Glenwood PSD) will only occur through an approved modification to the contract. Without modification, no work will be conducted outside the perimeters of the drawings and specifications.

    The State of West Virginia, the Purchasing Division, the State Conservation Committee, the WVCA, the Oversight Engineer, the Mercer County Commission, the Green Valley-Glenwood PSD, and the NRCS will not be held responsible or liable for any work or any resulting damage from work performed outside of the contract or work limits.

13. **Utility Identification:** It is the responsibility of the contractor before any ground-disturbing activities to place a telephone call to Miss Utility of West Virginia to ensure that utilities are

identified at the project site. You can also get additional information at their website at www.WV811.com. **To make contact, dial 811 or 1-800-245-4848**.

14. **Existing Conditions**: If discrepancies are discovered between the existing conditions and those noted in the specifications, Vendor must immediately notify the Agency's representative. Vendor must also immediately notify the Agency if suspected hazardous materials are encountered.

15. **Construction Schedule:** The construction contractor shall submit a construction schedule within 21 days following the contract award. Schedule should identify milestones that show a projected start date, substantial completion date, final completion date, and duration of critical activities that demonstrate an understanding of the timeline specified within this document and is consistent with the Brush Creek site 15 construction contract sequencing criteria. Major work areas such as the upstream embankment, downstream embankment, & auxiliary spillway at each site must be identified.

    The schedule shall be presented in a chart and graphical form. and a digital copy of the schedule shall be provided with each submission or update.

    The Gantt chart schedule shall be prepared in construction scheduling software that includes work activities linked together with logic between tasks. The start, finish, duration, and interdependent tasks shall be shown for each construction task.

    All liquidated damage milestones shall be shown in the schedule.

    The schedule shall also include the status of reservoir the pools (pool operating normally, being drained, drained, refilling, pool lowered, etc.) throughout the timeline of the construction period.

    The forty-six (46) bid line-items for Brush Creek Site 15 shall be included as scheduled tasks at a minimum (contractor can choose to include more items) to sufficiently detail the work to be performed. The schedule should assume a notice to proceed with field work of March 2, 2026.

    Preconstruction work activities such as preparation of submittals, work plans, continuous video monitoring set-up, and shop drawings are anticipated to occur between the contract award and notice to proceed dates.

    Following approval of the contractor initial schedule submission, the contractor shall expand the schedule to include the contractor and subcontractor resources and requirements for each task, identify and track bid schedule costs within tasks, and track the progress of all tasks. The schedule shall be updated and resubmitted with each monthly request for payment and as requested by the WVCA.

16. **Project Closeout**: Project Closeout shall include the following:

    a. The construction contractor shall participate in a "Substantial Completion Inspection" and a "Final Completion Inspection" prior to release from the contract. In each of these inspections, the COR, Oversight Engineer, and/or any additional subject matter expert(s)

designated by West Virginia Conservation Agency will participate as inspectors to identify any deficiencies.

b. Substantial Completion Inspection: The purpose of this inspection will be to identify deficiencies that need to be remedy prior to the Agency's final completion inspection. During this period the contractor is still obligated to perform in accordance with the contract and must take all actions necessary to ensure that work complies with the requirements of the contract prior to final acceptance.

c. Prior to the final completion inspection, the contractor shall complete a final clean-up of the project site. The contractor is responsible for removing and disposing of all unused and/or unnecessary materials and/or debris, off site and at the contractor's expense.

d. Final Completion Inspection: the purpose of this inspection will be to inspect those deficiencies found in the substantial completion inspection and verify that all deficiencies have been addressed. If all deficiencies have been corrected, final acceptance of the work will be given. The vendor shall submit any warranty documents to the Agency project manager at final inspection.

17. Mobilization and Demobilization:

The work shall consist of the mobilization and demobilization of the equipment and personnel necessary for performing the work required for the contract.

During mobilization, the construction of all temporary access roads will be completed as necessary to begin work on a substantial phase of the contract, when applicable. The cost for this will be included in the bid for mobilization and demobilization.

Mobilization may include additional buildings and other facilities (upon written approval of the WVCA Contracting Officer).

Also, during the mobilization process, the contractor shall include the establishment of the contractor's field office (field office is bid as a separate line item from the mobilization and demobilization line item. For Brush Creek site 15 is line item #45).

Demobilization shall include all activities involving removal from the sites of equipment, supplies, and personnel after completion of the work including cleanup of all rubbish and waste materials generated during the construction of this project; and restoration of any damage to existing site improvements resulting from the contractor's activities at the site.

Measurement and Basis of Payment for Mobilization and Demobilization: The line item shall be bid as a Lump Sum amount. Line-item number seven (7) on the Bid Schedule Sheet contains Mobilization and Demobilization.

Payment of Mobilization and Demobilization: Payment criteria is established in the technical specification CS8. It provides for a mobilization payment of 75% of the lump sum amount and a demobilization payment of 25% of the lump sum amount upon completion.

18. **FACILITIES ACCESS:** Performance of Contract Services may require access cards and/or keys to gain entrance to Agency's facilities. In the event that access cards and/or keys are required:

    a. Vendor must identify principal service personnel which will be issued access cards and/or keys to perform service.

    b. Vendor will be responsible for controlling cards and keys and will pay replacement fee, if the cards or keys become lost or stolen.

    c. Vendor shall notify Agency immediately of any lost, stolen, or missing card or key.

    d. Anyone performing under this Contract will be subject to Agency's security protocol and procedures.

    e. Vendor shall inform all staff of Agency's security protocol and procedures.

19. **GENERAL CONSTRUCTION SITE OPERATIONS:**

    a. **START OF CONSTRUCTION:**
    The WVCA will issue a "Notice to Proceed" to the awarded contractor which provides for the start of work. Upon the contractor's receipt of the "Notice to Proceed", the awarded contractor will follow the Sequencing Document/construction schedule and begin work.

    b. **WORK TIMEFRAME:**
    The Pre-construction activities can begin following the receipt of the "Notice to Proceed". The on-site construction will start **March 02, 2026**, and conclude on the established "substantial completion date" of **December 30, 2027**.

    An additional 30 days will be given to complete the rest of the work for final completion.

    To assist the vendor, we have calculated the number of Total Available Workdays and the Total Available Non-Restricted Workdays between the two dates given above.

    The total available workdays in 2026 are 206 workdays.
    The total available workdays in 2027 are 246 workdays.

    The non-restricted workdays in 2026 are 188 workdays.
    The non-restricted workdays in 2027 are 174 workdays.

    To derive at those numbers, the WVCA identified the **Total Number of Days** and then subtracted the total number of days in (a) **Non-Available Days** (Saturday, Sunday, Holidays) and then broke down further by calculating the number of days in (b) **Limited Construction Work Period**.

Total Number of Days: There are 669 days between the two dates with 305 days in 2026 and 364 days in 2027.

Non-Available Days: Days the WVCA has determined that the contractor will be off from work as a standard routine is Saturdays, Sundays, and Holidays. If during the construction season, the contractor wishes to work on these days, the contractor will need to seek approval from the WVCA and if approved a contract modification will be written.

Saturdays, Sundays Off: There are a total of forty-three (43) Saturdays off from work and forty-three (43) Sundays off from work in the calendar year 2026. There are a total of fifty-two (52) Saturdays off from work and fifty-two (52) Sundays off from work in the calendar year 2027.

Holidays Off: The holidays that will be observed in 2026 and 2027 are provided below for each of the two construction seasons. There is a total of thirteen (13) observed holidays in calendar year 2026. There is a total of fourteen (14) observed holidays in calendar year 2027. Additional mandated State and Federal holidays may be observed in addition to those listed below.

2026		2027
Primary Election Day* – May 12, 2026		**New Years Day** – January 01, 2027
Memorial Day – May 25, 2026		**Martin Luther King Jr. Day** – January 18, 2027
Juneteenth Day – June 19, 2026		**Presidents' Day** – February 15, 2027
Independence Day – July 3, 2026		**Memorial Day** – May 31, 2027
Labor Day – September 07, 2026		**Juneteenth Day** – June 18, 2027
Columbus Day – October 12, 2026		**West Virginia Day*** – June 21, 2027
General Election Day – November 3, 2026		**Independence Day** – July 5, 2027
Veterans' Day – November 11, 2026		**Labor Day** – September 6, 2027
Thanksgiving Day – November 26, 2026		**Columbus Day** – October 11, 2027
Day After Thanksgiving* – November 27, 2026		**Veterans' Day** – November 11, 2027
Christmas Eve* – December 24, 2026		**Thanksgiving Day** – November 25, 2027.
Christmas Day – December 25, 2026		**Day After Thanksgiving*** – November 26, 2027
New Years Eve* – December 31, 2026		**Christmas Eve*** (observed) – December 23, 2027
		Christmas Day (observed) – December 24, 2027

* West Virginia State Holidays.

Limited Construction Work Period: A winter shutdown is not required for the project; however, contractors should anticipate that winter weather conditions will impact the ability to perform work activities. In this contract, the limited construction work period is from December 14, 2026, through March 12, 2027.

During this timeframe the contractor must notify the Contracting Officer Representative (COR) to seek approval for any work activities they plan to complete during the limited construction work period. The COR, in consultation with the Oversight Engineer, will determine if that work can be completed based on the restrictions in the specifications and quality control requirements. The specifications and the quality control requirements will be strictly adhered to and may limit the work that can be performed during this period.

From December 14, 2026, through March 12, 2027, the WVCA has an estimated sixty-one (61) limited workdays (minus weekends and Holidays) in the "Limited Construction Work Period" for this contract.

Adverse Weather Days: Are not calculated into the total number of days available (As shown above in number 2). The design has an estimated sixty-five (65) days per construction season and should be assumed lost due to adverse weather conditions. This estimate is based on adverse weather conditions when rainfall **exceeded 0.1 - inches** of rain per day.

Contractors should plan for this amount of lost work time. Time extension for adverse weather conditions would only be considered by the WVCA if the contractor experiences delay that exceed the 65 days and is adequately supported by construction diaries, entries and site weather conditions.

c. **TIMEFRAME SUCCESS THROUGH STRICK ADHERENCE TO THE CONSTRUCTION SCHEDULE:** The WVCA has concluded that this contract can be completed during this timeframe that has been presented. Contractors should schedule the work in accordance with the Construction Sequencing Criteria and provide a workforce to complete the work within the identified timeframe.

Workweek: The WVCA expects that the standard for a workweek shall be at a minimum Monday through Friday.

Variations may be made to the Workweek schedule: Any variation to the work week (requesting to work weekends or holidays) shall be requested by the contractor. The contractor will make a request to the COR. The COR, in consultation with the Oversight Engineer, will decide on the proposal. If approved, the WVCA Contracting Officer (CO) will issue a change order.

Workday: The WVCA expects that the standard workday shall be at a minimum from 7:00 a.m. to 5:30 p.m. A mandatory lunch break of a minimum of 30 minutes will be taken by the contractor and crew each day.

Variations may be made to the Workday schedule: Any variation to the workday shall be requested by the contractor. One such variation would be the adjustment of the workday start time and end time based upon the time of year concerning Eastern Standard Time or Daylight Savings Time. Another such variation would be the use of Multiple Shifts.

The contractor may contemplate this option for multiple tasks to include, but not limited to, the Site 15 upstream berm work and the Roller Compacted Concrete (RCC) work.

The contractor will make a request to the COR. The COR, in consultation with the Oversight Engineer, will decide on the proposal. If approved, the WVCA Contracting Officer (CO) will issue a change order.

Multiple Shifts: To implement multiple shifts, the contractor will make a request to the Contracting Officer Representative (COR). The COR, in consultation with the Oversight Engineer, will decide on the proposal. If approved, the WVCA Contracting Officer (CO) will issue a change order.

When multiple shifts are approved by the WVCA, the number of shifts and the number of hours per shift will be determined and placed into a change order.

The contractor will have an experienced and acceptable workforce on-site during this time.

Also, the contractor will have equipment in serviceable and operating condition on-site during this time.

d. **AUTHORITY OF THE CONTRACTING OFFICER REPRESENTATIVE (COR):** Is responsible for assisting the Contracting Officer (CO) in managing and overseeing a specific contract, acting as the CO's representative at the project site. The COR serves as the primary point of contact on the project site. The COR will direct discussions between the government and the contractor at the project site. The COR will facilitate communications from the project site which includes communications from the contractor to the CO and from the Oversight Engineer to the CO.

The COR will monitor the performance of all personnel at the project site, ensure quality standards are met. The COR ensures the contractor fulfills the contract's technical and performance requirements by comparing the contractor's work to the construction specification, drawings, permits, and construction timeline. To ensure this the COR will implement the following:

(a) Communicate daily with the Oversight Engineer on implementation of the construction specification, drawings by the contractor.
(b) Discuss the implementation of the Quality Assurance Plan with the Oversight Engineer.
(c) Ensure all operations continue to move forward each day.
(d) Elevate issues and concerns to the Contracting Officer.
(e) Monitor work on the ground versus the Construction Timeline and any variance needs to be elevated.
(f) Call for the removal of any individual interfering with project operations.

(h) Document daily construction activities, including daily job diary entries, photos, and videos.
(i) Is the lead representative for the WVCA during the update meetings with the contractor, oversight engineer, and project stakeholders.

e. **AUTHORITY OF THE OVERSIGHT ENGINEER:** Is responsible for construction oversight by providing technical guidance and quality assurance to the WVCA on implementation of all construction related activities. Ensuring work on the ground adherence to standards of all construction documents and to the highest standards of quality, safety, and efficiency as follows:

(a) Implement the Quality Assurance Plan, including, but not limited to surveying, material testing, construction observation, inspections, and record keeping.
(b) Ensure all tasks follow the drawings and specifications. Any variation is to be reported to the COR.
(c) Oversee quality control inspections and tests performed by the vendor.
(d) Prepare (as-built) drawings.
(e) Review vendor submittals and coordinate the submittal review responses with project stakeholders.
(f) Review and verifying vendor survey notes for compliance with contract documents.
(g) Document daily construction activities, including daily job diary entries, photos, and videos.
(h) Monitor pollution control measures for compliance with the NPDES permit, state and local regulations.
(i) Monitor safety plan and construction schedule.
(j) Processing the pay estimates, as required by WVCA, and assist with pay-roll-related contract requirements.
(k) Provide independent cost estimates for contract modifications and changes.
(l) Coordinates and leads updating meetings with the contractor and project stakeholders.

Dispute Management: Any disagreements between the Contractor and the Oversight Engineer on interpretation of the drawings and specifications made by the Oversight Engineer will be elevated to the COR. The decision of the COR with a written response from the WVCA Contracting Officer will be final.

Obligating the State: The Oversight Engineer is not authorized to increase the obligation of the State of West Virginia, the State Conservation Committee, the WVCA, the Oversight Engineer, the Mercer County Commission, and the Green Valley-Glenwood PSD in this contract unless a Change Order is issued changing the obligations.

20. PROJECT OVERSIGHT: The contractor shall contact the WVCA and coordinate prior to mobilization to the site. The contractor shall meet with the COR and the Oversight Engineer at the site prior to the start of work.

Performance: Work shall be performed by the contractor as shown in the work drawings and as stated in the work specifications. The COR will provide oversight with consultation from the Oversight Engineer, to ensure drawings and specifications are followed.

Safety: Safety is a top priority, and any unsafe condition or act shall immediately shut down operations at the project site. This action can be announced by the WVCA, COR, or the Oversight Engineer. Work will resume when the COR determines the condition, or act has been corrected and gives the order for work to restart.

Suspension of Work: The COR, with consultation from the Oversight Engineer, may suspend the work, in whole or in part, for such time as the COR deems it necessary to prevent unsafe conditions for the employees or the public, or for any other condition or reason deemed to be of public interest.

All such suspension orders will be verbally stated to the contractor by the COR and work will cease immediately. A written suspension order from the CO to the contractor will follow the verbal order.

The COR may suspend the work, in whole or in part, for such time as the COR deems it necessary because of contractor shortfalls (inefficient operation, equipment not in good operating condition, or any condition or circumstance that is considered unsatisfactory for the performance of the work), unsatisfactory work performance, or failure of the contractor to comply with any of the requirements of this contract. Work suspension due to contractor shortfalls will not extend the end date established in this contract.

The COR may suspend the work, in whole or in part, for such time as the COR deems it necessary because of adverse weather conditions (the weather that places the contractor's staff and agency staff in harm's way or conditions that will cause equipment to do damage to the structure during operations). Adverse weather conditions exceeding the stated 65 days will cause the creation of a change order to adjust schedule and Liquidated damages.

Extension of Contract beyond Established End Date: If in order to complete the project it requires the contract end date is extended, a determination will be made as to if it was a result of Contractor Shortfall or Adverse Weather/ "Act of God".

If it is determined to be Contractor Shortfall based on COR/Oversight Engineer documentation (daily work log showing no work when work could have been completed), the contractor will not be additionally monetarily compensated for expenses incurred by the contractor for work beyond the established end date.

If it is determined to be Adverse Weather/"Act of God" based on COR/Oversight Engineer documentation (daily work log showing that work could not proceed for more than the allotted adverse weather/"Act of God" days [65 days]) or the contractor can provide evidence that the delay was due to conditions outside the control of the contractor, the contractor shall be entitled to seek additional monetarily compensated for expenses incurred by the contractor for work beyond the established end date. This action will cause the creation of a change order to adjust compensation.

Increase Cost over the life of the Project: If, during the course of the project, the contractor can show valid justification for increased costs due to unforeseen events in the World, the contractor shall be entitled to seek additional monetarily compensated for expenses incurred by the contractor for increased costs of more than 15% above the original bid on materials. Also, if the Oversight Engineer determines during the course of work that additional work must be added to complete the project, the contractor shall be entitled to seek additional monetarily compensated for expenses incurred by the contractor for increased costs Thess actions will cause the creation of a change order to adjust compensation.

21. **THE WEST VIRGINIA CONSERVATION AGENCY INSPECTIONS AND TESTING:** All work (which term includes but is not restricted to materials, workmanship, and manufacture and fabrication of components) shall be subject to inspection and testing by the WVCA at all reasonable times and at places before acceptance. Any such inspection and testing are for the sole benefit of the WVCA and shall not relieve the contractor of the responsibility of providing quality control measures to ensure that the work strictly complies with the contract requirements.

    No inspections or tests by the WVCA shall be construed as constituting or implying acceptance. Inspections or tests shall not relieve the contractor of responsibility for damage to or loss of the material before acceptance, nor in any way affect the continuing rights of the WVCA after acceptance of the completed work.

22. **INSPECTIONS OF CONSTRUCTION:** The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. The Contractor shall maintain complete inspection records and make them available to the Oversight Engineer and the WVCA. All work shall be conducted under the general observation of the Oversight Engineer and is subject to inspections and tests by the Oversight Engineer and the WVCA at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract.

    Such inspections and tests are for the sole benefit of the WVCA and do not:
    (a) Relieve the contractor's responsibility for providing adequate quality control measures.
    (b) Relieve the contractor's responsibility for damage to or loss of the material before acceptance.
    (c) Constitute or imply acceptance.
    (d) Affect the continuing rights of the State and Federal Government after acceptance of the completed work under the last paragraph of this section.

    The presence or absence of an inspector does not relieve the contractor from any contract requirement. No inspector is authorized to change any term or condition of the contract, specification, or drawings without written authorization (modification/change order).

    The WVCA may charge the contractor any additional cost of inspection or test when work is not ready at the time specified by the contractor for inspection or test, or when prior rejection makes re-inspection or retest necessary.

The Oversight Engineer and the COR shall perform all inspections and tests in a manner that will not unnecessarily delay the work. All special, full-size, and performance tests shall be performed as described in the contract.

The contractor shall, without charge, replace or correct work found by the COR and/or Oversight Engineer which does not conform to contract requirements, unless, in the public interest, the WVCA consents to accept the work with an appropriate adjustment in the contract price. The contractor shall promptly segregate and remove rejected material from the premises.

If the contractor does not promptly replace or correct rejected work, the WVCA may:

(a) By contract or otherwise, replace or correct the work and charge the cost to the contractor.
(b) Terminate for default the contractor's right to proceed.

If, before acceptance of the entire work, the COR and the Oversight Engineer decide to examine already completed work by removing it or tearing it out, the contractor, on request, shall promptly furnish all necessary facilities, labor, and material.

If the work is found to be defective or nonconforming in any material respect due to the fault of the contractor or its subcontractors, the contractor shall defray the expenses of the examination and of satisfactory reconstruction.

However, if the work is found to meet contract requirements, the WVCA shall make an equitable adjustment for the additional services involved in the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

Unless otherwise specified in the contract, the Oversight Engineer and the WVCA shall accept, as promptly as practicable after completion and inspection, all work required by the contract or that portion of the work the WVCA determines to be accepted separately.

Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the State of West Virginia, the State Conservation Committee, the WVCA, the Oversight Engineer, the Mercer County Commission, and the Green Valley-Glenwood PSD' rights under any warranty or guarantee.

23. CONTRACTOR'S RESPONSIBILITIES: The contractor is responsible for ensuring the safe and efficient execution of the project and its supervisors overseeing the entire construction process. The contractor will accomplish this through adhering to the contract documents, project management, maintaining high standards of quality and safety throughout the construction process, planning, executing, overseeing, and inspecting the project from start to finish, coordinating subcontractors, and providing materials and labor, and managing budgets and timelines. This encompasses various tasks, from initial planning and coordination to final completion and closeout.

Key Responsibilities of a Contractor: In 9.1.2 through 9.1.14 are some of the items of responsibility the contractor has in this project and include, but not limited to, the following:

Project Management: This includes planning, scheduling, and overseeing all aspects of the construction project, ensuring it stays on track and within budget.

Safety: Implementing and maintaining a safe working environment for all personnel, adhering to safety regulations, conducting regular safety inspections, and that all workers are properly trained and equipped.

Planning and Coordination: Integrating erosion and sediment control practices into the project plan, coordinating with relevant authorities (state, local, and federal), and ensuring all work aligns with the contract documents.

Quality Control: Upholding the highest quality standards throughout the project, from material selection to construction methods. This involves close observation of construction activities, adherence to specifications, and timely reporting of any deviations.

Communication: Contractors need to effectively communicate with all stakeholders, including clients, subcontractors, and suppliers, to keep everyone informed and address any issues that arise.

Schedule Management: Developing and maintaining a construction schedule and monitoring progress to ensure the project stays on track.

Materials and Equipment: Providing the necessary materials and equipment for the project and managing their delivery and storage on the job site.

Legal and Regulatory Compliance: Ensuring all work complies with relevant laws, regulations, and building codes.

Budget Management: Contractors are responsible for managing project costs, tracking expenses, and ensuring the project stays within the allocated budget.

Hiring and Procurement: Contractors may be responsible for hiring employees, as well as procuring necessary materials and equipment from vendors.

Subcontractor Management: Contractors hire and manage subcontractors, ensuring their work is completed to the required specifications and the quality of work performed by subcontractors achieves the required standards. All within the agreed-upon timeframe.

Change Orders: Managing any changes to the original project scope, including documenting requests, negotiating costs, and ensuring the changes are properly incorporated into the project plan.

Project Construction Site: The contractor will take all reasonable actions to observe and understand the project site. This includes site conditions throughout the life of the project.

Site Investigation and Conditions Affecting the Work: The contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions that can affect the work or its cost, including but not limited to (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, electric power, and roads; (3) uncertainties of weather, groundwater levels, stream stages, river stages, or similar physical conditions at the site; (4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance.

The contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the government, as well as from the drawings and specifications made a part of this contract. Any failure of the contractor to take the actions described and acknowledged in this paragraph will not relieve the contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the State of West Virginia, the State Conservation Committee, the WVCA, the Oversight Engineer, the Mercer County Commission, and the Green Valley-Glenwood PSD.

The State of West Virginia, the Purchasing Division, the State Conservation Committee, the WVCA, the Oversight Engineer, the Mercer County Commission, and the Green Valley-Glenwood PSD assume no responsibility for any conclusions or interpretations made by the contractor based on the information made available by this group. Nor does this group assume responsibility for any understanding reached or representation made concerning conditions, which can affect the work by any of its officers or employees before the execution of this contract, unless that understanding, or representation is expressly stated in this contract.

Differing Site Conditions Pre-Construction: The contractor shall promptly, and before the conditions are disturbed (start of work), give written notice to the Oversight Engineer and the COR that site conditions have so dramatically changed since the job showing that the site now differs from those indicated in this contract.

The Oversight Engineer shall investigate the site conditions promptly after receiving the notice and provide a written report to the COR.

If, in the opinion of the Oversight Engineer, site conditions have so dramatically changed since the job showing that the site now differs from those indicated in this contract and causes an increase or decrease in the contractor's cost of, or the time required for, performing any part of the work under this contract, the Oversight Engineer will indicate any additional cost or additional time required to complete the project.

If, in the opinion of the Oversight Engineer, site conditions have not changed since the job showing, the Oversight Engineer will report what was found during the site investigation.

Based upon the Oversight Engineer's report, the WVCA will decide on whether differing site conditions exist or not. If differing site conditions exist, the WVCA will determine if the equitable adjustment is justified under this clause and will decide if a contract modification/change order is needed. Also, the WVCA will decide if a financial change to the contract is needed and incorporate it into the modification/change order.

The Change Order will be signed by the WVCA Contracting Officer and sent out for implementation.

If it is determined that the site changes identified do not pose a threat or change to the outcome if work continues, the WVCA Contracting Officer will provide a statement in writing that the conditions are safe to continue. The contractor will continue to work with no modification/change order.

If differing site conditions do not exist in the opinion of the WVCA, the WVCA Contracting Officer will provide a written statement that no differing site conditions could be found, and no modification will be written.

No request by the contractor for an equitable adjustment to the contract for the differing site conditions shall be allowed if done after the work is completed in the area of suspected differing site conditions and after the final inspection is completed.

Differing Site Conditions During Construction: If the contractor comes across conditions that are so different from those presented in the construction design reports, specifications and drawings, the contractor shall stop work and promptly give written notice to the Oversight Engineer and the COR that these differing site conditions exist, and the design can no longer be followed.

The Oversight Engineer shall investigate the site conditions promptly after receiving the notice and provide a written report to the COR.

If, in the opinion of the Oversight Engineer, site conditions have so dramatically changed from the design reports, specifications, or drawings, that the site now differs from those indicated in the design documents and will cause an increase or decrease in the contractor's cost of, or the time required for, performing any part of the work under this contract, the Oversight Engineer will indicate any additional cost or additional time required to complete the project.

If, in the opinion of the Oversight Engineer, site conditions have not changed in comparison to the design documents, the Oversight Engineer will report what was found during the site investigation.

Based upon the Oversight Engineer's report, the WVCA will decide on whether differing site conditions exist or not. If differing site conditions exist, the WVCA will determine if the equitable adjustment is justified under this clause and will decide if a contract modification/change order is needed. Also, the WVCA will decide if a financial change to the contract is needed and incorporate it into the modification/change order.

The Change Order will be signed by the WVCA Contracting Officer and sent out for implementation.

If it is determined that the site changes identified do not pose a threat or change to the outcome if work continues, the WVCA Contracting Officer will provide a statement in writing that the conditions are safe to continue. The contractor will continue to work with no modification/change order.

If differing site conditions do not exist in the opinion of the WVCA, the WVCA Contracting Officer will provide a written statement that no differing site conditions could be found, and no modification will be written.

No request by the contractor for an equitable adjustment to the contract for the differing site conditions shall be allowed if done after the work is completed in the area of suspected differing site conditions and after the final inspection is completed.

24. CONTRACTOR'S PERFORMANCE OF WORK: The contractor is responsible for the means, methods, techniques, sequences, or procedures of work. It is contemplated that the contractor will furnish the necessary personnel/skilled labor, material, equipment, services, and facilities (except as otherwise specified) to perform the Statement of Work/Specifications, and all other items necessary for the successful completion of work. The contractor shall give the work the constant attention necessary to facilitate progress.

Contractor Management: The contractor shall always have on the work site a competent superintendent capable of reading and thoroughly understanding the plans and specifications. One who is thoroughly experienced in the type of work being performed and who will effectively communicate and consult with the Contracting Officer Representative (COR) and the Oversight Engineer.

On contractual matters, the contractor shall go through the COR who shall elevate it to the CO. The CO, in consultation with the WVCA Procurement Officer and the West Virginia Purchasing Division, provide a response to all contract questions.

The contractor shall provide a list of addresses and telephone numbers of their personnel who may be reached in case of emergency during hours when no work is to be performed to the COR.

On weekends, holidays, suspensions of work, and the occurrence of storms, the contractor shall alert certain members of their personnel to stand by and inform the COR of arrangements made.

Workforce: The contractor shall perform work on the site (the contractor and his or her employees) equivalent to at least 15 percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement to this contract if, during the performance of the work, the contractor requests a reduction, and the WVCA determines that the reduction would be to the advantage of the government.

An employee of the contractor is an individual for whom the contractor withholds, and pays, employment taxes (FICA). All others will be considered Subcontractors. The West Virginia Purchasing Division or the WVCA reserves the right to require successful contractors to produce evidence showing the payment of employment taxes for all onsite workers.

Equipment Operators: The contractor shall at all times employ sufficient equipment operators to prosecute the several classes of work to full completion in the manner and time required by these specifications.

Qualified Operator: The contractor shall provide qualified operators. Unqualified or inefficient operators shall immediately be replaced at the discretion of the COR in consultation with the Oversight Engineer. Should a contractor fail to remove such a person, or people as required above or fail to furnish suitable and sufficient personnel for the proper prosecution of the work, the WVCA may suspend the work by written notice until such order is complied with.

Laborers: The contractor shall always employ sufficient labor for prosecuting the several classes of work to full completion in the manner and time required by these Specifications. All employees will have sufficient skill and experience to perform the work assigned to them

properly. Employees engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform all work properly and satisfactorily.

Disorderly or Threating Laborer: Any person who, in the opinion of the COR and in consultation with the Oversight Engineer, is disorderly or deemed a threat to another employee of the contractor, an employee of NRCS, an employee of the State of West Virginia, a member of the State Conservation Committee, an employee of the WVCA, an employee of the Oversight Engineer, a member of the Mercer County Commission, an employee of Green Valley-Glenwood PSD, or to the general public shall, at the request of the COR, be removed forthwith.

Any contractor employing such a person shall not reemploy such person on the project without the written approval of the WVCA Contracting Officer. Should a contractor fail to remove such a person, or people as required above or fail to furnish suitable and sufficient personnel for the proper prosecution of the work, the WVCA may suspend the work by written notice until such order is complied with.

Equipment: The contractor shall always provide enough equipment for prosecuting the several classes of work to full completion in the manner and time required by these specifications. Equipment will be of sufficient size and in such a mechanical condition as to meet the requirements of the work and to produce a satisfactory quality of work.

Mounted or attached equipment shall be customarily manufactured for the respective size of the tractor being offered. Backhoe(s) and excavator(s) shall have mounted or attached equipment that is customarily manufactured for the respective size of the backhoe or excavator being offered.

Horsepower shall be flywheel horsepower rating. Horsepower and bucket capacities shall be listed in the current edition of Rental Rate Blue Book for Construction Equipment (Published by Dataquest) or similar reliable reference approved by the WVCA. The equipment should not deviate from the minimum and/or maximum horsepower specified in the Bid Schedule of this invitation to be considered as being acceptable to the terms of the contract. Equipment used on any portion of the project shall be such that no injury to the adjacent property will result from its use.

All equipment shall be maintained in a proper working condition and shall be free of any fluid leaks. Equipment in need of repair that prohibits work to its full potential shall be immediately replaced. The contractor shall provide all the oil and lubricants and perform the required maintenance promptly.

Personal Protective Equipment (PPE): At a minimum, all workers and contractor management on the project site shall have Hard Hats, Safety shirts/vests, Steel-toe boots, and safety goggles/glasses.

Hard Hat Areas: The entire job site, except for offices, shall be considered a Hard Hat Area. All people entering this area, without exception, are required to wear hard hats. This is a safety issue and all personnel on site shall ensure all visitors entering hard hat areas are wearing hard hats. This will be supervised by the contractor and the COR. If someone enters the hard hat

area without wearing a hard hat, work will cease, and the individual will be escorted outside the hard hat area before work can continue.

Labels for hard hats shall bear a manufacturer's label indicating design compliance with the appropriate ANSI (American National Standards Institute) standard.

Safety Shirt/Vest: Safety shirts or vests shall be worn, at all times, on the entire job site. Any person entering the designed work area is, without exception, required to wear a safety shirt or vest. The contractor and the Oversight Engineer shall ensure all visitors entering the work area comply. If someone enters the identified work area without wearing a safety shirt or vest, work will cease, and the individual will be escorted outside the work area before work can continue.

Steel-toe boots: Steel-toe boots should be worn, at all times, on the entire job site. All people entering the area are, without exception, required to wear Steel-toe boots.

Safety Goggles/Glasses: Safety glasses should be worn at all times unless operating equipment with an enclosed cab. A face shield should be used, in addition to safety glasses, when operating a string/brush trimmer and other times when your face could be hit by debris. All personnel involved in or within 100 feet (33 yards) diameter around the working area of brush removal and tree removal must wear protective safety goggles/glasses.

Chainsaw Chaps: Chainsaw chaps refer to a type of personal protective equipment (PPE) that is to be worn by anyone using a chainsaw on the project site.

25. **CONTINUOUS VIDEO MONITORING:** The contractor will be required to supply and provide maintenance services on two (2) trailer mounted cameras to be placed at locations at the discretion of the Oversight Engineer. Each camera must meet the requirements set forth in the CONSTRUCTION SPECIFICATION 96-FIELD OFFICE.

    In this specification - The Contractor shall provide cameras for real-time remote monitoring of construction activities.

    Brush Creek Site 15 Cameras: The specification requirement will be connected to Bid Schedule Sheet Site 15, bid line-item number 45 (Field Office) to provide two (2) trailer mounted cameras at this site.

26. MISCELLANEOUS:

26.1 Contract Manager: During its performance of this Contract, Vendor must designate and maintain a primary contract manager responsible for overseeing Vendor's responsibilities under this Contract. The Contract manager must be available during normal business hours to address any customer service or other issues related to this Contract. Vendor should list its Contract manager and his or her contact information below.

EXHIBIT B – PROJECT PLANS

Exhibit B – Project Plans – PDF files attached to solicitation include:

1. BC15 Drawings
2. BC15 Specifications
3. BC15 Construction Sequencing Criteria
4. BC15 As-Built Drawings
5. BC15 Geotechnical Investigation Report
6. BC 9-14-15 Geophysical Report
7. BC15 Piezometer Data Summary
8. NRCS Supplement to OSHA Parts 1910 and 1926
9. 2024-09-27 BC15 Operation and Maintenance Plan
10. 2024-09-27 BC15 Quality Assurance and Inspection Staffing Plan

EXHIBIT C – LIQUIDATED DAMAGES

LIQUIDATED DAMAGES:

Liquidated damages are not punitive and are not negative performance incentives. Liquidated damages are used to compensate the WVCA for calculable damages. Therefore, the liquidated damages rate will be based upon those identified costs that the State of West Virginia, the State Conservation Committee, the WVCA, the Oversight Engineer, Mercer County Commission, and Green Valley-Glenwood PSD acquire because the contractor failed to work within the time specified in the contract to meet milestones and to complete all aspects of the contract by the established date. **Liquidated Damages have been calculated at the following rates for milestones and completion of project:**

Project Completion

- **Site 15** – If all work is not completed within four or less consecutive construction seasons, ending December 30, 2027, the rate of LD will be **$ 4,183.33 per day**.

Milestones

- **Site 15** – If the Site 15 reservoir draining, upstream riprap berm installation, and riser work is not completed by December 30, 2026, of the current construction season, the rate of LD will be **$ 2,500.00 per day**.

FEDERAL FUNDS ADDENDUM

2 C.F.R. §§ 200.317 – 200.327

Purpose: This addendum is intended to modify the solicitation in an attempt to make the contract compliant with the requirements of 2 C.F.R. §§ 200.317 through 200.327 relating to the expenditure of certain federal funds. This solicitation will allow the State to obtain one or more contracts that satisfy standard state procurement, state federal funds procurement, and county/local federal funds procurement requirements.

Instructions: Vendors who are willing to extend their contract to procurements with federal funds and the requirements that go along with doing so, should sign the attached document identified as: "REQUIRED CONTRACT PROVISIONS FOR NON-FEDERAL ENTITY CONTRACTS UNDER FEDERAL AWARDS (2 C.F.R. § 200.317)"

Should the awarded vendor be unwilling to extend the contract to federal funds procurement, the State reserves the right to award additional contracts to vendors that can and are willing to meet federal funds procurement requirements.

Changes to Specifications: Vendors should consider this solicitation as containing two separate solicitations, one for state level procurement and one for county/local procurement.

State Level: In the first solicitation, bid responses will be evaluated with applicable preferences identified in sections 15, 15A, and 16 of the "Instructions to Vendors Submitting Bids" to establish a contract for both standard state procurements and state federal funds procurements.

County Level: In the second solicitation, bid responses will be evaluated with applicable preferences identified in Sections 15, 15A, and 16 of the "Instructions to Vendors Submitting Bids" omitted to establish a contract for County/Local federal funds procurement.

Award: If the two evaluations result in the same vendor being identified as the winning bidder, the two solicitations will be combined into a single contract award. If the evaluations result in a different bidder being identified as the winning bidder, multiple contracts may be awarded. The State reserves the right to award to multiple different entities should it be required to satisfy standard state procurement, state federal funds procurement, and county/local federal funds procurement requirements.

State Government Use Caution: State agencies planning to utilize this contract for procurements subject to the above identified federal regulations should first consult with the federal agency providing the applicable funding to ensure the contract is complaint.

County/Local Government Use Caution: County and Local government entities planning to utilize this contract for procurements subject to the above identified federal regulation should first consult with the federal agency providing the applicable funding to ensure the contract is complaint. For purposes of County/Local government use, the solicitation resulting in this contract was conducted in accordance with the procurement laws, rules, and procedures governing the West Virginia Department of Administration, Purchasing Division, except that vendor preference has been omitted for County/Local use purposes and the contract terms contained in the document entitled "REQUIRED CONTRACT PROVISIONS FOR NON-FEDERAL ENTITY CONTRACTS UNDER FEDERAL AWARDS (2 C.F.R. § 200.317)" have been added.

FEDERAL FUNDS ADDENDUM

REQUIRED CONTRACT PROVISIONS FOR NON-FEDERAL ENTITY CONTRACTS UNDER FEDERAL AWARDS (2 C.F.R. § 200.317):

The State of West Virginia Department of Administration, Purchasing Division, and the Vendor awarded this Contract intend that this Contract be compliant with the requirements of the Procurement Standards contained in the Uniform Administrative Requirements, Cost Principles, and Audit Requirements found in 2 C.F.R. § 200.317, et seq. for procurements conducted by a Non-Federal Entity. Accordingly, the Parties agree that the following provisions are included in the Contract.

1. **MINORITY BUSINESSES, WOMEN'S BUSINESS ENTERPRISES, AND LABOR SURPLUS AREA FIRMS:**
(2 C.F.R. § 200.321)

   a. The State confirms that it has taken all necessary affirmative steps to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible. Those affirmative steps include:

      (1) Placing qualified small and minority businesses and women's business enterprises on solicitation lists;
      (2) Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources;
      (3) Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses, and women's business enterprises;
      (4) Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority businesses, and women's business enterprises;
      (5) Using the services and assistance, as appropriate, of such organizations as the Small Business Administration and the Minority Business Development Agency of the Department of Commerce; and
      (6) Requiring the prime contractor, if subcontracts are to be let, to take the affirmative steps listed in paragraphs (1) through (5) above.

   b. Vendor confirms that if it utilizes subcontractors, it will take the same affirmative steps to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible.

2. **DOMESTIC PREFERENCES:**
(2 C.F.R. § 200.322)

   a. The State confirms that as appropriate and to the extent consistent with law, it has, to the greatest extent practicable under a Federal award, provided a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United

States (including but not limited to iron, aluminum, steel, cement, and other manufactured products).

b. Vendor confirms that will include the requirements of this Section 2. Domestic Preference in all subawards including all contracts and purchase orders for work or products under this award.

c. Definitions: For purposes of this section:

(1) "Produced in the United States" means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.
(2) "Manufactured products" means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.

3. **BREACH OF CONTRACT REMEDIES AND PENALTIES:**
(2 C.F.R. § 200.327 and Appendix II)

(a) The provisions of West Virginia Code of State Rules § 148-1-5 provide for breach of contract remedies, and penalties. A copy of that rule is attached hereto as Exhibit A and expressly incorporated herein by reference.

4. **TERMINATION FOR CAUSE AND CONVENIENCE:**
(2 C.F.R. § 200.327 and Appendix II)

(a) The provisions of West Virginia Code of State Rules § 148-1-5 govern Contract termination. A copy of that rule is attached hereto as Exhibit A and expressly incorporated herein by reference.

5. **EQUAL EMPLOYMENT OPPORTUNITY:**
(2 C.F.R. § 200.327 and Appendix II)

Except as otherwise provided under 41 CFR Part 60, and if this contract meets the definition of "federally assisted construction contract" in 41 CFR Part 60–1.3, this contract includes the equal opportunity clause provided under 41 CFR 60–1.4(b), in accordance with Executive Order 11246, "Equal Employment Opportunity" (30 FR 12319, 12935, 3 CFR Part, 1964–1965 Comp., p. 339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

6. **DAVIS-BACON WAGE RATES:**
(2 C.F.R. § 200.327 and Appendix II)

Vendor agrees that if this Contract includes construction, all construction work in excess of $2,000 will be completed and paid for in compliance with the Davis–Bacon Act (40 U.S.C. 3141–3144, and 3146–3148) as supplemented by Department of Labor regulations (29 CFR Part 5, "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction"). In accordance with the statute, contractors must:

(a) pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor.
(b) pay wages not less than once a week.

A copy of the current prevailing wage determination issued by the Department of Labor is attached hereto as Exhibit B. The decision to award a contract or subcontract is conditioned upon the acceptance of the wage determination. The State will report all suspected or reported violations to the Federal awarding agency.

7. **ANTI-KICKBACK ACT:**
(2 C.F.R. § 200.327 and Appendix II)

Vendor agrees that it will comply with the Copeland Anti-KickBack Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). Accordingly, Vendor, Subcontractors, and anyone performing under this contract are prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The State must report all suspected or reported violations to the Federal awarding agency.

8. **CONTRACT WORK HOURS AND SAFETY STANDARDS ACT**
(2 C.F.R. § 200.327 and Appendix II)

Where applicable, and only for contracts awarded by the State in excess of $100,000 that involve the employment of mechanics or laborers, Vendor agrees to comply with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, Vendor is required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

9. **RIGHTS TO INVENTIONS MADE UNDER A CONTRACT OR AGREEMENT.**
(2 C.F.R. § 200.327 and Appendix II)

If the Federal award meets the definition of "funding agreement" under 37 CFR § 401.2 (a) and the recipient or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that "funding agreement," the recipient or subrecipient must comply with the requirements of 37 CFR Part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the awarding agency.

10. **CLEAN AIR ACT**
(2 C.F.R. § 200.327 and Appendix II)

Vendor agrees that if this contract exceeds $150,000, Vendor is to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401–7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251–1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

11. **DEBARMENT AND SUSPENSION**
(2 C.F.R. § 200.327 and Appendix II)

The State will not award to any vendor that is listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), "Debarment and Suspension." SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.

12. **BYRD ANTI–LOBBYING AMENDMENT**
(2 C.F.R. § 200.327 and Appendix II)

Vendors that apply or bid for an award exceeding $100,000 must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Each tier must also disclose any lobbying with non–Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non–Federal award.

13. PROCUREMENT OF RECOVERED MATERIALS
(2 C.F.R. § 200.327 and Appendix II; 2 C.F.R. § 200.323)

Vendor agrees that it and the State must comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act. The requirements of Section 6002 include procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds $10,000 or the value of the quantity acquired during the preceding fiscal year exceeded $10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.

14. PROHIBITION ON CERTAIN TELECOMMUNICATIONS AND VIDEO SURVEILLANCE SERVICES OR EQUIPMENT.
(2 C.F.R. § 200.327 and Appendix II; 2 CFR § 200.216)

Vendor and State agree that both are prohibited from obligating or expending funds under this Contract to:

(1) Procure or obtain;
(2) Extend or renew a contract to procure or obtain; or
(3) Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Public Law 115–232, section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

(i) For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).
(ii) Telecommunications or video surveillance services provided by such entities or using such equipment.
(iii) Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

In implementing the prohibition under Public Law 115–232, section 889, subsection (f), paragraph (1), heads of executive agencies administering loan, grant, or subsidy programs shall prioritize available funding and technical support to assist affected businesses, institutions and organizations as is reasonably necessary for those affected entities to transition from covered communications equipment and services, to procure replacement equipment and services, and to ensure that communications service to users and customers is sustained.

State of West Virginia Purchasing Division	Vendor Name:
By: _____	By: _____
Printed Name: _____	Printed Name: _____
Title: _____	Title: _____
Date: _____	Date: _____

EXHIBIT A To:
REQUIRED CONTRACT PROVISIONS FOR NON-FEDERAL ENTITY CONTRACTS UNDER FEDERAL AWARDS (2 C.F.R. § 200.317):

W. Va. CSR § 148-1-5

West Virginia Code of State Rules
Title 148. Department of Administration
Legislative Rule (Ser. 1)
Series 1. Purchasing

W. Va. Code St. R. § 148-1-5
§ 148-1-5. Remedies.
Currentness

5.1. The Director may require that the spending unit attempt to resolve any issues that it may have with the vendor prior to pursuing a remedy contained herein. The spending unit must document any resolution efforts and provide copies of those documents to the Purchasing Division.

5.2. Contract Cancellation.

5.2.1. Cancellation. The Director may cancel a purchase or contract immediately under any one of the following conditions including, but not limited to:

5.2.1.a. The vendor agrees to the cancellation;

5.2.1.b. The vendor has obtained the contract by fraud, collusion, conspiracy, or is in conflict with any statutory or constitutional provision of the State of West Virginia;

5.2.1.c. Failure to honor any contractual term or condition or to honor standard commercial practices;

5.2.1.d. The existence of an organizational conflict of interest is identified;

5.2.1.e. Funds are not appropriated or an appropriation is discontinued by the legislature for the acquisition;

5.2.1.f. Violation of any federal, state, or local law, regulation, or ordinance, and

5.2.1.g. The contract was awarded in error.

5.2.2. The Director may cancel a purchase or contract for any reason or no reason, upon providing

the vendor with 30 days' notice of the cancellation.

5.2.3. Opportunity to Cure. In the event that a vendor fails to honor any contractual term or condition, or violates any provision of federal, state, or local law, regulation, or ordinance, the Director may request that the vendor remedy the contract breach or legal violation within a time frame the Director determines to be appropriate. If the vendor fails to remedy the contract breach or legal violation or the Director determines, at his or her sole discretion, that such a request is unlikely to yield a satisfactory result, then he or she may cancel immediately without providing the vendor an opportunity to perform a remedy.

5.2.4. Re-Award. The Director may award the cancelled contract to the next lowest responsible bidder (or next highest scoring bidder if best value procurement) without a subsequent solicitation if the following conditions are met:

5.2.4.a. The next lowest responsible bidder (or next highest scoring bidder if best value procurement) is able to perform at the price contained in its original bid submission, and

5.2.4.b. The contract is an open-end contract, a one-time purchase contract, or a contract for work which has not yet commenced.

Award to the next lowest responsible bidder (or next highest scoring bidder if best value procurement) will not be an option if the vendor's failure has in any way increased or significantly changed the scope of the original contract. The vendor failing to honor contractual and legal obligations is responsible for any increase in cost the state incurs as a result of the re-award.

5.3. Non-Responsible. If the Director believes that a vendor may be non-responsible, the Director may request that a vendor or spending unit provide evidence that the vendor either does or does not have the capability to fully perform the contract requirements, and the integrity and reliability necessary to assure good faith performance. If the Director determines that the vendor is non-responsible, the Director shall reject that vendor's bid and shall not award the contract to that vendor. A determination of non-responsibility must be evaluated on a case-by-case basis and can only be made after the vendor in question has submitted a bid. A determination of non-responsibility will only extend to the contract for which the vendor has submitted a bid and does not operate as a bar against submitting future bids.

5.4. Suspension.

5.4.1. The Director may suspend, for a period not to exceed 1 year, the right of a vendor to bid on

procurements issued by the Purchasing Division or any state spending unit under its authority if:

5.4.1.a. The vendor has submitted a bid and then requested that its bid be withdrawn after bids have been publicly opened.

5.4.1.b. The vendor has exhibited poor performance in fulfilling his or her contractual obligations to the State. Poor performance includes, but is not limited to any of the following: violations of law, regulation, or ordinance; failure to deliver timely; failure to deliver quantities ordered; poor performance reports; or failure to deliver commodities, services, or printing at the quality level required by the contract.

5.4.1.c. The vendor has breached a contract issued by the Purchasing Division or any state spending unit under its authority and refuses to remedy that breach.

5.4.1.d. The vendor's actions have given rise to one or more of the grounds for debarment listed in W. Va. Code § 5A-3-33d.

5.4.2. Vendor suspension for the reasons listed in section 5.4 above shall occur as follows:

5.4.2.a. Upon a determination by the Director that a suspension is warranted, the Director will serve a notice of suspension to the vendor.

5.4.2.b. A notice of suspension must inform the vendor:

5.4.2.b.1. Of the grounds for the suspension;

5.4.2.b.2. Of the duration of the suspension;

5.4.2.b.3. Of the right to request a hearing contesting the suspension;

5.4.2.b.4. That a request for a hearing must be served on the Director no later than 5 working days of the vendor's receipt of the notice of suspension;

5.4.2.b.5. That the vendor's failure to request a hearing no later than 5 working days of

the receipt of the notice of suspension will be deemed a waiver of the right to a hearing and result in the automatic enforcement of the suspension without further notice or an opportunity to respond; and

5.4.2.b.6. That a request for a hearing must include an explanation of why the vendor believes the Director's asserted grounds for suspension do not apply and why the vendor should not be suspended.

5.4.2.c. A vendor's failure to serve a request for hearing on the Director no later than 5 working days of the vendor's receipt of the notice of suspension will be deemed a waiver of the right to a hearing and may result in the automatic enforcement of the suspension without further notice or an opportunity to respond.

5.4.2.d. A vendor who files a timely request for hearing but nevertheless fails to provide an explanation of why the asserted grounds for suspension are inapplicable or should not result in a suspension, may result in a denial of the vendor's hearing request.

5.4.2.e. Within 5 working days of receiving the vendor's request for a hearing, the Director will serve on the vendor a notice of hearing that includes the date, time and place of the hearing.

5.4.2.f. The hearing will be recorded and an official record prepared. Within 10 working days of the conclusion of the hearing, the Director will issue and serve on the vendor, a written decision either confirming or reversing the suspension.

5.4.3. A vendor may appeal a decision of the Director to the Secretary of the Department of Administration. The appeal must be in writing and served on the Secretary no later than 5 working days of receipt of the Director's decision.

5.4.4. The Secretary, or his or her designee, will schedule an appeal hearing and serve on the vendor, a notice of hearing that includes the date, time and place of the hearing. The appeal hearing will be recorded and an official record prepared. Within 10 working days of the conclusion of the appeal hearing, the Secretary will issue and serve on the vendor a written decision either confirming or reversing the suspension.

5.4.5. Any notice or service related to suspension actions or proceedings must be provided by certified mail, return receipt requested.

5.5. Vendor Debarment. The Director may debar a vendor on the basis of one or more of the grounds for debarment contained in W. Va. Code § 5A-3-33d or if the vendor has been declared ineligible to participate in procurement related activities under federal laws and regulation.

5.5.1. Debarment proceedings shall be conducted in accordance with W. Va. Code § 5A-3-33e and these rules. A vendor that has received notice of the proposed debarment by certified mail, return receipt requested, must respond to the proposed debarment within 30 working days after receipt of notice or the debarment will be instituted without further notice. A vendor is deemed to have received notice, notwithstanding the vendor's failure to accept the certified mail, if the letter is addressed to the vendor at its last known address. After considering the matter and reaching a decision, the Director shall notify the vendor of his or her decision by certified mail, return receipt requested.

5.5.2. Any vendor, other than a vendor prohibited from participating in federal procurement, undergoing debarment proceedings is permitted to continue participating in the state's procurement process until a final debarment decision has been reached. Any contract that a debarred vendor obtains prior to a final debarment decision shall remain in effect for the current term, but may not be extended or renewed. Notwithstanding the foregoing, the Director may cancel a contract held by a debarred vendor if the Director determines, in his or her sole discretion, that doing so is in the best interest of the State. A vendor prohibited from participating in federal procurement will not be permitted to participate in the state's procurement process during debarment proceedings.

5.5.3. If the Director's final debarment decision is that debarment is warranted and notice of the final debarment decision is mailed, the Purchasing Division shall reject any bid submitted by the debarred vendor, including any bid submitted prior to the final debarment decision if that bid has not yet been accepted and a contract consummated.

5.5.4. Pursuant to W.Va. Code § 5A-3-33e(e), the length of the debarment period will be specified in the debarment decision and will be for a period of time that the Director finds necessary and proper to protect the public from an irresponsible vendor.

5.5.5. List of Debarred Vendors. The Director shall maintain and publicly post a list of debarred vendors on the Purchasing Division's website.

5.5.6. Related Party Debarment. The Director may pursue debarment of a related party at the same time that debarment of the original vendor is proceeding or at any time thereafter that the Director determines a related party debarment is warranted. Any entity that fails to provide the Director with full, complete, and accurate information requested by the Director to determine related party

status will be presumed to be a related party subject to debarment.

5.6. Damages.

5.6.1. A vendor who fails to perform as required under a contract shall be liable for actual damages and costs incurred by the state.

5.6.2. If any commodities delivered under a contract have been used or consumed by a spending unit and on testing the commodities are found not to comply with specifications, no payment may be approved by the Spending Unit for the merchandise until the amount of actual damages incurred has been determined.

5.6.3. The Spending Unit shall seek to collect damages by following the procedures established by the Office of the Attorney General for the collection of delinquent obligations.

Credits

History: Filed 4-1-19, eff. 4-1-19; Filed 4-16-21, eff. 5-1-21.

Current through register dated May 7, 2021. Some sections may be more current. See credits for details.
W. Va. C.S.R. § 148-1-5, WV ADC § 148-1-5

End of Document

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EXHIBIT B To:
REQUIRED CONTRACT PROVISIONS FOR NON-FEDERAL ENTITY CONTRACTS UNDER FEDERAL AWARDS (2 C.F.R. § 200.317):

Prevailing Wage Determination

☐ – Not Applicable Because Contract Not for Construction

☐ – Federal Prevailing Wage Determination on Next Page

APPENDIX A, 2 C.F.R. § 418 – CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure

   Form to Report Lobbying," (Appendix B to 2 C.F.R. § 418) in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

The Contractor,_____, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. Chap.

38, Administrative Remedies for False Claims and Statements, apply to this certification and disclosure, if any.

_____

Name and Title of Contractor's Authorized Official

_____

Signature of Contractor's Authorized Official

_____

Date

BRUSH CREEK WATERSHED SITE 15
REHABILITATION PROJECT (NID ID: WV05511)
MERCER COUNTY, WEST VIRGINIA

DRAINAGE AREA	2.7 SQUARE MILES
FLOOD STORAGE (TO AUXILIARY SPILLWAY CREST)	2,079 ACRE-FEET
WATER SUPPLY STORAGE	1,516 ACRE-FEET
WATER SURFACE AREA (AT WATER SUPPLY POOL)	75 ACRES
HEIGHT OF DAM	76 FEET

PREPARED FOR THE U.S. DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICE
IN COOPERATION WITH THE WEST VIRGINIA CONSERVATION AGENCY, THE MERCER COUNTY COMMISSION, THE CITY OF PRINCETON, AND THE GREEN VALLEY-GLENWOOD PUBLIC SERVICE DISTRICT
SEPTEMBER 27, 2024

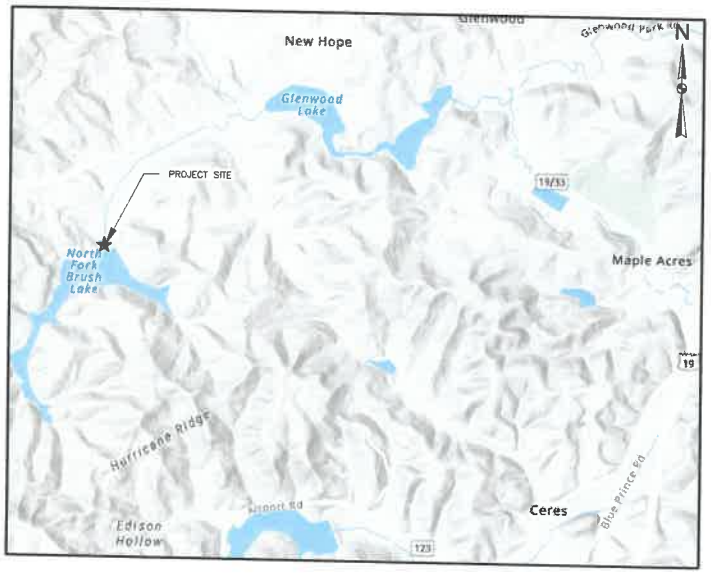
I, Jonathan Pittman, do hereby certify pursuant to the penalties of W.Va. Code, Chapter 30, Article 13 to the best of my knowledge, information and belief, that the information contained in the accompanying plans, specifications, and reports has been prepared in accordance with accepted engineering practice, is true and correct.
To the best of my professional knowledge, judgement, and belief, these plans meet applicable NRCS standards.

JONATHAN W. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

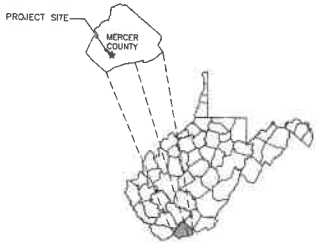
DATE: 09-27-2024

I, _____, do hereby certify pursuant to the penalties of W.Va. Code, Chapter 30, Article 13 to the best of my knowledge, information and belief, that the information contained in the accompanying plans, specifications, and reports has been installed in accordance with accepted engineering practice, is true and correct.
To the best of my professional knowledge, judgement, and belief, this practice is installed in accordance with the plans and specifications and meets applicable NRCS standards.

DATE: _____



VICINITY MAP



KEY MAP

CALL BEFORE YOU DIG!
WEST VIRGINIA LAW REQUIRES 2 WORKING DAYS NOTICE PRIOR TO EXCAVATION

JOB CLASS VIII

SHEET INDEX OF DRAWINGS

SHEET NUMBER	DRAWING NUMBER	SHEET TITLE
1	15-G-01	COVER SHEET
2	15-G-02	SYMBOL LEGEND AND GENERAL NOTES
3	15-C-01	EXISTING SITE PLAN
4	15-C-02	EXISTING EMBANKMENT DETAILS
5	15-C-03	EXISTING TRENCH DRAIN AND IMPACT BASIN DETAILS
6	15-C-04	PROPOSED SITE PLAN
7	15-C-05	SUBSURFACE EXPLORATION PLAN AND PROJECT LAYOUT AND CONTROL PLAN
8	15-C-06	GEOLOGIC PROFILES AND SECTIONS - SHEET 1 OF 3
9	15-C-07	GEOLOGIC PROFILES AND SECTIONS - SHEET 2 OF 3
10	15-C-08	GEOLOGIC PROFILES AND SECTIONS - SHEET 3 OF 3
11	15-C-09	SITE ACCESS AND STAGING PLAN
12	15-C-10	DEMOLITION PLAN
13	15-C-11	TOE DRAIN EXCAVATION PLAN
14	15-C-12	PROPOSED TOE DRAIN PLAN
15	15-C-13	EMBANKMENT SECTIONS
16	15-C-14	TOE DRAIN PROFILE
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26	15-C-24	AUXILIARY SPILLWAY SECTIONS - SHEET 3 OF 4
27	15-C-25	AUXILIARY SPILLWAY SECTIONS - SHEET 4 OF 4
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EROSION AND SEDIMENT CONTROL SHEET INDEX

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4	15-ES-04	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 1A SHT 3
5	15-ES-05	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 1A SHT 4
6	15-ES-06	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 1B SHT 1
7	15-ES-07	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 1B SHT 2
8	15-ES-08	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 1B SHT 3
9	15-ES-09	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 1B SHT 4
10	15-ES-10	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 2 SHT 1
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12	15-ES-12	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 2 SHT 3
13	15-ES-13	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 2 SHT 4
14	15-ES-14	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 3 SHT 1
15	15-ES-15	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 3 SHT 2
16	15-ES-16	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 3 SHT 3
17	15-ES-17	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 3 SHT 4
18	15-ES-18	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 4 SHT 1
19	15-ES-19	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 4 SHT 2
20	15-ES-20	EROSION AND SEDIMENT CONTROL CONTROL PLAN PHASE 4 SHT 3
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23	15-ES-23	EROSION AND SEDIMENT CONTROL PLAN DETAILS
24	15-ES-24	EROSION AND SEDIMENT CONTROL PLAN DETAILS AND NOTES
25	15-ES-25	EROSION AND SEDIMENT CONTROL PLAN NOTES

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

BRUSH CREEK SITE 15 DAM REHABILITATION
COVER SHEET
Brush Creek Watershed — Mercer County, WV

		Date
Designed	GDS	SEP 24
Drawn	CRP	SEP 24
Checked	FBB	SEP 24
Approved	JMP	SEP 24
Approved	ANDY DEICHERT	SEP 24

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USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-G-01

SEPTEMBER 2024

SHEET 1 OF 61

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ABBREVIATIONS

AB	ANCHOR BOLTS
ABC	AGGREGATE BASE COURSE
AC	ACRE
ACB	ARTICULATED CONCRETE BLOCK
ADH	ADHESIVE
ALT	ALTERNATIVE, ALTERNATE
ANC	ANCHOR
APPROX	APPROXIMATE
ASW	AUXILIARY SPILLWAY
AWS	AMERICAN WELDING SOCIETY
AWWA	AMERICAN WATER WORKS ASSOCIATION
BM	BENCH MARK
BOM	BILL OF MATERIALS
BOT	BOTTOM
BF	BOTTOM FACE
C-C	CENTER TO CENTER
CHK	CHECK
CG	CENTER OF GRAVITY
CJ	CONSTRUCTION JOINT
CPA	CONCRETE PLACEMENT AREA
CTR	CENTER, CENTERS
CM/SEC	CENTIMETERS PER SECOND
CMP	CORRUGATED METAL PIPE
CNTR	CENTER
CONC	CONCRETE
COR	CONTRACTING OFFICER'S REPRESENTATIVE
CS	CONSTRUCTION SPECIFICATION
DBA	DEFORMED BAR ANCHOR
DEG	DEGREES
DET	DETAIL
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
D/S	DOWNSTREAM
DWG	DRAWING
DWL	DOWEL
EA	EACH
EF	EACH FACE
EL	ELEVATION
EMB	EMBEDMENT
EQ	EQUAL
ES	EQUAL SPACE
EW	EACH WAY
EXP ANC	EXPANSION ANCHOR
FF	FAR FACE
FPS	FEET PER SECOND
FS	FAR SIDE
FT	FEET
FUI	FUTURE UNIT INTAKE
GPM	GALLONS PER MINUTE
HDPE	HIGH DENSITY POLYETHYLENE
HK	HOOK
HORIZ	HORIZONTAL
HS	HIGH STRENGTH
HSS	HOLLOW STRUCTURAL SECTION
HW	HEADWATER
HYDRO	HYDROPHILIC
ID	INSIDE DIAMETER
IN	INCHES
INJ	INJECTION
INV	INVERT
LB	POUND
LT	LEFT
LG	LONG, LENGTH
MAX	MAXIMUM
MIN	MINIMUM
NF	NEAR FACE
NOM	NOMINAL
NS	NEAR SIDE
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
PL	PLATE
PT ANC	POST TENSION ANCHOR
PROJ	PROJECT
PSW	PRINCIPAL SPILLWAY
PVC	POLYVINYL CHLORIDE PIPE
R	RADIUS
RCC	ROLLER COMPACTED CONCRETE
RCP	REINFORCED CONCRETE
REINF	REINFORCING, REINFORCED
REF	REFERENCE
REQD	REQUIRED
RT	RIGHT
RHT	RIGHT HAND THREAD
SF	SILT FENCE
SHT	SHEET
SIM	SIMILAR
SL	STOP LOG
SP	SPACE
SPEC	SPECIFICATION
SS	STAINLESS STEEL
SSF	SUPER SILT FENCE
STD	STANDARD
STL	STEEL
SYM	SYMMETRICAL
TEMP	TEMPORARY
TF	TOP FACE
TR	TRASH RACK
TS	TUBE STEEL
TYP	TYPICAL
TOS	TOP OF STEEL
TW	TAILWATER
UNO	UNLESS NOTED OTHERWISE
U/S	UPSTREAM
UV	UNIFORMLY VARYING
VERT	VERTICAL
VWP	VIBRATING WIRE PIEZOMETER
W/	WITH
W/O	WITHOUT
WP	WORK POINT
WS	WATER STOP
WSTUD	WELDABLE STUD

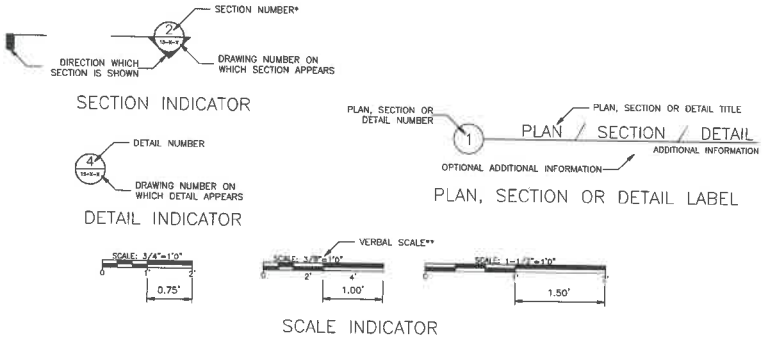
EXISTING FEATURES LEGEND

EXISTING IRON PIN	O EIP
EXISTING REBAR	O EIR
NO POINT SET	● NPS
IRON REBAR SET	● IRS
LIGHT POLE	
ELECTRIC MANHOLE	(E)
ELECTRIC METER	E
ELECTRIC TRANSFORMER	
UTILITY POLE	
BOLLARD	
CLEAN OUT	
SEWER MANHOLE	
SIGN	
STORM MANHOLE	
FIRE HYDRANT	
WATER MANHOLE	
WATER METER	
WATER VALVE	WV
WELL	
MANHOLE	MH
TREE	
RIGHT-OF-WAY	R/W
CONCRETE MONUMENT	CM
CHORD	CH
SIGHT EASEMENT	SE
DEED BOOK	DB
PLAT BOOK	PB
CURB AND GUTTER	C&G
REINFORCED CONC PIPE	RCP
CORRUGATED METAL PIPE	CMP
CORRUGATED PLASTIC PIPE	CPP
MAJOR COUNTOUR	2440
MINOR COUNTOUR	
SANITARY SEWER LINE	SS
UNDERGROUND ELECTRIC LINE	UE
OVERHEARD ELECTRIC LINE	OHE
TREE LINE	
WATER LINE	W
FENCE LINE	F
EXISTING RIPRAP LIMITS	
EDGE OF WATER	
LIMITS OF DISTURBANCE	LOD
ASPHALT	
CONCRETE	
FINE DRAINFILL	
COARSE DRAINFILL	
WETLANDS	
GRAVEL	
RIPRAP	
BEDDING STONE	
NONWOVEN GEOTEXTILE	
CLEARING AND GRUBBING	

GENERAL NOTES

1. THE CONTRACTOR IS RESPONSIBLE FOR CHECKING AND VERIFYING THE EXISTING INFORMATION PRESENTED ON THESE DRAWINGS. ANY DISCREPANCIES SHALL BE ADDRESSED TO THE CONTRACTOR OFFICER'S REPRESENTATIVE (COR) IN WRITING.
2. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO PERFORM ALL WORK IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS CONCERNING THE DISTURBANCE OF WETLANDS AND STREAMS.
3. ALL PUBLIC ROADWAYS SHALL REMAIN OPEN AT ALL TIMES. IT IS THE CONTRACTOR'S RESPONSIBILITY TO MAINTAIN ROAD SURFACES CLEAN AND FREE OF CONSTRUCTION SEDIMENT AND DEBRIS AT ALL TIMES.
4. ALL WORK SHALL BE IN ACCORDANCE WITH APPLICABLE LOCAL, COUNTY, STATE, AND FEDERAL REGULATIONS AND PERMIT REQUIREMENTS. THE CONTRACTOR IS RESPONSIBLE FOR NOTIFYING AND COORDINATING ALL WORK WITH THE AFFECTED UTILITY COMPANIES.
5. THE CONTRACTOR SHALL ESTABLISH PERMANENT BENCHMARKS. THE LOCATIONS OF THESE BENCHMARKS SHALL BE APPROVED BY THE COR PRIOR TO INSTALLATION.
6. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING THE EXISTING UTILITY INFORMATION PRESENTED ON THESE DRAWINGS. ANY DISCREPANCIES SHALL BE ADDRESSED TO THE ENGINEER AND CONTRACTING OFFICER'S REPRESENTATIVE (COR) IN WRITING. THE CONTRACTOR IS RESPONSIBLE FOR NOTIFYING AND COORDINATING WORK WITH THE AFFECTED UTILITY COMPANIES.
7. TOPOGRAPHIC AND BATHYMETRIC DATA WAS PROVIDED BY NRCS ON MAY 15, 2019. TOPOGRAPHIC DATA AND EXISTING SITE FEATURES ARE BASED ON THE GANNETT FLEMING SURVEY PERFORMED IN MARCH 2016. BATHYMETRIC DATA IS BASED ON THE GANNETT FLEMING SURVEY PERFORMED IN MAY 2016.
8. THE REFERENCED COORDINATE SYSTEM FOR ALL DRAWINGS ARE THE NAVD88 VERTICAL DATUM AND NAD83 (2011) HORIZONTAL DATUM, WEST VIRGINIA STATE PLANE SOUTH COORDINATE SYSTEM.
9. LIMITS OF DISTURBANCE: 23.41 ACRES
10. CALL BEFORE YOU DIG! CONTRACTOR SHALL CONTACT WEST VIRGINIA 811 CALL SYSTEM AT LEAST TWO WORKING DAYS PRIOR TO ANY EXCAVATION.
11. REFERENCES TO "LEFT" AND "RIGHT" WITHIN THESE PLANS ASSUME ONE IS LOOKING DOWNSTREAM.
12. THE CONTRACTOR SHALL PROVIDE ADEQUATE MEANS OF CLEANING TRUCKS AND/OR OTHER EQUIPMENT OF MUD PRIOR TO ENTERING THE WVDOT AND LOCAL RIGHT-OF-WAY. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CLEAN ALL STREETS, TO ALLAY DUST AND TO TAKE WHATEVER MEASURES NECESSARY TO ENSURE THE ROAD(S) ARE MAINTAINED IN A CLEAN, MUD AND DUST FREE CONDITION AT ALL TIMES.
13. WHERE EXISTING NATURAL DRAINAGE DITCHES OR STREAM BANKS ARE DISTURBED DURING CONSTRUCTION THE CONTRACTOR SHALL RESTORE THESE AREAS TO ORIGINAL ALIGNMENT, GRADE, AND INVERT UNLESS OTHERWISE SHOWN ON THE DRAWINGS.
14. THE CONTRACTOR SHALL RESTORE ALL DISTURBED AREAS WITH SEED AND MULCH OR SOD UNLESS OTHERWISE SHOWN ON THE DRAWINGS.
15. THE CONTRACTOR SHALL CONFORM WITH NRCS SUPPLEMENT TO OSHA PARTS 1910 AND 1926 AS FOUND IN NEH 645, APPENDIX F.

DRAWING SYMBOLS LEGEND



* SECTION AND ELEVATION INDICATORS ARE SIMILAR. SECTION AND ELEVATION NUMBERS ARE COMBINED AND SEQUENTIAL ON EACH DRAWING.

** VERBAL SCALE IS SHOWN FOR CONVENIENCE ONLY AND IS APPLICABLE TO ANSI D 22"X34" SHEETS ONLY. THE VERBAL SCALE IS NOT ACCURATE WHEN DRAWINGS ARE NOT PLOTTED AT THE INTENDED SIZE OF ANSI D 22"X34". ALL DRAWINGS SHOULD BE CHECKED TO ENSURE THAT THE SCALE BAR IS SHOWN CORRECTLY AT THE PLOTTED SHEET SIZE.

JONATHAN W PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed GDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JWP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

SYMBOL LEGEND AND GENERAL NOTES

Brush Creek Watershed *Mercer County, WV*

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Natural Resources Conservation Service

Contract No. 12SPEC18D0023

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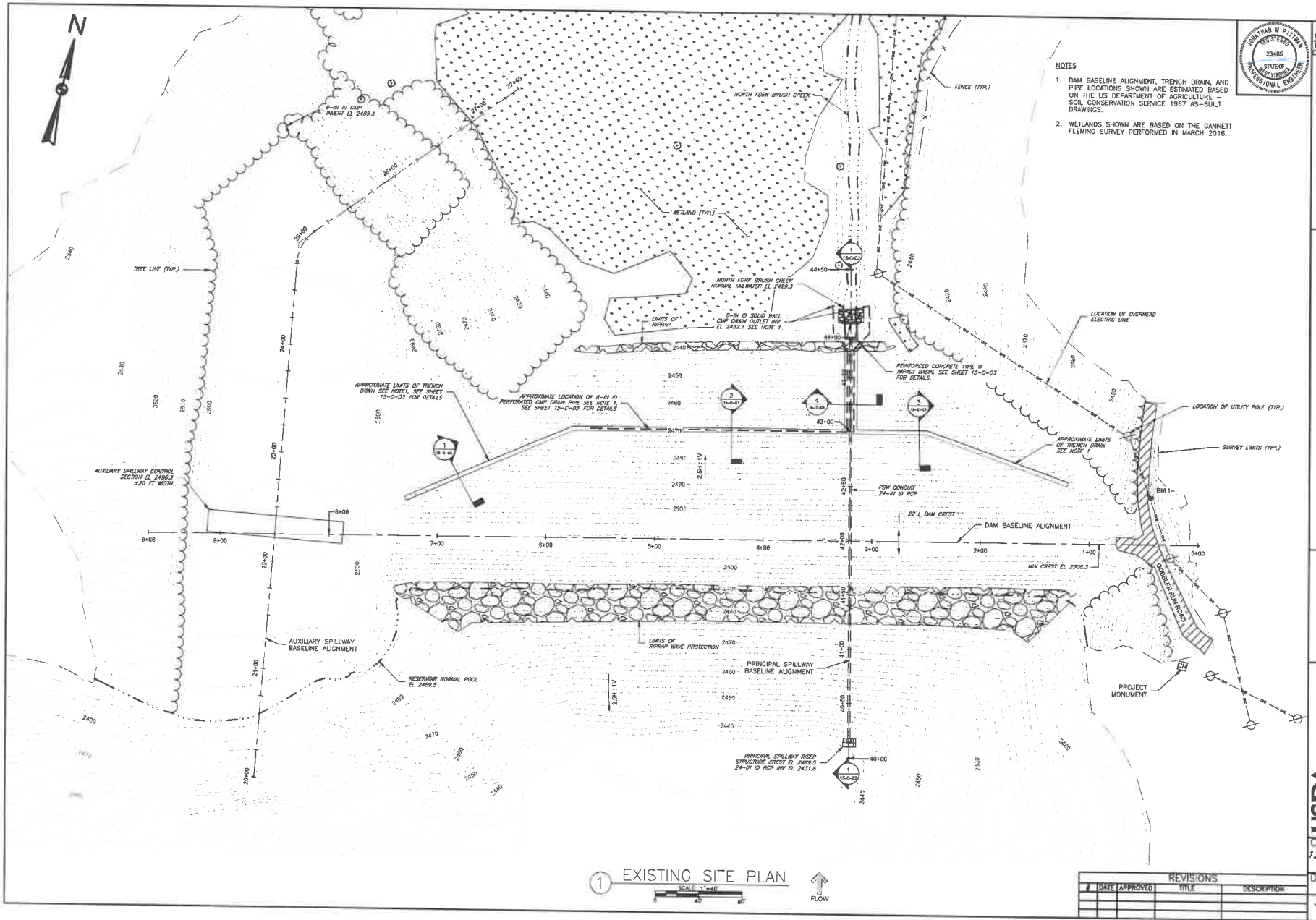

1 EXISTING SITE PLAN
SCALE: 1"=40'

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Designed	CDS	SEP 24
Drawn	CRP	SEP 24
Checked	EBB	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

EXISTING SITE PLAN

Brush Creek Watershed Mercer County, WV

USDA United States Department of Agriculture Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-01

SEPTEMBER 2024

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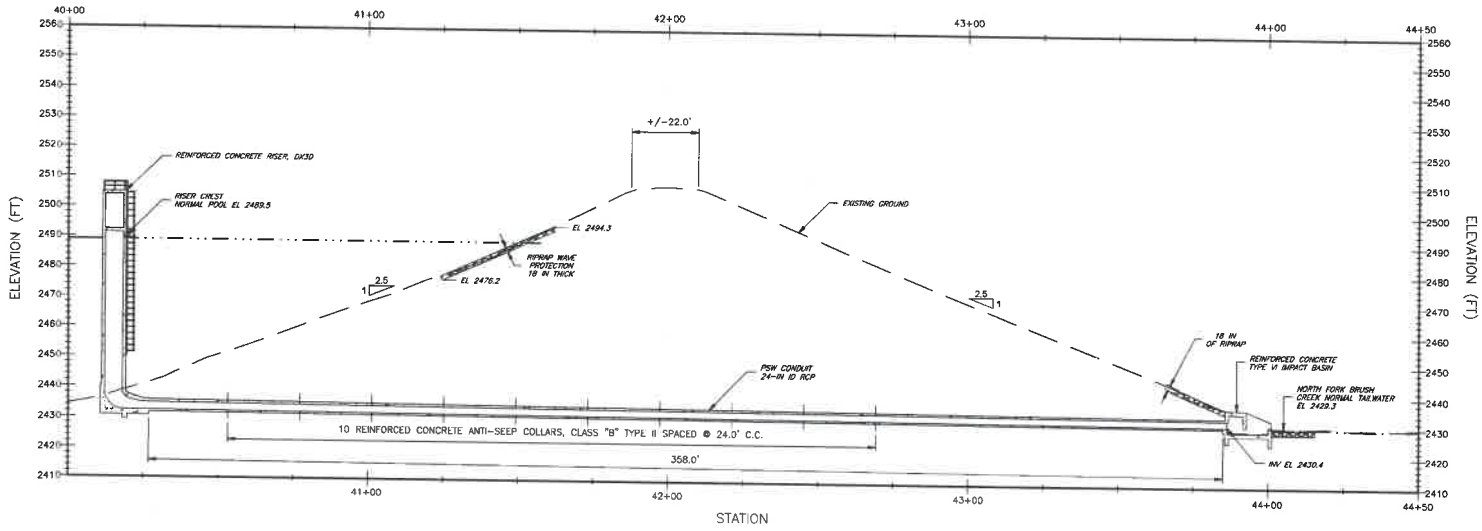
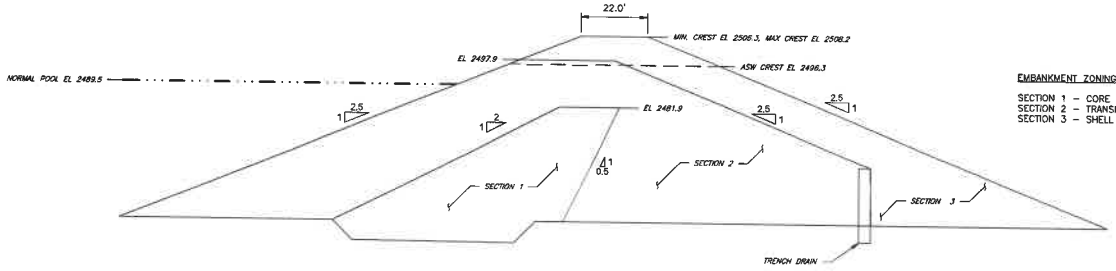


1 PRINCIPAL SPILLWAY PROFILE



2 TYPICAL EMBANKMENT DETAILS

SCALE: 1" = 20'

EMBANKMENT ZONING

SECTION 1 – CORE
SECTION 2 – TRANSITION
SECTION 3 – SHELL

NOTES

1. TYPICAL EMBANKMENT DETAILS SHOWN ARE BASED ON US DEPARTMENT OF AGRICULTURE – SOIL CONSERVATION SERVICE 1967 AS-BUILT DRAWINGS.

JONATHAN M PITTMAN
REGISTERED
23485
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

	Designed	Drawn	Checked	Approved
Date	SEP 24	SEP 24	SEP 24	SEP 24
	CDS	CRP	ERB	JMP

BRUSH CREEK SITE 15 DAM REHABILITATION

EXISTING EMBANKMENT DETAILS

Brush Creek Watershed — Mercer County, WV

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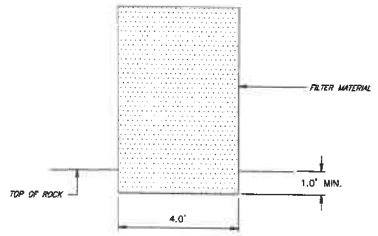
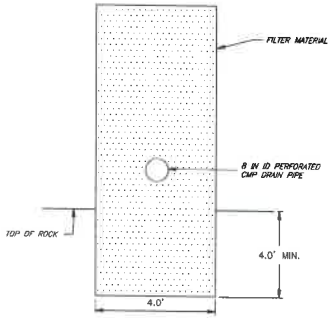


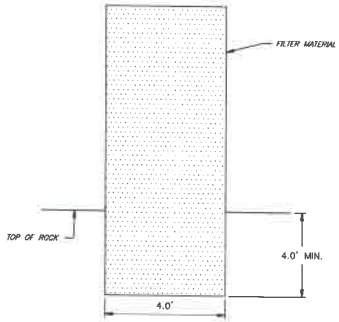
1 TRENCH DRAIN STA 6+80

SCALE: 1"=2'



2 TRENCH DRAIN STA 4+30

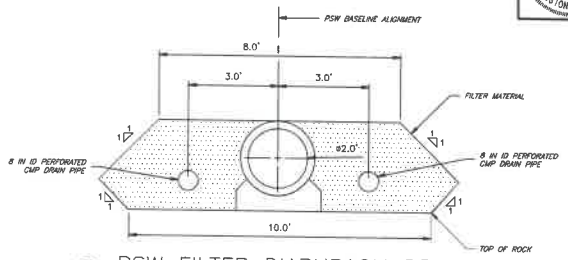
SCALE: 1"=2'



3 TRENCH DRAIN STA 2+60

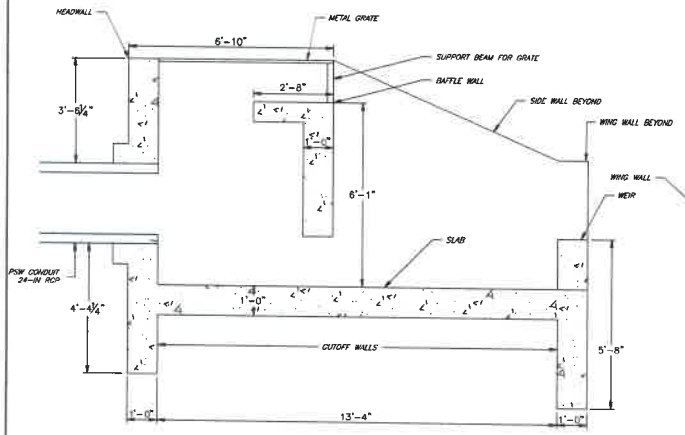
SCALE: 1"=2'

NOTE: DETAILS 1-3 STATIONING ARE BASED ON THE DAM BASELINE ALIGNMENT.



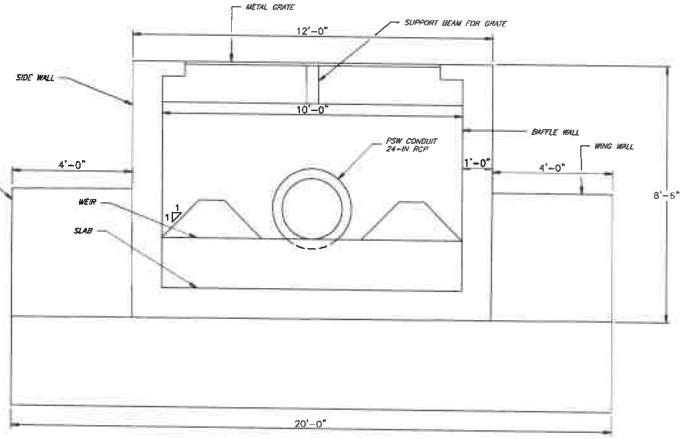
4 PSW FILTER DIAPHRAGM DETAILS

SCALE: 1"=2'



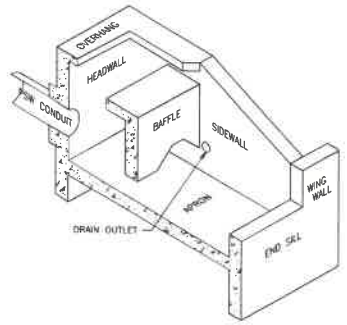
5 IMPACT BASIN SECTION

SCALE: 1"=2'



6 IMPACT BASIN ELEVATION

SCALE: 1"=2'



7 IMPACT BASIN HALF ISOMETRIC

NTS

NOTES

1. EXISTING DETAILS SHOWN ARE BASED ON US DEPARTMENT OF AGRICULTURE – SOIL CONSERVATION SERVICE 1967 AS-BUILT DRAWINGS

REVISIONS				
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JONATHAN M PITTMAN
REGISTERED
23465
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

Date	
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

EXSTING TRENCH DRAIN AND IMPACT BASIN DETAILS

Brush Creek Watershed — Mercer County, WV

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SHEET 5 OF 61

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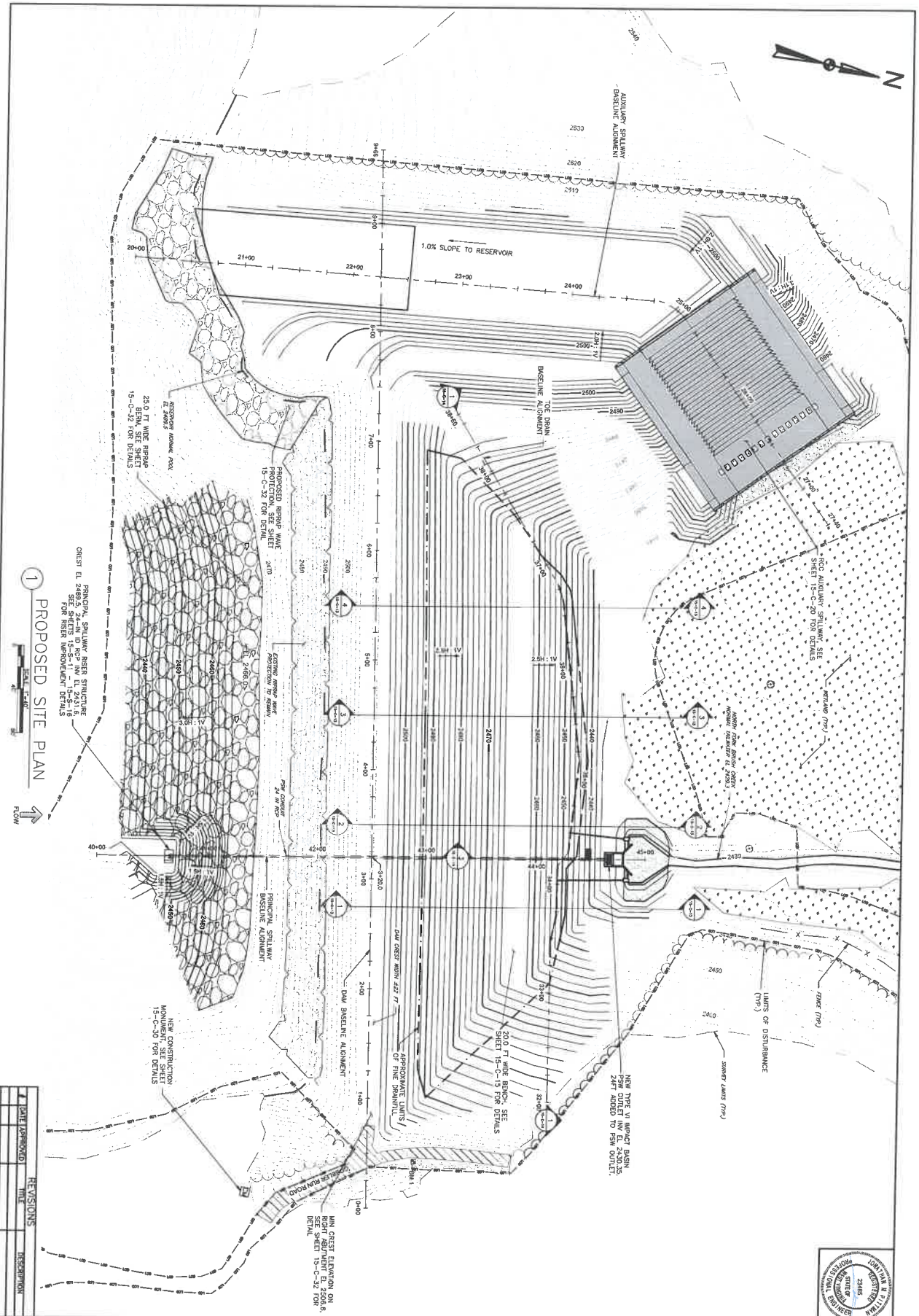

REVISIONS			
DESCRIPTION	TITLE	DATE APPROVED	

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Contract No. 12SPEC1800023
Drawing No. 15-C-04
SEPTEMBER 2024
SHEET 6 OF 61

USDA United States Department of Agriculture
Natural Resources Conservation Service

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Phone: 336-274-9456
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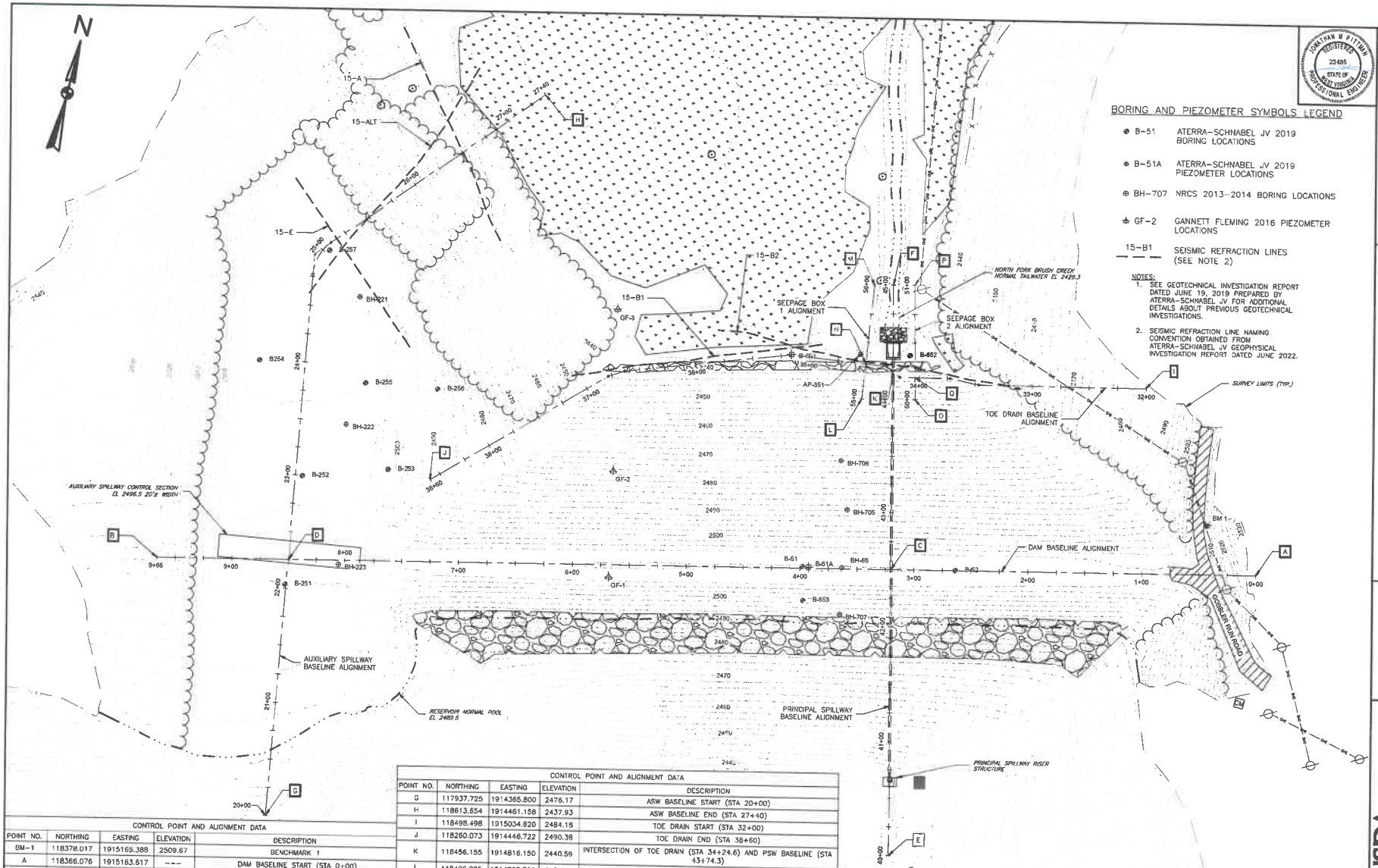
BRUSH CREEK SITE 15 DAM REHABILITATION

PROPOSED SITE PLAN

Brush Creek Watershed — *Mercer County, WV*

		Date
Designed	CDS	SEP 24
Drawn	CRP	SEP 24
Checked	EBB	SEP 24
Approved	JMP	SEP 24

PROFESSIONAL ENGINEER — STATE OF WEST VIRGINIA — JOHN MATTHEW PARSONS — 23485 — REGISTERED



BORING AND PIEZOMETER SYMBOLS LEGEND

- ● B-51 — ATERRA–SCHNABEL JV 2019 BORING LOCATIONS
- ✱ B-51A — ATERRA–SCHNABEL JV 2019 PIEZOMETER LOCATIONS
- ⊕ BH-707 — NRCS 2013–2014 BORING LOCATIONS
- ✱ GF-2 — GANNETT FLEMING 2016 PIEZOMETER LOCATIONS
- 15-B1 — SEISMIC REFRACTION LINES (SEE NOTE 2)

NOTES:
1. SEE GEOTECHNICAL INVESTIGATION REPORT DATED JUNE 19, 2019 PREPARED BY ATERRA–SCHNABEL JV FOR ADDITIONAL DETAILS ABOUT PREVIOUS GEOTECHNICAL INVESTIGATIONS.
2. SEISMIC REFRACTION LINE NAMING CONVENTION OBTAINED FROM ATERRA–SCHNABEL JV GEOPHYSICAL INVESTIGATION REPORT DATED JUNE 2022.

CONTROL POINT AND ALIGNMENT DATA

POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION
BM-1	118378.017	1915165.388	2509.67	BENCHMARK 1
A	118366.076	1915163.617	---	DAM BASELINE START (STA 0+00)
B	118132.310	1914230.705	2515.08	DAM BASELINE END (STA 9+66)
C	118286.975	1914857.932	2508.11	INTERSECTION OF DAM BASELINE (STA 3+20) AND PSW BASELINE (STA 42+00)
D	118160.086	1914343.346	2496.47	INTERSECTION OF DAM BASELINE (STA 8+50) AND ASW BASELINE (STA 22+25)
E	118044.724	1914917.668	2434.36	PSW BASELINE START (STA 40+00)
F	118529.660	1914797.844	2429.70	PSW BASELINE END (STA 45+00)

CONTROL POINT AND ALIGNMENT DATA

POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION
G	117937.725	1914365.800	2476.17	ASW BASELINE START (STA 20+00)
H	118613.654	1914461.158	2437.93	ASW BASELINE END (STA 27+40)
I	118498.498	1915034.820	2484.18	TOE DRAIN START (STA 32+00)
J	118260.073	1914446.722	2490.38	TOE DRAIN END (STA 38+60)
K	118456.155	1914816.150	2440.59	INTERSECTION OF TOE DRAIN (STA 34+24.6) AND PSW BASELINE (STA 43+74.3)
L	118426.295	1914795.702	2450.41	SEEPAGE BOX 1 ALIGNMENT START (STA 55+00)
M	118525.323	1914781.796	2435.44	SEEPAGE BOX 1 ALIGNMENT END (STA 56+00)
N	118458.844	1914791.412	2438.42	INTERSECTION OF SB1 ALIGNMENT (STA 55+30.9) AND TOE DRAIN ALIGNMENT (STA 34+50.3)
O	118438.222	1914840.940	2450.34	SEEPAGE BOX 2 ALIGNMENT START (STA 50+00)
P	118534.240	1914816.176	2435.64	SEEPAGE BOX 2 ALIGNMENT END (STA 51+00)
Q	118456.093	1914836.331	2442.80	INTERSECTION OF SB2 ALIGNMENT (STA 50+19.3) AND TOE DRAIN ALIGNMENT (STA 34+03.4)

1 SUBSURFACE EXPLORATION AND PROJECT LAYOUT PLAN

SCALE: 1"=40'

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

SUBSURFACE EXPLORATION PLAN AND PROJECT LAYOUT AND CONTROL PLAN

Mercer County, WV

Brush Creek Watershed

ATERRA | Schnabel ENGINEERING

300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 267-274-9256
schnabel-eng.com

USDA United States Department of Agriculture Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-05

SEPTEMBER 2024

SHEET 7 OF 61

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

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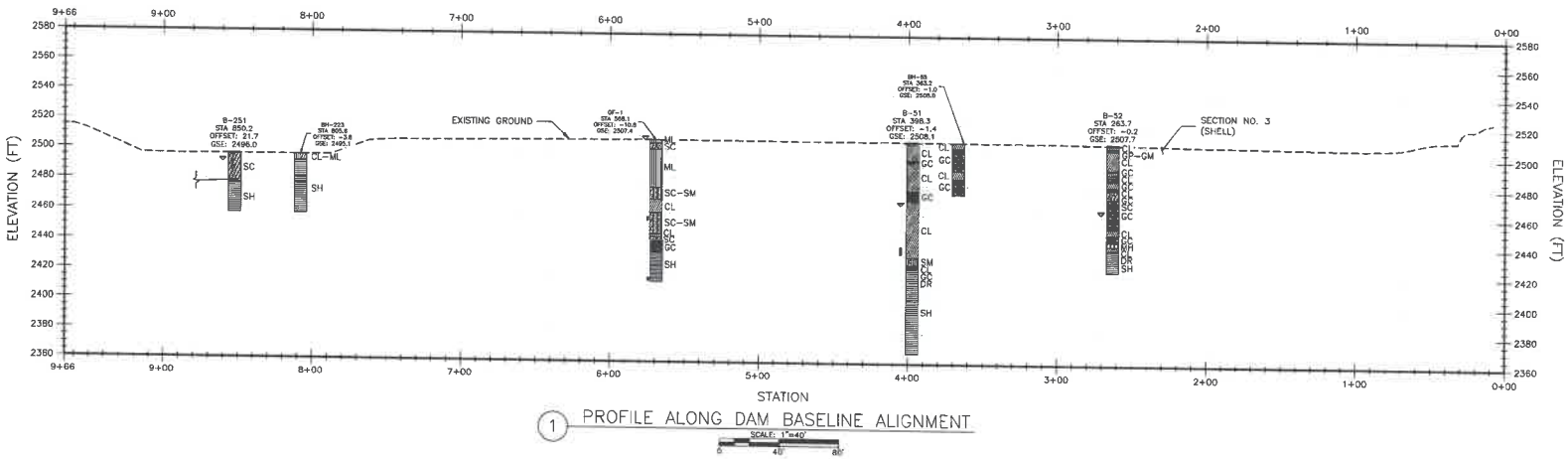
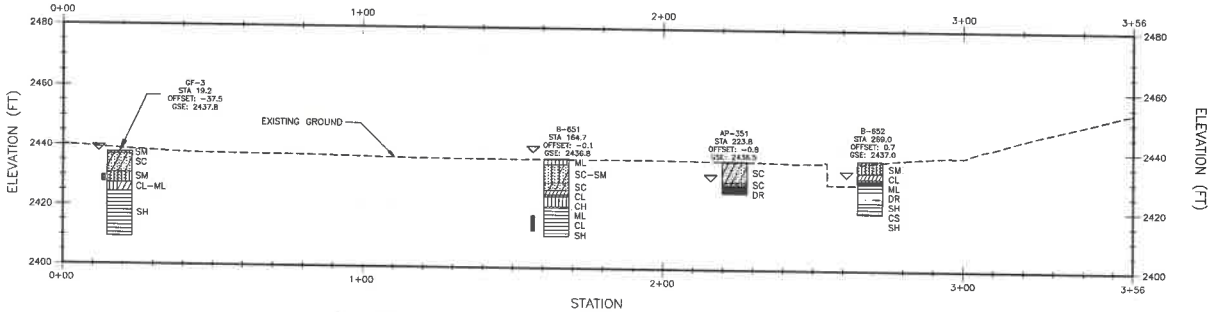


1 PROFILE ALONG DAM BASELINE ALIGNMENT

SCALE: 1"=40'



2 PROFILE ALONG DOWNSTREAM EMBANKMENT TOE

SCALE: 1"=20'

LEGEND

CH		SC-SM	
CL		SM	
CL-ML		SP	
GC		SP-SM	
GM		DISINTEGRATED ROCK (DR)	
GP		CLAYSTONE (CS)	
GP-GM		SHALE (SH)	
GW-GC		LIMESTONE W/ SHALE (LS/SH)	
MH		OBSERVED WATER LEVEL	
ML		PIEZOMETER SCREEN LOCATION	
SC			

NOTES:

1. BORING DATA OBTAINED BY ATERRA–SCHNABEL JV IS PRESENTED IN THE FINAL GEOTECHNICAL INVESTIGATION REPORT, REVISION 1, DATED OCTOBER 28 2021
2. STRATIGRAPHY AND WATER LEVELS OBSERVED IN THE BORINGS MAY NOT BE REPRESENTATIVE OF SUBSURFACE CONDITIONS BETWEEN BORINGS. GROUNDWATER LEVELS SHOWN ARE THE LAST READING BEFORE GROUTING OR WERE MEASURED IN PIEZOMETERS, IF INSTALLED.
3. BORING DATA OBTAINED BY OTHERS IS BASED ON DATA PRESENTED IN THE SUPPLEMENTAL WATERSHED PLAN – ENVIRONMENTAL ASSESSMENT FOR THE REHABILITATION OF BRUSH CREEK SITE 15 WATERSHED DAM DATED FEBRUARY 2017.

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

REVISIONS			
#	DATE APPROVED	TITLE	DESCRIPTION

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Date	
Designed COS	SEP 24
Drawn CRP	SEP 24
Checked FBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

GEOLOGIC PROFILES AND SECTIONS – SHEET 1 OF 3

Brush Creek Watershed *Mercer County, WV*

USDA United States Department of Agriculture Natural Resources Conservation Service

ATERRA SCHNABEL JV

300 Brookside Ave, Bldg 18, Suite 100, Ambler, PA 19002
Phone: 267-219-3456
267-219-3457

Contract No. 12SPEC18D0023

Drawing No. 15-C-06

SEPTEMBER 2024

SHEET 8 OF 61

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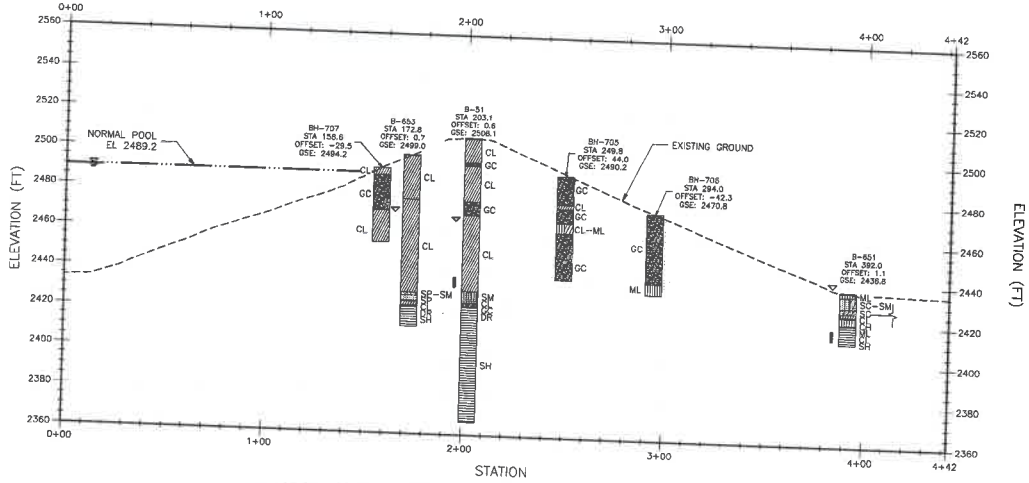
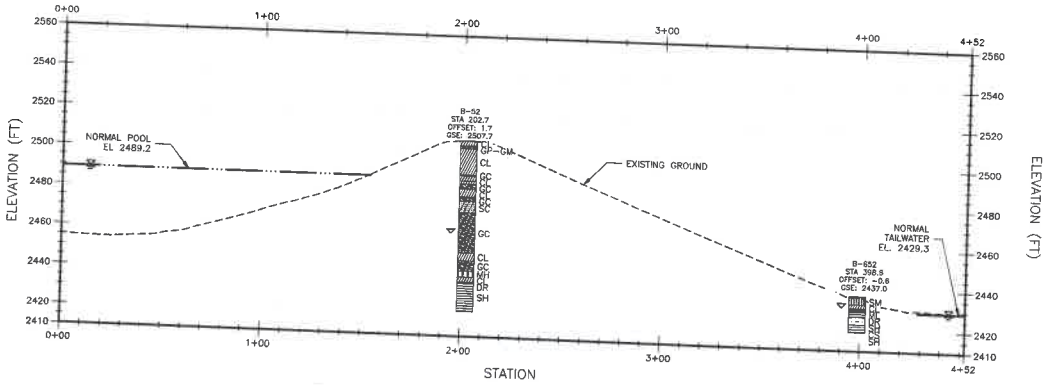


FLOW 3 EMBANKMENT SECTION AT STATION 4+00

SCALE: 1"=30'



FLOW 4 EMBANKMENT SECTION AT STATION 2+65

SCALE: 1"=30'

LEGEND

CH	SC-SM
CL	SM
CL-ML	SP
GC	SP-SM
GM	DISINTEGRATED ROCK (DR)
GP	CLAYSTONE (CS)
GP-GM	SHALE (SH)
GW-GC	LIMESTONE W/ SHALE (LS/SH)
MH	OBSERVED WATER LEVEL
ML	PIEZOMETER SCREEN LOCATION
SC	

NOTES:

1. BORING DATA OBTAINED BY ATERRA-SCHNABEL JV IS PRESENTED IN THE FINAL GEOTECHNICAL INVESTIGATION REPORT, REVISION 1, DATED OCTOBER 28, 2021
2. STRATIGRAPHY AND WATER LEVELS OBSERVED IN THE BORINGS MAY NOT BE REPRESENTATIVE OF SUBSURFACE CONDITIONS BETWEEN BORINGS. GROUNDWATER LEVELS SHOWN ARE THE LAST READING BEFORE GROUTING OR WERE MEASURED IN PIEZOMETERS, IF INSTALLED.
3. BORING DATA OBTAINED BY OTHERS IS BASED ON DATA PRESENTED IN THE SUPPLEMENTAL WATERSHED PLAN – ENVIRONMENTAL ASSESSMENT FOR THE REHABILITATION OF BRUSH CREEK SITE 15 WATERSHED DAM DATED FEBRUARY 2017.

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Designed	Drawn	Checked	Approved
	CDS	CRP	EBB	JMP
Date	SEP 24	SEP 24	SEP 24	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

GEOLOGIC PROFILES AND SECTIONS – SHEET 2 OF 3

Brush Creek Watershed *Mercer County, WV*

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United States Department of Agriculture

USDA Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-07

SEPTEMBER 2024

SHEET 9 OF 61

#	DATE	APPROVED	REVISIONS TITLE	DESCRIPTION

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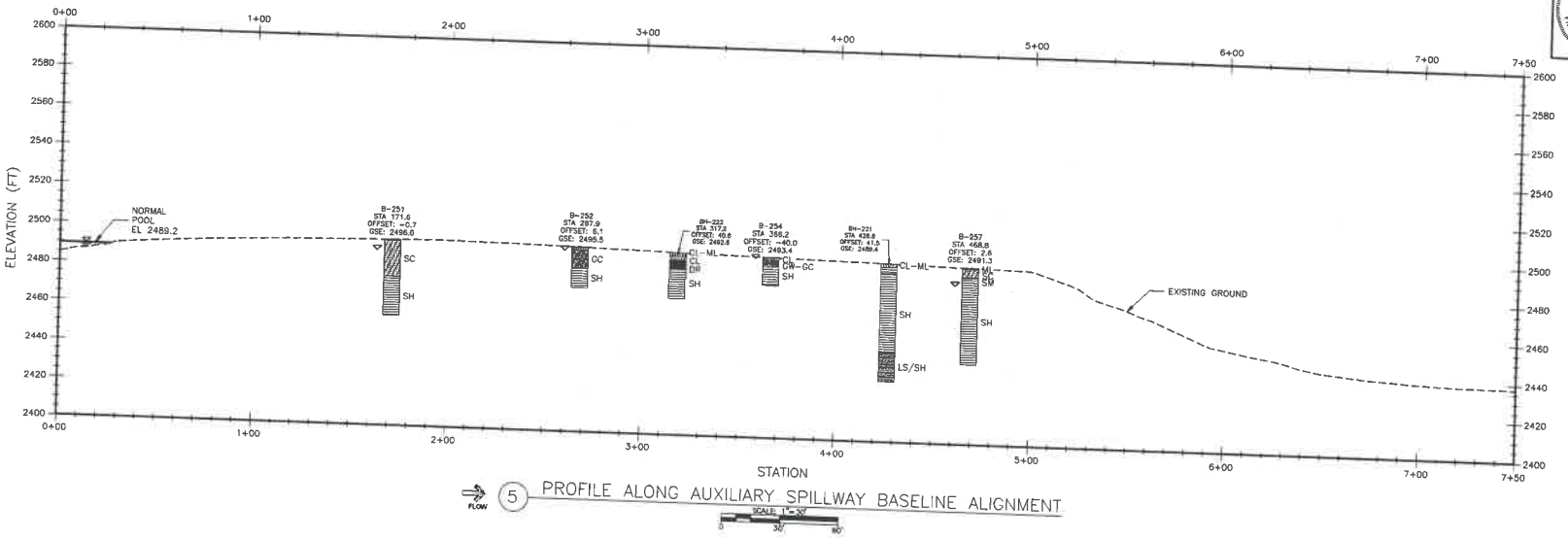
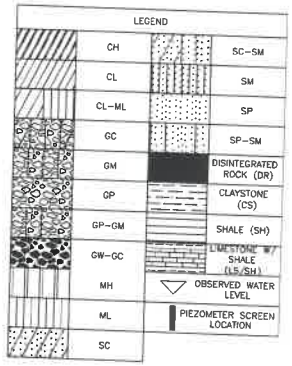
AND SECTIONS - SHEET 2 OF 3



5 PROFILE ALONG AUXILIARY SPILLWAY BASELINE ALIGNMENT

SCALE: 1" = 30'



NOTES:

1. BORING DATA OBTAINED BY ATERRA–SCHNABEL JV IS PRESENTED IN THE FINAL GEOTECHNICAL INVESTIGATION REPORT, REVISION 1. DATED OCTOBER 28, 2021.
2. STRATIGRAPHY AND WATER LEVELS OBSERVED IN THE BORINGS MAY NOT BE REPRESENTATIVE OF SUBSURFACE CONDITIONS BETWEEN BORINGS. GROUNDWATER LEVELS SHOWN ARE THE LAST READING BEFORE GROUTING OR WERE MEASURED IN PIEZOMETERS, IF INSTALLED.
3. BORING DATA OBTAINED BY OTHERS IS BASED ON DATA PRESENTED IN THE SUPPLEMENTAL WATERSHED PLAN – ENVIRONMENTAL ASSESSMENT FOR THE REHABILITATION OF BRUSH CREEK SITE 15 WATERSHED DAM DATED FEBRUARY 2017.

JONATHAN W. PITTMAN REGISTERED 22485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

REVISIONS			
#	DATE	APPROVED	TITLE / DESCRIPTION

	Date
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked FBB	SEP 24
Approved JWP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

GEOLOGIC PROFILES AND SECTIONS – SHEET 3 OF 3

Brush Creek Watershed *Mercer County, WV*

ATERRA | Schnabel

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United States Department of Agriculture

USDA Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-08

SEPTEMBER 2024

SHEET 10 OF 61

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PWD: NOTE (15C-15-11-GB) - SHEET 3 OF 3

1 SITE ACCESS AND STAGING AREA PLAN

SCALE: 1" = 100'

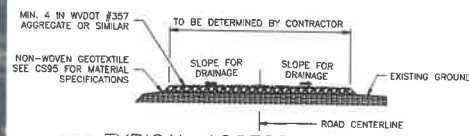
NOTES:

1. SEE SHEETS ES-01 – ES-15 FOR EROSION AND SEDIMENT CONTROL DETAILS.
2. AUXILIARY SPILLWAY MAY BE USED AS A STAGING/STOCKPILING AREA DURING THE EMBANKMENT WORK PROVIDED THE REQUIREMENTS IN THE SPECIAL CONDITIONS ARE MET
3. AREAS USED FOR SITE ACCESS, STAGING, AND STOCKPILING SHALL BE REPAIRED TO PRE-WORK CONDITIONS OR BETTER TO THE SATISFACTION OF THE COR UNLESS OTHERWISE SHOWN ON THE DRAWINGS.
4. EXISTING ROADWAY TO DAM CREST AND BOAT RAMP SHALL BE ACCESSIBLE BY THE SPONSORS AND PSD AT ALL TIMES. THE CONTRACTOR IS RESPONSIBLE FOR COSTS ASSOCIATED WITH IMPROVEMENTS TO ACCOMMODATE CONTRACTOR'S MEANS/METHODS TO THIS EXISTING ROADWAY. THE CONTRACTOR SHALL REPAIR THE ROADWAY TO PRE-CONSTRUCTION CONDITIONS AND TO THE SATISFACTION OF THE COR.

LEGEND

- EXISTING ROAD
- TEMPORARY ROAD/ CONSTRUCTION STAGING/ STOCKPILE AREA
- CLEARING AND GRUBBING LIMITS
- WETLANDS

SITE IMPACTS	
DESCRIPTION	AREA (AC)
LIMITS OF DISTURBANCE	20.16
CONSTRUCTION STAGING/STOCKPILING	5.87
CLEARING AND GRUBBING	2.22
PERMANENT WETLAND IMPACTS	0.15
TEMPORARY WETLAND IMPACTS	2.75



2 TYPICAL ACCESS ROAD DETAIL

NTS

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REVISIONS			
#	DATE	APPROVED	TITLE	DESCRIPTION

Date		
Designed	CDS	SEP 24
Drawn	CRP	SEP 24
Checked	RBB	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

SITE ACCESS AND STAGING PLAN

Brush Creek Watershed — Mercer County, WV

USDA United States Department of Agriculture Natural Resources Conservation Service

ATERRA SCHNABEL

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Contract No. 12SPEC18D0023

Drawing No. 15-C-09

SEPTEMBER 2024

SHEET 11 OF 61

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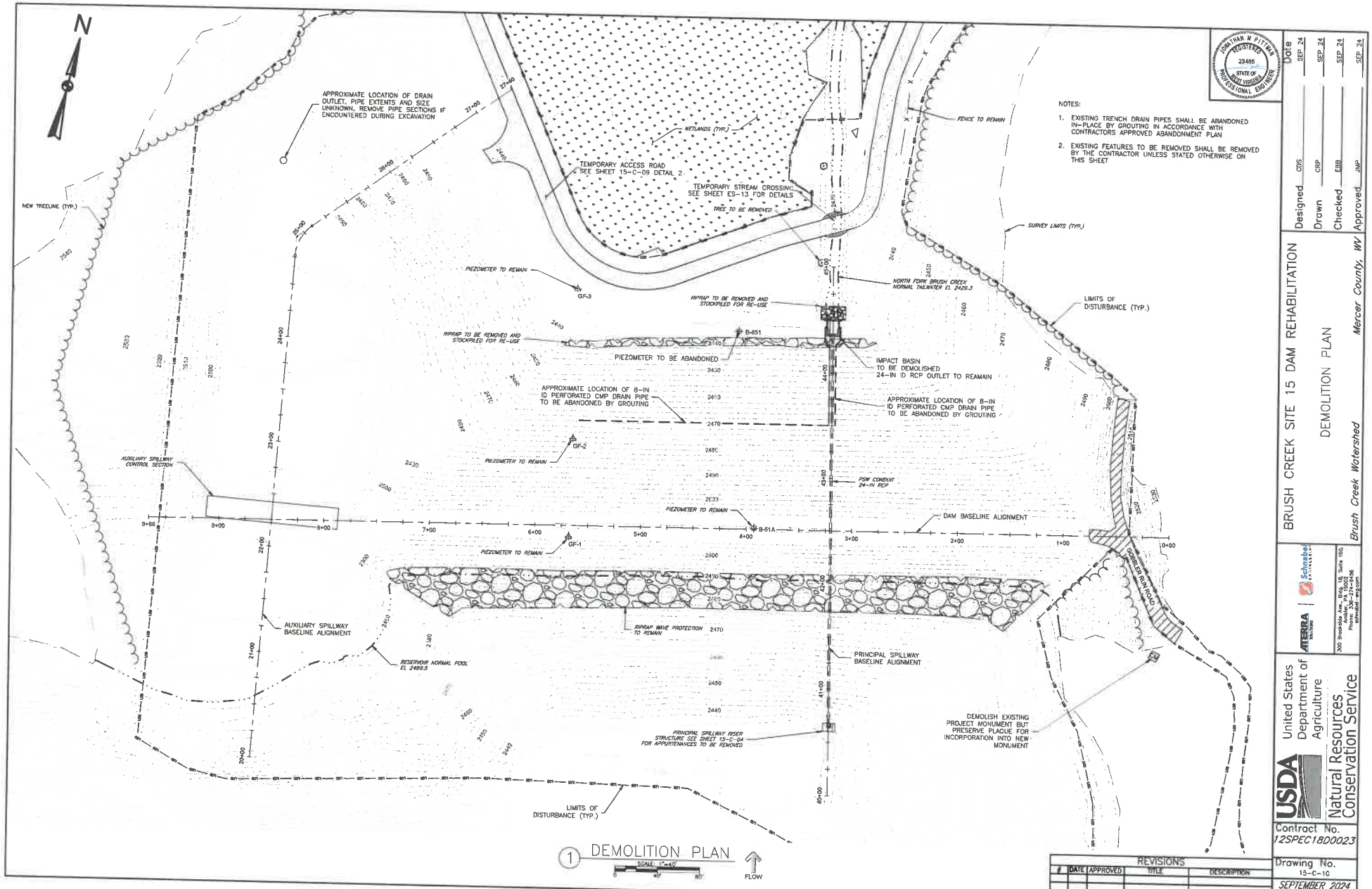

1 DEMOLITION PLAN
SCALE: 1"=40'

JONATHAN M. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

REVISIONS			
#	DATE APPROVED	TITLE	DESCRIPTION

BRUSH CREEK SITE 15 DAM REHABILITATION

DEMOLITION PLAN

Brush Creek Watershed — Mercer County, WV

		Date
Designed	CDS	SEP 24
Drawn	CRP	SEP 24
Checked	EBB	SEP 24
Approved	JMP	SEP 24

USDA United States Department of Agriculture Natural Resources Conservation Service

Aterra Schnabel

300 Brookside Ave., Bldg. 18, Suite 102, Beckley, WV 25801
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Contract No. 12SPEC18D0023

Drawing No. 15-C-10

SEPTEMBER 2024

SHEET 12 OF 61

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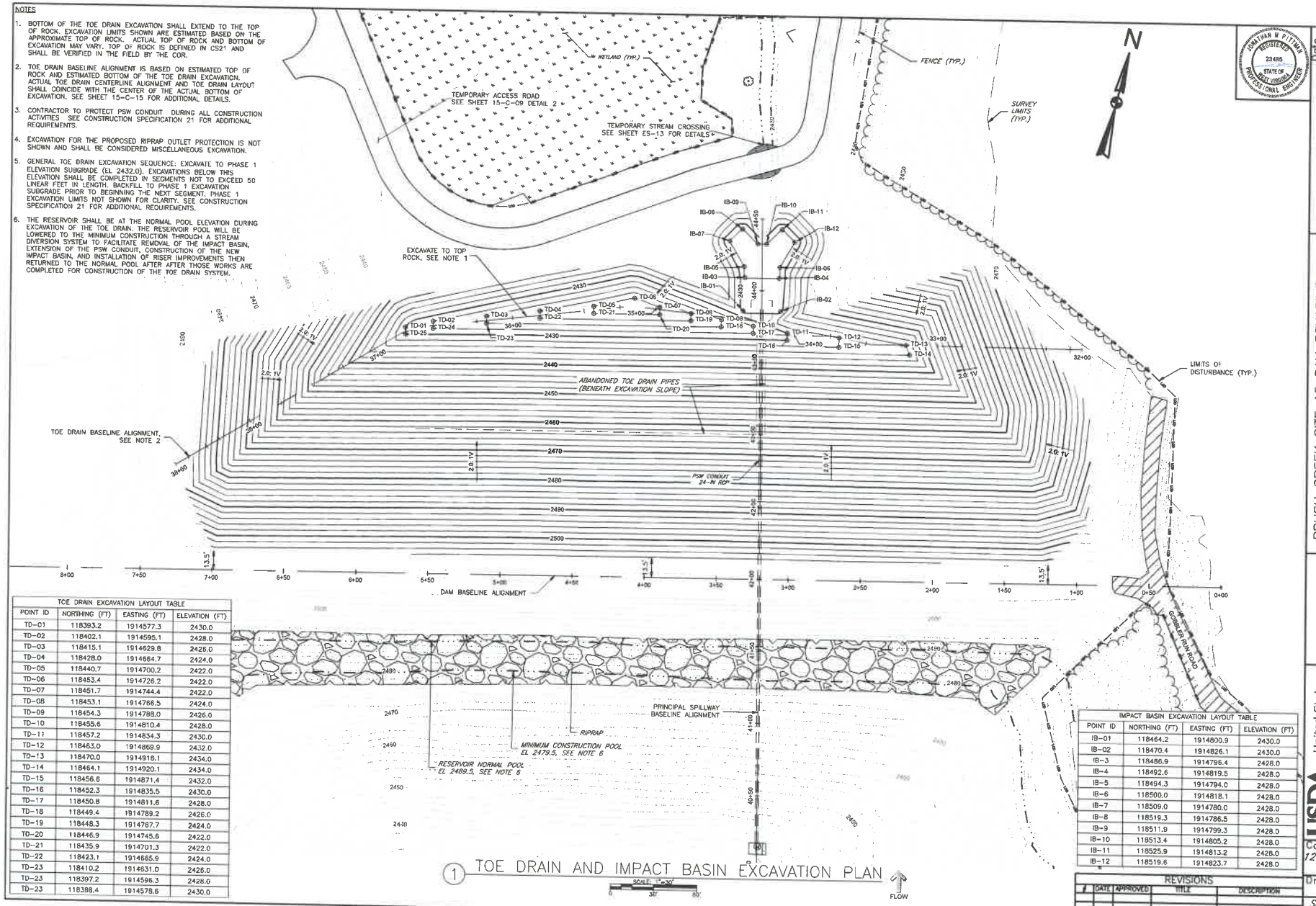
NOTES

1. BOTTOM OF THE TOE DRAIN EXCAVATION SHALL EXTEND TO THE TOP OF ROCK. EXCAVATION LIMITS SHOWN ARE ESTIMATED BASED ON THE APPROXIMATE TOP OF ROCK. ACTUAL TOP OF ROCK AND BOTTOM OF EXCAVATION MAY VARY. TOP OF ROCK IS DEFINED IN CS21 AND SHALL BE VERIFIED IN THE FIELD BY THE COR.
2. TOE DRAIN BASELINE ALIGNMENT IS BASED ON ESTIMATED TOP OF ROCK AND ESTIMATED BOTTOM OF THE TOE DRAIN EXCAVATION. ACTUAL TOE DRAIN CENTERLINE ALIGNMENT AND TOE DRAIN LAYOUT SHALL COINCIDE WITH THE CENTER OF THE ACTUAL BOTTOM OF EXCAVATION. SEE SHEET 15-C-15 FOR ADDITIONAL DETAILS.
3. CONTRACTOR TO PROTECT PSW CONDUIT DURING ALL CONSTRUCTION ACTIVITIES. SEE CONSTRUCTION SPECIFICATION 21 FOR ADDITIONAL REQUIREMENTS.
4. EXCAVATION FOR THE PROPOSED RIPRAP OUTLET PROTECTION IS NOT SHOWN AND SHALL BE CONSIDERED MISCELLANEOUS EXCAVATION.
5. GENERAL TOE DRAIN EXCAVATION SEQUENCE: EXCAVATE TO PHASE 1 ELEVATION SUBGRADE (EL 2432.0). EXCAVATIONS BELOW THIS ELEVATION SHALL BE COMPLETED IN SEGMENTS NOT TO EXCEED 50 LINEAR FEET IN LENGTH. BACKFILL TO PHASE 1 EXCAVATION SUBGRADE PRIOR TO BEGINNING THE NEXT SEGMENT. PHASE 1 EXCAVATION LIMITS NOT SHOWN FOR CLARITY. SEE CONSTRUCTION SPECIFICATION 21 FOR ADDITIONAL REQUIREMENTS.
6. THE RESERVOIR SHALL BE AT THE NORMAL POOL ELEVATION DURING EXCAVATION OF THE TOE DRAIN. THE RESERVOIR POOL WILL BE LOWERED TO THE MINIMUM CONSTRUCTION THROUGH A STREAM DIVERSION SYSTEM TO FACILITATE REMOVAL OF THE IMPACT BASIN, EXTENSION OF THE PSW CONDUIT, CONSTRUCTION OF THE NEW IMPACT BASIN, AND INSTALLATION OF RISER IMPROVEMENTS THEN RETURNED TO THE NORMAL POOL AFTER AFTER THOSE WORKS ARE COMPLETED FOR CONSTRUCTION OF THE TOE DRAIN SYSTEM.



1 TOE DRAIN AND IMPACT BASIN EXCAVATION PLAN

SCALE: 1"=30'

TOE DRAIN EXCAVATION LAYOUT TABLE

POINT ID	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)
TD-01	118393.2	1914577.3	2430.0
TD-02	118402.1	1914595.1	2428.0
TD-03	118415.1	1914629.8	2426.0
TD-04	118428.0	1914664.7	2424.0
TD-05	118440.7	1914700.2	2422.0
TD-06	118453.4	1914726.2	2422.0
TD-07	118451.7	1914744.4	2422.0
TD-08	118453.1	1914766.5	2424.0
TD-09	118454.3	1914788.0	2426.0
TD-10	118455.6	1914810.4	2428.0
TD-11	118457.2	1914834.3	2430.0
TD-12	118463.0	1914869.9	2432.0
TD-13	118470.0	1914916.1	2434.0
TD-14	118464.1	1914920.1	2434.0
TD-15	118456.6	1914871.4	2432.0
TD-16	118452.3	1914835.5	2430.0
TD-17	118450.8	1914811.6	2428.0
TD-18	118449.4	1914789.2	2426.0
TD-19	118448.3	1914767.7	2424.0
TD-20	118446.9	1914745.6	2422.0
TD-21	118435.9	1914701.3	2422.0
TD-22	118423.1	1914665.9	2424.0
TD-23	118410.2	1914631.0	2426.0
TD-23	118397.2	1914596.3	2428.0
TD-23	118388.4	1914578.6	2430.0

IMPACT BASIN EXCAVATION LAYOUT TABLE

POINT ID	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)
IB-01	118464.2	1914800.9	2430.0
IB-02	118470.4	1914826.1	2430.0
IB-3	118486.9	1914796.4	2428.0
IB-4	118492.6	1914819.5	2428.0
IB-5	118494.3	1914794.0	2428.0
IB-6	118500.0	1914818.1	2428.0
IB-7	118509.0	1914780.0	2428.0
IB-8	118519.3	1914786.5	2428.0
IB-9	118511.9	1914799.3	2428.0
IB-10	118513.4	1914805.2	2428.0
IB-11	118525.9	1914813.2	2428.0
IB-12	118519.6	1914823.7	2428.0

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked FBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

TOE DRAIN EXCAVATION PLAN

Brush Creek Watershed — Mercer County, WV

ATERRA SCHNABEL JV

Schnabel Engineering

300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002, Phone: 267-350-2646, schnabel-eng.com

USDA United States Department of Agriculture — Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-11

SEPTEMBER 2024

SHEET 13 OF 61

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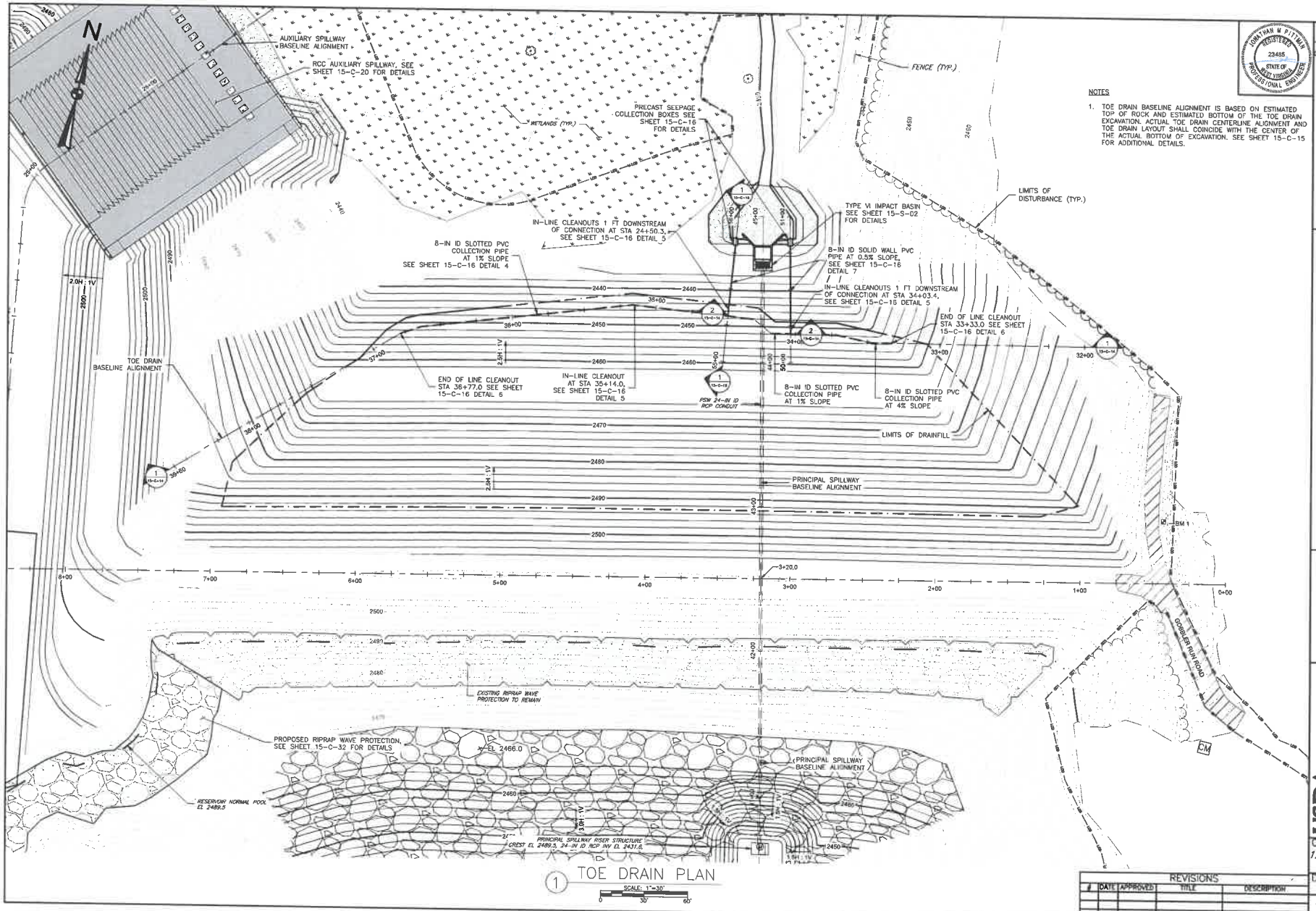
Last Saved By: CPATSIOS SaveDate: 10/2/2024 11:28 AM FilePath: I:\2022\22-0001\Design\15_DAM\02_HEC_Basin_Charts\Brush Protected\Brush-CAD\DWG\Brush-PWL_DESIGN\SITE 15\C-15-06-EXCV.dwg Layout: TOE DRAIN EXCAVATION PLAN



1 TOE DRAIN PLAN

SCALE: 1"=30'

0 30' 60'

NOTES

1. TOE DRAIN BASELINE ALIGNMENT IS BASED ON ESTIMATED TOP OF ROCK AND ESTIMATED BOTTOM OF THE TOE DRAIN EXCAVATION. ACTUAL TOE DRAIN CENTERLINE ALIGNMENT AND TOE DRAIN LAYOUT SHALL COINCIDE WITH THE CENTER OF THE ACTUAL BOTTOM OF EXCAVATION. SEE SHEET 15-C-15 FOR ADDITIONAL DETAILS.

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

PROPOSED TOE DRAIN PLAN

Brush Creek Watershed *Mercer County, WV*

Aterra Schnabel JV

300 Brookside Ave., Bldg. 15, Suite 160, Ambler, PA 19002 Phone: 484-275-3168 www.aterra-schnabel.com

United States Department of Agriculture

USDA Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-12

SEPTEMBER 2024

SHEET 14 OF 61

REVISIONS			
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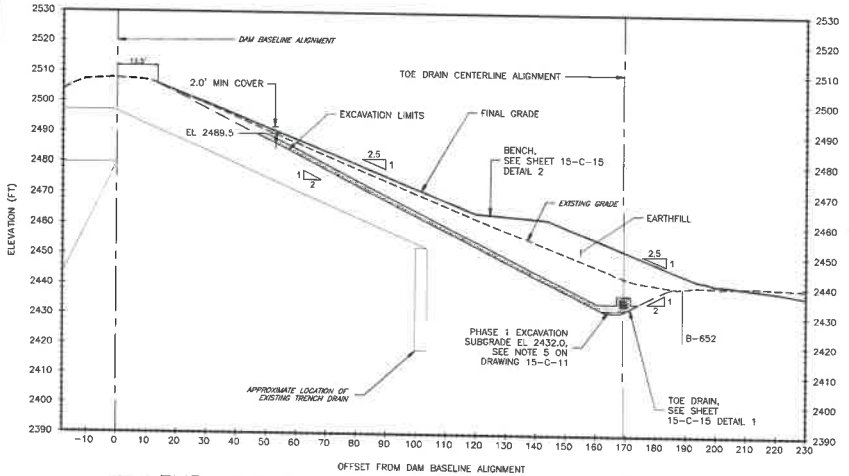
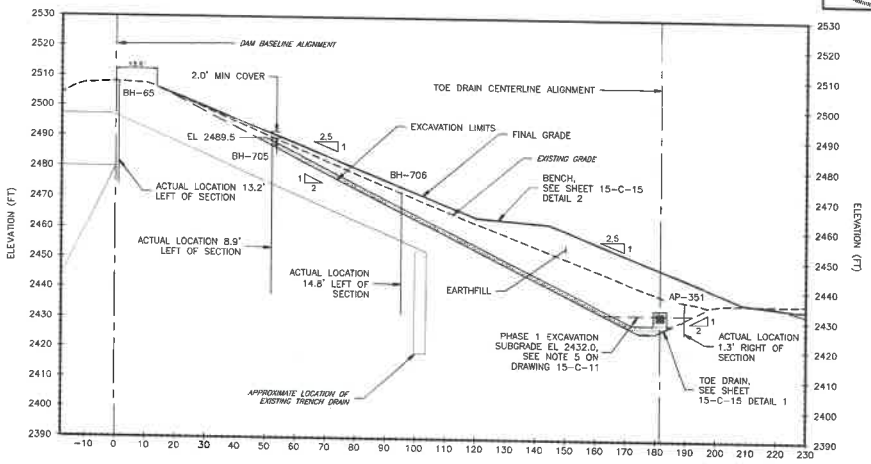


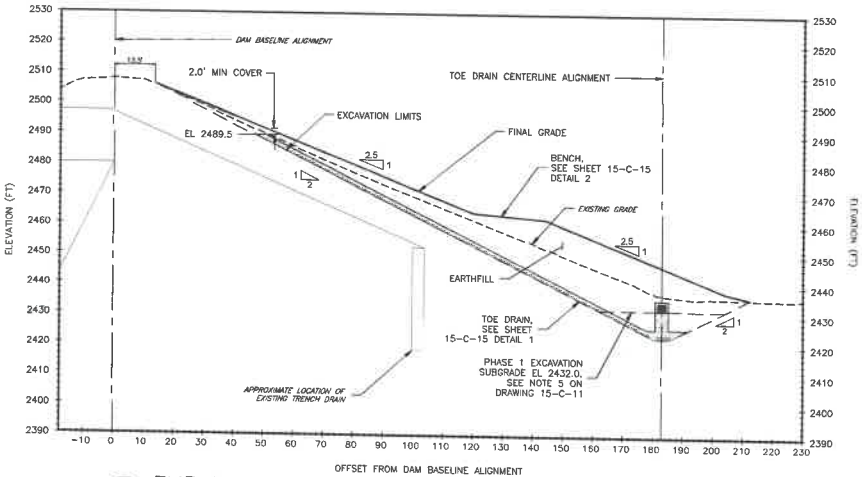
1 15-C-04 EMBANKMENT SECTION AT DAM BASELINE STA 2+75

SCALE: 1"=20'



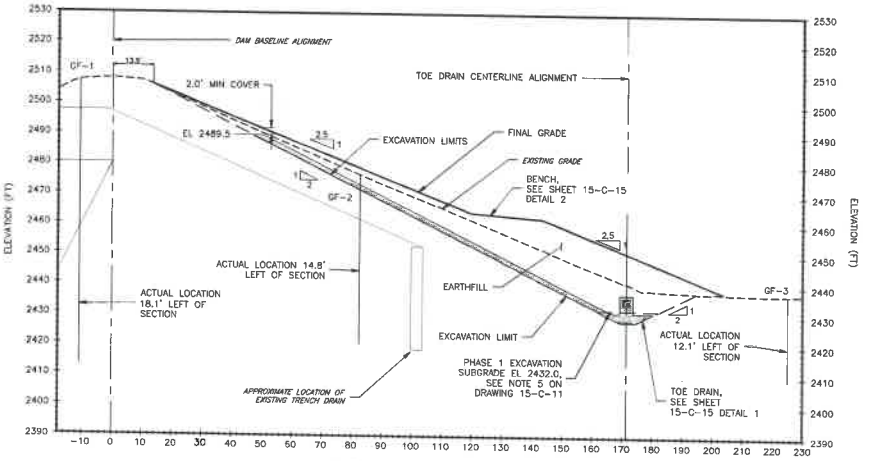
2 15-C-04 EMBANKMENT SECTION AT DAM BASELINE STA 3+50

SCALE: 1"=20'



3 15-C-04 EMBANKMENT SECTION AT DAM BASLINE STA 4+50

SCALE: 1"=20'



4 15-C-04 EMBANKMENT SECTION AT DAM BASELINE STA 5+50

SCALE: 1"=20'

NOTES

1. SEE SHEET 15-C-02 FOR TYPICAL EMBANKMENT ZONING DETAILS

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

		Date
Designed	CDS	SEP 24
Drawn	CRP	SEP 24
Checked	EBB	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

EMBANKMENT SECTIONS

Brush Creek Watershed — Mercer County, WV

Aterra-Schnabel JV
300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 267-733-4248
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-13

SEPTEMBER 2024

SHEET 15 OF 61

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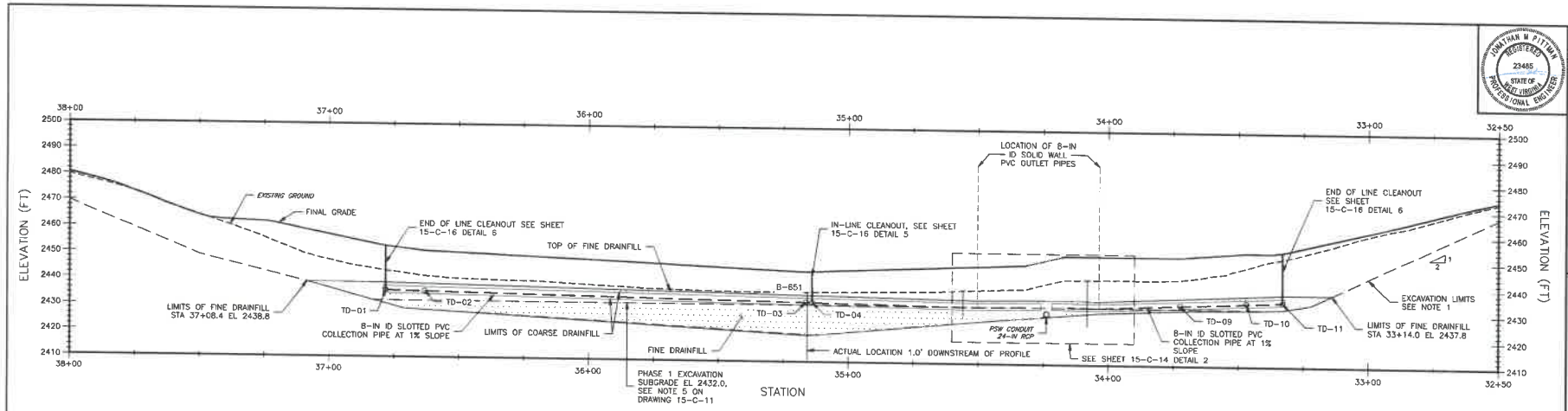
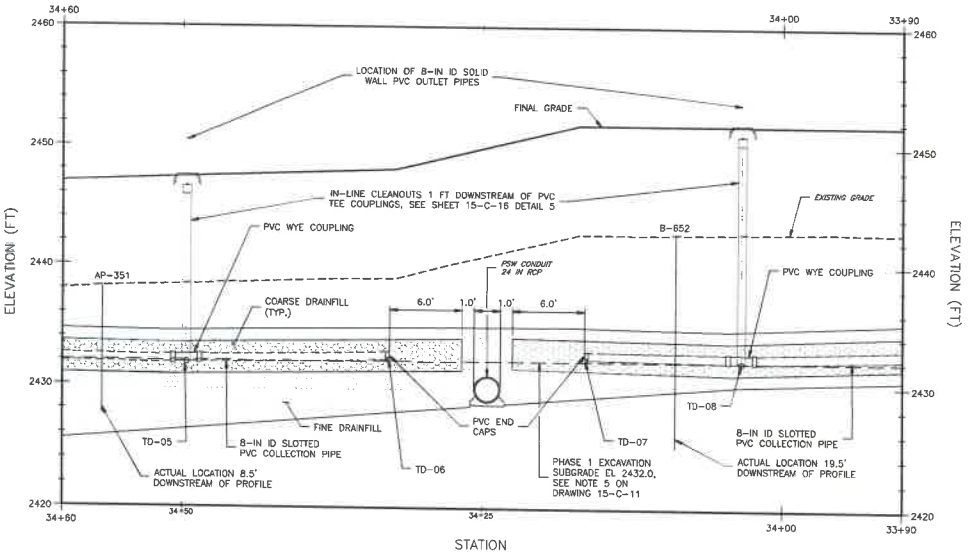


1 PROFILE ALONG TOE DRAIN BASELINE ALIGNMENT

SCALE: 1"=20'



2 TOE DRAIN PROFILE AT PSW CONDUIT

15-C-14

SCALE: 1"=5'

TOE DRAIN LAYOUT			
POINT	STATION	INV. EL	DESCRIPTION
TD-01	36+28.25	2435.8	END OF LINE CLEANOUT
TD-02	36+63.22	2435.6	11.25° BEND
TD-03	35+16.24	2433.0	11.25° BEND
TD-04	35+14.00	2432.9	IN-LINE CLEANOUT
TD-05	34+50.25	2431.8	PVC WYE COUPLING TO OUTLET PIPE
TD-06	34+32.80	2432.1	END OF LINE END CAPS
TD-07	34+16.43	2432.2	END OF LINE END CAPS
TD-08	34+03.41	2432.0	PVC WYE COUPLING TO OUTLET PIPE
TD-09	33+72.45	2433.2	11.25° BEND
TD-10	33+46.89	2433.3	11.25° BEND
TD-11	33+33.00	2434.8	END OF LINE CLEANOUT

NOTES

1. BOTTOM OF THE TOE DRAIN EXCAVATION SHALL EXTEND TO THE TOP OF ROCK. EXCAVATION LIMITS SHOWN ARE ESTIMATED BASED ON THE APPROXIMATE TOP OF ROCK. ACTUAL TOP OF ROCK AND BOTTOM OF EXCAVATION MAY VARY. TOP OF ROCK IS DEFINED IN CS21 AND WILL BE VERIFIED IN THE FIELD BY THE ENGINEER.
2. TOE DRAIN BASELINE ALIGNMENT IS BASED ON ESTIMATED TOP OF ROCK AND ESTIMATED BOTTOM OF THE TOE DRAIN EXCAVATION. ACTUAL TOE DRAIN BASELINE ALIGNMENT WILL BE IN LINE WITH THE INVERT OF THE PIPE IF TOP OF ROCK IS DETERMINED TO BE AT A LOWER OR HIGHER ELEVATION IN THE FIELD. SEE SHEET 15-C-15 FOR ADDITIONAL DETAILS.

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

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JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed GDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

TOE DRAIN PROFILE

Brush Creek Watershed — Mercer County, WV

ATERRA | Schnabel ENGINEERING
300 Brookside Ave., Bldg. 18, Suite 1601, Ambler, PA 19002
Phone: 215-654-9456
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

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SEPTEMBER 2024

SHEET 16 OF 61

Last Saved By: CPHILTON@Schnabel-eng.com Save Date: 10/2/2024 11:22 AM PlotDate: 10/2/2024 3:09 PM
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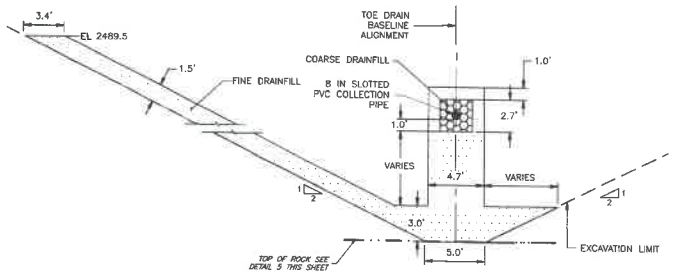
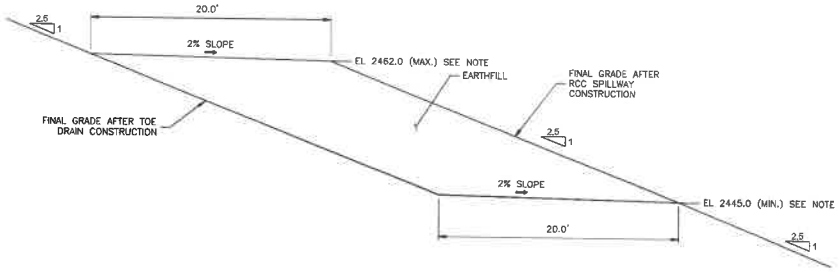
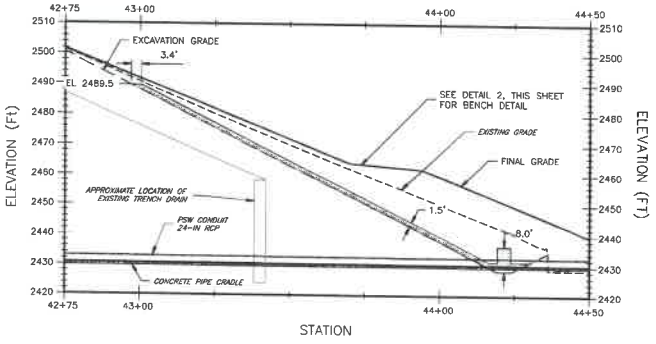


1 TYPICAL TOE DRAIN DETAIL
NTS

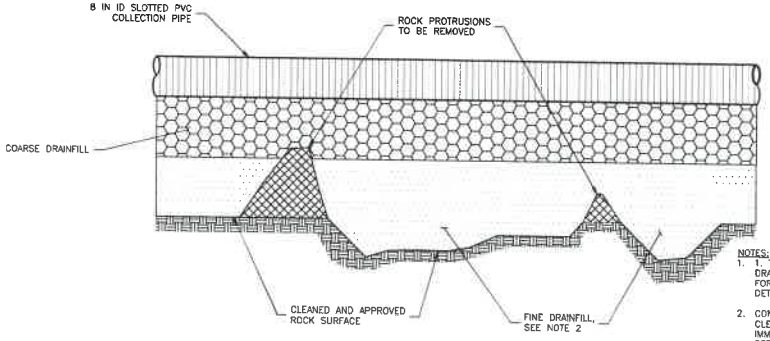


2 TYPICAL DOWNSTREAM SLOPE BENCH DETAIL
SCALE: 1"=8'

NOTE: ELEVATION OF TOP OF BENCH MAY VARY BASED ON ACTUAL VOLUME OF EXCESS EARTHFILL MATERIALS.

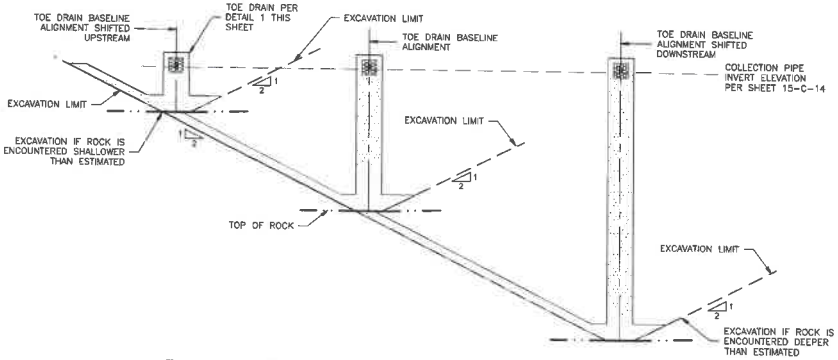


3 TOE DRAIN SECTION AT PSW CONDUIT
15-C-04
SCALE: 1"=20'



4 REMOVAL OF ROCK PROTRUSION AND PLACEMENT OF DRAINFILL IN DEPRESSIONS
SCALE: 1"=1'

NOTES:
1. THIS DETAIL APPLIES TO TOE DRAIN ONLY. SEE SHEET 15-C-28, FOR RCC FOUNDATION PREPARATION DETAILS.
2. CONTRACTOR SHALL COVER THE CLEANED APPROVED ROCK SURFACE IMMEDIATELY AFTER FINAL CLEANING. SEE CONSTRUCTION SPECIFICATION 63 FOR ADDITIONAL DETAILS.
3. FOUNDATION GRADE SHALL HAVE NO VERTICAL SURFACES. VERTICAL SURFACES FOUND IN ROCK SHALL BE TRIMMED TO A MINIMUM SLOPE OF 1H:1V OR AS DIRECTED BY COR



5 TOE DRAIN DETAIL FOR TOP OF ROCK VARIABILITY
NTS

JONATHAN M. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Date	
Designed	SEP 24
Drawn	SEP 24
Checked	SEP 24
Approved	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

TOE DRAIN DETAILS - SHEET 1 OF 2

Brush Creek Watershed — Mercer County, WV

Aterra | Schnabel JV

300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 215-654-0200
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-15

SEPTEMBER 2024

SHEET 17 OF 61

REVISIONS			
#	DATE APPROVED	TITLE	DESCRIPTION

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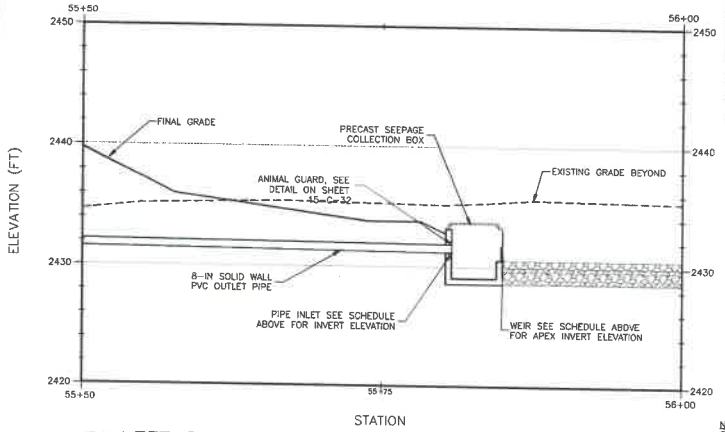
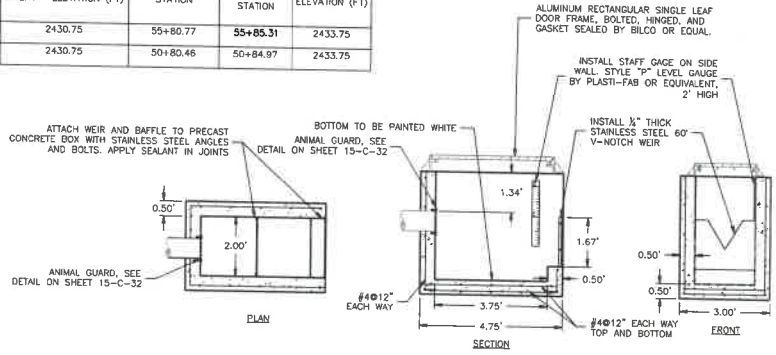
PRECAST SEEPAGE COLLECTION BOX SCHEDULE

SEEPAGE BOX	INLET PIPE INVERT ELEVATION (FT)	WEIR (V-NOTCH) APEX INVERT ELEVATION (FT)	INLET INVERT STATION	OUTLET INVERT STATION	TOP OF BOX ELEVATION (FT)
1	2431.20	2430.75	55+80.77	**55+85.31**	2433.75
2	2431.20	2430.75	50+80.46	50+84.97	2433.75



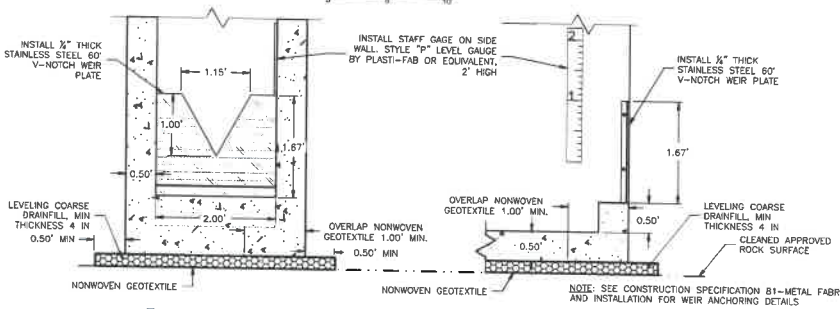
1 LEFT PRECAST SEEPAGE COLLECTION BOX PROFILE

NOTE: SEE SCHEDULE ABOVE FOR RIGHT PRECAST SEEPAGE COLLECTION BOX STATIONING AND ELEVATIONS



2 TYPICAL PRECAST SEEPAGE COLLECTION BOX DETAILS

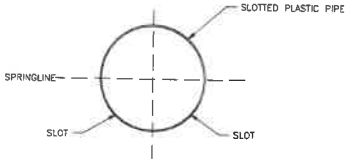
NTS



NOTE: SEE CONSTRUCTION SPECIFICATION 81-METAL FABRICATION AND INSTALLATION FOR WEIR ANCHORING DETAILS

3 PRECAST SEEPAGE COLLECTION BOX WEIR PLATE DETAIL

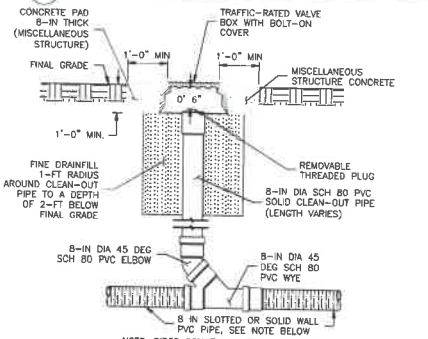
NTS



NOTE: SEE CS45 FOR SLOT SIZING AND PLACEMENT REQUIREMENTS

4 SLOTTED COLLECTION PIPE DETAIL

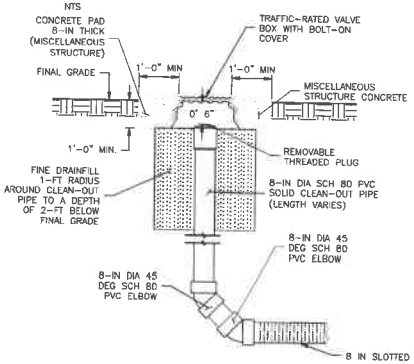
NTS



NOTE: PIPES CONNECTED BY CLEANOUTS LOCATED ALONG THE TOE DRAIN BASELINE ALIGNMENT TO BE SLOTTED. ALL OTHER CONNECTED TO CLEANOUT TO BE SLOTTED

5 TYPICAL IN-LINE CLEANOUT DETAIL

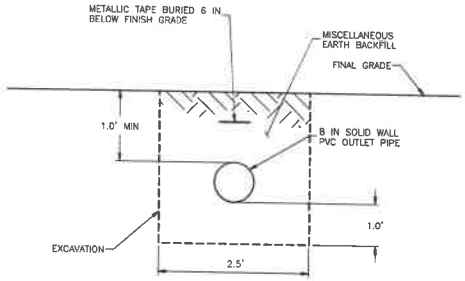
NTS



NOTE: DRAINFILL ENCAPSULATES COLLECTION PIPE NOT SHOWN FOR CLARITY

6 TYPICAL END-OF-LINE CLEANOUT DETAIL

NTS



7 TYPICAL SOLID WALL PIPE BEDDING DETAIL

NTS

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JONATHAN M PITTMAN REGISTERED 23465 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed COS	SEP 24
Drawn CKP	SEP 24
Checked FBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

TOE DRAIN DETAILS - SHEET 2 OF 2

Mercer County, WV

Brush Creek Watershed

Schnabel Engineering
ATERRA SOLUTIONS
300 Brookside Ave., Bldg. 18, Suite 160, Beckley, WV 25801
Phone: 336-274-8456
jpittman@atsllc.com

United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-16

SEPTEMBER 2024

SHEET 18 OF 61

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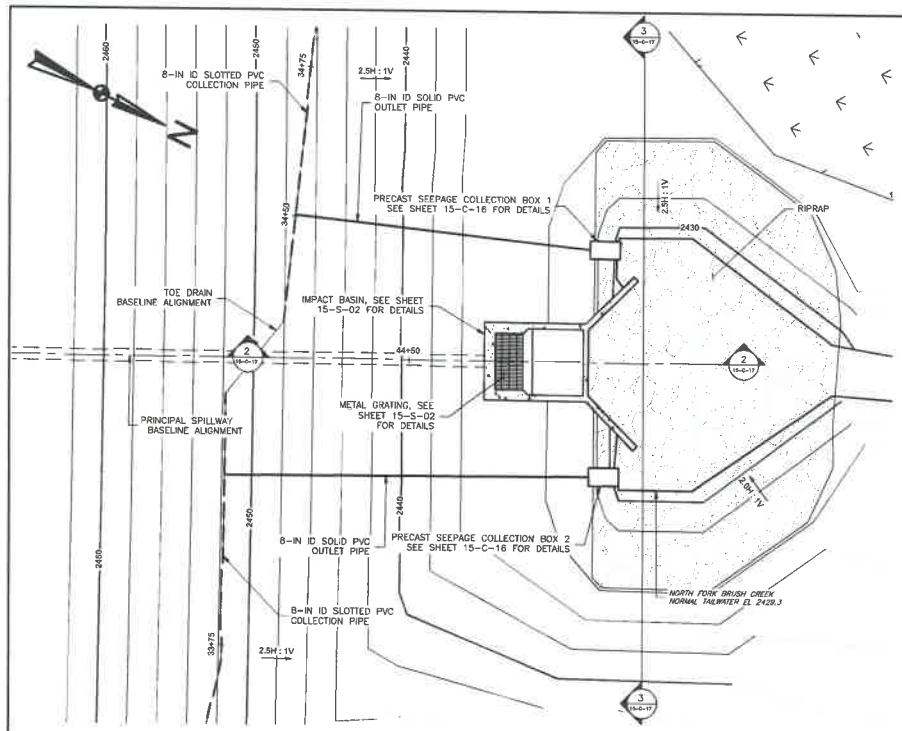
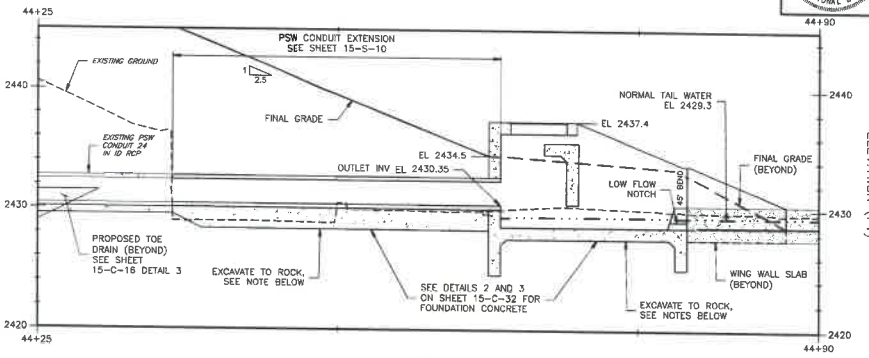


1 PRINCIPAL SPILLWAY OUTLET PLAN

SCALE: 1" = 10'

FLOW

NOTE: EXCAVATION FOR PSW SPILLWAY EXTENSION AND IMPACT BASIN OUTLET IS CLASSIFIED AS MISCELLANEOUS EXCAVATION SUBSIDIARY TO THE IMPACT BASIN OUTLET WORK.



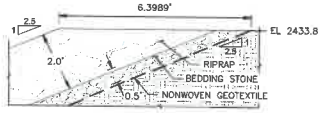
2 PRINCIPAL SPILLWAY OUTLET PROFILE

SCALE: 1" = 5'

FLOW

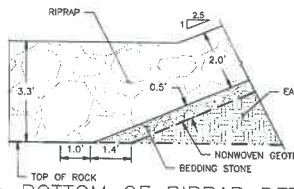
NOTES

1. EXCAVATION FOR PSW SPILLWAY EXTENSION AND IMPACT BASIN OUTLET IS CLASSIFIED AS MISCELLANEOUS EXCAVATION SUBSIDIARY TO THE IMPACT BASIN OUTLET WORK. NECESSARY EXCAVATION FOR THE REMOVAL OF THE EXISTING IMPACT BASIN WILL BE PERFORMED BEFORE CONSTRUCTION OF NEW IMPACT BASIN.
2. CONTRACTOR SHALL COVER THE CLEANED, APPROVED ROCK SURFACE IMMEDIATELY AFTER FINAL CLEANING. SEE CONSTRUCTION SPECIFICATION 63 FOR ADDITIONAL DETAILS.
3. GUARDRAIL NOT SHOWN FOR CLARITY, SEE SHEET 15-S-02 FOR DETAILS



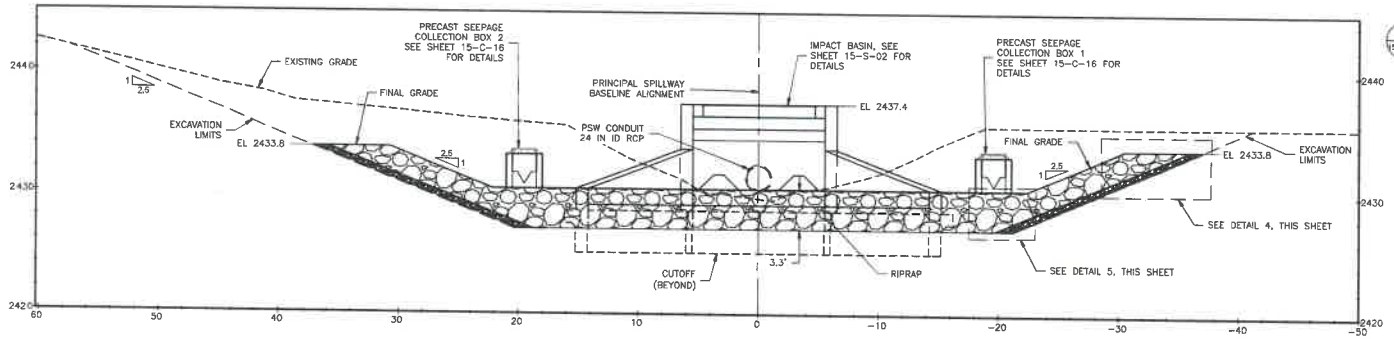
4 TOP OF RIPRAP DETAIL

SCALE: 1"=2'



5 BOTTOM OF RIPRAP DETAIL

SCALE: 1"=2'



3 PRINCIPAL SPILLWAY OUTLET ELEVATION VIEW

SCALE: 1" = 5'

NOTE: GUARDRAIL NOT SHOWN FOR CLARITY, SEE SHEET 15-S-02 FOR DETAILS

JONATHAN M PITTMAN REGISTERED 23465 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

		Date
Designed	CDS	SEP 24
Drawn	CRP	SEP 24
Checked	EBB	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

PROPOSED PRINCIPAL SPILLWAY OUTLET PLAN, PROFILE, AND ELEVATION

Mercer County, WV

Brush Creek Watershed

Schnabel | ATERRA SOLUTIONS
300 Broadcast Ave., Bldg. 18, Suite 160, Asheville, NC 28805
Phone: 336-274-8436

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-17

SEPTEMBER 2024

SHEET 19 OF 61

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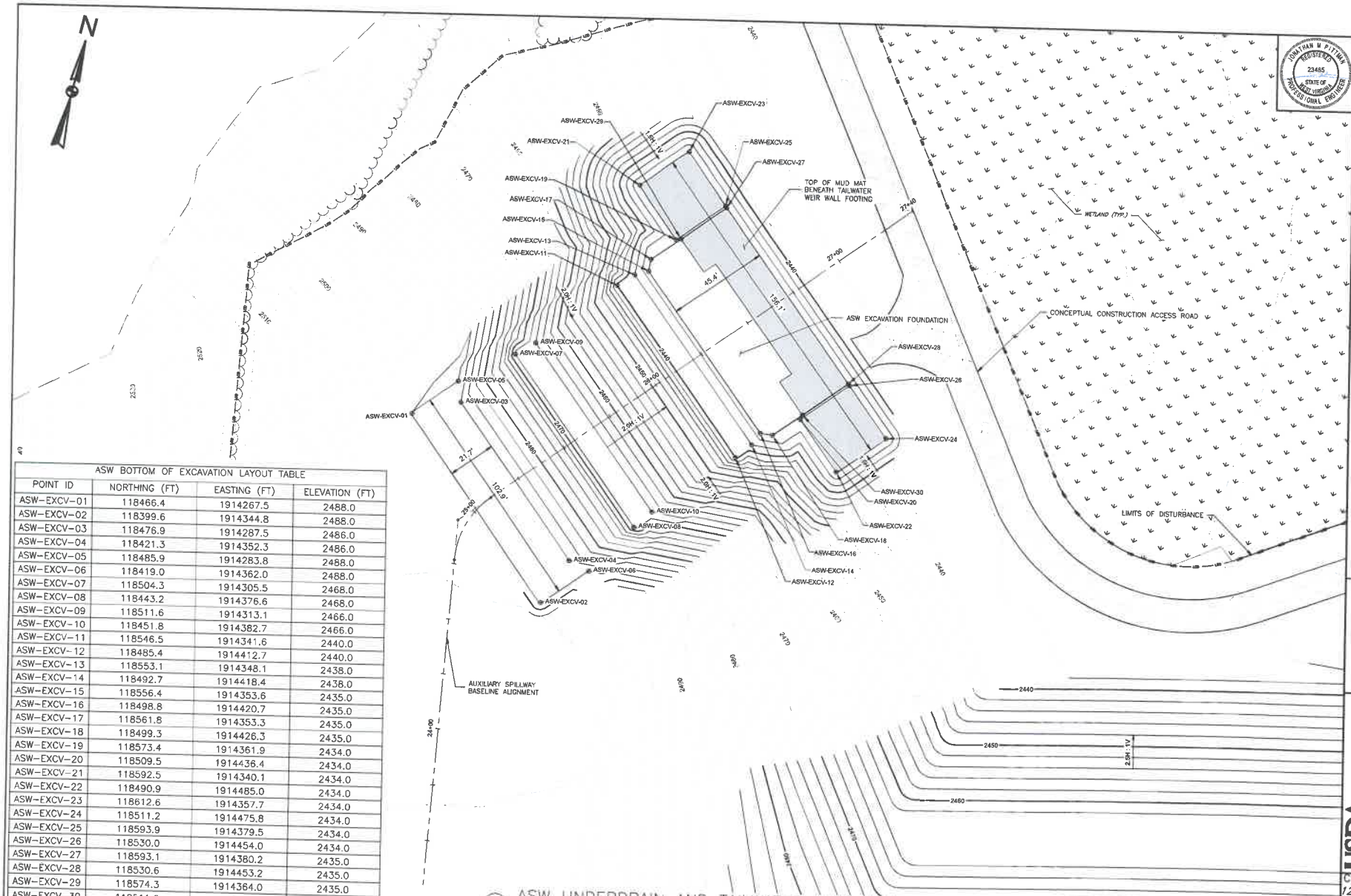

ASW BOTTOM OF EXCAVATION LAYOUT TABLE

POINT ID	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)
ASW-EXCV-01	118466.4	1914267.5	2488.0
ASW-EXCV-02	118399.6	1914344.8	2488.0
ASW-EXCV-03	118476.9	1914287.5	2486.0
ASW-EXCV-04	118421.3	1914352.3	2486.0
ASW-EXCV-05	118485.9	1914283.8	2488.0
ASW-EXCV-06	118419.0	1914362.0	2488.0
ASW-EXCV-07	118504.3	1914305.5	2468.0
ASW-EXCV-08	118443.2	1914376.6	2468.0
ASW-EXCV-09	118511.6	1914313.1	2466.0
ASW-EXCV-10	118451.8	1914382.7	2466.0
ASW-EXCV-11	118546.5	1914341.6	2440.0
ASW-EXCV-12	118485.4	1914412.7	2440.0
ASW-EXCV-13	118553.1	1914348.1	2438.0
ASW-EXCV-14	118492.7	1914418.4	2438.0
ASW-EXCV-15	118556.4	1914353.6	2435.0
ASW-EXCV-16	118498.8	1914420.7	2435.0
ASW-EXCV-17	118561.8	1914353.3	2435.0
ASW-EXCV-18	118499.3	1914426.3	2435.0
ASW-EXCV-19	118573.4	1914361.9	2434.0
ASW-EXCV-20	118509.5	1914436.4	2434.0
ASW-EXCV-21	118592.5	1914340.1	2434.0
ASW-EXCV-22	118490.9	1914485.0	2434.0
ASW-EXCV-23	118612.6	1914357.7	2434.0
ASW-EXCV-24	118511.2	1914475.8	2434.0
ASW-EXCV-25	118593.9	1914379.5	2434.0
ASW-EXCV-26	118530.0	1914454.0	2434.0
ASW-EXCV-27	118593.1	1914380.2	2435.0
ASW-EXCV-28	118530.6	1914453.2	2435.0
ASW-EXCV-29	118574.3	1914364.0	2435.0
ASW-EXCV-30	118511.6	1914436.9	2435.0

1 ASW UNDERDRAIN AND TAILWATER WEIR WALL FOUNDATION PLAN

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

		Date
Designed	CDS	SEP 24
Drawn	CBP	SEP 24
Checked	EBB	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

ASW UNDERDRAIN AND TAILWATER WEIR WALL FOUNDATION PLAN

Brush Creek Watershed — Mercer County, WV

Aterra-Schnabel JV | Schnabel Engineering | Aterra Solutions
300 Brookside Ave., Bldg. 15, Suite 160, Ambler, PA 19002
Phone: 336-274-3456
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-18

SEPTEMBER 2024

SHEET 20 OF 61

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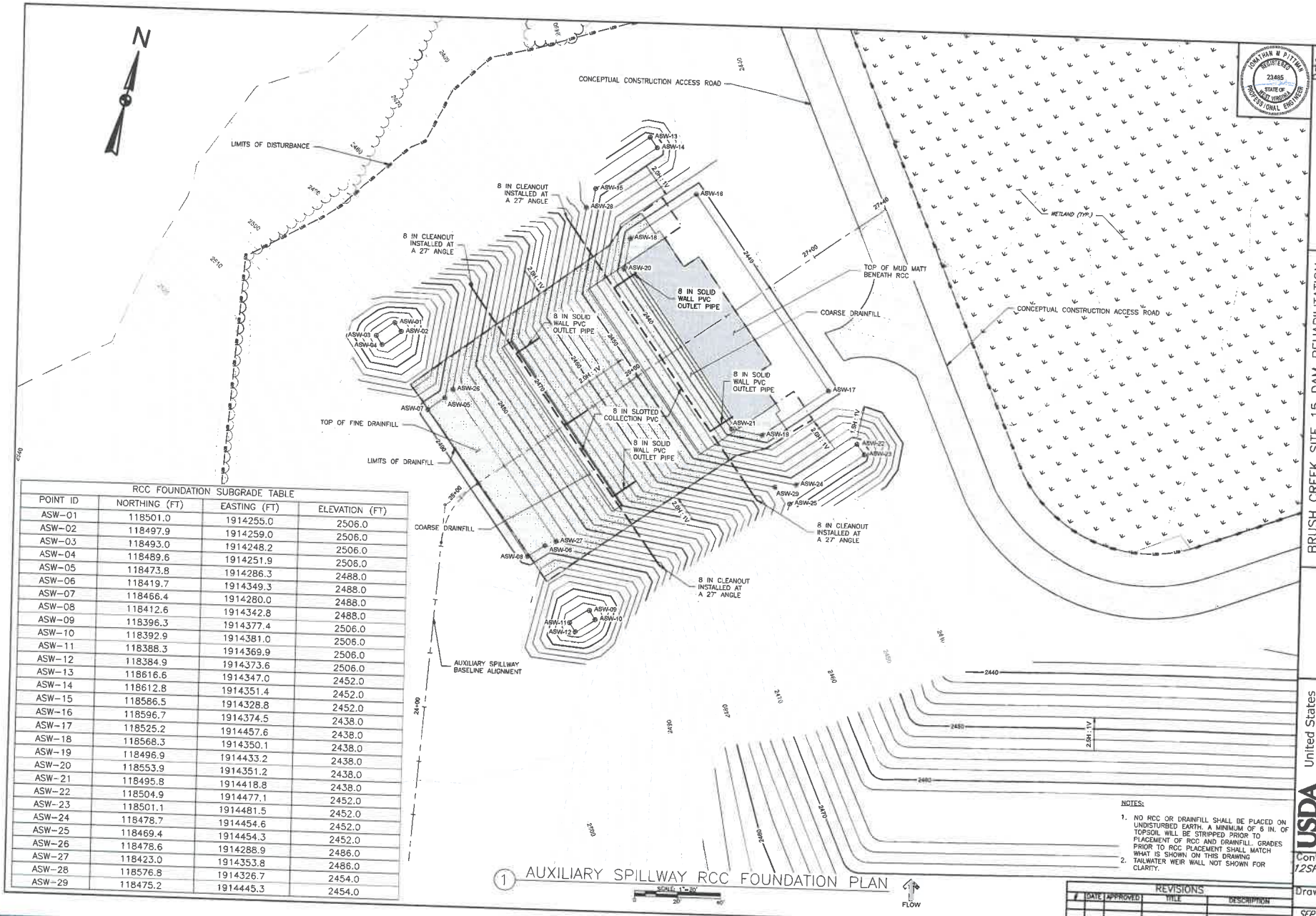
Description: ASW Foundation Excavation Plan and Profile



RCC FOUNDATION SUBGRADE TABLE			
POINT ID	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)
ASW-01	118501.0	1914255.0	2506.0
ASW-02	118497.9	1914259.0	2506.0
ASW-03	118493.0	1914248.2	2506.0
ASW-04	118489.6	1914251.9	2506.0
ASW-05	118473.8	1914286.3	2488.0
ASW-06	118419.7	1914349.3	2488.0
ASW-07	118466.4	1914280.0	2488.0
ASW-08	118412.6	1914342.8	2488.0
ASW-09	118396.3	1914377.4	2506.0
ASW-10	118392.9	1914381.0	2506.0
ASW-11	118388.3	1914369.9	2506.0
ASW-12	118384.9	1914373.6	2506.0
ASW-13	118616.6	1914347.0	2452.0
ASW-14	118612.8	1914351.4	2452.0
ASW-15	118586.5	1914328.8	2452.0
ASW-16	118596.7	1914374.5	2438.0
ASW-17	118525.2	1914457.6	2438.0
ASW-18	118568.3	1914350.1	2438.0
ASW-19	118496.9	1914433.2	2438.0
ASW-20	118553.9	1914351.2	2438.0
ASW-21	118495.8	1914418.8	2438.0
ASW-22	118504.9	1914477.1	2452.0
ASW-23	118501.1	1914481.5	2452.0
ASW-24	118478.7	1914454.6	2452.0
ASW-25	118469.4	1914454.3	2452.0
ASW-26	118478.6	1914353.8	2452.0
ASW-27	118423.0	1914288.9	2486.0
ASW-28	118576.8	1914326.7	2454.0
ASW-29	118475.2	1914445.3	2454.0

1 AUXILIARY SPILLWAY RCC FOUNDATION PLAN
SCALE: 1"=40'

NOTES:
1. NO RCC OR DRAINFILL SHALL BE PLACED ON UNDISTURBED EARTH. A MINIMUM OF 6 IN. OF TOPSOIL WILL BE STRIPPED PRIOR TO PLACEMENT OF RCC AND DRAINFILL. GRADES PRIOR TO RCC PLACEMENT SHALL MATCH WHAT IS SHOWN ON THIS DRAWING
2. TAILWATER WEIR WALL NOT SHOWN FOR CLARITY.

REVISIONS

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JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

		Date
Designed	CDS	SEP 24
Drawn	CRP	SEP 24
Checked	FBB	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION
AUXILIARY SPILLWAY RCC FOUNDATION PLAN
Brush Creek Watershed Mercer County, WV

Aterra Schnabel
300 Brockside Ave., Bldg. 1B, Suite 160, Ambler, PA 19002
Phone: 267-422-1946
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023
Drawing No. 15-C-19
SEPTEMBER 2024
SHEET 21 OF 61

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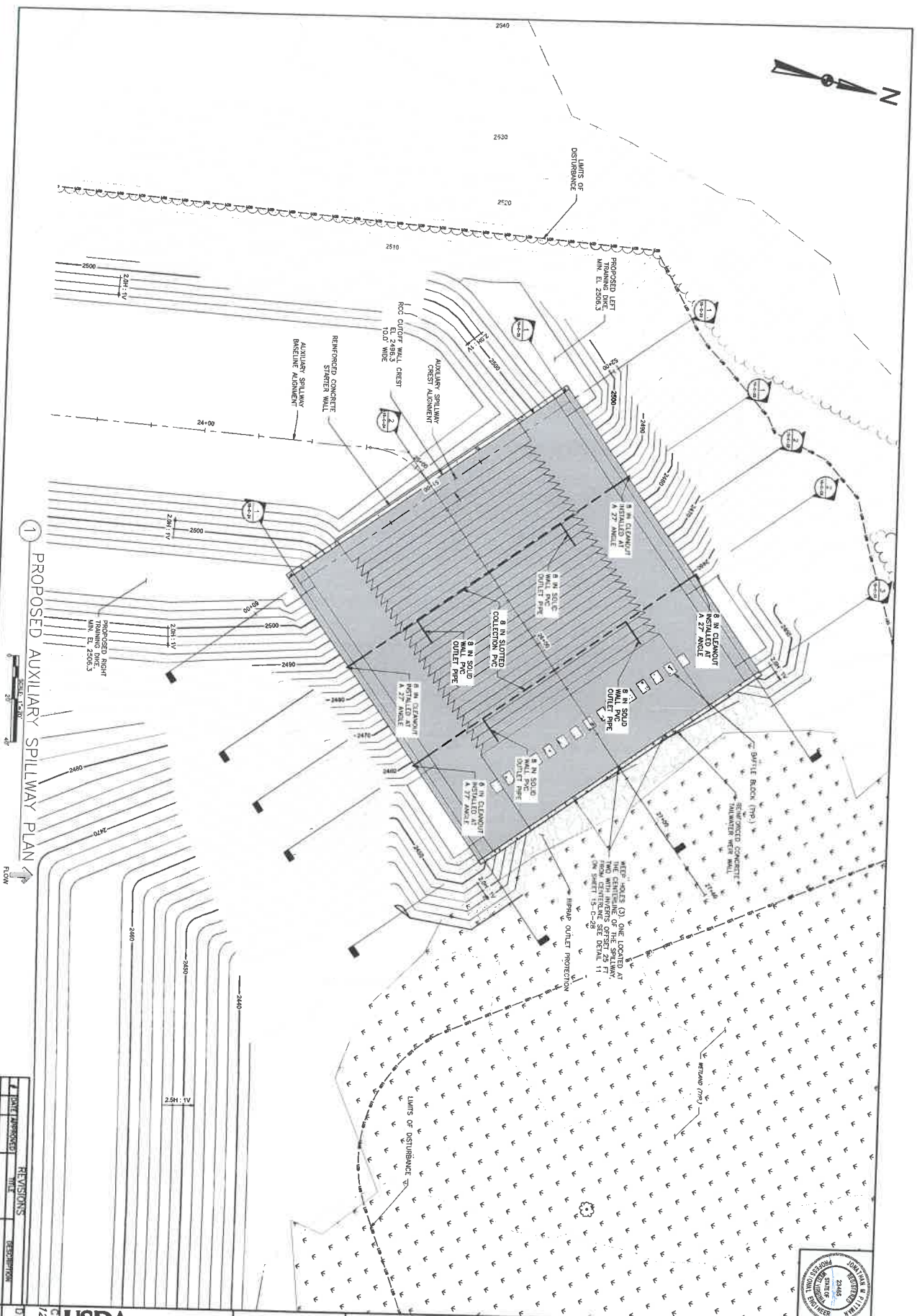
AUXILIARY SPILLWAY PLAN- SHEET 1 OF 2



DATE APPROVED	REVISIONS	DESCRIPTION

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Drawing No. 15-C-20
SEPTEMBER 2024
SHEET 22 OF 61

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Phone: 336-274-9458
schnabel-eng.com

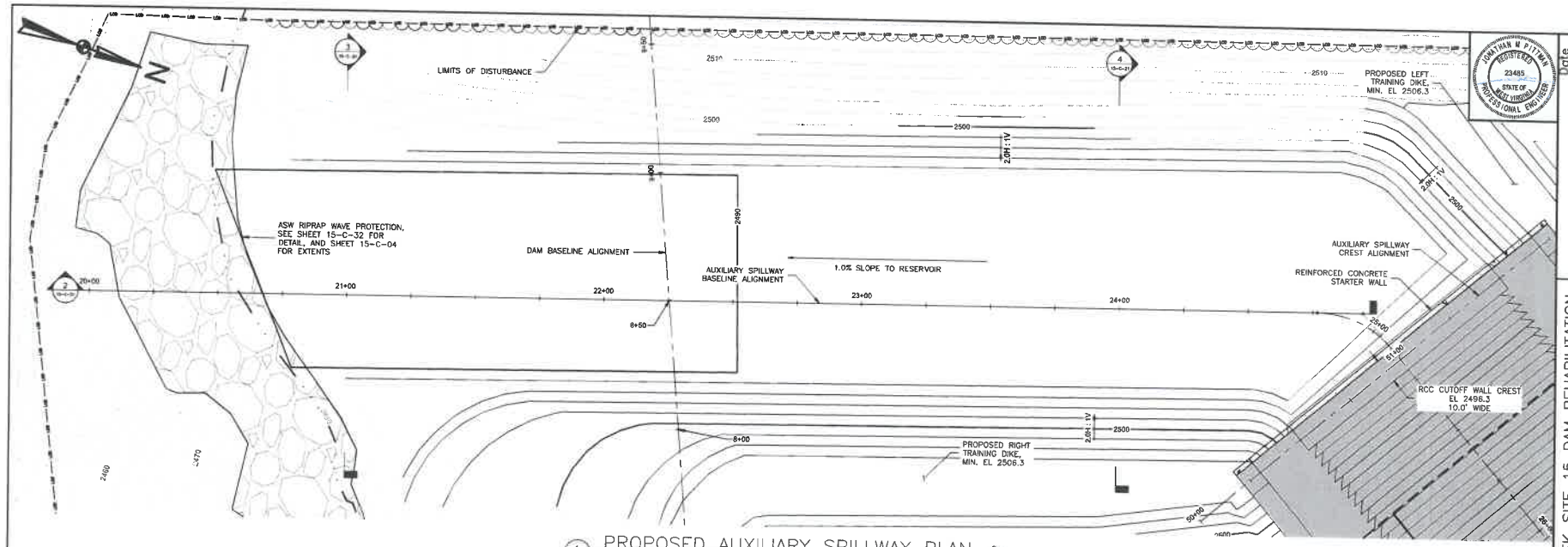
BRUSH CREEK SITE 15 DAM REHABILITATION

PROPOSED AUXILIARY SPILLWAY PLAN– SHEET 1 OF 2

Brush Creek Watershed *Mercer County, WV*

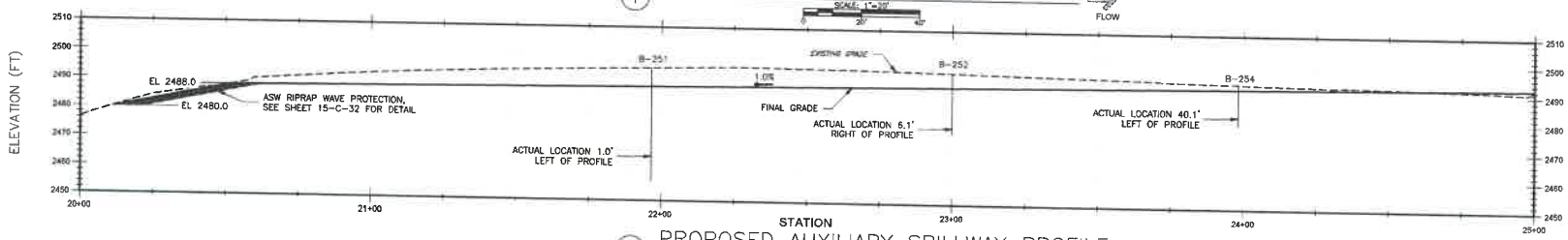
		Date
Designed	CDS	SEP 24
Drawn	CRP	SEP 24
Checked	EBB	SEP 24
Approved	JMP	SEP 24

JONATHAN M. PITTMAN — 23485 — STATE OF WEST VIRGINIA — PROFESSIONAL ENGINEER



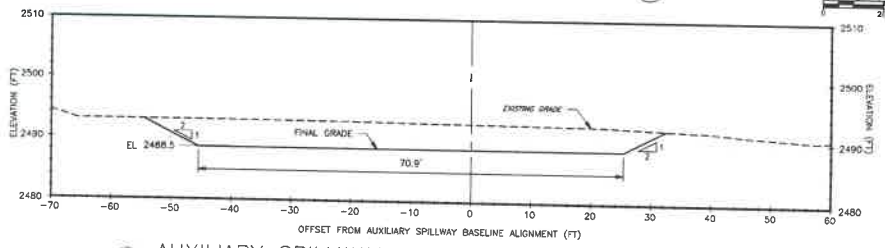
1 PROPOSED AUXILIARY SPILLWAY PLAN

SCALE: 1"=20'



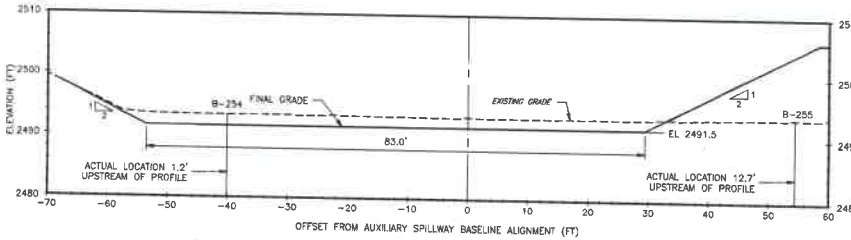
2 PROPOSED AUXILIARY SPILLWAY PROFILE

SCALE: 1"=20'



3 AUXILIARY SPILLWAY SECTION AT STA 21+00

SCALE: 1"=10'



4 AUXILIARY SPILLWAY SECTION AT STA 24+00

SCALE: 1"=10'

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

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		Date
Designed	CDS	SEP 24
Drawn	CRP	SEP 24
Checked	EBB	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

PROPOSED AUXILIARY SPILLWAY PLAN – SHEET 2 OF 2

Brush Creek Watershed *Mercer County, WV*

ATERRA CONSTRUCTORS | Schnabel Engineering

300 Brookside Ave., Bldg. 15, Suite 160, Ambler, PA 19002, Phone: 267-773-5540, schnabel-inc.com

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Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-21

SEPTEMBER 2024

SHEET 23 OF 61

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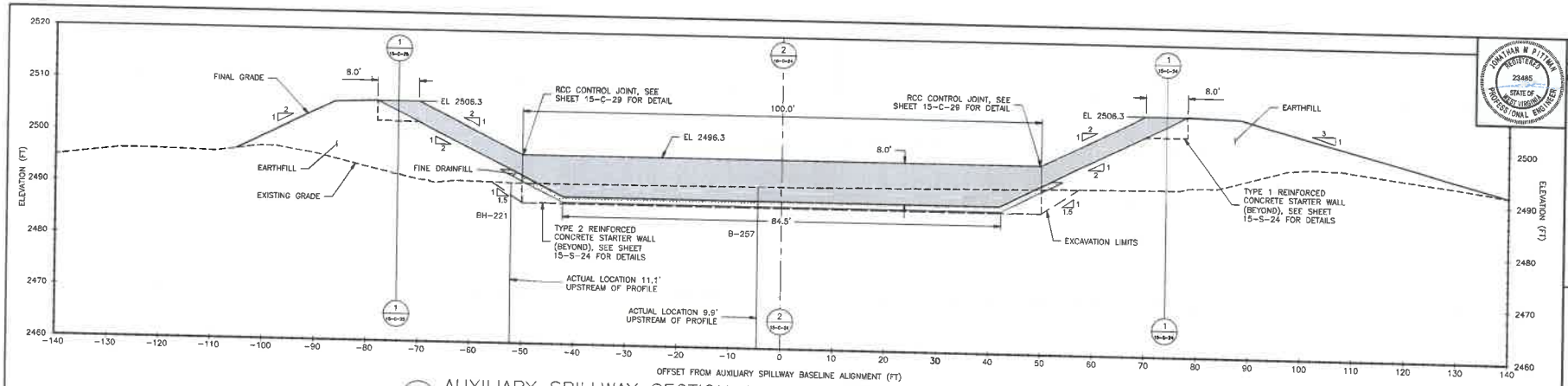
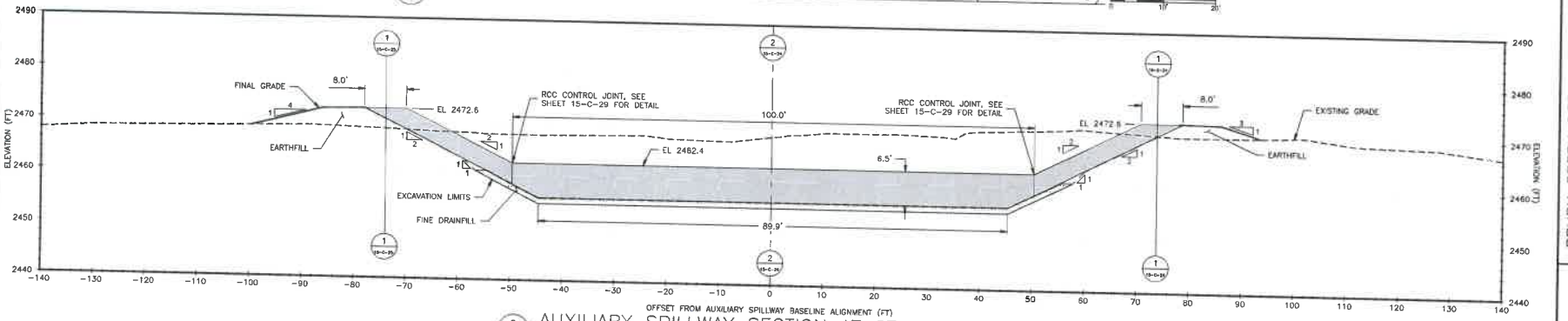


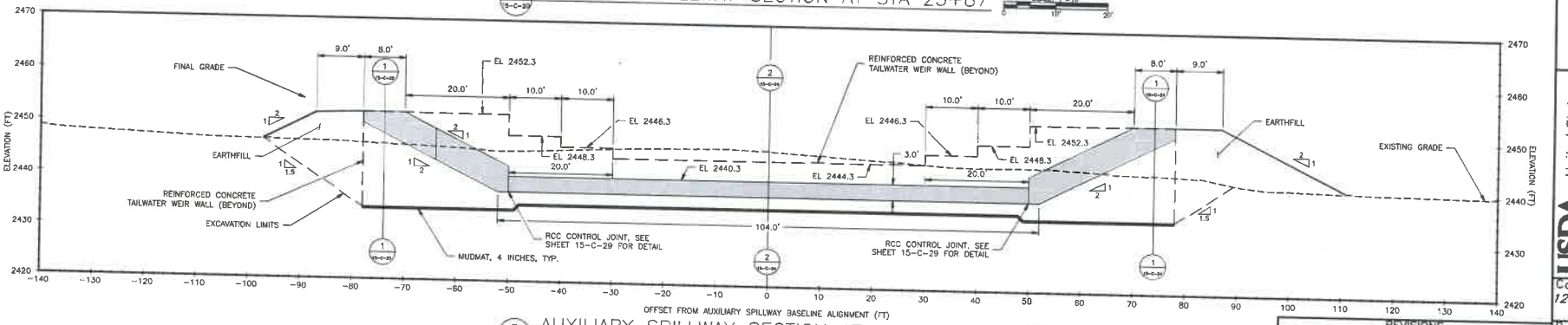
1 15-C-23 AUXILIARY SPILLWAY SECTION ALONG CUTOFF CREST (STA 25+15)

SCALE: 1"=10'



2 15-C-25 AUXILIARY SPILLWAY SECTION AT STA 25+87

SCALE: 1"=10'



3 15-C-27 AUXILIARY SPILLWAY SECTION AT STA 26+62

SCALE: 1"=10'

JONATHAN W. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JWP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

AUXILIARY SPILLWAY SECTIONS – SHEET 1 OF 4

Brush Creek Watershed Mercer County, WV

Aterra Schnabel JV

300 Brookside Ave., Bldg. 15, Suite 160, Morgantown, WV 26501 Phone: 304-216-4246 schnabel-eng.com

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Contract No. 12SPEC18D0023

Drawing No. 15-C-22

SEPTEMBER 2024

SHEET 24 OF 61

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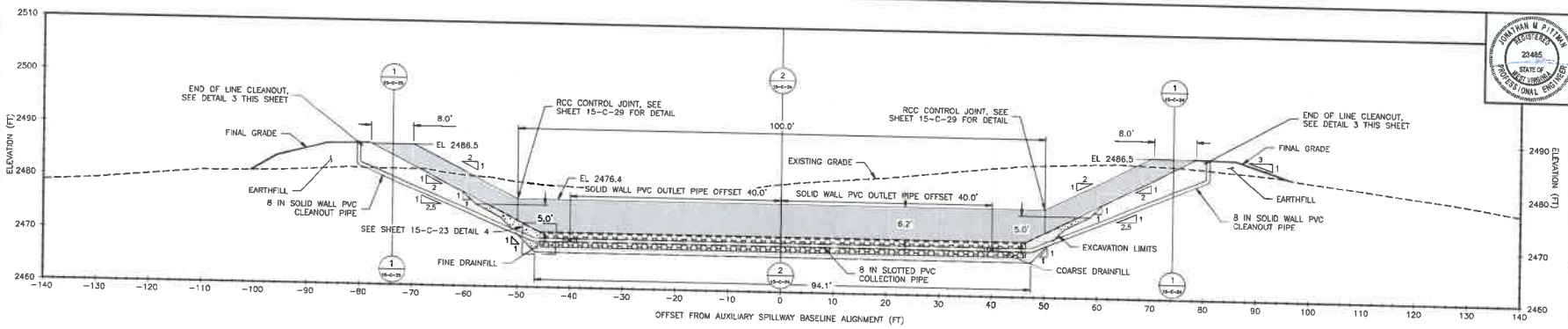
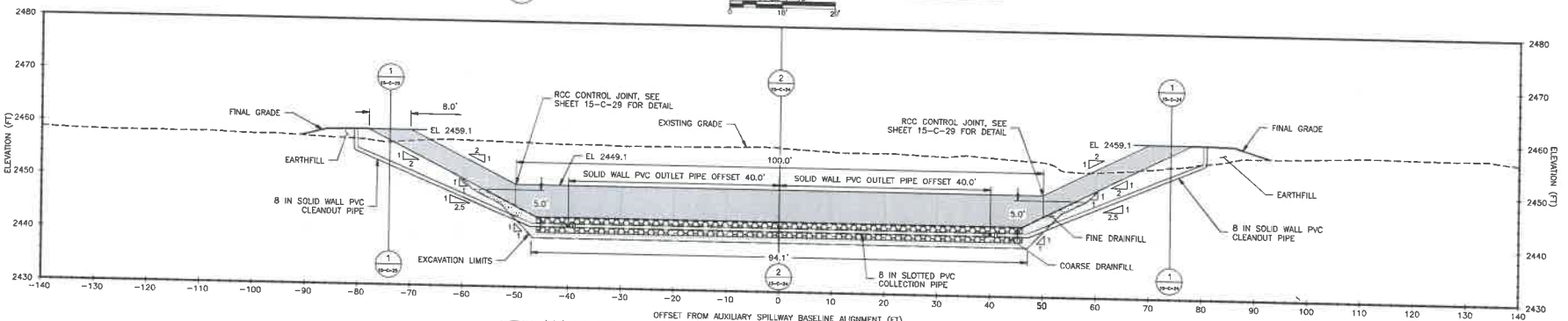
SPILLWAY SECTIONS - SHEET 1 OF 4



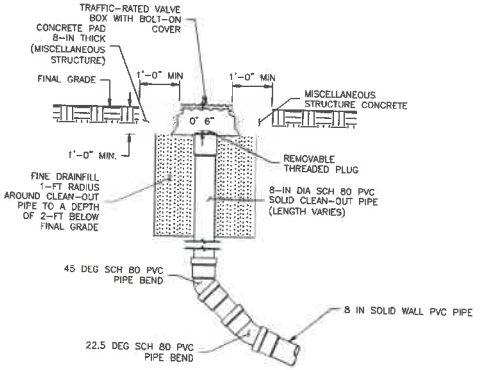
1 15-C-29 AUXILIARY SPILLWAY SECTION AT STA 25+59

SCALE 1"=10'



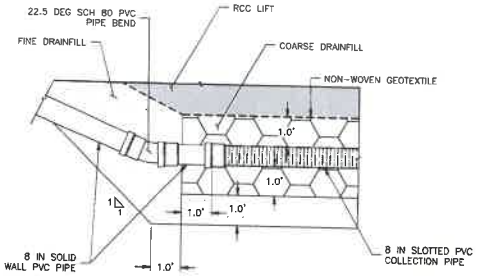
2 15-C-29 AUXILIARY SPILLWAY SECTION AT STA 26+14

SCALE 1"=10'



3 TYPICAL END OF LINE 27 DEGREE CLEANOUT

NTS



4 TRANSITION FROM SOLID TO PERFORATED PIPE

NTS

REVISIONS				
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Drawn CRP	SEP 24
Checked FBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

AUXILIARY SPILLWAY SECTIONS - SHEET 2 OF 4

Brush Creek Watershed *Mercer County, WV*

Aterra Schnabel
300 Brookside Ave., Bldg 18, Suite 160, Ambler, PA 19002
Phone: 336-274-9146
NYSDOS #PE-0089

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-23

SEPTEMBER 2024

SHEET 25 OF 61

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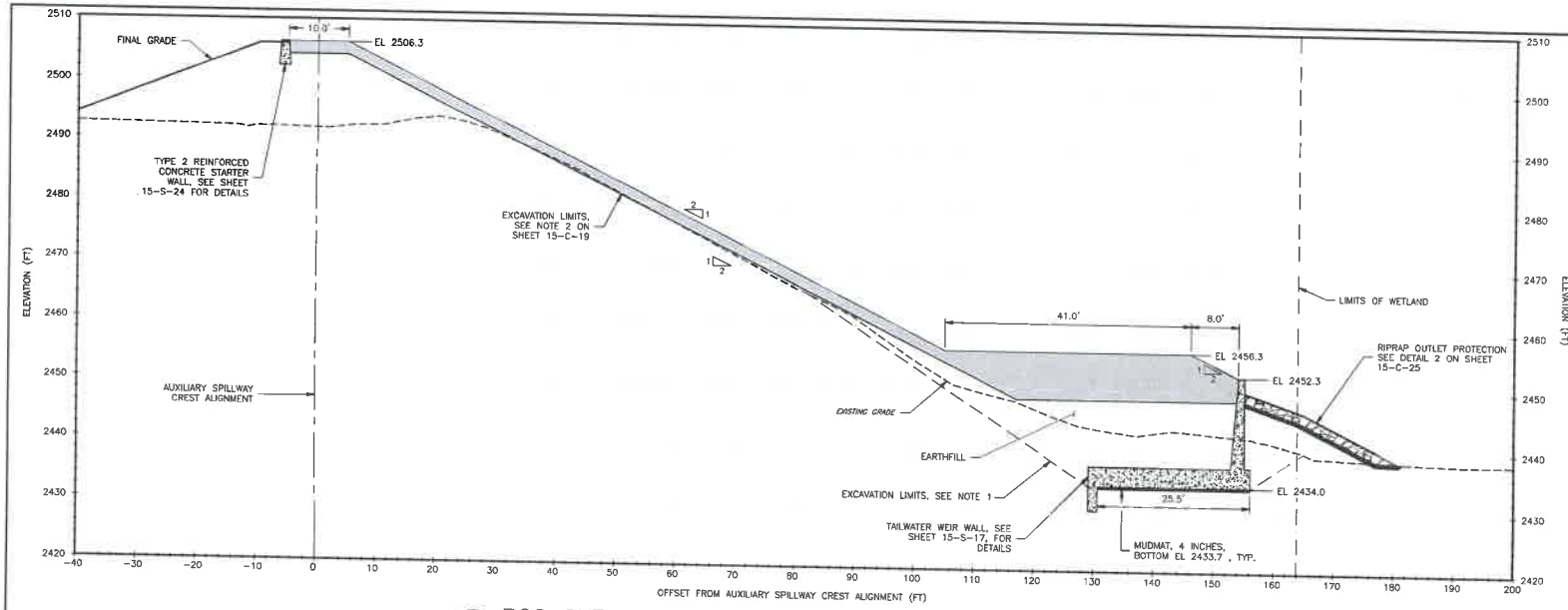
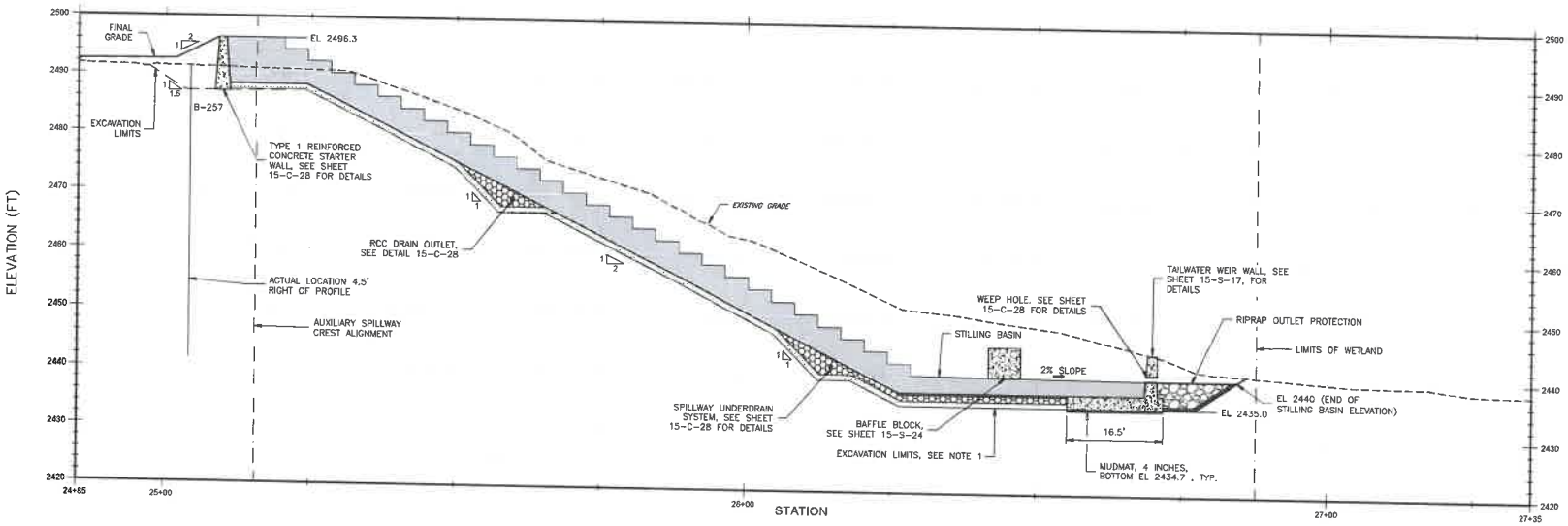


1 15-C-24 RCC CUTOFF WALL SECTION AT RIGHT TRAINING DIKE

SCALE: 1"=10'



2 15-C-24 PROFILE ALONG AUXILIARY SPILLWAY BASELINE ALIGNMENT

SCALE: 1"=10'

NOTES

1. TAILWATER WEIR WALL SUBGRADE SHALL BE THE TOP OF ROCK UNLESS OTHERWISE APPROVED BY THE COR. EXCAVATION LIMITS SHOWN ARE ESTIMATED BASED ON THE APPROXIMATE TOP OF ROCK. ACTUAL TOP OF ROCK AND BOTTOM OF EXCAVATION MAY VARY. TOP OF ROCK SHALL BE DEFINED IN THE FIELD BY THE COR.

JONATHAN M. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked FBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

AUXILIARY SPILLWAY SECTIONS - SHEET 3 OF 4

Brush Creek Watershed *Mercer County, WV*

ATERRA | Schnabel ENGINEERING

300 Brookside Ave., Bldg. 1B, Suite 160, Ambler, PA 19002 Phone: 267-338-1046 schnabel-eng.com

USDA United States Department of Agriculture Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-24

SEPTEMBER 2024

SHEET 26 OF 61

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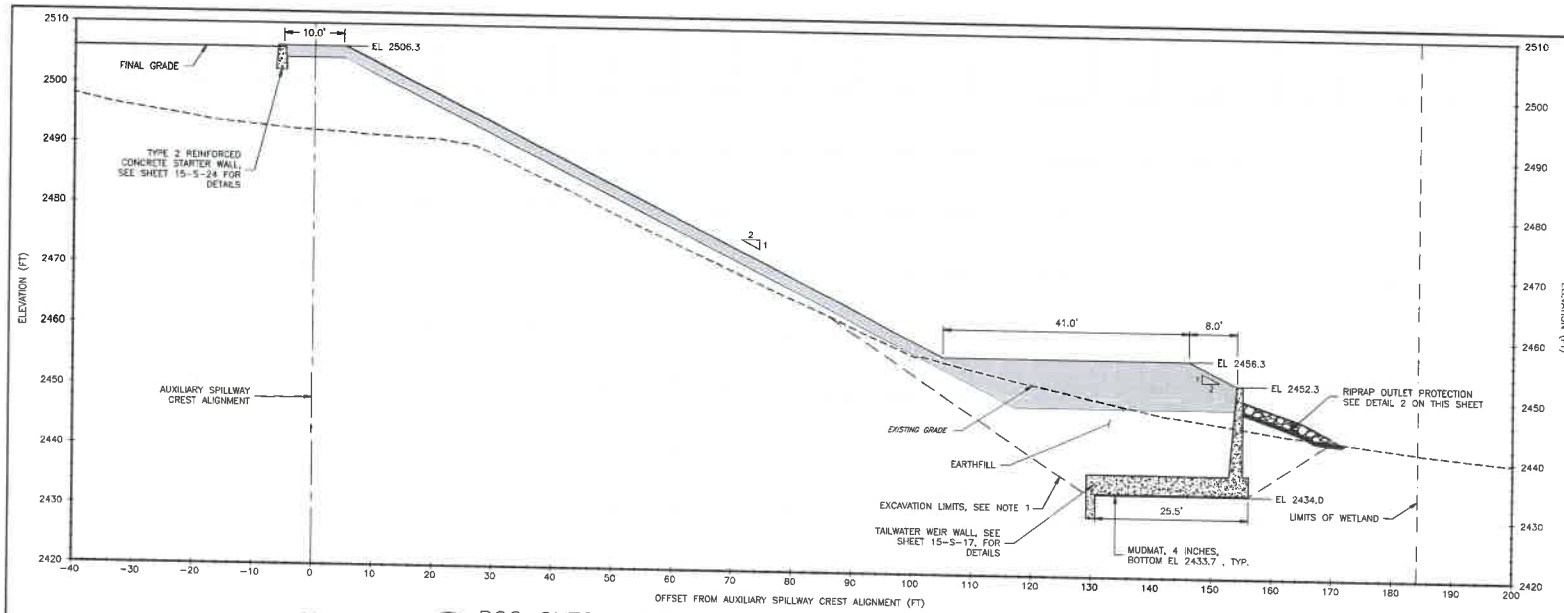
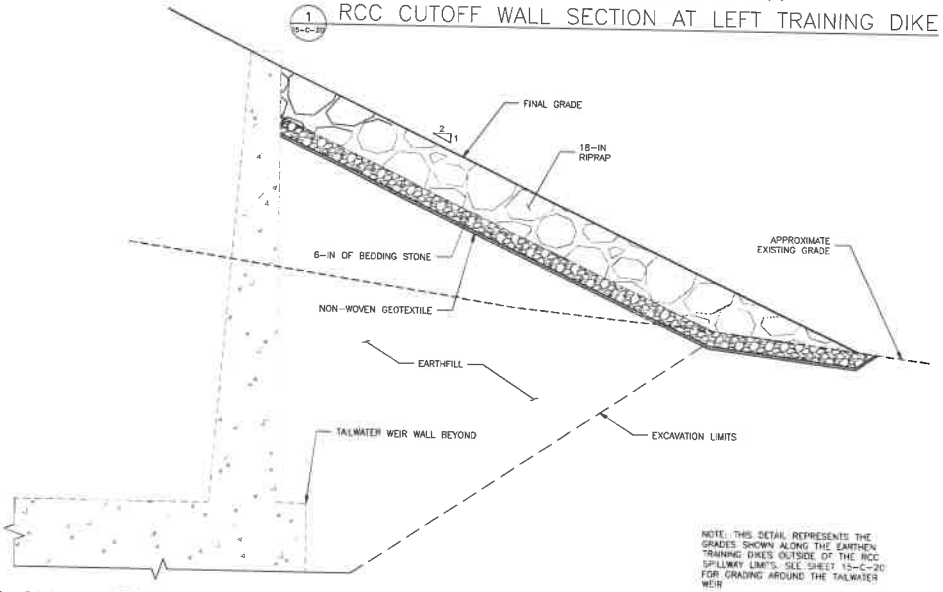


1 (15-C-20) RCC CUTOFF WALL SECTION AT LEFT TRAINING DIKE

SCALE: 1"=10'



NOTE: THIS DETAIL REPRESENTS THE GRADES SHOWN ALONG THE EARTHEN TRAINING DIKES OUTSIDE OF THE RCC SPILLWAY LIMITS. SEE SHEET 15-C-20 FOR GRADING AROUND THE TAILWATER WEIR

2 (15-C-21) RIPRAP OUTLET PROTECTION TYPICAL DETAIL DOWNSTREAM OF TRAINING DIKE

SCALE: 1"=5'

NOTES

1. TAILWATER WEIR WALL SUBGRADE SHALL BE THE TOP OF ROCK UNLESS OTHERWISE APPROVED BY THE COR. EXCAVATION LIMITS SHOWN ARE ESTIMATED BASED ON THE APPROXIMATE TOP OF ROCK. ACTUAL TOP OF ROCK AND BOTTOM OF EXCAVATION MAY VARY. TOP OF ROCK SHALL BE DEFINED IN THE FIELD BY THE COR.

JONATHAN W. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Designed	CDS	Date	SEP 24
Drawn	CRP		SEP 24
Checked	EBB		SEP 24
Approved	JWP		SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

AUXILIARY SPILLWAY SECTIONS - SHEET 4 OF 4

Brush Creek Watershed Mercer County, WV

ATERRA | Schnabel ENGINEERING

300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002, Phone: 267-464-1646, schnabel-eng.com

USDA United States Department of Agriculture

Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-25

SEPTEMBER 2024

SHEET 27 OF 61

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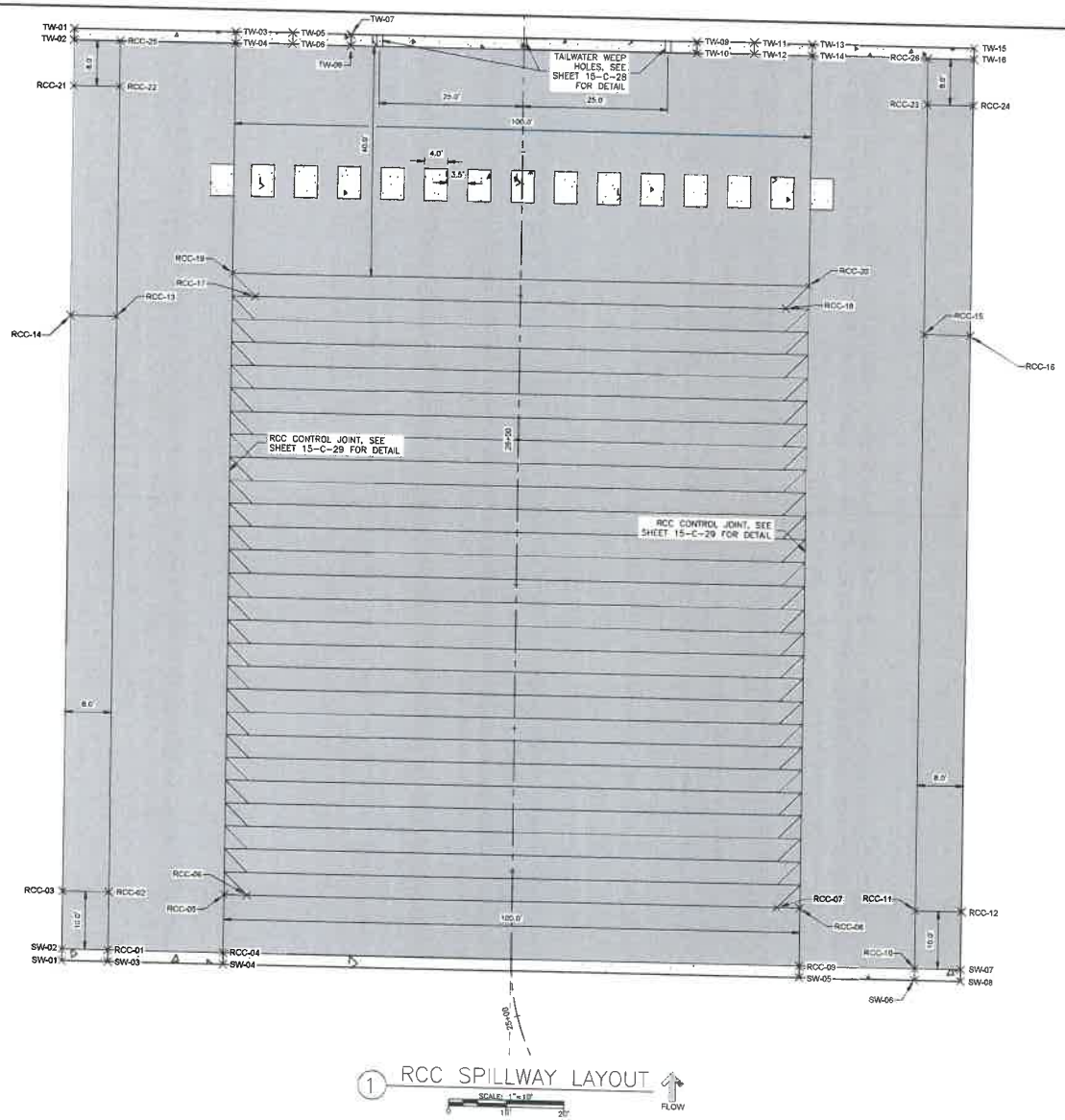

1 RCC SPILLWAY LAYOUT

SCALE: 1" = 10'

ASW AUXILIARY SPILLWAY CHANNEL LAYOUT

POINT ID	NOTHING (FT)	EASTING (FT)	TOP OF LIFT/ WALL ELEVATION (FT)
RCC-01	118484.62	1914258.1265	2506.30
RCC-02	118492.21	1914284.6435	2506.30
RCC-03	118497.42	1914258.5671	2506.30
RCC-04	118471.60	1914273.3021	2496.30
RCC-05	118479.18	1914279.8146	2496.30
RCC-06	118476.56	1914282.8334	2494.30
RCC-07	118416.62	1914352.6346	2494.30
RCC-08	118414.01	1914355.6675	2496.30
RCC-09	118406.45	1914349.1685	2496.30
RCC-10	118393.41	1914364.3432	2506.30
RCC-11	118401.00	1914370.8599	2506.30
RCC-12	118395.79	1914376.9239	2506.30
RCC-13	118568.11	1914329.7473	2456.30
RCC-14	118573.32	1914323.6768	2456.30
RCC-15	118476.83	1914436.0397	2456.30
RCC-16	118471.62	1914442.1080	2456.30
RCC-17	118555.47	1914350.5721	2442.30
RCC-18	118495.50	1914420.4055	2442.30
RCC-19	118561.11	1914350.1411	2440.30
RCC-20	118495.96	1914426.0277	2440.30
RCC-21	118603.66	1914349.7728	2456.30
RCC-22	118598.46	1914355.8283	2456.30
RCC-23	118507.21	1914452.1145	2456.30
RCC-24	118502.00	1914468.1844	2456.30
RCC-25	118604.53	1914361.0440	2452.30
RCC-26	118513.28	1914467.3245	2452.30
SW-01	118488.32	1914250.7528	2506.30
SW-02	118489.63	1914252.0535	2506.30
SW-03	118483.10	1914256.8183	2506.30
SW-04	118470.08	1914271.9988	2496.30
SW-05	118404.94	1914347.8706	2496.30
SW-06	118391.91	1914363.0521	2506.30
SW-07	118388.20	1914370.4022	2506.30
SW-08	118386.70	1914369.1157	2506.30
TW-01	118611.26	1914355.2772	2452.30
TW-02	118609.77	1914355.0010	2452.30
TW-03	118593.00	1914377.5244	2448.30
TW-04	118591.49	1914376.2265	2448.30
TW-05	118586.48	1914385.1117	2448.30
TW-06	118584.98	1914383.8195	2446.30
TW-07	118579.97	1914392.6991	2444.30
TW-08	118578.46	1914391.4069	2444.30
TW-09	118540.88	1914438.2205	2444.30
TW-10	118539.38	1914436.9312	2444.30
TW-11	118534.37	1914445.8081	2446.30
TW-12	118532.86	1914444.5186	2446.30
TW-13	118527.85	1914453.3947	2448.30
TW-14	118526.35	1914452.1051	2448.30
TW-15	118509.58	1914474.6996	2452.30
TW-16	118508.07	1914473.3954	2452.30

NOTE: RCC – AUXILIARY SPILLWAY
SW – STARTER WALL
TW – TAILWATER WEIR

JONATHAN M. PITTMAN
REGISTERED
23485
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

	Date
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved MP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

AUXILIARY SPILLWAY LAYOUT PLAN

Brush Creek Watershed *Mercer County, WV*

Aterra Schnabel JV
300 Brookside Ave., Bldg. 15, Suite 160, Ambler, PA 19002
Phone: 336-274-2048
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-28

SEPTEMBER 2024

SHEET 28 OF 61

REVISIONS

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Last Saved By: CDS8520AS Savedtime: 10/2/2024 11:19 AM Filename: 0:\2022\22-0001\Engineering\Drawings\Civil\Sheets\15-C-28 ASW AUXILIARY SPILLWAY LAYOUT PLAN.dwg

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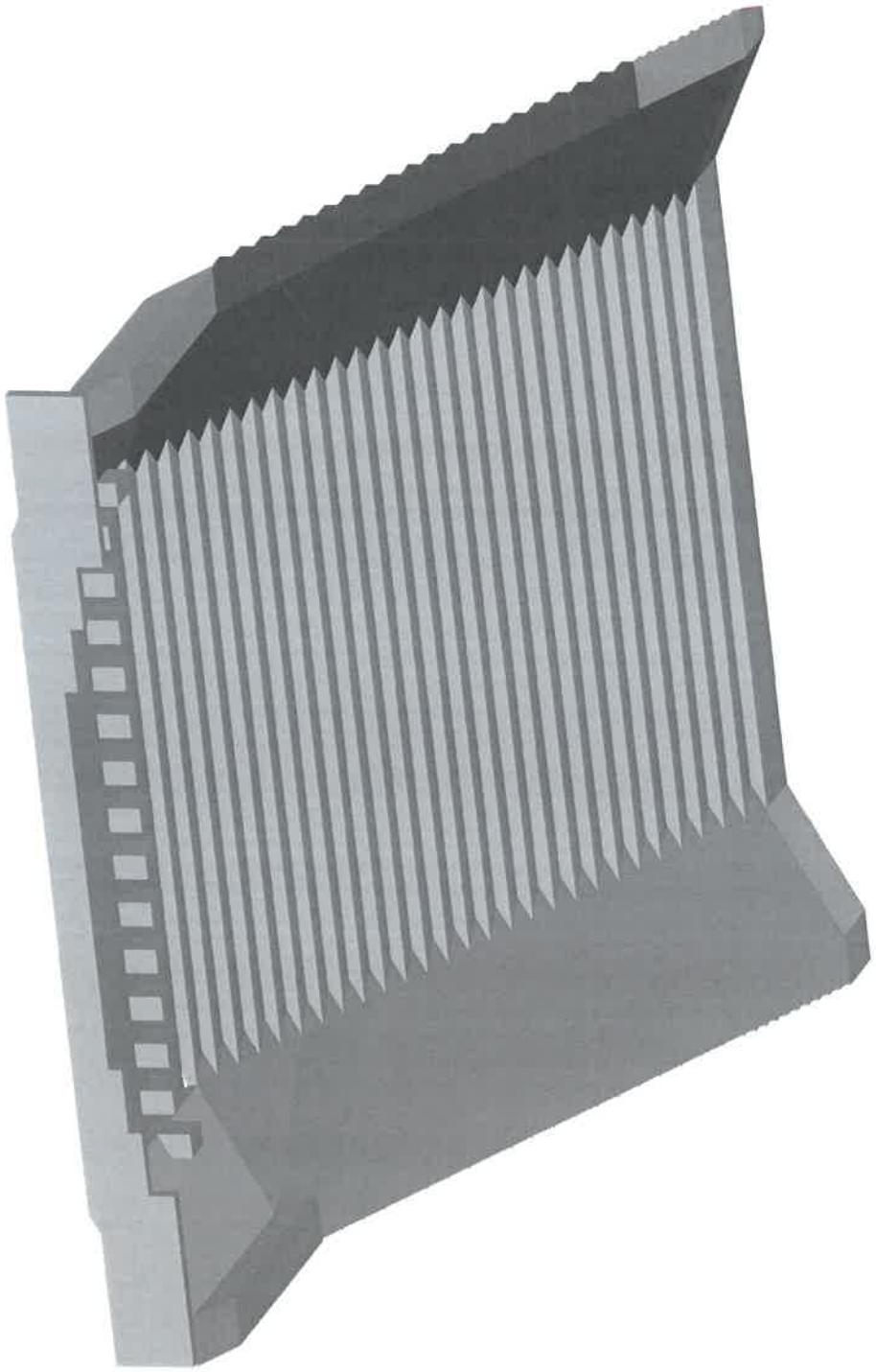

1 RCC SPILLWAY 3D ISOMETRIC VIEW
NTS

REVISIONS			
NO.	DESCRIPTION	TITLE	DATE APPROVED

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Contract No. 12SPEC18D0023
Drawing No. 15-C-27
SEPTEMBER 2024
SHEET 28 OF 61

ATERRA SOLUTIONS | Schnabel ENGINEERING
300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 336-274-9458
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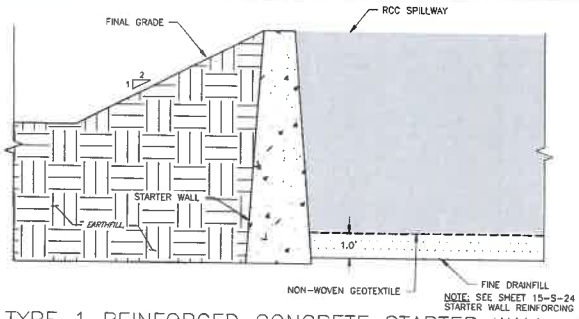
BRUSH CREEK SITE 15 DAM REHABILITATION

AUXILIARY SPILLWAY 3D MODEL

Brush Creek Watershed *Mercer County, WV*

		Date
Designed	CDS	SEP 24
Drawn	CRP	SEP 24
Checked	JMP	SEP 24
Approved	----	SEP 24

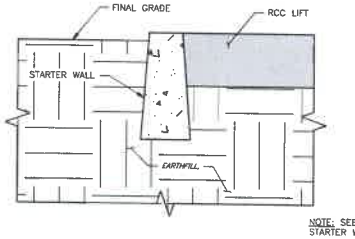
JONATHAN M. PITTMAN REGISTERED PROFESSIONAL ENGINEER 23485 STATE OF WEST VIRGINIA



NOTE: SEE SHEET 15-S-24 FOR STARTER WALL REINFORCING DETAILS

1 TYPE 1 REINFORCED CONCRETE STARTER WALL

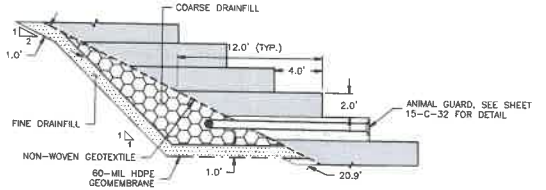
NTS



NOTE: SEE SHEET 15-S-24 FOR STARTER WALL REINFORCING DETAILS

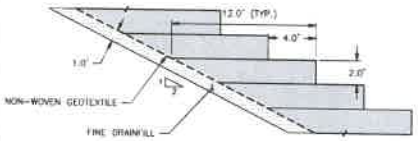
2 TYPE 2 REINFORCED CONCRETE STARTER WALL

NTS



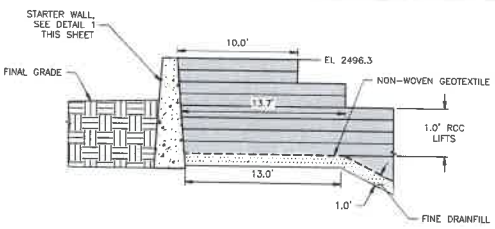
3 TOP RCC DRAIN OUTLET DETAIL – SECTION

SCALE: 1"=5'



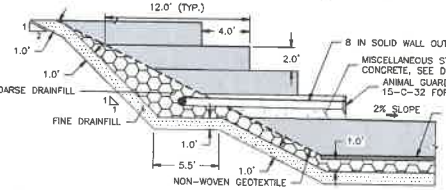
4 TYPICAL RCC STEP DETAIL

SCALE: 1"=5'



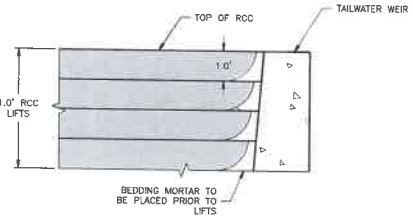
5 TYPICAL STARTER WALL–RCC PLACEMENT DETAIL

SCALE: 1"=5'



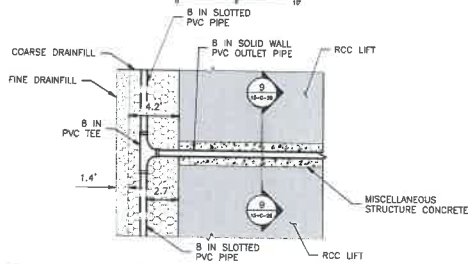
6 BOTTOM RCC DRAIN OUTLET DETAIL – SECTION

SCALE: 1"=5'



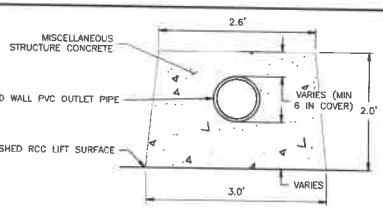
7 RCC–TAILWATER WEIR CONTACT DETAIL

SCALE: 1"=5'



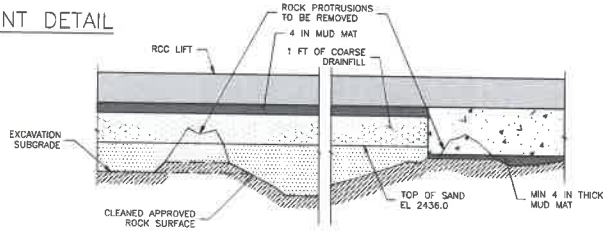
8 RCC DRAIN OUTLET DETAIL – PLAN

SCALE: 1"=5'



9 PIPE ENCASEMENT DETAIL

SCALE: 1"=1'

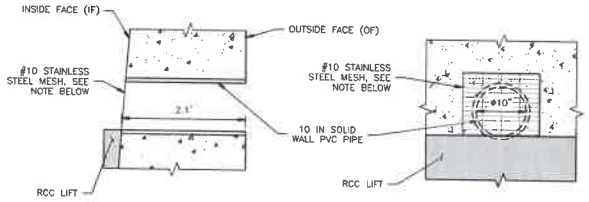


NOTES:

1. THIS DETAIL ONLY APPLIES TO THE RCC SUBGRADE. SEE SHEET 15-C-15 FOR TOE DRAIN FOUNDATION PREPARATION DETAILS.
2. CONTRACTOR SHALL COVER THE CLEANED, APPROVED ROCK SURFACE IMMEDIATELY AFTER FINAL CLEANING. SEE CONSTRUCTION SPECIFICATION 63 FOR ADDITIONAL DETAILS.
3. FOUNDATION GRADE SHALL HAVE NO VERTICAL SURFACES. VERTICAL SURFACES FOUND IN ROCK SHALL BE TRIMMED TO A MINIMUM SLOPE OF 1H:1V OR AS DIRECTED BY COR

10 ASW FOUNDATION PREPARATION DETAILS

NTS



NOTE: MOUNT #10 MESH TO THE INSIDE FACE OF THE WALL TO COVER AT LEAST 2 INCHES BEYOND THE EXTENTS OF THE PVC OUTLET ON TOP, LEFT, AND RIGHT SIDES. ATTACH THE MESH TO THE WALL USING STAINLESS STEEL FASTENERS. FOLLOW MANUFACTURES INSTRUCTIONS FOR INSTALLATION.

11 TAILWATER WEIR WEEP HOLE

SCALE: 1"=1'

NOTES:

1. ALL COLD JOINTS SHALL BE TREATED IN ACCORDANCE WITH CS 36. COLD JOINT TREATMENT INCLUDING PLACEMENT OF BONDING MORTAR.

REVISIONS			
#	DATE APPROVED	TITLE	DESCRIPTION

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JONATHAN M PITTMAN REGISTERED 23465 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

AUXILIARY SPILLWAY DETAILS

Mercer County, WV

Brush Creek Watershed

ATERRA | Schnabel ENGINEERING
300 Brookside Ave., Bldg. 18, Suite 160, Beckley, WV 25801
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USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-28

SEPTEMBER 2024

SHEET 30 OF 61

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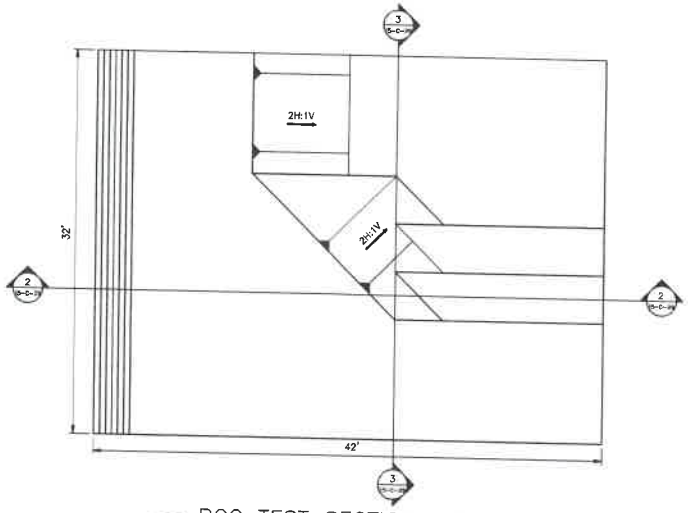
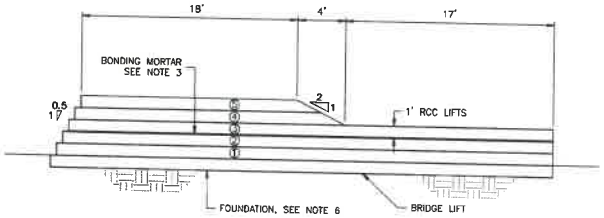


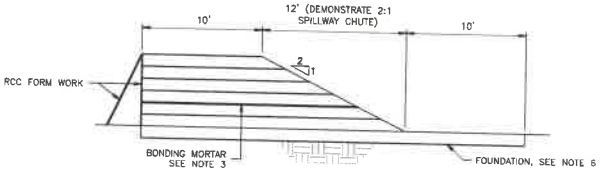
1 RCC TEST SECTION PLAN

SCALE: 1"=5'



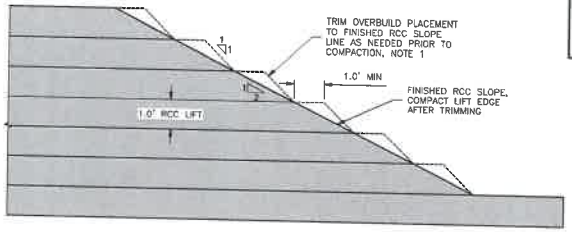
2 RCC TEST SECTON – PROFILE VIEW

SCALE: 1"=5'



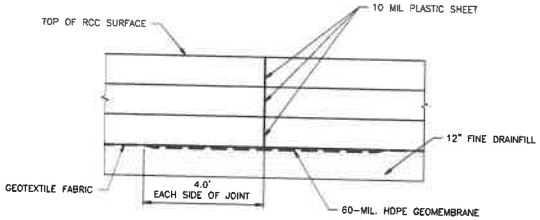
3 RCC TEST SECTION – SECTION VIEW

SCALE: 1"=5'



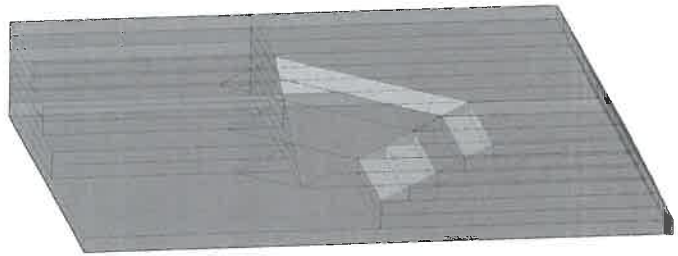
4 UNFORMED SLOPED TRAINING WALL EDGE FINISHING DETAIL

SCALE: 1"=2'



5 RCC CONTROL JOINT TYPICAL DETAIL

SCALE: 1"=2'



6 RCC TEST SECTION 3D ISOMETRIC VIEW

NTS

NOTES:

1. PRIOR TO RCC PRODUCTION, THE CONTRACTOR MUST CONSTRUCT A TEST SECTION IN ACCORDANCE WITH CS 36.
2. ALL EQUIPMENT PROPOSED FOR USE IN THE PERMANENT WORK SHALL BE DEMONSTRATED AT THE RCC TEST SECTION.
3. ALL COLD JOINTS OCCURRING DURING THE TEST SECTION SHALL BE TREATED IN ACCORDANCE WITH CS 36. COLD JOINT TREATMENT INCLUDING PLACEMENT OF BONDING MORTAR SHALL BE DEMONSTRATED AT ONE FULL LIFT PRIOR TO PLACEMENT OF LIFT 3.
4. ALL PROCEDURES SPECIFIED FOR CONSTRUCTION OF THE RCC SHALL BE INCORPORATED IN ALL LIFTS PLACED INCLUDING JOINTS, CURING, LIFT SURFACE PREPARATION AND QUALITY CONTROL.
5. IF DIRECTED BY THE COR, HEIGHT OF TEST SECTION MAY BE INCREASED TO FURTHER DEMONSTRATE PLACING TECHNIQUES PRIOR TO INITIATION OF PERMANENT WORK.
6. LIFT 1 SHALL BE PLACED WITHIN 24 HOURS OF PLACING BRIDGE LIFT.
7. DETERMINE THE AMD ON LIFT 2 IN ACCORDANCE WITH CS 36. REPEAT THE PROCEDURE ON LIFT 3 IF DEEMED NECESSARY BY THE ENGINEER.

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

JONATHAN M PITTMAN
REGISTERED
23485
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

	Date
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

RCC TEST SECTION DETAILS

Brush Creek Watershed *Mercer County, WV*

Schnabel Engineering
ATERRA SOLUTIONS
300 Brookside Ave., Bldg. 15, Suite 160, Morgantown, WV 26501
Phone: 330-274-8456
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United States Department of Agriculture
USDA
Natural Resources Conservation Service

Contract No.
12SPEC18D0023

Drawing No.
15-C-29

SEPTEMBER 2024

SHEET 31 OF 51

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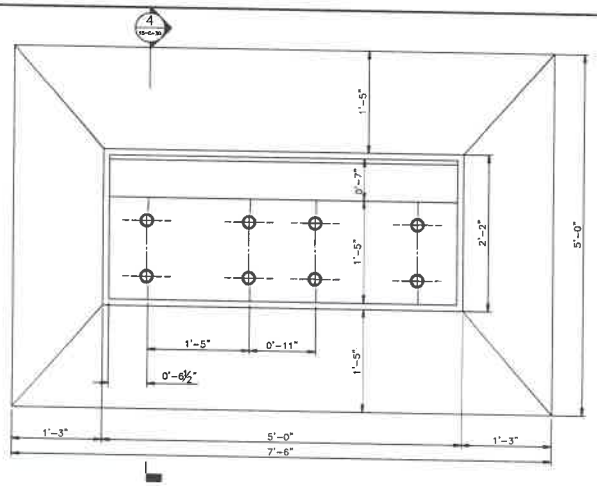
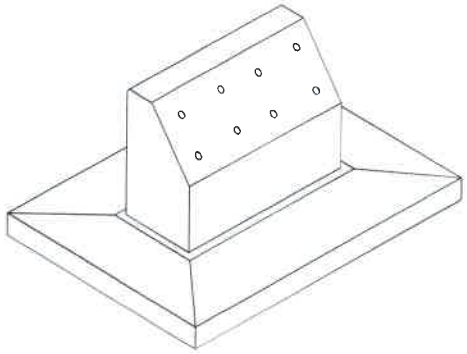


1 PROJECT MONUMENT – PLAN

SCALE: 1"=10'

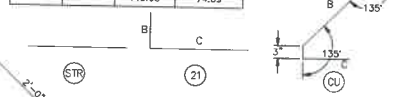


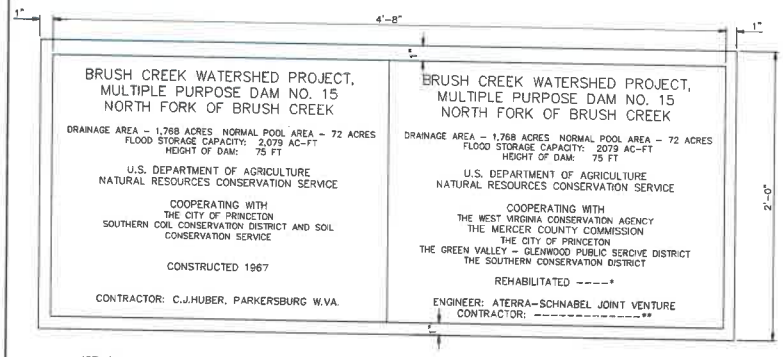
2 PROJECT MONUMENT – ISOMETRIC

NTS

PROJECT MONUMENT STEEL SCHEDULE							
MARK	SIZE	QUAN.	LENGTH	TYPE	B	C	TOTAL LENGTH
701	4	5	6' 10"	STR			34' 2"
702	4	8	4' 6"	STR			36' 0"
703	4	7	2' 7"	21	1' 0"	1' 7"	18' 1"
704	4	7	3' 11"	21	1' 0"	2' 11"	27' 5"
705	4	2	4' 6"	STR			9' 0"
706	4	7	2' 11"	CU	1' 11"	1' 0"	20' 5"

	BAR SIZE	LINEAR FT	WEIGHT LBS
TOTAL	4	145.08	74.09

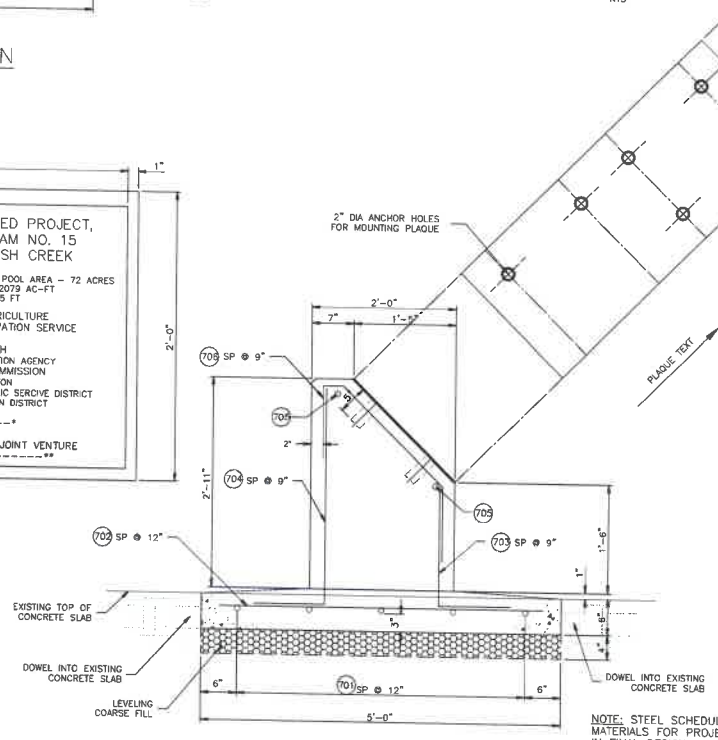




*REHABILITATION YEAR SHALL BE YEAR CONSTRUCTION IS COMPLETE.
**CONTRACTOR IS TO BE DETERMINED

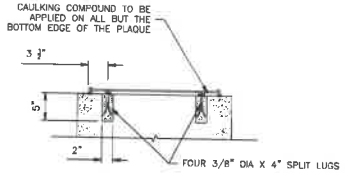
3 PROJECT MONUMENT – PLAQUE

SCALE: 1"=5'



4 PROJECT MONUMENT – ELEVATION

SCALE: 1"=10'



5 PLAQUE MOUNTING DETAIL

NTS

PROJECT MONUMENT NOTES:

1. 3/4" CHAMFER ALL EXPOSED EDGES OF MONUMENT.
2. USE A CARBORRUNDUM RUBBED FINISH ON MONUMENT.

NOTE: STEEL SCHEDULE AND DOWEL SPACING AND MATERIALS FOR PROJECT MONUMENT TO BE ADDED IN FINAL DESIGN

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

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JONATHAN M PITTMAN
REGISTERED
23485
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

Date	
Designed COS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

PROJECT MONUMENT DETAILS

Brush Creek Watershed

Mercer County, WV

Schnabel ENGINEERING
ATERRA SOLUTIONS
300 Brookside Ave., Bldg. 18, Suite 160,
Beckley, WV 25801
Phone: 336-272-4245
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United States Department of Agriculture
Natural Resources Conservation Service

Contract No.
12SPEC18D0023

Drawing No.
15-C-30

SEPTEMBER 2024

SHEET 32 OF 61

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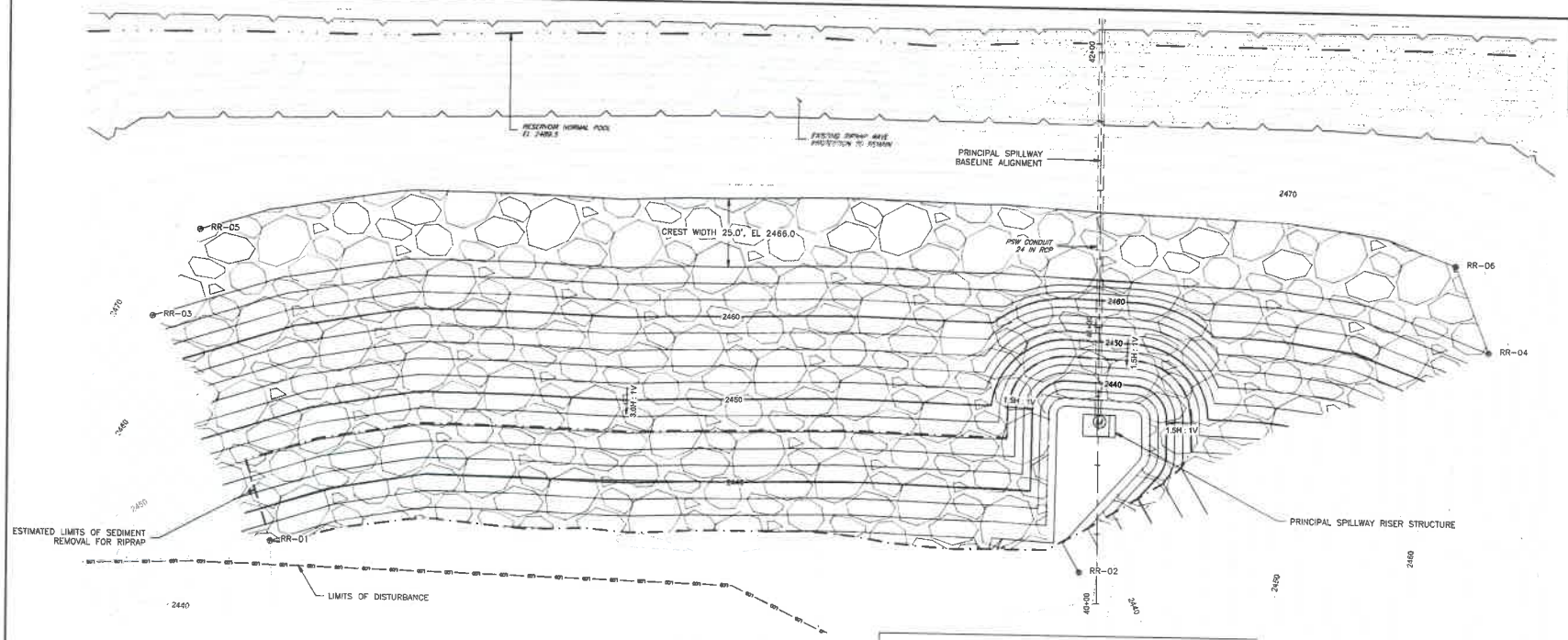
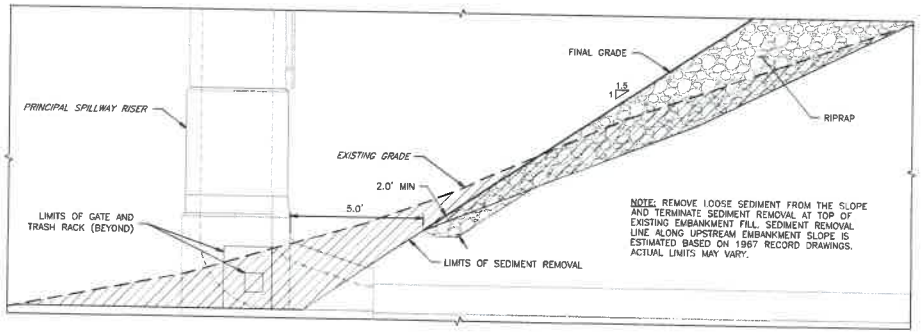


1 RIPRAP BERM PLAN

SCALE 1"=20'

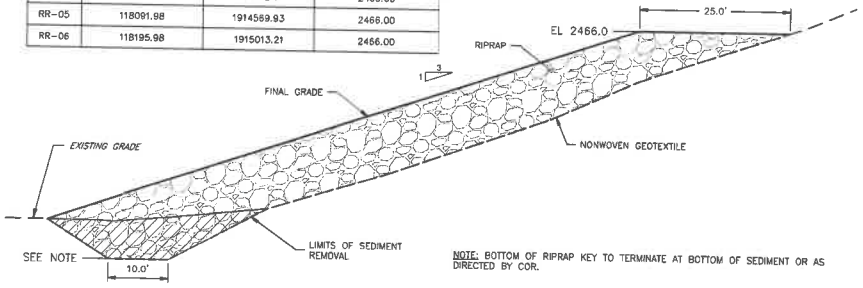
RIPRAP BERM POINT TABLE			
POINT	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)
RR-01	117989.16	1914622.30	2434.00
RR-02	118053.53	1914908.86	2434.00
RR-03	118057.25	1914560.99	2466.00
RR-04	118168.42	1915032.67	2466.00
RR-05	118091.98	1914569.93	2466.00
RR-06	118195.98	1915013.21	2466.00



2 RIPRAP NEAR RISER TYPICAL SECTION

NTS

FLOW



3 RIPRAP BERM TYPICAL SECTION

SCALE 1"=10'

FLOW

NOTES:

1. REMOVE SEDIMENT WITHIN THE FOOTPRINT OF RIPRAP. CONTRACTOR TO VERIFY SEDIMENT ELEVATIONS PRIOR TO STARTING EXCAVATION.

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

JONATHAN W. PITTMAN REGISTERED 22485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JWP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

UPSTREAM RIPRAP BERM DETAILS

Brush Creek Watershed — Mercer County, WV

Schnabel ENGINEERING

ATERRA SOLUTIONS

300 Brookside Ave., Bldg. 18, Suite 160, Beckley, WV 25801 Phone: 304-763-2246 schnabel-eng.com

USDA United States Department of Agriculture Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-31

SEPTEMBER 2024

SHEET 33 OF 61

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Last Saved By: CPM@SCHNABEL Save Date: 9/6/2024 11:33 AM File Date: 9/5/2024 2:14 PM
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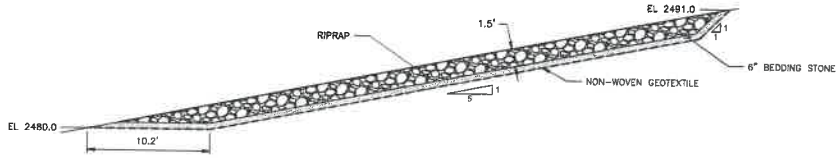
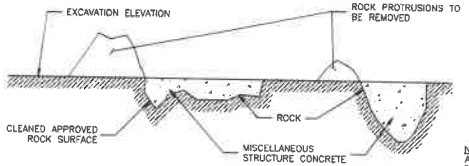


1 PROPOSED ASW ENTRANCE RIPRAP WAVE PROTECTION

SCALE: 1"=5'

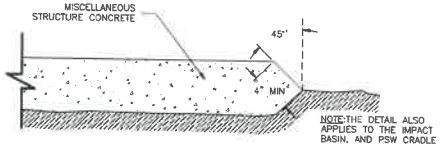
NOTE: SLOPE SHOWN IS TYPICAL VARIES ACROSS ENTRACE OF AUXILIARY SPILLWAY CHANNEL



NOTE: THE DETAIL ALSO APPLIES TO THE IMPACT BASIN, AND PSW CRADLE

2 ROCK REMOVAL AND BACKFILL CONCRETE

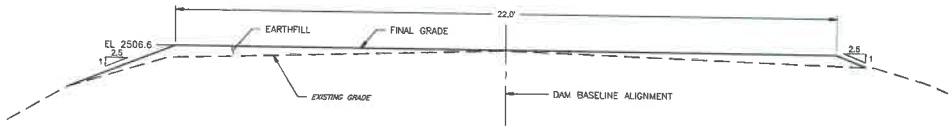
SCALE: 1"=10'



NOTE: THE DETAIL ALSO APPLIES TO THE IMPACT BASIN, AND PSW CRADLE

3 BACKFILL CONCRETE FINISHING DETAIL

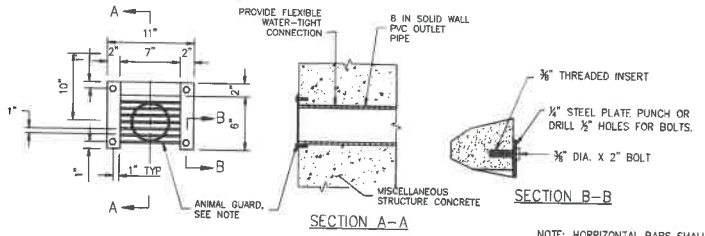
SCALE: 1"=10'



5 CREST IMPROVEMENTS TYPICAL DETAIL

SCALE: 1"=2'

NOTE: THIS DETAIL SHALL APPLY TO THE ENTIRETY OF THE EMBANKMENT CREST AND TRAINING DIKES OR WHERE DETERMINED AS NEEDED BY THE COR.



NOTE: HORRIZONTAL BARS SHALL BE 5 EQUALLY SPACED BARS FOR GIVEN PIPE DIAMETERS

4 ANIMAL GUARD DETAIL

NTS

JONATHAN M. PITTMAN
REGISTERED
23485
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

	Date
Designed COS	SEP 24
Drawn CRP	SEP 24
Checked FBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

MISCELLANEOUS CIVIL DETAILS

Brush Creek Watershed Mercer County, WV

Aterra Solutions | Schnabel Engineering

300 Brookside Ave., Bldg. 18, Suite 100, Ambler, PA 19002
Phone: 336-217-2456
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-C-32

SEPTEMBER 2024

SHEET 34 OF 61

REVISIONS			
#	DATE	APPROVED	TITLE / DESCRIPTION

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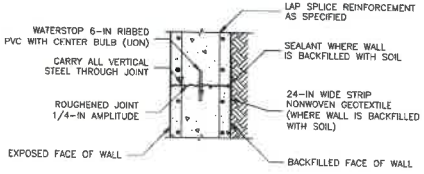
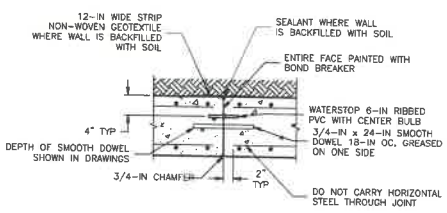
Last Saved By: CPRITCHARD, Date/Time: 10/2/2024 11:57 AM, Pathname: I:\2024\Projects\Mercer County\Brush Creek\Design\Drawings\Civil\Miscellaneous\Brush Creek Misc Civil Details.dwg, Layout: MISCELLANEOUS CIVIL DETAILS

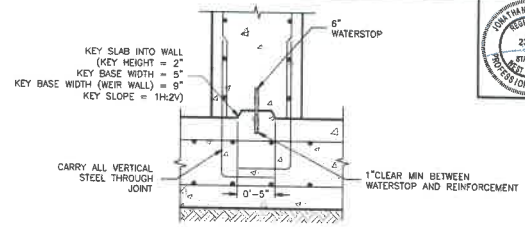


1 HORIZONTAL CONSTRUCTION JOINT (CJ) IN WALLS



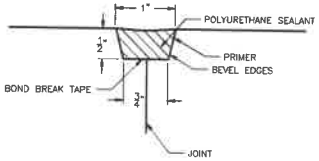
2 CONTRACTION JOINT IN WALLS (PLAN)

NTS



3 CONSTRUCTION JOINT AT BASE OF WALLS

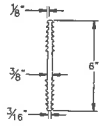
NTS



4 JOINT SEALANT DETAIL

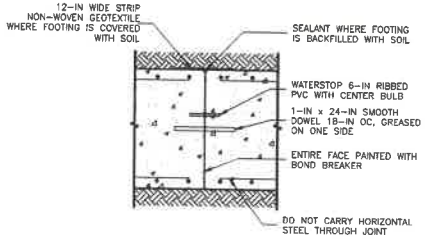
NOTE: EXPANSION JOINT MATERIAL NOT SHOWN FOR CLARITY.

NTS



5 TYPICAL PVC WATERSTOP

SCALE: 3"=1'0"



6 CONTRACTION JOINT IN WEIR WALL SLABS

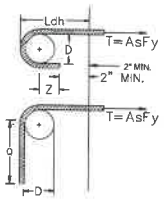
NTS

MINIMUM REINF. BAR DEVELOPMENT LENGTH (IN)		
BAR SIZE	TOP	OTHER
#3	12	12
#4	14	12
#5	18	14
#6	21	17
#7	31	24
#8	35	27
#9	45	34
#10	55	42
#11	66	51

MINIMUM REINF. BAR LAP SPLICE LENGTH (IN)		
BAR SIZE	TOP	OTHER
#3	16	16
#4	19	16
#5	24	19
#6	28	23
#7	41	32
#8	46	36
#9	59	45
#10	72	55
#11	86	67

MINIMUM END HOOK DEVELOPMENT LENGTH (IN)*				
BAR SIZE	Ldh	Q	Z	D
#3	6	4.5	2.5	2.25
#4	7	6	2.5	3
#5	8	7.5	2.5	3.75
#6	10	9	3	4.5
#7	11	10.5	3.5	5.25
#8	13	12	4	6
#9	15	13.5	4.5	9
#10	16	15	5	10
#11	18	16.5	5.5	11

** SIDE COVER MUST BE ≥ 2.5"
** END COVER MUST BE ≥ 2"



NOTES:

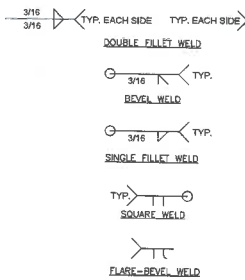
1. TABULATED VALUES ARE BASED ON UNCOATED GRADE 60 REBAR AND CONCRETE WITH f'c=4500 PSI AND 2.5" COVER.
2. TENSION DEVELOPMENT LENGTHS AND TENSION LAP SPLICE LENGTHS ARE CALCULATED IN ACCORDANCE WITH ACI 12.2.3 AND 12.15, RESPECTIVELY.
3. LAP SPLICE LENGTHS ARE MULTIPLES OF TENSION DEVELOPMENT LENGTHS; CLASS A=1.0*ld AND CLASS B=1.3*ld (ACI 12.15.1).
4. BAR CENTER-TO-CENTER SPACING WAS ASSUMED TO BE GREATER THAN TWICE THE CONCRETE COVER PLUS ONE BAR DIAMETER, SO THAT "c" WAS GOVERNED BY CONCRETE COVER RATHER THAN BY BAR SPACING. THEREFORE TABULATED VALUES ARE NOT APPLICABLE FOR CENTER-TO-CENTER BAR SPACING LESS THAN 6".
5. TOP BARS ARE HORIZONTAL BARS WITH MORE THAN 12 INCHES OF CONCRETE CAST BELOW THE BARS.

GENERAL CONCRETE NOTES:

1. ALL STRUCTURAL CONCRETE SHALL BE f'c=4500 PSI. ALL CONCRETE SHALL ALSO BE AIR ENTRAINED (4.5 TO 7.5%) AND HAVE A MAXIMUM SLUMP OF 5 INCHES WITHOUT WATER REDUCING ADMIXTURE AND 6.5 INCHES MAXIMUM WITH WATER REDUCING ADMIXTURE.
2. CONCRETE SHALL BE PREPARED, PLACED, AND CURED IN ACCORDANCE WITH THE REQUIREMENTS ADOPTED BY THE AMERICAN CONCRETE INSTITUTE (ACI) AND LOCAL CODES.
3. MAINTAIN MINIMUM CONCRETE COVER AROUND REINFORCING STEEL AS FOLLOWS, UNLESS OTHERWISE INDICATED ON THE DRAWINGS:
   WALLS EXPOSED TO WEATHER OR BACKFILL – 2 INCHES
   WALLS CONTINUALLY EXPOSED TO WATER – 2.5 INCHES
   FOOTINGS AND CONCRETE FORMED AGAINST EARTH – 3 INCHES
4. ALL REINFORCING STEEL SHALL BE DEFORMED BILLET STEEL BARS CONFORMING TO ASTM 615, 60 KSI YIELD GRADE.
5. REINFORCING STEEL SPLICES NOT SHOWN ON THESE DRAWINGS SHALL BE SHOWN ON THE SHOP DRAWINGS AND APPROVED BY THE ENGINEER IN ACCORDANCE WITH THE SPECIFICATIONS. LOCATE SPLICES AT POINT OF MINIMUM STRESS.
6. CHAMFER ALL EXPOSED EDGES, HORIZONTAL, TOP, AND VERTICAL JOINTS IN WALLS 3/4" UNLESS INDICATED ON THE DRAWINGS.
7. PROVIDE CONSTRUCTION, AND CONTRACTION JOINTS AS INDICATED ON THE DRAWINGS, OR AS DIRECTED BY THE ENGINEER. CONTRACTION JOINTS HAVE NO REINFORCING THROUGH THE JOINTS AND THE CONCRETE SURFACES ARE UNBONDED. 6" RIBBED WATERSTOPS ARE REQUIRED ON ALL CONTRACTION AND CONSTRUCTION JOINTS, UNLESS NOTED OTHERWISE. ONLY STRAIGHT BUTT SPLICES MAY BE PERFORMED IN THE FIELD. ALL OTHER SPLICES SHALL BE FACTORY MADE.
8. END VERTICAL WATERSTOP 3" FROM TOP OF WALLS.
9. WATERSTOP SHALL EXTEND FROM SLAB INTO WALLS. MINIMUM RADIUS OF BEND AROUND CORNERS SHALL BE 9"
10. THE FOLLOWING ABBREVIATIONS APPLY

CJ	= CONSTRUCTION JOINT	JT	= JOINT
OCJ	= OPTIONAL CONSTRUCTION JOINT	EJ	= EXPANSION JOINT
BF	= BOTTOM FACE	WP	= WORKING-POINT
NF	= NEAR FACE	EL	= ELEVATION
EF	= EACH FACE	WS	= WATER SURFACE
TF	= TOP FACE	TW	= TAILWATER
FF	= FAR FACE	HW	= HEADWATER
NS	= NEAR SIDE	SPC	= SPACE OR SPACES
FS	= FAR SIDE	CTR	= CENTER OR CENTERS
ES	= EQUALLY SPACED	OC	= ON CENTER
EW	= EACH WAY	HSS	= HOLLOW STRUCTURAL SECTION
UV	= UNIFORMLY VARYING		

WELD SYMBOLS LEGEND



REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

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	Date
Designed COS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

STRUCTURAL NOTES AND TYPICAL DETAILS

Mercer County, WV

Brush Creek Watershed

Schnabel Engineering | ATARRA GROUP
300 Brookside Ave., Bldg. 18, Suite 1901, Ambler, PA 19002, Phone: 267-685-2706, schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-01

SEPTEMBER 2024

SHEET 35 OF 61

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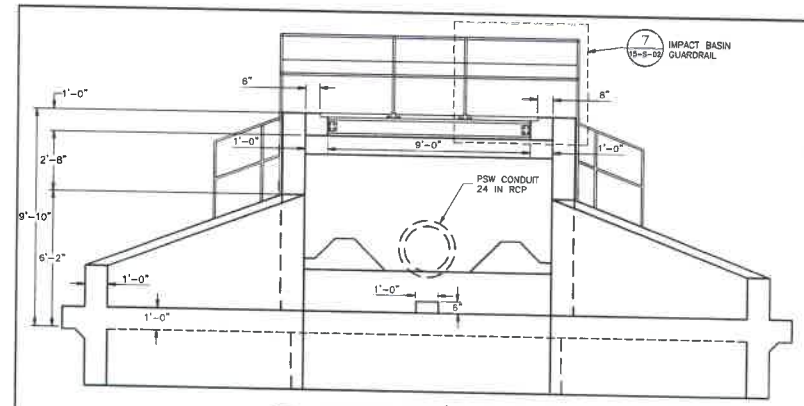
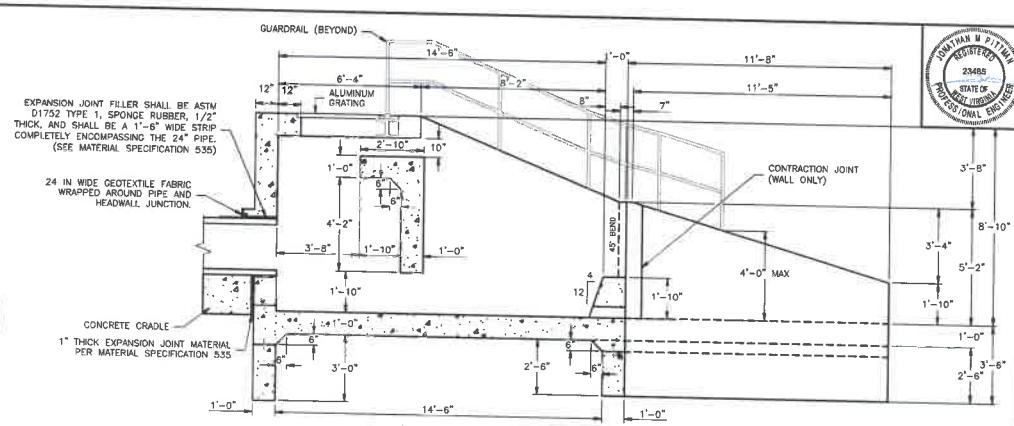
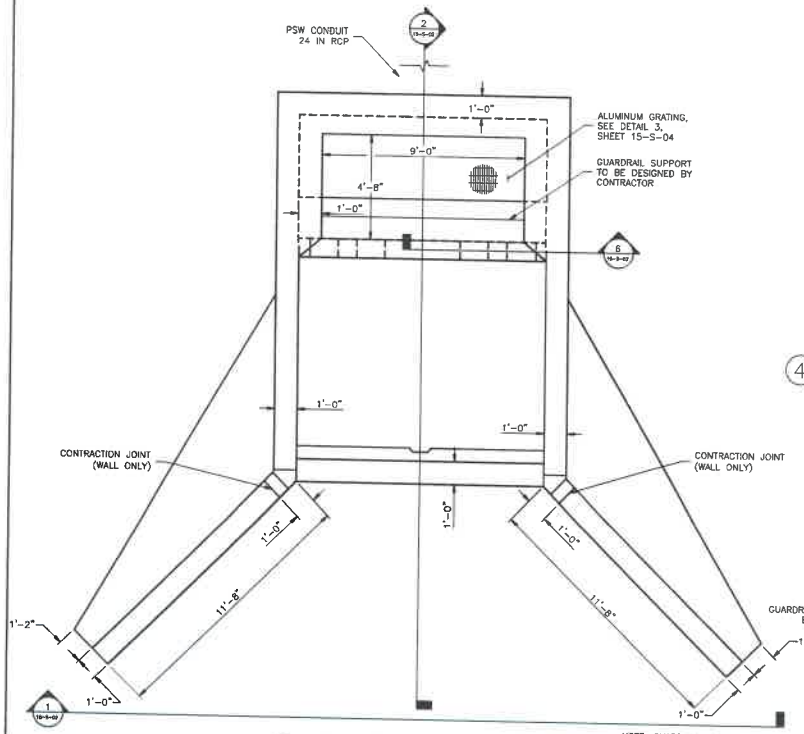
Layout: STRUCTURAL NOTES AND TYPICAL DETAILS



1 IMPACT BASIN ELEVATION
15-S-02
SCALE: 3/8"=1'0"
0 2' 4'

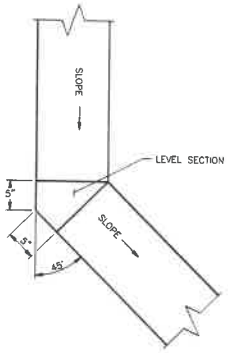


2 IMPACT BASIN SECTION
15-S-02
SCALE: 3/8"=1'0"
0 2' 4'

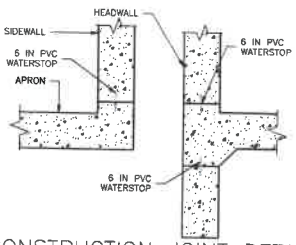


3 IMPACT BASIN PLAN
SCALE: 3/8"=1'0"
0 2' 4'

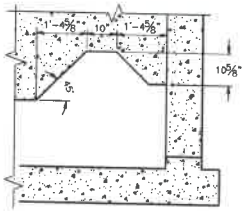
NOTE: GUARDRAIL NOT SHOWN FOR CLARITY



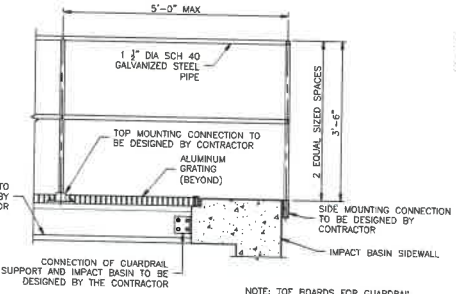
4 JUNCTION PLAN DETAIL
SCALE: 1"=10'
0 10' 20'



5 CONSTRUCTION JOINT DETAILS
SCALE: 1"=20'
0 20' 40'

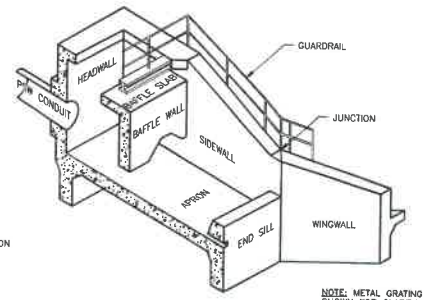


6 BAFFLE SECTION
SCALE: 1"=20'
0 20' 40'



NOTE: TOE BOARDS FOR GUARDRAIL NOT SHOW, BUT SHALL BE PROVIDED IN DESIGN FROM CONTRACTOR

7 IMPACT BASIN GUARDRAIL DETAIL
15-S-02
SCALE: 3/4"=1'0"
0 1' 2'



NOTE: METAL GRATING NOT SHOWN FOR CLARITY

8 IMPACT BASIN HALF ISOMETRIC
NTS

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JONATHAN W. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CRP	SEP 24
Drawn CRP	SEP 24
Checked CDS	SEP 24
Approved JWP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

IMPACT BASIN PLAN, SECTION, AND DETAILS

Mercer County, WV

Brush Creek Watershed

Aterra Schnabel
300 Brookside Ave., Bldg. 18, Suite 160, Beckley, WV 25801
Phone: 336-214-6406
schnabel-eng.com

United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC1800023

Drawing No. 15-S-02

SEPTEMBER 2024

SHEET 36 OF 61

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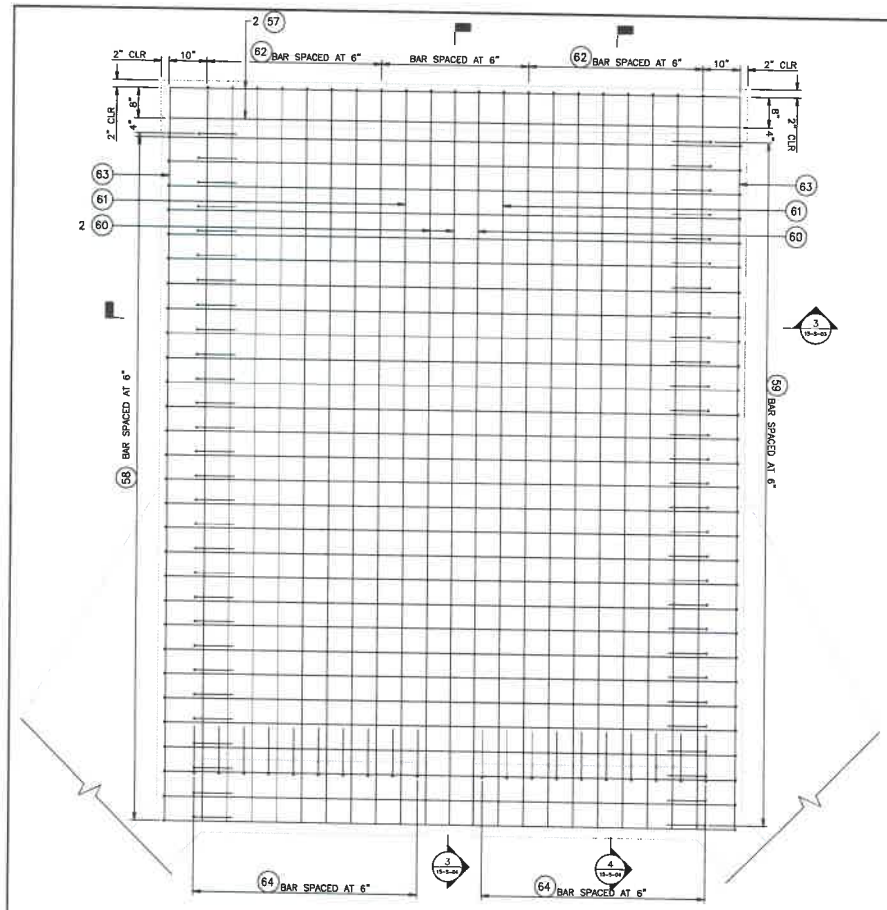
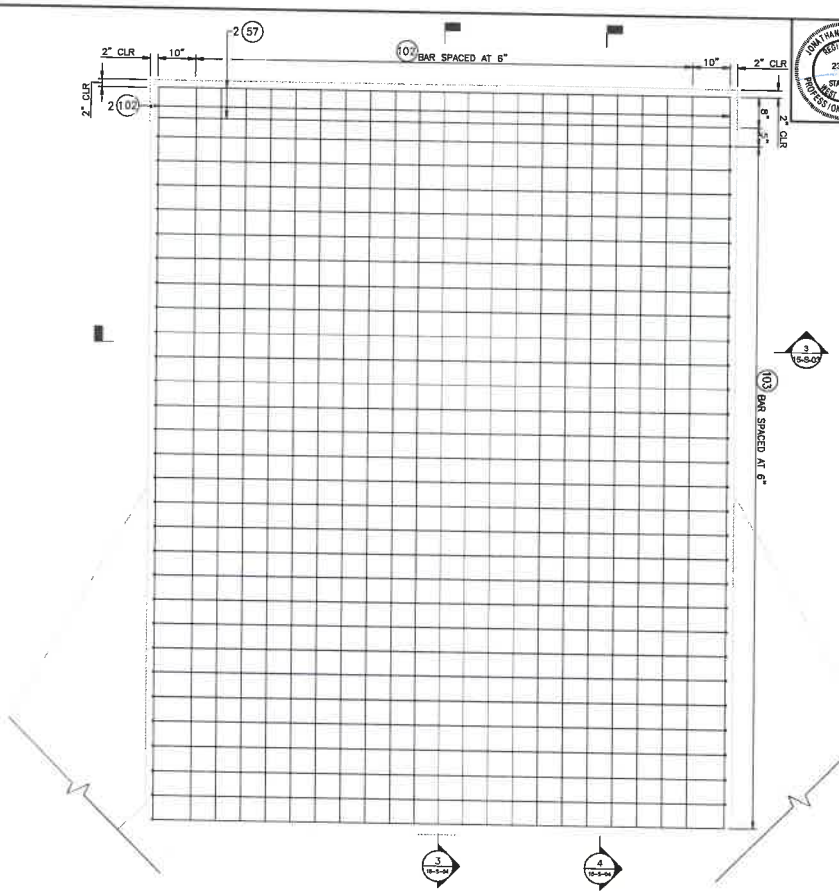


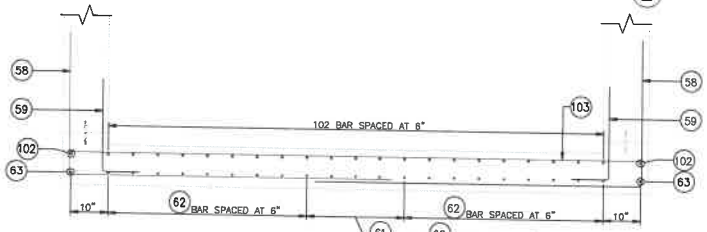
1 PLAN OF APRON – BOTTOM FACE

SCALE: 3/4"=1'0"



2 PLAN OF APRON – TOP FACE

SCALE: 3/4"=1'0"



3 SECTION OF APRON

SCALE: 3/4"=1'0"

NOTES:

1. ALL DIMENSIONS OUTLINED ON IMPACT BASIN DRAWINGS REPRESENT THE OUTSIDE TO OUTSIDE DIAMETER DISTANCE FROM BAR TO BAR. THE REINFORCING BARS SHOWN ON THESE DRAWINGS REPRESENT THE CENTERLINES OF EACH BAR.
2. WINGWALL SLAB STEEL NOT SHOWN FOR CLARITY. SEE SHEET 15-S-07 FOR WINGWALL SLAB DETAILS.

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

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JONATHAN W. PITTMAN REGISTERED 23465 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CRP	SEP 24
Drawn CRP	SEP 24
Checked CWS	SEP 24
Approved JWP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

IMPACT BASIN STEEL PLACEMENT – SHEET 1 OF 6

Brush Creek Watershed Mercer County, WV

ATERRA SCHNABEL JV
300 Brookside Ave., Bldg. 15, Suite 150, Beckley, WV 25801
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USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-03

SEPTEMBER 2024

SHEET 37 OF 61

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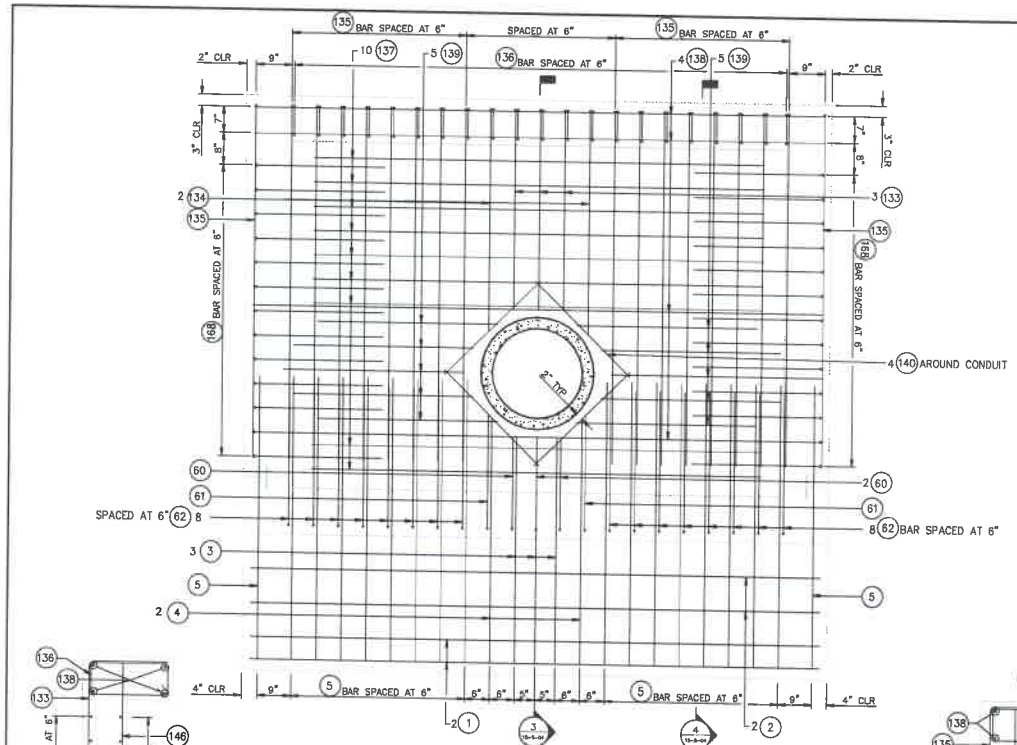
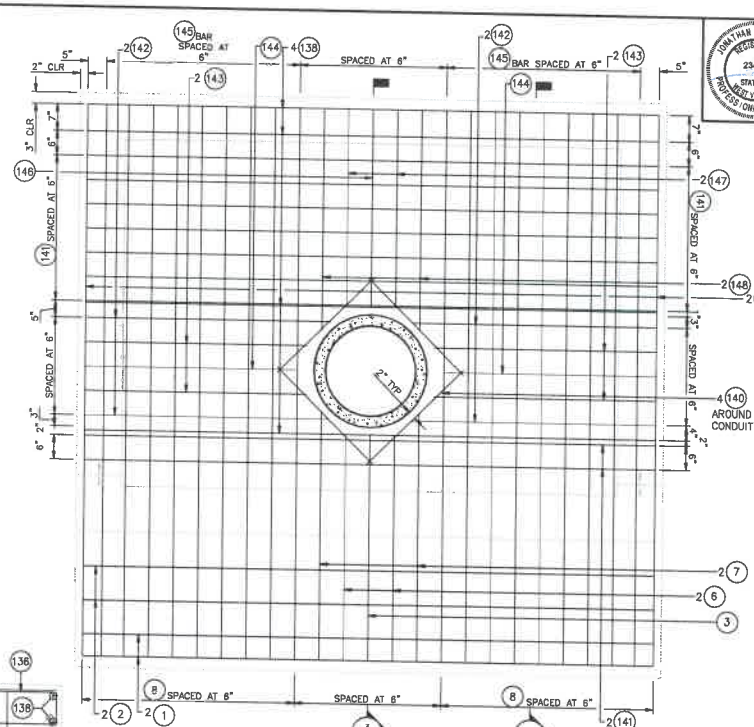


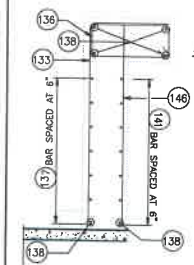
1 HEADWALL UPSTREAM FACE ELEVATION

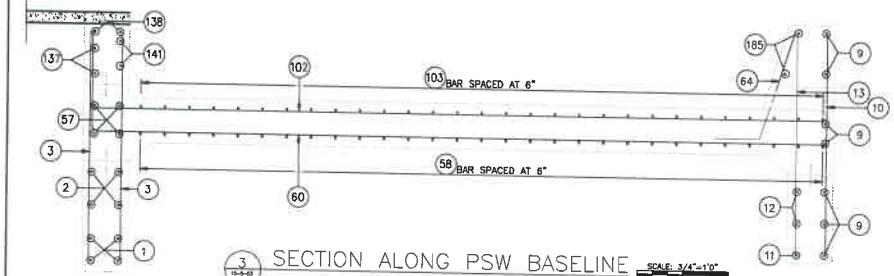
SCALE: 3/4"=1'0"



2 HEADWALL DOWNSTREAM FACE ELEVATION

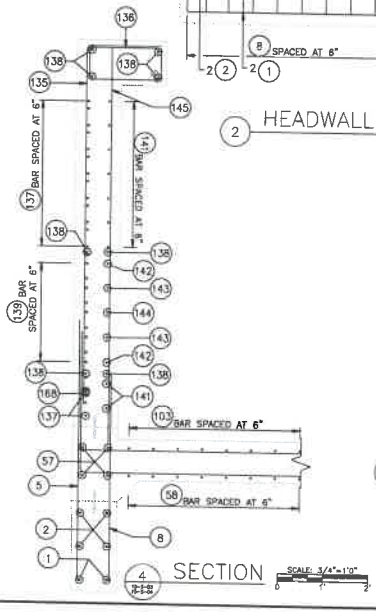
SCALE: 3/4"=1'0"





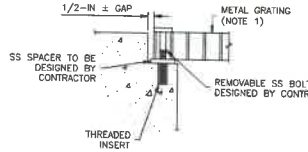
3 SECTION ALONG PSW BASELINE

SCALE: 3/4"=1'0"



4 SECTION

SCALE: 3/4"=1'0"



NOTES:

1. PROVIDE (2-1/4 IN X 3/16 IN) RECTANGULAR BAR DOVETAIL PRESSURE LOCKED 6063-T6 ALUMINUM GRATING WITH SEPARATED SURFACE AND BANDED SIDES.
2. BOLT GRATING SUPPORT WITHIN 12 INCHES OF EACH END AND SPACED A MAXIMUM OF 24 INCHES ON CENTER AS DESIGNED BY CONTRACTOR.
3. SPACERS SHALL BE PROVIDED BETWEEN THE INTERFACE OF THE GRATING AND CONCRETE FOR ALL BOLT CONNECTIONS.

5 TYPICAL GRATING CONNECTION SUPPORT

NTS

NOTES:

1. ALL DIMENSIONS OUTLINED ON IMPACT BASIN DRAWINGS REPRESENT THE OUTSIDE TO OUTSIDE DIAMETER DISTANCE FROM BAR TO BAR. THE REINFORCING BARS SHOWN ON THESE DRAWINGS REPRESENT THE CENTERLINES OF EACH BAR.

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CRP	SEP 24
Drawn CRP	SEP 24
Checked CDS	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

IMPACT BASIN STEEL PLACEMENT - SHEET 2 OF 6

Brush Creek Watershed *Mercer County, WV*

Alterra | Schnabel

300 Brookside Ave., Bldg. 18, Suite 100, Ambler, PA 19002, Phone: 267-384-7456, schnabel-eng.com

United States Department of Agriculture

Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-04

SEPTEMBER 2024

SHEET 38 OF 61

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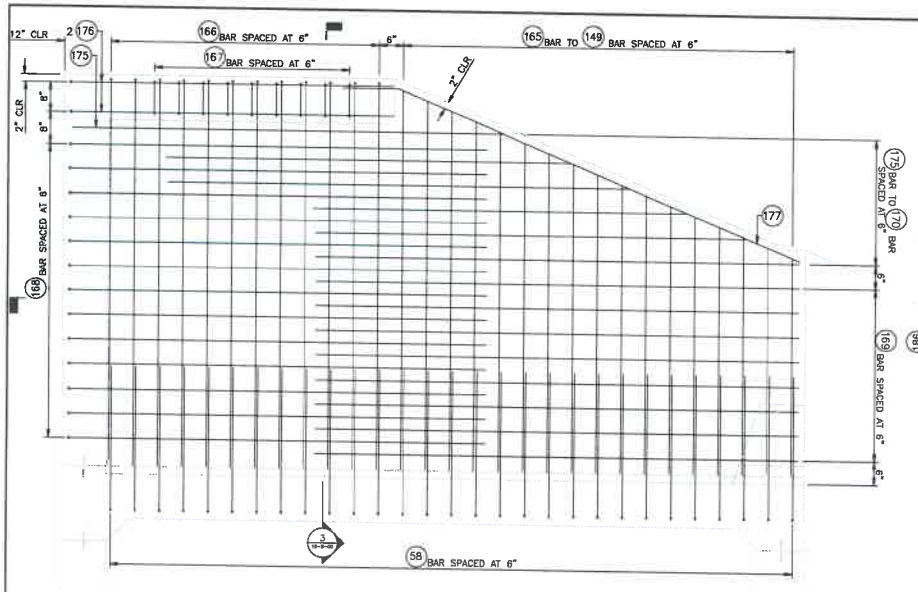
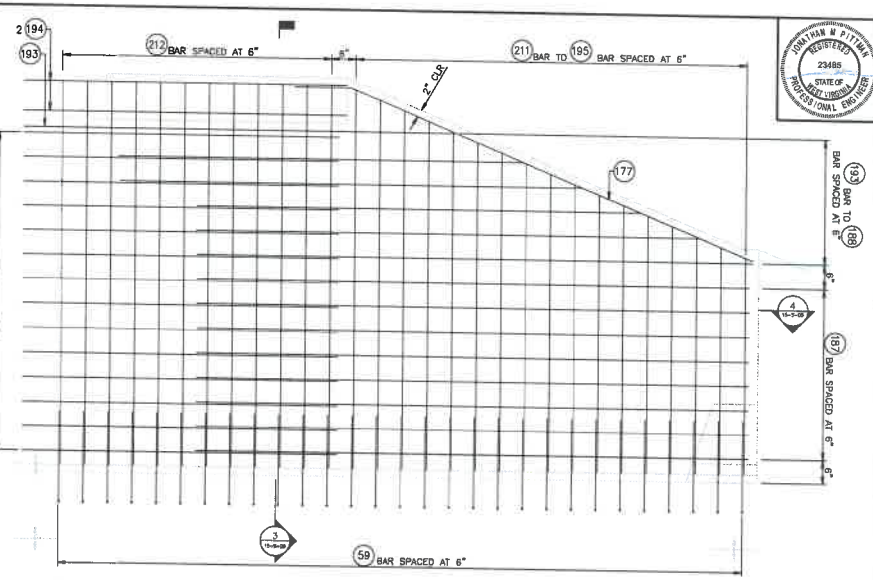
Last Saved By: CSTEVENS DrawDate: 10/2/2024 11:28 AM PlotDate: 10/2/2024 3:04 PM
File: C:\Users\cstevens\Schnabel Engineering\Brush Creek Dam - Documents\Design\Drawings\Civil\Structural\Concrete\Impact Basin\15-S-04 IMPACT BASIN STEEL PLACEMENT - SHEET 2 OF 6.dwg Layout: IMPACT BASIN



1 SIDEWALL ELEVATION–UNEXPOSED FACE

SCALE: 3/4"=1'0"

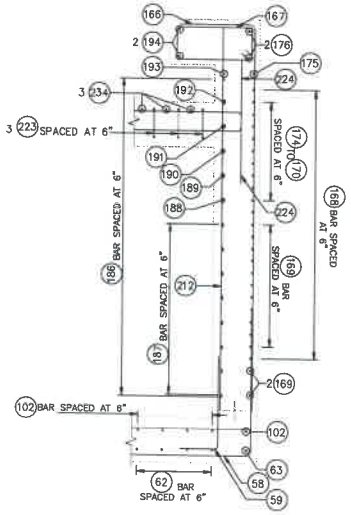
NOTE: GUARDRAIL NOT SHOWN FOR CLARITY, SEE DRAWING 15-S-10 FOR DETAILS



2 SIDEWALL ELEVATION–EXPOSED FACE

SCALE: 3/4"=1'0"

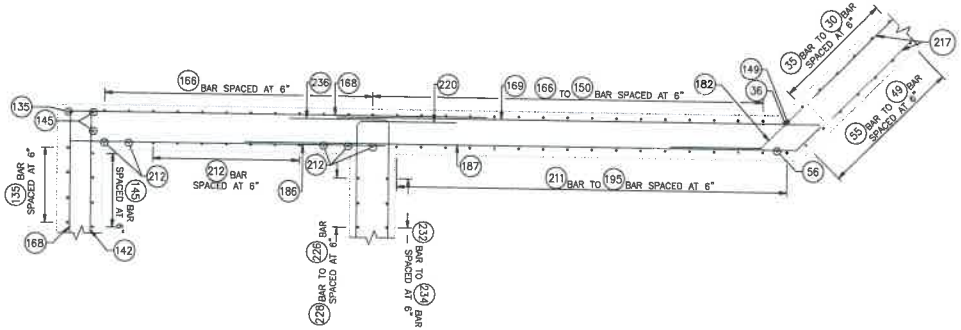
NOTE: GUARDRAIL NOT SHOWN FOR CLARITY, SEE DRAWING 15-S-10 FOR DETAILS



3 BAFFLE SLAB TO SIDEWALL CONECTION

SCALE: 3/4"=1'0"

NOTE: GUARDRAIL NOT SHOWN FOR CLARITY, SEE DRAWING 15-S-10 FOR DETAILS



4 SIDEWALL PLAN VIEW SECTION

SCALE: 3/4"=1'0"

NOTES:

1. ALL DIMENSIONS OUTLINED ON IMPACT BASIN DRAWINGS REPRESENT THE OUTSIDE TO OUTSIDE DIAMETER DISTANCE FROM BAR TO BAR. THE REINFORCING BARS SHOWN ON THESE DRAWINGS REPRESENT THE CENTERLINES OF EACH BAR.

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

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JONATHAN M. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CRP	SEP 24
Drawn CRP	SEP 24
Checked CDS	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

IMPACT BASIN STEEL PLACEMENT – SHEET 3 OF 6

Brush Creek Watershed — Mercer County, WV

ATERRA | Schnabel

300 Brookside Ave., Bldg. 15, Suite 100, Ambler, PA 19002, Phone: 267-419-2500, www.schnabel-eng.com

USDA United States Department of Agriculture

Natural Resources Conservation Service

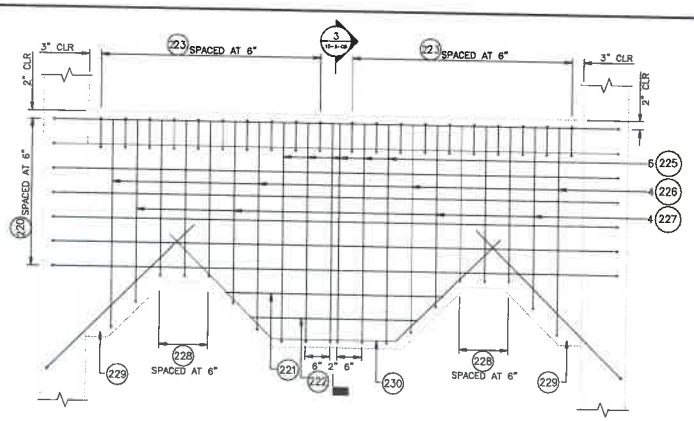
Contract No. 12SPEC18D0023

Drawing No. 15-S-05

SEPTEMBER 2024

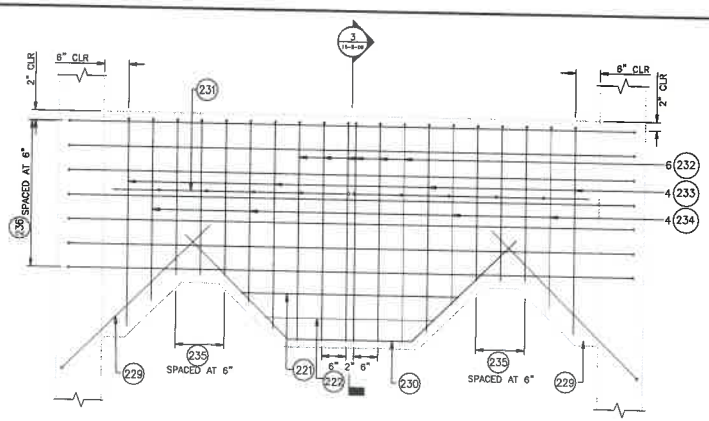
SHEET 39 OF 61

Last Saved By: CPATSONS SavaDate: 10/2/2024 11:29 AM PltDate: 10/2/2024 3:34 PM
File: C:\Users\cpatsons\Schnabel Engineering\Aterra-Schnabel JV - Documents\Projects\Brush_Creek\05-DE Production\15-S-05-BASIN.dwg Layout: IMPACT BASIN STEEL PLACEMENT - SHEET 3 OF 6



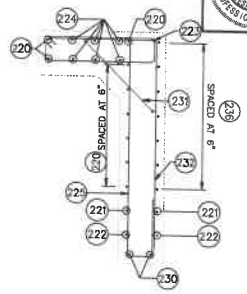
1 BAFFLE ELEVATION – UPSTREAM FACE

SCALE: 3/4"=1'0"



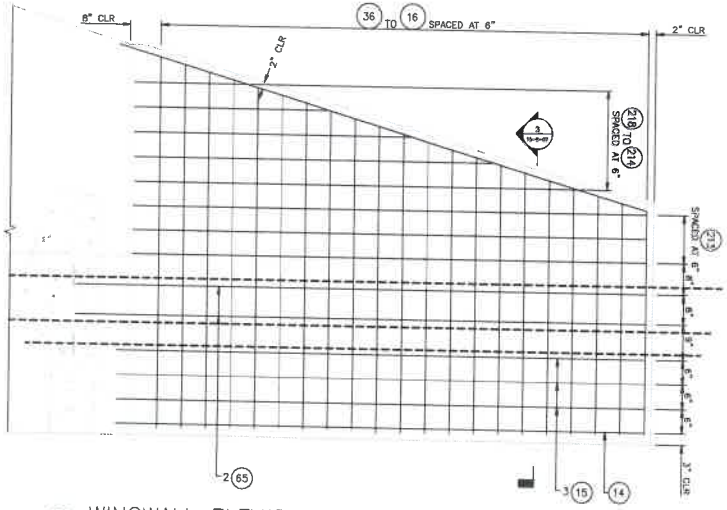
2 BAFFLE ELEVATION – DOWNSTREAM FACE

SCALE: 3/4"=1'0"



3 BAFFLE SECTION

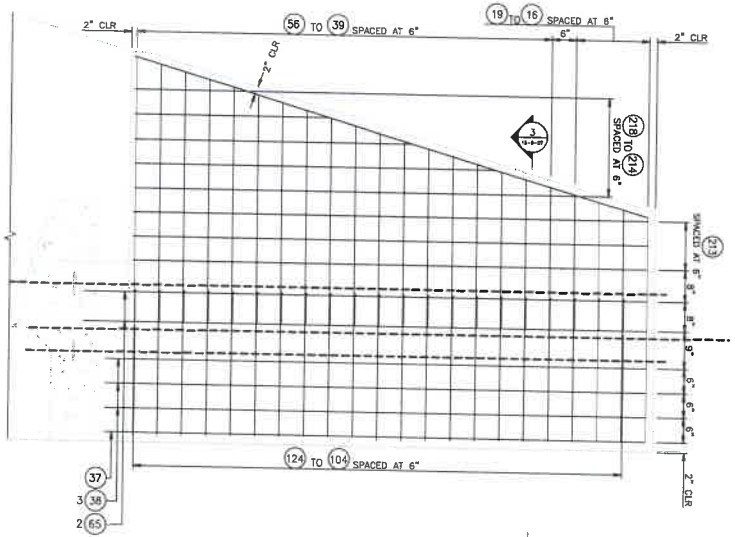
SCALE: 3/4"=1'0"



4 WINGWALL ELEVATION – UNEXPOSED FACE

SCALE: 3/4"=1'0"

NOTE: GUARDRAIL NOT SHOWN FOR CLARITY, SEE DRAWING 15-S-10 FOR DETAILS



5 WINGWALL ELEVATION – EXPOSED FACE

SCALE: 3/4"=1'0"

NOTE: GUARDRAIL NOT SHOWN FOR CLARITY, SEE DRAWING 15-S-10 FOR DETAILS

NOTES:

1. ALL DIMENSIONS OUTLINED ON IMPACT BASIN DRAWINGS REPRESENT THE OUTSIDE TO OUTSIDE DIAMETER DISTANCE FROM BAR TO BAR. THE REINFORCING BARS SHOWN ON THESE DRAWINGS REPRESENT THE CENTERLINES OF EACH BAR.

JONATHAN M. SMITH-MILLER
REGISTERED
23485
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

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	Date
Designed CRP	SEP 24
Drawn CRP	SEP 24
Checked CDS	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

IMPACT BASIN STEEL PLACEMENT – SHEET 4 OF 6

Brush Creek Watershed Mercer County, WV

Aterra Schnabel
300 Brookside Ave., Bldg 18, Suite 160, Morgantown, WV 26501
Phone: 336-274-9456
aterraschnabel.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-06

SEPTEMBER 2024

SHEET 40 OF 61

Last Saved By: CPARSONS SavedDate: 10/2/2024 11:29 AM PlotDate: 10/2/2024 3:39 PM
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BY DGN: Fy24DGN01 - SHEET 4 OF 6

1 PLAN WINGWALL FOOTING – BOTTOM FACE

SCALE: 3/4"=1'0"

2 PLAN WINGWALL FOOTING – TOP FACE

SCALE: 3/4"=1'0"

3 WINGWALL SECTION

3
15-S-07
15-S-08

SCALE: 3/4"=1'0"

VIEW 1

VIEW 2

4 PLAN WINGWALL SECTIONS

SCALE: 3/4"=1'0"

NOTE: VIEW 1 AND VIEW 2 FOR THE PLAN WINGWALL SECTIONS ARE CUT AT THE SAME LOCATION. SECOND VIEW ADDED FOR ANNOTATION CLARITY

NOTES:

1. ALL DIMENSIONS OUTLINED ON IMPACT BASIN DRAWINGS REPRESENT THE OUTSIDE TO OUTSIDE DIAMETER DISTANCE FROM BAR TO BAR. THE REINFORCING BARS SHOWN ON THESE DRAWINGS REPRESENT THE CENTERLINES OF EACH BAR.

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

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JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CRP	SEP 24
Drawn CRP	SEP 24
Checked CDS	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

IMPACT BASIN STEEL PLACEMENT – SHEET 5 OF 6

Brush Creek Watershed — Mercer County, WV

ATERRA JV | Schnabel Engineering
300 Brookside Ave., Bldg. 15, Suite 160, Ambler, PA 19002
Phone: 267-464-1466
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No.
12SPEC18D0023

Drawing No.
15-S-07

SEPTEMBER 2024

SHEET 41 OF 61

Last Saved By: CPATZIOS SaveDate: 10/2/2024 11:29 AM PlotDate: 10/2/2024 5:04 PM
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1 ELEVATION OF ENDSILL AND TOEWALL – UPSTREAM FACE

SCALE: 3/4"=1'0"

2 ELEVATION OF ENDSILL AND TOEWALL – DOWNSTREAM FACE

SCALE: 3/4"=1'0"

NOTES:

1. ALL DIMENSIONS OUTLINED ON IMPACT BASIN DRAWINGS REPRESENT THE OUTSIDE TO OUTSIDE DIAMETER DISTANCE FROM BAR TO BAR. THE REINFORCING BARS SHOWN ON THESE DRAWINGS REPRESENT THE CENTERLINES OF EACH BAR.

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#	DATE	APPROVED	TITLE	DESCRIPTION

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JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CRP	SEP 24
Drawn CRP	SEP 24
Checked CDS	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

IMPACT BASIN STEEL PLACEMENT – SHEET 6 OF 6

Brush Creek Watershed *Mercer County, WV*

ALERRA SERVICES | Schnabel ENGINEERING
300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 267-464-1505
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-08

SEPTEMBER 2024

SHEET 42 OF 61

Last Saved By: CPIRSIGNS SaveDate: 10/2/2024 11:33 AM FileDate: 10/2/2024 3:04 PM
File: C:\Users\CPIRSIGNS\Schnabel Engineering\Brush Creek Watershed - Documents\Design\Drawings\Sheets\Structural\STRUCTURAL_ALL\Brush_Creek_Watershed_Sheets\BC-SHEETS-STEEL PLACEMENT - SHEET 6 OF 6

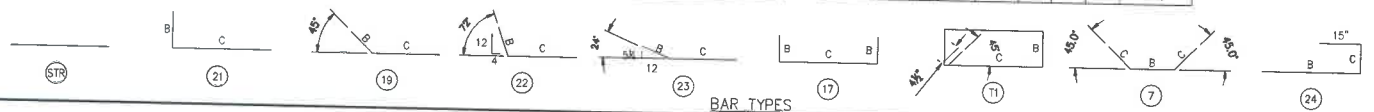
LOCATION	MARK	SIZE	QUAN.	LENGTH	TYPE	B	C	TOTAL LENGTH
HEADWALL	1	5	4	12'8"	STR			50'8"
"	2	5	4	12'8"	STR			50'8"
"	3	4	4	5'0"	STR			20'0"
"	4	4	2	5'5"	STR			10'10"
"	5	4	18	6'3"	STR			112'6"
"	6	4	2	5'0"	STR			10'0"
"	7	4	2	5'6"	STR			11'0"
"	8	4	20	5'1"	STR			101'8"
ENDSILL	9	5	7	11'3"	STR			78'9"
"	10	5	20	4'11"	STR			98'4"
"	11	5	1	11'3"	STR			11'3"
"	12	5	2	11'3"	STR			22'6"
"	13	5	20	4'11"	STR			98'4"
W'GWALL	14	5	2	13'0"	19	1'3"	11'9"	26'0"
"	15	4	6	12'9"	19	1'0"	11'9"	76'6"
"	16	5	4	5'0"	STR			20'0"
"	17	4	4	5'2"	STR			20'8"
"	18	4	4	5'4"	STR			21'4"
"	19	4	4	5'6"	STR			22'0"
"	20	4	2	5'8"	STR			11'4"
"	21	4	2	5'10"	STR			11'8"
"	22	4	2	6'-0"	STR			12'0"
"	23	4	2	6'2"	STR			12'4"
"	24	4	2	6'4"	STR			12'8"
"	25	4	2	6'6"	STR			13'0"
"	26	4	2	6'8"	STR			13'4"
"	27	4	2	6'10"	STR			13'8"
"	28	4	2	6'11"	STR			13'10"
"	29	4	2	7'1"	STR			14'2"
"	30	4	2	7'3"	STR			14'6"
"	31	4	2	7'5"	STR			14'10"
"	32	4	2	7'7"	STR			15'2"
"	33	4	2	7'9"	STR			15'6"
"	34	4	2	7'11"	STR			15'10"
"	35	4	2	8'1"	STR			16'2"
"	36	4	2	8'3"	STR			16'6"
"	37	5	2	13'3"	19	1'3"	12'0"	26'6"
"	38	4	6	13'0"	19	1'0"	12'0"	78'0"
"	39	4	2	5'8"	STR			11'4"
"	40	4	2	5'10"	STR			11'8"
"	41	4	2	6'0"	STR			12'0"
"	42	4	2	6'2"	STR			12'4"
"	43	4	2	6'4"	STR			12'8"
"	44	4	2	6'6"	STR			13'0"
"	45	4	2	6'8"	STR			13'4"
"	46	4	2	6'10"	STR			13'8"
"	47	4	2	6'11"	STR			13'10"
"	48	4	2	7'1"	STR			14'2"
"	49	4	2	7'3"	STR			14'6"
"	50	4	2	7'5"	STR			14'10"
"	51	4	2	7'7"	STR			15'2"
"	52	4	2	7'9"	STR			15'6"
"	53	4	2	7'11"	STR			15'10"
"	54	4	2	8'1"	STR			16'2"
"	55	4	2	8'3"	STR			16'6"
"	56	4	2	8'5"	STR			16'10"
APRON	57	5	4	12'6"	STR			50'8"
"	58	4	58	9'10"	21	3'2"	7'2"	570'4"
"	59	4	58	2'10"	21	2'0"	0'10"	164'4"
"	60	4	3	18'3"	21	2'0"	16'3"	54'9"
"	61	4	2	16'9"	21	2'6"	16'3"	37'6"

LOCATION	MARK	SIZE	QUAN.	LENGTH	TYPE	B	C	TOTAL LENGTH
"	62	4	16	19'4"	21	3'1"	16'3"	309'4"
"	63	5	2	16'3"	STR			32'6"
"	64	5	20	3'2"	22	0'10"	2'4"	63'4"
W'GWALL	65	4	8	12'6"	STR			100'0"
"	66	4	4	20'0"	STR			80'0"
"	67	4	4	19'3"	STR			77'0"
"	68	4	4	18'6"	STR			74'0"
"	69	4	4	17'9"	STR			71'0"
"	70	4	4	15'6"	STR			62'0"
"	71	4	4	12'6"	STR			50'0"
"	72	4	4	9'7"	STR			38'4"
"	73	4	2	1'11"	STR			3'10"
"	74	4	2	2'1"	STR			4'2"
"	75	4	2	2'2"	STR			4'4"
"	76	4	2	2'4"	STR			4'8"
"	77	4	2	2'6"	STR			5'0"
"	78	4	2	2'7"	STR			5'2"
"	79	4	2	2'9"	STR			5'6"
"	80	4	2	2'11"	STR			5'10"
"	81	4	2	3'1"	STR			6'2"
"	82	4	2	3'2"	STR			6'4"
"	83	4	2	3'4"	STR			6'8"
"	84	4	2	3'6"	STR			7'0"
"	85	4	2	3'7"	STR			7'2"
"	86	4	2	3'9"	STR			7'6"
"	87	4	2	3'11"	STR			7'10"
"	88	4	2	4'1"	STR			8'2"
"	89	4	2	4'2"	STR			8'4"
"	90	4	2	4'4"	STR			8'8"
"	91	4	2	4'6"	STR			9'0"
"	92	4	2	4'7"	STR			9'2"
"	93	4	2	4'9"	STR			9'6"
"	94	4	2	4'11"	STR			9'10"
"	95	4	2	5'0"	STR			10'0"
"	96	4	2	5'0"	STR			10'0"
"	97	4	2	4'10"	STR			9'8"
"	98	4	2	4'8"	STR			9'4"
"	99	4	2	4'2"	STR			8'4"
"	100	4	2	3'8"	STR			7'4"
"	101	4	2	3'2"	STR			6'4"
APRON	102	5	23	16'3"	STR			373'9"
"	103	5	29	12'8"	STR			367'4"
W'GWALL	104	4	2	2'7"	21	0'8"	1'11"	5'2"
"	105	4	2	2'9"	21	0'8"	2'1"	5'6"
"	106	4	2	2'10"	21	0'8"	2'2"	5'8"
"	107	4	2	3'0"	21	0'8"	2'4"	6'0"
"	108	4	2	3'2"	21	0'8"	2'6"	6'4"
"	109	4	2	3'3"	21	0'8"	2'7"	6'6"
"	110	4	2	3'5"	21	0'8"	2'9"	6'10"
"	111	4	2	3'7"	21	0'8"	2'11"	7'2"
"	112	4	2	3'9"	21	0'8"	3'1"	7'6"
"	113	4	2	3'10"	21	0'8"	3'2"	7'8"
"	114	4	2	4'0"	21	0'8"	3'4"	8'0"
"	115	4	2	4'2"	21	0'8"	3'6"	8'4"
"	116	4	2	4'3"	21	0'8"	3'7"	8'6"
"	117	4	2	4'5"	21	0'8"	3'9"	8'10"
"	118	4	2	4'7"	21	0'8"	3'11"	9'2"
"	119	4	2	4'9"	21	0'8"	4'1"	9'6"
"	120	4	2	5'0"	21	0'8"	4'4"	10'0"
"	121	4	2	5'0"	21	0'8"	4'4"	10'0"
"	122	4	2	5'2"	21	0'8"	4'6"	10'4"

LOCATION	MARK	SIZE	QUAN.	LENGTH	TYPE	B	C	TOTAL LENGTH
"	123	4	2	5'3"	21	0'8"	4'7"	10'6"
"	124	4	2	5'7"	21	0'8"	4'11"	11'2"
"	125	4	2	4'11"	STR			9'10"
"	126	4	2	5'0"	STR			10'0"
"	127	4	2	5'0"	STR			10'0"
"	128	4	2	4'10"	STR			9'8"
"	129	4	2	4'8"	STR			9'4"
"	130	4	2	4'2"	STR			8'4"
"	131	4	2	3'8"	STR			7'4"
"	132	4	2	3'2"	STR			6'4"
HEADWALL	133	5	3	6'1"	21	4'5"	1'8"	18'3"
"	134	5	2	6'7"	21	4'11"	1'8"	13'2"
"	135	5	18	9'6"	21	7'10"	1'8"	171'0"
"	136	4	21	4'4"	TI	0'8"	1'6"	91'0"
"	137	4	9	10'0"	STR			90'0"
"	138	5	8	12'8"	STR			101'4"
"	139	4	10	4'0"	STR			40'0"
"	140	5	8	3'0"	STR			24'0"
"	141	4	9	12'8"	STR			114'0"
"	142	4	4	5'5"	STR			21'8"
"	143	4	4	4'11"	STR			19'8"
"	144	4	2	4'8"	STR			9'4"
"	145	4	20	8'4"	STR			166'8"
"	146	4	1	4'5"	STR			4'5"
"	147	4	2	4'5"	STR			8'10"
"	148	4	2	4'11"	STR			9'10"
SIDEWALL	149	4	2	4'9"	STR			9'6"
"	150	4	2	5'0"	STR			10'0"
"	151	4	2	5'3"	STR			10'6"
"	152	4	2	5'5"	STR			10'10"
"	153	4	2	5'7"	STR			11'2"
"	154	4	2	5'10"	STR			11'8"
"	155	4	2	6'0"	STR			12'0"
"	156	4	2	6'3"	STR			12'6"
"	157	4	2	6'6"	STR			13'0"
"	158	4	2	6'8"	STR			13'6"
"	159	4	2	6'11"	STR			13'10"
"	160	4	2	7'2"	STR			14'4"
"	161	4	2	7'5"	STR			14'10"
"	162	4	2	7'7"	STR			15'2"
"	163	4	2	7'10"	STR			15'8"
"	164	4	2	8'1"	STR			16'2"
"	165	4	2	8'4"	STR			16'8"
"	166	4	24	9'10"	21	8'6"	1'4"	236'0"
"	167	4	18	4'4"	TI	0'8"	1'6"	78'0"
"	168	4	26	12'1"	21	2'10"	9'3"	314'2"
"	169	4	16	10'9"	STR			172'0"
"	170	4	2	10'7"	STR			21'2"
"	171	4	2	9'7"	STR			19'2"
"	172	4	2	8'4"	STR			16'8"
"	173	4	2	10'3"	STR			20'6"
"	174	4	2	9'0"	STR			18'0"
"	175	4	2	9'7"	STR			19'2"
"	176	5	4	8'5"	21	1'3"	7'2"	33'8"
"	177	5	4	10'9"	STR	1'3"	9'6"	43'0"
"	178	4	2	3'3"	19	1'3"	2'0"	6'6"
"	179	4	2	3'3"	19	1'3"	2'0"	6'6"
"	180	4	2	3'3"	19	1'3"	2'0"	6'6"
"	181	4	2	3'3"	19	1'3"	2'0"	6'6"
"	182	4	2	3'3"	19	1'3"	2'0"	6'6"
"	183	4	2	3'11"	19	1'0"	2'11"	7'10"

LOCATION	MARK	SIZE	QUAN.	LENGTH	TYPE	B	C	TOTAL LENGTH
"	184	5	2	13'6"	19	1'3"	12'3"	27'0"
ENDSILL	185	5	2	14'8"	17	1'3"	12'2"	29'4"
SIDEWALL	186	4	28	7'0"	STR			196'0"
"	187	4	16	13'0"	19	0'9"	12'3"	208'0"
"	188	4	2	12'2"	STR			24'4"
"	189	4	2	11'2"	STR			22'4"
"	190	4	2	9'10"	STR			19'8"
"	191	4	2	10'3"	STR			20'6"
"	192	4	2	9'0"	STR			18'0"
"	193	4	2	9'7"	STR			19'2"
"	194	5	4	9'0"	19	1'10"	7'2"	36'0"
"	195	4	2	4'9"	STR			9'6"
"	196	4	2	5'0"	STR			10'0"
"	197	4	2	5'3"	STR			10'6"
"	198	4	2	5'5"	STR			10'10"
"	199	4	2	5'7"	STR			11'2"
"	200	4	2	5'10"	STR			11'8"
"	201	4	2	6'0"	STR			12'0"
"	202	4	2	6'3"	STR			12'6"
"	203	4	2	6'6"	STR			13'0"
"	204	4	2	6'9"	STR			13'6"
"	205	4	2	6'11"	STR			13'10"
"	206	4	2	7'2"	STR			14'4"
"	207	4	2	7'5"	STR			14'10"
"	208	4	2	7'7"	STR			15'2"
"	209	4	2	7'10"	STR			15'8"
"	210	4	2	8'1"	STR			16'2"
"	211	4	2	8'4"	STR			16'8"
SIDEWALL	212	4	24	8'6"	STR			204'0"
W'GWALL	213	4	12	11'5"	STR			137'0"
"	214	4	4	9'10"	STR			39'4"
"	215	4	4	8'0"	STR			32'0"
"	216	4	4	6'2"	STR			24'8"
"	217	4	4	4'4"	STR			17'4"
"	218	4	4	2'6"	STR			10'0"
"	219	5	2	13'2"	19	1'3"	11'11"	26'4"
BAFFLE	220	4	7	16'6"	17	2'1"	12'6"	116'6"
"	221	4	2	4'10"	STR			9'8"
"	222	4	2	3'9"	STR			7'6"
"	223	4	20	6'2"	T1	0'8"	2'5"	123'4"
"	224	4	6	15'8"	17	1'6"	12'6"	93'0"
"	225	4	6	6'6"	24	4'10"	0'5"	39'0"
"	226	4	4	6'3"	24	4'7"	0'5"	25'0"
"	227	4	4	5'1"	24	3'5"	0'5"	20'4"
"	228	4	6	5'1"	24	3'5"	0'5"	30'6"
"	229	5	4	5'7"	21	1'0"	4'7"	22'4"
"	230	5	2	9'3"	7	2'9"	3'3"	18'6"
"	231	5	10	4'1"	17	1'0"	2'1"	40'10"
"	232	4	6	7'2"	21	2'4"	4'10"	43'0"
"	233	4	4	6'11"	21	2'3"	4'8"	27'8"
"	234	4	4	6'3"	21	2'3"	4'0"	25'0"
"	235	4	6	5'8"	21	2'3"	3'5"	34'0"
"	236	4	7	16'8"	17	2'1"	12'8"	116'8"

	BAR SIZE	LINEAR FT	WEIGHT LBS
	4	6027.00	4026.04
	5	1879.50	1960.32
TOTAL		7906.50	5985.35



BAR TYPES

JONATHAN M PITTMAN
REGISTERED
23485
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

	Date
Designed CRP	SEP 24
Drawn CRP	SEP 24
Checked GDS	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

IMPACT BASIN STEEL SCHEDULE

Brush Creek Watershed — Mercer County, WV

Schnabel Engineering | TERRA Solutions
300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 856-273-9456
schnabel-eng.com

United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC1800023

Drawing No. 15-S-09

SEPTEMBER 2024

SHEET 43 OF 61

REVISIONS			
#	DATE	APPROVED	TITLE	DESCRIPTION

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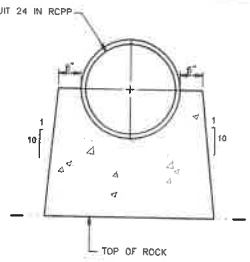
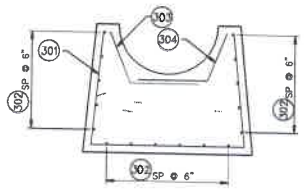
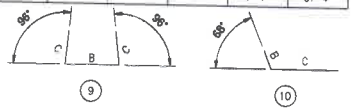




CONCRETE CRADLE PIPE EXTENSION STEEL SCHEDULE

MARK	SIZE	QUAN.	LENGTH	TYPE	B	C	TOTAL LENGTH
301	5	23	8'-5"	9	3'-4"	2'-6"	193' 7"
302	5	32	12'-11"	ST			413' 4"
303	5	23	2'-9"	10	1'-2"	1'-7"	63' 3"
304	5	23	2'-8"	10	1'-1"	1'-7"	61' 4"

CONCRETE CRADLE BAR LENGTH AND WEIGHT TOTALS		
BAR SIZE	LINEAR FT	WEIGHT LBS
5	731.50	762.43



1 CONCRETE CRADLE SECTION

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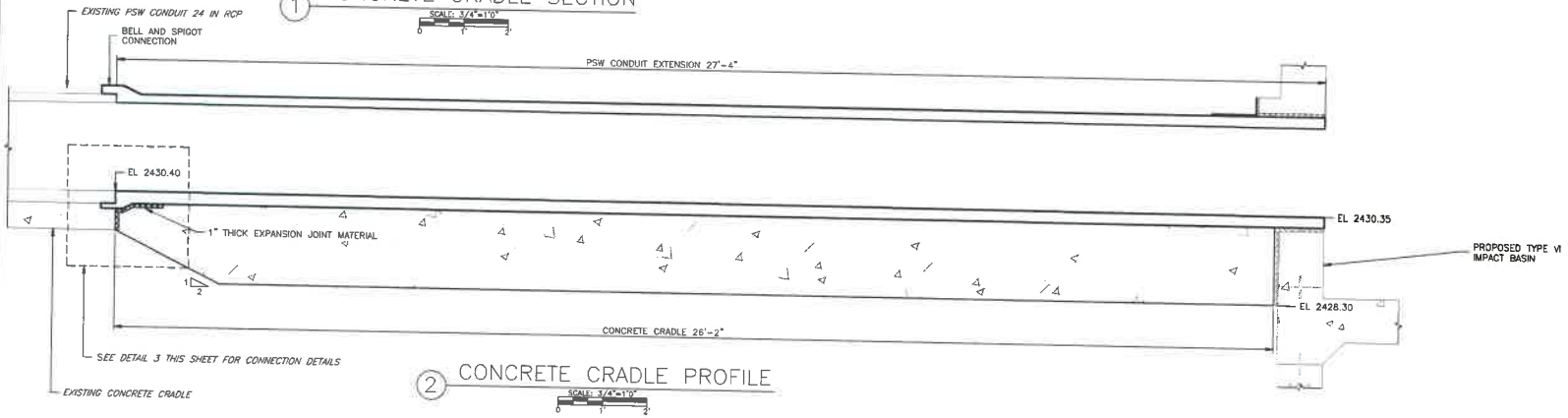
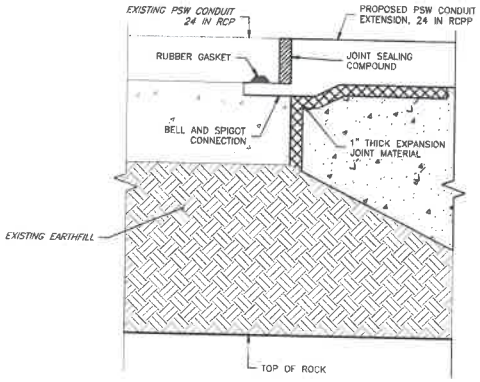


2 CONCRETE CRADLE PROFILE

SCALE: 3/4"=1'0"



NOTE: JOINT LENGTH EQUALS WATERTIGHT JOINT EXTENSIBILITY PLUS JOINT GAP. THE PIPE SHALL BE DRAWN TOGETHER SO THAT THE MAXIMUM JOINT GAP DOES NOT EXCEED ⅜" FOR PIPE LAID ON A STRAIGHT LINE.

3 EXISTING TO PROPOSED CRADLE JOINT DETAIL

NTS

NOTE: CONTRACTOR IS RESPONSIBLE FOR PERFORMING FIELD MEASUREMENTS AND VERIFYING THE COMPATIBILITY BETWEEN THE EXISTING PSW CONDUIT AND THE PROPOSED PIPE EXTENSION PRIOR TO ORDERING THE PIPE AND ACCESSORIES.

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

JONATHAN W. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed CRP	SEP 24
Drawn CRP	SEP 24
Checked CDS	SEP 24
Approved JWP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

PRINCIPAL SPILLWAY CONDUIT EXTENTION DETAILS

Brush Creek Watershed *Mercer County, WV*

Alterra Schnabel JV

300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 336-274-8456
schnabel-eng.com

United States Department of Agriculture

USDA Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-10

SEPTEMBER 2024

SHEET 44 OF 61

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Last Saved By: CHRISONS Date/Time: 8/8/2024 11:39 AM Plotted: 08/12/24 1:10 PM
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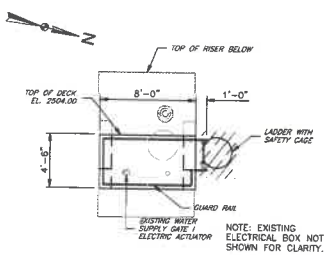
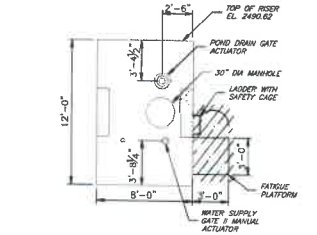


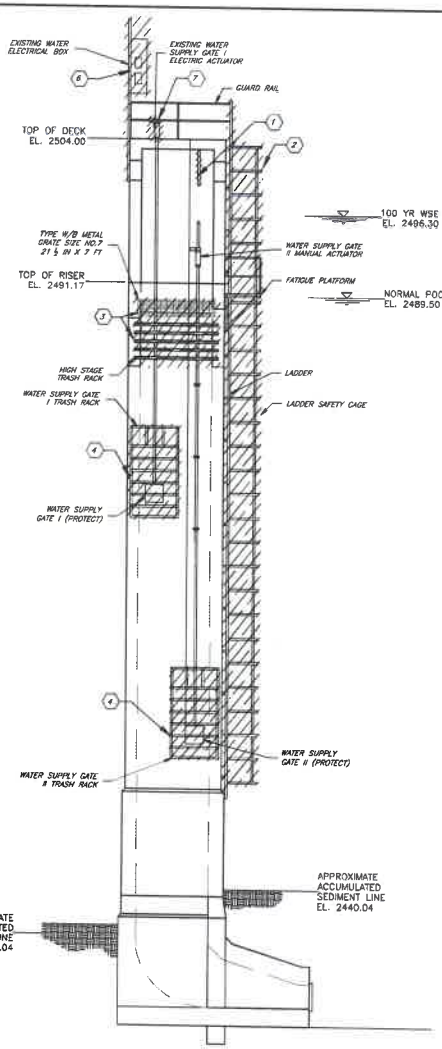
TOP OF DECK
PLAN EL. 2504.00

FLOW ① SCALE: 1"=5'



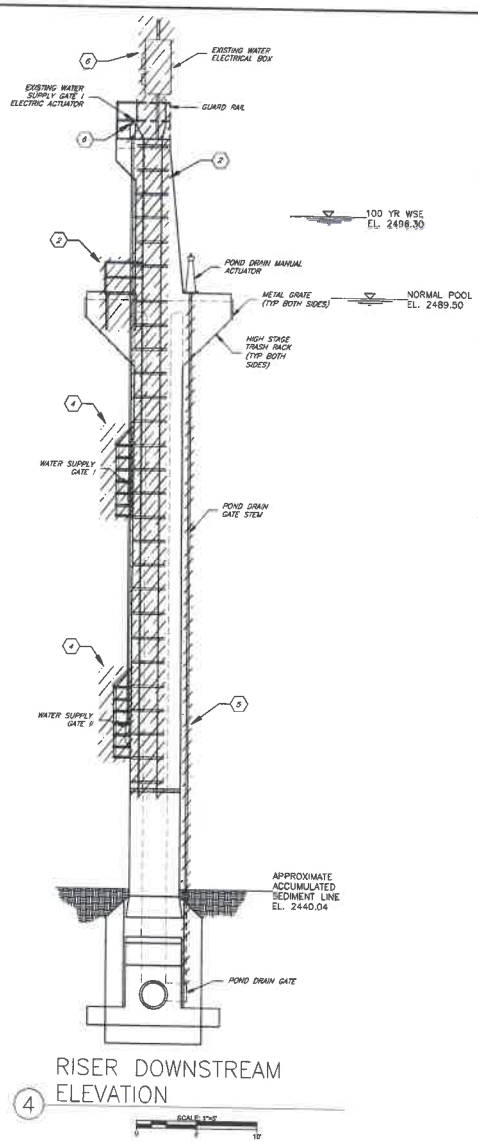
TOP OF RISER
PLAN EL. 2491.17

FLOW ② SCALE: 1"=5'



RISER RIGHT SIDE
ELEVATION

FLOW ③ SCALE: 1"=5'



RISER DOWNSTREAM
ELEVATION

④ SCALE: 1"=5'

KEY NOTES:

1. REMOVE AND DISPOSE OF EXISTING STEM COVER.
2. REMOVE AND REPLACE EXISTING LADDER, LADDER SAFETY CAGE AND FATIGUE PLATFORM.
3. REMOVE AND REPLACE EXISTING HIGH STAGE TRASH RACKS, AND HIGH STAGE GRATING.
4. REMOVE AND REPLACE BOTH EXISTING WATER SUPPLY TRASH RACKS.
5. REMOVE AND REPLACE POND DRAIN GATE, STEM, AND STEM GUIDES. PROTECT AND REINSTALL EXISTING MANUAL ACTUATOR.
6. REMOVE AND DISPOSE OF EXISTING ELECTRICAL BOX.
7. REMOVE WATER SUPPLY GATE I ELECTRICAL ACTUATOR.

POND DRAIN GATE NOTES:

1. REMOVE EXISTING 18" X 18" SQUARE CAST IRON SLIDE GATE FROM RISER.
2. PROVIDE SURFACE PREPARATION OF EXISTING CAST IRON GATE IN ACCORDANCE WITH SSPC-SP10.
3. VISUALLY INSPECT ALL MEMBERS AND WELDS AND CHECK MEMBER THICKNESSES. SEE CONSTRUCTION SPECIFICATION 71 FOR MORE DETAILS.
4. REPLACEMENT GATE SHALL BE HYDRO GATE HG560 OR APPROVED EQUAL. REPLACEMENT GATE SHALL MATCH EXISTING OPENING AND BOLT PATTERN FOR WALL THIMBLE.
5. SLIDE GATE SHALL BE SUITABLE FOR 57 FT OF SEATING HEAD, AND 0 FT OF UNSEATING HEAD.

GENERAL DEMOLITION NOTES:

1. PRESERVE AND PROTECT WATER SUPPLY GATES I & II AND THEIR STEMS AND STEM GUIDES. CUT WITH GRINDER OR EQUIVALENT.
2. CUT EXISTING CONCRETE ANCHORS NOT PLANNED FOR REUSE FLUSH TO CONCRETE FACE WITH GRINDER OR EQUIVALENT. NO TORCH CUTTING CAN BE USED.
3. REMOVE SEDIMENT AROUND RISER STRUCTURE & POND DRAIN GATE. CONTRACTOR TO VERIFY SEDIMENT ELEVATIONS PRIOR TO STARTING EXCAVATION.
4. SALVAGEABLE MATERIALS SHALL BE PROPERTY OF OWNER. OTHER MATERIALS SHALL BE DISPOSED OF OFF-SITE IN ACCORDANCE WITH LOCAL REGULATIONS, AT CONTRACTOR EXPENSE.

JONATHAN M PITTMAN
REGISTERED
23485
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

	Date
Designed SNP	SEP 24
Drawn BST	SEP 24
Checked KLS	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

RISER HARDWARE AND REMOVAL PLAN

Brush Creek Watershed *Mercer County, WV*

ATERRA SCHNABEL JV
300 Brookside Ave., Bldg. 18, Suite 100
Ambler, PA 19002
Phone: 267-487-4555
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No.
12SPEC18D0023

Drawing No.
15-S-11

SEPTEMBER 2024

SHEET 45 OF 61

REVISIONS			
#	DATE	APPROVED	TITLE	DESCRIPTION

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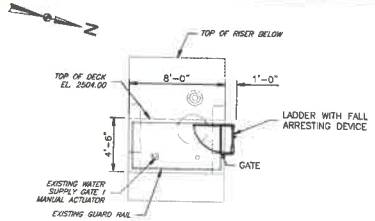
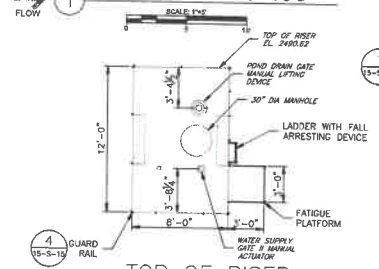


TOP OF DECK PLAN EL. 2504.00

FLOW ① SCALE: 1"=5'



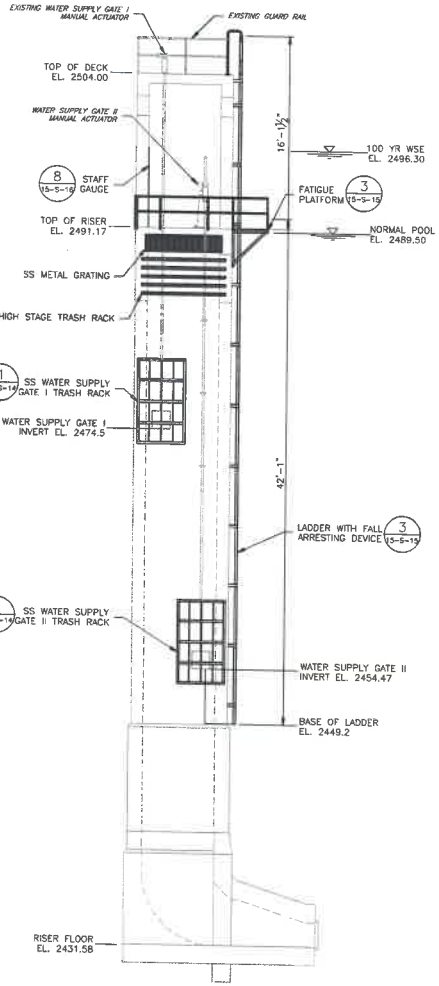
FLOW

TOP OF RISER PLAN EL. 2491.17

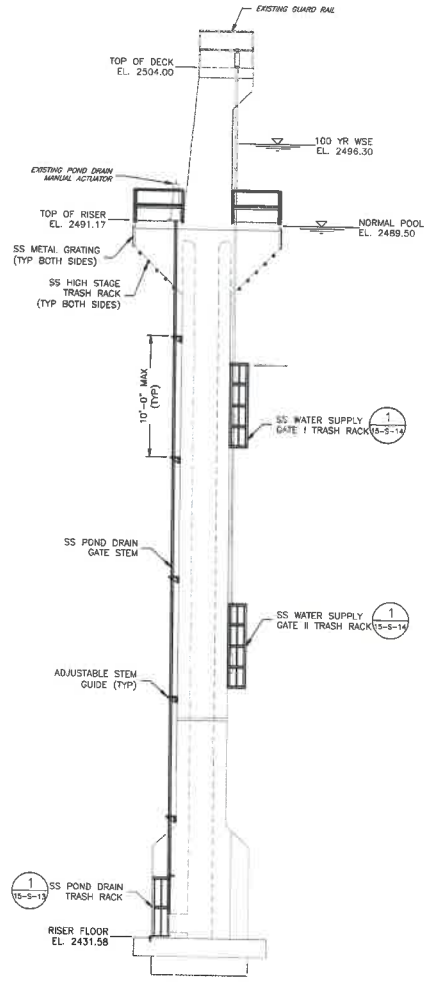
② SCALE: 1"=5'

RISER IMPROVEMENTS GENERAL NOTES:

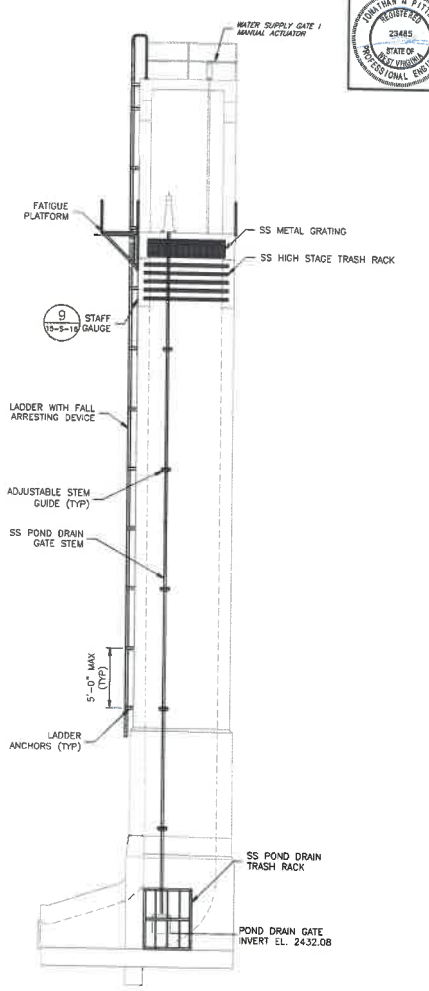
1. THESE NOTES ARE GENERAL AND APPLY TO ALL PARTS OF THE IMPROVEMENTS TO THE RISER UNLESS NOTED OTHERWISE.
2. ALL STRUCTURAL MEMBERS SHALL BE TYPE 304 STAINLESS STEEL OR GALVANIZED STEEL AS SHOWN.
3. CONTRACTOR SHALL VERIFY ALL ELEVATIONS, DIMENSIONS AND CONDITIONS OF EXISTING INFRASTRUCTURE PRIOR TO ORDERING REPLACEMENT PARTS OR BEGINNING CONSTRUCTION ACTIVITIES.
4. ALL FASTENERS & ANCHORS SHALL BE 316 STAINLESS STEEL. USE SS ANCHORS IN WET AREAS. USE C651 SILICONE BRONZE NUTS FOR ALL SS BOLTS AND EMBEDDED ANCHORS.
5. USE ANTI-SEIZE LUBRICANT FOR ALL STAINLESS STEEL FASTENERS.
6. ALL WELDING SHALL BE IN ACCORDANCE WITH AWS D1.6 FOR STAINLESS STEEL AND AWS D1.1 FOR CARBON STEEL.
7. ALL WELDS SHALL BE FULL PENETRATION WELDS UNLESS NOTED OTHERWISE.
8. WELD CONNECTIONS AND GRIND SMOOTH.
9. PRESERVE AND PROTECT ALL GATE ACTUATORS DURING CONSTRUCTION. STORE AS DIRECTED BY ENGINEER IF EQUIPMENT IS UNINSTALLED DURING CONSTRUCTION.
10. ANCHORS EMBEDDED IN CONCRETE SHALL BE ADHESIVE ANCHORS. ADHESIVE SHALL BE HILTI HIT-RE 500V 3 OR EQUIVALENT. ANCHOR HOLES SHALL BE HAMMER DRILLED.
11. WELD A CAP TO THE ENDS OF ALL EXPOSED HSS.
12. REPAIR CONCRETE INSIDE OF THE RISER WITH XYPEX MEGAMIX II OR APPROVED EQUAL. APPLY PER MANUFACTURERS RECOMMENDATION.
13. AFTER REPAIRING THE CONCRETE, COAT CONCRETE WITH XYPEX CONCENTRATE PER MANUFACTURERS RECOMMENDATION.



FLOW ③ RISER RIGHT ELEVATION SCALE: 1"=5'



④ RISER UPSTREAM ELEVATION SCALE: 1"=5'



FLOW ⑤ RISER LEFT ELEVATION SCALE: 1"=5'

JONATHAN M. PITTMAN LICENSED PE 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed SND	SEP 24
Drawn BJY	SEP 24
Checked KLS	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

PROPOSED RISER PLAN AND ELEVATION

Brush Creek Watershed — Mercer County, WV

ATERRA | Schnabel ENGINEERING
300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 267-468-8405
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-12

SEPTEMBER 2024

SHEET 46 OF 61

#	DATE	APPROVED	REVISIONS TITLE	DESCRIPTION

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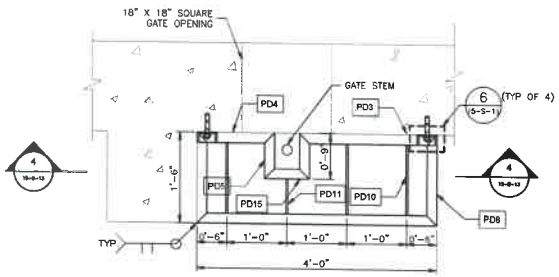
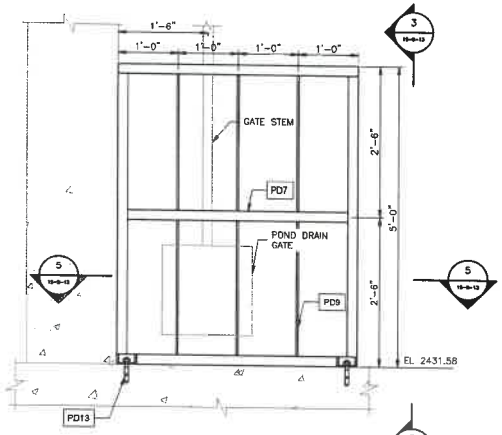


POND DRAIN GATE TRASH RACK PLAN

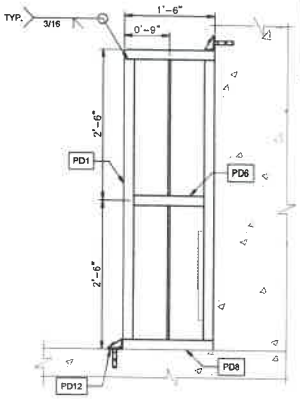
1 SCALE: 1"=1'0"

FLOW

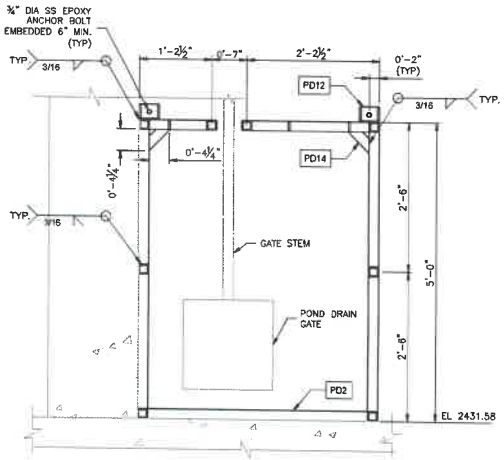


POND DRAIN GATE TRASH RACK ELEVATION

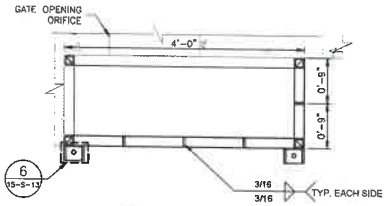
2 SCALE: 1"=1'0"



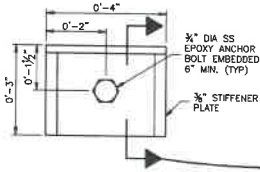
3 SECTION 15-S-13 SCALE: 1"=1'0"



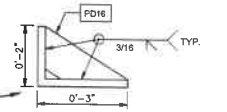
4 SECTION 15-S-13 SCALE: 1"=1'0"



FLOW 5 SECTION 15-S-13 SCALE: 1"=1'0"



6 ANCHOR BRACKET PLAN 15-S-13 SCALE: 1"=1'0"



7 ANCHOR BRACKET SECTION 15-S-13 SCALE: 1"=1'0"

POND DRAIN TRASH RACK BILL OF MATERIALS

MARK	QTY	DESCRIPTION	LENGTHS	MATERIAL
PD1	4	HSS 2x2x⅜"	4'-8"	TYPE 304 SS
PD2	3	HSS 2x2x⅜"	4'-0"	TYPE 304 SS
PD3	1	HSS 2x2x⅜"	2'-3½"	TYPE 304 SS
PD4	1	HSS 2x2x⅜"	1'-3½"	TYPE 304 SS
PD5	2	HSS 2x2x⅜"	0'-9"	TYPE 304 SS
PD6	2	HSS 2x2x⅜"	1'-2"	TYPE 304 SS
PD7	1	HSS 2x2x⅜"	3'-8"	TYPE 304 SS
PD8	4	HSS 2x2x⅜"	1'-6"	TYPE 304 SS
PD9	8	2x⅜" BAR	2'-3"	TYPE 304 SS
PD10	3	2x⅜" BAR	1'-2"	TYPE 304 SS
PD11	1	2x⅜" BAR	0'-7"	TYPE 304 SS
PD12	4	L 3x2x¼"	0'-4"	TYPE 304 SS
PD13	4	¾" SS ANCHOR	EMBED 6" MIN	TYPE 304 SS
PD14	2	⅜" GUSSET PLATE	SEE SECTION 4 SHEET 15-S-13	TYPE 304 SS
PD15	1	HSS 2x2x⅜"	0'-9"	TYPE 304 SS
PD16	8	⅜" STIFFENER PLATE	0'-3½"	TYPE 304 SS

NOTES:

1. ALL STEEL SHALL BE TYPE 304 STAINLESS STEEL.
2. ALL WELDS SHALL BE IN ACCORDANCE WITH AWS D1.6 STANDARDS.
3. ANCHORS BOLTS SHALL BE TYPE 316 SS EPOXY ANCHORS.

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

JONATHAN N PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Date	
Designed SNO	SEP 24
Drawn BJY	SEP 24
Checked KLS	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

POND DRAIN GATE TRASH RACK DETAILS

Mercer County, WV

Brush Creek Watershed

ATERRA SCHNABEL JV

300 Brodhead Ave., Bldg. 18, Suite 401, Aliquippa, PA 15001, Phone: 724-273-3400, FAX: 724-273-3401

USDA United States Department of Agriculture

Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-13

SEPTEMBER 2024

SHEET 47 OF 61

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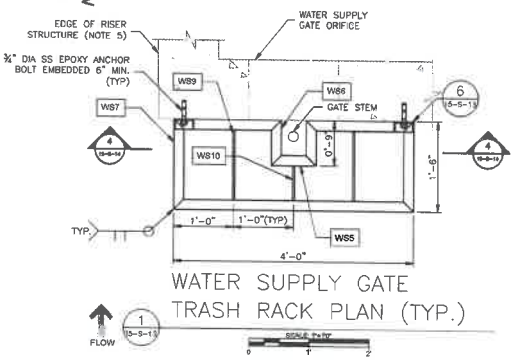
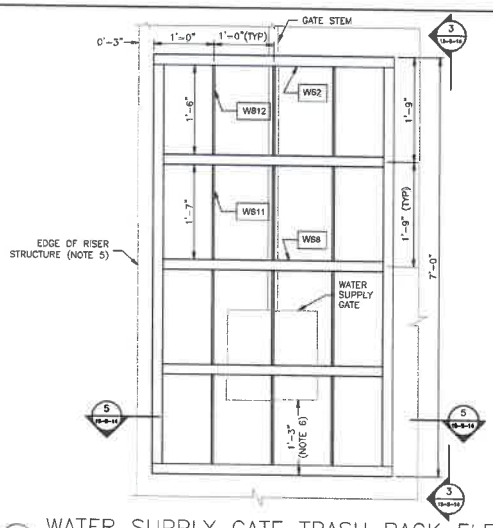
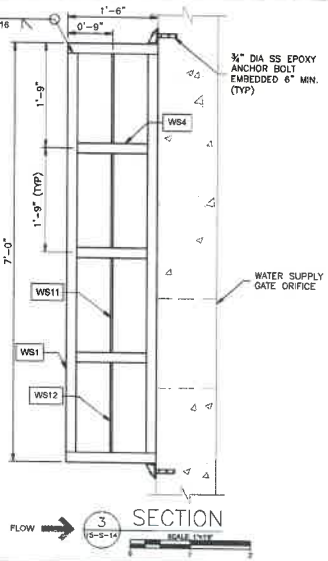


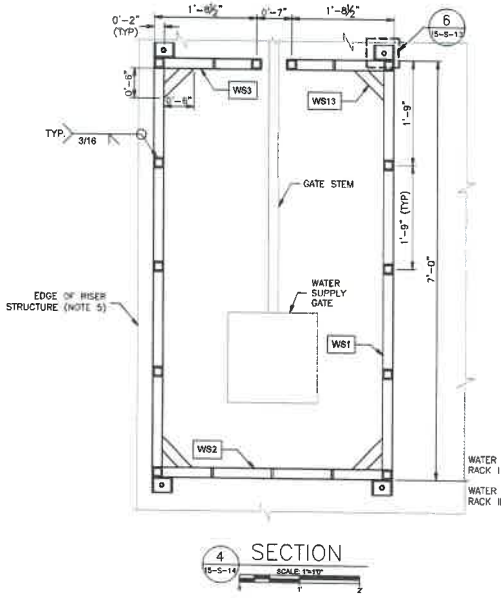
WATER SUPPLY GATE TRASH RACK PLAN (TYP.)



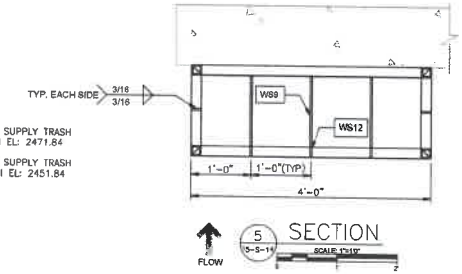
2 WATER SUPPLY GATE TRASH RACK ELEVATION



3 SECTION



4 SECTION



5 SECTION

WATER SUPPLY GATE TRASH RACK BILL OF MATERIALS

MARK	QTY	DESCRIPTION	LENGTHS	MATERIAL
WS1	4	HSS 2x2x⅜"	6'-8"	TYPE 304 SS
WS2	3	HSS 2x2x⅜"	4'-0"	TYPE 304 SS
WS3	2	HSS 2x2x⅜"	1'-9⅛"	TYPE 304 SS
WS4	6	HSS 2x2x⅜"	1'-2"	TYPE 304 SS
WS5	1	HSS 2x2x⅜"	0'-9"	TYPE 304 SS
WS6	2	HSS 2x2x⅜"	0'-8"	TYPE 304 SS
WS7	4	HSS 2x2x⅜"	1'-6"	TYPE 304 SS
WS8	3	HSS 2x2x⅜"	3'-8"	TYPE 304 SS
WS9	5	2x⅜" BAR	1'-2"	TYPE 304 SS
WS10	1	2x⅜" BAR	0'-7"	TYPE 304 SS
WS11	10	2x⅜" BAR	1'-7"	TYPE 304 SS
WS12	10	2x⅜" BAR	1'-6"	TYPE 304 SS
WS13	4	⅜" GUSSET PL	SEE SECTION 4 SHEET 15-S-14	TYPE 304 SS
WS14	4	L3x2x¼" ANCHOR	SEE DETAIL 6 SHEET 15-S-13	TYPE 304 SS
WS15	8	⅜" STIFFENER PLATE	SEE DETAIL 6 SHEET 15-S-13	TYPE 304 SS

NOTES:

1. ALL STEEL SHALL BE TYPE 304 STAINLESS STEEL.
2. ALL WELDS SHALL BE IN ACCORDANCE WITH AWS D1.6 STANDARDS.
3. ANCHORS SHALL BE TYPE 304 SS EPOXY ANCHORS.
4. PROVIDE 2 IDENTICAL FABRICATIONS OF THE WATER SUPPLY TRASH RACK FOR WATER SUPPLY GATES I AND II. B.O.M. IS COMPLETE FOR A SINGLE TRASH RACK FABRICATION.
5. THE EDGE OF STRUCTURE IS MIRRORED FOR WATER SUPPLY TRASH RACK II.
6. WATER SUPPLY GATE I; INVERT ELEVATION= 2473.09
   WATER SUPPLY GATE II; INVERT ELEVATION= 2453.09

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

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JONATHAN W PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

		Date
Designed	SND	SEP 24
Drawn	BJY	SEP 24
Checked	MLS	SEP 24
Approved	JWP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

WATER SUPPLY GATES I & II TRASH RACK DETAILS

Brush Creek Watershed *Mercer County, WV*

USDA United States Department of Agriculture Natural Resources Conservation Service

ATERRA SOLUTIONS | Schnabel ENGINEERING

300 Brookside Ave, Bldg 18, Suite 160, Ambler, PA 19002 Phone: 336-274-9458 schnabel-eng.com

Contract No. 12SPEC18D0023

Drawing No. 15-S-14

SEPTEMBER 2024

SHEET 48 OF 81

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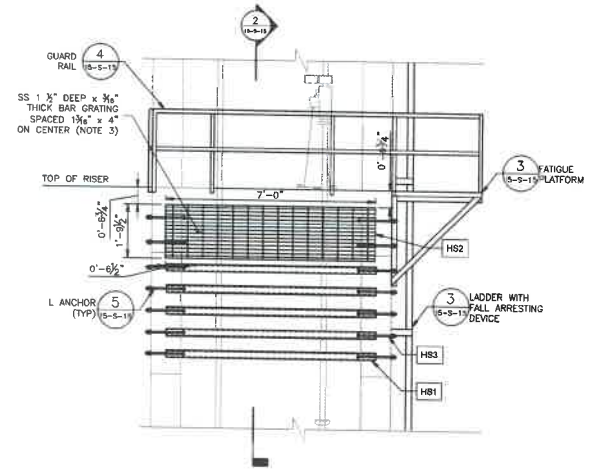
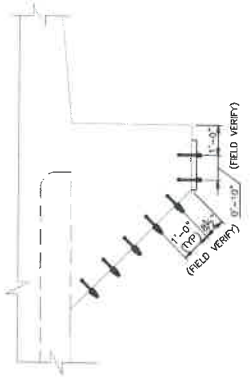


HIGH STAGE TRASH RACK ELEVATION



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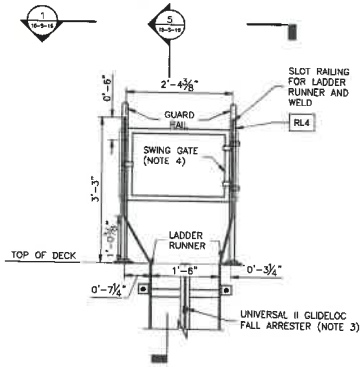
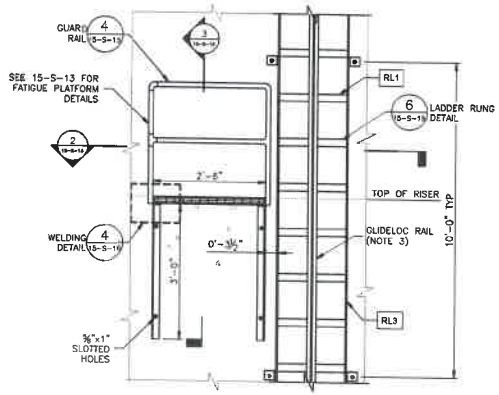
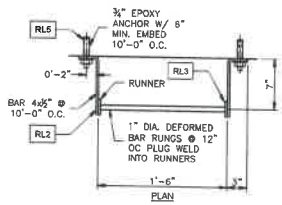
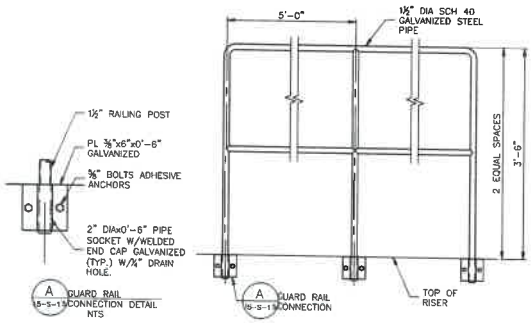




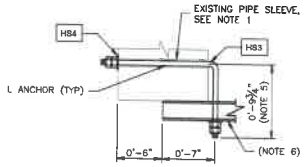
LADDER AND FATIGUE PLATFORM ELEVATION



LADDER RUNG DETAIL



GALVANIZED GUARD RAILS



L ANCHOR BOLT DETAIL

NOTES:

1. REUSE ¾" EXISTING PIPE SLEEVE. CLEAN EXISTING PIPE SLEEVE AND PREPARE SURFACE IN ACCORDANCE WITH SSPC-SP3.
2. GRATING SHALL BE BANDED ALL AROUND.
3. PROVIDE A GLIDELOC VERTICAL HEIGHT ACCESS LADDER SYSTEM KIT. THE VERTICAL RAIL SHALL BE GALVANIZED. ALL OTHER COMPONENTS SHALL BE STAINLESS STEEL. PROVIDE THREE UNIVERSAL II GLIDELOC FALL ARRESTERS OR EQUIVALENT.
4. SWING GATE SHALL BE PS SAFETY ACCESS EDGEHALT LADDER SAFETY GATE OR EQUIVALENT.
5. FIELD VERIFY REQUIRED LENGTH FOR REPLACEMENT L-ANCHORS.
6. WELD A CAP TO THE END OF EXPOSED HSS.
7. NEW GUARD RAIL SHALL ENCOMPASS PERIMETER OF TOP OF RISER.

RISER ACCESS LADDER BILL OF MATERIALS

MARK	QTY	DESCRIPTION	LENGTHS	MATERIAL
RL1	55	1" BAR RUNG	DETAIL 6 SHEET 15-S-15	GALVANIZED STEEL
RL2	12	ATTACHMENT BAR	DETAIL 6 SHEET 15-S-15	GALVANIZED STEEL
RL3	2	RUNNER	58'-3"	GALVANIZED STEEL
RL4	2	LADDER RAIL	DETAIL 5 SHEET 15-S-15	GALVANIZED STEEL
RL5	12	¾" EPOXY ANCHOR	DETAIL 6 SHEET 15-S-15	STAINLESS STEEL

HIGH STAGE TRASH RACK BILL OF MATERIALS

MARK	QTY	DESCRIPTION	LENGTHS	MATERIAL
HS1	10	HSS 2x2x¼"	7'-0"	TYPE 304 SS
HS2	2	SS 1 -1/2" DEEP x ⅜" THICK BAR GRATING	DETAIL 1 SHEET 15-S-15	TYPE 304 SS
HS3	28	⅝" DIA ANCHOR	DETAIL 5 SHEET 15-S-15	TYPE 304 SS
HS4	28	2x2 WASHER PLATE	N/A	TYPE 304 SS

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

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JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed SND	SEP 24
Drawn BSY	SEP 24
Checked KLS	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

MISCELLANEOUS METAL DETAILS - SHEET 1 OF 2

Brush Creek Watershed — Mercer County, WV

ATERRA | Schnabel ENGINEERING
300 Brookside Ave., Bldg. 15, Suite 140, Ambler, PA 19002
Phone: 267-468-8450
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-15

SEPTEMBER 2024

SHEET 49 OF 61

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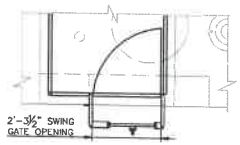
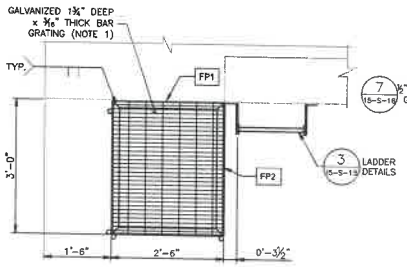
MISCELLANEOUS METAL DETAILS - SHEET 1 OF 2



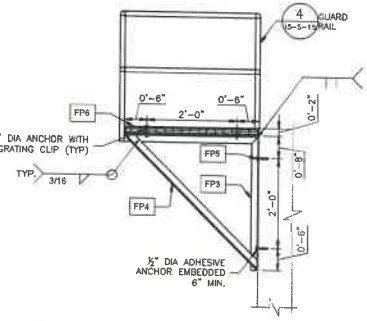
1 15-S-13 SWING GATE PLAN

SCALE: 1/2"=1'-0"



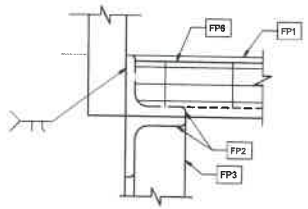
2 15-S-13 FATIGUE PLATFORM PLAN

SCALE: 3/4"=1'-0"



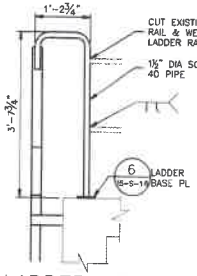
3 15-S-13 FATIGUE PLATFORM SECTION

SCALE: 3/4"=1'-0"



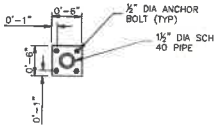
4 15-S-13 WELDING DETAIL

SCALE: 6"=1'-0"



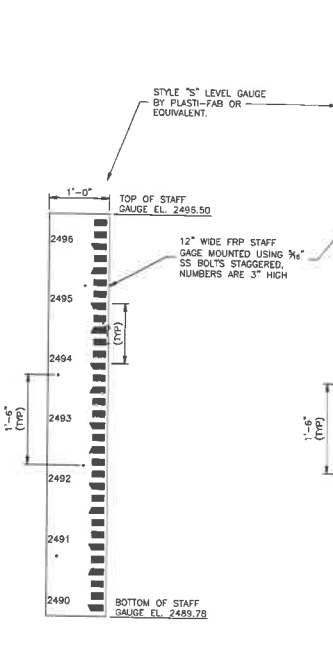
5 15-S-13 LADDER RAIL

SCALE: 3/4"=1'-0"



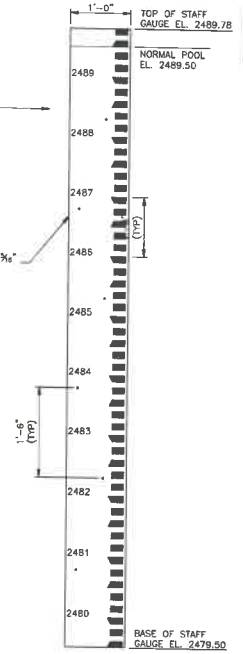
6 15-S-16 LADDER RAIL BASE PLATE

SCALE: 1"=1'-0"



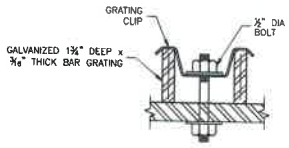
8 15-S-12 UPPER STAFF GAUGE

SCALE: 1"=1'-0"



9 15-S-12 LOWER STAFF GAUGE

SCALE: 1"=1'-0"



7 15-S-16 GRATING CLIP DETAIL

NTS

FATIGUE PLATFORM BILL OF MATERIALS

MARK	QTY	DESCRIPTION	LENGTHS	MATERIAL
FP1	2	L 2x2x3/16"	2'-6"	GALVANIZED STEEL
FP2	4	L 2x2x3/16"	3'-0"	GALVANIZED STEEL
FP3	2	L 2x2x3/16"	3'-0"	GALVANIZED STEEL
FP4	2	L 2x2x3/16"	4'-10½"	GALVANIZED STEEL
FP5	4	½" ANCHORS	EMBED 6" MIN	GALVANIZED STEEL
FP6	1	GRATING	DETAIL 2 15-S-13	GALVANIZED STEEL

NOTES:

1. GRATING SHALL BE BANDED ALL AROUND.

JONATHAN W. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Date	
Designed SND	SEP 24
Drawn BJY	SEP 24
Checked KLS	SEP 24
Approved JWP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

MISCELLANEOUS METAL DETAILS - SHEET 2 OF 2

Brush Creek Watershed Mercer County, WV

Aterra-Schnabel JV

300 Brookside Ave., Bldg. 15, Suite 160, Ambler, PA 19002 Phone: 267-464-4646 schnabel-eng.com

USDA United States Department of Agriculture Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-16

SEPTEMBER 2024

SHEET 50 OF 61

REVISIONS			
#	DATE APPROVED	TITLE	DESCRIPTION

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Last Saved By: CPARSONS SaveDate: 10/2/2024 11:28 AM FileDate: 10/2/2024 3:55 PM
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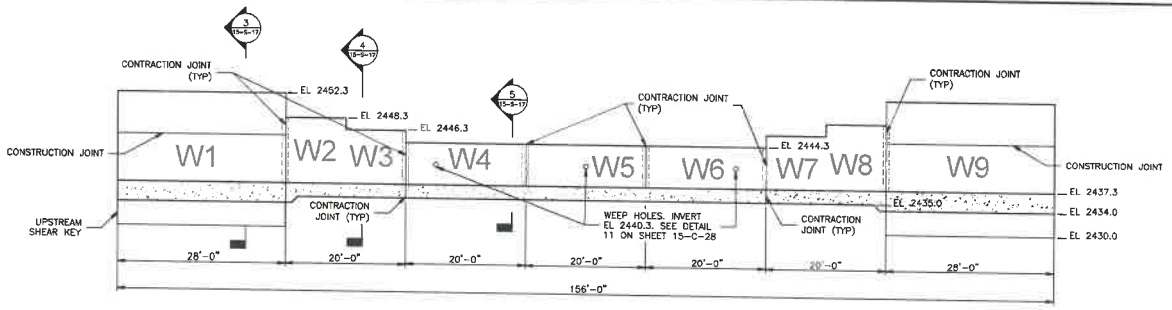
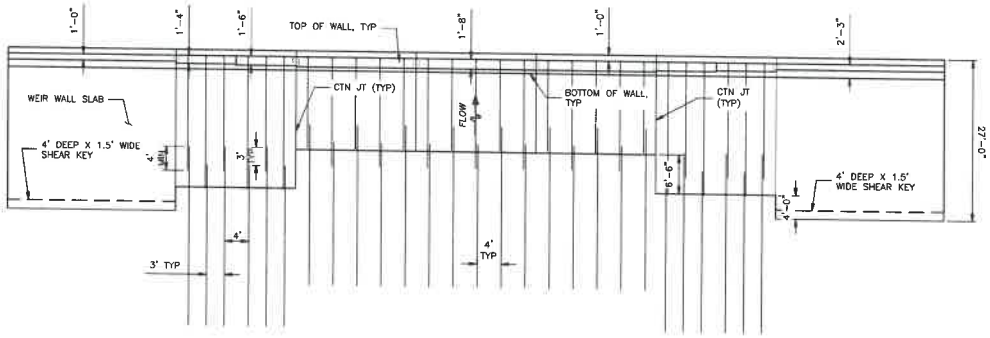
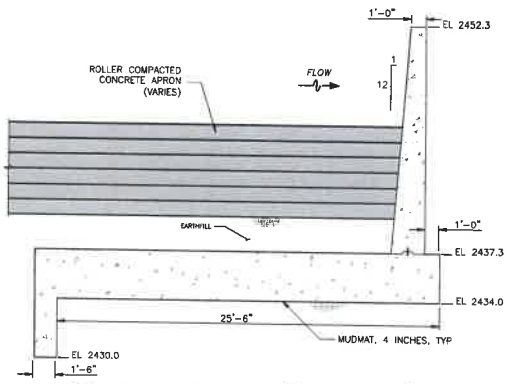
MISCELLANEOUS METAL DETAILS - SHEET 2 OF 2



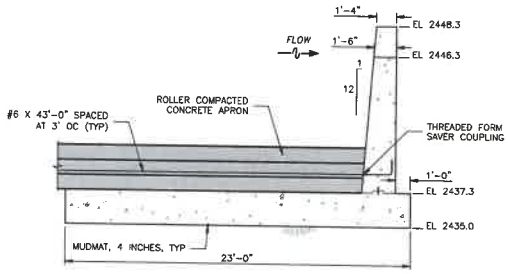
1 TAILWATER WEIR WALL ELEVATION



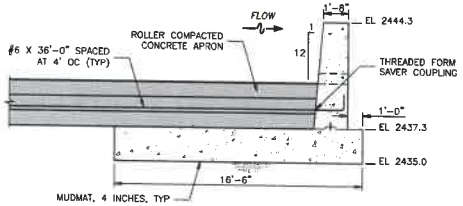
2 TAILWATER WEIR WALL PLAN



3 WALL PROFILE (W1 & W9)



4 WALL PROFILE (W2, W3, W7, & W8)



5 WALL PROFILE (W4, W5, & W6)

JONATHAN M. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

		Date
Designed	JTG	SEP 24
Drawn	JTG	SEP 24
Checked	MLD	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

TAILWATER WEIR WALL PLAN, ELEVATION, AND SECTION

Brush Creek Watershed *Mercer County, WV*

ATERRA SCHNABEL JV

300 Brookside Ave., Bldg. I-8, Suite 160, Ambler, PA 19002
Phone: 334-273-3406
Contact: Kevin Smith

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-17

SEPTEMBER 2024

SHEET 51 OF 81

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

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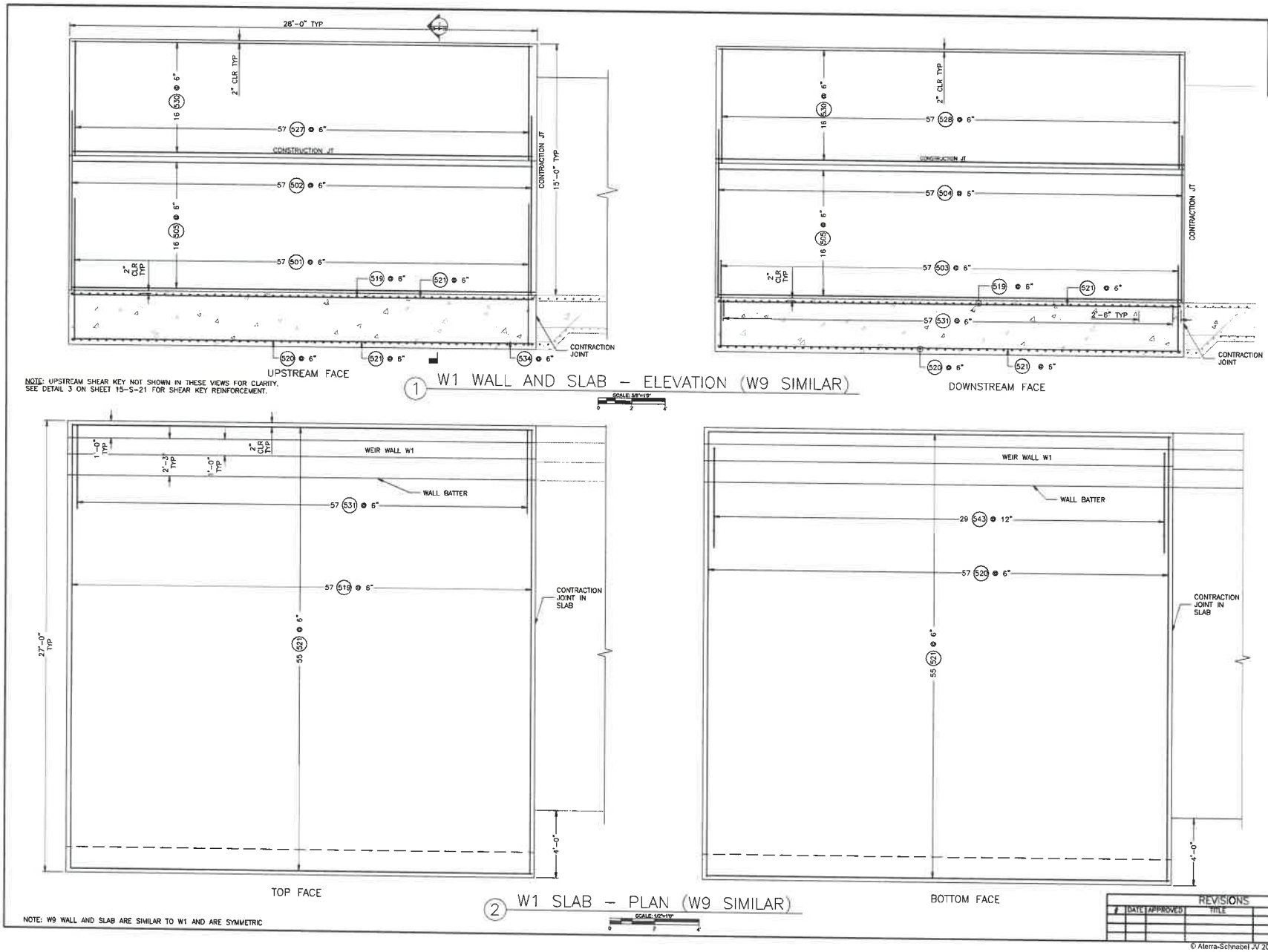
TitleHeight:1 WEIR WALL PLAN ELEVATION AND SECTION



JONATHAN M. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed JTG	SEP 24
Drawn JTG	SEP 24
Checked MLD	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

TAILWATER WEIR WALL STEEL PLACEMENT

SHEET 1 OF 5

Mercer County, WV

Brush Creek Watershed

Aterra Solutions | Schnabel Engineering

300 Brookside Ave., Bldg. 18, Suite 180, Ambler, PA 19002 Phone: 267-718-0546 schnabel-eng.com

USDA United States Department of Agriculture Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-18

SEPTEMBER 2024

SHEET 52 OF 61

REVISIONS			
#	DATE	APPROVED	TITLE / DESCRIPTION

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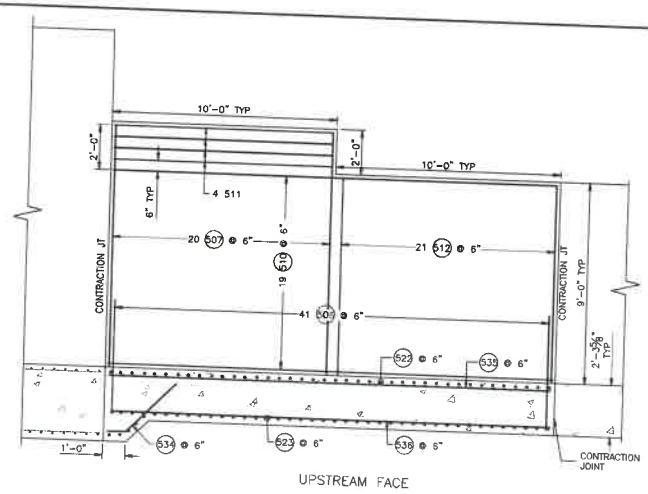
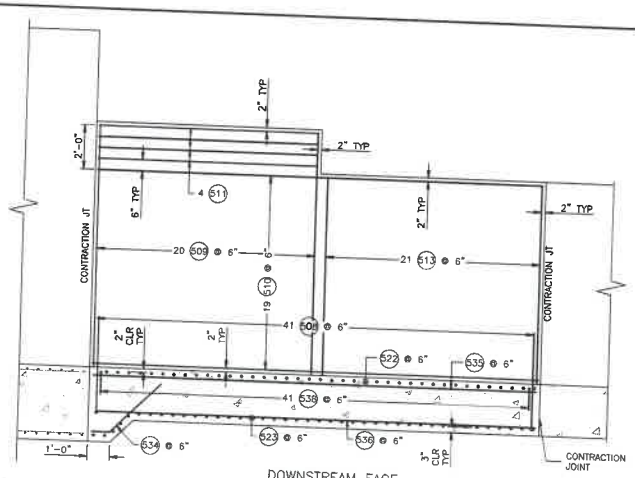
Filename: C:\Users\CRATSOMO\Aterra-Schnabel JV\Brush Creek - 12SPEC18D0023 - Documents\02-Production\CAD\DWG\BSD\BSD-PRIM_DESIGN\SITE 15\S-15-16 to S-15-22 WEIR WALL.dwg Layout: TAILWATER WEIR WALL STEEL PLACEMENT - SHEET 1 OF 5



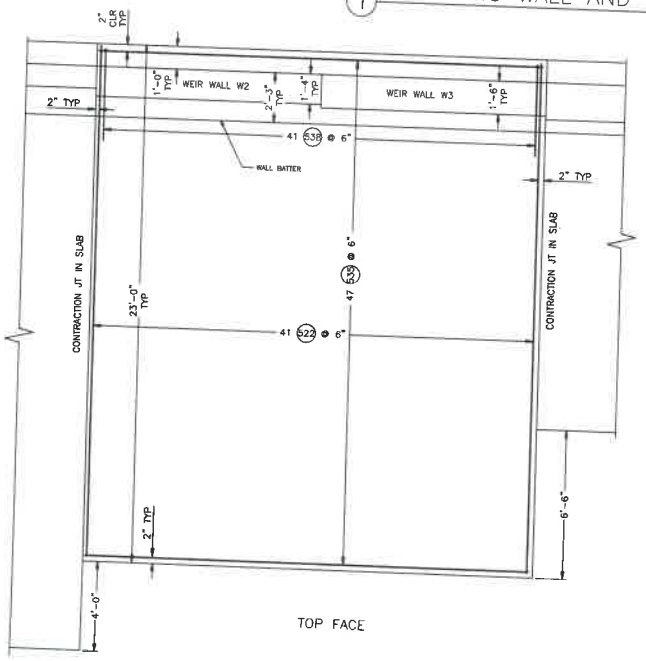
UPSTREAM FACE



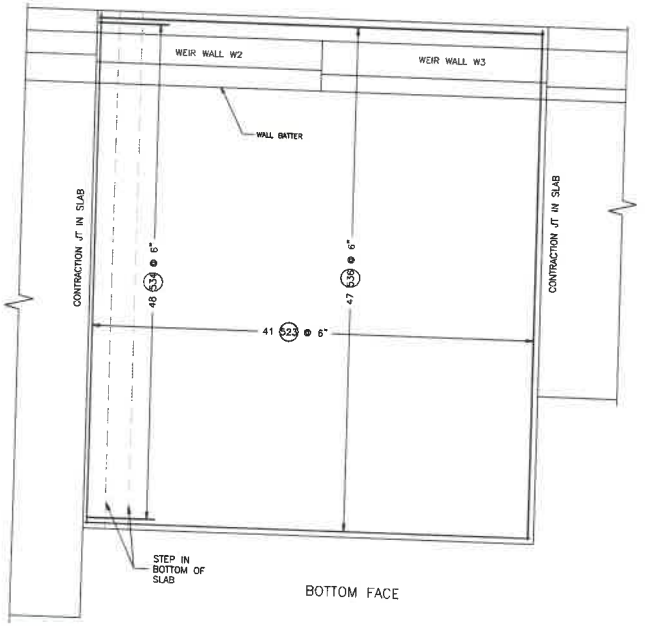
DOWNSTREAM FACE

1 W2 & W3 WALL AND SLAB – ELEVATION (W7 & W8 SIMILAR)

SCALE: 3/8"=1'0"



TOP FACE



BOTTOM FACE

NOTE: W7 & W8 WALL AND SLAB ARE SIMILAR TO W2 & W3 AND ARE SYMMETRIC

2 W2 & W3 SLAB – PLAN (W7 & W8 SIMILAR)

SCALE: 3/8"=1'0"

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JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed JTG	SEP 24
Drawn JTG	SEP 24
Checked MLP	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

TAILWATER WEIR WALL STEEL PLACEMENT
SHEET 2 OF 5

Brush Creek Watershed
Mercer County, WV

Aterra | Schnabel
300 Brookside Ave., Bldg. 18, Suite 160
Ambler, PA 19002
Phone: 267-464-4545
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-19

SEPTEMBER 2024

SHEET 53 OF 61

Last Saved By: CPARSONS SaveDate: 7/30/2024 11:57 AM PlotDate: 08/20/24 3:50 PM
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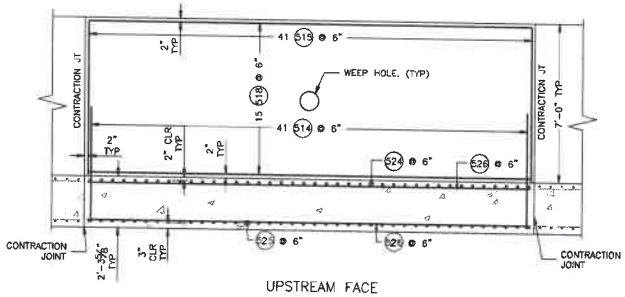
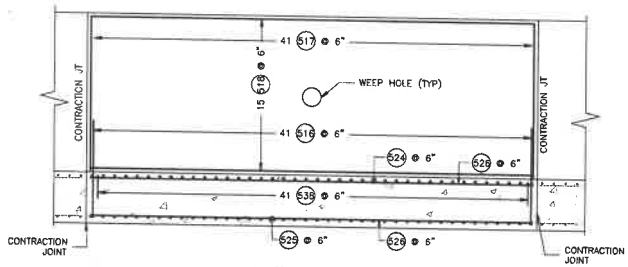
TAILWATER WEIR WALL STEEL PLACEMENT - SHEET 2 OF 5



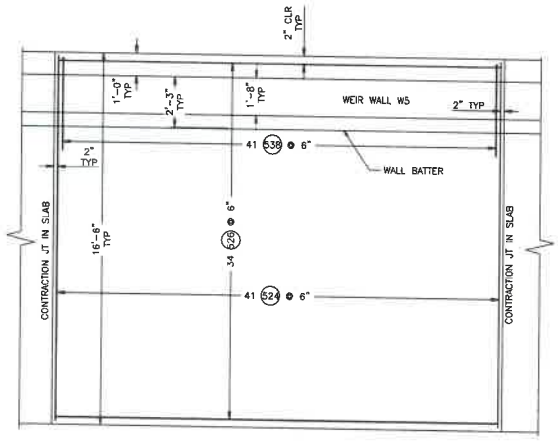
UPSTREAM FACE



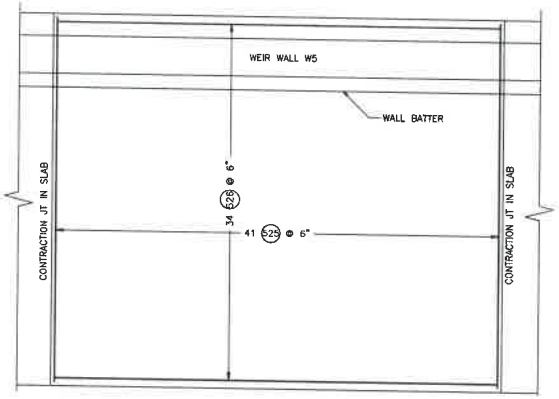
DOWNSTREAM FACE

1 W5 WALL AND SLAB – ELEVATION (W4 & W6 SIMILAR)

SCALE: 3/8"=1'0"



TOP FACE



BOTTOM FACE

2 W5 SLAB – PLAN (W4 & W6 SIMILAR)

SCALE: 1/2"=1'0"

NOTE: W4 & W6 WALL AND SLAB ARE SIMILAR TO W5 AND ARE SYMMETRIC

JONATHAN F. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Designed	Drawn	Checked	Approved
Date	SEP 24	SEP 24	SEP 24	SEP 24
	JTG	JTG	MLD	JMP

BRUSH CREEK SITE 15 DAM REHABILITATION

TAILWATER WEIR WALL STEEL PLACEMENT

SHEET 3 OF 5

Brush Creek Watershed *Mercer County, WV*

ATERRA NETWORK | Schnabel Engineering

300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002, Phone: 267-464-1480, schnabel-eng.com

USDA United States Department of Agriculture Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-20

SEPTEMBER 2024

SHEET 54 OF 61

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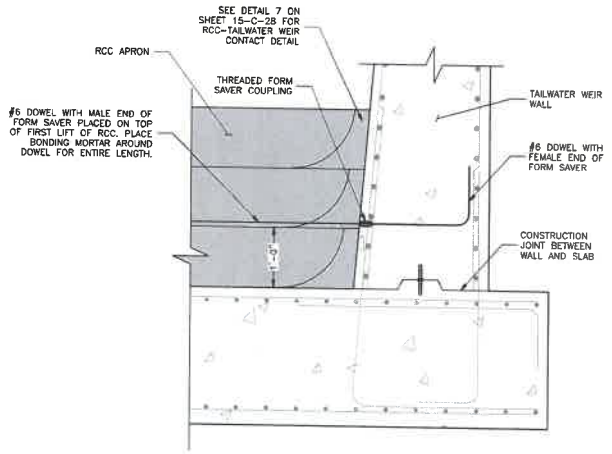
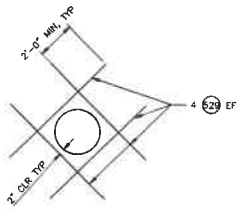
TAILWATER WEIR WALL STEEL PLACEMENT - SHEET 3 OF 5



1 DOWEL INTO RCC CONNECTION TO WEIR WALL

SCALE: 1"=1'0"

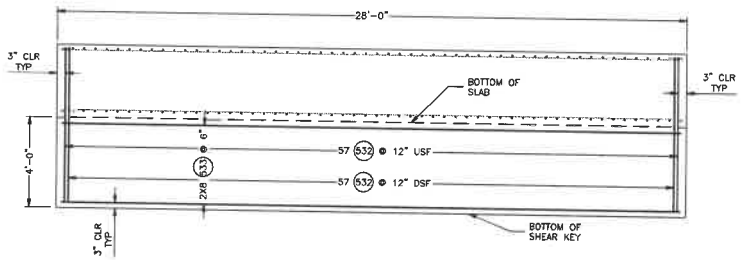


2 WEEP HOLE OPENING DETAIL

NOT TO SCALE

NOTES:

1. PROVIDE ADDITIONAL REINFORCEMENT AT ALL 8" WEEP HOLE PENETRATIONS. ADDITIONAL REINFORCEMENT TO MATCH SIZE OF TYPICAL REINFORCEMENT. PROVIDE ADDITIONAL REINFORCEMENT AT EACH FACE OF WALL.
2. CUT VERTICAL AND HORIZONTAL REINFORCEMENT OR ADJUST SPACING TO FIT AROUND PENETRATION WITH A MINIMUM CLEAR DISTANCE OF 2" BETWEEN THE PIPE AND REINFORCEMENT.



3 W1 & W9 SHEAR KEY REINFORCEMENT PROFILE

SCALE: 3/8"=1'0"

JONATHAN N. PITTMAN
REGISTERED
23485
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

	Date
Designed JTG	SEP 24
Drawn JTG	SEP 24
Checked MLD	SEP 24
Approved JNP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

TAILWATER WEIR WALL STEEL PLACEMENT

SHEET 4 OF 5

Brush Creek Watershed *Mercer County, WV*

ATERRA SCHNABEL JV

Schnabel Engineering

300 Brookside Ave., Bldg. 18, Suite 103, Ambler, PA 19002, Phone: 267-514-1645, schnabel-eng.com

USDA United States Department of Agriculture

Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-21

SEPTEMBER 2024

SHEET 55 OF 61

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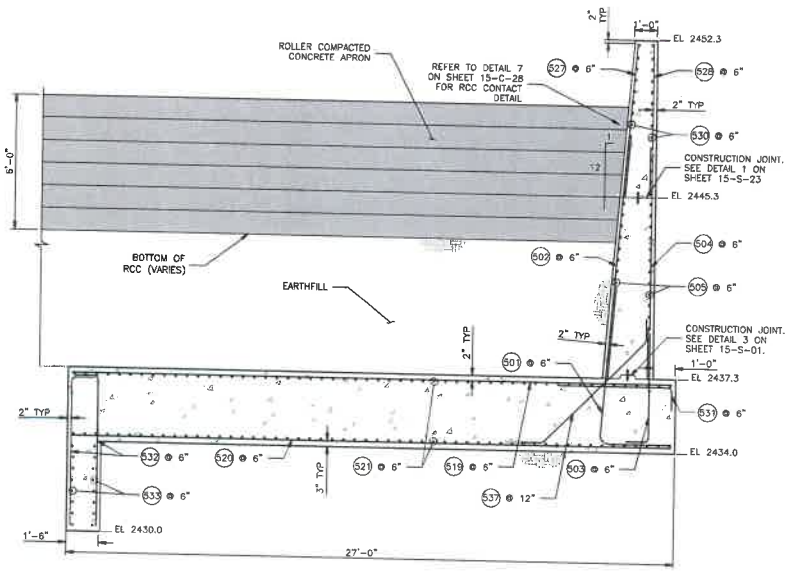
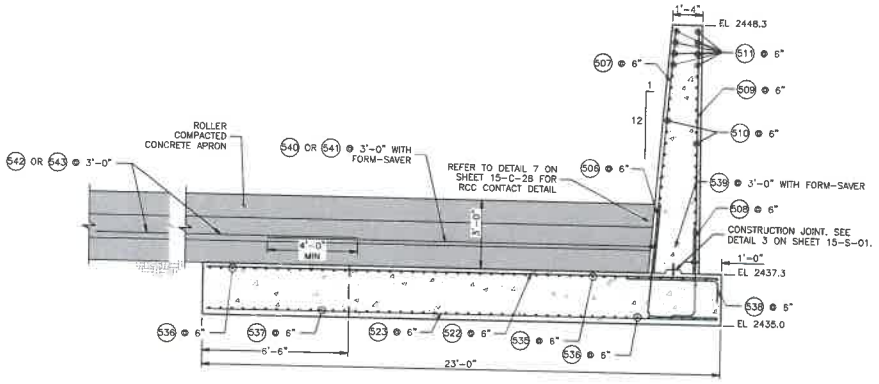
File Name: C:\Users\CPARSONS\ATERRA-SCHNABEL JV\BRUSH CREEK SITE 15 - Documents\06-DESIGN\WORKING\15-S-21 TAILWATER WEIR WALL STEEL PLACEMENT.dgn Model: 3D_Sheet Plot Config: 24x36.pltcfg
Products\06-DESIGN\WORKING\15-S-21 TAILWATER WEIR WALL STEEL PLACEMENT.dgn Model: 3D_Sheet Plot Config: 24x36.pltcfg
Project: C:\Users\CPARSONS\ATERRA-SCHNABEL JV\BRUSH CREEK SITE 15 - Documents\06-DESIGN\SUITE 165\15-15-18 to 5-15-28 WEIR WALL.dwg Layout: TAILWATER WEIR WALL STEEL PLACEMENT - SHEET 5 OF 5



1 W1 WALL AND SLAB – PROFILE (W9 SIMILAR)

SCALE: 3/8"=1'0"

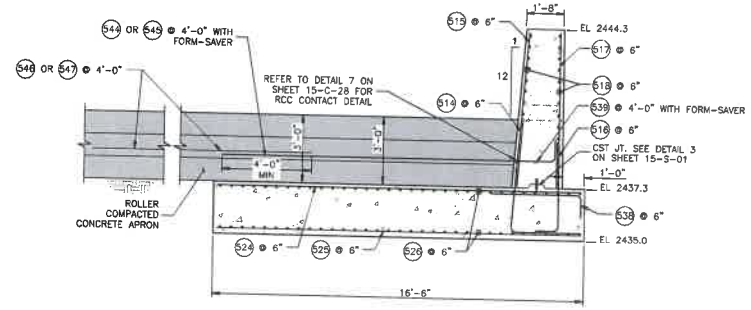


2 W2 WALL AND SLAB – PROFILE (W8 SIMILAR)

SCALE: 3/8"=1'0"

NOTES:

1. FOR DOWELS INTO RCC, EXTEND CONTINOUSLY TO AT LEAST 43'-0" UPSTREAM OF WALL FACE. STAGGER SPLICE LOCATIONS AT LEAST 3 FT AS SHOWN ON DETAIL 2 OF SHEET 15-S-17. PROVIDE A MINIMUM 4' LAP SPLICE OR A MECHANICAL COUPLING PER SPECIFICATIONS.

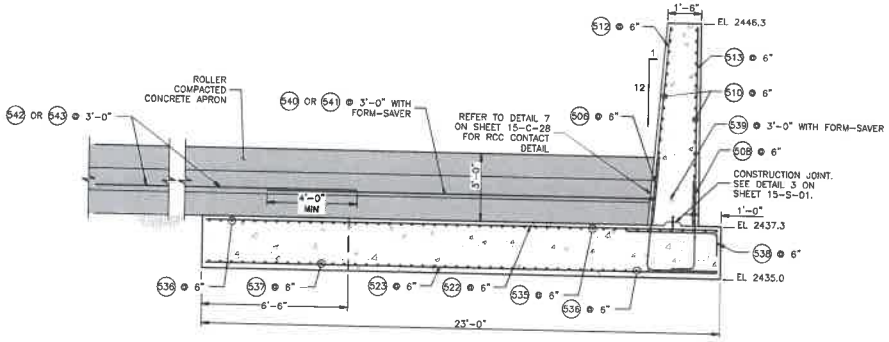


3 W5 WALL AND SLAB – PROFILE (W4 & W6 SIMILAR)

SCALE: 3/8"=1'0"

NOTES:

1. FOR DOWELS INTO RCC, EXTEND CONTINOUSLY TO AT LEAST 36'-0" UPSTREAM OF WALL FACE. STAGGER SPLICE LOCATIONS AT LEAST 3 FT AS SHOWN ON DETAIL 2 OF SHEET 15-S-17. PROVIDE A MINIMUM 4' LAP SPLICE OR A MECHANICAL COUPLING PER SPECIFICATIONS.



4 W3 WALL AND SLAB – PROFILE (W7 SIMILAR)

SCALE: 3/8"=1'0"

NOTES:

1. FOR DOWELS INTO RCC, EXTEND CONTINOUSLY TO AT LEAST 43'-0" UPSTREAM OF WALL FACE. STAGGER SPLICE LOCATIONS AT LEAST 3 FT AS SHOWN ON DETAIL 2 OF SHEET 15-S-17. PROVIDE A MINIMUM 4' LAP SPLICE OR A MECHANICAL COUPLING PER SPECIFICATIONS.

JONATHAN M PITTMAN
REGISTERED
23485
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

	Date
Designed JTG	SEP 24
Drawn JTG	SEP 24
Checked MLD	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION
TAILWATER WEIR WALL STEEL PLACEMENT
SHEET 5 OF 5
Brush Creek Watershed — Mercer County, WV

Aterra | Schnabel Engineering
300 Brookside Ave., Bldg. I-8, Suite 160,
Ambler, PA 19002
Phone: 267-757-6548
schnabel-eng.com

USDA
United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023
Drawing No. 15-S-22
SEPTEMBER 2024
SHEET 56 OF 61

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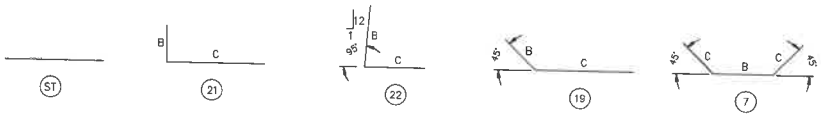
STEEL SCHEDULE								
LOCATION	MARK	SIZE	QUAN.	LENGTH	TYPE	B	C	TOTAL LENGTH
WEIR WALL	501	9	114	10'3"	22	7' 1"	3' 2"	1168'6"
"	502	7	114	10' 9"	STR			1225' 6"
"	503	5	114	5' 11"	21	5' 1"	0' 10"	674'6"
"	504	5	114	10' 0"	STR			1140'0"
"	505	8	64	27' 8"	STR			1770'8"
"	506	8	82	8' 2"	22	5' 1"	3' 1"	669' 8"
"	507	6	40	10' 11"	STR			436'8"
"	508	5	82	4' 11"	21	4' 1"	0' 10"	403' 2"
"	509	5	40	10' 10"	STR			433' 4"
"	510	6	76	19' 8"	STR			1494' 8"
"	511	6	16	9' 8"	STR			154' 8"
"	512	6	42	8' 11"	STR			374'6"
"	513	5	42	8' 10"	STR			371' 0"
"	514	6	123	8' 2"	22	5' 1"	3' 1"	1004' 6"
"	515	6	123	6' 11"	STR			850' 9"
"	516	5	123	4' 11"	21	4' 1"	0' 10"	604' 9"
"	517	5	123	6' 10"	STR			840' 6"
"	518	6	90	19' 8"	STR			1770' 0"
SLAB	519	9	114	26' 8"	STR			3040' 0"
"	520	6	114	26' 8"	STR			3040' 0"
"	521	6	220	27' 8"	STR			6086' 8"
"	522	8	82	22' 8"	STR			1858'8"
"	523	5	82	22' 8"	STR			1858'8"
"	524	6	123	16' 1"	STR			1978' 3"
"	525	5	123	16' 1"	STR			1978' 3"
"	526	6	204	19' 8"	STR			4012' 0"
WEIR WALL	527	7	114	6' 11"	STR			769' 6"
"	528	5	114	6' 10"	STR			779' 0"
"	529	6	24	5'-0"	STR			120' 0"
"	530	6	56	27' 8"	STR			1549' 4"
SLAB	531	6	114	6' 0"	21	5' 0"	1' 0"	684' 0"
"	532	6	228	8' 1"	21	7' 1"	1' 0"	1843' 0"
"	533	6	32	27' 8"	STR			885' 4"
"	534	6	96	3' 11"	19	3'2"	0' 9"	376' 0"
"	535	6	94	19' 8"	STR			1848' 8"
"	536	6	94	19' 8"	STR			1848' 8"
"	537	6	56	8' 10"	7	6' 10"	1' 0"	494' 8"
"	538	6	145	5' 0"	21	4' 0"	1' 0"	725' 0"
WEIR WALL	539	6	27	3' 0"	21	2' 0"	1' 0"	81' 0"
RCC	540	6	6	17' 0"	STR			102' 0"
"	541	6	6	20' 0"	STR			120' 0"
"	542	6	6	30' 0"	STR			180' 0"
"	543	6	6	27' 0"	STR			162' 0"
"	544	6	9	13' 0"	STR			117' 0"
"	545	6	9	16' 0"	STR			144' 0"
"	546	6	9	27' 0"	STR			243' 0"
"	547	6	9	24' 0"	STR			216' 0"

	BAR SIZE	LINEAR FT	WEIGHT (LBS)
	5	9083.17	9474
	6	32942.33	49479
	7	2014.00	4117
	8	4299.00	11478
	9	4208.50	14309
TOTAL		52547.00	88857



BAR TYPES

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed JTG	SEP 24
Drawn JTG	SEP 24
Checked MLD	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

TAILWATER WEIR WALL STEEL SCHEDULE

Brush Creek Watershed *Mercer County, WV*

ATERRA | Schnabel ENGINEERING

300 Brookside Ave., Bldg. 19, Suite 160, Ambler, PA 19002, Phone: 267-703-6540, schnabel-eng.com

USDA United States Department of Agriculture Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-23

SEPTEMBER 2024

SHEET 57 OF 61

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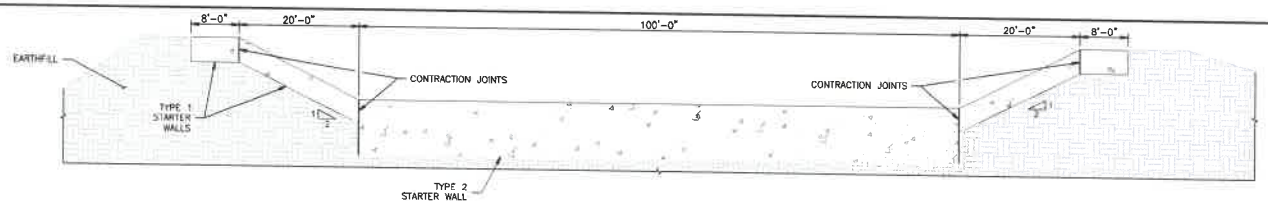
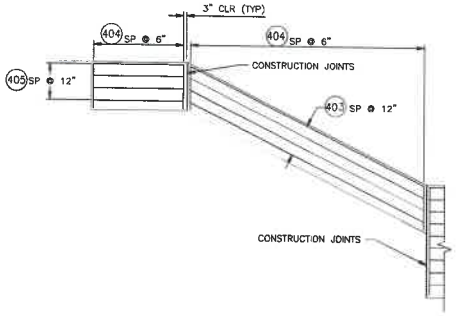
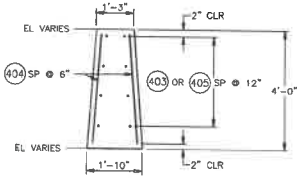


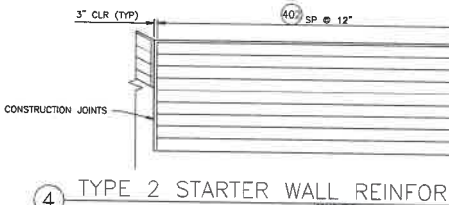
1 STARTER WALL ELEVATION VIEW



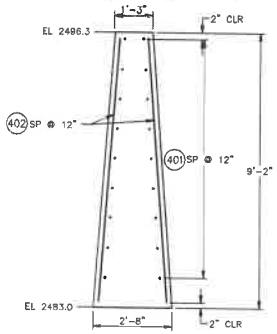
2 TYPE 1 STARTER WALL REINFORCEMENT ELEVATION



3 TYPE 1 STARTER WALL REINFORCEMENT SECTION



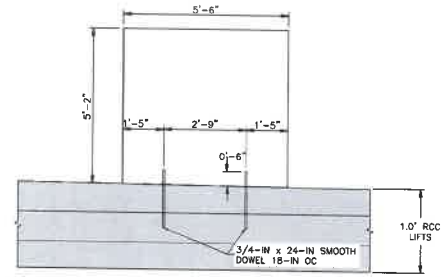
4 TYPE 2 STARTER WALL REINFORCEMENT ELEVATION



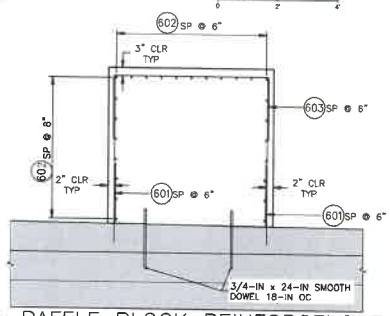
5 TYPE 2 STARTER WALL REINFORCEMENT SECTION

STARTER WALL STEEL SCHEDULE							
MARK	SIZE	QUAN.	LENGTH	TYPE	B	C	TOTAL LENGTH
401	5	180	10'-0"	STR			1800'-0"
402	5	200	8'-10"	STR			1766'-8"
403	5	32	10'-11"	STR			349'-4"
404	5	108	3'-8"	STR			396'-0"
405	5	16	7'-6"	STR			120'-0"

	BAR SIZE	LINEAR FT	WEIGHT LBS
TOTAL	5	6009.00	6267.39



6 SECTION AT BAFFLE BLOCK



7 BAFFLE BLOCK REINFORCEMENT

BAFFLE BLOCK STEEL SCHEDULE							
MARK	SIZE	QUAN.	LENGTH	TYPE	B	C	TOTAL LENGTH
601	6	120	2'-8"	STR			320'-0"
602	5	375	3'-6"	STR			1312'-6"
603	5	120	9'-2"	17	2'-0"	5'-2"	1100'-0"

	BAR SIZE	LINEAR FT	WEIGHT LBS
	5	2412.50	2516.42
	6	320.00	480.64
TOTAL		2732.50	2997.06

BAR TYPES

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

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Date	
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Drawn CRP	SEP 24
Checked ERB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

STARTERWALL AND BAFFLE BLOCK DETAILS

Brush Creek Watershed *Mercer County, WV*

Aterra Schnabel
300 Brookside Ave., Bldg. 19, Suite 150, Beckley, WV 25801
Phone: 304-274-1456
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USDA United States Department of Agriculture Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-S-24

SEPTEMBER 2024

SHEET 58 OF 61

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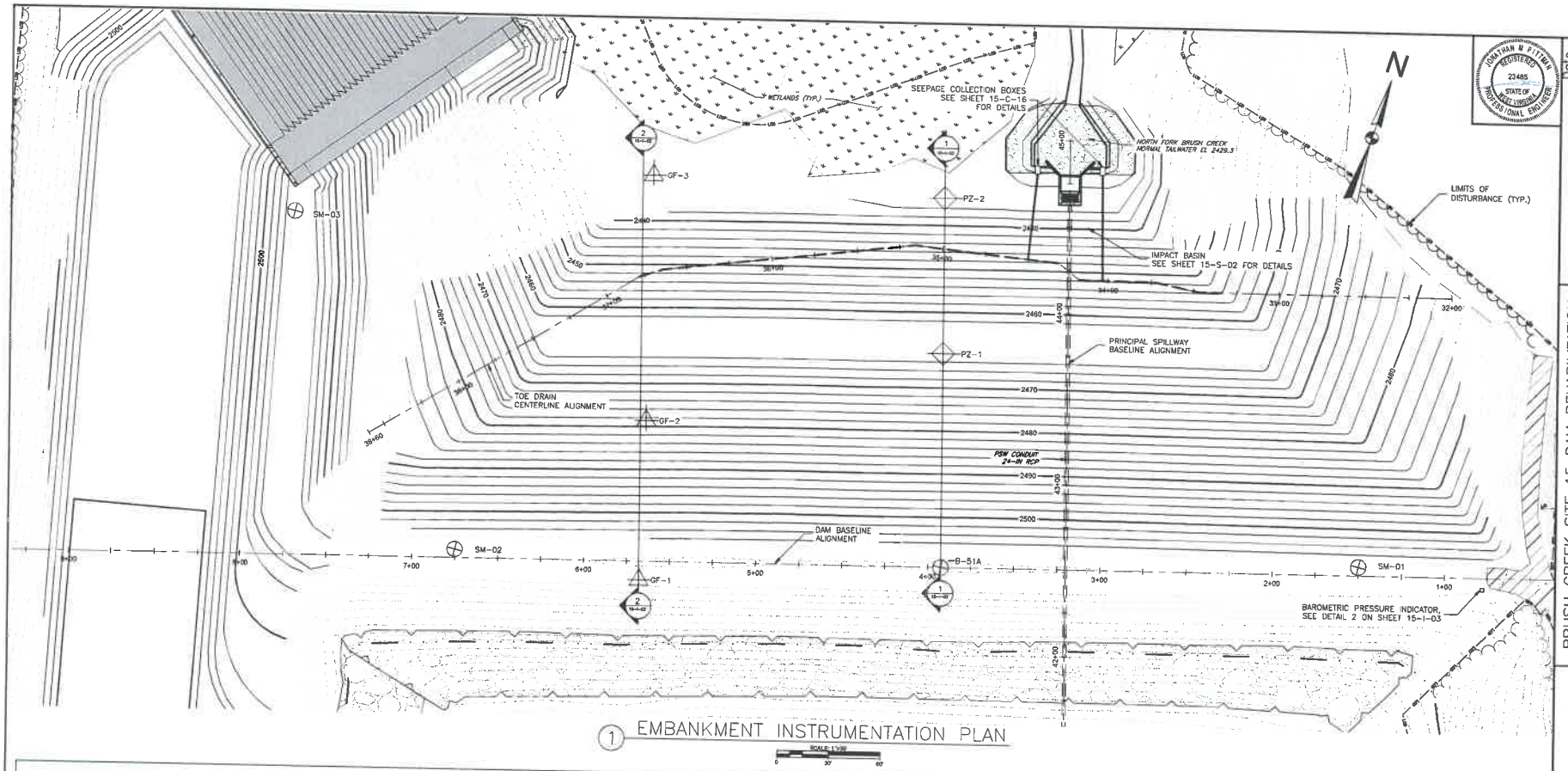

1 EMBANKMENT INSTRUMENTATION PLAN

INSTRUMENTATION SCHEDULE

INSTRUMENT ID	STATION (DAM BASELINE)	OFFSET (FEET FROM DAM BASELINE)	NORTHING (FT)	EASTING (FT)	GROUND SURFACE ELEVATION (FT)	SCREENED INTERVAL ELEVATION (FT)	VIBRATING WIRE PIEZOMETER (VWP) TIP ELEVATION (FT)	NOTES
GF-3	5+61.97	224.82	118447.3	1914569.2	2437.94	EL 2427.8 – EL 2429.8	EL 2428.8	EXISTING OPEN STANDPIPE TO REMAIN
GF-2	5+68.00	82.40	118308.4	1914600.5	2476.65	EL 2444.5 TO EL 2442.5 (S) EL 2423.0 TO EL 2421.0 (D)	EL 2443.5 (S) EL 2422.0 (D)	EXISTING OPEN STANDPIPE TO REMAIN
GF-1	5+64.82	-10.78	118217.1	1914619.7	2507.32	EL 2413.9 – EL 2415.9 (D) EL 2454.4 – EL 2456.4 (S)	EL 2414.9 (D) EL 2455.4 (S)	EXISTING OPEN STANDPIPE TO REMAIN
PZ-2	3+92.50	215.00	118478.4	1914736.1	2435.66	EL 2424.82– EL 2429.82	EL 2427.32	PROPOSED OPEN STANDPIPE TO BE INSTALLED
PZ-1	3+92.50	125.00	118391.0	1914757.6	2465.11	EL 2423.4 – EL 2428.4	EL 2425.9	PROPOSED OPEN STANDPIPE TO BE INSTALLED
B-51A	3+92.50	1.09	118270.7	1914787.3	2508.12	EL 2433.5 – EL 2438.1	EL 2435.8	EXISTING OPEN STANDPIPE TO REMAIN
SM-01	1+50.00	5.00	118332.5	1915021.8	2506.4	N/A	N/A	PROPOSED SURFACE MONUMENT
SM-02	6+75.00	5.00	118206.8	1914512.1	2507.1	N/A	N/A	PROPOSED SURFACE MONUMENT
SM-03	7+70.00	200.00	118373.4	1914373.1	2506.0	N/A	N/A	PROPOSED SURFACE MONUMENT

INSTRUMENTATION LEGEND

- PROPOSED PIEZOMETER TO BE INSTALLED
- GANNETT FLEMING 2016 PIEZOMETERS TO REMAIN
- ATERRA–SCHNABEL JV 2019 PIEZOMETER LOCATIONS TO REMAIN
- SURFACE MONUMENT LOCATION

NOTES:
1. CONTRACTOR SHALL PROTECT ALL EXISTING OPEN STANDPIPE PIEZOMETERS TO REMAIN IN ACCORDANCE WITH THE CONSTRUCTION SPECIFICATIONS
2. NEW VIBRATING WIRE PIEZOMETERS SHALL BE INSTALLED IN ALL OPEN STANDPIPE PIEZOMETERS SEE SHEET 15-I-03 FOR DETAILS

REVISIONS

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Drawn	CRP	SEP 24
Checked	EBB	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

EMBANKMENT INSTRUMENTATION PLAN

Brush Creek Watershed *Mercer County, WV*

ATERRA | Schnabel JOINT VENTURE

300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002, Phone: 330-274-0068

United States Department of Agriculture

USDA Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-I-01

SEPTEMBER 2024

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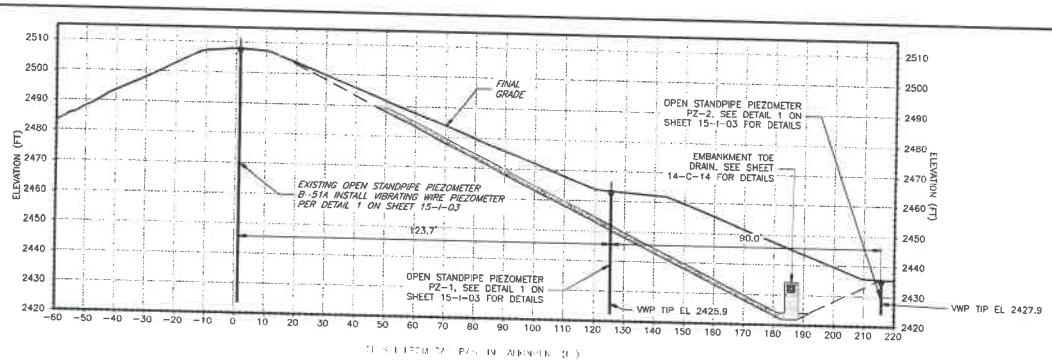
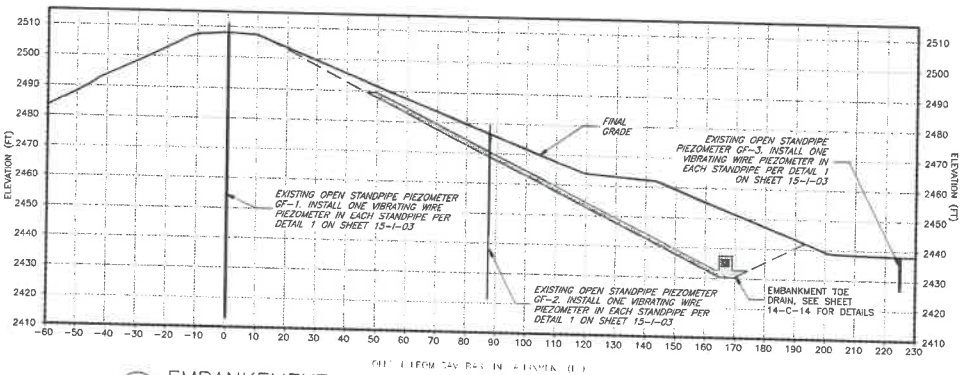


1 / 15-I-01 EMBANKMENT SECTION AT DAM BASELINE STA 3+92.50

SCALE 1"=20'



2 / 15-I-01 EMBANKEMENT SECTION AT DAM BASELINE STA 5+68

SCALE 1"=20'

NOTES:
1. EXISTING OPEN STANDPIPE PIEZOMETER GF-3 IS NOT SHOWN, SEE SHEET 15-I-01 FOR LOCATION. INSTALL ONE VIBRATING WIRE PIEZOMETER IN GF-3 PER DETAIL 1 ON SHEET 15-I-03.

REVISIONS

#	DATE	APPROVED	TITLE	DESCRIPTION

JONATHAN M. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

		Date
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Drawn	CRP	SEP 24
Checked	EBB	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION

EMBANKMENT INSTRUMENTATION SECTIONS

Brush Creek Watershed *Mercer County, WV*

Aterra Schnabel JV
300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 336-274-0408

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Contract No. 12SPEC18D0023

Drawing No. 15-I-02

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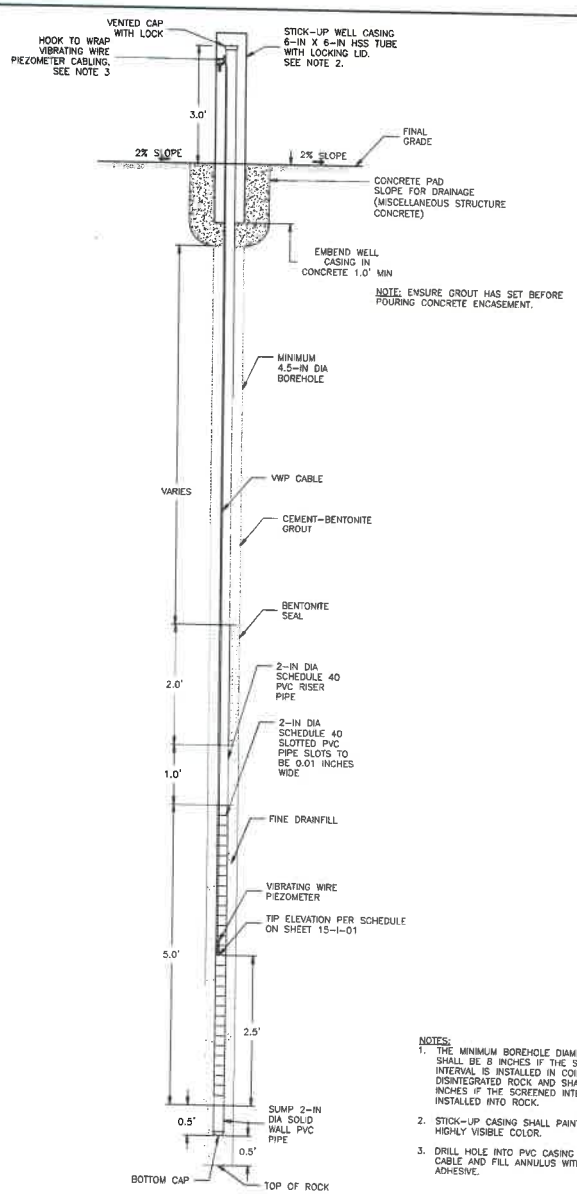
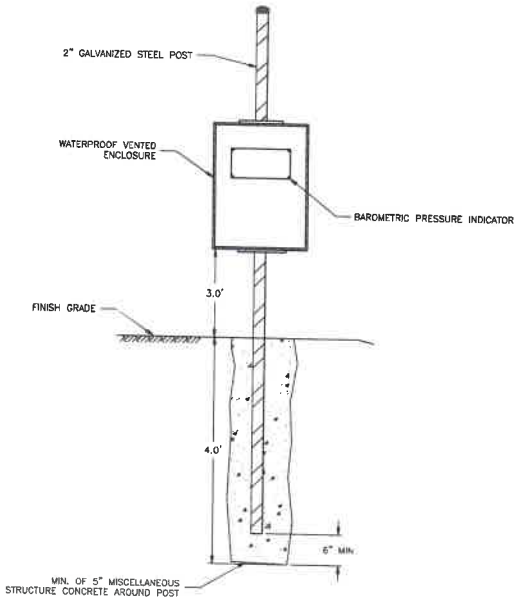


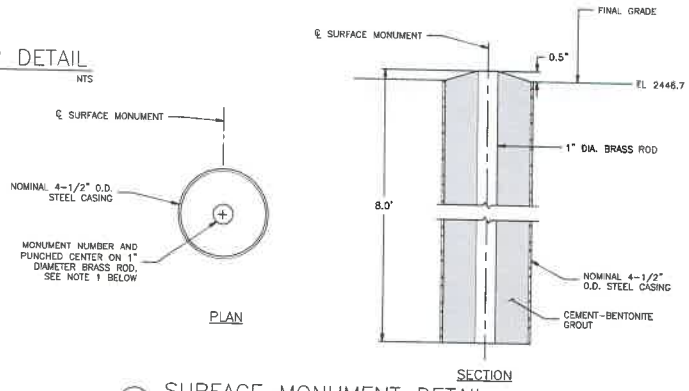
1 TYPICAL OPEN STANDPIPE PIEZOMETER DETAIL
NTS

NOTES:
1. THE MINIMUM BOREHOLE DIAMETER SHALL BE 8 INCHES IF THE SCREENED INTERVAL IS INSTALLED IN COIL AND DISINTEGRATED ROCK AND SHALL BE 6 INCHES IF THE SCREENED INTERVAL IS INSTALLED INTO ROCK.
2. STICK-UP CASING SHALL PAINTED IN A HIGHLY VISIBLE COLOR.
3. DRILL HOLE INTO PVC CASING FOR CABLE AND FILL ANNULUS WITH EPOXY ADHESIVE.



2 BAROMETRIC PRESSURE INDICATOR DETAIL
NTS

NOTE: PROVIDE LIGHTNING PROTECTION IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.



3 SURFACE MONUMENT DETAIL
NTS

MONUMENT NOTES:
1. PUNCH ALIGNMENT POINT AND STAMP MONUMENT NUMBER ON END OF BRASS ROD AFTER INSTALLATION.
2. CONTRACTOR SHALL SURVEY X, Y, AND Z, COORDINATES TO NEAREST 0.01 FT AND SUBMIT DATA FOR AS-BUILT RECORDS. SEE SHEET 15-I-01 FOR INSTALLATION LOCATIONS.
3. TOP OF DAM CONTROL SURFACE MONUMENTS SHALL BE CONSTRUCTED IN TRUE HORIZONTAL ALIGNMENT ALONG BASELINE OF DAM.

JONATHAN M. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

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BRUSH CREEK SITE 15 DAM REHABILITATION
EMBANKMENT INSTRUMENTATION DETAILS
Brush Creek Watershed *Mercer County, WV*

ATERRA | Schnabel
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JONATHAN M PITTMAN REGISTERED 23486 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

		Date
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Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION
OVERALL SITE MAP
Brush Creek Watershed *Mercer County, WV*

Aterra-Schnabel JV
300 Brookside Ave., Bldg. 15, Suite 160A, Beckley, WV 25801
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jmpittman@gmail.com

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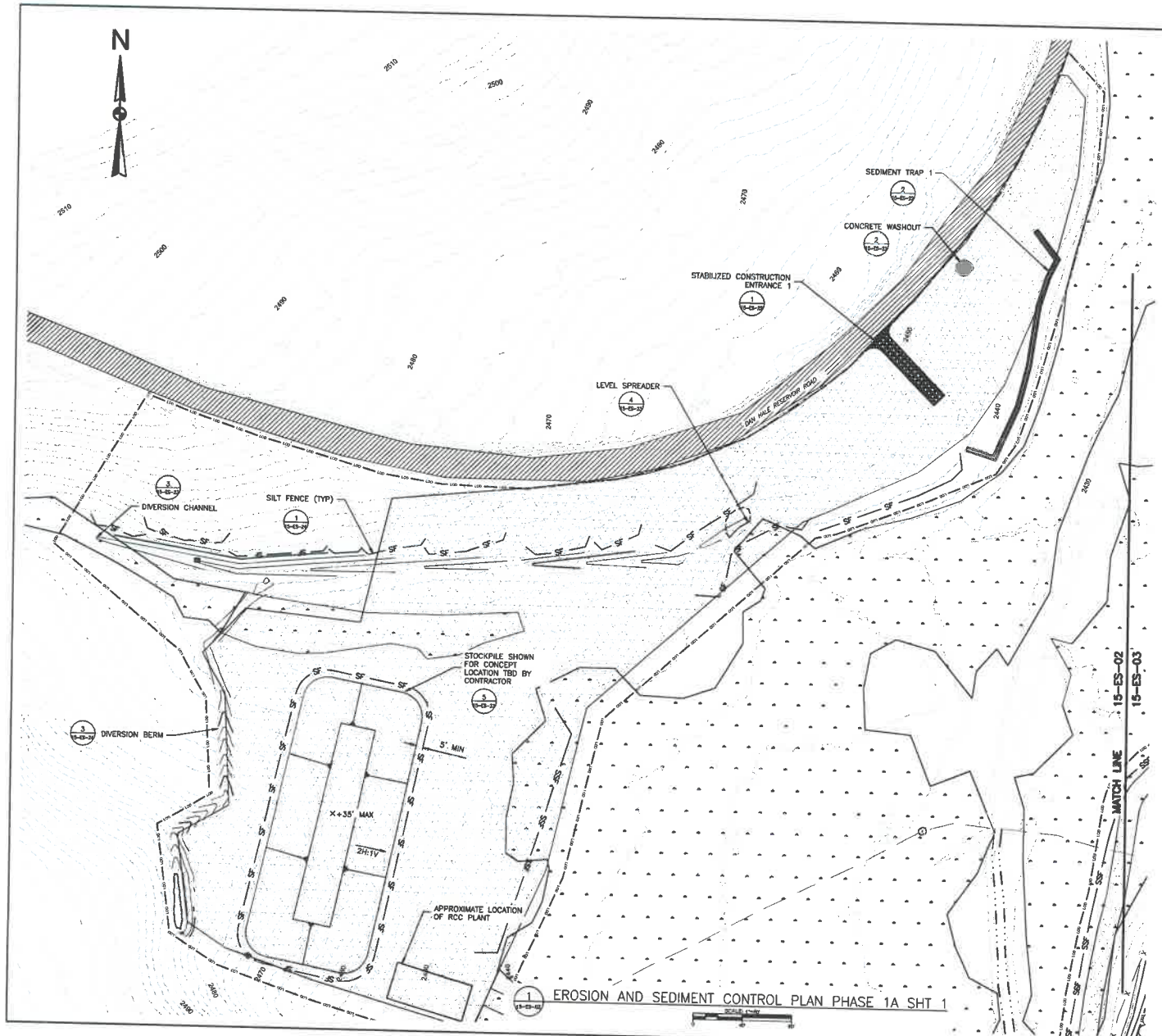

PRE-CONSTRUCTION ACTIVITIES

CONTRACT AWARD
PRE-CONSTRUCTION SUBMITTALS (SCHEDULE, SAFETY PLAN, ETC.)

PHASE 1A – EMBANKMENT TOE DRAIN EXCAVATION (TO BE PERFORMED CONCURRENTLY WITH PHASE 1B)

1. MOBILIZATION.
2. STAKE AND FLAG THE LIMITS OF DISTURBANCE AND LIMITS OF CLEARING AND GRUBBING, PERFORM INITIAL SET UP SURVEYS (STAGING AREAS, LAYOUT CONTROL POINTS).
3. INSTALL INITIAL POLLUTION CONTROL (E&SC) SILT FENCE, SUPER SILT FENCE, AND COMPOST FILTER SOCK MEASURES FOR SITE PERIMETER AND SITE ACCESS.
4. BEGIN LOWERING THE RESERVOIR BY 10 FEET THOUGH THE EXISTING WATER SUPPLY GATES AND PSW CONDUIT.
5. INSTALL STABILIZED CONSTRUCTION ENTRANCES, ACCESS ROADS WITH A TEMPORARY ROAD CULVERT AND STREAM CROSSING. INSTALL WEIGHTED FILTER SOCK DOWNSTREAM OF STREAM CROSSING BEFORE INSTALLING THE STREAM CROSSING. REMOVE WEIGHTED FILTER SOCK AFTER INSTALLATION OF THE STREAM CROSSING, INSTALL ADDITIONAL SILT FENCE AT THE STREAM CROSSING.
6. PERFORM CLEARING.
7. INSTALL ADDITIONAL PHASE 1 E&SC MEASURES INCLUDING THE DIVERSION CHANNEL, DIVERSION BERMS, LEVEL SPREADER, SEDIMENT TRAPS, AND CONCRETE WASHOUT.
8. PERFORM GRUBBING.
9. ESTABLISH TEMPORARY FACILITIES, INCLUDING CONSTRUCTION STAGING AND STOCKPILE AREAS, FIELD OFFICE, AND QA/QC LAB.
10. IMPLEMENT STREAM DIVERSION SYSTEM TO DIVERT FLOWS THROUGH THE IMPACT BASIN WORK AREA AND TO THE OUTLET CHANNEL. INSTALL DEWATERING FILTER BAG.
11. ABANDON THE CURRENT EMBANKMENT DRAIN SYSTEM.
12. DEMOLISH IMPACT BASIN AND REMOVE AND STOCKPILE RIPRAP OUTLET PROTECTION.
13. STRIP AND STOCKPILE TOPSOIL WITHIN EXCAVATION AND EARTHFILL LIMITS OF THE EMBANKMENT. INSTALL SILT FENCE AROUND THE STOCKPILE. PROTECT THE STOCKPILED TOPSOIL WITH TEMPORARY SEED AND MULCH.
14. EXCAVATE FOR EMBANKMENT TOE DRAIN AND IMPACT BASIN AND PERFORM FOUNDATION PREPARATION ACTIVITIES. STOCKPILE EXCAVATED MATERIALS AND INSTALL SILT FENCE AROUND THE STOCKPILE. PROTECT THE STOCKPILED MATERIALS WITH TEMPORARY SEED AND MULCH

NOTES:

1. THIS SEQUENCE IS DEVELOPED IN REGARD TO EROSION AND SEDIMENT CONTROL IMPLEMENTATION. THE CONTRACTOR MAY DEVELOP AN ALTERNATE CONSTRUCTION SCHEDULE THAT COMPLIES WITH THE CONTRACT CRITERIA. THE CONTRACTOR WILL BE RESPONSIBLE TO AMEND THE E&S CONTROL SEQUENCE TO BE CONSISTENT WITH THE APPROVED CONSTRUCTION SCHEDULE.

LEGEND

- SF — SF — SILT FENCE (1 / 15-ES-04)
- SSF — SSF — SUPER SILT FENCE (2 / 15-ES-04)
- C&G — C&G — CLEAR & GRUB
- LOD — LIMIT OF DISTURBANCE
- WATER EDGE

JONATHAN M. PITTMAN, REGISTERED 25465, STATE OF WEST VIRGINIA, PROFESSIONAL ENGINEER

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Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN
PHASE 1A SHT 1

Brush Creek Watershed *Mercer County, WV*

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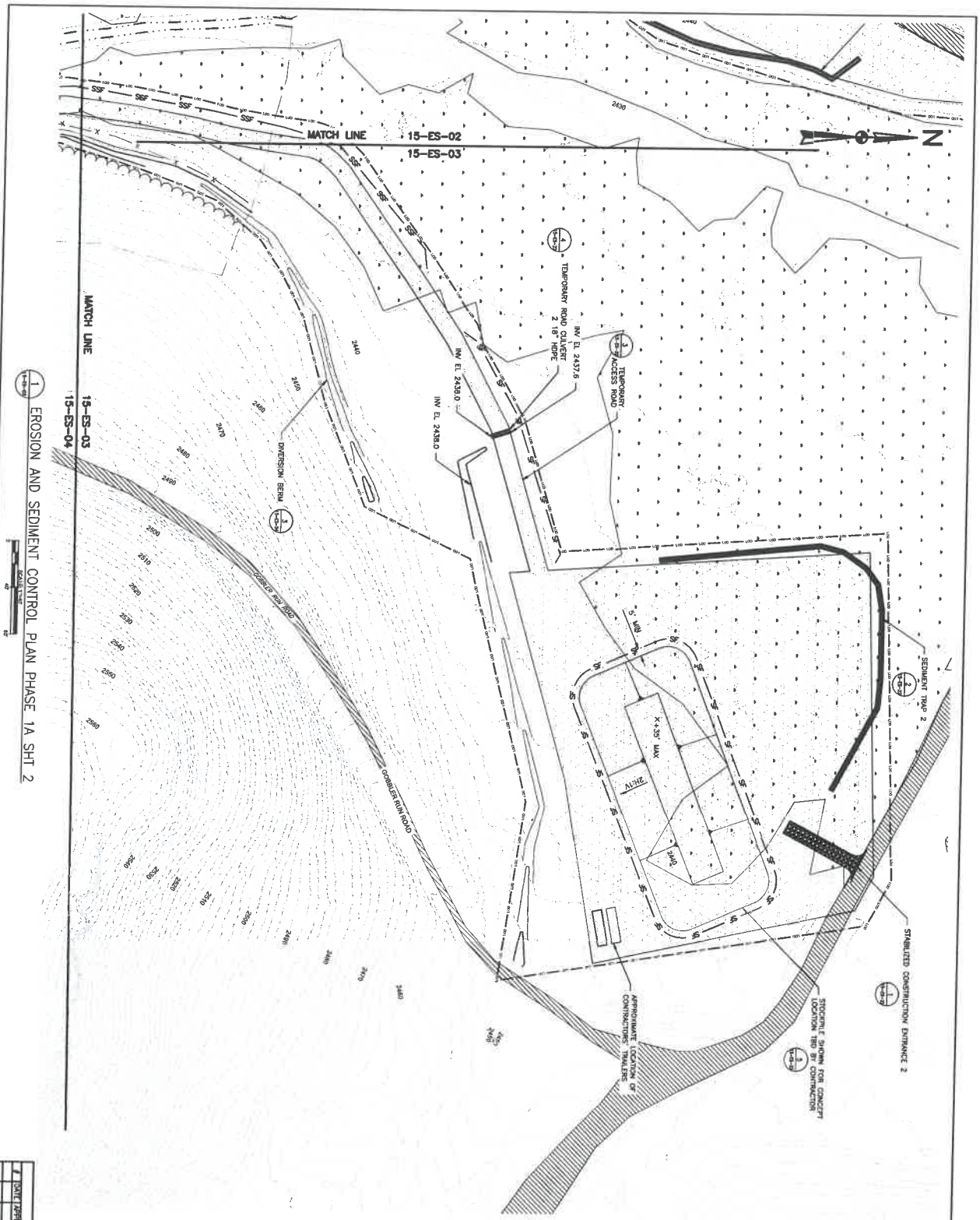

EROSION AND SEDIMENT CONTROL PLAN PHASE 1A SHT 2

SCALE: 1"=60'

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BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN
PHASE 1A SHT 2

Brush Creek Watershed — Mercer County, WV

		Date
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Drawn	AEW	SEP 24
Checked	COS	SEP 24
Approved	JMP	SEP 24

JONATHAN M. PUTNAM 23485 PROFESSIONAL ENGINEER

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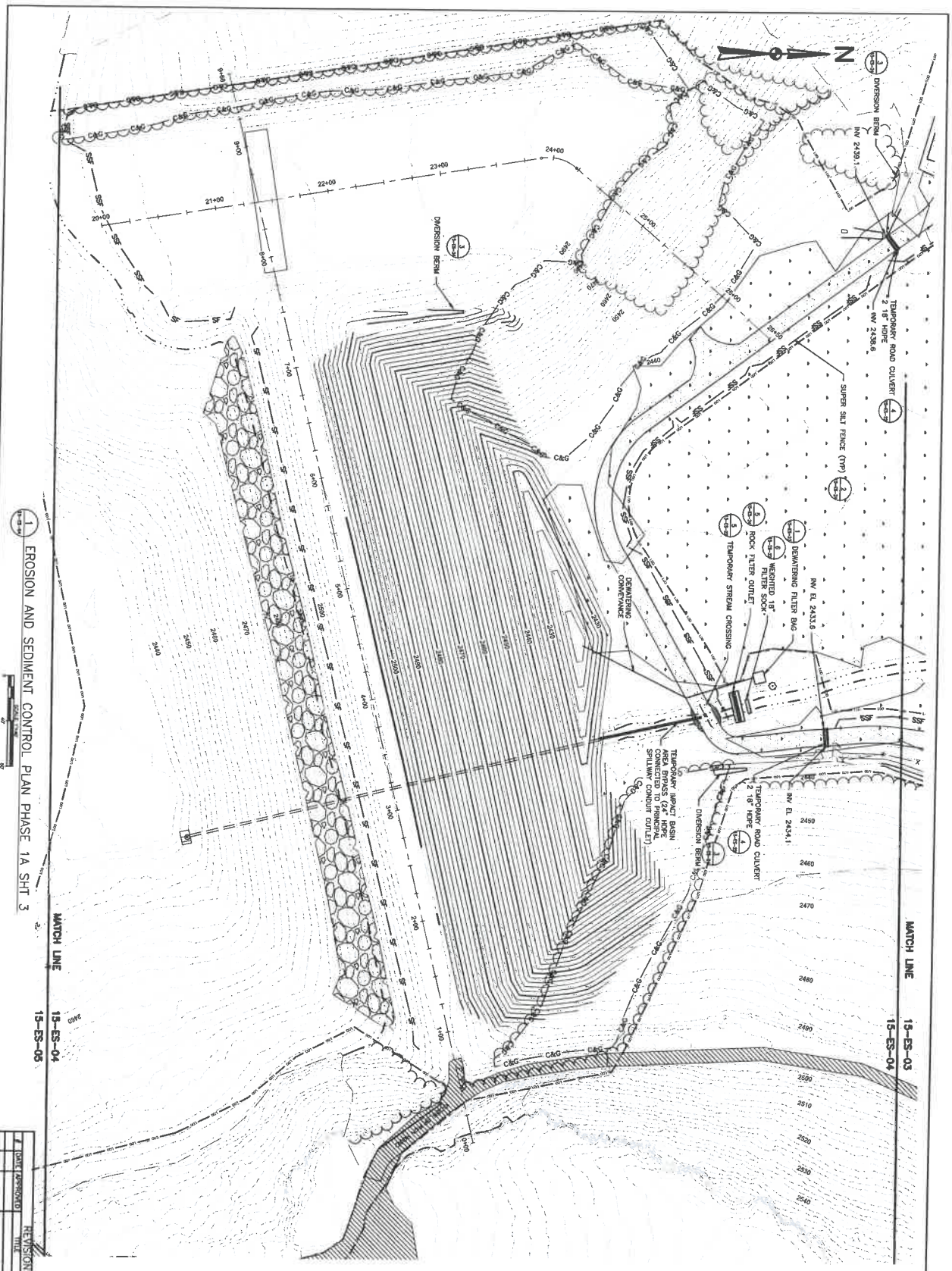

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Drawing No. 15-ES-04
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BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN
PHASE 1A SHT 3

Brush Creek Watershed — *Mercer County, WV*

		Date
Designed	ARB	SEP 24
Drawn	AEW	SEP 24
Checked	COS	SEP 24
Approved	JMP	SEP 24

JONATHAN M. PITTMAN — 23485 — STATE OF WEST VIRGINIA — REGISTERED PROFESSIONAL ENGINEER

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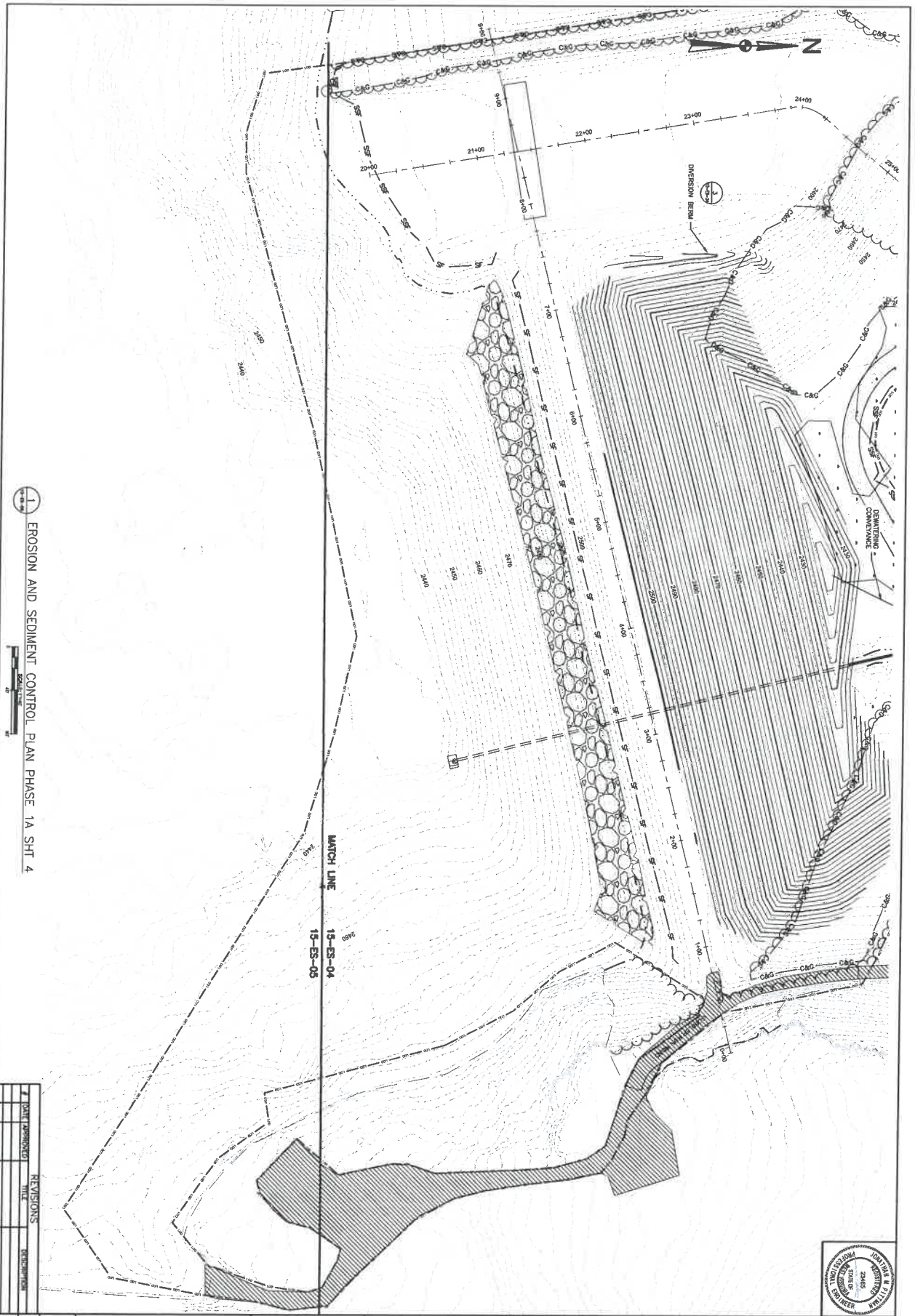

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BRUSH CREEK SITE 15 DAM REHABILITATION
ERISION AND SEDIMENT CONTROL PLAN
PHASE 1A SHT 4

Brush Creek Watershed *Mercer County, WV*

		Date
Designed	ARB	SEP 24
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Contract No. 12SPEC180023
Drawing No. 15-ES-05
SEPTEMBER 2024
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1 EROSION AND SEDIMENT CONTROL PLAN PHASE 1B SHT 1

SCALE: 1"=40'

PHASE 1B – PRINCIPAL SPILLWAY IMPROVEMENTS (TO BE PERFORMED CONCURRENTLY WITH PHASE 1A)

1. ORDER NEW POND DRAIN GATE.
2. INSTALL EROSION CONTROL MEASURES FOR DRAINING THE RESERVOIR, INCLUDING WEIGHTED SEDIMENT FILTER SOCK AND ROCK FILTER.
3. DRAIN RESERVOIR. REMOVE WEIGHTED SEDIMENT FILTER TUBE AND ROCK FILTER AFTER RESERVOIR IS DRAINED.
4. INSTALL POND DRAIN GATE.
5. COMPLETE RISER MODIFICATIONS.
6. INSTALL EROSION AND SEDIMENT CONTROL MEASURES ON THE UPSTREAM SIDE OF THE DAM, AND THEN INSTALL UPSTREAM SLOPE STABILITY BERM. REMOVE UPSTREAM EROSION AND SEDIMENT CONTROL MEASURES AFTER ROCK BERM INSTALLATION IS COMPLETE
7. BEGIN REFILLING RESERVOIR.

NOTES:

1. THIS SEQUENCE IS DEVELOPED IN REGARD TO EROSION AND SEDIMENT CONTROL IMPLEMENTATION. THE CONTRACTOR MAY DEVELOP AN ALTERNATE CONSTRUCTION SCHEDULE THAT COMPLIES WITH THE CONTRACT CRITERIA. THE CONTRACTOR WILL BE RESPONSIBLE TO AMEND THE E&S CONTROL SEQUENCE TO BE CONSITENT WITH THE APPROVED CONSTRUCTION SCHEDULE.

LEGEND

SF — SF	SILT FENCE
SSF — SSF	SUPER SILT FENCE
C&G — C&G	CLEAR & GRUB
LOD	LIMIT OF DISTURBANCE
	WATER EDGE

JONATHAN N PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

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BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN
PHASE 1B SHT 1

Brush Creek Watershed *Mercer County, WV*

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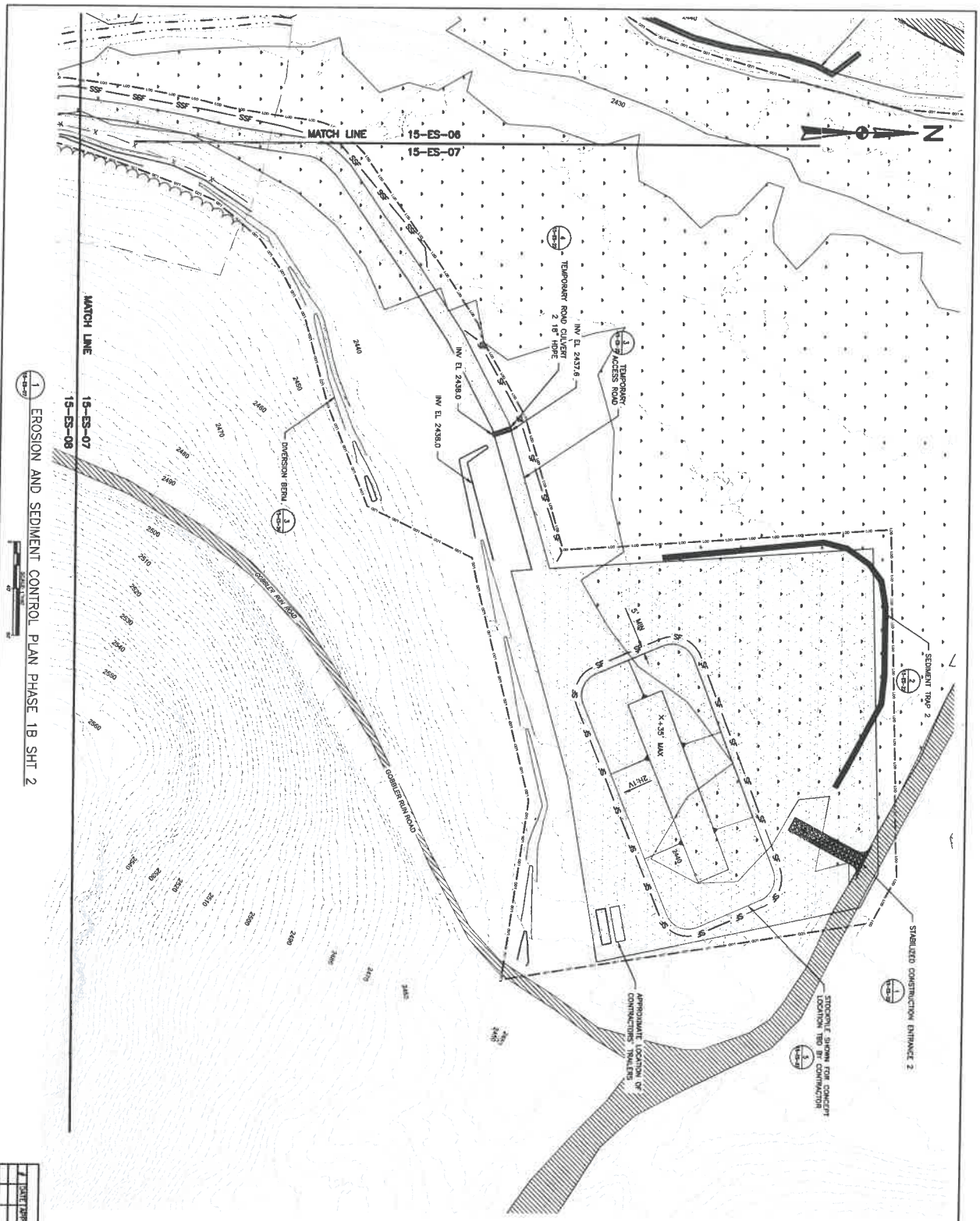

EROSION AND SEDIMENT CONTROL PLAN PHASE 1B SHT 2

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BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN
PHASE 1B SHT 2

Brush Creek Watershed *Mercer County, WV*

		Date
Designed	ARB	SEP 24
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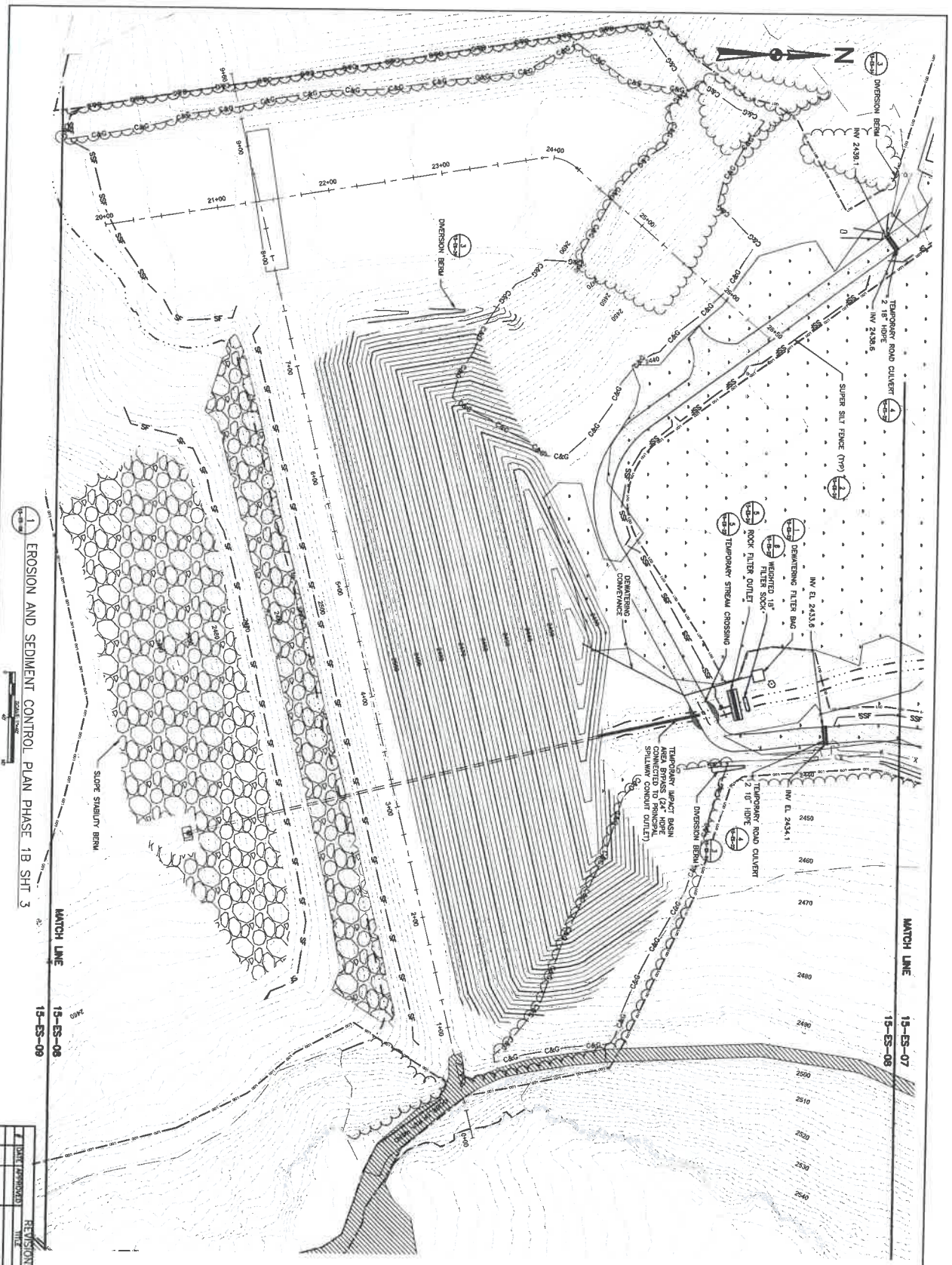

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BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN PHASE 1B SHT 3

Brush Creek Watershed — *Mercer County, WV*

		Date
Designed	ARB	SEP 24
Drawn	AEW	SEP 24
Checked	COS	SEP 24
Approved	JMP	SEP 24

REGISTERED PROFESSIONAL ENGINEER — STATE OF WEST VIRGINIA — 22485 — MATTHEW N. PITTMAN

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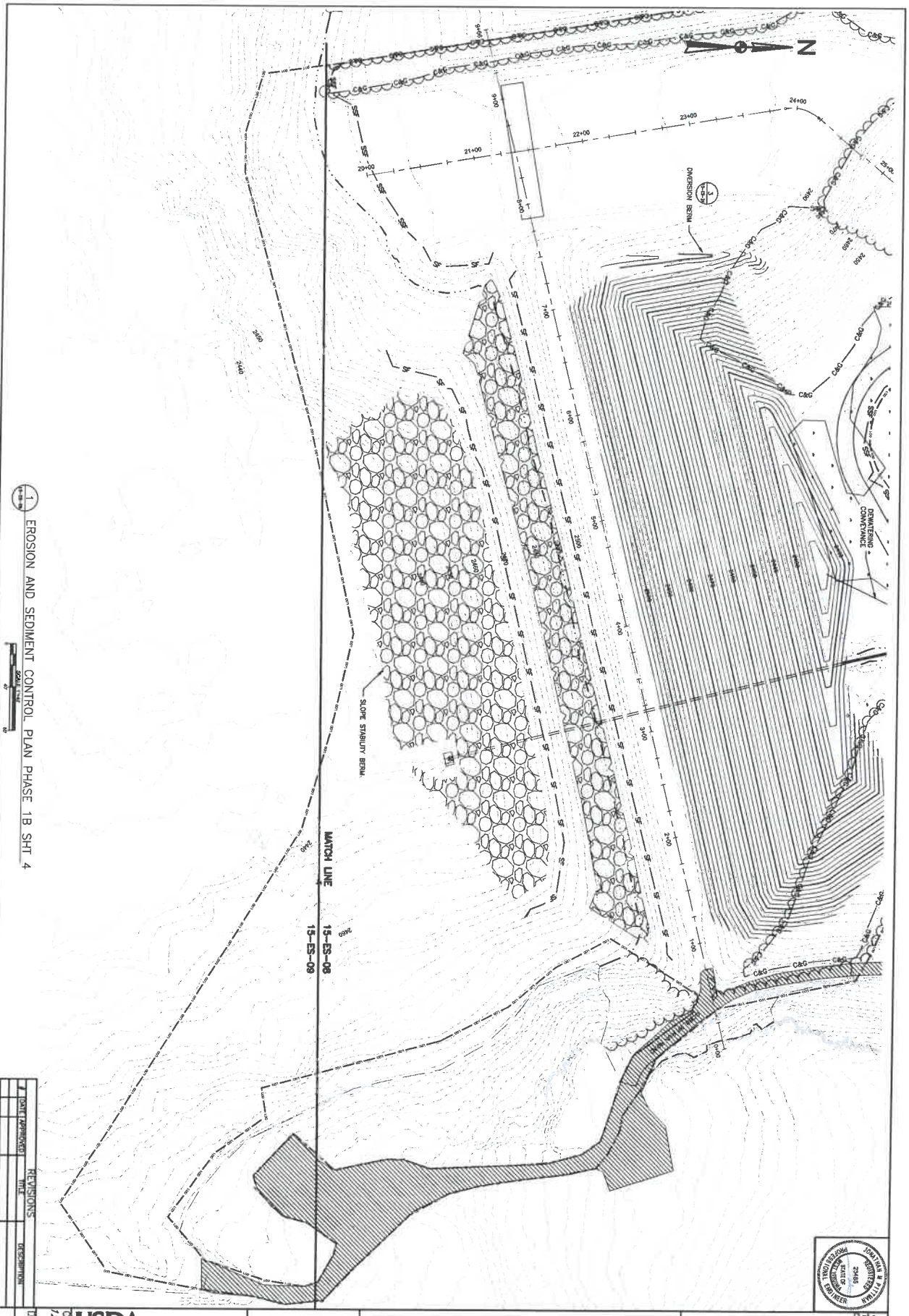

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BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN PHASE 1B SHT 4

Brush Creek Watershed — *Mercer County, WV*

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Drawn	AEW	SEP 24
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Approved	JMP	SEP 24

REGISTERED PROFESSIONAL ENGINEER — JOSEPH M. PATTEN — 23465 — STATE OF WEST VIRGINIA

1 EROSION AND SEDIMENT CONTROL PLAN PHASE 2 SHT 1

SCALE 1"=40'

PHASE 2 – EMBANKMENT TOE DRAIN CONSTRUCTION

1. INSTALL PRINCIPAL SPILLWAY PIPE CRADLE AND CONDUIT EXTENSION.
2. CONSTRUCT IMPACT BASIN, SEEPAGE COLLECTION BOXES AND RIPRAP OUTLET PROTECTION. DEWATER AS NECESSARY BY PUMPING INTO DEWATERING FILTER BAG AS SHOWN ON THE DRAWINGS.
3. REMOVE STREAM DIVERSION SYSTEM AND DIVERT FLOWS THROUGH THE PRINCIPAL SPILLWAY RISER AND NEW IMPACT BASIN.
4. INSTALL RIPRAP WAVE PROTECTION ON UPSTREAM END OF ASW.
5. BEGIN PROPOSED EMBANKMENT TOE DRAIN DRAINFILL AND EARTHFILL. PREPARE FOR WINTER SHUTDOWN BY PROTECTING EXPOSED SOIL SUBGRADES AND EARTHFILL WITH TEMPORARY SEED AND MULCH.
6. WINTER SHUTDOWN.
7. SPRING START-UP.
8. HAUL AND STOCKPILE RCC AGGEGATES AND SET UP RCC BATCH PLANT. INSTALL CONCRETE WASHOUT AND SEDIMENT TRAP AT RCC BATCH PLANT.
9. PERFORM RCC TEST SECTION.
10. RESUME THE PROPOSED EMBANKMENT TOE DRAIN DRAINFILL AND EARTHFILL, BACKFILL TO MINIMUM TOE BERM ELEVATION SHOWN ON THE DRAWINGS.
11. PLACE TEMPORARY SEEDING AND MULCHING ON THE EMBANKMENT.

NOTES:

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LEGEND

- SF — SF — SILT FENCE (1 / 15-ES-39)
- SSF — SSF — SUPER SILT FENCE (2 / 15-ES-39)
- C&G — C&G — CLEAR & GRUB
- LOD — LOD — LIMIT OF DISTURBANCE
- WATER EDGE

	Designed	Drawn	Checked	Approved
Date	SEP 24	SEP 24	SEP 24	SEP 24
	ARB	AEW	COS	JMP

BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN
PHASE 2 SHT 1

Brush Creek Watershed — *Mercer County, WV*

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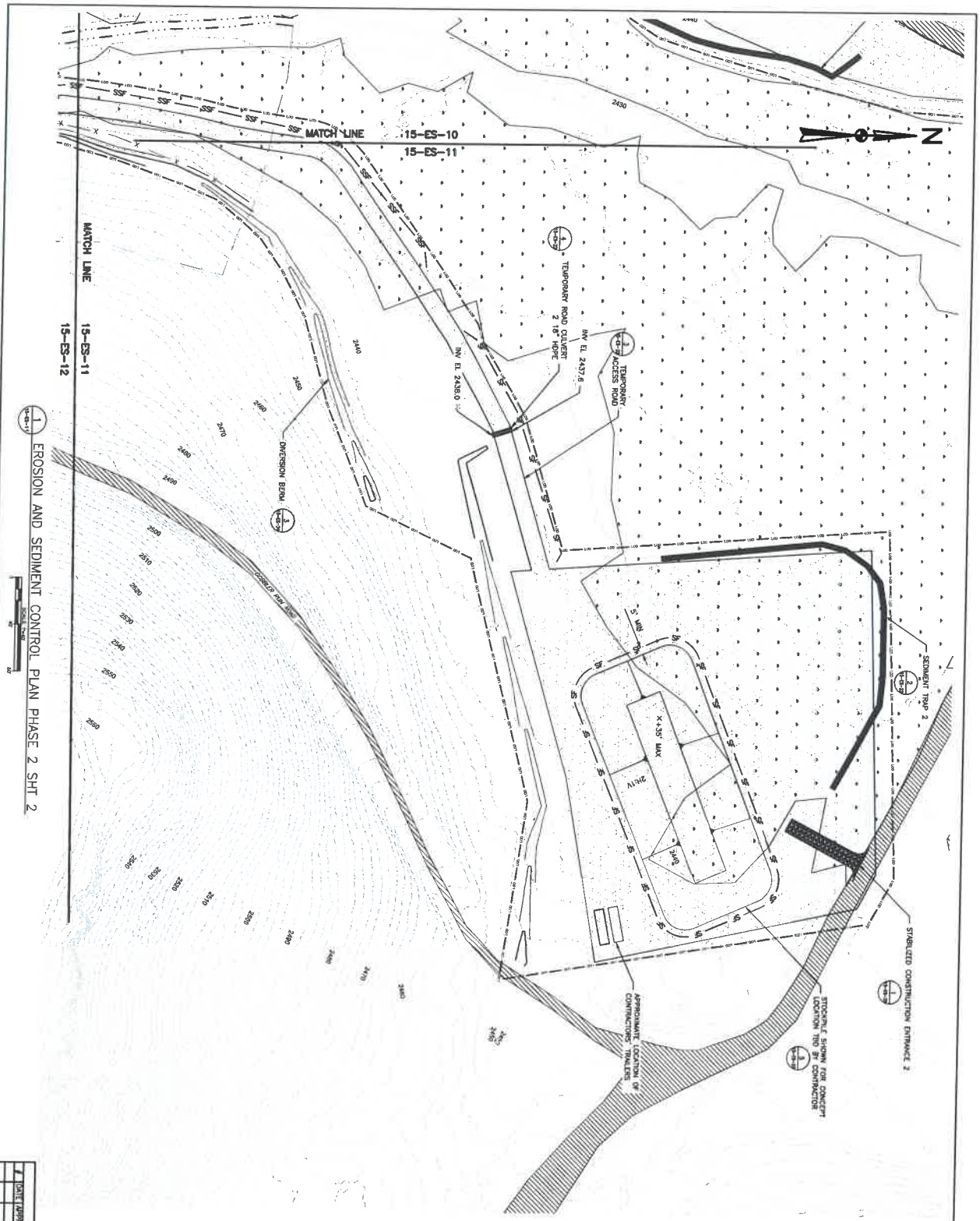

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BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN PHASE 2 SHT 2

Brush Creek Watershed — *Mercer County, WV*

JONATHAN M. PITTMAN REGISTERED PROFESSIONAL ENGINEER STATE OF WEST VIRGINIA 23485

		Date
Designed	ARB	SEP 24
Drawn	AEW	SEP 24
Checked	COS	SEP 24
Approved	JMP	SEP 24

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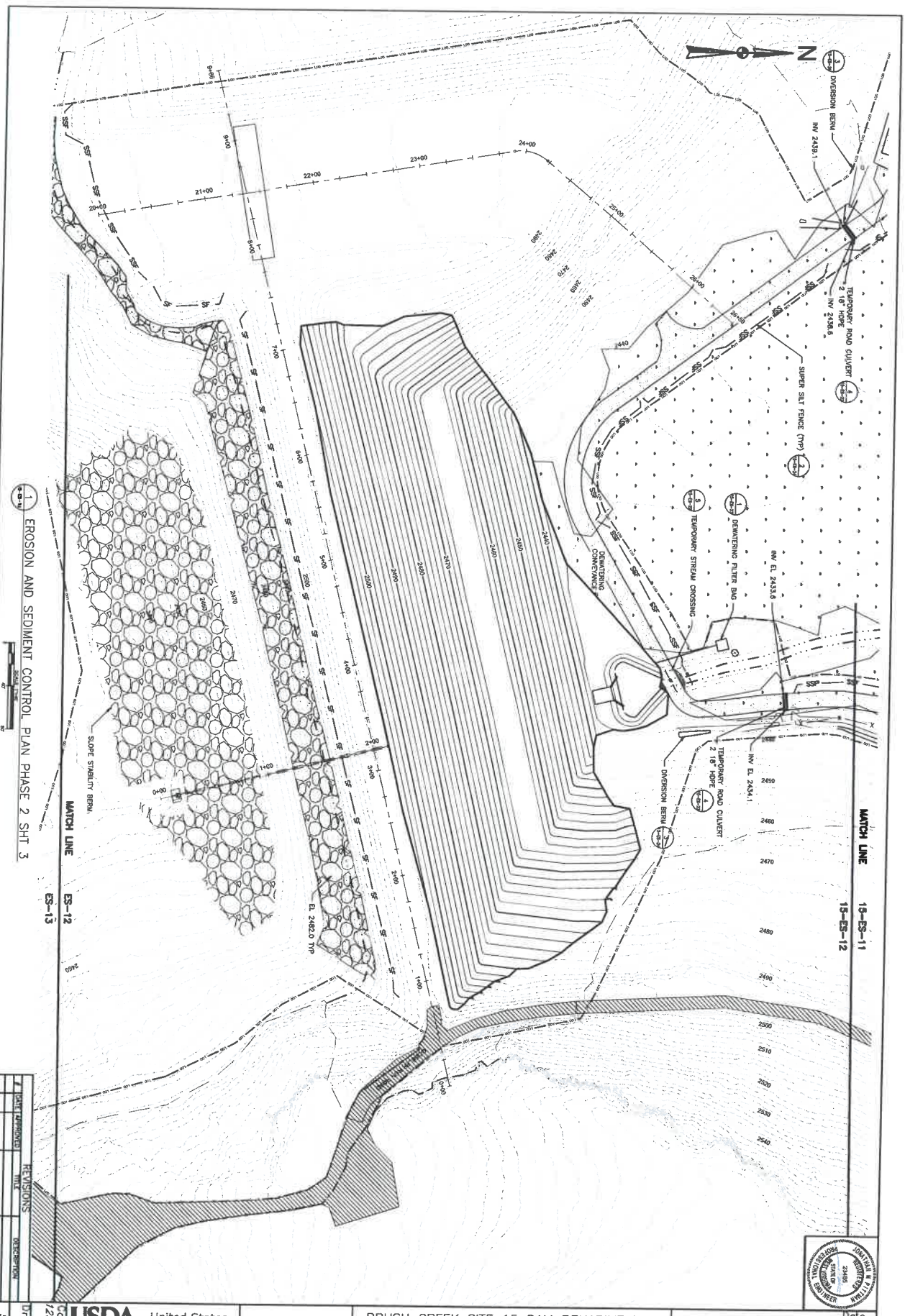

1 EROSION AND SEDIMENT CONTROL PLAN PHASE 2 SHT 3

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BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN PHASE 2 SHT 3

Brush Creek Watershed — *Mercer County, WV*

		Date
Designed	ARB	SEP 24
Drawn	AEW	SEP 24
Checked	COS	SEP 24
Approved	JMP	SEP 24

JONATHAN M. TILMAN 23485 REGISTERED PROFESSIONAL ENGINEER

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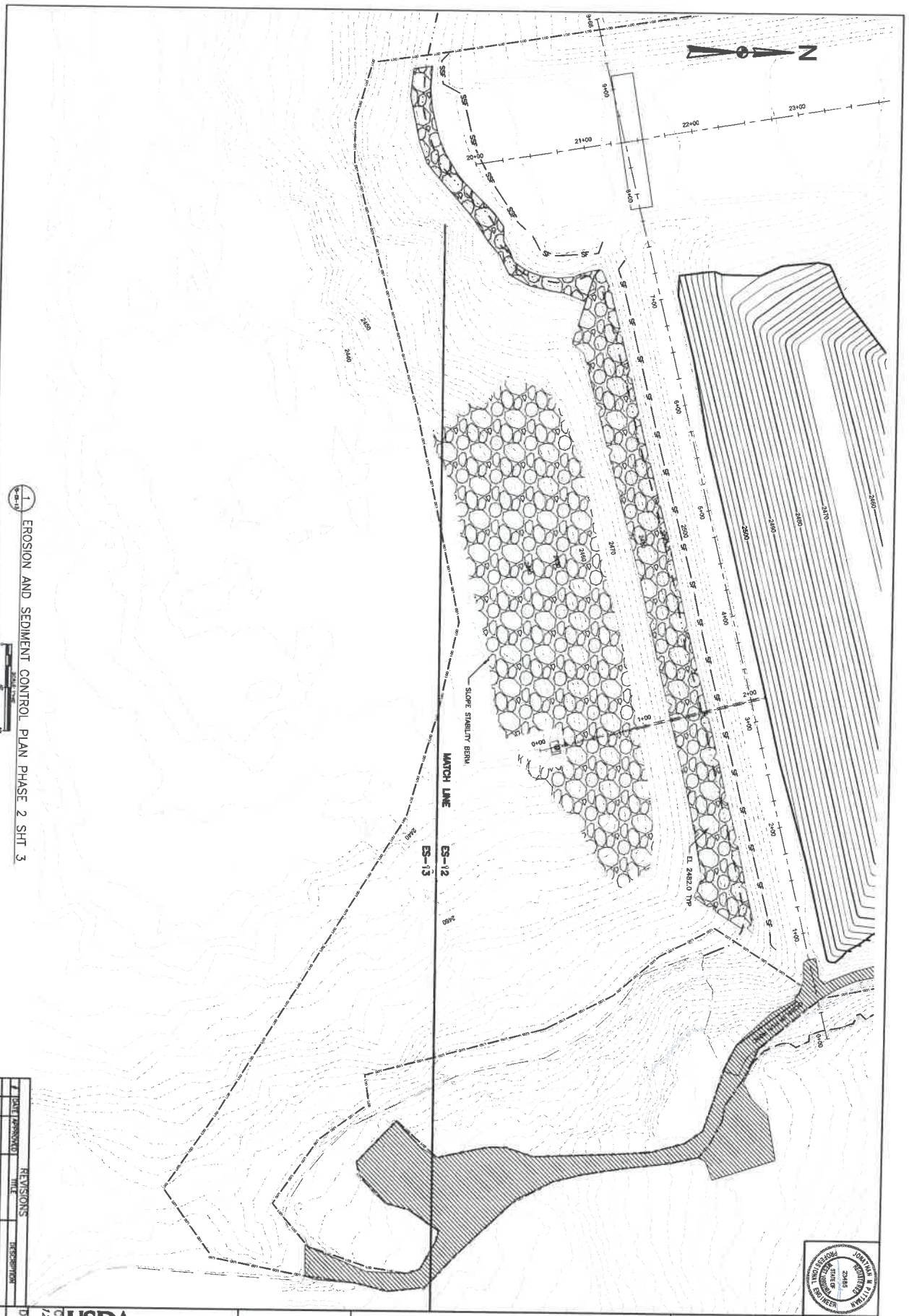

1 EROSION AND SEDIMENT CONTROL PLAN PHASE 2 SHT 3
SCALE: 1" = 80'

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BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN PHASE 2 SHT 4

Brush Creek Watershed — *Mercer County, WV*

		Date
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JONATHAN M. PITTMAN — REGISTERED PROFESSIONAL ENGINEER — STATE OF WEST VIRGINIA — 23485

PHASE 3 – AUXILIARY SPILLWAY ECAVATION

1. INSTALL PHASE 3 ADDITIONAL E&SC MEASURES INCLUDING ADDITIONAL SILT FENCE.
2. STRIP AND STOCKPILE TOPSOIL WITHIN EXCAVATION AND EARTHFILL LIMITS OF AUXILIARY SPILLWAY. INSTALL SILT FENCE AROUND THE STOCKPILE. PROTECT THE STOCKPILED TOPSOIL WITH TEMPORARY SEED AND MULCH.
3. EXCAVATE FOR AUXILIARY SPILLWAY RCC CHUTE SPILLWAY AND PERFORM FOUNDATION PREPARATION ACTIVITIES. STOCKPILE EXCAVATED MATERIALS AND INSTALL SILT FENCE AROUND THE STOCKPILE. PROTECT THE STOCKPILED MATERIALS WITH TEMPORARY SEED AND MULCH.

NOTES:

1. THIS SEQUENCE IS DEVELOPED IN REGARD TO EROSION AND SEDIMENT CONTROL IMPLEMENTATION. THE CONTRACTOR MAY DEVELOP AN ALTERNATE CONSTRUCTION SCHEDULE THAT COMPLIES WITH THE CONTRACT CRITERIA. THE CONTRACTOR WILL BE RESPONSIBLE TO AMEND THE E&S CONTROL SEQUENCE TO BE CONSITENT WITH THE APPROVED CONSTRUCTION SCHEDULE.

LEGEND

- SF — SF — SILT FENCE (1 / 15-ES-14)
- SSF — SSF — SUPER SILT FENCE (2 / 15-ES-14)
- C&G — C&G — CLEAR & GRUB
- LOD — LIMIT OF DISTURBANCE
- WATER EDGE

	Date
Designed ARB	SEP 24
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Checked CDS	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN
PHASE 3 SHT 1

Brush Creek Watershed — *Mercer County, WV*

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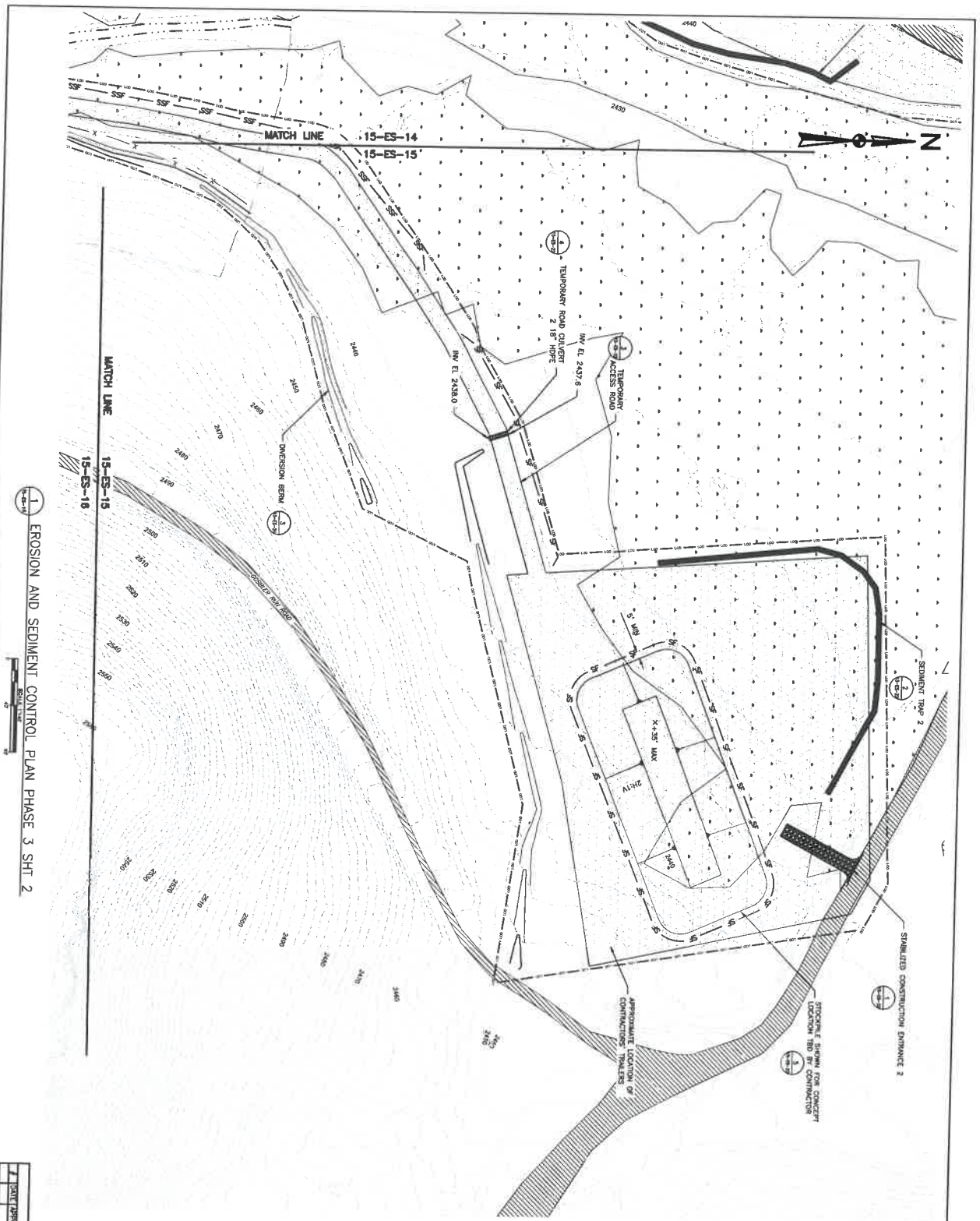

1 EROSION AND SEDIMENT CONTROL PLAN PHASE 3 SHT 2

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BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN
PHASE 3 SHT 2

Brush Creek Watershed — *Mercer County, WV*

		Date
Designed	ARB	SEP 24
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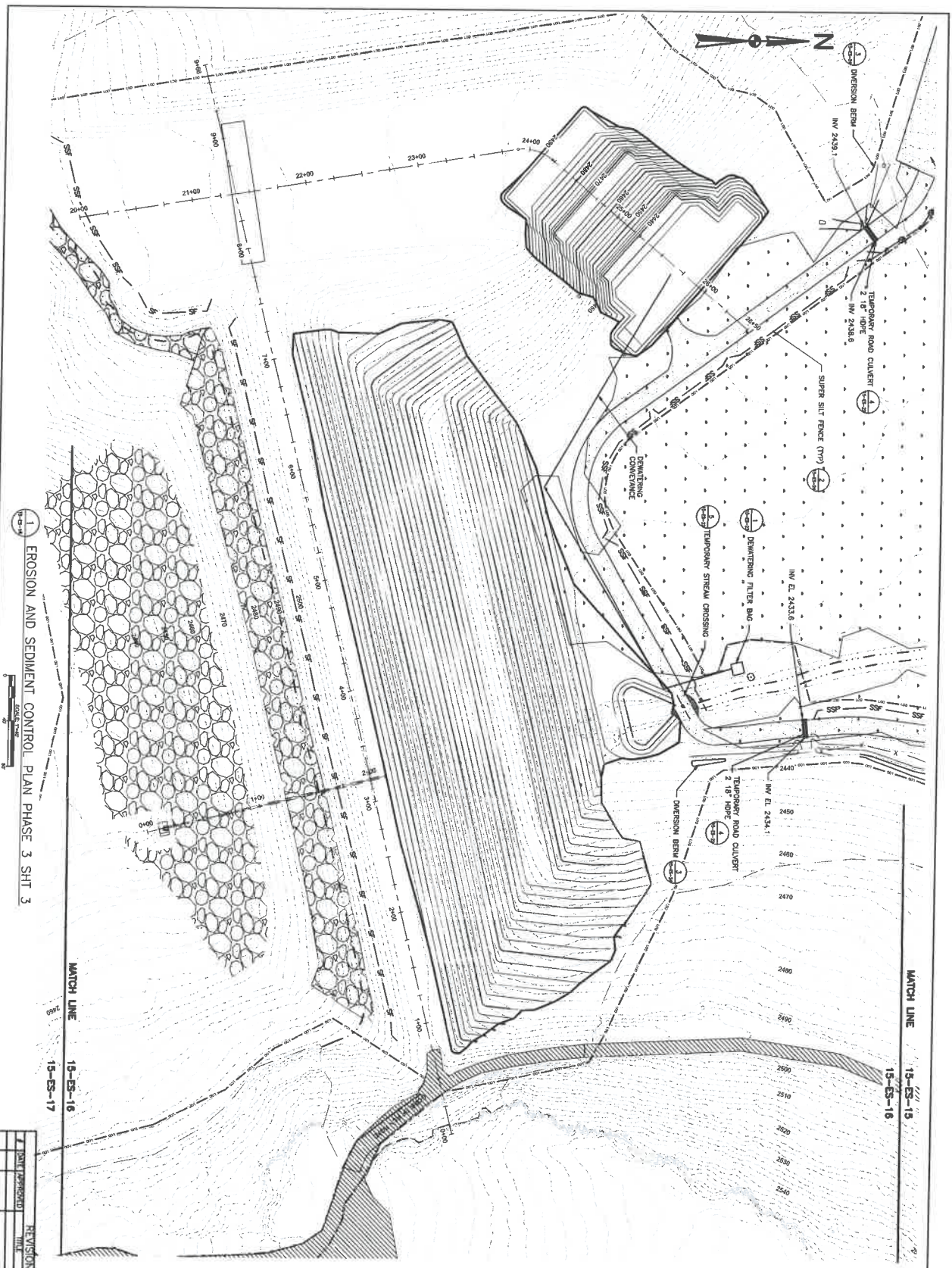

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BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN PHASE 3 SHT 3

Brush Creek Watershed — *Mercer County, WV*

		Date
Designed	ARB	SEP 24
Drawn	AEW	SEP 24
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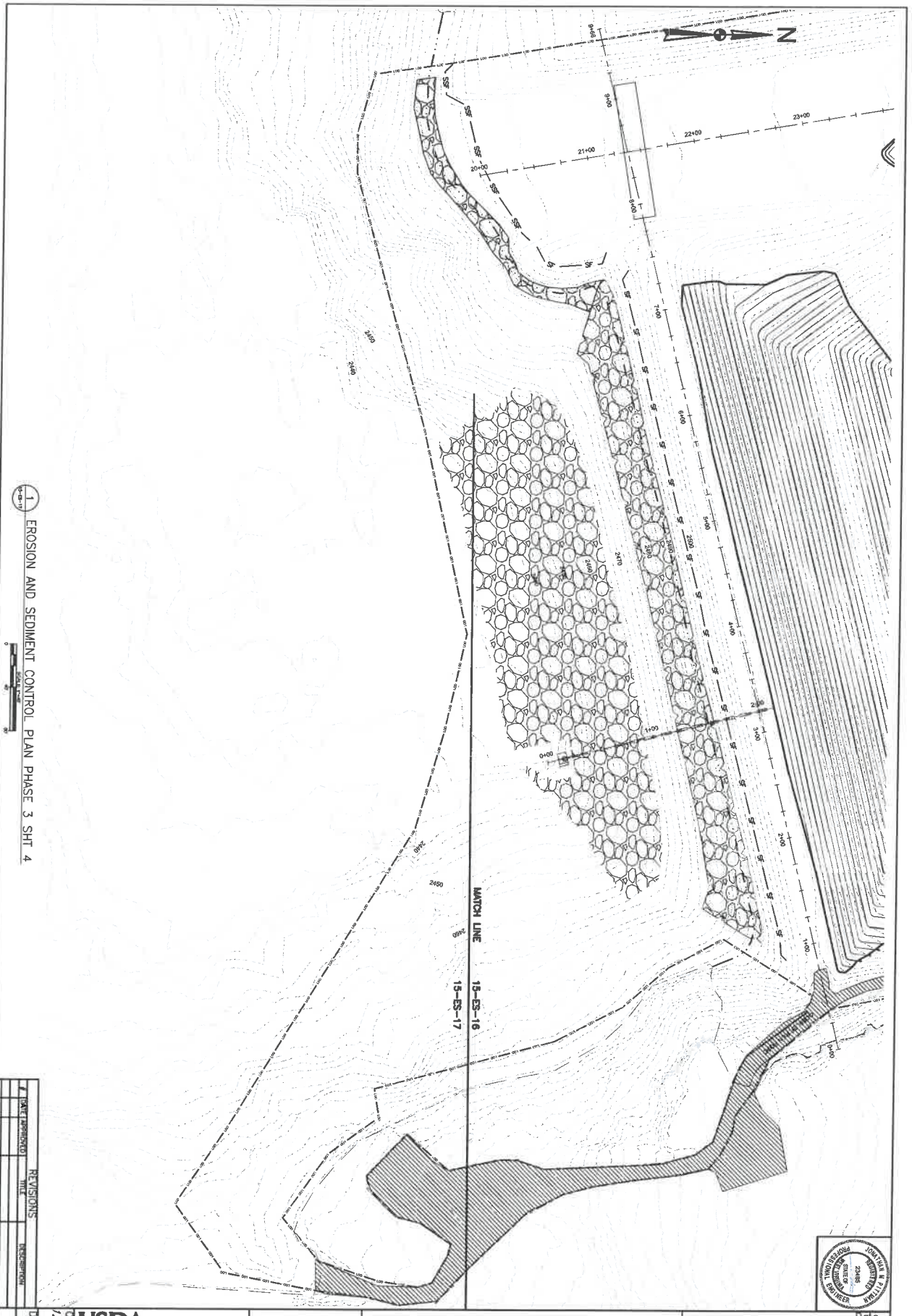

1 EROSION AND SEDIMENT CONTROL PLAN PHASE 3 SHT 4
1in=30ft

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SEPTEMBER 2024
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BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN PHASE 3 SHT 4

Brush Creek Watershed — *Mercer County, WV*

		Date
Designed	ARB	SEP 24
Drawn	AEW	SEP 24
Checked	COS	SEP 24
Approved	JMP	SEP 24

JONATHAN M. WILLIAM — 23485 — REGISTERED PROFESSIONAL ENGINEER — STATE OF WEST VIRGINIA

PHASE 4 – AUZILIARY SPILLWAY CONSTRUCTION

1. CONSTRUCT TAILWATER WEIR WALL FOOTING, DOWNSTREAM CUTOFF WALL AND UPSTREAM STARTER WALL.
2. INSTALL THE CHUTE SPILLWAY UNDERDRAINAGE SYSTEM AND CONSTRUCT RCC STEPS AND TRAINING WALLS.
3. CONSTRUCT LEFT AND RIGHT AUXILIARY SPILLWAY TRAINING DIKES TO FINAL GRADES.
4. CONSTRUCT TAILWATER WEIR WALL AND BAFFLE BLOCKS.
5. BACKFILL EMBANKMENT TOE BERM TO FINAL GRADE.
6. INSTALL EMBANKMENT GEOTECHNICAL INSTRUMENTATION
7. COMPLETE FINAL GRADING, PLACE TOPSOIL FOR TRAINING DIKES, EMBANKMENT TOE BERM, AND DISPOSAL AREAS AND SEED, MULCH AND STABILIZE. INSTALL EROSION CONTROL BLANKET ON SEEDED SLOPES.
8. REMOVE E&SC MEASURES. INSTALL WEIGHTED FILTER SOCK DOWNSTREAM FROM TEMPORARY STREAM CROSSING BEFORE REMOVING THE STREAM CROSSING. REMOVE WEIGHTED FILTER SOCK AFTER STREAM CROSSING IS REMOVED.
9. SITE CLEAN-UP AND RESTORATION.
10. SUBSTANTIAL COMPLETION.
11. PUNCH LIST, FINAL RECORD SURVEYS, AND DEMOBILIZATION.
12. FINAL COMPLETION

NOTES:

1. THIS SEQUENCE IS DEVELOPED IN REGARD TO EROSION AND SEDIMENT CONTROL IMPLEMENTATION. THE CONTRACTOR MAY DEVELOP AN ALTERNATE CONSTRUCTION SCHEDULE THAT COMPLIES WITH THE CONTRACT CRITERIA. THE CONTRACTOR WILL BE RESPONSIBLE TO AMEND THE E&S CONTROL SEQUENCE TO BE CONSISTENT WITH THE APPROVED CONSTRUCTION SCHEDULE.

LEGEND

- SF — SF — SILT FENCE (1 / 15-ES-37)
- SSF — SSF — SUPER SILT FENCE (2 / 15-ES-37)
- C&G — C&G — CLEAR & GRUB
- LOD — LIMIT OF DISTURBANCE
- WATER EDGE

	Date
Designed ARB	SEP 24
Drawn AEW	SEP 24
Checked COS	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN PHASE 4 SHT1

Brush Creek Watershed — *Mercer County, WV*

ALERRA SCHNABEL JOINT VENTURE
300 Brookside Ave., Bldg. 18, Suite 100, Ambler, PA 19002
Phone: 267-784-4566
schnabel-eng.com

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

JONATHAN M PITTMAN REGISTERED 23455 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

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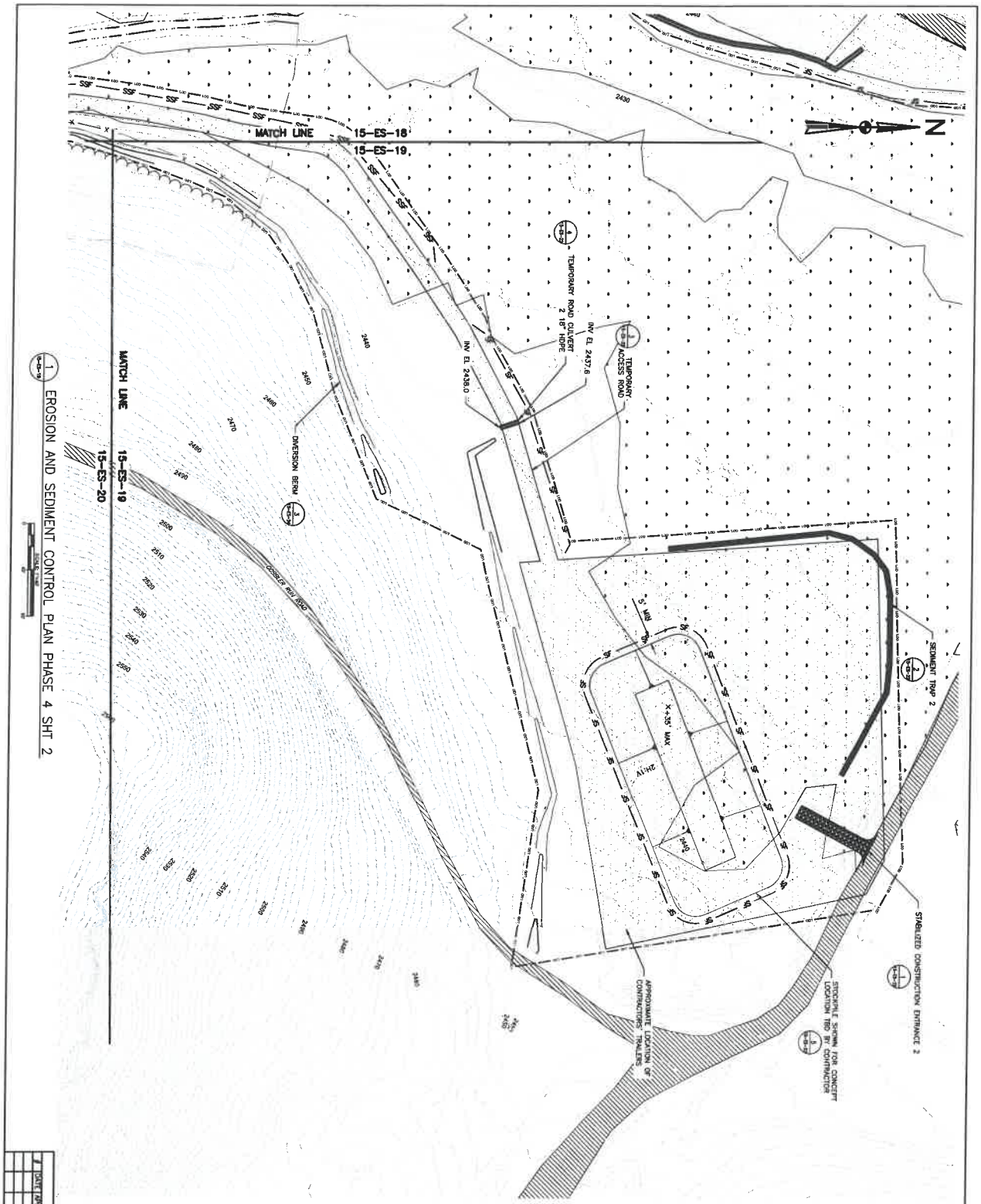

EROSION AND SEDIMENT CONTROL PLAN PHASE 4 SHT 2

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BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN
PHASE 4 SHT 2

Brush Creek Watershed *Mercer County, WV*

		Date
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Checked	COS	SEP 24
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JONATHAN M. PITTMAN 2495 REGISTERED PROFESSIONAL ENGINEER

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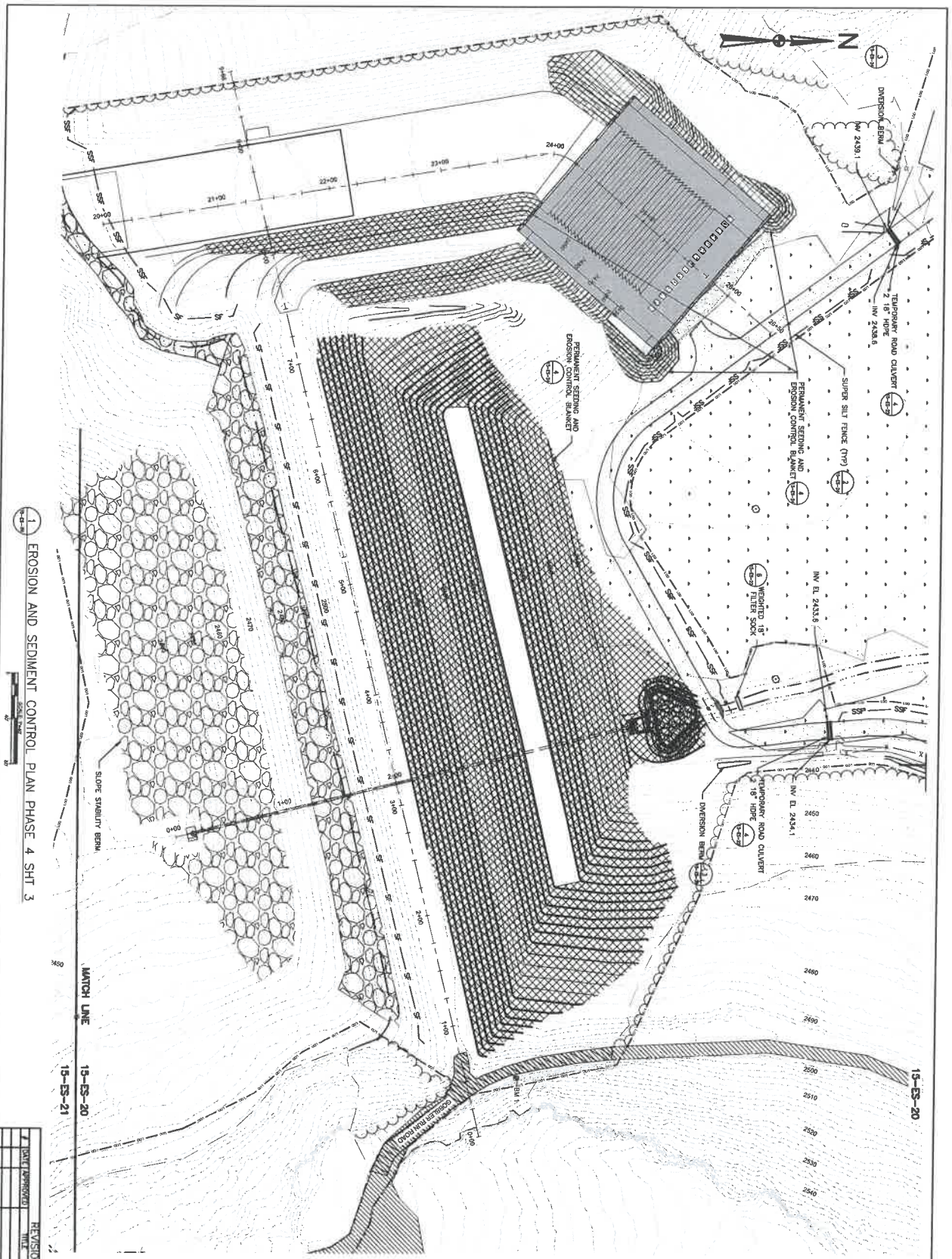

EROSION AND SEDIMENT CONTROL PLAN PHASE 4 SHT 3

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BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN
PHASE 4 SHT 3

Brush Creek Watershed *Mercer County, WV*

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Checked	COS	SEP 24
Approved	JMP	SEP 24

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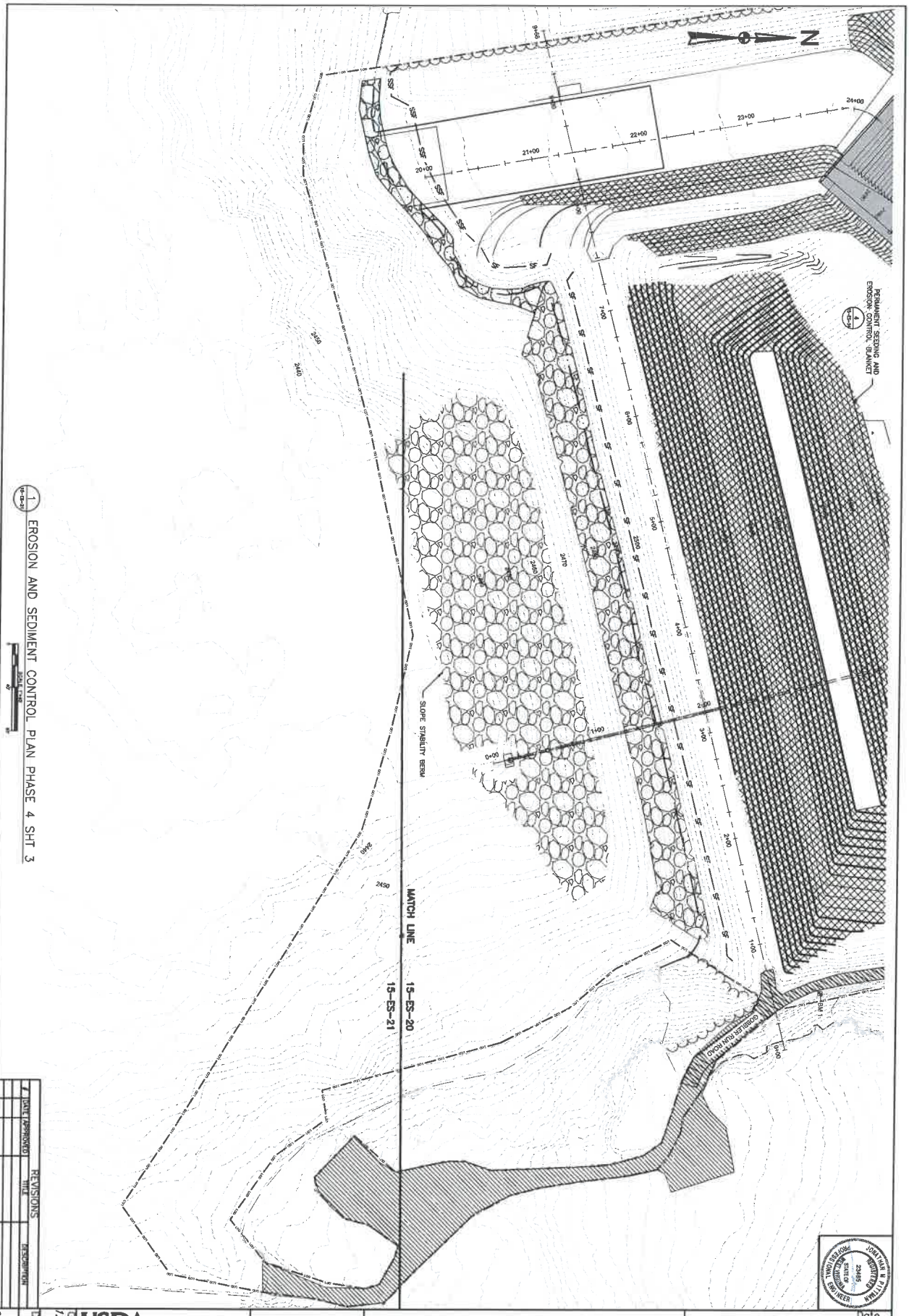

1 (15-ES-21) EROSION AND SEDIMENT CONTROL PLAN PHASE 4 SHT 3

REVISIONS

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BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN
PHASE 4 SHT 4

Brush Creek Watershed *Mercer County, WV*

		Date
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Approved	JMP	SEP 24

JONATHAN M. PETTIGREW 23495 STATE OF WEST VIRGINIA REGISTERED PROFESSIONAL ENGINEER

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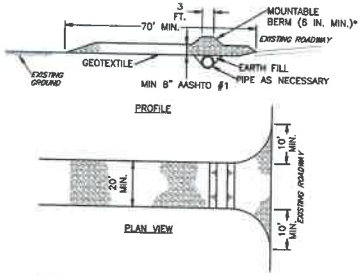
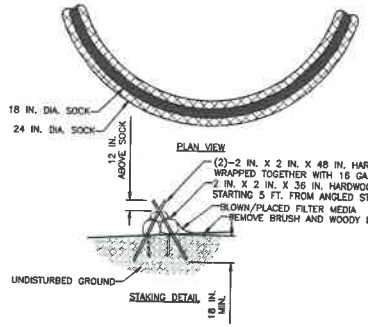


NOTES:
1. REMOVE TOPSOIL PRIOR TO INSTALLATION OF ROCK CONSTRUCTION ENTRANCE.
2. A GEOTEXTILE UNDERLAYMENT SHALL BE PLACED OVER THE EXISTING GROUND PRIOR TO PLACING THE STONE.
3. EXTEND ROCK OVER FULL WIDTH OF ENTRANCE.
4. RUNOFF SHALL BE DIVERTED FROM ROADWAY TO A SUITABLE SEDIMENT REMOVAL BMP PRIOR TO ENTERING ROCK CONSTRUCTION ENTRANCE.
5. ROCK CONSTRUCTION ENTRANCE THICKNESS SHALL BE CONSTANTLY MAINTAINED TO THE SPECIFIED DIMENSIONS BY ADDING ROCK. A STOCKPILE SHALL BE MAINTAINED ON SITE FOR THIS PURPOSE.
6. ALL SEDIMENT DEPOSITED ON PAVED ROADWAYS SHALL BE REMOVED AND RETURNED TO THE CONSTRUCTION SITE IMMEDIATELY.
7. IF EXCESSIVE AMOUNTS OF SEDIMENT ARE BEING DEPOSITED ON ROADWAY, EXTEND LENGTH OF ROCK CONSTRUCTION ENTRANCE BY 50 FOOT INCREMENTS UNTIL CONDITION IS ALLEVIATED OR INSTALL WASH RACK.
8. WASHING THE ROADWAY OR SWEEPING THE DEPOSITS INTO ROADWAY DITCHES, SEWERS, CULVERTS, OR OTHER DRAINAGE COURSES IS NOT ACCEPTABLE.

1 STABILIZED CONSTRUCTION ENTRANCE
15-ES-22



NOTES:
1. SOCK MATERIAL SHALL MEET THE STANDARDS OF TABLE 4.1.
2. COMPOST SHALL MEET THE STANDARDS OF TABLE 4.2.
3. COMPOST SOCK SEDIMENT TRAPS SHALL NOT EXCEED THREE SOCKS IN HEIGHT AND SHALL BE STACKED IN PYRAMIDAL FORM AS SHOWN ABOVE.
4. MINIMUM TRAP HEIGHT IS ONE 24" DIAMETER SOCK.
5. THE SOCK SHALL HAVE A MINIMUM FUNCTIONAL LONGEVITY OF ONE YEAR.
6. COMPOST SOCK SEDIMENT TRAPS SHALL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT.
7. SEDIMENT SHALL BE REMOVED WHEN IT REACHES 1/3 THE HEIGHT OF THE SOCKS.

2 SEDIMENT TRAP
15-ES-22

TABLE 4.1
Compost Sock Fabric Minimum Specifications

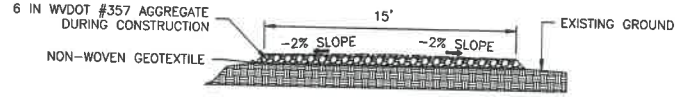
Material Type	3 mil HDPE	5 mil HDPE	5 mil HDPE	Multi-Filament Polypropylene (MFPP)	Heavy Duty Multi-Filament Polypropylene (HDMFPP)
Material Characteristics	Photo-degradable	Photo-degradable	Bio-degradable	Photo-degradable	Photo-degradable
Sock Diameters	12" 18"	12" 18" 24" 32"	12" 18" 24" 32"	12" 18" 24" 32"	12" 18" 24" 32"
Mesh Opening	3/8"	3/8"	3/8"	3/8"	1/8"
Tensile Strength		26 psi	26 psi	44 psi	202 psi
Ultraviolet Stability % Original Strength (ASTM G-155)	23% at 1000 hr.	23% at 1000 hr.		100% at 1000 hr.	100% at 1000 hr.
Minimum Functional Longevity	6 months	9 months	6 months	1 year	2 years
Two-ply systems					
Inner Containment Netting	HDPE biaxial net Continuously wound Fusion-welded junctures 3/4" X 3/4" Max. aperture size				
Outer Filtration Mesh	Composite Polypropylene Fabric (Woven layer and non-woven fleece mechanically fused via needle punch) 3/16" Max. aperture size				

Sock fabrics composed of burlap may be used on projects lasting 6 months or less.
Filtrexx & JMD

TABLE 4.2
Compost Standards

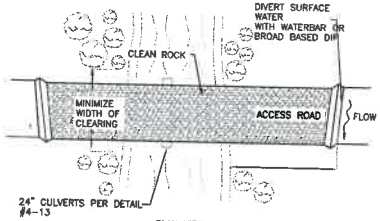
Organic Matter Content	80% - 100% (dry weight basis)
Organic Portion	Fibrous and elongated
pH	5.5 - 8.0
Moisture Content	35% - 55%
Particle Size	98% pass through 1" screen
Soluble Salt Concentration	5.0 dS/m (mmhos/cm) Maximum

Filtrexx



3 TEMPORARY ACCESS ROAD
15-ES-22

4 TEMPORARY ROAD CULVERT
15-ES-22

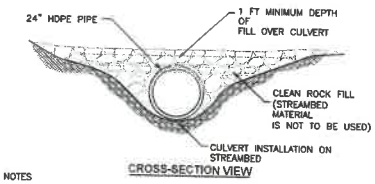


NOTES

WATERBARS AND BROAD-BASED DIPS SHALL DISCHARGE TO SEDIMENT REMOVAL FACILITY.

CLEAN ROCK SHALL CONFORM TO AASHTO #1 REQUIREMENTS.

FOLLOW PERMIT CONDITIONS REGARDING REMOVAL OF CROSSING.



NOTES

PROVIDE 50' STABILIZED ACCESS TO CROSSING ON BOTH SIDES OF STREAM CHANNEL.

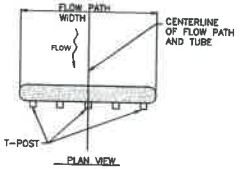
PIPES SHALL EXTEND BEYOND THE TOE OF THE ROADWAY.

RUNOFF FROM THE ROADWAY SHALL BE DIVERTED OFF THE ROADWAY AND INTO A SEDIMENT REMOVAL BMP BEFORE IT REACHES THE ROCK APPROACH TO THE CROSSING.

MAINTENANCE

1. TEMPORARY STREAM CROSSING SHALL BE INSPECTED ON A DAILY BASIS.
2. DAMAGED CROSSING SHALL BE REPAIRED WITHIN 24 HOURS OF THE INSPECTION AND BEFORE ANY SUBSEQUENT USE.
3. SEDIMENT DEPOSITS ON THE CROSSING OR ITS APPROACHES SHALL BE REMOVED WITHIN 24 HOURS OF INSPECTION.
4. AS SOON AS THE TEMPORARY CROSSING IS NO LONGER NEEDED, IT SHALL BE REMOVED. ALL MATERIALS SHALL BE DISPOSED OF PROPERLY AND DISTURBED AREAS SHALL BE STABILIZED.

5 TEMPORARY STREAM CROSSING
15-ES-22



NOTES:
1. THE DETAIL APPLICABLE TO FLOW PATHS WITH WIDTHS LESS THAN OR EQUAL TO ONE TUBE LENGTH.
2. METAL T-POST SHALL BE INSTALLED AT THE CENTER AND EACH END OF THE TUBE. ADDITIONAL T-POSTS SHALL BE INSTALLED AS NEEDED TO MEET THE MAXIMUM 2-FOOT SPACING.
3. SEDIMENT TUBES SHALL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT.
4. ACCUMULATED SEDIMENT SHALL BE REMOVED WHEN IT REACHES HALF THE HEIGHT OF THE TUBE AND DISPOSED AS DIRECTED ELSEWHERE IN THE E&S PLAN.
5. DAMAGED TUBES SHALL BE REPAIRED OR REPLACED WITHIN 24 HOURS OF INSPECTION. A SUPPLY OF TUBES SHALL BE KEPT ON SITE FOR THIS PURPOSE .
6. THE CONTRACTOR SHALL PROVIDE AN ALTERNATE MEANS OF ANCHORING THE WEIGHTED SEDIMENT FILTER TUBE IF IT IS NOT FEASIBLE TO ANCHOR WITH METAL POSTS.

6 WEIGHTED FILTER SOCK
15-ES-22

JONATHAN N PITTMAN
REGISTERED
23485
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

		Date
Designed	ARB	SEP 24
Drawn	AEW	SEP 24
Checked	COS	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN
DETAILS

Brush Creek Watershed — Mercer County, WV

ATERRA | Schnabel
300 Brookside Ave., Bldg. 18, Suite 160; Ambler, PA 19002
Phone: 267-274-2400

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Natural Resources Conservation Service

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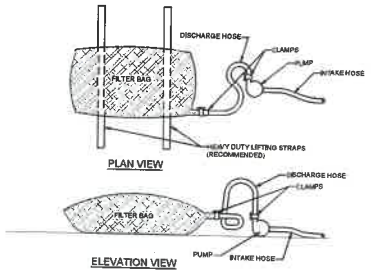
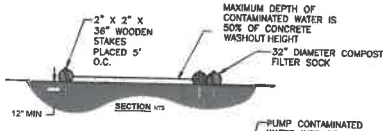


NOTES:
1. LOW VOLUME FILTER BAGS SHALL BE MADE FROM NONWOVEN GEOTEXTILE MATERIAL SEWN WITH HIGH STRENGTH, DOUBLE STITCHED "J" TYPE SEAMS. THEY SHALL BE CAPABLE OF TRAPPING PARTICLES LARGER THAN 150 MICRONS.
2. HIGH VOLUME FILTER BAGS SHALL BE MADE FROM WOVEN GEOTEXTILES THAT MEET THE FOLLOWING STANDARDS:

PROPERTY	TEST METHOD	MINIMUM STANDARD
AVG. WIDE WIDTH STRENGTH	ASTM D-4884	60 LB/IN
GRAB TENSILE	ASTM D-4632	295 LB
PUNCTURE	ASTM D-4833	110 LB
MULLEN BURST	ASTM D-3786	350 PSI
UV RESISTANCE	ASTM D-4355	70%
AOS % RETAINED	ASTM D-4751	80 SIEVE

3. A SUITABLE MEANS OF ACCESSING THE BAG WITH MACHINERY REQUIRED FOR DISPOSAL PURPOSES SHALL BE PROVIDED.
4. FILTER BAGS SHALL BE REPLACED WHEN THEY BECOME ½ FULL OF SEDIMENT.

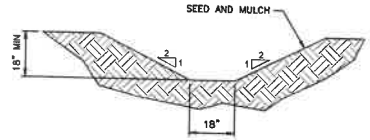
1 PUMPED DEWATERING FILTER BAG



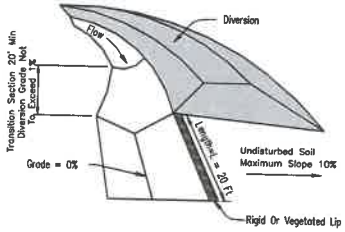
PLAN NTS

NOTES:
1. SEDIMENT SHALL BE REMOVED WHEN IT REACHES HALF THE HEIGHT OF THE COMPOST FILTER SOCK.
2. DAMAGED OR CLOGGED INSTALLATIONS SHALL BE REPAIRED OR REPLACED IMMEDIATELY.
3. BECAUSE THE SYSTEM DISCHARGES TO A HQ SURFACE WATER, A 6" THICK COMPOST LAYER SHALL BE SECURELY ANCHORED ON OUTSIDE AND OVER TOP OF STONE.
4. COMPOST SHALL MEET THE STANDARDS IN TABLE 4.2 (SEE 2/ES-14).

2 CONCRETE WASHOUT

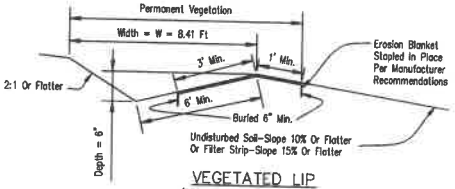


3 DIVERSION CHANNEL



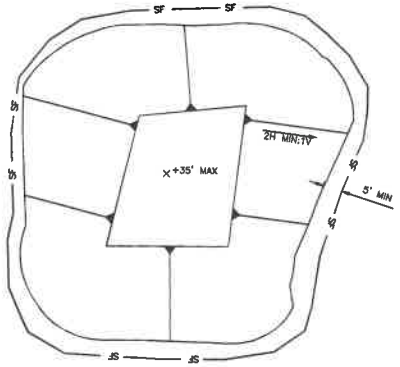
NOTES:
1. ENDS OF SPREADER SHALL BE TIED INTO HIGHER GROUND TO PREVENT FLOW AROUND LEVEL SPREADER.
2. SEE PLANS FOR L AND W DIMENSIONS.

4 LEVEL SPREADER



VEGETATED LIP
(DESIGN FLOWS 4 C.F.S. OR LESS)

NOTES:
1. COARSE AGGREGATE SHALL MEET ONE OF THE FOLLOWING AASHTO GRADATIONS: #1, #2 OR #3
2. SEE PLANS FOR PERMANENT SEEDING REQUIREMENTS
3. SEE PLANS FOR D AND W DIMENSIONS.
4. GEOTEXTILE (NON-WOVEN, NEEDLE PUNCHED) MIN. CRITERIA:
   GRAB TENSILE STRENGTH (LB) ASTM D 4632 _____ 202
   ELONGATION AT FAILURE (%) ASTM D 4832 _____ ≥50
   TRAPEZOIDAL TEAR STRENGTH (LB) ASTM D 4533 _____ 79
   PUNCTURE STRENGTH (LB) ASTM D 6241 _____ 433
   ULTRAVIOLET LIGHT (% RETAINED STRENGTH) ASTM 4355 _____ MIN 50
   APPARENT OPENING SIZE (AOS) ASTM D 4751 _____ MAX 0.22 MM (US SIEVE SIZE 70)
   PERMITTIVITY SEC^{-1}/ ASTM D 4491 _____ MIN 0.70
5. ANY GEOTEXTILE SPLICES SHALL OVERLAP A MINIMUM OF 18 INCHES, WITH UPSTREAM OR UPSLOPE GEOTEXTILE OVERLAPPING THE ABUTTING DOWNSLOPE GEOTEXTILE.



NOTES

TEMPORARY STOCKPILES SHALL NOT BE HIGHER THAN 35 FEET AND SLOPES SHALL NOT BE STEEPER THAN 2H:1V.
SILT FENCE SHALL BE INSTALLED AROUND THE ENTIRE STOCKPILE PERIMETER.

SILT FENCE SHALL NOT BE INSTALLED CLOSER THAN 5 FEET FROM THE STOCKPILE TOE TO ALLOW SPACE FOR WATER PONDING.

STOCKPILES SHALL BE PROTECTED AGAINST EROSION BY SEEDING AND MULCHING AT THE END OF EACH WORKDAY. STOCKPILES SHALL NOT BE LEFT UNPROTECTED.

5 STOCKPILE DETAIL

JONATHAN W. PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Designed	ARB	Date SEP 24
Drawn	AEW	SEP 24
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BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN
DETAILS
Mercer County, WV
Brush Creek Watershed

Aterra Schnabel JV
300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
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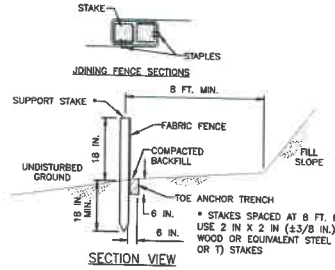


NOTES:

FABRIC SHALL HAVE THE MINIMUM PROPERTIES AS SHOWN IN TABLE 4.3 OF THE PA DEP EROSION CONTROL MANUAL.

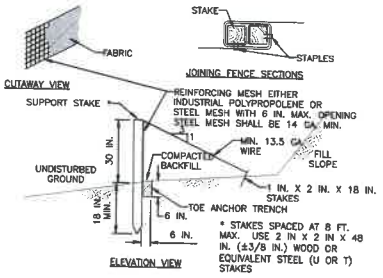
FABRIC WIDTH SHALL BE 30 IN. MINIMUM. STAKES SHALL BE HARDWOOD OR EQUIVALENT STEEL (U OR T) STAKES.

SILT FENCE SHALL BE PLACED AT LEVEL EXISTING GRADE. BOTH ENDS OF THE FENCE SHALL BE EXTENDED AT LEAST 8 FEET UP SLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT.

SEDIMENT SHALL BE REMOVED WHEN ACCUMULATIONS REACH HALF THE ABOVE GROUND HEIGHT OF THE FENCE.

FENCE SHALL BE REMOVED AND PROPERLY DISPOSED OF WHEN TRIBUTARY AREA IS PERMANENTLY STABILIZED.

1 15-ES-24 SILT FENCE



NOTES:

FABRIC SHALL HAVE THE MINIMUM PROPERTIES AS SHOWN IN TABLE 4.3 OF THE PA DEP EROSION CONTROL MANUAL.

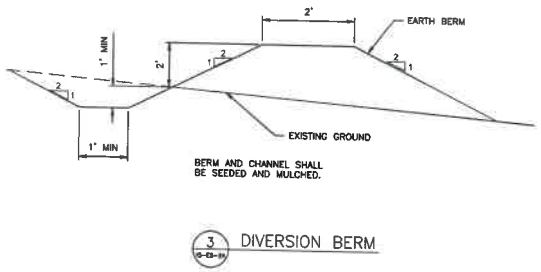
FABRIC WIDTH SHALL BE 42 IN. MINIMUM. STAKES SHALL BE HARDWOOD OR EQUIVALENT STEEL (U OR T) STAKES. AN 18 IN. SUPPORT STAKE SHALL BE DRIVEN 12 IN. MINIMUM INTO UNDISTURBED GROUND.

SILT FENCE SHALL BE PLACED AT LEVEL EXISTING GRADE. BOTH ENDS OF THE FENCE SHALL BE EXTENDED AT LEAST 8 FEET UP SLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT.

SEDIMENT SHALL BE REMOVED WHEN ACCUMULATIONS REACH HALF THE ABOVE GROUND HEIGHT OF THE FENCE.

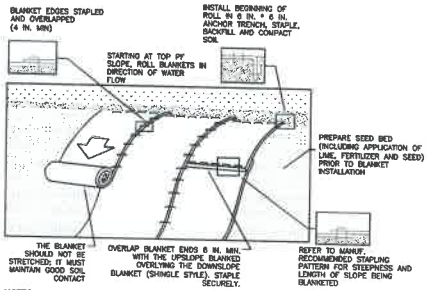
FENCE SHALL BE REMOVED AND PROPERLY DISPOSED OF WHEN TRIBUTARY AREA IS PERMANENTLY STABILIZED.

2 15-ES-24 SUPER SILT FENCE



BERM AND CHANNEL SHALL BE SEEDED AND MULCHED.

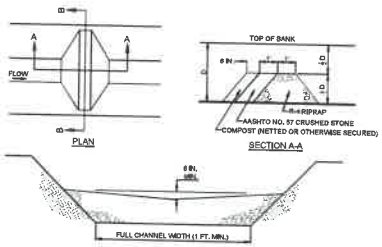
3 15-ES-24 DIVERSION BERM



NOTES

REMOVE ANCHOR TRENCH AT TOE OF SLOPE: IN SIMILAR FASHION AS AT TOP PF SLOPE. SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS, AND GRASS. BLANKET SHALL HAVE GOOD CONTINUOUS CONTACT WITH UNDERLYING SOIL THROUGHOUT ENTIRE LENGTH. LAY BLANKET LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH SOIL. DO NOT STRETCH BLANKET.
THE BLANKET SHALL BE STAPLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
BLANKETED AREAS SHALL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT UNTIL PERENNIAL VEGETATION IS ESTABLISHED TO A MINIMUM UNIFORM 70% COVERAGE THROUGHOUT THE BLANKETED AREA. DAMAGED OR DISPLACED BLANKETS SHALL BE RESTORED OR REPLACED WITHIN 4 CALENDAR DAYS.

4 15-ES-24 EROSION CONTROL BLANKET



NOTES

1. THE FILTER SHOULD BE EQUAL IN HEIGHT TO HALF THE TOTAL CHANNEL DEPTH WITH A 6' DEPRESSION IN THE CENTER.
2. A ONE FOOT THICK LAYER OF AASHTO #57 (OR SMALLER) STONE SHOULD BE PLACED ON THE UPSTREAM SIDE OF THE FILTER.
3. THIS IS A SPECIAL PROTECTION WATERSHED. THE CONTRACTOR SHALL PLACE AND ANCHOR A 6' LAYER OF COMPOST ON TOP OF THE FILTER STONE.
4. THE R-4 RIPRAP GRADATION SHALL BE USED AND SHALL HAVE THE FOLLOWING GRADATION: 100 PERCENT PASSING 12-INCH SIZE, 15-50 PERCENT PASSING THE 6-INCH SIZE, AND 0-15 PERCENT PASSING THE 3-INCH SIZE.
5. ROCK FILTERS SHOULD BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT.
6. CLOGGED FILTER STONE (AASHTO # 57) SHOULD BE REPLACED.
7. NEEDED REPAIRS SHOULD BE INITIATED IMMEDIATELY AFTER THE INSPECTION.
8. SEDIMENT SHALL BE REMOVED WHEN ACCUMULATIONS REACH 1/2 THE HEIGHT OF THE FILTER.
9. IMMEDIATELY UPON STABILIZATION OF THE UPSTREAM AREA, THE CONTRACTOR SHALL REMOVE ACCUMULATED SEDIMENT, REMOVE ROCK FILTER, AND STABILIZE ANY ADJACENT DISTURBED AREAS

5 15-ES-24 ROCK FILTER OUTLET

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

	Date
Designed AEB	SEP 24
Drawn AEW	SEP 24
Checked COS	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN
DETAILS AND NOTES

Brush Creek Watershed *Mercer County, WV*

ATERRA Schnabel

300 Brookside Ave., Bldg. 15, Suite 100, Ambler, PA 19002
Phone: 330-274-9456
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USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-ES-24

SEPTEMBER 2024

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REVISIONS			
#	DATE	APPROVED	TITLE / DESCRIPTION

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Last Saved By: ALFRED WELLS RevDate: 9/10/2024 4:18 PM PlotDate: 9/24/2024 8:31 AM
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EROSION, SEDIMENT CONTROL AND POLLUTION CONTROL NOTES:

1. ALL EARTH DISTURBANCES, INCLUDING CLEARING AND GRUBBING AS WELL AS CUTS AND FILLS SHALL BE DONE IN ACCORDANCE WITH THE APPROVED E&S PLAN. A COPY OF THE APPROVED DRAWINGS (STAMPED, SIGNED AND DATED BY THE REVIEWING AGENCY) MUST BE AVAILABLE AT THE PROJECT SITE AT ALL TIMES. THE REVIEWING AGENCY SHALL BE NOTIFIED OF ANY CHANGES TO THE APPROVED PLAN PRIOR TO IMPLEMENTATION OF THOSE CHANGES. THE REVIEWING AGENCY MAY REQUIRE A WRITTEN SUBMITTAL OF THOSE CHANGES FOR REVIEW AND APPROVAL AT ITS DISCRETION.

2. ALL EARTH DISTURBANCE ACTIVITIES SHALL PROCEED IN ACCORDANCE WITH THE SEQUENCE PROVIDED ON THE PLAN DRAWINGS. DEVIATION FROM THAT SEQUENCE MUST BE APPROVED IN WRITING FROM THE WEST VIRGINIA DEP PRIOR TO IMPLEMENTATION.

3. CLEARING, GRUBBING, AND TOPSOIL STRIPPING SHALL BE LIMITED TO THOSE AREAS DESCRIBED IN EACH STAGE OF THE CONSTRUCTION SEQUENCE. GENERAL SITE CLEARING, GRUBBING AND TOPSOIL STRIPPING MAY NOT COMMENCE IN ANY STAGE OR PHASE OF THE PROJECT UNTIL THE E&S BMPS SPECIFIED BY THE BMP SEQUENCE FOR THAT STAGE OR PHASE HAVE BEEN INSTALLED AND ARE FUNCTIONING AS DESCRIBED IN THIS E&S PLAN.

4. AT NO TIME SHALL CONSTRUCTION VEHICLES BE ALLOWED TO ENTER AREAS OUTSIDE THE LIMIT OF DISTURBANCE BOUNDARIES SHOWN ON THE PLAN MAPS. THESE AREAS MUST BE CLEARLY MARKED BEFORE CLEARING AND GRUBBING OPERATIONS BEGIN.

5. IMMEDIATELY UPON DISCOVERING UNFORESEEN CIRCUMSTANCES POSING THE POTENTIAL FOR ACCELERATED EROSION AND/OR SEDIMENT POLLUTION, THE OPERATOR SHALL IMPLEMENT APPROPRIATE BEST MANAGEMENT PRACTICES TO MINIMIZE THE POTENTIAL FOR EROSION AND SEDIMENT POLLUTION AND NOTIFY THE DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT.

6. ALL BUILDING MATERIALS AND WASTES SHALL BE REMOVED FROM THE SITE AND RECYCLED OR DISPOSED OF. NO BUILDING MATERIALS OR WASTES OR UNUSED BUILDING MATERIALS SHALL BE BURNED, BURIED, DUMPED, OR DISCHARGED AT THE SITE.

7. ALL OFF-SITE WASTE AND BORROW AREAS MUST HAVE AN E&S PLAN APPROVED AND FULLY IMPLEMENTED PRIOR TO BEING ACTIVATED.

8. ALL PUMPING OF WATER FROM ANY WORK AREA SHALL BE DONE ACCORDING TO THE PROCEDURE DESCRIBED IN THIS PLAN.

9. UNTIL THE SITE IS STABILIZED, ALL EROSION AND SEDIMENT BMPS SHALL BE MAINTAINED PROPERLY.
   a. INSPECTION FREQUENCIES SHOULD BE EVERY 4 DAYS AND WITHIN 24 HOURS OF A PRECIPITATION EVENT GREATER THAN 0.25" IN A 24-HOUR PERIOD.
   b. REPAIRS AND MAINTENANCE TO BMP'S SHALL BE PERFORMED WITHIN 24 HOURS, HOWEVER, PERMITEES MUST IMPLEMENT ALTERNATE BMP'S PRIOR TO STORM EVENTS WHILE AWAITING REPAIR OF THE PRIMARY ENHANCED BMP.
   c. TEMPORARY SEEDING AND MULCHING WITHIN 4 DAYS WHEN AREAS WILL NOT BE RE-DISTURBED FOR MORE THAN 14 DAYS.
   d. PERMANENT SEEDING AND MULCHING WITHIN 4 DAYS OF REACHING FINAL GRADE.
   e. FINAL STABILIZATION SHALL BE WITHIN 4 DAYS AFTER CONSTRUCTION IS COMPLETED.

10. A LOG SHOWING DATES THAT E&S BMPS WERE INSPECTED AS WELL AS ANY DEFICIENCIES FOUND AND THE DATE THEY WERE CORRECTED SHALL BE MAINTAINED ON THE SITE AND BE MADE AVAILABLE TO REGULATORY AGENCY OFFICIALS AT THE TIME OF INSPECTION.

11. SEDIMENT TRACKED ONTO ANY PUBLIC ROADWAY OR SIDEWALK SHALL BE RETURNED TO THE CONSTRUCTION SITE IMMEDIATELY AND DISPOSED IN THE MANNER DESCRIBED IN THIS PLAN. IN NO CASE SHALL THE SEDIMENT BE WASHED, SHOVELED, OR SWEPT INTO ANY ROADSIDE DITCH, STORMSEWER, OR SURFACE WATER.

12. ALL SEDIMENT REMOVED FROM BMPS SHALL BE DISPOSED OF IN THE MANNER DESCRIBED ON THE PLAN DRAWINGS.

13. IMMEDIATELY AFTER EARTH DISTURBANCE ACTIVITIES CEASE IN ANY AREA OR SUBAREA OF THE PROJECT, THE CONTRACTOR SHALL STABILIZE ALL DISTURBED AREAS. DURING NON-GERMINATING MONTHS, MULCH OR PROTECTIVE BLANKETING SHALL BE APPLIED AS DESCRIBED IN THE PLAN. AREAS NOT AT FINISHED GRADE, WHICH WILL BE REACTIVATED WITHIN 1 YEAR, MAY BE STABILIZED IN ACCORDANCE WITH THE TEMPORARY STABILIZATION SPECIFICATIONS. THOSE AREAS WHICH WILL NOT BE REACTIVATED WITHIN 1 YEAR SHALL BE STABILIZED IN ACCORDANCE WITH THE PERMANENT STABILIZATION SPECIFICATIONS.

14. PERMANENT STABILIZATION IS DEFINED AS A MINIMUM UNIFORM, PERENNIAL 70% VEGETATIVE COVER OR OTHER PERMANENT NON-VEGETATIVE COVER WITH A DENSITY SUFFICIENT TO RESIST ACCELERATED EROSION. CUT AND FILL SLOPES SHALL BE CAPABLE OF RESISTING FAILURE DUE TO SLUMPING, SLIDING, OR OTHER MOVEMENTS.

15. E&S BMPS SHALL REMAIN FUNCTIONAL AS SUCH UNTIL ALL AREAS TRIBUTARY TO THEM ARE PERMANENTLY STABILIZED OR UNTIL THEY ARE REPLACED BY ANOTHER BMP APPROVED BY THE DEPARTMENT OF ENVIRONMENTAL PROTECTION.

16. UPON COMPLETION OF ALL EARTH DISTURBANCE ACTIVITIES AND PERMANENT STABILIZATION OF ALL DISTURBED AREAS, THE OWNER AND/OR OPERATOR SHALL CONTACT THE WEST VIRGINIA DEP FOR AN INSPECTION PRIOR TO REMOVAL/CONVERSION OF THE E&S BMPS.

17. AFTER FINAL SITE STABILIZATION HAS BEEN ACHIEVED, TEMPORARY EROSION AND SEDIMENT BMPS MUST BE REMOVED OR CONVERTED TO PERMANENT POST CONSTRUCTION STORMWATER MANAGEMENT BMPS. AREAS DISTURBED DURING REMOVAL OR CONVERSION OF THE BMPS SHALL BE STABILIZED IMMEDIATELY. IN ORDER TO ENSURE RAPID REVEGETATION OF DISTURBED AREAS, SUCH REMOVAL/CONVERSIONS ARE TO BE DONE ONLY DURING THE GERMINATING SEASON.

18. UPON COMPLETION OF ALL EARTH DISTURBANCE ACTIVITIES AND PERMANENT STABILIZATION OF ALL DISTURBED AREAS, THE OWNER AND/OR OPERATOR SHALL CONTACT THE DEPARTMENT OF ENVIRONMENTAL PROTECTION TO SCHEDULE A FINAL INSPECTION AND FILE A NOTICE OF TERMINATION WITH WEST VIRGINIA DEP.

19. CONCRETE WASH WATER SHALL BE HANDLED IN THE MANNER DESCRIBED ON THE PLAN DRAWINGS. IN NO CASE SHALL IT BE ALLOWED TO ENTER ANY SURFACE WATERS OR GROUNDWATER SYSTEMS.

20. SEDIMENT BASINS AND/OR TRAPS SHALL BE KEPT FREE OF ALL CONSTRUCTION WASTE, WASH WATER, AND OTHER DEBRIS HAVING POTENTIAL TO CLOG THE BASIN/TRAP OUTLET STRUCTURES AND/OR POLLUTE THE SURFACE WATERS.

21. ANY DAMAGE THAT OCCURS IN WHOLE OR IN PART AS A RESULT OF BASIN OR TRAP DISCHARGE SHALL BE IMMEDIATELY REPAIRED IN A PERMANENT MANNER SATISFACTORY TO THE DEPARTMENT OF ENVIRONMENTAL PROTECTION AND THE OWNER OF THE DAMAGED PROPERTY.

22. UPON REQUEST, THE APPLICANT OR HIS CONTRACTOR SHALL PROVIDE AN AS-BUILT (RECORD DRAWING) FOR ANY SEDIMENT BASIN OR TRAP TO THE DEPARTMENT OF ENVIRONMENTAL PROTECTION.

23. EROSION CONTROL BLANKETING SHALL BE INSTALLED ON ALL SLOPES 3H:1V OR STEEPER WITHIN 50 FEET OF A SURFACE WATER AND ON ALL OTHER DISTURBED AREAS SPECIFIED ON THE PLAN MAPS AND/OR DETAIL SHEETS.

24. THE E&S PLAN SHALL BE MODIFIED AND WV DEP NOTIFIED WHENEVER THERE IS A SIGNIFICANT CHANGE IN DESIGN, CONSTRUCTION, OPERATION, OR MAINTENANCE OF ANY BMP.

25. ONSITE FUEL STORAGE SHALL BE PROTECTED FROM VANDALISM AND SPILLAGE. ANY SPILLAGE MUST BE IMMEDIATELY CLEANED UP. ANY NON-COMPLIANCE SPILL OR ACCIDENTAL DISCHARGE WHICH MAY ENDANGER HUMAN HEALTH, OR THE ENVIRONMENT SHALL BE REPORTED IMMEDIATELY AFTER BECOMING AWARE OF THE CIRCUMSTANCES.

26. SEDIMENT REMOVED FROM SEDIMENT TRAPS MUST BE EITHER STABILIZED ONSITE OR REMOVED FROM THE PROJECT. CONCRETE WASH WATER COLLECTED FROM THE CONCRETE WASHOUT MUST BE REMOVED FROM THE SITE.

EARTHFILL CONSTRUCTION NOTES:

1. AREAS TO BE FILLED ARE TO BE CLEARED, GRUBBED, AND STRIPPED OF TOPSOIL TO REMOVE TREES, VEGETATION, ROOTS AND OTHER OBJECTIONABLE MATERIAL.

2. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT ANY MATERIAL BROUGHT ON SITE IS CLEAN FILL.

3. ALL FILLS SHALL BE COMPACTED AS REQUIRED TO REDUCE EROSION, SLIPPAGE, SETTLEMENT, SUBSIDENCE OR OTHER RELATED PROBLEMS. FILL INTENDED TO SUPPORT BUILDINGS, STRUCTURES AND CONDUITS, ETC. SHALL BE COMPACTED IN ACCORDANCE WITH LOCAL REQUIREMENTS OR THE STANDAED PROCTOR TEST, ASTM D698. MOISTURE CONTENT SHALL BE BETWEEN -2% AND +3% OF OPTIMUM.

4. ALL EARTHEN FILLS SHALL BE PLACED IN COMPACTED LAYERS NOT TO EXCEED 9 INCHES IN THICKNESS.

5. FILL MATERIALS SHALL BE FREE OF FROZEN PARTICLES, BRUSH, ROOTS, SOD, OR OTHER FOREIGN OR OBJECTIONABLE MATERIALS THAT WOULD INTERFERE WITH OR PREVENT CONSTRUCTION OF SATISFACTORY FILLS.

6. FROZEN MATERIALS OR SOFT, MUCKY, OR HIGHLY COMPRESSIBLE MATERIALS SHALL NOT BE INCORPORATED INTO FILLS.

7. FILL SHALL NOT BE PLACED ON SATURATED OR FROZEN SURFACES.

8. SEEPS OR SPRINGS ENCOUNTERED DURING CONSTRUCTION SHALL BE HANDLED IN ACCORDANCE WITH THE STANDARD AND SPECIFICATION FOR SUBSURFACE DRAIN OR OTHER APPROVED METHOD.

9. ALL GRADED AREAS SHALL BE PERMANENTLY STABILIZED IMMEDIATELY UPON REACHING FINISHED GRADE. CUT SLOPES IN COMPETENT BEDROCK AND ROCK FILLS NEED NOT BE VEGETATED. SEEDED AREAS WITHIN 50 FEET OF A SURFACE WATER, OR AS OTHERWISE SHOWN ON THE PLAN DRAWINGS, SHALL BE BLANKETED ACCORDING TO THE STANDARDS OF THIS PLAN.

10. PERMANENT STABILIZATION IS DEFINED AS A MINIMUM UNIFORM, PERENNIAL 70% VEGETATIVE COVER OR OTHER PERMANENT NON-VEGETATIVE COVER WITH A DENSITY SUFFICIENT TO RESIST ACCELERATED EROSION. CUT AND FILL SLOPES SHALL BE CAPABLE OF RESISTING FAILURE DUE TO SLUMPING, SLIDING, OR OTHER MOVEMENTS.

11. FILL MATERIAL FOR EMBANKMENTS AND COFFERDAMS SHALL BE FREE OF ROOTS, OR OTHER WOODY VEGETATION, ORGANIC MATERIAL, LARGE STONES, AND OTHER OBJECTIONABLE MATERIALS. THE EMBANKMENT SHALL BE COMPACTED AS DESCRIBED IN THE SPECIFICATIONS.

TOPSOIL AND SEEDING CONSTRUCTION NOTES:

1. TOPSOIL REQUIRED FOR THE ESTABLISHMENT OF VEGETATION SHALL BE STOCKPILED AT THE LOCATION(S) SHOWN ON THE PLAN MAPS(S) IN THE AMOUNT NECESSARY TO COMPLETE THE FINISH GRADING OF ALL EXPOSED AREAS THAT ARE TO BE STABILIZED BY VEGETATION. EACH STOCKPILE SHALL BE PROTECTED IN THE MANNER SHOWN ON THE PLAN DRAWINGS. STOCKPILE HEIGHTS SHALL NOT EXCEED 35 FEET. STOCKPILE SLOPES SHALL BE 2H:1V OR FLATTER.

2. AREAS WHICH ARE TO BE TOPSOILED SHALL BE SCARIFIED TO A MINIMUM DEPTH OF 3 TO 5 INCHES — 6 TO 12 INCHES ON COMPACTED SOILS — PRIOR TO PLACEMENT OF TOPSOIL. AREAS TO BE VEGETATED SHALL HAVE A MINIMUM 4 INCHES OF TOPSOIL IN PLACE PRIOR TO SEEDING AND MULCHING. FILL OUTSLOPES SHALL HAVE A MINIMUM OF 6 INCHES OF TOPSOIL.

3. TOPSOIL PLACEMENT AND GRADING SHALL BE IN ACCORDANCE WITH SPECIFICATION REQUIREMENTS.

4. SEEDING SHALL MEET THE REQUIREMENTS OF SPECIFICATION REQUIREMENTS.

TEMPORARY CONSTRUCTION IMPACTS TO WETLANDS

1. WHERE TEMPORARY IMPACTS TO WETLANDS OCCUR, VEGETATION MAY BE CUT TO GROUND LEVEL BUT THE ROOT MASS MAY NOT BE REMOVED.

2. NO GRADING IS ALLOWED IN WETLAND AREAS.

3. EXTRA HEAVY GEOTEXTILE, AS SHOWN IN THE DRAWINGS, IS REQUIRED TO BE PLACED WHERE THE TEMPORARY ACCESS ROAD CROSSES WETLAND AREAS AND WHERE STOCKPILES WILL BE PLACED ON WETLAND AREAS.

4. WETLANDS IMPACTED BY TEMPORARY CONSTRUCTION ACTIVITIES SHALL BE RESTORED IN ACCORDANCE WITH WV DEP PERMIT REQUIREMENTS.

INSPECTION AND STABILIZATION SCHEDULE REQUIREMENTS

1. INSPECTION OF ALL EROSION AND SEDIMENT CONTROL BMPS WITHIN DISTURBED AREAS SHALL BE CONDUCTED AT LEAST ONCE EVERY FOUR CALENDAR DAYS AND WITHIN 24 HOURS AFTER ANY PRECIPITATION EVENT GREATER THAN 0.25 INCHES PER 24 HOURS PERIOD.

2. REPAIRS OR MAINTENANCE TO BMPS SHALL BE PERFORMED WITHIN 24 HOURS; HOWEVER, ALTERNATE BMPS SHALL BE INSTALLED PRIOR TO STORM EVENTS WHILE AWAITING REPAIR OF THE PRIMARY ENHANCED BMP.

3. TEMPORARY SEEDING AND MULCHING SHALL BE PERFORMED WITHIN 4 DAYS WHEN AREAS WILL NOT BE RE-DISTURBED FOR MORE THAN 14 DAYS.

4. PERMANENT SEEDING AND MULCHING SHALL BE PERFORMED WITHIN 4 DAYS OF REACHING FINAL GRADE.

5. FINAL STABILIZATION SHALL BE ACCOMPLISHED WITHIN 4 DAYS AFTER CONSTRUCTION HAS BEEN COMPLETED..

JONATHAN M PITTMAN REGISTERED 23485 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION

		Date
Designed	ARB	SEP 24
Drawn	AEW	SEP 24
Checked	COS	SEP 24
Approved	JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION
EROSION AND SEDIMENT CONTROL PLAN
NOTES

Brush Creek Watershed *Mercer County, WV*

ATERRA Schnabel JV

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USDA United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023

Drawing No. 15-ES-25

SEPTEMBER 2024

Sheet 25 of 25

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CONSTRUCTION AND MATERIAL SPECIFICATIONS FOR

Brush Creek Site 15 Dam Rehabilitation (WV05511)
Mercer County, West Virginia

Prepared for the USDA Natural Resources Conservation Service

Contract #12SPEC18D0023
Task Order #12SPEC18F0053
Aterra-Schnabel Reference 18proj007
May 27, 2025

05/27/25

Jonathan M. Pittman, PE

WV Professional Engineer No. 23485

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USDA United States Department of Agriculture
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CONSTRUCTION SPECIFICATIONS CONTENTS

Construction Specification	Title	Version Date
2	Clearing and Grubbing	May 2001
3	Structure Removal	May 2001
5	Pollution Control	January 2014
6	Seeding, Sprigging, and Mulching	Amend. 2, Sept. 2018
7	Construction Surveys	January 2009
8	Mobilization and Demobilization	May 2001
10	Water for Construction	January 2009
11	Removal of Water	May 2001
21	Excavation	May 2001
23	Earthfill	February 2020
24	Drainfill	May 2001
26	Topsoiling	May 2001
31	Concrete for Major Structures	Amend 2, Sept. 2018
34	Steel Reinforcement	Amend. 2, Sept. 2018
35	Concrete Repair	April 2015
36	Roller Compacted Concrete	Amend 2, Sept. 2018
41	Reinforced Concrete Pressure Pipe Conduits	January 2014
45	Plastic Pipe	January 2009
61	Rock Riprap	Amend. 2, Sept. 2018
63	Treatment of Rock Surfaces	May 2001
71	Water Control Gates	May 2001
81	Metal Fabrication and Installation	May 2001
93	Identification Markers or Plaques	May 2001
94	Contractor Quality Control	January 2009
95	Geotextile	January 2014
96	Field Office	May 2001
97	Geomembrane Liner	September 2014
401	Geotechnical Instrumentation	September 2024
402	Diving Services	September 2024

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MATERIAL SPECIFICATIONS CONTENTS

Material Specification	Title	Version Date
521	Aggregates for Drainfill and Filters	2nd Ed., February 2022
522	Aggregates for Portland Cement Concrete	2nd Ed., February 2022
523	Rock for Riprap	2nd Ed., Amend. 1, April 2022
524	Aggregates for Roller Compacted Concrete	2nd Ed., February 2022
531	Portland Cement	2nd Ed., February 2022
532	Supplementary Cementitious Materials	2nd Ed., February 2022
533	Chemical Admixtures for Concrete	2nd Ed., February 2022
534	Concrete Curing Compound	2nd Ed., February 2022
535	Preformed Expansion Joint Filler	2nd Ed., February 2022
536	Sealing Compound for Joints for Concrete and Concrete Pipe	2nd Ed., Amend. 1, April 2022
537	Nonmetallic Waterstops	2nd Ed., February 2022
539	Steel Reinforcement (for concrete)	2nd Ed., Amend. 2, July 2022
541	Reinforced Concrete Pressure Pipe	2nd Ed., February 2022
547	Plastic Pipe	2nd Ed., Amend. 1, April 2022
571	Slide Gates	2nd Ed., Amend. 1, April 2022
581	Metal	2nd Ed., Amend. 1, April 2022
582	Galvanizing	2nd Ed., February 2022
592	Geotextile	2nd Ed., Amend. 1, April 2022
594	Geomembrane Liner	2nd Ed., Amend. 1, April 2022

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CONSTRUCTION SPECIFICATIONS

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CONSTRUCTION SPECIFICATION 2—CLEARING AND GRUBBING

1. Scope

The work consists of clearing and grubbing and disposal of trees, snags, logs, brush, stumps, shrubs, and rubbish from the designated areas.

2. Protection of existing vegetation

Trees and other vegetation designated to remain undisturbed shall be protected from damage throughout the duration of the construction period. Any damages resulting from the contractor's operations or neglect shall be repaired by the contractor.

Earthfill, stockpiling of materials, vehicular parking, and excessive foot or vehicular traffic shall not be allowed within the drip line of vegetation designated to remain in place. Vegetation damaged by any of these or similar actions shall be replaced with viable vegetation of the same species, similar condition, and like size unless otherwise approved by the contracting officer.

Any cuts, skins, scrapes, or bruises to the bark of the vegetation shall be carefully trimmed and local nursery accepted procedures used to seal damaged bark.

Any limbs or branches 0.5 inch or larger in diameter that are broken, severed, or otherwise seriously damaged during construction shall be cut off at the base of the damaged limb or branch flush with the adjacent limb or tree trunk. All roots one (1) inch or larger in diameter that are cut, broken, or otherwise severed during construction operations shall have the end smoothly cut perpendicular to the root. Roots exposed during excavation or other operations shall be covered with moist earth or backfilled as soon as possible to prevent the roots from drying out.

3. Marking

The limits of the area(s) to be cleared and grubbed will be marked by stakes, flags, tree markings, or other suitable methods. Trees to be left standing and uninjured will be designated by special markings placed on the trunk about six (6) feet above the ground surface.

4. Clearing and grubbing

All trees not marked for preservation and all snags, logs, brush, stumps, shrubs, rubbish, and similar materials shall be cleared from within the limits of the designated areas. Unless otherwise specified, all stumps, roots, and root clusters that have a diameter of one (1) inch or larger shall be grubbed out to a depth of at least two (2) feet below subgrade for concrete structures and one (1) foot below the ground surface at embankment sites and other designated areas.

5. Disposal

All materials cleared and grubbed from the designated areas shall be disposed of at locations shown on the drawings or in a manner specified in Section 7. The contractor is responsible for complying with all local rules and regulations and the payment of any and all fees that may result from disposal at locations away from the project site.

6. Measurement and payment

Method 1 — For items of work for which specific units prices are established in the contract, the cleared and grubbed area is measured to the nearest 0.1 acre. Payment for clearing and grubbing is made for the total area within the designated limits at the contract unit price. Such payment will constitute full

compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Method 2 — For items of work for which specific unit prices are established in the contract, the length of the cleared and grubbed area is measured to the nearest full station (100 feet) along the line designated on the drawing or identified in the specifications. Payment for clearing and grubbing is made for the total length within the designated limits at the contract unit price. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Method 3 — For items of work for which specific unit prices are established in the contract, each tree, stump, and snag having a diameter of 4 inches or larger and each log having a diameter of 4 inches or larger and a length of 10 feet are measured before removal. The size of each tree and snag is determined by measuring its trunk at breast height above the natural ground surface. The size of each log is determined by measuring the butt and by measuring its length from butt to tip. The size of each stump is measured at the top. Diameter is determined by dividing the measured circumference by 3.14.

Payment for clearing and grubbing of each tree, stump, and snag having a diameter of 4 inches or larger and each log having a diameter of 4 inches or larger and a length of 10 feet or larger is made at the contract unit price for its size designation as determined by the following schedule:

Measured diameter (in)	Size designation (in)
4 to 8	6
8 to 12	10
12 to 24	18
24 to 36	30
36 to 60	48
Over 60	60

The sum of such payments shall constitute full compensation for clearing and grubbing (including the clearing and grubbing of smaller trees, stumps, snags, logs, brush, shrubs, and roots), applicable permits and associated fees, and rubbish removal. Such payment shall constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Method 4 — For items of work for which specific lump sum prices are established in the contract, payment for clearing and grubbing is made at the contract lump sum price. Such payment shall constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

All Methods — The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7.

7. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. *Bid Item 1 – Clearing and Grubbing*

1) This item shall consist of all clearing and grubbing required for the installation of the works of improvement as shown on the Drawings, including but not limited to trees, brush, and woody vegetation in:

   a. Excavated and fill areas;
   b. On and within 25 feet of the dam and associated appurtenances; and
   c. All areas necessary for implementation of the erosion and sediment control plan as approved by authorities having jurisdiction.

2) The Contractor shall submit a Clearing and Grubbing Plan illustrating the proposed limits, schedule, methods of clearing and disposal, proposed offsite disposal locations and permits to the COR for approval within 21 days of contract award and prior to beginning the work. The Contractor shall also survey and flag the limits of clearing and grubbing for approval by the COR prior to the start of clearing operations. Clearing and grubbing operations shall not begin until the plan and flagged limits have been approved. Blasting is not allowed.

3) In Section 4, Clearing and Grubbing, all stumps, roots, and root clusters greater than 1 inch in diameter shall be removed regardless of depth below subgrade.

4) In Section 5, Disposal, no disposal will be allowed on site. All materials resulting from Clearing and Grubbing shall become the property of the Contractor and shall be removed from the site and disposed of in accordance with all applicable federal, state, and local regulations.

5) Burning of trees, limbs, and brush shall be local to the area being cleared and shall have a minimum buffer of 150 feet maintained between the burn area and any existing structures and trees. Burning shall be accomplished at such times and manner as to minimize the annoyance or discomfort to the inhabitants of the area and not create nuisance conditions. The initiation of burning shall commence no earlier than one hour after sunrise and shall be completed on the same day not later than one hour before sunset, and shall be attended by a responsible party at all times during the active burn phase. Burning shall be in accordance with state and local regulations.

6) Burying burned debris on site will not be a permitted. Remove from the site any portions of the material to be burned that do not completely combust, including all ashes. Dispose of the remaining materials in accordance with all applicable federal, state, and local regulations.

7) Land clearing debris (trees, limbs, and brush) may be mulched onsite using a wood chipper. The location of mulch stockpiles shall be approved by the COR. Mulch may be used for erosion control. All unused mulch shall be disposed of off-site by the Contractor at the conclusion of the project. Land clearing debris (trees, snags, logs, brush, shrubs, and stumps) too large to be mulched, which are not burned, shall be disposed of off-site by the Contractor.

8) Costs for off-site disposal and all necessary permits and fees shall be incidental to the item of work.

9) All trees, snags, logs, brush, shrubs, stumps, and rubbish that are felled, detached, or otherwise dislocated in or near the lake or stream channels shall be disposed of as specified or removed to higher ground prior to the end of each workday. The Contractor is to take precaution, when temporarily stockpiling cleared and grubbed materials, to guard against

such cleared and grubbed materials being floated or transported off the worksite by rainstorm runoff.

10) Upon completion of the clearing and grubbing operation, all areas which have been cleared shall be dressed to be reasonably smooth by blading, dragging or floating. The entire area shall be reasonably free of abrupt mounds, dips and windrows to provide a clear area for construction staking. Earthfill for repairing grubbed areas shall be placed in accordance with Construction Specification 23, Earthfill and shall be incidental to the completion of the work.

11) All trash (rubbish) and all other such waste and refuse materials shall be removed from the worksite and disposed of an approved landfill in accordance with all state and local regulations and laws. Costs for off-site disposal, including all necessary permits and fees, shall be incidental to the item of work.

12) In Section 6, Measurement and Payment, Method 1 shall apply. Measurement is based on horizontal distance (distance in plan view) of the final cleared and grubbed areas.

****End of Construction Specification 2****

CONSTRUCTION SPECIFICATION 3—STRUCTURE REMOVAL

1. Scope

The work shall consist of the removal, salvage, and disposal of structures (including fences) from the designated areas.

2. Marking

Method 1—Each structure or structure part to be removed will be marked with stakes, flags, paint, or other suitable method.

Method 2—The area boundaries from which structures must be removed will be marked using stakes, flags, paint, or other suitable method. Structures to remain undisturbed or to be salvaged will be designated by special markings.

3. Removal

Method 1—All structures designated for removal in the contract shall be removed to the specified extent and depth.

Method 2—Within the areas so marked, all visible and buried structures identified shall be removed to the specified extent and depth.

4. Salvage

Structures or structure parts that are designated to be salvaged shall be carefully removed and neatly placed in the specified or approved storage location. Salvaged structures that are capable of being disassembled shall be dismantled into individual members or sections. Such structures shall be neatly and systematically match marked with paint before disassembly. All connectors and other parts shall be marked to indicate their proper location within the structure and shall be fastened to the appropriate structural member or packed in suitable containers.

Material from fences designated to be salvaged shall be placed outside the work area on the property on which the fence was originally located. Fence wire shall be rolled into uniform rolls of suitable size and neatly piled with other salvaged materials. Posts and rails shall be neatly stacked.

5. Disposal of refuse materials

Refuse materials resulting from structure removal shall be disposed of in a manner and at locations specified in Section 7 of this specification or in an acceptable manner and at locations approved by the contracting officer. Disposal by burning shall be in accordance with local rules and regulations.

6. Measurement and payment

Method 1—For items of work for which specific unit prices are established by the contract, payment for the removal of each structure unit, except fences, is made at the contract unit price. Fences removed or removed and salvaged are measured to the nearest linear foot. Payment for fence removal or removal and salvage is made at the contract unit prices for each type and size of fence.

Such payment will constitute full compensation for all labor, equipment, tools, applicable permits and associated fees for burning and disposal of refuse, and all other items necessary and incidental to the completion of the work.

Method 2—For items of work for which specific lump sum prices are established by the contract, payment for structure removal is made at the contract lump sum price.

Such payment will constitute full compensation for all labor, equipment, tools, applicable permits and associated fees for burning and disposal of refuse, and all other items necessary and incidental to the completion of the work.

All Methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed as a contract line item number in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and items to which they are made subsidiary are identified in Section 7 of this specification.

7. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Bid Item 2 – Structure Removal

1) This item shall consist of the removal and disposal of structures shown on the Drawings and as specified herein, including the existing principal spillway riser appurtenances designated to be removed, impact basin and associated drain pipes, and any other miscellaneous structures required for performance of the work as approved by the COR. Abandonment of existing geotechnical instrumentation is not included in this Bid Item but is covered under Bid Item 46, Geotechnical Instrumentation, Construction Specification 401, Geotechnical Instrumentation.

2) The existing impact basin shall be removed without damaging the existing principal spillway conduit and concrete cradle. Any damage to the existing principal spillway conduit and cradle (including the spigot end and steel bell) shall be repaired as directed by the COR at the Contractor's expense and no additional cost to the Government.

3) Earthfill used for repairing areas damaged by structure removal shall be placed in accordance with Construction Specification 23, Earthfill and shall be incidental to the completion of the work.

4) The Contractor shall submit a Demolition Plan to the COR for approval at least 45 days prior to beginning work activity. At a minimum, the Plan shall include / indicate:

   a. Schedule and sequence of demolition activities.

   b. Required preparatory tasks.

   c. Coordination with other construction activities such as pollution control and stream diversion.

   d. Proposed demolition methods for each structure or facility as shown on the Drawings, including equipment needs.

   e. Materials, methods, and sequence for protection of existing structures to remain.

   f. Material disposal plans, including the locations of proposed off-site disposal facilities.

   g. Any interruptions required for utility and other services (as necessary).

5) In Section 2 – Marking, Method 1 will apply. The Contractor shall be responsible for marking.

6) Section 3 – Removal, Method 1 will apply. Structures designated for removal are shown on the Drawings.

7) In Section 4 – Salvage, no structures are designated to be salvaged.

8) In Section 5 – Disposal of Refuse Materials, refuse materials resulting from structural removal shall become the property of the Contractor and shall be removed from the site and disposed of in accordance with all applicable federal, state, and local regulations. The disposal location is subject to the approval of the Contracting Officer. Burning of refuse materials and blasting shall not be allowed on site. Costs for offsite disposal, including all necessary permits and fees, shall be incidental to the work.

9) In Section 6 – Measurement and Payment, Method 2 will apply. Progress payments may be prorated based on the contract lump sum price in accordance with the planned construction schedule.

B. Bid Item 3 – Trench Drain Abandonment

1) This item includes furnishing all labor, equipment, materials, and other items necessary and incidental to flushing, inspecting, and abandoning in-place the existing 8-inch diameter corrugated metal pipe (CMP) collector pipes and outlet pipes within the existing trench drains as shown on the Drawings and specified herein. There are two drains, one on either side of the existing principal spillway conduit. The existing trench drain consists of both perforated and solid-wall piping. All work associated with this Bid Item shall be completed prior to beginning excavation for new embankment toe drain.

   a. Flushing, inspecting, and grouting the existing 8-inch diameter CMP collector pipes and outlet pipes may be performed from the outlet ends of the pipes. Flush, inspect, and grout the 8-inch diameter CMP on the left and right side of the PSW conduit (looking downstream) at a minimum up to the 90-degree bend and the end cap, respectively, located in plan view near the mid-point of the embankment downstream slope.

2) The Contractor is required to submit a Trench Drain Abandonment Plan to the COR at least 45 days prior to beginning work activity. The Trench Drain Abandonment Plan shall address the following:

   a. Proposed work sequence and schedule from the start to finish of grouting operations.

   b. Means and methods to clean, inspect, and tremie grout the existing trench drain pipes.

   c. Methods to monitor placed grout volumes and grout pressure and to demonstrate that the entire pipe volume is fully grouted. Batching and pumping rate shall be indicated. Quantify the volume of grout during the grouting operation to confirm the pipe is completely grouted. Address the installation of bulkheads, vents, grout nipples, slick lines, and any other materials and equipment necessary to maintain pressure and flow of the mix.

   d. Proposed non-shrink grout mix design, including test results indicating compliance with these Specifications. Include a detailed description of the mechanisms that will be used for producing and conveying the job mix into the conduit. Once approved by the COR, the statement of materials and proportions will constitute the job mix. Any change to the job mix must be approved by the COR.

   e. Proposed mixing, pumping and conveying equipment.

3) Provide a cementitious, non-shrink grout designed by the Contractor to completely fill the full length of the pipe completely to the crown of the pipe. Grout mix shall consist of a mixture of Type I/II Portland Cement (ASTM C150), water, admixtures, sand, and/or bulk filler. Sand shall be Fine Aggregate for Portland Cement Concrete meeting the requirements of West Virginia Department of Transportation Division of Highways Standard Specifications Roads and Bridges Section 702. All admixtures shall conform to the requirements of Material Specification 533, Chemical Admixtures for Concrete. Grout mix ratios shall be expressed in cubic feet (cf) of water to bag of cement to cubic feet bulk filler [W (cf):C (bag):BF (cf)]. Cement shall be furnished in 47 or 94-lb bags. Grout mix shall meet the following requirements:

   a. Grout mix shall have a minimum water to cement ratio of 0.5 and a maximum water to cement ratio of 1.0. Other additives will be expressed in pounds, gallons, or pints to one bag of cement.

   b. Marsh Funnel time shall be between 40 and 90 seconds when tested in accordance with ASTM D6910. Contractor shall perform this testing in the presence of the COR for each proposed grout mix.

   c. Grout mix shall have a maximum bleed of 2 percent when tested in accordance with ASTM DC940. Contractor shall perform this testing in the presence of the COR for each proposed grout mix.

d. Collect six (6) 2-inch by 4-inch cylinders per mix. Perform compressive strength testing at 3, 7, and 28 days in accordance with ASTM C39. The remaining three cylinders will be kept for backup. Each proposed grout mix shall have a minimum compressive strength of 1,000 psi.

4) Provide mixer of the high speed colloidal type, equipped with a high speed diffuser centrifugal pump. Mixer shall be designed to mix cement, water, and bulk fillers thoroughly, and to produce a grout of uniform texture at the specified mix ratios. Provide one water flow meter. The water flow meter shall be graduated in tenths of gallons or hundredths of cubic feet and shall be able to be reset.

5) Prior to beginning grouting operations, the Contractor shall flush the trench drain pipes with water and remove foreign objects and sediment. Flushing methods which may result in damage to the existing drain pipes and erosion of embankment soils will not be permitted.

6) Following flushing, the Contractor shall inspect the full length of each drain pipe using appropriate video equipment. The video inspection footage shall be provided to the COR for review and approval prior to grouting. Additional cleaning of the pipe may be required, as determined by the COR, after review of the video inspection footage.

7) Abandon the existing trench drain collector and outlet pipes by placing the approved non-shrink grout mix through a tremie hose that extends to the upstream end of the existing pipes such that the pipe is filled from the upstream end toward the outlet (i.e., downstream) end. The injected grout volume shall be no less than the sum of the theoretical collector pipe and outlet pipe volumes. Monitor grout pressure at the bulkhead installed at the outlet. Maintain 2 psi of grout pressure at the pipe outlet for a minimum 10 minutes with zero pressure loss, at which point abandonment shall be considered complete. This procedure may be altered in the field by the COR to suit the conditions encountered and to meet the design objectives. Changes in the grout mix and grouting procedure shall be made when and as directed by the COR, and shall not be made without the approval of the COR.

8) Grout pressure shall not exceed 2 psi at the header unless specifically authorized by the COR. The pumping rate shall not exceed 3 cubic feet per minute (cfm).

9) The quantity of grout prepared in advance shall be kept to a minimum. Grout which has been kept in the mixer with or without agitation for longer than one hour shall be discarded, unless otherwise directed by the COR. For each pipe, grout placement shall occur during one continuous operation with no break in work shifts.

10) Grout temperatures shall be not lower than 50 degrees F and not higher than 90 degrees F at time of placement.

11) The Contractor shall keep a complete and accurate record of all grouting operations. This record shall include a time log of the grout mixes and admixtures used, the related pressures and grout take rates, back pressures, and observations on excessive leakage and other non-routine conditions. One copy of the records shall be furnished to the COR at the end of each shift, or as directed.

12) The Contractor shall demonstrate to the satisfaction of the COR that the existing drain pipes are entirely filled with grout as defined. After the drain pipes are entirely filled with grout, install one new, permanently secured end cap at the outlet end of each drain pipe.

13) After grouting is completed, the Contractor shall remove the grouting plant and all related parts, equipment, and supplies from the site, including unused materials and waste that is unsightly or would interfere with efficient operation by others.

14) In Section 6 – Measurement and Payment, Method 2 will apply.

a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control

15) Items subsidiary to this Bid Item include:

a. Water for Construction, Construction Specification 10 – Water for Construction

****End of Construction Specification 3****

CONSTRUCTION SPECIFICATION 5—POLLUTION CONTROL

1. Scope

The work consists of installing measures or performing work to control erosion and minimize the production of sediment and other pollutants to water and air from construction activities.

The following BioPreferred® product categories are applicable to this specification: — mulch and compost materials:

- erosion control materials
- fertilizers
- dust suppressants
- agricultural spray adjuvants

2. Material

Silt fence shall conform to the requirement of Materials Specification 592, Geotextile. All other material furnished shall meet the requirements of the material specifications listed in Section 8 of this specification.

3. Erosion and sediment control measures and works

The measures and works shall include, but are not limited to, the following:

Staging of earthwork activities—The excavation and moving of soil materials shall be scheduled to minimize the size of areas disturbed and unprotected from erosion for the shortest reasonable time.

Seeding—Seeding to protect disturbed areas shall occur as soon as reasonably possible following completion of that earthwork activity.

Mulching—Mulching to provide temporary protection of the soil surface from erosion.

Diversions—Diversions to divert water from work areas and to collect water from work areas for treatment and safe disposition. They are temporary and shall be removed and the area restored to its near original condition when the diversions are no longer required or when permanent measures are installed.

Stream crossings—Culverts or bridges where equipment must cross streams. They are temporary and shall be removed and the area restored to its near original condition when the crossings are no longer required or when permanent measures are installed.

Sediment basins—Sediment basins collect, settle, and eliminate sediment from eroding areas from impacting properties and streams below the construction site(s). These basins are temporary and shall be removed and the area restored to its original condition when they are no longer required or when permanent measures are installed.

Sediment filters—Straw bale filters or geotextile silt fences trap sediment from areas of limited runoff. Sediment filters shall be properly anchored to prevent erosion under or around them. Silt fences shall be installed and maintained in accordance with ASTM D6462. These filters are temporary and shall be removed and the area restored to its original condition when they are no longer required or when permanent measures are installed.

Waterways—Waterways for the safe disposal of runoff from fields, diversions, and other structures or measures. These works are temporary and shall be removed and the area restored to its original condition when they are no longer required or when permanent measures are installed.

Other—Additional protection measures as specified in Section 8 of this specification or required by Federal, State, or local government.

4. Chemical pollution

The Contractor shall provide watertight tanks or barrels or construct a sump sealed with plastic sheets to collect and temporarily contain chemical pollutants, such as drained lubricating or transmission fluids, grease, soaps, concrete mixer washwater, or asphalt, produced as a by-product of the construction activities. Pollutants shall be disposed of in accordance with appropriate state and Federal regulations. At the completion of the construction work, tanks, barrels, and sumps shall be removed and the area restored to its original condition as specified in Section 8 of this specification. Sump removal shall be conducted without causing pollution.

Sanitary facilities, such as chemical toilets, or septic tanks shall not be located next to live streams, wells, or springs. They shall be located at a distance sufficient to prevent contamination of any water source. At the completion of construction activities, facilities shall be disposed of without causing pollution as specified in Section 8 of this specification.

5. Air pollution

The burning of brush or slash and the disposal of other materials shall adhere to state and local regulations.

Fire prevention measures shall be taken to prevent the start or spreading of wildfires that may result from project activities. Firebreaks or guards shall be constructed and maintained at locations shown on the drawings.

All public access or haul roads used by the Contractor during construction of the project shall be sprinkled or otherwise treated to fully suppress dust. All dust control methods shall ensure safe construction operations at all times. If chemical dust suppressants are applied, the material shall be a commercially available product specifically designed for dust suppression and the application shall follow manufacturer's requirements and recommendations. A copy of the product data sheet and manufacturer's recommended application procedures shall be provided to the Engineer 5 working days before the first application.

6. Maintenance, removal, and restoration

All pollution control measures and temporary works shall be adequately maintained in a functional condition for the duration of the construction period. All temporary measures shall be removed and the site restored to near original condition.

7. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, each item is measured to the nearest unit applicable. Payment for each item is made at the contract unit price for that item. For water or chemical suppressant items used for dust control for which items of work are established in section 8 of this specification, measurement for payment will not include water or chemical suppressants that are used inappropriately or excessive to need. Such payment will constitute full compensation for the completion of the work.

Method 2—For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds and supported by invoices presented by the contractor that reflect actual costs. If the total of all progress payments is less than the lump sum contract price for this item, the balance remaining for this item will be included in the final contract payment. Payment of the lump sum contract price will constitute full compensation for completion of the work.

Method 3—For items of work for which lump sum prices are established in the contract, payment will be prorated and provided in equal amounts on each monthly progress payment estimate. The number of months used for prorating shall be the number estimated to complete the work as outlined in the Contractor's approved construction schedule. The final month's prorate amount will be provided with the final contract payment. Payment as described will constitute full compensation for completion of the work.

All Methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items, and the items to which they are made subsidiary, are identified in Section 8 of this specification.

8. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Bid Item 4 – Pollution Control

1) The item shall consist of scheduling operations, obtaining the required permits, performing work and installing, maintaining, and removing temporary erosion and sediment control measures to control erosion and minimize the production of sediment and other pollutants to water and air from construction activities as specified herein and in accordance with all applicable West Virginia Department of Environmental Protection (WVDEP) and County Conservation District rules, regulations, and permits.

2) The Project Sponsors have obtained the Construction Stormwater General Permit from the WVDEP and have paid the applicable permit fees. The permit approval is based on the Stormwater Pollution Prevention Plan (SWPPP) shown on the Drawings. The Contractor is responsible for implementation and maintenance of the SWPPP controls in accordance with the Drawings and these Specifications. If the Contractor's plan of work differs from the SWPPP design and permitted activities, then the Contractor is required to modify the SWPPP drawings and design documentation and to submit the proposed modifications to the COR for review within 21 days of contract award and prior to beginning the work. If the Contractor's proposed modifications are approved by the COR, then the Contractor shall prepare and submit the proposed modifications to the WVDEP at no additional cost to the Government and shall pay any and all applicable fees to support the modifications.

3) The Contractor shall prepare and submit a Pollution Control Plan (Plan) to the COR for approval within 21 days of contract award and prior to beginning the work. The Plan shall supplement the approved erosion and sediment control measures and plan shown on the Drawings. This Plan shall include fill stockpile area(s), proposed equipment and material staging and storage area(s), vehicle and equipment maintenance area(s), vehicle and equipment fueling area, material staging area(s), and dewatering effluent filtering methods and locations. Product data sheets for all pollution control measures required and/or proposed, including those in the approved erosion and sediment control plan, shall also be included in the Plan.

4) The Pollution Control Plan Pollution Control Plan shall include a Spill Prevention and Response Plan. The major objectives are to ensure that:

   a. All pollutants and their sources associated with construction activities are identified and controlled.

   b. All non-stormwater discharges are identified and eliminated, controlled, or treated.

   c. Selected best management practices (BMPs) are implemented properly and are effective in reducing or eliminating pollutants in discharges from construction activities.

   d. Methods to implement BMP inspections and visual monitoring are instituted.

   e. The Spill Prevention and Response Plan (SPRP) will

      i. Identify personnel and their companies are responsible for the implementation of this SPRP: Name, Organization and Position Telephone Cell Number.

      ii. Describe how onsite and offsite spills, or the potential for spills, will be reported to the COR and Site Superintendent.

      iii. How the magnitude and risk associated with the spill will be determine, the most effective way to contain and clean the spill, and evaluate if there was a release of any chemicals offsite due to the spill that should be reported.

   f. Describe the Best Management Practices to be used to prevent spills and respond to spills.

5) Land and water resources within the work limits but outside the limits of permanent work shall be preserved in their present condition or shall be restored to a condition that will appear to

be natural and not distract from the appearance of the project.

6) The location of the Contractor's camps, access and haul roads, storage, and other construction buildings, required temporarily in the performance of the work, shall be detailed in the Plan and approved by the COR prior to installation.

7) The Contractor shall not deface, injure, or destroy trees or shrubs beyond the limits shown on the Drawings, nor remove or cut them without special authority. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage unless authorized by the COR.

8) Monuments, markers, works of art, and sites of natural, historical, or archaeological significance (if present) shall be protected before beginning operations near them.

9) In Section 2 – Material

   a. In addition to the following material requirements, all vegetative and structural erosion and sediment control practices shall be constructed and maintained according to minimum standards and specifications of the West Virginia Erosion and Sediment Control Field Manual and West Virginia Erosion and Sediment Control Best Management Practice Manual. The most recent version at the time of bid advertisement of referenced Specifications shall apply and are available on the DEP and DOT web sites.

   b. Each temporary stream crossing culvert shall meet AASHTO H-20 loading.

   c. Compost Filter Sock shall have a minimum required diameter as shown on Drawings. Wooden stakes shall be 2 inches by 2 inches by 48 inches. Smaller diameter barriers may be stacked in a pyramid configuration to achieve an effective diameter that equals or exceeds the minimum required diameter. The Contractor shall maintain a stockpile of 50-LF of each diameter Compost Filter Sock used on site for use as needed to avoid material delivery delays.

   d. Temporary Construction Entrance shall consist of AASHTO No. 1 Coarse Aggregate meeting the requirements of West Virginia Department of Transportation Division of Highways Standard Specifications Roads and Bridges Section 704.6; and Separation Geotextile meeting the requirements of West Virginia Department of Transportation Division of Highways Standard Specifications Roads and Bridges Section 715.11.4.

   e. Erosion Control Blanket shall consist of Type 2.D Short-Term Temporary Rolled Earth Erosion Control Product (RECP) meeting the requirements of the West Virginia Erosion and Sediment Control Best Management Practice Manual Section 3.13. The product shall contain 100% agricultural straw and two organic jute nets securely sewn together with biodegradable thread. Polypropylene netting is prohibited. Provide biodegradable stakes.

   f. Pumped Water Filter Bag shall meet the requirements shown on the Drawings.

   g. Temporary seeding and permanent seeding shall consist of the seed mixes shown in Construction Specification 6, Seeding, Sprigging, and Mulching and on the Drawings for the applicable times of year.

   h. Weighted Filter Sock shall meet the requirements shown on the Drawings.

   i. Diversion Compost Filter Sock shall meet the requirements shown on the Drawings.

   j. Concrete Washout shall meet the requirements shown on the Drawings.

   k. Compost sock sediment traps shall meet the requirements shown on the Drawings.

10) In Section 3 – Erosion and Sediment Control Measures and Works

a. Install Compost Filter Sock to the limits shown on the Drawings. The barrier shall meet flush with existing grade. Riprap or other materials shall be removed to accommodate a uniform grade for the installation. Support stakes shall be driven to the required depth below the existing ground surface at the intervals shown on the Drawings.

b. Silt fence and Super Silt Fence shall be installed to the limits shown on the Drawings and shall be installed in accordance with the details shown on the Drawings.

c. The Contractor shall install erosion control measures prior to, during, and after any earth disturbance and perform maintenance and corrective actions as deemed necessary by the COR and authorities having jurisdiction during and after installation of erosion control measures.

d. The formation of concentrated flows on the drainage slope above the Compost Filter Sock or other measures are not permitted. If concentrated flow does occur, direct slope stabilization measures shall be employed to prevent such conditions.

e. The temporary access road shall be constructed as shown on the Drawings.

f. Riprap stream protection at the discharge end of the pump around shall be constructed as shown on the Drawings.

g. Surface water shall be diverted away from excavations by means of diversion compost filter sock, diversion ditches, and diversion berms.

h. During dewatering operations, the effluent shall be filtered through a pumped water filter bag approved by the erosion control permitting agency or pumped into a temporary sediment trap that has been constructed in accordance with West Virginia Erosion and Sediment Control Field Manual and the West Virginia Erosion and Sediment Control Best Management Practice Manual and shall be removed in their entirety from the site following completion of the work.

i. The Contractor shall schedule and conduct his operations to limit erosion of soils, and to prevent silting and muddying of downstream systems.

j. Construction of drainage facilities and performance of Work that will contribute to the control of erosion and sedimentation shall be carried out in conjunction with earthwork operations, or as soon thereafter as practicable. The area of bare soil exposed at any one time by construction operations shall be limited. Temporary seed and mulch areas within 4 days when areas will not be re-disturbed for more than 14 days.

k. The tires of all vehicles shall be cleaned prior to leaving the site. In the event that sediment is inadvertently tracked onto roadways, Contractor shall clean roadway in accordance with WVDEP requirements.

l. All access and haul roads used during construction shall have cross drains installed in all drainage ways. Road surfaces shall be free draining. Concentrations of water shall be directed into stabilized water courses or piped to stable outlets. Debris shall be disposed of at an approved landfill.

m. Concrete washdown of tools, concrete mixer chutes, hoppers, and the rear of vehicles shall be performed at the concrete waste management location identified in the approved Pollution Control Plan. Washout of the concrete mixer drum at the construction site is prohibited.

n. The Contractor shall not stockpile equipment, topsoil, materials, etc. in otherwise undisturbed areas and areas indicated for the preservation of existing vegetation.

o. Temporary soil stockpiles shall be stabilized with temporary seeding and mulching and protected with compost filter sock as shown on the Drawings.

p. Permanent seeding and mulching shall occur within 4 days of reaching final grade and final stabilization shall be within 4 days after construction is completed as outlined in

Construction Specification 6, Seeding, Sprigging, and Mulching.

q. The project site shall be available at all times for inspection by authorized employees of WVDEP and the Project Sponsors.

r. The Contractor shall always maintain copies of the approved Pollution Control Plan and SWPPP on site.

s. Should any specified measures prove incapable of adequately removing sediment from on-site flows prior to discharge of stabilizing the surface involved, additional measures shall be immediately implemented to address such problems. All costs for any additional measures are not eligible for additional compensation from the Federal Government or Project Sponsors.

11) In Section 4 – Chemical Pollution

a. All discharges leaving the site shall be composed entirely of storm water and natural stream flow, with the exception of discharges from firefighting activities; fire hydrant flushing; potable water sources including water line flushing; irrigation drainage; air conditioning condensate; springs; uncontaminated ground water; and foundation or footing drains where flows are not contaminated with process materials or pollutants.

b. Pollutants such as fuels, lubricants, bitumens, raw sewage, and other harmful materials shall not be discharged into or near rivers, streams and impoundments, or into natural or man-made channels leading thereto.

c. All applicable regulations of fish and wildlife agencies and statutes relating to the prevention and abatement of pollution shall be complied with.

d. Sanitary facilities such as chemical toilets, and sumps, tanks, or barrels used to temporarily store chemical pollutants such as drained lubricating oils, shall be disposed of in accordance with applicable regulations of the State of West Virginia.

12) In Section 5 – Air Pollution, there are no firebreaks or guards to be constructed.

13) In Section 6 – Maintenance, Removal, and Restoration

a. Until the site is stabilized, all erosion and sedimentation control measures shall be maintained properly. Maintenance shall include inspection of all erosion and sedimentation control every 4 days and within 24 hours after each runoff event of 0.25 inches or greater in a 24-hour period. All prevention and remedial maintenance work, including clean out, repair, replacement, regrading, reseeding, remulching, and renetting, shall be performed immediately and shall meet the standards of the West Virginia Erosion and Sediment Control Field Manual and the West Virginia Erosion and Sediment Control Best Management Practice Manual.

b. Any disturbed area on which activity has ceased and that will remain exposed for more than 14 days shall be seeded and mulched within 4 days. Apply temporary seed mix and mulch as specified in Construction Specification 6, Seeding, Sprigging, and Mulching. A permanent vegetative cover shall be applied to areas that will be left unworked for a period of more than 6 months. Areas mulched during the non-germinating period of December 1st to March 1st shall be limed, fertilized, seeded, and mulched by April 20.

c. All temporary erosion and sediment control measures shall be removed within 30 days after final site stabilization as determined by the Contracting Officer.

14) In Section 7 – Measurement and Payment, Method 3 will apply.

15) Items of work subsidiary to this Bid Item are:

a. Temporary Seeding and Mulching, Construction Specification 6 – Seeding, Sprigging, and Mulching.

b. Water for Construction, Construction Specification 10 – Water for Construction

****End of Construction Specification 5****

CONSTRUCTION SPECIFICATION 6—SEEDING, SPRIGGING, AND MULCHING

1. Scope

The work consists of preparing the area for treatment; furnishing and placing seed, sprigs, mulch, fertilizer, inoculant, lime, and other soil amendments; and anchoring mulch in designated areas as specified.

The following BioPreferred® product categories are applicable to this specification:

- Mulch and compost materials
- Erosion control materials
- Fertilizers
- Agricultural spray adjuvants

2. Material

Seed—All seed must conform to the current rules and regulations of the State where it is being used and must be from the latest crop available. It must meet or exceed the standard for purity and germination listed in Section 7.

Seed must be labeled in accordance with State laws and U.S. Department of Agriculture rules and regulations under the Federal Seed Act in effect on the date of invitations for bids. Bag tag figures are evidence of purity and germination. No seed may be accepted with a test date of more than 9 months before the date of delivery to the site.

Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be accepted. The percent of noxious weed seed allowable must be as defined in the current State laws relating to agricultural seeds. Each type of seed must be delivered in separate sealed containers and fully tagged unless an exception is granted in writing by the Contracting Officer.

Fertilizer—Unless otherwise specified, the fertilizer must be a commercial-grade fertilizer. It must meet the standard for grade and quality specified by State law. Where fertilizer is furnished from bulk storage, the contractor must furnish a supplier's certification of analysis and weight. When required by the contract, a representative sample of the fertilizer must be furnished to the Contracting Officer for chemical analysis.

Inoculants—The inoculant for treating legume seeds must be a pure culture of nitrogen-fixing bacteria prepared specifically for the species and must not be used later than the date indicated on the container or as otherwise specified. A mixing medium, as recommended by the manufacturer, must be used to bond the inoculant to the seed. Two times the amount of the inoculant recommended by the manufacturer must be used, except that four times the amount must be used when seed is applied using a hydraulic seeder. Seed must be sown within 24 hours of treatment and must not remain in the hydraulic seeder longer than 4 hours.

Lime and other soil amendments—Lime must consist of standard ground agriculture limestone, or approved equivalent. Standard ground agriculture limestone is defined as ground limestone meeting current requirements of the State department of agriculture. Other soil amendments must meet quality criteria and application requirements specified in Section 7.

Mulch tackifiers—Asphalt emulsion tackifiers must conform to the requirements of ASTM D977, Specification for Emulsified Asphalt. The emulsified asphalt may be rapid setting, medium setting, or slow setting. Nonasphaltic tackifiers required because of environmental considerations must be as specified in Section 7.

Straw mulch material—Straw mulch must consist of wheat, barley, oat or rye straw, hay, grass cut from native grasses, or other plants as specified in Section 7. The mulch material must be air-dry, reasonably

light in color, and must not be musty, moldy, caked, or otherwise of low quality. The use of mulch that contains noxious weeds is not permitted. The Contractor must provide a method satisfactory to the contracting officer for determining weight of mulch furnished.

Other mulch materials—Mulching materials, such as wood cellulose fiber mulch, mulch tackifiers, synthetic fiber mulch, netting, and mesh may be required for specialized locations and conditions. These materials, when specified, must be accompanied by the manufacturer's recommendations for methods of application.

3. Seeding mixtures, sod, sprigs, and dates of planting

The application rate per acre for seed mixtures, sprigs, or sod and date of seeding or planting must be as shown on the plans or as specified in Section 7.

4. Seedbed preparation and treatment

Areas to be treated must be dressed to a smooth, firm surface. On sites where equipment can operate on slopes safely, the seedbed must be adequately loosened (4 to 6 inches deep) and smoothed. Depending on soil and moisture conditions, disking or cultipacking, or both, may be necessary to properly prepare a seedbed. Where equipment cannot operate safely, the seedbed must be prepared by hand methods by scarifying to provide a roughened soil surface so that broadcast seed will remain in place.

If seeding is to be accomplished immediately following construction operations, seedbed preparation may not be required except on a compacted, polished, or freshly cut soil surface.

Rocks larger than 6 inches in diameter, trash, weeds, and other debris that will interfere with seeding or maintenance operations must be removed or disposed of as specified in Section 7.

Seedbed preparation must be discontinued when soil moisture conditions are not suitable for the preparation of a satisfactory seedbed as determined by the responsible Engineer.

5. Seeding, sprigging, fertilizing, mulching, and stabilizing

All seeding or sprigging operations must be performed in such a manner that the seed or sprigs are applied in the specified quantities uniformly in the designated areas. The method and rate of seed application must be as specified in Section 7. Unless otherwise specified, seeding or sprigging must be accomplished within 2 days after final grading is completed and approved.

Fertilizer, lime, and other soil amendments must be applied as specified in Section 7. When specified, the fertilizer and soil amendments must be thoroughly incorporated into the soil immediately following surface application.

The rate, amount, and kind of mulching or mesh must be as specified in Section 7. Mulches must be applied uniformly to the designated areas. They must be applied to areas seeded not later than 2 working days after seeding has been performed. Straw mulch material must be stabilized within 24 hours of application using a mulch crimper or equivalent anchoring tool or by a suitable tackifier. When the mulch crimper or equivalent anchoring tool is used, it must have straight blades and be the type manufactured expressly for and capable of firmly punching the mulch into the soil. Where the equipment can be safely operated, it must be operated on the contour. Hand methods must be used where equipment cannot safely operate to perform the work required.

The tackifier must be applied uniformly over the mulch material at the specified rate, or it must be injected into the mulch material as it is being applied. Mesh or netting stabilizing materials must be applied smoothly but loosely on the designated areas. The edges of these materials must be buried or securely anchored using spikes or staples as specified in Section 7.

The Contractor must maintain the mesh or netting areas until all work under the contract has been completed and accepted. Maintenance must consist of the repair of areas damaged by water erosion, wind, fire, or other causes. Such areas must be repaired to reestablish the intended condition and to the

design lines and grades required by the contract. The areas must be refertilized, reseeded, and remulched before the new application of the mesh or netting.

6. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, each area treated is measured as specified in Section 7 and the area is calculated to the nearest 0.1 acre. Payment for treatment is made at the contract unit price for the designated treatment, which will constitute full compensation for completion of the work.

When specified as an item of work, mesh or netting is measured to the nearest square yard of surface area covered and accepted. Payment is made at the contract unit price and will constitute full compensation for completion of the work.

Method 2—For items of work for which specific lump-sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for this item is made at the contract lump-sum price for the item and constitutes full compensation for the completion of the work.

Method 3—For items of work for which lump-sum prices are established in the contract, payment is made as the work proceeds. Progress payments are determined as specified in section 7. Payment of the lump sum contract price constitutes full compensation for completion of the work.

All Methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7.

7. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Bid Item 5 – Permanent Seeding and Mulching

1) This item consists of preparing the area for treatment; furnishing and placing seed, sprigs, mulch, fertilizer, inoculant, lime, and other soil amendments, and erosion control blanket in designated areas shown on the Drawings and as specified herein.

2) In Section 2 – Material

   a. Submit product data for seed mix, fertilizer, mulch, and other associated materials to COR for approval.

   b. Seed mix shall meet the requirements of West Virginia Department of Environmental Protection (WVDEP) Erosion and Sediment Control Best Management Practice Manual:

      i. Kentucky 31 Fescue (*Festuca arundinacea*) 65 lbs/Acre

      ii. Red Fescue (*Festuca rubra*) 20 lbs/Acre

      iii. Birdsfoot Trefoil (*Lotus corniculatus*) 5 lbs/Acre

      iv. In addition, a nurse crop of temporary seed mix shall be added to the permanent seeding mixture for planting periods shown in the Temporary Seeding Schedule at the following application rates:

         - Annual Rye (*Lolium multiflorum*): 25 pounds per acre
         - Japanese Millet (*Echinochloa crusgalli*): 15 pounds per acre
         - Winter Rye (*Secale cereale*): 90 pounds per acre

   c. Minimum purity: 98%

   d. Minimum germination: 85%

   e. Fertilizer: 10-20-20 Analysis Commercial Fertilizer

   f. Lime: Pulverized with 100% passing the U.S. Number 10 sieve, minimum 90% passing the U.S. Number 20 sieve, and minimum 60% passing the U.S. Number 100 sieve. Limes shall meet one of the following chemical requirements:

   g. Type MH-High Magnesium (Dolomite), 21% MgO, 20% CaO, 43% $MgCO_3$ and 51% $CaCO_3$

   h. Type MO-Mixed Oxides (Magnesium), 50% MgO + CaO

3) In Section 3 – Seeding Mixtures, Sod, Sprigs, and Dates of Planting, seed mix shall be applied between March 1 – April 15 and August 1 – October 1.

4) Seeding rates shall be increased by 50% for dormant seedings (December 1 to March 1). A nurse crop of Winter Wheat (Triticum aestivum) shall be added with a dormant seeding at the rate of 90 lbs/Acre.

5) In Section 4, Seedbed Preparation and Treatment, roots, limbs rocks larger than 2 inches in diameter shall be removed. All debris resulting from the seeding shall be removed from the worksite and disposed of in a landfill in accordance with all state and local regulations and laws. Costs for offsite disposal, including all necessary permits and fees, shall be incidental to the work.

6) In Section 5 – Seeding, Sprigging, Fertilizing, Mulching, and Stabilizing

   a. Apply seed by broadcasting, drilling, or by hydroseeding according to the West Virginia Erosion and Sediment Control Field Manual and West Virginia Erosion and Sediment Control Best Management Practice Manual. Perform all planting operations at right angles to the slope. Necessary site preparation, roughening of the soil surface, should be

done just prior to seeding. All required seedbed preparation, loosening of soil by disking or dozer tracking, should be performed just prior to seeding.

b. Perform soil sample analysis for topsoil in accordance with County Agriculture Extension Service recommendations and provide recommendations for adjustments to specified lime and fertilizer application rates. Submit results to COR for review.

c. Agricultural lime shall be applied at the rate of 90 pounds per 1000 SY. Fertilizer shall be applied at the rate of 23 pounds per 1000 SY. Agricultural lime and fertilizer shall be incorporated into the surface during tillage.

d. Before seeding commences, topsoil shall be smoothed with a drag and all clods broken up. All deleterious material, large stones, roots, limbs, and other debris shall be removed to leave a smooth area that would be suitable for mowing. Conform to the tolerance requirements in Construction Specification 26, Topsoiling.

e. Mulch on all seeded areas, except the auxiliary spillway entrance section, shall be Erosion Control Blanket and shall consist of Type 2.D Short-Term Temporary Rolled Earth Erosion Control Product (RECP) meeting the requirements of the West Virginia Erosion and Sediment Control Best Management Practice Manual Section 3.13. The product shall contain 100% agricultural straw and two organic jute nets securely sewn together with biodegradable thread. Polypropylene netting is prohibited. Provide biodegradable stakes.

f. The Erosion Control Blanket shall be installed according to the manufacturer's recommendations and the West Virginia Erosion and Sediment Control Best Management Practice Manual Section 3.13. The Contractor shall be responsible for temporary irrigation and for maintaining planting to optimal soil moisture content to establish permanent vegetation up to Final Payment and Acceptance.

g. Topsoil and seed before installation of the Erosion Control Blanket unless otherwise directed by the COR based on manufacturer's recommendations.

h. The Contractor must maintain the Erosion Control Blanket until all work under the contract has been completed and accepted. Maintenance must consist of the repair of areas damaged by water erosion, wind, fire, or other causes. Such areas must be repaired to reestablish the intended condition and to the design lines and grades required by the contract. The areas must be refertilized and reseeded before the new application of the Erosion Control Blanket.

i. After seeding, and for three months after substantial completion, perform the following:

   i. Mow grass at regular intervals to maintain at a maximum height of 4 inches.

   ii. Do not cut more than ⅓ of grass blade height at any one mowing.

   iii. Maintain optimal soil moisture content for the grass.

   iv. Roll surface to remove minor surface depressions and irregularities.

   v. Immediately reseed areas which show bare spots.

7) In Section 6 – Measurement and Payment, Method 1 (horizontal measurement) will apply.

8) Items subsidiary to this Bid Item include:

   a. Water for Construction, Construction Specification 10 – Water for Construction

B. Subsidiary Item – Temporary Seeding and Mulching

1) This item consists of the any required temporary seeding of disturbed areas within the limits of work, including but not limited to staging areas, temporary access roads, auxiliary spillway, excavation and earthfill areas.

2) This item includes preparing the areas for treatment, furnishing and placing seed, mulch, fertilizer, inoculant, lime, and other soil amendments; and anchoring mulch as shown on the Drawings and as specified herein.

3) Specified requirements for Bid Item 5– Permanent Seeding and Mulching apply to this Subsidiary Item, except as modified below:

4) In Section 2 – Material, Temporary Seeding shall be applied in accordance with the following table:

Temporary Seeding Schedule			
Seed Type	Planting Period	Planting Depth, in	Application Rate, Lbs/Acre
Annual Rye	2/16 – 5/15 and 8/1 – 11/1	0.25	40
Japanese Millet	5/15 – 8/15	0.5	30
Winter Rye	8/15 – 2/28	0.25	170

5) In Section 5 – Seeding, Sprigging, Fertilizing, Mulching, and Stabilizing:

   a. Straw mulch shall be uniformly spread over the entire area at a minimum rate of 2.5 tons per acre and spread to a depth of two inches loose measure.

   b. While moist, straw mulch shall be anchored in the soil by V-type wheel land packer or disc harrow to secure straw firmly in the ground to form a soil binding mulch and prevent loss of bunching by wind. On slopes where machinery cannot be used, mulching material shall be retained in place by shallow covering of earth, by twine and biodegradable stakes, or other suitable means that will not be detrimental to subsequent maintenance.

   c. Approved asphalt emulsion may be used as a "tie-down" in areas inaccessible to equipment and shall be applied uniformly over the entire area and through the mulch at a rate not less than 75 gallons per acre. The tackifier shall be non-toxic to plants and seeds.

6) In Section 6 – Measurement and Payment, no separate payment will be made for Temporary Seeding and Mulching. Compensation for Temporary Seeding and Mulching will be included in the payment for Bid Item 4, Pollution Control, Construction Specification 5 – Pollution Control.

C. Subsidiary Item – Staging and Stockpiling Area Permanent Seeding and Mulching

1) This item consists of preparing the Staging and Stockpiling area for treatment; furnishing and placing seed, sprigs, mulch, fertilizer, inoculant, lime, and other soil amendments; and anchoring mulch as shown on the Drawings and as specified herein.

2) Specified requirements for Bid Item 5 – Permanent Seeding and Mulching apply to this Subsidiary Item, except as modified below:

   a. In Section 6 – Measurement and Payment, no separate payment will be made for Staging and Stockpiling Area Permanent Seeding and Mulching. Compensation for Staging and Stockpiling Area Permanent Seeding and Mulching will be included in the payment for Bid Item 7, Mobilization and Demobilization, Construction Specification 8 – Mobilization and Demobilization.

****End of Construction Specification 6****

CONSTRUCTION SPECIFICATION 7— CONSTRUCTION SURVEYS

1. Scope

The work consists of performing all surveys, measurements, and computations required by this specification.

2. Equipment and material

Equipment for construction surveys shall be of a quality and condition to provide the required accuracy. The equipment shall be maintained in good working order and in proper adjustment at all times. Records of repairs, calibration tests, accuracy checks, and adjustments shall be maintained and be available for inspection by the Engineer. Equipment shall be checked, tested, and adjusted as necessary in conformance with manufacturer's recommendations.

Material is field notebooks, stakes, templates, platforms, equipment, spikes, steel pins, tools, and all other items necessary to perform the work specified.

3. Quality of work

All work shall follow recognized professional practice and the standards of the industry unless otherwise specified in Section 9 of this specification. The work shall be performed to the accuracy and detail appropriate for the type of job. Notes, sketches, and other data shall be complete, recorded neatly, legible, reproducible and organized to facilitate ease in review and allow reproduction of copies for job documentation. Survey equipment that requires little or no manual recording of field data shall have survey information documented as outlined in Section 9 of this specification.

All computations shall be mathematically correct and shall include information to identify the bid item, date, and who performed, checked, and approved the computations. Computations shall be legible, complete, and clearly document the source of all information used including assumptions and measurements collected.

If a computer program is used to perform the computations, the Contractor shall provide the Engineer with the software identification, vendor's name, version number, and other pertinent data before beginning survey activities. Computer generated computations shall show all input data including values assigned and assumptions made.

The elevations of permanent and temporary bench marks shall be determined and recorded to the nearest 0.01 foot. Differential leveling and transit traverses shall be of such precision that the error of vertical closure in feet shall not exceed plus or minus 0.1 times the square root of the traverse distance in miles. Linear measurements shall be accurate to within 1 foot in 5,000 feet, unless otherwise specified in Section 9 of this specification. The angular error of closure for transit traverses shall not exceed 1-minute times the square root of the number of angles turned.

The minimum requirements for placing slope stakes shall be at 100-foot stations for tangents, as little as 25 feet for sharp curves, breaks in the original ground surface and at any other intermediate stations necessary to ensure accurate location for construction layout and measurement. Slope stakes and cross sections shall be perpendicular to the centerline. Significant breaks in grade shall be determined for cross sections. Distances shall be measured horizontally and recorded to the nearest 0.1 foot. Side shots for interim construction stakes may be taken with a hand level.

Unless otherwise specified in Section 9 of this specification, measurements for stationing and establishing the location of structures shall be made to the nearest 0.1 foot.

Elevations for concrete work, pipes, and mechanical equipment shall be determined and recorded to the nearest 0.01 foot. Elevations for earth work shall be determined and recorded to the nearest 0.1 foot.

4. Primary control

The baselines and bench marks for primary control, necessary to establish lines and grades needed for construction are shown on the drawings and have been located on the job site.

These baselines and bench marks shall be used as the origin of all surveys, layouts, and measurements to establish construction lines and grades. The Contractor shall take all necessary precautions to prevent the loss or damage of primary control points. Any stakes or control points lost or damaged by construction activity will be reestablished by the Contractor or at Contractor's expense.

5. Construction surveys

Before work starts that requires the Contractor performed surveys, the Contractor shall submit in writing for the Engineer's review the name, qualifications, and experience of the individuals to be assigned to the survey tasks.

Method 1—Contractor performed surveys shall include:

- checking and any supplemental or interim staking
- performing quantity surveys, measurements, and computations for progress payment
- other surveys as described in Section 9 of this specification

Method 2—Contractor performed surveys shall consist of all work necessary for:

- establishing line and grade for all work
- setting slope stakes for all work
- checking and any supplemental or interim staking
- establishing final grade stakes
- performing quantity surveys, measurements, and computations for progress payment
- other surveys as described in Section 9 of this specification

Method 3—Contractor performed surveys shall consist of all work necessary for:

- establishing line and grade for all work
- setting slope stakes for all work
- checking and any supplemental or interim staking
- establishing final grade stakes
- performing quantity surveys, measurements, and computations for progress payments
- performing original (initial) and final surveys for determinations of final quantities
- other surveys as described in Section 9 of this specification.

6. Staking

The construction staking required for the item shall be completed before work on any item starts. Construction staking shall be completed as follows or as otherwise specified in Section 9 of this specification:

Clearing and grubbing—The boundary of the area(s) to be cleared and grubbed shall be staked or flagged at a maximum interval of 200 feet, closer if needed, to clearly mark the limits of work. When Contractor staking is the basis for determining the area for final payment, all boundary stakes will be reviewed by the Engineer before start of this work item.

Excavation and fill—Slope stakes shall be placed at the intersection of the specified slopes and ground

line. Slope stakes and the reference stakes for slopes shall be marked with the stationing, required cut or fill, slope ratio, and horizontal distance from the centerline or other control line. The minimum requirements for placing slope stakes is outlined in Section 3, Quality of work.

Structures—Centerline and offset reference line stakes for location, alignment, and elevation shall be placed for all structures.

7. Records

All survey data shall be recorded in fully identified standard hard-bound engineering survey field notebooks with consecutively numbered pages. All field notes and printed data shall include the purpose or description of the work, the date the work was performed, weather data, sketches, and the personnel who performed and checked the work. Electronically generated survey data and computations shall be bound, page numbered, and cross referenced in a bound field notebook containing the index for all survey activities. All work shall follow recognized professional practice.

The construction survey records shall be available at all times during the progress of the work for examination and use by the Engineer and when requested, copies shall be made available. The original field notebooks and other records shall be provided to and become the property of the owner before final payment and acceptance of all work.

Complete documentation of computations and supporting data for progress payments shall be submitted to the Engineer with each invoice for payment as specified in Section 9 of the specification. When the Contractor is required to conduct initial and final surveys as outlined in Section 5, Construction Surveys, notes shall be provided as soon as possible after completion to the engineer for the purpose of determining final payment quantities.

8. Payment

Method 1—For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds, after presentation of correct and accurate invoices by the contractor showing related costs and evidence of the charges of suppliers, subcontractors, and others for supplies furnished and work performed. Invoices for the total amount of the contract price will not be accepted until all surveys are complete and required documentation has been determined complete. If the total of such payments is less than the lump sum contract price for this item, the unpaid balance will be included in the final contract payment. Payment of the lump sum contract price will constitute full compensation for completion of all work under the bid item.

Method 2—For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds with progress payment amounts determined as a percentage of the total work planned as projected from the contractor's approved construction schedule. Payment of the lump sum contract price will constitute full compensation for completion of all work under this bid item.

All Methods—Payment will not be provided under this item for the purchase price of materials or equipment having a residual value.

Compensation for any item of work described in the contract, but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the item to which they are made subsidiary are identified in Section 9 of this specification.

9. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Bid Item 6 – Construction Surveys

1) This item consists of the surveying necessary for construction of the works of improvement shown on the drawings, including establishing survey controls, line and grade, setting slope stakes, checking existing staking and performing supplemental or interim staking, establishing final grade stakes, performing quantity surveys, measurements, computations for progress payments, and performing initial and final surveys for determinations of final quantities and for record drawings prepared by the COR. The neat lines shown on the Drawings will be used for the final payment quantities. Any approved excavation beyond the neat lines will be surveyed by the Contractor and quantities computed during construction.

2) The Contractor shall perform initial ground survey after topsoil is stripped and before any excavation is performed or earthfill is placed. Submit the initial ground survey to the COR for review and approval in accordance with the requirements of this section. The Contractor's approved initial ground survey will define the ground surface before construction for measurement and payment purposes.

3) In Section 3 – Quality of Work

   a. All surveys, as well as electronic models created for the purpose of aiding the Contractor in stake out and/or quantity computations and field layout and staking, shall be completed by or under responsible charge of professional staff licensed to practice surveying in the State of West Virginia.

   b. At least 14 calendar days prior to the start of construction operations, the Contractor shall furnish in writing to the COR, for approval, the names and qualifications of the persons proposed to perform the construction surveys.

   c. All points shall be located with respect to the datum specified on the Drawings.

   d. Linear measurement shall be accurate to within 1.0 ft in 10,000 ft.

   e. The angular error of closure for transit traverses shall not exceed 20 seconds times square root of the number of angles turned.

4) In Section 5 – Construction Surveys, Method 3 will apply. Quantity surveys for measurement of excavation, earthfill, drainfill, and roller compacted concrete placement quantities shall include surveyed cross-sections at the end of each area surveyed and spaced no more than 50 feet apart, at all grade changes, and at each section and profile shown on the Drawings. Each cross-section shall have points located at the top and bottom slopes, at all slope break lines, and intermediate points to ensure an accurate quantity survey.

5) Contractor may utilize survey methods involving drones or similar unmanned aerial vehicles if approved in writing by the COR. Contractor shall be responsible for demonstrating that the tolerances specified herein can be achieved with the proposed method. All drone surveys shall meet the quality requirements specified herein.

6) Plan view surveys and cross-section surveys for all Bid Item quantities measured by survey shall be provided by the Contractor. Cross sections or three-dimensional, computer-generated terrain models for progress payment determinations shall be produced by the Contractor at the same locations established in the initial surveys for quantity measurements. The Contractor's locations for cross sections shall be approved by the COR prior to any work activities.

7) Survey submittals shall include a plan view with points identified and electronic delivery of point data. Survey information shall have sufficient point data to generate contours and terrain models realistic of the site conditions. Break-lines and other site constraints needed for the generation of realistic terrain models shall be included with the submittal.

8) Survey points for vertical and horizontal control were established prior to the contract and shall be located or reestablished by the Contractor and used for control. If the survey points are within the work area, the contractor shall relocate the points to an area outside of, but convenient to the work area.

9) In Section 7 – Records, provide final as-built survey documentation to record the condition of the completed Work, document any changes that were installed, and confirm that the project was constructed according to the plans and specifications. Drawings shall be submitted electronically in a file format compatible with AutoCAD Civil 3D 2020, as well as a scaled plot on 22-inch by 34-inch paper which shall bear the seal, date, and signature of a Professional Surveyor currently licensed in the State of West Virginia. At a minimum, the following items shall be recorded:

   a. Foundation subgrade elevations, at a minimum at each full station and at any abrupt change in the centerline profile

   b. Dam crest and auxiliary spillway profile elevations and site grades, at a minimum at each full station, as well as along the auxiliary spillway centerline and along the maximum embankment section.

   c. Auxiliary spillway structures dimensions and elevations

   d. Topographic information for the area bounded by the limits of disturbance shown on the Drawings

   e. Horizontal and vertical limits of rock riprap

   f. Inverts of all principal spillway conduit segments that are impacted by the work

   g. Locations, dimensions, and elevations of concrete structures following each pour

   h. Horizontal and vertical limits of drainfill

   i. Drain collection pipe and outlet pipe invert elevations, at a minimum at each fitting, cleanout, and at the pipe ends

   j. Water control gate invert and top elevations

   k. Abandoned structures/items and instrumentation left in place

   l. Field changes of dimension and detail

   m. Changes authorized by Change Order, Field Order, Request for Information, addenda, or submittals

10) Measurement and payment for geotechnical instrumentation surveys are not included under this bid item.

11) In Section 8 – Payment, Method 2 will apply.

B. Subsidiary Item – Geotechnical Instrumentation Surveys

1) This item shall consist of the surveying necessary for establishing and recording locations and elevations of instrumentation to be installed as shown on the construction drawings and per Construction Specification 401, Geotechnical Instrumentation.

2) In Section 5, Construction Surveys, tasks specific to this item of work are outlined in Construction Specification 401, Geotechnical Instrumentation.

3) In Section 8, Payment, no separate payment will be made for Geotechnical Instrumentation Surveys. Compensation for Geotechnical Instrumentation Surveys will be included in the payment for Bid Item 46, Geotechnical Instrumentation, Construction Specification 401 – Geotechnical Instrumentation.

****End of Construction Specification 7****

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CONSTRUCTION SPECIFICATION 8—MOBILIZATION AND DEMOBILIZATION

1. Scope

The work consists of the mobilization and demobilization of the Contractor's forces and equipment necessary for performing the work required under the contract. It does not include mobilization and demobilization for specific items of work for which payment is provided elsewhere in the contract. Mobilization will not be considered as work in fulfilling the contract requirements for commencement of work.

2. Equipment and material

Mobilization shall include all activities and associated costs for transportation of Contractor's personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary general facilities for the Contractor's operations at the site; premiums paid for performance and payment bonds including coinsurance and reinsurance agreements as applicable; and other items specified in Section 4 of this specification.

Demobilization shall include all activities and costs for transportation of personnel, equipment, and supplies not required or included in the contract from the site; including the disassembly, removal, and site cleanup of offices, buildings, and other facilities assembled on the site specifically for this contract.

This work includes mobilization and demobilization required by the contract at the time of award. If additional mobilization and demobilization activities and costs are required during the performance of the contract as a result of changed, deleted, or added items of work for which the Contractor is entitled to an adjustment in contract price, compensation for such costs will be included in the price adjustment for the item or items of work changed or added.

3. Payment

Payment will be made as the work proceeds, after presentation of paid invoices or documentation of direct costs by the Contractor showing specific mobilization and demobilization costs and supporting evidence of the charges of suppliers, subcontractors, and others. When the total of such payments is less than the lump sum contract price, the balance remaining will be included in the final contract payment. Payment of the lump sum contract price for mobilization and demobilization will constitute full compensation for completion of the work.

Payment will not be made under this item for the purchase costs of materials having a residual value, the purchase costs of materials to be incorporated in the project, or the purchase costs of operating supplies.

4. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Bid Item 7 – Mobilization and Demobilization

1) The item consists of the mobilization and demobilization of the Contractor's forces and equipment necessary for performing the work required under the contract. It does not include mobilization and demobilization for specific items of work for which payment is provided elsewhere in the contract. Mobilization will not be considered as work in fulfilling the contract requirements for commencement of work.

2) This item also includes providing necessary signage, signals, and/or flagmen at all site entrances. The Contractor is entirely responsible for traffic and pedestrian control and maintenance on this project, including safe entry and exit for the construction entrances for construction vehicles and inspectors, as well as barriers and detours to deter public access.

3) The Contractor shall provide sanitary facilities (chemical toilets) at the site. A portable sink system with water and wastewater storage shall also be provided. Toilets and sink system shall be located within the work limits. The Contractor shall be responsible for maintaining the toilets and sink system in a clean, healthy manner and removing them from the site at the completion of work. Two toilets shall be provided, one for women and one for men, labeled applicably.

4) This item also includes the following activities to be performed within the limits of the Allowable Staging and Stockpiling Area. The maximum limits of disturbance for the Contractor Staging and Stockpiling Area are shown on the Drawings; however, the Contractor may elect to disturb less area at his discretion.

   a. Stripping and temporary stockpiling of existing topsoil.

   b. Respreading topsoil and seeding allowable staging and stockpiling disturbed areas.

5) This item also includes the following activities performed within the limits of the Allowable Staging and Stockpiling Area if necessary to suit the Contractor's needs:

   a. Site grading (i.e., excavation and earthfill).

   b. Temporarily covering all allowable staging and stockpiling disturbed areas with geotextile and crushed stone.

   c. Removing and disposing of geotextile and crushed stone.

6) This item also includes installation, maintenance, and removal of temporary access roads and stream crossings as shown on the Drawings, including restoration of the disturbed areas as specified herein.

7) Submit Staging and Stockpiling Plan to the COR for approval within 21 days of contract award and prior to beginning the work. Plan shall include, but is not limited to, sketches and figures clearly illustrating proposed limits of disturbance, grading, locations of stockpiles, parking, field offices, sheds, haul roads and other equipment.

8) Demobilization shall include the items of work enumerated in Section 2, Equipment and material of this specification. Demobilization shall also include restoration of the project area and the removal of all debris, trash, tires, equipment, equipment parts, chains, cables, and other such items resulting from the construction operation. This material shall be removed from the worksite and disposed of in an approved sanitary landfill of the Contractor's own choosing. No separate payment will be made for these restoration activities.

9) Demobilization shall also include the repair of any damage to paved public roads within the project vicinity in accordance with West Virginia Department of Transportation standards and used for heavy equipment access and material deliveries that exceeds the weight limits for

those roads. Damaged areas shall be repaired to pre-work condition or better to the satisfaction of the COR. No separate payment will be made for these restoration activities.

10) All disturbed areas shall be bladed or smoothed to blend the area with the surrounding land surface. The bladed or smoothed surface shall be free of abrupt mounds, windrows, depressions or other irregularities that would prevent the safe operation of ordinary farm equipment thereon. The finished surface shall prevent diversion of surface runoff and shall prevent standing or ponding water.

11) All buildings, trailers, temporary fencing, storage sheds, sanitary facilities, and other such items shall be removed from the worksite when construction work is completed.

12) All fencing removed to allow construction access shall be restored to equal or better than preconstruction conditions.

13) All temporary utilities shall be removed from the site as required by the owner of the utility after construction work is completed.

14) All traffic control devices, warning signs, barricades and any other material used for traffic control shall be removed.

15) Items of work subsidiary to this Bid Item are:

    a. Staging and Stockpiling Area Permanent Seeding and Mulching, Construction Specification 6 – Seeding, Sprigging, and Mulching.

    b. Mobilization and Demobilization for Earthfill, Construction Specification 23 – Earthfill.

    c. Staging and Stockpiling Areas for Topsoiling, Construction Specification 26 – Topsoiling.

    d. Geotextile, Construction Specification 95 – Geotextile.

16) Payment will be made for only initial mobilization and demobilization of the equipment necessary to perform the work. No additional payment will be made for equipment moved from or back to the site during the performance of the work.

17) Up to seventy-five percent (75%) of the lump sum amount for this bid item may be submitted for payment upon completion of mobilization as defined in this specification. The remaining twenty-five percent (25%) of the lump sum amount for this bid item may not be submitted for payment until the completion of the project to ensure proper clean-up and removal of equipment, parts, supplies, and all other such items.

****End of Construction Specification 8****

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CONSTRUCTION SPECIFICATION 10—WATER FOR CONSTRUCTION

1. Scope

The work consists of furnishing, transporting, measuring, and applying water as specified.

2. Facilities and equipment

The contractor shall install and maintain access and haul roads and furnish, operate, and maintain all pumps, meters, piping, tanks, storage, and other facilities required to load, transport, store, distribute, and use construction water as specified.

These facilities shall be equipped with accurate, work dedicated meters; tanks of known volume; or other devices that provide a correct measurement of water supplied. Meters shall be installed at the point of delivery into water hauling equipment or application system, such as sprinkler systems or flooding systems, as specified.

3. Dust abatement and haul road maintenance

Water for dust abatement and haul road maintenance shall be applied to haul roads and other dust producing areas as needed to prevent air pollution or excessive dust (which causes impaired vision on trafficked roads and in work areas) and to maintain the roads in good condition for safe and efficient operation during periods of use. Roads that may be jointly used with the public and by the contractor's equipment shall have dust abatement provisions acceptable to the public entity that has road maintenance responsibility. Compensation for water used for dust abatement and haul road maintenance shall be as specified in section 8 of this specification.

4. Earthfill, drainfill, and rockfill

Water required for proper installation of earthfill, drainfill, and/or rockfill shall be used in the fill materials as specified in the applicable construction specification(s). Compensation for construction water used for earthfill, drainfill, and/or rockfill shall be as specified in section 8 of this specification.

5. Concrete, mortar, and grout

Water required in the mixing or curing of concrete, shotcrete, roller compacted concrete, or other portland cement mortar or grout shall meet the requirements of the applicable construction specifications and shall be used in conformance with those specifications. Payment for construction water used in these items is covered by the applicable concrete, mortar, or grout specification, or a combination of these.

6. Other construction requiring water

Water required and used for other construction activities under this contract, but not specifically covered by this specification shall be considered subsidiary to the item(s) of work that requires its use.

7. Measurement and payment

Method 1—For water items for which specific unit prices are established in the contract, the volume of water furnished and used in accordance with the specifications will be measured to the nearest 1,000 gallons.

Payment for water is made at the contract unit price. Such payment will constitute full compensation for the direct costs of water. All other costs necessary for transportation, distribution, and application are subsidiary to the items of work with which they are associated.

Method 2—For water items for which specific unit prices are established in the contract, the volume of water furnished and used in accordance with the specifications will be measured to the nearest 1,000 gallons.

Payment for water and the cost associated with transportation, distribution, and application is made at the

contract unit price. Such payment will constitute full compensation for completion of the work.

Method 3—For water items for which specific unit prices are established in the contract, the volume of water used in accordance with the specifications will be measured to the nearest 1,000 gallons.

Payment for water is made at the contract unit price. Such payment, excluding water cost, will constitute full compensation for completion of the work.

All methods—The following provisions apply to all methods of measurement and payment:

- The measurement for payment will include all water used except as noted in sections 5, 6, and 8 of this specification. Measurement for payment will not include water that is used inappropriately or in excess of that needed to accomplish the specified task.

- Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 8 of this specification.

8. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Subsidiary Item – Water for Construction

1) This item shall consist of locating, providing, conveying, spreading, and sprinkling of water as applicable for dust abatement, earthfill, drainfill, topsoil, establishing permanent vegetative cover, mixing roller compacted concrete, and any other construction activity.

2) Water shall be obtained from the on-site stream/lake, an off-site source, or from an on-site well installed by the Contractor. If the Contractor proposes to install a well, they shall be responsible for obtaining the required permits and adhering to applicable local, state, and federal regulations. Wells, if used, shall be installed and abandoned to the satisfaction of the COR. Submit well installation and abandonment details to COR for review and approval. Submit well abandonment records to COR.

3) In Section 7 – Measurement and Payment, no separate payment will be made for this item of work. Compensation for this item will be included in the payment for:

   a. Construction Specification 3, Bid Item 3, Trench Drain Abandonment
   b. Construction Specification 5, Bid Item 4, Pollution Control
   c. Construction Specification 6, Bid Item 5, Permanent Seeding and Mulching
   d. Construction Specification 23, Bid Item 12, Earthfill
   e. Construction Specification 24, Bid Item 13, Fine Drainfill
   f. Construction Specification 24, Bid Item 14, Coarse Drainfill
   g. Construction Specification 36, Bid Item 23, Roller Compacted Concrete
   h. Construction Specification 61, Bid Item 31, Embankment Upstream Stability Berm
   i. Construction Specification 63, Bid Item 32, Rock Foundation Preparation, Embankment
   j. Construction Specification 63, Bid Item 33, Rock Foundation Preparation, ASW

****End of Construction Specification 10****

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CONSTRUCTION SPECIFICATION 11—REMOVAL OF WATER

1. Scope

The work consists of the removal of surface water and ground water as necessary to perform the construction required by the contract in accordance with the specifications. It shall include: (1) constructing, installing, building, and maintaining all necessary temporary water containment facilities, channels, and diversions; (2) furnishing, installing, and operating all necessary pumps, piping, and other facilities and equipment; and (3) removing all such temporary works and equipment after their intended function is no longer required.

2. Diverting surface water

The Contractor shall install, maintain, and operate all cofferdams, channels, flumes, sumps, and all other temporary diversion and protective works needed to divert streamflow and other surface water through or around the construction site. Control of surface water shall be continuous during the period that damage to construction work could occur. Unless otherwise specified and/or approved, the diversion outlet shall be into the same drainageway that the water would have reached before being diverted.

The Contractor shall furnish the Contracting Officer, in writing, a proposed plan for diverting surface water before beginning any construction activities for which a diversion is required, unless waived in Section 8 of this specification. Acceptance of this plan or the waiving of the plan requirement will not relieve the contractor of the responsibilities related to this activity during the process of completing the work as specified.

3. Dewatering the construction site

Foundations, cutoff trenches, and all other parts of the construction site shall be dewatered and kept free of standing water and muddy conditions as necessary for the proper execution of the work. The Contractor shall furnish, install, operate, and maintain all drains, sumps, pumps, casings, well points, and all other equipment required to properly dewater the site as specified. Dewatering systems that cause a loss of soil fines from the foundation areas will not be permitted.

The Contractor shall furnish the Contracting Officer, in writing, a proposed plan for dewatering before commencing with any construction activity for which dewatering may be required, unless waived in Section 8 of this specification. Acceptance of this plan or the waiving of the plan requirement will not relieve the Contractor of the responsibilities for completing the specified work.

4. Dewatering borrow areas

The Contractor shall maintain all borrow areas free of surface water or otherwise provide for timely and effective removal of surface and subsurface water that accumulates within the borrow area, unless waived in Section 8 of this specification. Borrow material shall be processed as necessary to achieve proper and uniform moisture content at the time of placement.

If pumping to dewater borrow areas is included as a bid item of work in the bid schedule, each pump discharge pipe shall be equipped with a water meter. The meter shall be such that the measured quantity of water is accurate within 3 percent of the true quantity. The contractor shall provide necessary support to perform accuracy tests of the water meter when requested by the Contracting Officer.

5. Erosion and pollution control

Removal of water from the construction site, including the borrow areas, shall be accomplished so that erosion and the transporting of sediment and other pollutants are minimized. Dewatering activities shall be accomplished in a manner that the water table water quality is not altered. Pollution control activities shall not conflict with the requirements of Construction Specification 5, Pollution Control, if it is a part of

this contract.

6. Removal of temporary works

When temporary works are no longer needed, the contractor shall remove and return the area to a condition similar to that which existed before construction. Areas where temporary works were located shall be graded for sightly appearance with no obstruction to natural surface waterflows or the proper functioning and access to the works of improvement installed. The contractor shall exercise extreme care during the removal stages to minimize the loss of soil sediment and debris that was trapped during construction.

Pipes, casings, and any other material used to dewater the site shall be removed from temporary wells. The wells shall be filled to ground level with clean gravel or other suitable material approved by the Contracting Officer. The Contractor shall exercise extreme care to prevent pollution of the ground water by these actions.

7. Measurement and payment

Method 1—Items of work listed in the bid schedule for removal of water, diverting surface water, and dewatering construction sites and borrow areas are paid for at the contract lump sum prices. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Method 2—Items of work listed in the bid schedule for removal of water, diverting surface water, dewatering construction sites, and dewatering borrow areas are paid for at the contract lump sum prices. Such payment will constitute full compensation for furnishing, installing, operating, and maintaining the necessary trenches, drains, sumps, pumps, and piping and for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work. The exception is that additional payment for pumping to dewater borrow areas and the removal of water will be made as described in the following paragraph.

If pumping to dewater borrow areas is a contract bid item, payment is made at the contract unit price, which shall be the price per 1,000 gallons shown in the bid schedule. Such payment will constitute full compensation for pumping only. Compensation for equipment and preparation and for other costs associated with pumping is included in the lump sum payment for removal of water or the lump sum payment for dewatering the borrow areas. Payment is made only for pumping that is necessary to dewater borrow areas that cannot be effectively drained by gravity or that must have the water table lowered to be usable as a suitable borrow source. Pumping for other purposes will not be included for payment under this item.

All Methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the contract line item to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 8 of this specification.

8. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Bid Item 8 –Excavation Dewatering

1) This Item consists of planning, designing, furnishing, installing, operating, maintaining, and removing all foundation dewatering systems necessary for the removal of surface water and ground water to permit construction of the following:

   a. Embankment toe drain, principal spillway conduit extension, impact basin, and rock riprap downstream of impact basin. **Artesian conditions may be encountered during the embankment excavation.**

   b. Auxiliary spillway RCC, drainfill, concrete starter wall, and concrete cutoff wall.

   c. Approved excavation, earthfill and all other work requiring removal of surface water and ground water to permit construction of the work as shown in the Drawings and these specifications.

2) A Professional Engineer registered in the State of West Virginia shall design the dewatering system, oversee its installation, periodically evaluate its performance, and identify and implement modifications and/or additions to the system to meet the performance required under this contract. The dewatering engineer shall have at least five (5) years of experience in design of dewatering systems and with experience on at least two dam foundations in the last five years. The dewatering engineer shall be available for meetings at the project site whenever the system is not operating in accordance with the specifications.

3) In Section 3, The Contractor shall submit an Excavation Dewatering Plan to the COR for review 45 days prior to beginning work activity. The Excavation Dewatering Plan shall be provided with and shall be coordinated with the Excavation Plan required in Construction Specification 21, Excavation and the Fill Placement Plan required in Construction Specification 23, Earthfill. The Excavation Dewatering Plan shall describe means and methods of the dewatering system to comply with the requirements of this specification. The Excavation Dewatering Plan shall include at least the following:

   a. Dewatering system components and layout, (locations, spacing, depths), dewatering pump locations, pipe sizes, capacities, grades, filter sand gradations, water disposal method, and location. All filter sand used in the Contractor's Excavation Dewatering Plan shall meet the gradation requirements for Fine Drainfill as specified in Construction Specification 24, Drainfill.

   b. Location and capacity of power systems.

   c. Detailed description of dewatering system installation procedures, maintenance procedures, and procedures for operation of the system in relation to the proposed sequence of excavation, drain installation, and backfill placement.

   d. Relieving hydrostatic pressures in water-bearing strata below and within excavations to mitigate risk of uplift or other instabilities. Provide narrative and supporting diagrams describing the means, methods, and equipment to meet the performance requirements herein. Specifically address means, methods, and work sequence for collecting, filtering, and lowering groundwater levels related to artesian conditions that may be encountered during excavations.

   e. Narrative and supporting diagrams describing methods, materials, and equipment for maintaining stability of sides and bottoms of excavations and dry excavations at all times in accordance with this specification. Include procedures for preventing loss of soil fines from foundations and excavations.

   f. Narrative describing means and methods to demonstrate the effectiveness, through monitoring or other methods, of the dewatering system and compliance with the requirements of this specification. Describe procedures to implement additional

measures as needed.

g. Monitoring thresholds identifying when the Contractor's dewatering engineer shall be notified to evaluate and mitigate (if necessary) the risk of uplift or other instabilities.

h. Describe the changes in the dewatering program during each phase of construction and the transition between phases.

i. Product Data, including filter materials and dewatering pumps.

j. Methods for disposal of water from excavations in accordance with applicable federal, state, and local regulations (see Construction Specification 5, Pollution Control, for additional requirements).

k. Dewatering system removal and decommissioning procedures. All excavation dewatering measures shall be entirely removed after dewatering operations are discontinued.

4) Design of the excavation dewatering system and preparation of the Excavation Dewatering Plan are the Contractor's responsibility and shall be completed, signed, and sealed by a Professional Engineer's seal registered in the State of West Virginia with expertise in the appropriate technical disciplines and specializing in or having experience with excavation dewatering systems in similar conditions for at least five years. Calculations and shop drawings shall be included with the Plan, as appropriate, to support the Contractor's design. Review of the Contractor's Excavation Dewatering Plan, with or without comments by the COR, does not relieve the Contractor of any responsibility for the adequacy of the Contractor's dewatering system. The Contractor shall be solely responsible for the adequacy of the dewatering system and for coordination with other work.

5) Dewatering systems shall dewater to a minimum depth of 2 feet below all earthen foundations where earthfill material, drainfill material, reinforced concrete, RCC, or any other materials are to be placed. Dewatering below bedrock is not required, although the bedrock foundation surface will need to be treated in accordance with the requirements in CS 63 – Treatment of Rock Surfaces.

6) Prior to starting excavations, all engineering controls for control of water, excavation support and protection, dewatering, and erosion and sediment control shall be installed and operating properly in accordance with the Contract Documents and approved submittals.

7) The Contractor shall monitor groundwater levels along the toe of the existing embankment and shall not begin excavation for the toe drain until the Contractor's dewatering engineer certifies that hydrostatic pressures in water-bearing strata below and within excavations are acceptable for stable excavations. The Contractor shall monitor groundwater levels during the excavation for and construction of the toe drain.

8) No open dewatering trenches will be permitted.

9) At locations where fill, concrete, and other materials are to be placed, excavation surfaces shall be free from flowing or standing water that is in any way detrimental to proper execution of the work. Any excavation surface that is unstable due to the presence of water shall be stabilized with additional dewatering facilities before commencing with any activities thereon. The COR shall inspect and approve all foundation subgrades prior to placement of materials.

10) At any time water is encountered on the surface of any excavation or work surface, the Contractor shall cease excavation or other construction operations, inform the COR, have the site inspected by the Contractor's dewatering engineer, and implement appropriate supplemental dewatering operations. Operations shall be resumed only when surfaces are free of all flowing or standing water.

11) The Contractor shall prepare a written plan, if requested by the COR, summarizing the problem and proposed corrective actions and submit this plan for review and comment prior to proceeding with any corrective actions.

12) Water from excavation dewatering operations shall not be pumped directly into live streams. At a minimum, pumped water shall be directed to a filter bag before being discharged into live streams. Surface water may be directed around the work area and discharge downstream provided the requirements in the approved Stormwater Pollution Prevention Plan (SWPPP) and in Construction Specification 5, Pollution Control are met.

13) Submit as-built drawings and reports of trench drain and well installation details (as required), including, but not limited to, surveyed ground elevation and horizontal coordinates, total depth, screened interval, sand pack depth, backfill and grout materials and quantities, results of well development, initial dewatering flow rates, and specifications of all instrumentation, pumps, valves, fittings installed at each well, as per the requirements of the Excavation Dewatering Plan.

14) Provide progress reports of effectiveness of the dewatering system as requested by the COR to show that the system is performing adequately. The report should include flow rates and volume totals per day for pumping systems (deep wells, well points, eductors, etc.), ground water levels if observation wells are provided, and any data to the characteristics of the discharge water (fines, murky, clear, etc.).

15) The Contractor shall maintain or have ready access to additional Fine Drainfill and Coarse Drainfill as specified in Construction Specification 24, Drainfill; Bedding Stone and Riprap as specified in Construction Specification 61, Riprap; and Geotextile as specified in Construction Specification 95, Geotextile at the site through substantial completion. These materials may be used to address potential seepage issues (if encountered).

16) In Section 4 – There are no designated on-site Borrow Areas; however, if one is required, the requirements of Section 4 apply, and associated work is subject to the approval of the COR.

17) In Section 7 – Measurement and Payment, Method 1 will apply. However, payment will be prorated and provided in equal amounts on each monthly progress payment estimate. The number of months used for prorating shall be the number estimated to complete the work as outlined in the Contractor's approved construction schedule. The final month's prorate amount will be provided with the final contract payment. Up to 85% of the contract value for this Bid Item will be paid for design, installation, and maintenance of the Contractor's dewatering system. The remaining 15% will be paid upon completion of removal of all temporary works and submission of record documentation as specified herein. Payment as described will constitute full compensation for completion of the work.

B. Bid Item 9 - Stream Diversion

1) This Item consists of planning, designing, furnishing, installing, operating, maintaining, and removing all systems necessary to divert stream flow to permit construction of the following:

   a. Embankment toe drain, principal spillway riser improvements, principal spillway conduit extension, impact basin, rock riprap downstream of impact basin, and upstream embankment stability berm.

   b. All other work requiring diversion of the stream to permit construction of the work as shown in the Drawings and these specifications.

2) The reservoir will be drained for the installation of the upstream stability berm and riser drain gate replacement. The dam is currently operated by the Green Valley-Glenwood Public Service District (PSD) as a raw water supply. The PSD may be drawing water from the reservoir during construction using the intake located on the right abutment of the reservoir upstream of the work area. The Contractor shall maintain the reservoir water level at the normal pool elevation throughout the duration of the construction contract except during the principal spillway riser improvements, principal spillway conduit extension, impact basin work, installation of the upstream stability berm, or as otherwise approved by the COR and the PSD in writing. The Contractor may use the existing water supply gates to control the pool level

during construction. The Contractor shall coordinate any reservoir drawdowns with the PSD prior to beginning drawdown operations and shall coordinate water supply needs with PSD in the event of a drought. Reservoir drawdowns shall not exceed 1 foot per day at any point unless approved by the COR.

3) The following dates will apply to the construction year in which work will be started. The Contractor may drain the reservoir starting August 1. The reservoir drain gate may remain open from August 1 until December 1. The reservoir drain gate shall be closed December 1. In December, water supply gate II at elevation 2454.47 may remain open. All gates must be closed by December 30th to facilitate the reservoir refilling to normal pool elevation. Work associated with draining, the upstream stability berm, and riser improvements shall be completed between August 1st and December 30th.

4) The Contractor is responsible to design and install necessary stream diversion elements to support the drained reservoir.

5) Criteria for the draining the reservoir includes but is not limited to:

   i. A maximum drawdown of 1-foot per day.

   ii. Use of the water supply and drain gate is at the Contractor's risk. The operability of the water supply gates and drain gate is unknown. The drain gate may be partially covered or fully covered by sediment.

   iii. Installing downstream sediment trapping measures to prevent downstream sedimentation.

   iv. Monitoring and measurements of reservoir levels during periods of lowering and de-watering. Frequency of monitoring shall be included in Contractor's Stream Diversion Plan.

6) The Contractor shall protect the principal spillway riser and impact basin work areas for base flows and storm flows. The concept shown on the Drawings is to use the reservoir as storage for storm flows up to the normal pool (NP) elevation (EL 2489.5) and to protect the impact basin work area using the temporary downstream access road as a cofferdam. The concept shown on the Drawings also includes a stream diversion system connected to the existing principal spillway conduit to divert flows through the impact basin work area and temporary stream crossing into the outlet channel. The Contractor may elect to install a more robust stream diversion system (e.g., pump around system) based on their risk tolerance.

   The minimum downstream cofferdam crest elevation and stream diversion measures shall be determined by the Contractor based on their proposed approach. Baseflow was estimated to be 1.12 cfs per square mile or approximately 3.0 cfs (1350 gpm), which varies by season. Approximate reservoir water surface elevations for the 5,10, and 25-year, 24-hour storms are shown in the following table for a 24-hour period assuming the reservoir begins at EL 2479.5. Contractor's design may be based on other storm events not shown. Values shown do not account for PSD water withdrawals. The Contractor is responsible for obtaining water withdrawal rates from PSD.

Storm Frequency	Approximate Peak Reservoir Water Elevation (ft) based on continuously bypass pumping at 1,350 gpm	Approximate Peak Reservoir Water Elevation (ft) without bypass pumping
5-year, 24-hour storm	2481.8	2482.0
10-year, 24-hour storm	2482.5	2482.6
25-year, 24-hour storm	2483.4	2483.6

These values are provided for the Contractor's convenience, but the Contractor is ultimately responsible for developing their own site-specific hydrologic data to plan and implement their stream diversion system. Hydrologic and hydraulic modeling used for the design can be provided to the Contractor upon request after contract award. The Contractor is also responsible for understanding the level of risk associated with their planned stream diversion and dewatering systems which includes the frequency of principal spillway riser and cofferdam overtopping and the consequences of overtopping and/or system failure. The Contractor is solely responsible for control of water and developing a design to protect the construction area from the entry of water from the reservoir by cofferdam, sumps, pumps and/or other means, until the construction works are completed.

7) The Contractor's proposed stream diversion and dewatering operations and all other construction operations shall minimize the negative impact to the reservoir, streams, wetlands, etc. The periods in which water flow will be completely shut off shall be minimized and shall be indicated in the Stream Diversion Plan discussed below.

8) Flowing water shall not be allowed to come in contact with any newly placed concrete for a 48-hr period after the concrete is placed. The COR may request removal and replacement of the concrete at the Contractor's expense if such conditions occur.

9) The Contractor's proposed stream diversion and dewatering methods shall be limited to flow through the existing principal spillway and pumping over the embankment dam. The existing principal spillway riser shall not be modified for the stream diversion system. Methods which require excavations through the dam, abutments, or auxiliary spillway are not allowed.

    i. The existing condition of the existing principal spillway conduit and existing riser structure shall be maintained throughout the duration of construction with the exception of modifications specified or as shown on the Drawings. Contractor shall be responsible for maintaining the flow capacity of the principal spillway conduit. Temporary trash racks shall immediately be fastened over all temporary diversion openings to the principal spillway conduit to prevent any debris from entering the principal spillway conduit that may clog or affect the flow capacity of the conduit. The principal spillway conduit shall remain unobstructed and free of sediment deposits and debris throughout its entire length for the entire duration of construction. If the existing principal spillway conduit becomes clogged or obstructed at any time during construction, the Contractor shall immediately clear the clog or obstruction at no additional cost. Any leaks or damage to the existing riser structure, the existing principal spillway conduit or their appurtenances caused by debris or the Contractor's activities shall be repaired by the Contractor, at the Contractor's expense, as approved by the COR.

    ii. No additional compensation will be provided to repair damaged existing features or facilities or to repair contract work. Contractor must complete all repair work to the satisfaction of the COR with no additional compensation.

10) In Section 2 – Diverting Surface Water, the Contractor shall submit a Stream Diversion Plan to the COR for review 45 days prior to beginning work activity. The Plan shall include at least the following:

    a. Narrative describing means and methods for stream diversion system used to divert flows from the existing principal spillway conduit, through the impact basin work area and temporary stream crossing, and to the outlet channel so that the impact basin and principal spillway conduit can be constructed in the dry. The narrative should also describe the means and methods for draining the reservoir to install the upstream riprap

berm and the riser work.

b. Stream diversion system components and layout, pump locations, pipe sizes, capacities, grades, and discharge location(s).

c. Level of flood frequency protection provided by the stream diversion system supported by hydrologic and hydraulic analyses. Also, the Contractor shall agree to the following provisions:

    a. Pursue the diversion operations in a manner that will prevent blockage or clogging of the diversion works.

    b. Provide the Contracting Officer with a telephone number for the person who will be available at all times during the construction period.

    c. If, at any time during the Contractor's operations, weather conditions occur or are anticipated to occur that might be expected to cause flooding that would endanger the integrity of the work under this Contract, the Contractor shall take all possible precautions to protect partial or completed permanent work from damage, and perform all other work associated with the Contractor's operations as may be required by the COR in the event of an anticipated flood.

    d. Evaluate current stream flow conditions, current weather conditions, and forecasted weather conditions and accept sole responsibility for determining if such conditions are anticipated to cause flooding.

    e. Accept responsibility for any and all such precautionary measures that may be required in the event of an anticipated flood and any and all work necessary to reestablish construction site and activities subsequent thereto, at no additional cost.

d. Measures required for pollution control in accordance with the requirements of Construction Specification 5, Pollution Control.

e. Location and capacity of power systems (if used).

f. Detailed description of stream diversion system installation procedures, maintenance procedures, and procedures for operation of the system in relation to the proposed work.

g. Periods in which water flow through the site will be shut off, periods when the reservoir will be drained, periods when the reservoir will be lowered to the minimum water supply elevation, and periods when the reservoir will be in the process of refilling. Provide means and methods for achieving and monitoring for the criteria for draining the reservoir outlined above.

h. Product Data, including pipe materials and pumps. Pipes shall have water-tight joints.

i. Thrust blocks for stream diversion pipe system shall be designed and implemented by the Contractor at pipe elbows.

j. If the temporary stream crossing is not used as a cofferdam, provide temporary downstream cofferdam design in accordance with the requirements of these specifications and as shown on the drawings. Provide cofferdam design details and shop drawings; material specifications; design calculations, such as slope stability calculations (as applicable); and foundation preparation requirements. Removal of reservoir and stream channel sediment from the project site will not be permitted. The Contractor shall design and implement dewatering systems to maintain interior of downstream cofferdam in dry condition. The cofferdam can be constructed with soil-filled bulk bags, earthfill, or rockfill as designed by the Contractor's stream diversion designer. Surveys should be performed prior to cofferdam installation and after removal to ensure the areas have been restored to their pre-construction conditions. Provide selection of materials, either earth or synthetics, to serve as hydraulic barriers. Sheet pile cofferdams are not permitted.

k. Earth or rockfill material used in the construction of the cofferdam shall be obtained from within the excavation limits identified on the Drawings or from an off-site location. The Contractor may request a temporary borrow area within the construction limits with approval from the COR, but earth or rockfill borrow material for use in cofferdams shall not be excavated from the embankment or within 20 feet of the embankment. If a borrow area is approved, the Contractor is required to return the fill material to the borrow area such that the area is restored to original elevation and grade and provide stabilization and protective cover as required by the Drawings. All other materials including pipes, synthetic liners, etc. shall be salvaged by the Contractor or disposed of off-site by the Contractor in a lawfully approved landfill area.

l. Procedures the Contractor will use to ensure, that in the event of a storm that fills the reservoir, open excavations and work in-place is protected to the extent possible. This requirement is not limited by the size of the storm.

m. Stream diversion system removal and decommissioning procedures. The stream diversion system shall be entirely removed after it has served its purpose.

11) Design of the stream diversion system and preparation of the Stream Diversion Plan are the Contractor's responsibility and shall be completed, signed, and sealed by a Professional Engineer registered in the State of West Virginia with expertise in the appropriate technical disciplines and specializing in or having experience with stream diversion systems in similar conditions for at least five years. Calculations and shop drawings shall be included with the Plan to support the Contractor's design. Temporary cofferdams shall be designed to be stable for all anticipated loading conditions as determined by the Contractor's engineer. Review of the Contractor's Stream Diversion Plan, with or without comments by the COR, does not relieve the Contractor of any responsibility for the adequacy of the Contractor's Stream Diversion Plan. The Contractor shall be solely responsible for the adequacy of the Stream Diversion Plan and for coordination with other work.

12) In Section 6 – Removal of temporary works, the stream diversion system may only be removed written upon approval from the COR.

13) In Section 7 – Measurement and Payment, Method 1 will apply. However, payment will be prorated and provided in equal amounts on each monthly progress payment estimate. The number of months used for prorating shall be the number estimated to complete the work as outlined in the Contractor's approved construction schedule. The final month's prorate amount will be provided with the final contract payment. Payment as described will constitute full compensation for completion of the work.

    i. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control.

****End of Construction Specification 11****

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CONSTRUCTION SPECIFICATION 21—EXCAVATION

1. Scope

The work shall consist of the excavation required by the drawings and specifications and disposal of the excavated materials.

2. Classification

Excavation is classified as common excavation, rock excavation, or unclassified excavation in accordance with the following definitions.

Common excavation is defined as the excavation of all materials that can be excavated, transported, and unloaded using heavy ripping equipment and wheel tractor-scrapers with pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by excavators having a rated capacity of one cubic yard or larger and equipped with attachments (shovel, bucket, backhoe, dragline, or clam shell) appropriate to the material type, character, and nature of the materials.

Rock excavation is defined as the excavation of all hard, compacted, or cemented materials that require blasting or the use of ripping and excavating equipment larger than defined for common excavation. The excavation and removal of isolated boulders or rock fragments larger than 1 cubic yard encountered in materials otherwise conforming to the definition of common excavation shall be classified as rock excavation. The presence of isolated boulders or rock fragments larger than 1 cubic yard is not in itself sufficient cause to change the classification of the surrounding material.

For the purpose of these classifications, the following definitions shall apply:

Heavy ripping equipment is a rear-mounted, heavy duty, single-tooth, ripping attachment mounted on a track type tractor having a power rating of at least 250 flywheel horsepower unless otherwise specified in Section 10.

Wheel tractor-scraper is a self-loading (not elevating) and unloading scraper having a struck bowl capacity of at least 12 cubic yards.

Pusher tractor is a track type tractor having a power rating of at least 250 flywheel horsepower equipped with appropriate attachments.

Unclassified excavation is defined as the excavation of all materials encountered, including rock materials, regardless of their nature or the manner in which they are removed.

3. Blasting

The transportation, handling, storage, and use of dynamite and other explosives shall be directed and supervised by a person(s) of proven experience and ability who is authorized and qualified to conduct blasting operations.

Blasting shall be done in a manner as to prevent damage to the work or unnecessary fracturing of the underlying rock materials and shall conform to any special requirements in Section 10 of this specification. When specified in Section 10, the Contractor shall furnish the Engineer, in writing, a blasting plan before blasting operations begin.

4. Use of excavated material

Method 1—To the extent they are needed, all suitable material from the specified excavations shall be used in the construction of required permanent earthfill or rockfill. The suitability of material for specific purposes is determined by the Engineer. The Contractor shall not waste or otherwise dispose of suitable excavated material.

Method 2—Suitable material from the specified excavations may be used in the construction of required earthfill or rockfill. The suitability of material for specific purposes is determined by the engineer.

5. Disposal of waste materials

Method 1—All surplus or unsuitable excavated materials are designated as waste and shall be disposed of at the locations shown on the drawings.

Method 2—All surplus or unsuitable excavated materials are designated as waste and shall be disposed of by the Contractor at sites of his own choosing away from the site of the work. The disposal shall be in an environmentally acceptable manner that does not violate local rules and regulations.

6. Excavation limits

Excavations shall comply with OSHA Construction Industry Standards (29CFR Part 1926) Subpart P, Excavations, Trenching, and Shoring. All excavations shall be completed and maintained in a safe and stable condition throughout the total construction phase. Structure and trench excavations shall be completed to the specified elevations and to the length and width required to safely install, adjust, and remove any forms, bracing, or supports necessary for the installation of the work. Excavations outside the lines and limits shown on the drawings or specified herein required to meet safety requirements shall be the responsibility of the Contractor in constructing and maintaining a safe and stable excavation.

7. Borrow excavation

When the quantities of suitable material obtained from specified excavations are insufficient to construct the specified earthfills and earth backfills, additional material shall be obtained from the designated borrow areas. The extent and depth of borrow pits within the limits of the designated borrow areas shall be as specified in Section 10 or as approved by the Engineer.

Borrow pits shall be excavated and finally dressed to blend with the existing topography and sloped to prevent ponding and to provide drainage.

8. Over excavation

Excavation in rock beyond the specified lines and grades shall be corrected by filling the resulting voids with portland cement concrete made of materials and mix proportions approved by the engineer. Concrete that will be exposed to the atmosphere when construction is completed shall meet the requirements of concrete selected for use under Construction Specification 31, Concrete for Major Structures, or 32, Structure Concrete, as appropriate.

Concrete that will be permanently covered shall contain not less than five bags of cement per cubic yard. The concrete shall be placed and cured as specified by the Engineer.

Excavation in earth beyond the specified lines and grades shall be corrected by filling the resulting voids with approved, compacted earthfill. The exception to this is that if the earth is to become the subgrade for riprap, rockfill, sand or gravel bedding, or drainfill, the voids may be filled with material conforming to the specifications for the riprap, rockfill, bedding, or drainfill. Before correcting an over excavation condition, the Contractor shall review the planned corrective action with the Engineer and obtain approval of the corrective measures.

9. Measurement and payment

For items of work for which specific unit prices are established in the contract, the volume of each type and class of excavation within the specified pay limits is measured and computed to the nearest cubic yard by the method of average cross-sectional end areas or by methods outlined in Section 10 of this specification. Regardless of quantities excavated, the measurement for payment is made to the specified pay limits except that excavation outside the specified lines and grades directed by the Engineer to remove unsuitable material is included. Excavation required because unsuitable conditions result from the Contractor's improper construction operations, as determined by the Engineer, is not included for measurement and payment.

Method 1—The pay limits shall be as designated on the drawings.

Method 2—The pay limits shall be defined as follows:

a. The upper limit shall be the original ground surface as it existed before the start of construction operations except that where excavation is performed within areas designated for previous excavation or earthfill, the upper limit shall be the modified ground surface resulting from the specified previous excavation or earthfill.

b. The lower and lateral limits shall be the neat lines and grades shown on the drawings.

Method 3—The pay limits shall be defined as follows:

a. The upper limit shall be the original ground surface as it existed before the start of construction operations except that where excavation is performed within areas designated for previous excavation or earthfill, the upper limit shall be the modified ground surface resulting from the specified previous excavation or earthfill.

b. The lower and lateral limits shall be the true surface of the completed excavation as directed by the engineer.

Method 4—The pay limits shall be defined as follows:

a. The upper limit shall be the original ground surface as it existed before the start of construction operations except that where excavation is performed within areas designated for previous excavation or earthfill, the upper limit shall be the modified ground surface resulting from the specified previous excavation or earthfill.

b. The lower limit shall be at the bottom surface of the proposed structure.

c. The lateral limits shall be 18 inches outside of the outside surface of the proposed structure or shall be vertical planes 18 inches outside of and parallel to the footings, whichever gives the larger pay quantity, except as provided in d below.

d. For trapezoidal channel linings or similar structures that are to be supported upon the sides of the excavation without intervening forms, the lateral limits shall be at the underside of the proposed lining or structure.

e. For the purposes of the definitions in b, c, and d, above, any specified bedding or drainfill directly beneath or beside the structure will be considered to be a part of the structure.

All methods—The following provisions apply to all methods of measurement and payment. Payment for each type and class of excavation is made at the contract unit price for that type and class of excavation. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to the performance of the work except that extra payment for backfilling over excavation will be made in accordance with the following provisions.

Payment for backfilling over excavation, as specified in Section 8 of this specification, is made only if the excavation outside specified lines and grades is directed by the Engineer to remove unsuitable material and if the unsuitable condition is not a result of the Contractor's improper construction operations as determined by the Engineer.

Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 10 of this specification.

10. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. General

1) The Contractor is required to submit an Excavation Plan to the COR at least 45 days prior to beginning work activity. The Excavation Plan shall contain the following, at a minimum:

   a. Description of the Contractor's proposed work sequence and schedule, as well as plans for creating stockpiles.

   b. Stockpile locations within the approved staging areas shown on the Drawings. All stockpile areas are to be located outside of the 100-yr floodplain.

   c. Plans and diagrams for handling excavation, earthfill, and spoil materials.

   d. Protection of stockpiles.

   e. Haul routes.

   f. Makes, models, and quantities of proposed excavating and hauling equipment; excavation proposed for the Contractor's convenience.

   g. Means and methods for protection of structures to remain, including but not limited to the principal spillway conduit.

   h. Means and methods for protection of existing embankment fill materials to remain.

   i. Means and methods for drying excavated wet soils prior to stockpiling and/or reuse as earthfill.

   j. Sequencing of embankment toe drain excavation. Provide detailed narrative describing proposed approach to completing the Phase 1 excavation, segmental excavations, and backfilling as required below.

2) An Excavation Dewatering Plan shall be provided with the Excavation Plan, as specified in Construction Specification 11, Removal of Water. A Fill Placement Plan shall also be provided with the Excavation Plan, as specified in Construction Specification 23, Earthfill. These three plans shall be coordinated. A Foundation Preparation Plan shall also be provided with the Excavation Plan, as specified in Construction Specification 63, Treatment of Rock Surfaces.

3) In addition, Excavation shall be performed within the following tolerances:

   a. Common excavation, plus or minus 0.1 feet from plan line and grade.

   b. For foundations of concrete structures, plus 0.1 feet to minus 0.5 feet.

B. Bid Item 10 – Embankment, Common Excavation

1) The item consists of excavation of material (after stripping) within the limits of embankment toe drain excavation, including excavations for the principal spillway conduit extension, impact basin, and precast seepage collection boxes, to the depths and grades shown on the Drawings or as directed by the COR.

2) The design intent is for the embankment toe drain excavation to extend to the bottom of the materials meeting the requirements for Common Excavation as defined in Section 10.B.9). The bottom of the toe drain excavation shall terminate at the top of materials meeting the requirements for Rock Excavation as defined in Section 2. Additional requirements are provided as notes and details on the Drawings.

3) Any heavy, mechanized excavation equipment used to perform excavation around the existing principal spillway conduit and concrete cradle shall not be closer than 5 feet from the structure all times, unless otherwise shown on the Drawings. The Contractor shall repair any damages to the existing principal spillway conduit and concrete cradle resulting from the

Contractor's improper construction operations as determined by the COR at no cost to the Government.

4) Suitable materials resulting from the required excavations shall be used to construct the specified fills and shall be stockpiled at the approved staging areas shown in the Contractor's approved Excavation Plan or designated by the COR. Unsuitable materials shall be placed in on-site waste areas designated by the COR.

5) The Contractor is required to sequence the excavation such that excavations below the Phase 1 excavation subgrade elevation shown on the Drawings are completed in segments not to exceed 50 linear feet in length. Backfill to the Phase 1 excavation subgrade prior to beginning the next segment.

6) If during excavation, groundwater is encountered, excavation operations shall cease, the excavation shall be stabilized, and excavation shall not continue until the area is dewatered to the required depth, as specified in Construction Specification 11, Removal of Water.

7) Meet the requirements of Construction Specification 63, Treatment of Rock Surfaces.

8) Contractor shall coordinate embankment backfilling activities with any planned winter shutdowns. The schedule provided in the Excavation Plan shall indicate the proposed target earthfill subgrade elevation prior to commencement of any winter shutdown.

9) In Section 2 – Classification, excavation is classified as Common Excavation. *Heavy ripping equipment* and *Pusher tractor* are re-defined as having a power rating of at least 150 flywheel horsepower.

10) In Section 3 – Blasting, blasting is prohibited.

11) In Section 4 – Use of Excavation Material, Method 1 will apply. Suitable materials resulting from these excavations shall be used as onsite Earthfill, as approved by the COR. Soil resulting from these excavations that is wet or saturated does not, in and of itself, constitute unsuitable material. Unsuitable material will be determined by the COR, The Contractor is responsible to manage wet soils, separate from dry soils, and moisture condition wet or dry soils for reuse as earthfill within the project activity time requirements. The Contractor will be permitted to stockpile excavated materials only within the approved staging areas shown in the Contractor's Excavation Plan. The excavated material shall be protected for re-use in a manner that will minimize contamination and moisture absorption, as approved by the COR. Stockpiled excavated materials shall meet the soil erosion and sediment control requirements stated on the drawings and in Construction Specification 5, Pollution Control.

12) In Section 5 – Disposal of Waste Materials, Method 1 will apply. Disposal of any excess soil materials from excavations shall be as specified in Construction Specification 23, Earthfill, Bid Item 12, Earthfill. On-site disposal will be allowed in the embankment downstream toe berm as shown on the Drawings or in the staging areas shown on the Drawings or as allowed by the COR in writing.

13) In Section 6 – Excavation Limits, Embankment Excavation shall be performed as shown on the Drawings. The Contractor shall furnish, put in place, and maintain any required trench boxes, supports, and bracing required to support the sides of the excavation and prevent loss of ground that could damage or delay the work or endanger adjacent structures. Driven sheet piles for excavation support will not be permitted. The excavation limits shown on the Drawings are neat lines for payment quantities. The Contractor is responsible for determining excavation limits to comply with OSHA Construction Industry Standards (29CFR Part 1926) Subpart P, Excavations, Trenching, and Shoring, as well as the NRCS Supplement to OSHA.

14) In Section 8 – Over excavation

   a. The estimated depth and extent of excavation is shown on the Drawings. During the progress of the work, the slopes, grades, or dimensions of the excavations may require adjustment from those shown on the plans or specified herein based on conditions encountered in the field.

b. All necessary precautions shall be taken to preserve the material below and beyond the indicated or specified lines of all excavations in the best possible condition. Any and all excess excavation for the convenience of the Contractor or over excavation performed by the Contractor for any purpose or reason except as may be ordered in writing by the COR shall be at the expense of the Contractor. Where required to complete the work, all such excess excavation and over excavation shall be refilled at the expense of and by the Contractor.

c. Backfill materials for use in areas of over excavation shall be as directed by the COR. Where earth backfill is used, over excavation shall be backfilled to the moisture and density specified for Earthfill in Construction Specification 23, Earthfill.

d. Following foundation preparation, the COR shall visually observe the foundation subgrades. The Contractor shall remove any unsuitable soils, as determined by the COR, and replace with suitable material as directed by the COR. Subgrades that have been properly dewatered in accordance with Construction Specification 11, Removal of Water and exhibit soft, loose, or weakened conditions shall be removed and replaced at the direction of the COR and will be paid for in accordance with Section 9. Subgrades and excavation slopes that have become loosened or weakened requiring removal and replacement due to lack of proper dewatering shall be removed and replaced as directed by the COR at no additional cost to the Government. The COR will be the sole judge of whether subgrades have been properly dewatered.

15) In Section 9 – Measurement and Payment, Method 3 shall apply. The neat lines and grades shown on the Drawings shall be considered the true surface of the completed excavation unless otherwise approved by the COR. After the limits of excavation shown on the Drawings are complete, the COR will examine the completed surface and mark areas that need additional excavation to remove unsuitable materials. The Contractor shall survey the completed limits of excavation for quantity calculations.

a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control

C. *Bid Item 11 – Auxiliary Spillway, Common Excavation*

1) The item shall consist of excavation of material (after stripping) within the limits of the auxiliary spillway to the depths and grades shown on the Drawings or as directed by the COR.

2) The design intent is for the auxiliary spillway excavation is to excavate materials meeting the requirements for Common Excavation as defined in Section 2 and to terminate at the lines and grades shown on the Drawings, unless the COR directs additional excavation be performed to remove unsuitable materials as defined herein.

3) Specified requirements for Bid Item 10 – Embankment, Common Excavation apply to this Bid Item, except as modified below:

a. In Section 2 – Classification, excavation is classified as Common Excavation. *Heavy ripping equipment* and *Pusher tractor* are defined as having a power rating of at least 150 flywheel horsepower.

b. In Section 6 – Excavation Limits, Auxiliary Spillway Excavation shall be performed as shown on the Drawings within the Auxiliary Spillway. The Contractor shall furnish, put in place, and maintain sheeting and bracing required to support the sides of the excavation and prevent loss of ground that could damage or delay the work or endanger adjacent structures.

4) In Section 9 – Measurement and Payment, Method 3 shall apply. The neat lines and grades shown on the drawings shall be considered the true surface of the completed excavation unless otherwise approved by the COR. After the limits of excavation shown on the drawings are complete, the COR will examine the completed surface and mark areas that need additional excavation to remove unsuitable materials. The Contractor shall survey the completed limits of excavation for quantity calculations.

   a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control

D. Subsidiary Item, Miscellaneous Excavation

1) This item consists of all excavation required for constructing the auxiliary spillway riprap wave protection, embankment toe drain outlet pipe, auxiliary spillway drain cleanouts, outlet channel rock riprap, surface completions for geotechnical instrumentation, and other miscellaneous structures shown on the Drawings.

2) In Section 3, Blasting, blasting will not be permitted.

3) In Section 4, Use of Excavated Materials, Method 1 shall apply.

4) In Section 5, Disposal of Waste Materials, Method 1 shall apply. Disposal of any excess soil materials from excavations shall be as specified in Construction Specification 23, Earthfill, Bid Item 12, Earthfill. On-site disposal will be allowed in the embankment downstream toe berm as shown on the Drawings or in the staging areas shown on the Drawings or as allowed by the COR in writing.

5) In Section 9 – Measurement and Payment, no separate payment will be made for this item of work. Compensation for this item will be included in the payment for:

   a. Construction Specification 45, Bid Item 27, Toe Drain Piping
   b. Construction Specification 45, Bid Item 29, ASW Drain Piping
   c. Construction Specification 61, Bid Item 30, Rock Riprap, PSW Outlet and ASW Entrance
   d. Construction Specification 401, Bid Item 46, Geotechnical Instrumentation

****End of Construction Specification 21****

CONSTRUCTION SPECIFICATION 23—EARTHFILL

1. Scope

The work consists of the construction of earth embankments, other earthfills, and earth backfills required by the drawings and specifications.

Earthfill is composed of natural earth materials that can be placed and compacted by construction equipment operated in a conventional manner.

Earth backfill is composed of natural earth material placed and compacted in confined spaces or adjacent to structures (including pipes) by hand tamping, manually directed power tampers or vibrating plates, or their equivalent.

2. Material

All fill material shall be obtained from required excavations and designated borrow areas. The selection, blending, routing, and disposition of material in the various fills shall be subject to approval by the Engineer.

Fill materials shall contain no frozen soil, sod, brush, roots, or other perishable material. Rock particles larger than the maximum size specified for each type of fill shall be removed prior to compaction of the fill.

The types of material used in the various fills shall be as listed and described in the specifications and drawings.

3. Foundation preparation

Foundations for earthfill shall be stripped to remove vegetation and other unsuitable material or shall be excavated as specified.

Except as otherwise specified, earth foundation surfaces shall be graded to remove surface irregularities and shall be scarified parallel to the axis of the fill or otherwise acceptably scored and loosened to a minimum depth of 2 inches. The moisture content of the loosened material shall be controlled as specified for the earthfill, and the surface material of the foundation shall be compacted and bonded with the first layer of earthfill as specified for subsequent layers of earthfill.

Earth abutment surfaces shall be free of loose, uncompacted earth in excess of 2 inches in depth normal to the slope and shall be at such a moisture content that the earthfill can be compacted against them to produce a good bond between the fill and the abutments.

Rock foundation and abutment surfaces shall be cleared of all loose material by hand or other effective means and shall be free of standing water when fill is placed upon them. Occasional rock outcrops in earth foundations for earthfill, except in dams and other structures designed to restrain the movement of water, shall not require special treatment if they do not interfere with compaction of the foundation and initial layers of the fill or the bond between the foundation and the fill.

Foundation and abutment surfaces shall be no steeper than one horizontal to one vertical unless otherwise specified. Test pits or other cavities shall be filled with compacted earthfill conforming to the specifications for the earthfill to be placed upon the foundation.

4. Placement

Earthfill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by the engineer. Earthfill shall not be placed upon a frozen surface nor shall snow, ice, or frozen material be incorporated in the earthfill matrix.

Earthfill shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed the maximum thickness specified in Section 10 or shown on the drawings. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than the specified thickness before being compacted.

Hand compacted earth backfill shall be placed in layers whose thickness before compaction does not exceed the maximum thickness specified for layers of earth backfill compacted by manually directed power tampers.

Earth backfill shall be placed in a manner that prevents damage to the structures and allows the structures to assume the loads from the earth backfill gradually and uniformly. The height of the earth backfill adjacent to a structure shall be increased at approximately the same rate on all sides of the structure.

Earthfill and earth backfill in dams, levees, and other structures designed to restrain the movement of water shall be placed to meet the following additional requirements:

(a) The distribution of materials throughout each zone shall be essentially uniform, and the earthfill shall be free from lenses, pockets, streaks, or layers of material differing substantially in texture, moisture content, or gradation from the surrounding material. Zone earthfills shall be constructed concurrently unless otherwise specified.

(b) The surface of each layer shall be scarified parallel to the axis of the fill to a depth of not less than 2 inches before the next layer is placed.

(c) The top surface of embankments shall be maintained approximately level during construction with two exceptions: A crown or cross-slope of about 2 percent shall be maintained to ensure effective drainage, or as otherwise specified for drainfill or sectional zones.

(d) Dam embankments shall be constructed in continuous layers from abutment to abutment except where openings to facilitate construction or to allow the passage of streamflow during construction are specifically authorized in the contract.

(e) Embankments built at different levels as described under (c) or (d) above shall be constructed so that the slope of the bonding surfaces between embankment in place and embankment to be placed is not steeper than 3 feet horizontal to 1 foot vertical. The bonding surface of the embankment in place shall be stripped of all material not meeting the requirements of this specification and shall be scarified, moistened, and recompacted when the new earthfill is placed against it. This ensures a good bond with the new earthfill and obtains the specified moisture content and density at the contact of the inplace and new earthfills.

5. Control of moisture content

During placement and compaction of earthfill and earth backfill, the moisture content of the material being placed shall be maintained within the specified range.

The application of water to the earthfill material shall be accomplished at the borrow areas insofar as practicable. Water may be applied by sprinkling the material after placement on the earthfill, if necessary. Uniform moisture distribution shall be obtained by disking.

Material that is too wet when deposited on the earthfill shall either be removed or be dried to the specified moisture content prior to compaction.

If the top surface of the preceding layer of compacted earthfill or a foundation or abutment surface in the zone of contact with the earthfill becomes too dry to permit suitable bond, it shall either be removed or scarified and moistened by sprinkling to an acceptable moisture content before placement of the next layer of earthfill.

6. Compaction

Earthfill—Earthfill shall be compacted according to the following requirements for the class of compaction specified:

Class A compaction—Each layer of earthfill shall be compacted as necessary to provide the density of the earthfill matrix not less than the minimum density specified in Section 10 or identified on the drawings. The earthfill matrix is defined as the portion of the earthfill material finer than the maximum particle size allowed in the reference compaction test method specified (ASTM D698 or ASTM D1557).

Class B compaction—Each layer of earthfill shall be compacted to a mass density not less than the minimum density specified.

Class C compaction—Each layer of earthfill shall be compacted by the specified number of passes of the type and weight of roller or other equipment specified or by an approved equivalent method. Each pass shall consist of at least one passage of the roller wheel or drum over the entire surface of the layer.

Earth backfill—Earth backfill adjacent to structures shall be compacted to a density equivalent to that of the surrounding inplace earth material or adjacent required earthfill or earth backfill. Compaction shall be accomplished by hand tamping or manually directed power tampers, plate vibrators, walk-behind, miniature, or self-propelled rollers. Unless otherwise specified heavy equipment including backhoe mounted power tampers or vibrating compactors and manually directed vibrating rollers shall not be operated within 3 feet of any structure. Towed or self-propelled vibrating rollers shall not be operated within 5 feet of any structure. Compaction by means of drop weights operating from a crane or hoist is not permitted.

The passage of heavy equipment will not be allowed:

- Over cast-in-place conduits within 14-days after placement of the concrete
- Over cradled or bedded precast conduits within 7 days after placement of the concrete cradle or bedding
- Over any type of conduit until the backfill has been placed above the top surface of the structure to a height equal to one-half the clear span width of the structure or pipe or 3 feet, whichever is greater, except as may be specified in Section 10.

Compacting of earth backfill adjacent to structures shall not be started until the concrete has attained the strength specified in Section 10 for this purpose. The strength is determined by compression testing of test cylinders cast by the contractor's quality control personnel for this purpose and cured at the work site in the manner specified in ASTM C 31 for determining when a structure may be put into service.

When the required strength of the concrete is not specified as described above, compaction of earth backfill adjacent to structures shall not be started until the following time intervals have elapsed after placement of the concrete.

Structure	**Time interval** (days)
Vertical or near-vertical walls with earth loading on one side only	14
Walls backfilled on both sides simultaneously	7
Conduits and spillway risers, cast-in-place (with inside forms in place)	7
Conduits and spillway risers, cast-in-place (inside forms removed)	14
Conduits, pre-cast, cradled	2
Conduits, pre-cast, bedded	1
Cantilever outlet bents (backfilled both sides simultaneously)	3

7. Reworking or removal and replacement of defective earthfill

Earthfill placed at densities lower than the specified minimum density or at moisture contents outside the specified acceptable range of moisture content or otherwise not conforming to the requirements of the specifications shall be reworked to meet the requirements or removed and replaced by acceptable earthfill. The replacement earthfill and the foundation, abutment, and earthfill surfaces upon which it is

placed shall conform to all requirements of this specification for foundation preparation, approval, placement, moisture control, and compaction.

8. Testing

During the course of the work, the Contractor shall perform quality control tests, as applicable, to identify earthfill and earth backfill materials; determine the reference maximum density and optimum moisture content; and document that the moisture content of material at the time of compaction and the density of earthfill and earth backfill in place conform to the requirements of this specification.

Determining Reference Maximum Density and Optimum Moisture Content—For Class A compaction, the reference maximum density and optimum moisture content shall be determined in accordance with the compaction test and method specified on the drawings or in Section 10.

Documenting Specification Conformance—In-place densities of earthfill and earth backfill requiring Class A compaction shall be measured in accordance with ASTM D1556, D2167, D2937, D6938 or D8167. Moisture contents of earthfill and earth backfill at the time of compaction shall be measured in accordance with ASTM D2216, D4643, or D6938. Values of moisture content determined by ASTM D2216 are considered the true value of the soil moisture. Values of moisture content determined by ASTM D4643 or D6938 shall be verified by comparison to values obtained by ASTM D2216. Values of in-place density and moisture content determined by these tests shall be compared to the minimum density and moisture content range specified on the drawings or in Section 10.

Correction for Oversize Particles—If the materials to be used for earthfill or earth backfill contain more than 5 percent by dry weight of oversize rock particles (particles larger than those allowed in the specified compaction test and method), corrections for oversize particles shall be made using the appropriate procedures explained in ASTM D4718.

9. Measurement and payment

For items of work for which specific unit prices are established in the contract, the volume of each type and compaction class of earthfill and earth backfill within the specified zone boundaries and pay limits is measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Unless otherwise specified in Section 10, no deduction in volume is made for embedded items, such as, but not limited to, conduits, inlet structures, outlet structures, embankment drains, sand diaphragm and outlet, and their appurtenances.

The pay limits shall be as defined below, with the further provision that earthfill required to fill voids resulting from over excavation of the foundation, outside the specified lines and grades, will be included in the measurement for payment only under the following conditions:

- Where such over excavation is directed by the Engineer to remove unsuitable material, and
- Where the unsuitable condition is not a result of the Contractor's improper construction operations as determined by the Engineer.

Earthfill beyond the specified lines and grades to backfill excavation required for compliance with OSHA requirements will be considered subsidiary to the earthfill bid item(s).

Method 1—The pay limits shall be as designated on the drawings.

Method 2—The pay limits shall be the measured surface of the foundation when approved for placement of the earthfill and the specified neat lines of the earthfill surface.

Method 3—The pay limits shall be the measured surface of the foundation when approved for placement of the earthfill and the measured surface of the completed earthfill.

Method 4—The pay limits shall be the specified pay limits for excavation and the specified neat lines of the earthfill surface.

Method 5—The pay limits shall be the specified pay limits for excavation and the measured surface of the completed earthfill.

Method 6—Payment for each type and compaction class of earthfill and earth backfill is made at the contract unit price for that type and compaction class of earthfill. Such payment will constitute full

compensation for all labor, material, equipment, and all other items necessary and incidental to the performance of the work.

Method 7—Payment for each type and compaction class of earthfill and earth backfill is made at the contract unit price for that type and compaction class of earthfill. Such payment will constitute full compensation for all labor, material, equipment, and all other items necessary and incidental to the performance of the work except furnishing, transporting, and applying water to the foundation and earthfill material. Water applied to the foundation and earthfill material is measured and payment made as specified in Construction Specification 10.

All methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 10 of this specification.

10. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Bid Item 12 – Earthfill

1) This item consists of furnishing all labor, materials, and equipment required for production processing, moisture-conditioning, placing, and compacting the excavated embankment and auxiliary spillway materials required for construction of the embankment and auxiliary spillway modifications, including backfill for the impact basin, principal spillway conduit extension, and precast seepage collection boxes, in accordance with the requirements of this specification and as shown on the Drawings. This item also includes on-site disposal of excess soil materials as compacted earthfill in the embankment stability berm as shown on the Drawings.

2) The Contractor is required to submit a Fill Placement Plan to the COR at least 45 days prior to beginning work activity. The Fill Placement Plan shall describe the Contractor's proposed equipment and procedures for:

   a. Work sequence and schedule, including sequencing of excavation, stockpiling, processing, and placement of Earthfill and Drainfill. The Contractor is required to demonstrate dam embankment stability if his or her work sequence and schedule includes a shutdown of the Work, including but not limited to a winter shutdown, prior to achieving the final grades shown on the Drawings.

   b. Transporting, hauling, and stockpiling of fill soils.

   c. Moisture conditioning of fill soils to achieve the specified moisture content range for each type of fill.

   d. Protecting compacted and stockpiled fill from becoming adversely affected by weather.

   e. Protecting existing and new structures, including but not limited to the toe drain piping and structures, and the existing PSW riser and conduit, from damage during fill placement and compaction.

   f. Placing and compacting fill to specified densities within the specified moisture content range in large open areas and adjacent to structures.

3) In Section 2 – Material, Earthfill shall consist of soils excavated from the embankment and auxiliary spillway that classify as clayey sand (SC), silty sand (SM), clayey gravel (GC), silty gravel (GM), silt (ML), or lean clay (CL) according to the Unified Soil Classification System (ASTM D2487). The maximum particle size shall not exceed two thirds the lift height specified in Section 4. The plasticity index of the material passing the U.S. Standard No. 40 sieve shall be at least 7 and less than or equal to 30 when tested in accordance with ASTM D4318. Earthfill shall not be gap graded. Materials used for Earthfill shall be an approved on-site excavated material that is durable soil material free of debris, organic matter, or other deleterious materials.

4) In Section 3 – Foundation Preparation

   a. Prior to placement of the initial fill layer on rock foundations, meet the requirements of Construction Specification 63, Treatment of Rock Surfaces.

   b. Prior to placement of the initial fill layer on earthen foundations, the foundation shall be graded to remove surface irregularities, scarified parallel to the axis of the dam, loosened to a depth of approximately 2 inches, and, after any necessary moisture adjustments, shall be compacted with a minimum of six (6) complete passes of the compaction equipment. The moisture content of the foundation material shall be controlled as specified for Earthfill.

   c. All foundation and embankment surfaces shall be closely examined immediately prior to the placement of all Earthfill. All materials that exhibit drying cracks, slaking, or other

evidence of being desiccated, unstable or unsuitable, shall be removed or reworked by scarification, wetting, and compaction to the affected depths prior to the placement of fill. Additional compensation will not be made for removing or reworking the foundation or fill materials to meet the requirements herein specified.

5) In Section 4 – Placement

   a. Maximum layer thickness before compaction:

      i. 9 inches (heavy equipment > 10 Tons)

      ii. 4 inches (manual-directed power tampers)

   b. After being placed, each lift of fill material shall be spread, bladed, and smoothed to the extent necessary to ensure that the surface is free of abrupt mounds, depressions or windrows to provide a smooth uniform surface for operation of compaction equipment. Each lift of fill material shall then be tracked with a bulldozer to a minimum depth of 2 inches so as to thoroughly loosen and blend the material with the preceding lift before compaction is started.

6) In Section 5 – Control of Moisture Content, required moisture content of Earthfill as placed shall be between -2 percent and +3 percent of optimum moisture content as determined by ASTM D698.

7) In Section 6 – Compaction

   a. Class A Compaction shall apply. Minimum required Earthfill compaction shall be 95 percent of the maximum dry density as determined by ASTM D698, Method A.

   b. Compaction of Earthfill classifying as SM, SC, GM, or GC according to ASTM D2487 shall be performed with vibratory padded drum rollers. Compaction of earthfill classifying as ML or CL according to ASTM D2487 shall be performed with static equipment such as a sheepsfoot or tamping foot roller that imparts a kneading action. Vibratory smooth drum rollers are not allowed for compaction of Earthfill except for sealing lift surfaces at the completion of a work shift.

   c. Towed or self-propelled vibrating rollers shall not be operated within 5 feet of any structure or conduit.

   d. For the auxiliary spillway starter wall, place backfill and roller compacted concrete on both sides of the wall simultaneously.

8) In Section 8 – Testing the Contractor shall be responsible for the following:

   a. Testing performed before fill placement:

      i. Obtain representative samples from stockpile locations.

      ii. Perform one of each of the following tests for every 1,000 cubic yards of each type of Earthfill:

         - ASTM D698 – Laboratory Compaction Characteristics of Soil Using Standard Effort, Method A. Develop a family of Proctor curves of the various types to be used with the one-point field Proctor testing to establish maximum dry density and optimum moisture content during placement. Additional testing may be requested by the COR at no additional cost if the developed family of curves does not adequately characterize the various types of Earthfill.
         - ASTM D422 – Gradation
         - ASTM D4221 – Double Hydrometer
         - ASTM D4318 – Atterberg Limits
         - ASTM D854 – Specific Gravity of Soils by Water Pycnometer

iii. Submit all test results at least one week prior to fill placement. No Earthfill shall be placed until the test results have been reviewed and approved by the COR.

iv. Perform additional tests as determined by the COR based on the variability in character of the material.

b. Testing performed during fill placement:

i. Perform continuous inspection of Earthfills in progress. Verify that foundation or subgrade areas are in the specified condition for placement of Earthfill; Earthfill materials are free of undesirable materials, are of the classification specified, and obtained from the specified borrow areas or stockpiles; placement, compaction, and moisture requirements are being met as specified; and mechanical and hand directed compaction is being accomplished as specified. Do not place additional Earthfill until acceptance of prior lift by the COR.

ii. Perform one of each of the following tests for every 10,000 square feet of fill surface, one of each test per shift, or one of each test per lift, whichever is more frequent:

- ASTM D6938 – Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Method (Shallow Depth). Dry density shall be computed using moisture content based on tests performed by either direct heating method (ASTM D4959) or microwave oven method (ASTM D4643). Moisture contents obtained from ASTM D6938 are not acceptable.

  or

- ASTM D1556 – Density and Unit Weight of Soil in Place by Sand-Cone Method.

iii. Report station, offset, lift number or elevation, and test results, including soil moisture content at the time of compaction (obtained by a method other than nuclear method), and the in-place wet and dry density of the compacted soil.

iv. Record the location of where material is placed for each day's placement and location of sampling points.

v. Perform one-point Proctor tests in field on a representative sample of each soil type daily to compare with laboratory test results. Perform additional field tests and collect samples for laboratory testing if results differ and/or visual classification changes.

9) In Section 9 – Measurement and Payment:

a. Methods 2 and 6 shall apply. The final grades shown on the Drawings include topsoil. Limits of payment for this Bid Item are to the final grades shown on the Drawings minus the topsoil thickness specified in Construction Specification 26, Topsoiling.

b. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control.

10) Items subsidiary to this Bid Item include:

a. Water for Construction, Construction Specification 10 – Water for Construction

B. *Subsidiary Item – Mobilization and Demobilization for Earthfill*

1) This item shall consist of the mobilization and demobilization of the Contractor's forces and equipment necessary for placing and compacting all miscellaneous earthfill to establish access and Staging and Stockpiling Areas to suit the Contractor's needs.

2) Placement layer thickness, moisture content and compaction shall be to suit the Contractor's needs.

3) In Section 8 – Testing, testing is not required.

4) In Section 9 – Measurement and Payment, no separate payment will be made for Mobilization and Demobilization for Earthfill. Compensation will be included in the payment for Bid Item 7, Mobilization and Demobilization, Construction Specification 8 – Mobilization and Demobilization.

C. *Subsidiary Item – Miscellaneous Earth Backfill*

1) This item consists of all earth backfill required to backfill the embankment toe drain outlet pipe, auxiliary spillway drain cleanouts, surface completions for geotechnical instrumentation, and other miscellaneous structures as shown on the Drawings.

2) In Section 2 – Material, earth backfill shall have a maximum particle size of 3 inches, except within 24 inches of conduits. At these locations, earth backfill shall have a maximum particle size of 1 inch.

3) In Section 4 – Placement, the loose lift thickness of Earth Backfill within 3 feet of structures shall not exceed 4 inches. Elsewhere, the loose lift thickness of earth backfill shall not exceed 6 inches.

4) In Section 5 – Control of Moisture Content, required moisture content of earth backfill shall be maintained from –2 percent to +3 percent of the material's optimum moisture content as determined by ASTM D698.

5) In Section 6 – Compaction, compaction shall be Class A with a minimum density of 95% of the material's maximum dry density in accordance with ASTM D698. Earth Backfill placed within 3 feet of structures or conduits shall only be compacted using lightweight compaction equipment such as walk-behind power tampers.

6) In Section 9 – Measurement and Payment, no separate payment will be made for Miscellaneous Earth Backfill. Payment for Miscellaneous Earth Backfill will be included in the payment for:

   a. Bid Item 27, Toe Drain Piping, Construction Specification 45 – Plastic Pipe
   b. Bid Item 29, ASW Drain Piping, Construction Specification 45 – Plastic Pipe
   c. Bid Item 46, Geotechnical Instrumentation, Construction Specification 401 – Geotechnical Instrumentation

****End of Construction Specification 23****

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CONSTRUCTION SPECIFICATION 24—DRAINFILL

1. Scope

The work consists of furnishing, placing, and compacting drainfill required in the construction of structure drainage systems.

2. Material

Method 1—Drainfill material shall conform to the requirements of Material Specification 521, Aggregates for Drainfill and Filters. A minimum of 30 days before delivery of materials to the site, the contractor shall inform the Engineer in writing of the source(s) from which drainfill material will be obtained. The Contractor shall provide the Engineer free access to the source(s) for the purpose of obtaining samples for testing.

Method 2—Drainfill material shall be sand, gravel, or crushed stone, or mixtures thereof, obtained from the specified sources. The material shall be selected as necessary to avoid the inclusion of organic matter, clay balls, excessive fine particles, or other substances that would interfere with their free-draining properties.

3. Base preparation

Foundation surface and trenches shall be clean and free of organic matter, loose soil, foreign substance, and standing water when the drainfill is placed. Earth surfaces upon or against which drainfill will be placed shall not be scarified.

4. Placement

Drainfill shall not be placed until the subgrade has been inspected and approved by the Engineer. Drainfill shall not be placed over or around pipe or drain tile until the installation of the pipe or tile has been inspected and approved.

Drainfill shall be placed uniformly in layers not to exceed 12 inches thick before compaction. When compaction is accomplished by manually controlled equipment, the layers shall not exceed 8 inches thick. The material shall be placed to avoid segregation of particle sizes and to ensure the continuity and integrity of all zones. No foreign material shall be allowed to become intermixed with or otherwise contaminate the drainfill.

Traffic shall not be permitted to cross over drains at random. Equipment cross-overs shall be maintained, and the number and location of such crossovers shall be established and approved before the beginning of drainfill placement. Each crossover shall be cleaned of all contaminating material and shall be inspected and approved by the Engineer before the placement of additional drainfill material.

Any damage to the foundation surface or the trench sides or bottom occurring during placement of drainfill shall be repaired before drainfill placement is continued.

The upper surface of drainfill constructed concurrently with adjacent zones of earthfill shall be maintained at a minimum elevation of 1 foot above the upper surface of adjacent earthfill.

Drainfill over and/or around pipe or drain tile shall be placed to avoid any displacement in line or grade of the pipe or tile.

Drainfill shall not be placed adjacent to structures until the concrete has attained the strength specified in Section 9 of this specification. The strength shall be determined by compression testing of concrete test cylinders cast and field cured at the project site in accordance with ASTM Method C 31 for determining when a structure may be placed into service.

When the required strength of the concrete is not specified as described above, placement of drainfill adjacent to concrete structures shall not be commenced until the following item intervals have elapsed following placement of the concrete:

Structure type	Time interval (days)
Vertical or near-vertical wall with earth loading on one side only (retaining walls and counterforts)	14
Walls backfilled on both sides simultaneously	7
Conduits and galleries, cast-in-place	
(with inside forms in place)	7
(inside forms removed)	14
Conduits, precast, cradled	2
Conduits, precast, bedded	1
Cantilever outlet bents backfilled on both sides simultaneously	3

5. Control of moisture

The moisture content of drainfill material shall be controlled as specified in Section 9 of this specification. When additional water is required, it shall be applied in a manner to avoid excessive wetting to adjacent earthfill. Except as specified in Section 9 of this specification, control of moisture content will not be required.

6. Compaction

Drainfill shall be compacted according to the following requirements for the class of compaction specified:

Class A compaction—For drainfill materials with more than 70 percent passing the 3/4 inch sieve, each layer of drainfill shall be compacted to a minimum dry density of not less than the density specified in Section 9 of this specification as determined by ASTM D 698. For drainfill materials with 70 percent or less passing the 3/4 inch sieve, each layer of drainfill shall be compacted to a relative density of not less than 70 percent as determined by ASTM D 4254.

Class I compaction—Each layer of drainfill shall be compacted by a minimum of two passes over the entire surface with a steel-drum vibrating roller weighing at least 5 tons and exerting a vertical vibrating force of not less than 20,000 pounds at a minimum frequency of 1,200 times per minute, or by an approved equivalent method.

Class II compaction—Each layer of drainfill shall be compacted by one of the following methods or by an approved equivalent method. (A pass is defined as at least one complete coverage of the roller wheel, tire, or drum over the entire surface for each layer.)

a. A minimum of two passes over the entire surface with a pneumatic-tired roller exerting a minimum pressure of 75 pounds per square inch.

b. A minimum of four passes over the entire surface with the track of a crawler-type tractor weighing at least 20 tons.

c. Controlled movement of the hauling equipment so that the entire surface is traversed by not less than one tread track of the loaded hauling equipment.

Class III compaction—No compaction will be required beyond that resulting from the placing and spreading operations.

When compaction other than Class III compaction is specified, material placed in trenches or other locations inaccessible to heavy equipment shall be compacted by manually controlled pneumatic or

vibrating tampers as specified in Section 9 of this specification.

Heavy equipment shall not be operated within 2 feet of any structure. Vibrating rollers shall not be operated within 5 feet of any structure. Compaction by means of drop weights operating from cranes, hoists, or similar equipment will not be permitted.

7. Testing

The Contractor shall conduct such tests as necessary to verify that the drainfill material and the inplace drainfill meets the specification requirements.

The Engineer shall be granted access to perform such tests as are required to verify that the drainfill materials and the drainfill in place meets the requirements of the specifications. These tests are not intended to provide the Contractor with information needed to assure that the materials and workmanship meet the specification requirements. These verification tests will not relieve the Contractor of the responsibility of performing required tests for that purpose.

8. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, the volume of drainfill within the neat lines shown on the drawings are measured and computed to the nearest cubic yard. Where the Engineer directs placement of drainfill outside the neat lines to replace unsuitable foundation material, the volume of such drainfill is included. The volume included is only to the extent that the unsuitable condition is not a result of the contractor's improper construction operation in the determination of the Engineer.

Payment for drainfill is made at the contract unit price for each type of drainfill, complete in place. Except as otherwise specified in Section 9 of this specification, such payment will constitute full compensation for all labor, equipment, material, and all other items necessary and incidental to the performance of the work.

Method 2—For items of work for which specific unit prices are established in the contract, the quantity of drainfill placed within the specified limits is computed to the nearest 0.1 ton by actual weight. Where the engineer directs placement of drainfill outside the neat lines to replace unsuitable foundation material, the weight of such drainfill is included. The weight included is only to the extent that the unsuitable condition is not a result of the contractor's improper construction operation in the determination of the engineer.

Payment for drainfill is made at the contract unit price for each type of drainfill, complete in place. Except as otherwise specified in section 9 of this specification, such payment will constitute full compensation for all labor, equipment, material, and all other items necessary and incidental to the performance of the work.

Compensation for any item of work described in the contract, but not included in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 9 of this specification.

9. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Bid Item 13 – Fine Drainfill

1) This item includes furnishing, placing, and compacting aggregates for the Fine Drainfill installed for the embankment toe drain and auxiliary spillway underdrains as shown on the Drawings.

2) Submit for approval to the COR written certification from supplier that materials meet the specified requirements.

3) Stockpiling, protection, placement, and compaction of Fine Drainfill and Coarse Drainfill shall be addressed in the Contractor's Fill Placement Plan discussed in Construction Specification 23, Earthfill.

4) In Section 2 – Material, Method 1 shall apply. Drainfill material shall be natural river or glacial sand and shall not be manufactured from rock crushing operations.

   a. Fine Drainfill shall be a fine aggregate meeting the gradation requirements of ASTM C33 fine aggregate. Fines shall be non-plastic when tested in accordance with ASTM D4318. The Contractor shall be responsible for demonstrating that the requirements specified herein are met.

ASTM C33 Fine Aggregate	
Sieve Opening	% by Weight of Materials Passing Sieve
⅜"	Min. 100
No. 4	95 - 100
No. 8	80 - 100
No. 16	50 - 85
No. 30	25 - 60
No. 50	10 - 30
No. 100	0 - 10
No. 200	0 - 5

   b. Calcium carbonate drainfill or drainfill derived from materials having either cementitious or solutioning properties shall not be used.

   c. Existing on-site drainfill materials from the embankment toe drain excavation shall not be reused as Fine Drainfill.

5) In Section 3 – Base Preparation, meet the requirements of Construction Specification 63, Treatment of Rock Surfaces prior to placement of the initial fill layer on rock foundations,

6) In Section 4 – Placement:

   a. Drainfill shall be placed in level lifts.

   b. Drainfill materials shall be placed in a manner to avoid segregation of particle sizes, and to ensure the continuity and integrity of all zones. No foreign materials shall be allowed to become intermixed with, or otherwise contaminate, drainfill materials.

Exposed areas of drainfill materials placed against existing subgrade materials shall be protected from contamination caused by erosion of the existing subgrade material.

c. Protect drainfill placed beneath and adjacent to structures from surface runoff or other concentrated flow that may cause erosion and/or undermining. Damage to work in place shall be repaired or replaced as directed by the COR at no additional cost to Government.

7) In Section 5– Control of Moisture, Fine Drainfill shall be in wet or near saturated condition when placed. Each layer of fine drainfill shall be saturated immediately prior to compaction. Water pumped from the on-site stream/lake or well shall not be applied to drainfill. The Contractor is responsible for locating an acceptable water source and submitting the proposed source to the COR for review and approval.

8) In Section 6 – Compaction, Class II compaction shall apply. Compaction shall consist of at least two complete passes per layer utilizing manually-controlled vibrating tampers. Drainfill placed against the existing principal spillway conduit shall be flooded with clean water and compacted with internal concrete and/or pogo-stick compactors.

9) In Section 7 – Testing, the Contractor shall be responsible for the following:

   a. Verify that the materials are obtained from an approved source.

   b. Perform continuous inspection during placement to verify that the drainfill is placed to the required lines and grades and is not contaminated with any other material.

   c. Tests shall be performed on representative samples obtained as the drainfill is placed.

   d. Perform one of each of the following tests for every 1,000 cubic yards of each type of drainfill, with a minimum of one of each test required if the total quantity placed for the project is less than 500 cubic yards:

      i. ASTM D422- Gradation

      ii. ASTM D4318 - Atterberg Limits

   e. Report station, offset, lift number or elevation, and test results

   f. Test results shall be provided to the COR within 72 hours of material placement.

10) In Section 8 – Measurement and Payment, Method 1 shall apply.

   a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control.

11) Items subsidiary to this Bid Item include:

   a. Water for Construction, Construction Specification 10 – Water for Construction

B. Bid Item 14 – Coarse Drainfill

1) This item includes furnishing, placing, and compacting aggregates for the Coarse Drainfill installed for the embankment toe drain and auxiliary spillway underdrains as shown on the Drawings.

2) Specified requirements for Bid Item 13 – Fine Drainfill apply to this Bid Item, except as modified below.

3) In Section 2 – Material, Method 1 shall apply. Drainfill material shall not be manufactured from rock crushing operations and shall meet the following grading requirements:

   a. Coarse Drainfill: WVDOT No. 89 Coarse Aggregate meeting the gradation requirements of West Virginia Department of Transportation Division of Highways

Standard Specifications Roads and Bridges Section 703. Fines shall be non-plastic when tested in accordance with ASTM D4318.

WVDOT No. 8 Coarse Aggregate	
Sieve Opening	% by Weight of Materials Passing Sieve
½"	Min. 100
⅜"	85 - 100
No. 4	10 - 30
No. 8	Max. 10
No. 16	Max. 5

4) In Section 5– Control of Moisture, no control of moisture is required for Coarse Drainfill except water pumped from the on-site stream/lake or well shall not be applied to drainfill.

5) Section 8 – Measurement and Payment, Method 1 shall apply.

   a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control.

6) Items subsidiary to this Bid Item include:

   a. Water for Construction, Construction Specification 10 – Water for Construction

C. *Subsidiary Item – Coarse Drainfill beneath Concrete Structures*

1) This item consists of furnishing and installing the Coarse Drainfill required for the leveling course beneath the Precast Seepage Collection Boxes, as shown on the Drawings.

2) Coarse Drainfill beneath Concrete Structures shall meet the same material and gradation requirements specified herein for Bid Item 14, Coarse Drainfill.

3) In Section 2, Material, Method 1 shall apply.

4) In Section 6, Compaction, compaction shall be Class II for the Coarse Drainfill, utilizing manually-controlled vibrating tampers with a minimum of two passes per layer.

5) No separate payment will be made for Coarse Drainfill beneath Concrete Structures. Compensation for this item will be included in the payment for:

   a. Bid Item 28, Precast Seepage Collection Boxes, Construction Specification 45 – Plastic Pipe

****End of Construction Specification 24****

CONSTRUCTION SPECIFICATION 26—TOPSOILING

1. Scope

The work consists of furnishing and spreading topsoil to specified depths at locations shown on the drawings.

2. Quality of topsoil

Topsoil shall consist of friable surface soil reasonably free of grass, roots, weeds, sticks, rocks, or other unsuitable material. Additional quality requirements, if any, are in Section 7 of this specification.

3. Furnishing

Method 1—Topsoil shall be salvaged from designated earth surfaces that will be disturbed by construction activities. After designated sites have been cleared and grubbed, the topsoil shall be removed from the designated areas and stockpiled at locations shown on the drawings or acceptable to the Engineer. Unsuitable material encountered during removal of topsoil shall be disposed of at locations shown on the drawings or approved by the Engineer, or it will be otherwise hauled and disposed of at locations removed from the construction site. The Contractor is responsible for complying with all local rules and regulations and the payment of any and all fees that may result from the disposal at locations outside the construction work limits.

Method 2—Topsoil shall be furnished from an offsite source designated by the contractor. The engineer shall be granted access to the source for inspection and acceptance before delivery to the site. Test results and samples shall be provided when specified in Section 7 of this specification.

4. Stockpiling

Stockpiles of topsoil shall not conflict with the requirements of Construction Specification 5, Pollution Control, when made a part of this contract.

5. Spreading

Method 1—Spreading shall not be conducted when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to uniform spreading operations. Surfaces designated to receive a topsoil application shall be lightly scarified just before the spreading operation.

Following the spreading operation, the topsoil surface shall be left reasonably smooth and without ruts or surface irregularities that could contribute to concentrated waterflow downslope.

Method 2—Spreading shall not be performed when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to uniform spreading operations. Surfaces designated to receive a topsoil application shall be lightly scarified just before the spreading operation. Where compacted earthfills are designated to be topsoiled, the topsoil shall be placed concurrently with the earthfill and shall be bonded to the compacted fill with the compacting equipment.

Following the spreading operation, the topsoil surface shall be left reasonably smooth and without ruts or surface irregularities that could contribute to concentrated waterflow downslope.

6. Measurement and payment

Method 1—The total surface covered by topsoil is measured and the area(s) computed to the nearest square yard. Payment for furnishing and placing topsoil is made at the contract unit price.

Method 2—The total surface covered by topsoil, except the surface area of embankments, levees, dikes, and other earthfills not included for payment, is measured and the area(s) computed to the nearest square yard.

Payment for topsoil spread on the surface of embankments, levees, dikes, and other earthfills is included in the measurement and payment for that item of earthfill where topsoil application occurred.

Method 3—For items of work for which specific unit prices are established in the contract, the volume of topsoil furnished and spread is computed to the nearest cubic yard by the method of average cross-sectional end areas from surveys of the excavated topsoil stockpile or, if not stockpiled, cross-sectional surveys of the borrow area(s). Payment for furnishing and spreading topsoil is made at the contract unit price.

All methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

All payment methods—Payment will constitute full compensation for all labor, equipment, material, and all other items necessary and incidental to the completion of the work. This includes excavating, stockpiling, hauling, spreading, and the wasting of unsuitable excavated material.

7. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Bid Item 15 – Topsoil

1) The item consists of stripping and temporary stockpiling of existing topsoil, and loading, hauling, and respreading topsoil to specified depths at locations shown on the Drawings excluding the Staging and Stockpiling Areas.

2) In Section 3 – Furnishing, Method 1 shall apply. Stripping depth is estimated to vary up to 6 inches. Clear and grub surfaces as shown on the drawings and in accordance with the requirements of Construction Specification 2, Clearing and Grubbing. Perform soil sample analysis for topsoil in accordance with the requirements specified in Construction Specification 6, Seeding, Sprigging, and Mulching.

3) In Section 4 – Stockpiling, Stockpile stripped topsoil in the Staging Area shown on the Drawings.

4) In Section 5 – Spreading

   a. Method 1 shall apply.

   b. In the areas to be topsoiled, the Contractor shall complete all grading necessary to bring the surface to the lines indicated on the Contract Drawings and parallel to the proposed finished grade. These areas are to be free from rock or other foreign material of 2 inches or greater in any dimension.

   c. Topsoil shall not be placed until the area to be covered has been shaped, trimmed, finished, and all other construction work in the area has been completed. Topsoil shall be placed and spread to a depth sufficiently greater than 6 inches so that after compaction, the completed work shall conform to the lines, grades, and elevations indicated on the Contract Drawings. The depth of topsoil after compaction shall be 6 inches. Topsoil shall be placed within the following tolerances:

      i. For embankment slopes, gradual changes of plus or minus 0.1 feet from plan line and grade.

      ii. For the crest of the dam, specified elevation to +0.1 feet.

      iii. All other surfaces shall be within plus or minus 0.3 feet from plan line and grade.

   d. After spreading the topsoil, all large stiff clods, hard lumps, large rocks, stumps, litter, or other foreign matter shall be raked up, removed from the topsoil area, and disposed of by the Contractor.

   e. Add 2 inches of compost and till amended topsoil.

   f. The area shall then be rolled with a light roller weighing not less than 100 pounds and not over 210 pounds per foot of width with an approved cultipacker.

5) In Section 6 – Measurement and Payment, Method 1 shall apply. Measurement is based on horizontal distance (distance in plan view) of the final topsoiled placement areas.

B. Bid Item 16– Topsoil Import

1) This item shall consist furnishing all materials, equipment, manpower, and any other incidental items necessary to provide topsoil from an approved source provided by the Contractor, delivered to the site, and stockpiled for measurement.

2) Section 3, Furnishing, Method 2 shall apply. All imported topsoil shall be piled in no more than two piles upon completion of all import. Once the pile is complete it will be measured for payment. No imported topsoil shall be spread until hauling is complete and the stockpile(s) has been measured for payment. Perform soil sample analysis for topsoil in accordance with

the requirements specified in Construction Specification 6, Seeding, Sprigging, and Mulching.

3) In Section 4 – Stockpiling

   a. Stockpile stripped topsoil in the Staging Area shown on the Drawings.

   b. The stockpile area shall be protected from erosion in accordance with Construction Specification 5, Pollution Control.

4) Section 5, Spreading, does not apply.

5) In Section 6, Measurement and Payment, Method 3 shall apply with the exception this item only includes providing and stockpiling the topsoil. Spreading topsoil is part of the requirements for Bid Item 15, Topsoil.

C. *Subsidiary Item – Staging and Stockpiling Areas for Topsoiling*

1) This item consists of stripping and temporary stockpiling of existing topsoil and hauling and respreading topsoil to specified depths within the Staging and Stockpiling Areas shown on the Drawings.

2) Specified requirements for Bid Item 15 – Topsoil apply to this Subsidiary Item, except as modified below:

   c. In Section 6 – Measurement and Payment, no separate payment will be made for topsoiling the staging and stockpiling areas. Compensation will be included in Bid Item 7, Mobilization and Demobilization, Construction Specification 8 – Mobilization and Demobilization.

****End of Construction Specification 26****

CONSTRUCTION SPECIFICATION 31—CONCRETE FOR MAJOR STRUCTURES

1. Scope

The work consists of furnishing, forming, placing, finishing, and curing Portland Cement Concrete as required to build the structures designated in Section 25 of this specification.

The following BioPreferred® product category is applicable to this specification.
— Concrete release fluids (a.k.a., form-release agents)

2. Material

Aggregates must conform to the requirements of Section 25 and Material Specification 522, Aggregates for Portland Cement Concrete, unless otherwise specified.

Portland cement must conform to the requirements of Material Specification 531, Portland Cement, for the specified type. One brand only of any type of cement may be used in any single structure as defined in Section 25.

Fly ash must conform to the requirements of Material Specification 532, Supplementary Cementitious Materials.

Blast-furnace slag used as a partial substitution of Portland cement in concrete must conform to the requirements of Material Specification 532, Supplementary Cementitious Materials.

Silica fume must conform to the requirements of Material Specification 532, Supplementary Cementitious Materials.

Air-entraining admixtures must conform to the requirements of Material Specification 533, Chemical Admixtures for Concrete. If air-entraining cement is used, any additional air-entraining admixture must be of the same type as that in the cement.

Plasticizing admixtures must conform to the requirements of Material Specification 533, Chemical Admixtures for Concrete.

Water-reducing or retarding admixtures must conform to the requirements of Material Specification 533, Chemical Admixtures for Concrete.

Accelerating and water-reducing and accelerating admixtures, if specified in Section 25, must conform to the requirements of Material Specification 533, Chemical Admixtures for Concrete.

Curing compound must conform to the requirements of Material Specification 534, Concrete Curing Compound.

Preformed expansion joint filler must conform to the requirements of Material Specification 535, Preformed Expansion Joint Filler.

Sealing compound for joints must conform to the requirements of Material Specification 536, Sealing Compound for Joints in Concrete and Concrete Pipe.

Waterstops must conform to the requirements of Material Specifications 537, Nonmetallic Waterstops, and 538, Metal Waterstops, for the specified kinds.

Dowels must be a plain, round steel bar conforming to the requirements of Material Specification 539, Steel Reinforcement (for concrete).

Metal plates must conform to the requirements of Material Specification 581, Metal, for structural quality or commercial or merchant quality steel. Structural quality must be used only if specifically designated in the drawings or specifications.

Water used in mixing and curing concrete must be clean and free from injurious amounts of oil, salt, acid,

alkali, organic matter, or other deleterious substances.

3. Concrete mix design

Method 1

Responsibilities—The Contractor is responsible for the design and proportioning of the concrete. Job mixes must be prepared to meet the quality, consistency, and strength of concrete specified.

Submittals—At least 15 calendar days before the placement of any concrete, the Contractor must provide the Engineer with full documentation to support each job mix and any admixtures to be used in the work. The Contractor must furnish test results to the Engineer for each admixture showing that it meets the requirements of Material Specification 533, Chemical Admixtures for Concrete. Job mixes are reviewed and accepted or rejected by the Engineer within 8 calendar days following the date of submittal. After a job mix has been accepted, neither the source, character, nor gradation of the aggregates nor the type or brand of cement or admixtures may be changed without prior notice to the Engineer. Revisions or changes in a job mix that are determined to be significant by the Engineer must follow the same submittal and acceptance process as that for the initial job mix.

Design criteria—The class of concrete must be as specified in Section 25 and in accordance with the following specified compressive strength.

Class of concrete	Specified compressive strength (f'_c) at 28 days (lb/in^2)
5000	5,000
4000	4,000
3000	3,000
2500	2,500

Maximum water-cement ratio must be 0.50, unless otherwise specified.
Unless otherwise specified the air content (by volume) of the concrete at the time of placement must be:

Maximum size aggregate	Air content (%)
⅜ inch to I inch	5 to 7
Over I inch	4 to 6

The consistency of all concrete must allow it to be placed without segregation or excessive laitance. Unless otherwise specified, the slump must be:

Type of structural section	Slump (inches)
Massive sections, pavements, footings	2 ± 1
Heavy beams, thick slabs, thick walls (>12 inches)	3 ± 1
Columns, light beams, thin slabs, thin walls (12 inches or less)	4 ± l

Superplasticized concrete must contain either a water-reducing, high range admixture (ASTM C494, Type F or G) or a plasticizing admixture (ASTM C1017) at a dosage rate that reduces the quantity of water required to produce a concrete mix within the above slump range by 12 percent or more or produces an increase in the slump of at least 2 inches above the slump of the design mix containing no water reducer or plasticizing admixture.

A water-reducing admixture (ASTM C494, Type F or G), a plasticizing admixture (ASTM C1017), or both may be added to an approved job mix without resubmittal and reapproval of the job mix if the following requirements are met:

a. The admixture must be introduced into the concrete mix as specified by the manufacturer and be compatible with other admixtures in the job mix.

b. The water content must be equal to or less than that required in the job mix without the admixture.

c. The cement content must be the same as that required in the job mix without the admixture.

d. The air content must be within the specified range.

e. The slump must not exceed 7.5 inches unless the contractor demonstrates before placement that the job mix can be placed without segregation or excessive laitance at a slump greater than 7.5 inches. The concrete must retain the increased slump for not less than 30 minutes.

f. If the admixture is added at the job site, the slump of the concrete before the addition of the admixture must not exceed the slump specified above for concrete that does not contain the admixture.

Calcium chloride or other corrosive accelerators may not be used unless otherwise specified.
Fly ash may be used as a partial substitution for portland cement in an amount not greater than 25 percent (by weight) of cement in the concrete mix unless otherwise specified.

Ground granulated blast-furnace slag may be used as a partial substitution for portland cement in amounts between 25 to 70 percent (by weight) of cement in the concrete mix unless otherwise specified.

Silica fume may be used as a partial substitution for portland cement in an amount ranging from 5 to 10 percent (by weight) of cement in the concrete mix unless otherwise specified.

Job mix criteria—Proportioning of concrete for job mixes must be based on the standard deviation computed from compressive strength tests of previous batch records or established by laboratory trial mixes. Unless otherwise specified, a compressive strength test is the average of the compressive strengths of two standard cured cylinders prepared and tested in accordance with Section 4.

For a job mix based upon the standard deviation computed from compressive strength tests of previous

batch records, the previous batches must represent similar material and conditions to those expected for the job mix and have a strength within 1,000 pounds per square inch of the specified compressive strength (f'_c) at 28 days for the class of concrete specified. The contractor must provide to the Engineer copies of the facility's previous batching records that show the compressive strength Results and the batch mix design used.

For a job mix based upon a laboratory trial mix, the trial mix must contain the actual material to be used in the final job mix, have a slump within 0.75 inches of the maximum allowable slump, and have an air content within 0.5 percent of the maximum allowable air content. The contractor must provide the Engineer with copies of the actual compressive strength test records for the trial mix from the testing facility performing the test.

The trial job mix or previous batch records must include the water-reducing admixture when a water-reducing admixture is used in a concrete mix specifically to improve the physical properties of the hardened concrete or change portions of the mix components.

In meeting strength requirements, the selected job mix proportions must produce an average strength, f_{cr}, exceeding the specified compressive strength, f'_c, by the amount specified.

n	s_{30}	f_{cr}
>30	1.00 s	The larger of these
25	1.03 s	two equations:
20	1.08 s	$f'_c + 1.34\ s30$
15	1.16 s	$f'_c + 2.33\ s30–500$
<15		$f'_c + 1,000$ for $f'_c < 3,000$
		$f'_c + 1,200$ for $3,000 \leqq f'_c \leqq 5,000$
		$1.10\ f'_c + 700$ for $f'_c > 5,000$

Where—

n = number of consecutive compressive strength tests
s_{30} = standard deviation adjusted to 30 tests, lb/in^2
f_{cr} = required average compressive strength, lb/in^2
f'_c = specified compressive strength of concrete, lb/in^2
s = standard deviation (lb/in^2) computed as $\{[\text{sum}(Xi-Xa)^2]/[n-1]\}^{1/2}$
where:
Xi = individual strength test result, lb/in^2
Xa = average of n strength test results, lb/in^2

Method 2

Responsibilities—The engineer is responsible for the design and proportioning of the job mix. The initial job mix must be as specified in section 25. The engineer may adjust the initial job mix proportions to establish the designated job mix. The engineer will provide the contractor with a copy of each job mix as soon as the material and proportions have been determined. After the job mix has been designated, neither the source, character, nor gradation of the aggregates nor the type or brand of cement or admixtures may be changed without prior approval of the engineer. During the course of the work, the

engineer may adjust the job mix proportions and batch weights whenever necessary to meet special job conditions.

The contractor, for each class of concrete, is responsible for—

a. Taking the following actions and furnishing the engineer with the following information at least 35 calendar days before any placement of concrete, unless otherwise designated:

(1) Select the source of aggregates and sample and test the gradations of aggregates available.

(2) Select the brand and type of cement.

(3) Select the brand of admixtures and obtain manufacturer's test data and recommendation of use.

(4) Identify the concrete production facility, the type of mixer, and the mixing methods that will be used.

(5) Provide from the concrete production facility consecutive compressive strength test records and batching records for concrete mixes that have material, proportions, and compressive strengths within 1 000 pounds per square inch of the proposed design mix.

b. Batching at least 3 cubic yards of the initial job mix, in the presence of the engineer, for testing and evaluation not less than 30 calendar days before any placement of concrete.

4. Inspecting and testing

During the course of the work, the Engineer performs quality assurance testing as required to verify the concrete meets the contract requirements. The Engineer must have free entry to the plant and equipment furnishing concrete under the contract. Proper facilities must be provided for the Engineer to inspect material, equipment, and processes and to obtain samples of the concrete. All tests and inspections are conducted so as not to interfere unnecessarily with the manufacture, delivery, and placement of the concrete.

Any portion of a batch may be tested by the Engineer for any of the purposes shown below. Samples taken for testing must be representative of that part of the batch.

a. Determining uniformity of the batch.

b. Checking compliance with requirements for slump and air content when the batch is discharged over an extended period.

c. Checking compliance of the concrete with the specifications when the whole amount being placed in a small structure, or a distinct part of a larger structure, is less than full batch.

If concrete is conveyed to the placement location by pumping or conveyor belts, the samples must be collected at the discharge end.

When a plasticizing admixture is added to the concrete mix at the job site, slump tests are made both before the addition of the admixture to the concrete mix and after the admixture has been incorporated into the concrete mix.

The tests on concrete are performed by the following methods unless otherwise specified:

Type of test	Test method (ASTM designation)
Sampling	C172
Slump test	C143
Air content	C231 or C173
Compression test specimens	C31 or C42
Compressive strength testing	C39
Unit weight	C138
Temperature	C1064

A strength test for concrete is the average of two standard cured concrete cylinders prepared in accordance with ASTM C31 from the same sample of concrete and tested in accordance with ASTM C39 at 28 days, unless otherwise specified. If one cylinder shows manifest evidence of improper sampling, molding, curing, or testing, it must be discarded and the strength of the remaining cylinder must then be considered the compressive strength of the concrete. Should both cylinders show such defects, the entire test must be discarded.

If both cylinders are discarded or in-place concrete that was not sampled is in question, the in-place concrete may be sampled by coring in accordance with ASTM C42. For core tests, these requirements must be followed:

a. At least three representative cores must be taken from each area of concrete in question. If one or more of the cores shows signs of being damaged before testing, it must be replaced by a new one.

b. Test cores must be prepared for testing in accordance with moisture conditioning in ASTM C42 unless the Engineer determines that the concrete in the structure will be dry under service conditions. If the concrete is determined to be dry under service conditions, the cores must be air dried (temperature 60°F to 80°F and relative humidity less than 60%) for 7 days before testing and must be tested dry.

5. Handling and measurement of material

Aggregates must be stored or stockpiled in such a manner that separation of coarse and fine particles of each size is avoided and that various sizes do not become intermixed before proportioning. Methods of handling and transporting aggregates must avoid contamination, excessive breakage, segregation, degradation, or intermingling of various sizes.

Unless otherwise specified, scales must be beam type or spring-less dial type. They must be accurate when static load tested to plus 0.4 percent of the total capacity of the scales. All exposed fulcrums, clevises, and similar working parts of scales must be kept clean.

Measuring tanks for mixing water must be of adequate capacity to furnish the maximum amount of mixing water required per batch. Tanks must be equipped with outside taps and valves to verify their calibration unless other means are provided for readily and accurately determining the amount of water in the tank.

The quantities of each component of the concrete mix must be measured by the following methods and to the accuracy indicated below:

Cement, fly ash, slag—Cement, except as otherwise specifically permitted, must be measured by weight or in bags on which the weight is plainly marked. When cement, fly ash, and slag are supplied in bulk and are measured by weight, they must be weighed on a scale separate from that used for other material and in a hopper entirely free and independent of the hopper used for weighing the aggregate. When fly ash or slag is used in the job mix, the cement and the fly ash or slag may be weighed separately or cumulatively by weighing the cement first and then adding the fly ash or slag to arrive at the composite weight. The weight of the cement and the combined weight of the cement and fly ash or slag must be within plus or minus 1 percent of the required weight of the cementitious material. When cement is measured in bags, no fraction of a bag may be used unless weighed.

Aggregates—Aggregates must be measured by weight unless otherwise specifically permitted. Mix proportions must be based on saturated, surface-dry weights. The batch weight of each aggregate is the required saturated, surface-dry weight corrected by the weight of surface moisture it contains. The weight of each of the specified aggregates must be within plus or minus 2 percent of the required weight.

Mixing water—Mixing water consists of water added to the batch, ice added to the batch, water occurring as surface moisture on the aggregates, and water introduced in the form of admixtures. The added water must be measured by weight or volume to an accuracy of I percent of the required total mixing water. Added ice must be measured by weight. Wash water must not be used as part of the mixing water for succeeding batches.

Admixtures—Dry admixtures must be measured by weight. Paste or liquid admixtures must be measured by weight or volume. The admixtures must be within plus or minus 3 percent of the required weight or volume for each specific admixture.

6. Mixers and mixing

Mixers are either stationary parts of a central mixing plant or portable equipment, such as revolving drum truck mixers and volumetric batching/continuous mixing truck mixers. Mixers must be capable of thoroughly mixing the concrete ingredients into a uniform mass within the specified mixing time and of discharging the mix without segregation. Each mixer or agitator must bear a manufacturer's rating plate indicating the gross volume of the drum, the capacity of the drum or container in terms of the volume of mixed concrete, and the minimum and maximum mixing speeds of rotation of the drum, blades, or paddles. When the truck mixer is used for truck-mixed concrete as described in section 6a(2) or for shrink-mixed concrete as described in section 6a(3), the capacity of the drum or container in terms of the volume of mixed concrete must not exceed 63 percent of the gross volume of the drum. When the truck mixer is used to transport central-mixed concrete as described in section 6a(1), the capacity of the drum or container in terms of the volume of mixed concrete must not exceed 80 percent of the gross volume of the drum. The mixer must be operated in accordance with these recommendations.
Concrete must be uniform and thoroughly mixed when delivered to the forms in a freshly mixed and unhardened state. Variations in slump of more than 1 inch within a batch is considered evidence of inadequate mixing and must be corrected by changing batching procedures, increasing mixing time, changing mixers, or other means. Mixing time must be within the limits specified below unless the contractor demonstrates by mixer performance tests that adequate uniformity is obtained by different times of mixing.

No mixing water in excess of the amount called for by the job mix may be added to the concrete during mixing or hauling or after arrival at the delivery point. Water to compensate for up to a 1-inch loss in slump may be added, not to exceed the design maximum water cement ratio. Withholding some of the mixing water until the concrete arrives on the job, then adding the remaining water and turning the mixer 30 revolutions at mixing speed is allowed to overcome transporting conditions. When loss of slump or workability cannot be offset by these measures, complete mixing must be performed by onsite batching and mixing or by using a combination of centrally batching and transporting material to the site and adding remainder of material onsite.

Concrete may be furnished by ready-mix methods, by volumetric batching and continuous mixing at the site, or by batch mixing at the site.

a. Ready-mixed concrete

Ready-mixed concrete must be mixed, transported, and placed in a freshly mixed and unhardened state. The contractor must furnish the Engineer a batch ticket showing amount of concrete in cubic yards, the time of loading, the time the load was discharged, the revolution counter reading at the time of loading and discharge, and the type and actual quantity of each material including all admixtures used in each batch of concrete. The batch ticket must include information necessary to calculate the water-cementitious materials ratio.

Truck mixers and truck agitators must be equipped with revolution counters by which the number of revolutions of the drum or blades may be readily verified. Ready-mixed concrete must be mixed and delivered by one of the following methods:

(1) Central-mixed concrete—Central-mixed concrete is mixed completely in a stationary mixer and transported to the point of delivery either in a truck agitator, a truck mixer operating at agitating speed, or non-agitating equipment.

When a truck agitator or a truck mixer is used as an agitator and transports concrete that has been completely mixed in a stationary mixer, mixing during transportation must be at the speed designated by the manufacturer of the equipment as agitating speed. When concrete is transported in a truck mixer or truck agitator, the volume of the mixed concrete must not exceed 80 percent of the gross volume of the drum. The total number of revolutions of the truck mixer or truck agitator must not exceed 200 before discharge of the concrete, unless otherwise specified.

The use of non-agitating equipment to transport concrete to the site of the work is permitted only if the consistency and uniformity of the concrete as discharged at the point of delivery meet the requirements of this specification. Bodies of non-agitating hauling equipment must be constructed so that leakage of the concrete mix, or any part thereof, does not occur. Concrete hauled in open-top vehicles must be protected from rain and from more than 20 minutes exposure to the sun and wind when the air temperature is above 75 degrees Fahrenheit.

(2) Truck-mixed concrete—Truck-mixed concrete is completely mixed in a truck mixer. The total volume of all ingredients to be mixed in a revolving drum truck mixer must not exceed 63 percent of the gross volume of the drum. The concrete ingredients must be mixed between 70 and 100 revolutions of the drum or blades at the speed designated by the manufacturer as mixing speed. Mixing in excess of 100 revolutions must be at the speed designated by the manufacturer of the equipment as agitating speed.

(3) Shrink-mixed concrete—Shrink-mixed concrete is partly mixed at a central plant and the mixing is completed in a truck mixer. The mixing time in the central plant mixer is the minimum required to intermingle the ingredients. The volume of the mixed concrete in a truck mixer must not exceed 63 percent of the gross volume of the truck drum. The mixing must be completed in a truck mixer. The number of revolutions of the truck mixer drum or blades must be between 50 and 100 revolutions at the speed designated by the manufacturer as mixing speed. Mixing in excess of 100 revolutions must be at the speed designated by the manufacturer of the equipment as agitating speed.

b. Volumetric batching and continuous mixing at the site

Equipment used for volumetric batching and continuous mixing at the site is commonly referred to as mobile concrete mixers. Unless otherwise specified, volumetric batching and continuous mixing at the construction site is permitted. The batching and mixing equipment must conform to the requirements of ASTM C685 and must be demonstrated before placement of concrete by tests with the job mix to produce

concrete meeting the specified proportioning and uniformity requirements. Concrete made by this method must be produced, inspected, and documented in conformance with ASTM C685.

c. Batch mixing at the site

This method of batching and mixing concrete is either by batching and mixing all material onsite using paving mixers or stationary construction mixers or by using a combination of centrally batching part of the mix, transporting it to the site, and adding the rest of the material and mixing onsite.

Paving mixers or stationary construction mixers and associated transport vehicles must be in accordance with recommended practices described in method 1 for central mixed concrete. The time for mixing a batch of concrete in the mixer drum must be according to manufacturer's recommendations, but not less than 1 minute plus 0.25 minute for each cubic yard of concrete being mixed (8 yd^3 batch = 3 minutes).

When a combination of centrally batching and transporting material to the site and adding rest of material onsite is used, the contractor must prepare a written plan detailing how the batching and mixing of the concrete material will be accomplished and controlled. This written batching and mixing plan must be submitted to the Engineer for review and approval not less than 10 working days before the placement of concrete. The volume of the mixed concrete in a truck mixer must not exceed 63 percent of the gross volume of the drum.

The Contractor must furnish the Engineer a batching ticket for each batch of fresh concrete. The ticket shows the type, brand, and amount of cement; the type, name, and amount of each admixture; total water added to the batch, which includes free water on the aggregate; maximum size of aggregate; the type and dry weight of fine aggregate; the type and dry weight of coarse aggregate; the time of loading (the time that water was introduced to the cement); and the time the load was discharged.

7. Forms

Forms must be of good quality wood, plywood, steel, or other approved material and must be mortar tight. The forms and associated falsework must be substantial and unyielding and must be constructed so that the finished concrete conforms to the specified dimensions and contours. Form surfaces must be smooth and free from holes, dents, sags, or other irregularities and must be maintained in this condition throughout the work. Forms must be coated with a non-staining form release agent before being set into place. Acceptable tolerances for formed structure members are specified in Section 23.

When a superplasticized concrete mix is used, forms must be designed to withstand the increased pressures of the superplasticized concrete and the increased impact forces resulting from larger drop heights used in placing the superplasticized concrete. Form release agents must be specifically formulated, when specified, for use with plasticized concrete or documentation from the release agent manufacturer must be provided stating that formed concrete surfaces made using the form release agent with plasticized concrete have not varied significantly from nonplasticized concrete surfaces made using the same form release agent. If the form release agent is not specifically formulated for use with plasticized concrete and, after observing its performance, it is suspected the release agent is responsible for causing increased surface imperfections (bug-holes), a release agent specifically formulated for use with plasticized concrete must be used for all formed concrete to be subsequently placed.

Metal ties or anchorages that will be embedded in the concrete must be equipped with cones, she-bolts, or other devices that permit their removal to a depth of at least 1 inch without injury to the concrete. Ties designed to break off below the surface of the concrete must not be used without cones. If approved fiberglass or plastic form ties are used, the tie ends must be cut flush with the finished concrete and ground smooth.

All edges that will be exposed must be chamfered unless finished with molding tools as specified in Section 18.

8. Preparation of forms and subgrade

Before placement of concrete, the forms, embedments, and subgrade must be free of chips, sawdust, debris, water, ice, snow, extraneous oil, mortar, or other harmful substances or coatings. Any form release agent on the reinforcing steel or other surfaces required to be bonded to the concrete must be removed.

Rock surfaces must be cleaned by high pressure air-water cutting, sandblasting, or wire brush scrubbing, as necessary, and must be wetted immediately before placement of concrete. The earth surface must be firm and damp. Placement of concrete on mud, dried earth, non-compacted fill, or frozen subgrade is not permitted. All ice, snow, and frost must be removed, and the temperature of all surfaces, including the reinforcing steel and other steel inclusions, to be in contact with the new concrete must be no colder than 40 degrees Fahrenheit.

Items to be embedded in the concrete must be positioned accurately and anchored firmly.
Weep holes in walls or slabs must be formed with nonferrous material.

9. Conveying

Concrete must be delivered to the site and discharged completely into the forms within 1.5 hours after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85 degrees Fahrenheit or above, the time between the introduction of the cement to the aggregates and discharge must not exceed 45 minutes.

Superplasticized concrete may be conveyed and placed when the temperature of the concrete is below 95 degrees Fahrenheit and the slump of the concrete remains within the allowable slump range.

The Engineer may allow an appropriate extension of time when the setting time of the concrete is increased a corresponding amount by the addition of an approved admixture. In any case, concrete must be conveyed from the mixer to the forms as rapidly as practicable by methods that prevent segregation of the aggregates or loss of mortar.

10. Placing

Concrete must not be placed until the subgrade, forms, steel reinforcement, and other embedments are inspected and approved by the Engineer. For walls and columns, subsequent higher placements of concrete must not be placed until the concrete below the new placement has gained sufficient strength to support the concrete dead load and any superimposed loads without distress. Placement sequences and timing must consider form removal timing covered in Section 16.

If a placement plan is required in Section 25, concrete must not be placed until the placement plan has been reviewed and approved by the Engineer. The Contractor must have all equipment and material required for curing available at the site ready for use before placement of concrete begins.

Concrete must be placed only in the presence of the Engineer. The Contractor must give reasonable notice to the Engineer before each placement. Such notice must be far enough in advance to give the Engineer adequate time to verify that the subgrade, forms, steel reinforcement, and other preparations comply with specifications. Other preparations include, but are not limited to, the concrete batching plant, mixing and delivery equipment and system, placing and finishing equipment and system, schedule of work, workforce, and heating or cooling facilities, as applicable. All deficiencies are to be corrected before concrete is delivered for placing.

Concrete must be placed and consolidated to prevent segregation of the mix components. The concrete must be deposited as closely as possible to its final position in the forms. It must be worked into the corners and angles of the forms and around all reinforcement and embedded items to prevent segregation of aggregates or excessive laitance. The depositing of concrete must be regulated so that the concrete can be consolidated with a minimum of lateral movement. Concrete placement against a sloping

surface must start at the lowest elevation and work upwards to the highest elevation.

Concrete other than architectural concrete must not be dropped more than 5 feet vertically unless suitable equipment is used to prevent segregation. Architectural concrete must not be dropped more than 3 feet vertically unless suitable equipment is used to prevent segregation. When a superplasticized concrete mix is used, concrete other than architectural concrete must not be dropped more than 12 feet vertically and architectural concrete must not be dropped more than 10 feet vertically unless suitable equipment is used to prevent segregation.

11. Layers

Slab concrete must be placed to design thickness in one continuous layer unless otherwise specified. Formed concrete must be placed in horizontal layers not more than 20 inches deep. Where a superplasticized concrete mix is used, formed concrete may be placed in horizontal layers not more than 5 feet deep.

Successive layers of fresh concrete between construction joints must be placed at a rate fast enough that the preceding layer is still plastic and can be easily mixed with the fresh concrete such that seams (cold joints) or plane of weakness do not occur. If the surface of a previously placed layer of concrete has taken a set to the degree that it will not flow and mix with the succeeding layer when vibrated, the Contractor must discontinue placing concrete and must make a construction joint according to the procedure specified in Section 13. If placing is discontinued when a layer is incomplete, the ends of the incomplete layer must be formed by a vertical bulkhead.

12. Consolidating

All concrete must be consolidated with internal type mechanical vibrators capable of transmitting vibration to the concrete at frequencies not less than 8,000 impulses per minute, unless otherwise specified or approved before placement. Vibration must be supplemented by spading, rodding, and hand tamping as necessary to ensure smooth and dense concrete along the form surface, in corners, and around embedded items. The Contractor must provide a sufficient number of vibrators to properly consolidate the concrete immediately after it is placed. A sufficient number of standby vibrators must be kept onsite during the placement of concrete.

Vibration must compact the concrete and bring it into intimate contact with the forms, reinforcing steel, and other embedded items while removing voids and pockets of entrapped air. The location, insertion, duration, and removal of the vibrators must be such that maximum consolidation of the concrete is achieved without causing segregation of the mortar and coarse aggregate or causing water or cement paste to flush to the surface. Vibration must be applied to the freshly deposited concrete by rapidly inserting the vibrator and slowly, in an up and down motion, removing the vibrator at points uniformly spaced at not more than 1.5 times the radius of the area visibly effected by vibration. Generally, this is at 5 to 10 seconds per foot on 14-inch spacings or less. The area visibly effected by the vibrator must overlap the adjacent, just vibrated area. The vibrator must extend vertically into the previously placed layer of fresh concrete by at least 6 inches at all points. This ensures effective bond between layers. In thin slabs the vibrator(s) should be sloped toward the horizontal to allow operations in a fully embedded position.

Vibration must not be applied directly to the reinforcement steel, the forms, or other embedded items unless otherwise specified. Vibration must not be applied to concrete that has hardened to the degree that it does not become plastic when vibrated. If surface vibrators are used, they may contact forms when consolidating thin slabs.

The use of vibrators to transport concrete in the forms or conveying equipment is not permitted.

Surface vibrators may be used to consolidate slabs 8 inches and less in thickness. Slabs more than 8 inches thick must be consolidated with internal vibration and may be augmented through use of surface vibrator, such as vibrating screeds, plate or grid vibratory tampers, or vibratory roller screeds. If concrete

is to be consolidated using surface vibration methods, the contractor must detail how this work is to be performed in writing to the Engineer for review and approval. This report must be submitted no less than 30 calendar days before placing concrete by this method. It includes equipment selection and specifications.

13. Construction joints

Construction joints must be made at the locations shown on the drawings unless otherwise specified or approved by the Engineer. If construction joints are needed that are not shown on the drawings, they must be placed in locations approved by the Engineer.

Where a feather edge would be produced at a construction joint, as in the top surface of a sloping wall, an insert form must be used so that the resulting edge thickness on either side of the joint is not less than twice the maximum aggregate diameter used in the concrete mix.

Non-vertical construction joints in structural elements, such as walls and columns, must be consolidated and screeded to grade unless otherwise specified. Construction joints must be covered and wet cured for 7 days or until concrete placement resumes unless otherwise specified.

Steel tying and form construction next to concrete in place must not be started until the concrete has cured at least 12 hours. Before new concrete is deposited on or against concrete that has hardened, the forms must be retightened. New concrete must not be placed until the hardened concrete has cured at least 12 hours.

Method I—The surface of construction joints must be cleaned of all unsatisfactory concrete, laitance, coatings, stains, or debris by sandblasting or high-pressure air-water cutting, or both. Sandblasting can be used after the concrete has gained sufficient strength to resist excessive cutting, and high-pressure air-water cutting can be used as soon as the concrete has hardened sufficiently to prevent the jet from displacing the coarse aggregates. The surface of the concrete in place must be cut to expose clean, sound aggregate, but not so deep as to undercut the edges of larger particles of the aggregate. After cutting, the surface must be thoroughly washed to remove all loose material. If the surface is congested by reinforcing steel, is relatively inaccessible, has cured beyond the ability to cut with air-water blasting, or disturbing the concrete before it is hardened is considered undesirable, cleaning of the joint by air or water jets is not permitted. The sandblasting method is required after the concrete has hardened.

Immediately before new concrete is placed, all construction joints must be wetted and standing water removed.

Method 2—The surface of construction joints must be cleaned of all unsatisfactory concrete, laitance, coatings, stains, or debris by washing and scrubbing with a wire brush or wire broom, or by other means approved by the engineer. Immediately before new concrete is placed, all construction joints must be wetted and standing water removed.

14. Expansion and contraction joints

Expansion and contraction joints must be made only at locations shown on the drawings. Exposed concrete edges at expansion and contraction joints must be carefully tooled or chamfered, and the joints must be free of mortar and concrete. Joint filler must be fully exposed for its entire length with clean and true edges.

Where open joints or weakened plane "dummy" joints are specified, joints formed in fresh concrete must be constructed by the insertion and subsequent removal of a wood strip, metal plate, or other suitable template. This must be done so that the corners of the concrete do not chip or break. The edges of the fresh concrete at the joints must be finished with an edging tool before the joint strips are removed. Open joints or weakened plane dummy joints may also be saw-cut joints conforming to the depth and extent specified.

Preformed expansion joint filler must be held firmly in the correct position as the concrete is placed.

15. Waterstops

Waterstops must be held firmly in the correct position as the concrete is placed. Joints in metal waterstops must be brazed or welded. Joints in rubber or plastic waterstops must be cemented, welded, or vulcanized as recommended by the manufacturer. Joints must be watertight and of a strength equivalent to that specified in Material Specification 537. Intersecting waterstop joints must be prefabricated and supplied by the same manufacturer providing the waterstop.

16. Removal of forms, supports, and protective coverings

Forms, supports, and protective coverings must be removed as soon as practical after the concrete has gained sufficient strength to support its own weight and superimposed loads. Removal must be done so that the concrete surface is not damaged and sudden or excessive stresses are not induced. The minimum period from completion of the concrete placement to the removal of the forms must be based on either strength tests or cumulative times.

Strength tests—The strength of the in-place concrete is determined by testing concrete cylinders specifically cast for this purpose and cured adjacent to the member in accordance with the ASTM C31 method for determining removal time. Unless otherwise specified, forms supporting the weight of the concrete member may be removed after the concrete strength is 70 percent of that specified for the class of concrete. Forms not supporting the weight of the concrete member or other superimposed loads may be removed after the concrete strength has reached the strength specified in Section 25.

Cumulative time—The total accumulated time, not necessarily continuous, that the air adjacent to the concrete is above 50 degrees Fahrenheit and the specified concrete curing has occurred concurrently will be determined. Forms may be removed after the total accumulated time shown:

Accumulated form removal times

Forms		Time [1/]
Sides of slabs or beams		12 hours
Undersides of slabs or beams	Clear span	[2/]
	< 10 ft.	4 days
	10 - 20 ft.	7 days
	> 20 ft.	14 days
Sides of walls or columns	Height above form	[3/ 4/]
	< 10 ft.	12 hours
	< 20 ft.	24 hours
	> 20 ft.	72 hours

1/ Table values apply to normal concrete. Values for concrete that contains cements or admixtures that significantly retard or accelerate strength gain will be determined by the Engineer and based on actual design mix data.
2/ Values apply to members designed to support significant superimposed loads. Values for members designed for only self-weight when placed in service must be 50 percent greater.
3/ Values apply to members not subject to significant horizontal loads. Additional time or re-bracing is needed for members subject to significant wind or other horizontal loads.
4/ Subsequent higher lifts may be placed after 12 hours.

17. Finishing formed surfaces

All formed concrete surfaces must be true and even, and must be free from over-tolerance depressions, holes, projections, bulges, or other defects in the specified surface finish or alignment, unless otherwise specified in Section 25. Depressions are measured as the distance from the bottom of a 5-foot-long template or straight edge.

A surface to be backfilled or otherwise concealed when construction is completed must have the following surface treatment unless otherwise specified:

- Repair defective concrete.
- Fill all form tie holes.
- Correct surface depressions deeper than 1 inch.
- Remove or smooth fins and abrupt projections that exceed 0.75 inch.

A surface to be permanently exposed, where other finishes are not specified, must have the following treatment:

- Repair defective concrete.
- Fill all form tie holes.
- Remove or smooth all abrupt irregularities greater than 0.25 inch in depth or projection.
- Treat all depressions and irregularities so that they do not exceed 0.5 inch in depth.

Form bolt and tie holes and other holes of similar size and depth must be repaired and filled as specified in Section 20.

18. Finishing unformed surfaces

All exposed surfaces of the concrete must be accurately screeded to grade and then float finished unless otherwise specified. The float finish must result in a surface that has no irregularities of more than 0.25 inch when checked with a template or straight edge that is 10 feet long.

All exposed surfaces of concrete must be accurately struck off to grade after placement and consolidation are completed. Following strikeoff, the surface must be immediately smoothed by darbying or bull floating before any free water has bled to the surface. The concrete must then be allowed to rest until the bleed water and water sheen have left the surface and the concrete has stiffened to where it will sustain foot pressure with only about 0.25-inch indentation. At this time all joints and edges that are exposed to view and are not chamfered must be finished with edging tools. After edging and hand jointing is complete, all exposed surfaces must be floated with wood or magnesium floats. The floating should work the concrete no more than necessary to remove screed, edger, and jointer marks and to produce a compact surface uniform in texture.

Water must not be sprinkled or added to the surface of the concrete during the darbying, bull floating, floating, or other finishing operations to facilitate finishing.

19. Curing

Freshly placed concrete must be cured a minimum of 7 days in accordance with the recommended practices set forth in this section. A curing process must be started as soon as the concrete has hardened sufficiently to prevent surface damage. Curing concrete, including exposed surfaces of formed concrete and concrete in forms, must be maintained at a satisfactory moisture content for at least 7 days following placement. If forms are removed before the end of the 7-day curing period, the interrupted curing process must be reestablished and maintained until a full 7-day curing period is achieved. A satisfactory moisture condition is—

- Continuous or frequent application of water or use of a saturated cover material, such as canvas, cloth, burlap, earth, or sand.
- Prevention of excessive water loss from the concrete by use of an impermeable coating (curing compound) or covering (plastic, paper).

The application of water or covering must not erode, mar, or otherwise damage the concrete. Plastic film or paper must meet the requirements of ASTM C171. Black covering must not be used when concreting in hot weather.

Except as otherwise specified in Section 25, curing compound may be used for exposed surfaces or formed surfaces after patching and repair are completed. Curing compounds must not be used on a surface that is to receive additional concrete, paint, tile, or other coatings unless the contractor demonstrates that the membrane can be satisfactorily removed or can serve as a base for the later application.

Curing compound must be thoroughly mixed before applying and be agitated during application. Except as otherwise specified in Section 25, the compound must be applied at a pressure of 75 to 100 pounds per square inch. A continuously agitating pressure sprayer is used for application at a uniform rate of not less than 1 gallon per 175 square feet of surface. Manual hand pump sprayers must not be used for curing concrete surfaces exceeding 400 square feet unless otherwise specified. For individual concrete placements or repairs having a surface area of 400 square feet or less, curing compound may be applied with a soft-bristled brush, paint roller, or hand sprayer. The compound must form a uniform, continuous, adherent film that must not check, crack, or peel and must be free from pinholes or other imperfections.

All surfaces covered with curing compound must be continuously protected from damage to the protective film during the required curing period.

A surface subjected to heavy rainfall or running water within 3 hours after the compound has been applied or that is damaged by subsequent construction operations during the curing period must be resprayed in the same manner as for the original application.

Water for curing must be clean and free from any substances that cause discoloration of the concrete.

20. Concrete patching, repair or replacement

Patching—All form bolts, metal ties, and similar forming restraints must be removed to a depth of 1 inch below the surface of the concrete and their cavities repaired unless otherwise specifically permitted or specified. Small cavities, large air holes, minor honeycombed areas, and other superficial imperfections that require patching to meet the specified finish requirements must be thoroughly cleaned and filled. Holes left by bolts or straps that pass through the concrete section must be filled solid with a dense, well-bonded, non-shrink patching material. Dry-pack mortar and replacement concrete must follow the appropriate procedure detailed in the "Repair and Maintenance" chapter of the Concrete Manual, Bureau of Reclamation, U.S. Department of the Interior. Proprietary patching material must be appropriate for the type of repair, used within the manufacturer's recommended limits, and applied according to the manufacturer's recommendations.

Repair or replacement—The Contractor must repair or replace concrete that does not meet the requirements of this specification. Before starting any repair or replacement work, the contractor must prepare a written plan for the repair or replacement. The primary reference for material and repair methods for the plan must be the appropriate sections of the "Repair and Maintenance" chapter of the Concrete Manual, Bureau of Reclamation, U.S. Department of the Interior. The repair plan must be submitted to the Engineer for review at least 10 days before any repair or replacement work. Approval of the plan will be authorized in writing by the contracting officer.

When proprietary patching material is proposed in the plan, the manufacturer's data sheets and written recommendations must be included in the plan.

Repair material or replacement concrete must have properties, color, and texture similar to and compatible with the concrete being repaired or replaced. Repair or replacement concrete work may only be performed when the Engineer is present.
Curing of repaired or replaced concrete must be started immediately after finish work is completed and as specified in Section 19 or as specified by the manufacturer of proprietary compounds.

21. Concreting in cold weather

Methods for concreting in cold weather must be performed when, for more than 3 consecutive days, the following conditions exist:

- The average daily air temperature at the job site is less than 40 degrees Fahrenheit. (The average daily air temperature is the average of the highest and lowest temperatures occurring during the period from midnight to midnight.)
- The air temperature at the job site is less than, or equal to, 50 degrees Fahrenheit for more than half of any 24-hour period.

Concrete must be protected against freezing during the first 24 hours after placement whether or not the average weather conditions specified above for cold weather concreting exist. The following provisions also apply unless otherwise specified:

a. When the cement is added to the mix, the temperature of the mixing water must not exceed 140 degrees Fahrenheit nor the temperature of the aggregate exceed 150 degrees Fahrenheit.

b. The temperature of the concrete at the time of placing must be within the placement temperature range shown below, unless otherwise specified.

Least dimension of section (inches)	Placement temperature (F)
Less than 12	55 – 75
12 to 36	50 – 70
36 to 72	45 – 65
Greater than 72	40 – 60

c. The minimum temperature of the concrete for the first 72 hours after placement must not be less than the minimum temperature shown above. Concrete structures must be immediately protected after concrete placement by covering, housing, insulating, or heating concrete structures sufficiently to maintain the minimum temperature adjacent to the concrete surface. If the minimum temperature requirements are not met and the concrete did not freeze, the protection time will be extended a period equal to twice the number of hours the temperature was below the minimum temperature.

d. Exhaust flue gases from combustion heaters must be vented to the outside of the enclosure. The heat from heaters and ducts must be directed in such a manner as to not overheat or dry the concrete in localized areas or to dry the exposed concrete surface.

e. At the end of the protection period, the concrete must be allowed to cool gradually. The maximum decrease at the concrete surface in a 24-hour period must not exceed 40 degrees Fahrenheit.

22. Concreting in hot weather

Methods for concreting in hot weather must be in accordance with the requirements set forth below.

For the purpose of this specification, hot weather is defined as the weather condition at the jobsite that causes acceleration in the rate of moisture loss or rate of cement hydration of freshly mixed concrete, including an ambient temperature of 80 degrees Fahrenheit or higher, and an evaporation rate that exceeds 0.2 pounds per square foot per hour. The rate of moisture loss and rate of cement hydration may be accelerated if one or a combination of the following conditions exists:

- High ambient temperature
- High concrete temperature
- Low relative humidity
- Wind velocity
- Solar radiation

Whenever the above conditions exist or when climatic conditions are such that the temperature of the concrete may reasonably be expected to exceed 90 degrees Fahrenheit at the time of delivery to the worksite or during the placement operations, the following provisions apply:

a. The Contractor must maintain the temperature of the concrete below 90 degrees Fahrenheit during mixing, conveying, and placing.

b. Exposed concrete surfaces that tend to dry or set too rapidly must be continuously moistened using fog sprays or other means to maintain adequate moisture during the time between placement and finishing. Water must not be sprinkled or added directly to the surface of the concrete before finishing.

c. Finishing of slabs and other exposed surfaces must be started as soon as the condition of the concrete allows and must be completed without delay. Water must not be sprinkled or added to the surface of the concrete during the darbying, bull floating, floating, or other finishing operations to facilitate finishing.

d. Formed surfaces must be kept completely and continuously wet from the time the concrete takes initial set to when the forms are removed. After the forms are removed, the concrete surfaces must be kept completely and continuously wet for the duration of the curing period or until curing compound is applied in accordance to Section 21.

e. Exposed and unformed concrete surfaces, especially flat work placed with large areas of surface, must be kept completely and continuously wet for the duration of the curing period or until curing compound is applied in accordance to Section 19. The concrete must be protected against thermal shock from rapid cooling (5°F per hour or more than 40°F per 24-hour period) of the concrete by application of curing water or temperature changes during the first 24 hours of the curing period.

f. When any single or combination of conditions might result in very rapid setting or drying of the concrete, extreme conditions exist. For flat work and slab construction, extreme conditions exist when the evaporation rate exceeds 0.2 pound per square foot per hour. The Engineer may—

(1) Restrict placement to the most favorable time of the day.
(2) Restrict the depth of layers to assure coverage of the previous layer while it will still respond readily to vibration.

(3) Suspend placement until conditions improve.
(4) Restrict the removal of forms, repair, and patching to small areas that can be protected with curing compound immediately.

The evaporation rate for flat work and slab construction may be determined by calculating the evaporation rate from a cake pan having a surface area of at least 1 square foot or by other methods approved by the Engineer or designated in Section 25.

23. Acceptance of the concrete work

Acceptance of the concrete work will be a cumulative acceptance process based upon progressively meeting the requirements of the specifications and drawings for—

- Fresh concrete
- Concrete strength and durability
- Structure dimensions
- Structure appearance

Fresh concrete—Fresh concrete conforming to the mix proportions and quality requirements of the approved job mix and the handling and placement requirements of previous sections will be satisfactory.

Concrete strength—A strength test is the average of the compressive strengths of two standard cured cylinders prepared and tested in accordance with Section 4, unless otherwise specified. The strength of the hardened concrete is satisfactory if the following requirements are met:

a. If method 1 from Section 3 is specified and the concrete work is less than 75 total cubic yards for the class of concrete specified, the compressive strength of the concrete is satisfactory if no individual strength test falls more than 500 pounds per square inch below the specified compressive strength (f'_c) for the respective class of concrete.

b. If method 1 from Section 3 is specified and the concrete work is 75 total cubic yards or more for the class of concrete specified, the compressive strength of the concrete is satisfactory if both of the following requirements are met:

(1) No individual strength test falls more than 500 pounds per square inch below the specified compressive strength (f'_c) for the class of concrete specified.

(2) The average of any three consecutive strength tests is not less than the specified compressive strength (f'_c) for the class of concrete specified.

The Contractor must take steps to increase the average of subsequent strength tests when the average of any three consecutive strength tests falls below the specified concrete strength (f'_c).

c. The Engineer determines the structural adequacy and evaluates the durability of the in-place concrete when the concrete strength based on the standard cured concrete cylinders is unsatisfactory. The Engineer determines the need for additional quality assurance testing.

d. The contractor may core the concrete, have the cores tested by a certified testing laboratory at the Contractor's expense, and submit test results to the engineer for consideration and evaluation of concrete strength adequacy when the concrete strength based on the standard cured concrete cylinders is unsatisfactory.

e. Sampling and testing concrete by coring must conform to Section 4. The strength of the concrete based upon concrete cores is satisfactory if both of the following requirements are met:

(1) The average compressive strength of the three cores equal or exceed 85 percent of the specified compressive strength
(f'_c).

(2) The compressive strength of any individual core does not fall below 75 percent of the specified compressive strength
(f'_c).

f. If Method 2 from Section 3 is specified, the Engineer is responsible for the concrete job mix design and the quality concrete that results from the job mix.

The hardened concrete is satisfactory if the required batch tickets or other documentation acceptable to the engineer clearly show that the batch ingredients and weights of each ingredient including all admixtures conforms to the job mix provided by the engineer. Random periodic inspection of the batching operations may be made by the engineer to verify that ingredients and ingredient proportions conform to the batching documentation.

If the concrete ingredients, proportions, or admixtures varies from the job mix provided by the engineer, the concrete may be rejected if, in the judgment of the engineer, the variance will significantly affect the strength or durability of the concrete or will adversely affect the life expectancy or other components of the structure.

Structure dimensions and appearance

The appearance of the concrete must meet the requirements of Sections 17 and 18.

The dimensions of formed members, unless otherwise specified, are satisfactory if they conform to the requirements of the specifications, the locations shown on the drawings, and are within acceptable tolerances:

a. Variation from plumb for walls and column must be no more than 0.2 percent of the total wall or column height.

b. Variation from specified elevations for slabs, floors, or other horizontal members must be no more than 0.2 percent of the length of the member in the direction of grade.

c. Variations in the cross-sectional dimensions of columns and beams and in the thickness of walls and above-grade slabs must be no more than minus 0.25 inch or plus 0.5 inch from the shown dimensions.

24. Measurement and payment

For items of work for which specific unit prices are established in the contract, concrete is measured to the neat lines or pay limits shown on the drawings, and the volume of concrete is computed to the nearest 0.1 cubic yard. No deduction in volume is made for chamfers, rounded or beveled edges, or for any void or embedded item that is less than 5 cubic feet in volume. Where concrete is placed against the sides or bottom of an excavation without intervening forms, drainfill, or bedding, the volume of concrete required to fill voids resulting from over-excavation outside the neat lines or pay limits is included in the measurement for payment where such over-excavation is directed by the engineer to remove unsuitable foundation material. However, this payment is only to the extent that the unsuitable condition is not a result of the Contractor's improper construction operations, as determined by the Engineer.
Method 1—Payment for each item of concrete is made at the contract unit price for that item. The payment for concrete will constitute full compensation for completion of the concrete work, including joint fillers, waterstops, dowels or dowel assemblies, and metal plates, but not including reinforcing steel or other items listed for payment elsewhere in the contract.

Method 2—Payment for each item of concrete is made at the contract unit price for that item. The payment for concrete constitutes full compensation for completion of the concrete work, including joint fillers, waterstops, metal plates, dowels, and other assemblies. It does not include furnishing and placing reinforcing steel or furnishing and handling cement or other items listed for payment elsewhere in the contract.

Cement is measured by dividing the volume of concrete accepted for payment by the yield of the

applicable job mix. The yield is determined by the procedure specified in ASTM C138. If the amount of cement actually used per batch exceeds the amount in the job mix specified by the engineer, the measurement is based on the amount of cement specified by the engineer for the job mix. Unless otherwise stated in section 25, a bag of cement is considered 94 pounds. Payment for each type of cement will be made at the contract unit price for furnishing and handling that type of cement and such payment will constitute full compensation for furnishing and handling the cement.

All methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule, will be included in the payment for the item of work to which it is make subsidiary. Such items and the items to which they are made subsidiary are identified in Section 25 of this specification

25. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. General

1) At least 45 days prior to beginning work activity, the Contractor shall submit a Concrete Placement Plan (Plan). The Plan shall provide details about approach and schedule for formwork, concrete mix specification and testing, and concrete delivery, placement, curing, protection, and finishing for review and approval by the COR prior to initiation of concrete work. The Plan shall include the following:
   a. Method of determining the location of the limits and elevations for each placement.
   b. Overall schedule of concrete placement including sequence and timing of formwork and placement, stripping, finishing and joint construction, for each placement.
   c. Rate of concrete placement and management of resulting traffic loads.
   d. Conveyance plan, including belts, conveyors, concrete pumps, etc.
   e. Consolidation plan, including specifications of proposed vibratory and other equipment.
   f. Curing medium and methods to be used in conformance with applicable standards.
   g. Cold-weather placing plan including proposed materials, methods, and protection and conforming to the requirements of applicable standards.
   h. Hot-weather placing plan including proposed materials, methods, and protection and conforming to the requirements of applicable standards.
   i. Concrete Materials Statement, including the following for each proposed concrete mix:
      i. Concrete supplier proposed and location of plant or plants at which the concrete will be batched
      ii. Mix Designation and Identification
      iii. Mix proportions based on SSD Aggregates and one cubic yard
      iv. Moisture content of the aggregates as used in trials and corrections for the aggregate weights used
      v. Specific gravity and absorption of the aggregates
      vi. Admixture source and dosage
      vii. Yield and wet unit weight
      viii. Strength results and unit weights of cylinders
      ix. Strength requirements – Both the design compressive strength and the required average compressive strength with the applicable ASTM C-94 over design factor
      x. Cement and flyash source
      xi. Aggregate source, gradation and quality (include results of ASTM C1260)
      xii. Mix temperature
      xiii. Slump– design and actual
      xiv. Air Content– design and actual
      xv. For mixes with a high-range, water reducer present, the slump and air content at 15 to 20 minute time increments
2) Submit manufacturer's product data on joint devices, waterstop, joint sealant, form ties, and form removal oil to the COR for approval.

3) Structural Concrete Mock-up: Construct using same materials, methods, and work force that will be used for the Work. The Contractor should allow 1 week for evaluation of the mock-up by the COR. Claims for delay shall not be made for the evaluation of the mock-up.

   a. Pre-Installation Meeting: Schedule conference with COR to assure understanding of structural concrete work, requirements for construction and location of the mock-up, and to coordinate the Work.

   b. Size: At least 5-ft long by 3-ft high, or larger if needed to adequately illustrate various structural concrete elements (reinforcing steel, waterstop, dowels, form ties, joint devices, wall thimble, etc.). A form void may be used instead of a wall thimble. One mock-up is required for the entire project and should contain all required concrete features.

4) In Section 2, Materials, materials shall conform to the referenced Material Specifications and additional requirements specified below:

   a. Coarse Aggregate: Maximum size AASHTO No. 57 meeting the requirements of West Virginia Department of Transportation Division of Highways Standard Specifications Roads and Bridges Section 703.

   b. Fine Aggregate: Fine Aggregate for Portland Cement Concrete meeting the requirements of West Virginia Department of Transportation Division of Highways Standard Specifications Roads and Bridges Section 702.

   c. Portland Cement: ASTM C150, Type II (Moderate Sulfate Resistant), Low Alkali (LA). Type I/II cement will be acceptable.

   d. Fly Ash or Blast Furnace Slag is required as partial substitute for cement. Supplemental cementitious materials shall be furnished from the same source and supplier for all concrete. Supplemental cementitious material color shall not substantially alter the resulting concrete. Blast Furnace Slag shall comply with ASTM C989, Grade 120. Fly ash shall comply with ASTM C618 Type F and the following requirements:

      i. Loss on ignition shall be less than 2.5 percent

      ii. Sulfur trioxide content shall be less than 4 percent by weight

   e. Air Entraining Admixture: ASTM C260

   f. Water Reducing Admixture: ASTM C494 Type A

   g. High Range Water Reducing Admixture: ASTM C494, Type F

   h. Set Retarder Admixture: ASTM C494, Type B

   i. Accelerating Admixtures: ASTM C494, Type C or E shall not be used unless otherwise authorized by COR

   j. Preformed Expansion Joint Filler: ASTM D994 (bituminous type)

5) In Section 3, Concrete Mix Design:

   a. Method 1 shall apply.

   b. Concrete Mix Design: Minimum compressive strength 4,500 psi at 28 days (f'c). Either 25 percent of the cementitious material (by weight) shall consist of fly ash or 50 percent of the cementitious material (by weight) shall consist of blast furnace slag. The air content at the point of placement shall be 4.5% to 7.5%. The maximum water-cement ratio for the mix shall be 0.42.

c. Slump shall meet the requirements for columns, light beams, thin slabs, thin walls (12 inches or less).

6) In Section 4, Inspection and Testing, The Contractor shall:

a. Provide inspection of all foundation surfaces, form work, embedded items and anchorages to assure compliance with the design details and specifications. The Contractor's Quality Control Supervisor shall insure that no concrete is placed until all requirements of the plans and specifications are met. Continuous inspection during placement of concrete to verify placement in accordance with the specifications and design details. Each load or batch ticket shall be examined to verify the correct quantities of ingredients in accordance with the design job mix and to determine the time of cement induction and the number of mixing revolutions. Time of sample, truck or batch number, feature/location of placed concrete shall be recorded, and concrete cylinder numbers if test cylinders are required. Testing for slump, air content (by pressure method in accordance with ASTM C 231), unit weight, and temperature shall be provided on each mixer load of concrete prior to placement and at any apparent change in appearance or consistency of the concrete. If concrete is conveyed to the placement location by pumping or conveyor belts, the samples must be collected at the discharge end of the pump or conveyor. If a plasticizing admixture is added at the job site, slump shall be tested before and after addition of the admixture. One set of compressive strength test cylinders (eight 6" x 12" Cylinders or 12 4" x 8" Cylinders) shall be taken from every 50 cubic yards placed with a minimum of one set of cylinders prepared each day, unless requested additional tests are requested by the COR. Cylinders shall be tested in accordance with ASTM C39 at 7 days, 14 days, 28 days, and 56 days (if specified acceptance criteria are not achieved at 28 days) in accordance with the specifications. At each testing date, two 6" x 12" cylinders shall be tested.

b. Supply a portable concrete cylinder curing container with the following minimum requirements:

i. Capable of maintaining an internal temperature between 60.0 and 80.0 degrees Fahrenheit. Container shall be capable of maintaining the specified temperature range while containing up to 20 cylinder samples of fresh concrete and being subjected to outside ambient air temperatures. Supplemental heating and cooling of the container will likely be required.

ii. Lockable hinged access hatch with lock and key.

iii. Temperature monitoring device capable of continuous monitoring and recording and storing daily high and low temperatures.

iv. Minimum dimension of 4 feet long by 2 feet wide by 1-½ feet high.

v. Weather resistant exterior.

c. Transport, cure, and test specimens for compressive strength. Results of compressive strength tests shall be provided to the CORs Representative within 24 hours of the completion of each test.

7) In Section 6, Mixers and Mixing, submittal schedule does not apply. Instead, dates to submit in this section shall override any previous dates mentioned in Section 6 if applicable:

a. Concrete may be furnished by batch mixing at the site or by ready-mix methods. Batch plans shall conform to the applicable requirements of West Virginia Department of Transportation Division of Highways (WVDOH) Standard Specifications Roads and Bridges for automatic equipment and as specified herein and shall be approved by WVDOH.

b. If the Contactor uses a combination of centrally batching and transporting material to the site and adding rest of material onsite, the contractor must prepare a written plan detailing how the batching and mixing of the concrete material will be accomplished and controlled. This written batching and mixing plan must be submitted to the Engineer for review and approval at least 45 days prior to beginning work activity.

c. Concrete shall be uniform and thoroughly mixed when delivered to the site. Variations in slump of more than 1 inch within a batch will be considered evidence of inadequate mixing and shall be corrected by increasing mixing time or other means.

d. No mixing water in excess of the amount called for by the job mix shall be added to the concrete during mixing or hauling, or after arrival at the delivery point unless an appropriate amount of cement is added to maintain the proper water-cement ratio.

8) In Section 7, Forms, Construct formwork to maintain tolerances required by ACI 347, as outlined below:

a. Surfaces subject to high-velocity flow (inside walls and end sill of Impact Basin, upstream and downstream faces of Tailwater Weir Wall, upstream face of ASW Starter Wall, and baffle blocks) require a Class A formed surface with regard to abrupt irregularities.

b. Surfaces subject to high-velocity flow require a Class B surface with regard to gradual irregularities.

c. Irregularities on surfaces not subject to high-velocity flow shall meet the following requirements:

i. Backfilled surfaces	Class C
ii. All other surfaces	Class B

9) In Section 12, Consolidating, the Contractor shall take necessary precautions to ensure proper vibration around fittings.

10) In Section 13, Construction Joints, Method 1 shall apply.

11) In Section 15, Waterstops, waterstops shall be Class II (PVC), Type A (ribbed), 6 inches, meeting the requirements of Material Specification 537, such as Greenstreak Model No. 783 or equal.

12) In Section 16, Removal of Forms, Supports, And Protective Coverings, forms shall be removed in accordance with the Cumulative Time option.

13) In Section 17, Finishing Formed Surfaces:

a. Depressions are measured as the distance from the concrete surface to the edge of a ten-foot long straight edge. Over tolerance depressions or projections will not be allowed to accumulate. Finishing of formed surfaces shall be as specified below and shall be performed immediately upon removal of forms.

b. Form removal shall be performed sequentially such that completion of finishing operations can be accomplished within four hours of form removal.

c. Backfilled Surfaces: Repair defective concrete, fill form tie holes and surface depressions deeper than 1 inch, and remove or smooth fins and abrupt projections which exceed 3/4 inch.

d. Exposed Surfaces: Repair defective concrete, fill all form tie holes, remove projections larger than 1/4 inch, and patch voids larger than ¾ inch wide or 1/2 inch deep.

e. All form bolts and ties shall be removed to a depth at least one inch below the surface of the concrete. The cavities produced by form ties and all other holes of similar size and depth shall be thoroughly cleaned and, after the interior surfaces have been kept continuously wet for at least three hours, shall be carefully packed with a dry patching mortar (preshrunk) mixed not richer than one part cement to three parts sand.

   i. Holes left by form bolts or straps which pass through the wall shall be filled solid with mortar.

   ii. Patching mortar shall be thoroughly compacted into place to form a dense, well bonded unit, and the in place mortar shall be sound and free from shrinkage cracks. All patched areas shall be cured as specified in Section 19.

f. All concrete surfaces, except those surfaces that are required to be covered with earth or rock, shall be finished by the grout cleaned (sack rubbed) finish method as specified in ACI 301. The rubbing shall be started as soon as possible after the forms are removed, patching is finished, and the patching mortar has set thoroughly. Apply grout consisting of 1 part Portland cement to 1½ parts fine sand mixed with enough water to achieve the consistency of thick paint. Add white cement as needed to match the color of the surrounding concrete. Rub grout into all the voids on the surface of the concrete, and remove any excess. Wait for the surface to whiten, and re-rub grout onto the concrete surface. Maintain damp concrete surface for 36 hours.

14) In Section 19, Curing, concrete shall be wet cured. Concrete shall be prevented from drying for a curing period of at least 7 days after it is placed. Use WVDOH Section 603.8.2.3-Water Spray Curing to maintain sheen of moisture prior to wet cure. Exposed surfaces shall be kept continuously moist for the entire period. Moisture shall be maintained by sprinkling, flooding, or fog spraying; or by covering with continuously moistened canvas, cloth mats, straw, sand, or other approved material. Wood forms left in place during the curing period shall be kept wet. After water curing is terminated, sheeting or burlap should remain in place for 3 additional days (without wetting) to allow for gradual drying. The use of curing compounds will not be permitted.

15) In Section 21, Concreting in Cold Weather, comply with ACI 306R, ACI 207, and ACI 224.

16) In Section 22, Concreting in Hot Weather, comply with ACI 305R, ACI 207, and ACI 224.

17) In Section 23, Acceptance of the Concrete Work, Structure Dimensions and Appearance, the slope of all surfaces with respect to the specified plane shall not exceed the specified amounts when measured with a 10 foot straightedge.

B. Bid Item 17– Cast-In-Place Reinforced Concrete, Impact Basin

1) This item shall include all labor, equipment, materials, shipment, and all other items necessary and incidental to the completion of the reinforced concrete impact basin as shown on the Drawings and specified herein.

2) In Section 24, Measurement and Payment, Method 1 shall apply to Measurement. Work will be measured for payment per cubic yard of concrete placed and accepted by the COR. Measurements shall be confined to an area bounded by the neat line planes shown in the Drawings or as directed by the COR. Payment shall be full compensation for furnishing all materials, labor, and equipment necessary to construct the concrete items shown on the Drawings.

   a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control.

3) Items subsidiary to this Bid Item include:

a. Steel Reinforcement, Construction Specification 34 – Steel Reinforcement

C. Bid Item 18 – Cast-In-Place Reinforced Concrete, PSW Cradle

1) This item shall include all labor, equipment, materials, shipment, and all other items necessary and incidental to the completion of the reinforced concrete pipe cradle for the principal spillway conduit extension as shown on the Drawings and specified herein.In Section 24, Measurement and Payment, Method 1 shall apply to Measurement. Work will be measured for payment per cubic yard of concrete placed and accepted by the COR Measurements shall be confined to an area bounded by the neat line planes shown in the Drawings or as directed by the COR. Payment shall be full compensation for furnishing all materials, labor, and equipment necessary to construct the concrete items shown on the Drawings.

a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control.

2) Items subsidiary to this Bid Item include:

a. Steel Reinforcement, Construction Specification 34 – Steel Reinforcement

D. Bid Item 19 – Cast-In-Place Reinforced Concrete, ASW Starter Wall

1) This item shall include all labor, equipment, materials, shipment, and all other items necessary and incidental to the completion of the auxiliary spillway starter wall as shown on the Drawings and specified herein.

2) In Section 24, Measurement and Payment, Method 1 shall apply to Measurement. Work will be measured for payment per cubic yard of concrete placed and accepted by the COR Measurements shall be confined to an area bounded by the neat line planes shown in the Drawings or as directed by the COR. Payment shall be full compensation for furnishing all materials, labor, and equipment necessary to construct the concrete items shown on the Drawings.

a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control.

3) Items subsidiary to this Bid Item include:

a. Steel Reinforcement, Construction Specification 34 – Steel Reinforcement

E. Bid Item 20 – Cast-In-Place Reinforced Concrete, ASW Tailwater Weir and Baffle Blocks

1) This item shall include all labor, equipment, materials, shipment, and all other items necessary and incidental to the completion of the auxiliary spillway tailwater weir and baffle blocks as shown on the Drawings and specified herein.

2) In Section 24, Measurement and Payment, Method 1 shall apply to Measurement. Work will be measured for payment per cubic yard of concrete placed and accepted by the COR Measurements shall be confined to an area bounded by the neat line planes shown in the Drawings or as directed by the COR. Payment shall be full compensation for furnishing all materials, labor, and equipment necessary to construct the concrete items shown on the Drawings.

a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control.

3) Items subsidiary to this Bid Item include:

a. Steel Reinforcement, Construction Specification 34 – Steel Reinforcement

F. Bid Item 21 – Mudmat

1) This item shall consist of furnishing, placing, finishing, and curing the cast-in-place concrete "mudmat" for the auxiliary spillway foundation beneath the RCC and beneath the tailwater weir wall footings, as shown on the Drawings or as directed by the COR.

2) In Section 3, Concrete mix design, concrete for the mudmat shall be Class 2500.

3) In Section 24, Measurement and Payment, Method 1 shall apply to Measurement. Work will be measured for payment per cubic yard of concrete placed and accepted by the COR. Measurements shall be confined to an area bounded by the neat line planes shown in the Drawings or as directed by the COR. Payment shall be full compensation for furnishing all materials, labor, and equipment necessary to construct the concrete items shown on the Drawings.

a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control.

G. Subsidiary Item – Miscellaneous Structure Concrete

1) This item shall consist of furnishing, placing, finishing, and curing all concrete for installing the concrete pads around the surface casings for the piezometers, concrete for steel posts related to geotechnical instrumentation, surface enclosures for the embankment toe drain cleanouts, surface enclosures for the auxiliary spillway cutoff wall drain cleanouts, encasement concrete for auxiliary spillway cutoff wall drain outlet pipes, project monument, backfill concrete for the impact basin and principal spillway cradle foundations as shown on the Drawings, and other miscellaneous structures as shown on the Drawings.

2) In Section 3, Concrete mix design, all Miscellaneous Structure Concrete shall be the same mix as specified in Paragraph 25.A.5).

3) In Section 4, Inspection and Testing, the Contractor shall prepare one set of concrete test cylinders for each day backfill concrete is placed.

4) In Section 24, Measurement and Payment, no separate payment will be made for Miscellaneous Structure Concrete. Full compensation will be included in the payment for:

a. Bid Item 23, Roller Compacted Concrete, Construction Specification 36 – Roller Compacted Concrete

b. Bid Item 27, Toe Drain Piping, Construction Specification 45 – Plastic Pipe

c. Bid Item 29, ASW Drain Piping, Construction Specification 45 – Plastic Pipe

d. Bid Item 32, Rock Foundation Preparation, Embankment, Construction Specification 63 – Treatment of Rock Surfaces

e. Bid Item 43, Project Monument, Construction Specification 93 – Identification Markers or Plaques

f. Bid Item 46, Geotechnical Instrumentation, Construction Specification 401— Geotechnical Instrumentation

****End Construction Specification 31****

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CONSTRUCTION SPECIFICATION 34—STEEL REINFORCEMENT

1. Scope

The work consists of furnishing and placing steel reinforcement for reinforced concrete or pneumatically applied mortar.

2. Material

Steel reinforcement must conform to the requirements of Material Specification 539, Steel Reinforcement (for concrete). Before reinforcement is placed, the surface of the bars and fabric and any metal supports must be cleaned to remove any loose, flaky rust, mill scale, oil, grease, or other undesirable coatings or foreign substances. Epoxy-coated steel reinforcement must be free of surface damage. After placement, the reinforcement must be maintained in a clean and serviceable condition until it is completely embedded within the concrete.

3. Bar schedule, lists and diagrams

Any supplemental bar schedules, bar lists or bar-bending diagrams required in section 10 of this specification to accomplish the fabrication and placement of steel reinforcement must be provided by the Contractor. Before reinforcement is placed, the Contractor must furnish four copies of any such lists or diagrams to the Contracting Officer for approval. Acceptance of the reinforcement is not based on approval of these lists or diagrams, but on inspection of the steel reinforcement after it has been placed, tied, and supported and is ready to receive concrete.

4. Bending

Reinforcement must be cut and bent in compliance with the requirements of the American Concrete Institute Standard 315. Bars must not be bent or straightened in a manner that will injure or weaken the material. Bars with kinks, cracks, or improper bends must be rejected.

5. Splicing bar reinforcement

Method 1—Splices of reinforcement may only be made at locations shown on the drawings and provided by the steel schedule. Placement of bars at the lap splice locations shown, when not in contact, must not be farther apart than one-fifth the shown lap length and in any case no greater than 6 inches.

Method 2—Splices of reinforcement must be limited to those locations shown on the drawings. Splice lengths must be determined before fabrication and meet the requirements of ACI Standard 318, Building Code Requirements for Reinforced Concrete, based upon design information in Section 10 of this specification. Bar placement drawings and schedules must be provided for approval before fabrication. The drawings must show all splice locations, layouts, and lap dimensions.

6. Splicing welded wire reinforcement

Unless otherwise specified, welded wire reinforcement must be spliced in the following manner:

End-to-end—Adjacent sections must be spliced end-to-end (longitudinal lap) by overlapping a minimum of one full mesh plus 2 inches plus the length of the two end overhangs. The splice length is measured from the end of the longitudinal wires in one piece of fabric to the end of the longitudinal wire in the lapped piece of fabric.

Side-to-side—Adjacent sections must be spliced side to side (transverse lap) a minimum of one full mesh plus 2 inches. The splice length must be measured from the centerline of the first longitudinal wire in one piece of fabric to the centerline of the first longitudinal wire in the lapped piece of fabric.

7. Placing

Reinforcement must be accurately placed and secured in position to prevent its displacement during the placement of concrete. Tack welding of bars is not permitted. Metal chairs, metal hangers, metal spacers, and concrete chairs may be used to support the reinforcement. Metal hangers, spacers, and ties must be placed in such a manner that they are not exposed in the finished concrete surface. The legs of metal chairs or side form spacers that may be exposed on any face of slabs, walls, beams, or other concrete surfaces must have a protective coating or finish. The coating or finish must be hot dip galvanized, epoxy coated, plastic coated, or stainless steel. Metal chairs and spacers not fully covered by a protective coating or finish must have a minimum cover of 0.75 inch of concrete over the unprotected metal part. The exception is that those with plastic coatings may have a minimum cover of 0.5 inch of concrete over the unprotected metal part. Precast concrete chairs must be manufactured of the same class of concrete as specified for the structure and must have the tie wires securely anchored in the chair or a V-shaped groove at least 0.75 inch in depth molded into the upper surface to receive the steel bar at the point of support. Precast concrete chairs must be clean and moist at the time concrete is placed.

High-density or structural plastic rebar accessories designed to ensure maximum concrete bond may be substituted for metal or concrete accessories in spacer applications as approved by the Contracting Officer. Exposure of plastic rebar accessories at the finished concrete surface must be kept to a minimum. Plastic rebar accessories, when used, must be staggered along adjacent parallel bars and must be placed at intervals no closer than 12 inches. Plastic rebar accessories must not be used in concrete sections 6 inches or less in thickness.

Reinforcement must not be placed until the prepared site has been inspected and approved. After placement of the reinforcement, concrete must not be placed until the reinforcement has been inspected and approved by the responsible Engineer.

8. Storage

Steel reinforcement stored at the work site must be placed on platforms, skids, or other supports. This is done so that contact with the ground is avoided and the material is protected from mechanical damage and/or corrosion.

9. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, the weight of steel reinforcement placed in the concrete in accordance with the drawings is determined to the nearest pound by computation from the placing drawings. Measurement of hooks and bends is based on the requirements of ACI Standard 315. Computation of weights of reinforcement is based on the unit weights established in tables 34–1 and 34–2 of this specification. Computation of weights for welded wire reinforcement not shown in table 34–2 must be based on ACI Standard 315. The area of welded wire reinforcement placed in the concrete in accordance with the drawings is determined to the nearest square foot by computation from the placing drawings with no allowance for required laps. The weight of steel reinforcing in extra splices or extra-length splices approved for the convenience of the contractor or the weight of supports and ties is not included in the measurement for payment.

Payment for furnishing and placing reinforcing steel is made at the contract unit price. Such payment constitutes full compensation for all labor, material, equipment, and all other items necessary and incidental to the completion of the work including preparing and furnishing bar schedules, lists, or diagrams; furnishing and attaching ties and supports; and furnishing,

transporting, storing, cutting, bending, cleaning, and securing all reinforcements.

Method 2—For items of work for which specific unit prices are established in the contract, the weight of bar reinforcement placed in the concrete in accordance with the drawings is determined to the nearest pound by computation from the placing drawings. Measurement of hooks and bends is based on the requirements of ACI Standard 315. Computation of weights of bar reinforcement is based on the unit weights established in table 34–1 of this specification. The weight of steel reinforcing in extra splices or extra length splices approved for the convenience of the contractor or the weight of supports and ties is not included in the measurement for payment.

The area of welded wire reinforcement placed in the concrete in accordance with the drawings is determined to the nearest square foot by computation from the placing drawings with no allowance for required laps.

Payment for furnishing and placing bar reinforcing steel is made at the contract unit price for bar reinforcement. Payment for furnishing and placing welded wire reinforcing steel is made at the contract unit price for welded wire reinforcement. Such payment constitutes full compensation for all labor, material, equipment, and all other items necessary and incidental to the completion of the work including preparing and furnishing bar schedules, lists, or diagrams; furnishing and attaching ties and supports; and furnishing, transporting, cutting, bending, cleaning, and securing all reinforcement.

All Methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items to which they are made subsidiary are identified in Section 10 of this specification.

Table 34–1 Standard reinforcing bars

- - Bar size designations - -		Weight (lb/ft)
English	Metric	
3	10	0.376
4	13	0.668
5	16	1.043
6	19	1.502
7	22	2.044
8	25	2.670
9	29	3.400
10	32	4.303
11	36	5.313
14	43	7.650
18	57	13.600

1/ The bar diameter (inches) equals the bar size number divided by eight. For example, the diameter of a #4 bar is 4 ÷ 8 = 0.5 inch.

2/ The metric bar size has been rounded to a whole number that represents the approximate diameter of the bar in millimeters.

Table 34–2 Rectangular welded wire reinforcement

Style designation 1/		Weight
by W-number	by steel wire gauge (former designation)	(lb/100 ft2)
6 x 6 – W1.4 x W1.4	6 x 6 – 10 x 10	21
6 x 6 – W2.1 x W2.1	6 x 6 – 8 x 8	30
6 x 6 – W2.9 x W2.9	6 x 6 – 6 x 6	42
6 x 6 – W4.0 x W4.0	6 x 6 – 4 x 4	58
4 x 4 – W1.4 x W1.4	4 x 4 – 10 x 10	31
4 x 4 – W2.1 x W2.1	4 x 4 – 8 x 8	44
4 x 4 – W2.9 x W2.9	4 x 4 – 6 x 6	62
4 x 4 – W4.0 x W4.0	4 x 4 – 4 x 4	85
4 x 12 – W2.1 x W0.9 2/	4 x 12 – 8 x 12	25
4 x 12 – W2.5 x W1.1 2/	4 x 12 – 7 x 11	31

1/ Style designation is defined in ACI Standard 315 of the American Concrete Institute.

2/ Welded smooth wire reinforcement with wires smaller than size W1.4 is manufactured from galvanized wire.

10. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Subsidiary Item – Steel Reinforcement

1) This item shall include all labor, equipment, materials, shipment, and all other items necessary and incidental to furnishing and installing all steel reinforcement and accessories for Concrete for Major Structures as shown on the Drawings and specified herein.

2) In Section 2 – Material, reinforcing steel shall conform to ASTM A615, Grade 60 in accordance with Material Specification 539.

3) In Section 2 – Material, Epoxy Grout for Dowels shall be an approved dowel bar adhesive with the following characteristics: manufacturer approval for use in cracked concrete and suitable for underwater application with a 48-hour cure bond strength (as defined in ASTM C882-13A of at least 1,500 psi. Anchors shall have a minimum embedment depth of 6 inches, unless noted otherwise in the Contract Drawings. Submit manufacturer's product data to the COR for approval.

4) In Section 3 – Bar Schedule, Lists and Diagrams, submit mill test reports for the reinforcing steel and shop drawings indicating bar sizes, spacing, locations, weights, and quantities of reinforcing steel; bending and cutting schedules; and details of bar supports and spacing devices showing types, sizes, spacing, and sequence at least 45 days prior to beginning work activity. Shop drawings shall include field cutting steel necessary for wall penetrations in all formed concrete surfaces. Field cutting will not take place until drawings are approved. Submit manufacturer's product data for reinforcing chairs to the COR for approval.

5) The Contractor is responsible for verifying the adequacy of the steel quantities shown in the steel schedule on the Drawings.

6) In Section 5, Splicing Bar Reinforcement, Method 2 shall apply.

7) In Section 7 – Placing, Reinforcement shall be placed within tolerances defined in ACI Standard 117.

8) If during the placement of the concrete, any reinforcement is displaced more than 0.5 inch from its designated position, entirely remove and replace that reinforcement in its proper position. Inspection and approval of the reinforcement by the COR will not relieve the Contractor of the responsibility of ensuring the reinforcement is held in place and is not displaced during the placement of the concrete.

9) In Section 9 – Measurement and Payment, no separate payment will be made for steel reinforcement. Compensation for steel reinforcement will be included in the payment under the following bid items:

   a. Bid Item 17, Cast-In-Place Reinforced Concrete, Impact Basin, Construction Specification 31 – Concrete for Major Structures

   b. Bid Item 18, Cast-In-Place Reinforced Concrete, PSW Cradle, Construction Specification 31 – Concrete for Major Structures

   c. Bid Item 19, Cast-In-Place Reinforced Concrete, ASW Starter Wall, Construction Specification 31 – Concrete for Major Structures

d. Bid Item 20, Cast-In-Place Reinforced Concrete, ASW Tailwater Weir, Cutoff Wall, and Baffle Blocks, Construction Specification 31 – Concrete for Major Structures

e. Bid Item 23, Roller Compacted Concrete, Construction Specification 36 – Roller Compacted Concrete

f. Bid Item 43, Project Monument, Construction Specification 93 – Identification Markers or Plaques

****End of Construction Specification 34****

CONSTRUCTION SPECIFICATION 35—CONCRETE REPAIR

1. Scope

The work shall consist of removal of unsuitable concrete; surface and face preparation; forming; and furnishing, placing, finishing, and curing concrete repair material as required to repair structures designated in section 18 of this specification.

The following BioPreferred® product category is applicable to this specification:

— Concrete release fluids (aka form-release agents)

2. Material

Aggregates shall conform to the requirements of Material Specification 522, Aggregates for Portland Cement Concrete, unless otherwise specified. The grading of coarse aggregates shall be as specified in section 18, shown on the drawings, or as specified by the manufacturer of a proprietary repair material.

Portland cement shall conform to the requirements of Material Specification 531, Portland Cement, for the specified type. Only one brand of any type of cement shall be used in any single repair as defined in section 18.

Water used in mixing and curing of the concrete repair shall be clean and free from injurious amounts of oil, salt, acid, alkali, organic matter, or other deleterious substances.

Fly ash shall conform to the requirements of Material Specification 532, Supplementary Cementitious Materials.

Air-entraining admixtures shall conform to the requirements of Material Specification 533, Chemical Admixtures for Concrete. If air-entraining cement is used, any additional air-entraining admixture shall be the same type as that in the cement.

Chemical admixtures for water-reducing, retarding, or water-reducing and retarding shall conform to the requirements of Material Specification 533, Chemical Admixtures for Concrete.

Curing compound shall conform to the requirements of Material Specification 534, Concrete Curing Compound.

Shotcrete, Construction Specification 33.

Proprietary concrete repair material shall be subject to review and approval of the engineer before use. The material shall meet all specified salient features for repair material and not react detrimentally with the existing concrete or associated member of the structure being repaired.

Replacement concrete repair material shall be a material that consists essentially of a binding medium of Portland cement and water that will meet all the specified salient features for repair material and not react detrimentally with the existing concrete or associated members of the structure being repaired. This may be, but is not limited to, a conventional concrete mix with or without admixtures, shotcrete, preplaced aggregate concrete, or grout.

3. Preparation of areas to be repaired

All loose, cracked or otherwise unsuitable or defective concrete shall be removed from the existing structure as shown on the drawings or specified in section 18. The final extent of removal shall be determined by the engineer after inspection of prepared surfaces.

Feathered edges at the surface are not permitted. The surface edge of the repaired area shall be cut with a saw, drilled, or chipped to leave a sharp edge with a minimum of a 0.75-inch depth face perpendicular to the face of the wall.

The top side of the repair hole shall be shaped to a uniform, fairly straight face that is sloped upward on a 1-inch rise for each 3 inches of depth of cut toward the face from which the repair material will be placed. The repair hole shall be conical in shape with the large end at the surface from which repair material will be placed.

The bottom and vertical or near vertical sides of the hole shall be cut sharply and approximately perpendicular to the face of the wall. All interior corners shall be rounded to a minimum radius of 1 inch.

Where reinforcement is encountered, the concrete directly in contact with the sides of the reinforcement shall be removed to provide at least 1-inch clear distance between the reinforcement and the inplace concrete.

Before the concrete repair material is placed, all oil and grease shall be steam or solvent cleaned from all reinforcement and surfaces to which the repair material is required to bond. If solvent cleaning is used, solvents and solvent residue shall not impair the repair material or its bonding strengths.

After removal of all oil and grease, the reinforcement shall be cleaned to remove any loose, flaky rust, mill scale, and other coatings or foreign substances that would impair bonding of the repair material to the reinforcement. The prepared faces of the repair hole shall be cleaned by high pressure water jets or compressed air jetting with water to remove all loose particles and dust. The repair hole shall be free of chips, sawdust, debris, free water, ice, snow, or other harmful substances or coatings.

4. Disposal

Unless otherwise specified, all concrete and other debris resulting from the repair works shall be removed from the site and disposed of at location(s) of the contractor's selection. The contractor is responsible for complying with all local, State, and Federal regulations pertaining to the disposal of such waste.

5. Selection of concrete repair material

Only one brand of proprietary concrete repair material shall be used in any single repair operation unless compatibility between brands can be proven with actual test or performance data.

A conventional concrete mix to be used as a replacement concrete repair material shall be ready-mix concrete that meets all the specified salient features for repair material and conforms to ASTM C94. Option A from section 6 of ASTM C94 shall apply.

The contractor is responsible for the selection and correct application of the concrete repair material. At least 14 days before installation, the contractor shall provide the engineer for approval all technical data for the repair material. The technical data shall include the design mix and test results to verify satisfactory conformance to the salient feature requirements. If a proprietary material is used, the manufacturer's recommended preparation, use, and installation specifications shall also be submitted 14 days before installation. Concrete repair material shall not be placed before approval.

Concrete repair material shall have the following salient features:

a. Be a cementitious material that after hardening will remain stable in wet and moist environments and will not dissolve in water.

b. A 28-day compressive strength of 4,000 pounds per square inch or greater when tested according to ASTM C39, unless otherwise specified.

c. Bond strength of the repair material shall be tested in accordance with ASTM C882 procedures for type V material and shall have the minimum strength of 1,100 pounds per square inch at 28 days unless otherwise specified.

d. Shall be suitable for application at the minimum temperature of 55 degrees Fahrenheit.

e. Shall not contain chlorides, added gypsum, added lime, or high alumina cements. Shall be noncombustible both before and after cure.

f. Color shall be concrete gray unless otherwise specified.

g. Shall not produce a vapor barrier material and shall be thermally compatible with concrete.

h. Shall have a freeze-thaw resistance equal to or greater than 4,000 pounds per square inch, air-entrained concrete designed for severe exposure conditions according to ACI Standard Practice 211.1, unless otherwise specified.

i. Shall exhibit no shrinkage at 28 days and no more than 0.4 percent expansion at 3, 14, or 28 days after placement when tested according to the procedures in Corps of Engineers Specification for Non-shrink Grout, CRD-C621.

Additional site specific requirements for materials are defined in section 18.

6. Handling and measurement of material

For all types of repair material, the cementitious components shall be kept dry and protected from contamination until incorporated in the mix. Broken containers or bags of premeasured and premixed components will not be accepted.

Handling and measurement of conventional concrete mix repair material shall conform to ASTM C94.

Handling and measurement of prepackaged proprietary material shall follow the manufacturer's recommendations and requirements. Handling and measurement of components that are not prepackaged or premeasured shall be in accordance with the following requirements and the manufacturer's requirements. A copy of the manufacturer's written requirements will be provided to the engineer 14 days before installation. The handling and measurement requirements are:

- Aggregates shall be stored or stockpiled in such a manner that separation of coarse and fine particles of each size is avoided and that various sizes do not become intermixed before proportioning. Methods of handling and transporting aggregates shall be such as to avoid contamination, excessive breakage, segregation or degradation, or intermingling of various sizes.
- Scales for weighing aggregates and repair material components shall be beam type, electronic, or springless dial type. They shall be accurate within 0.4 percent under operating conditions. All exposed fulcrums, clevises, and similar working parts of scales shall be kept clean and properly maintained.
- The quantities by weight of repair material components and aggregates in each batch of material, as indicated by the scales, shall be within the following percentage of the required batch weights:

Aggregates	± 2 percent
Other components	± 1 percent

  Measuring tanks for mixing water or liquid shall be of adequate capacity to furnish the maximum amount of mixing water or liquid required per approved batch. Measuring tanks shall provide the means for readily and accurately measuring the amount of water or liquid required. Accuracy of water measurement shall be plus or minus 1 percent.

7. Forms

Forming material shall be wood, plywood, steel, or other approved material and shall be mortar tight. The forms and associated falsework shall be substantial and unyielding and shall be constructed so that the finished repair conforms to the specified dimensions and contours. Form surfaces shall be smooth and free from holes, dents, sags, or other irregularities.

Before the forms are set into place, the surface of the form shall be lined with plastic sheeting or coated with a nonstaining form release agent compatible with the repair material being used. This prevents bonding of the repair material to the forms. If the forms are lined with plastic, the plastic shall be stretched taut to remove all wrinkles and folds and maintain a smooth condition during the placement and curing of the repair material.

Metal ties or anchorage within the forms shall be equipped with cones, she-bolts, or other devices that permit their removal to a minimum depth of 1 inch without injury to the concrete or repair material. Ties designed to break off below the surface of the concrete shall not be used without cones.

All visible edges and corners included in the repair location shall be shaped the same as adjacent or similar edges or corners of the structure being repaired.

Forms shall be constructed to facilitate consolidation and complete filling of the repair void, and, when all surfaces are formed, to facilitate applying pressure to the repair material immediately after placement.

8. Mixing, conveying, and placing

Proprietary repair material shall be mixed and conveyed to the forms according to manufacturer's written recommendations. Material that cannot be placed within the manufacturer's time requirements shall not be placed in the forms and shall be discarded offsite at locations selected by the contractor.

Concrete repair material shall not be placed until the subgrade, forms, and steel reinforcement have been inspected and approved by the engineer.

The contractor shall have all equipment and material required for curing available at the site ready for use before placement of repair material begins.

No concrete repair material shall be placed except in the presence of the engineer. The contractor shall give reasonable notice to the engineer each time concrete repair material is scheduled for placement. Such notice shall be adequate to allow the engineer sufficient time to review and approve the subgrade, forms, steel reinforcement, and other preparations for compliance with the specifications. Other preparations include, but are not limited to, the mixing and delivery equipment and system, placing and finishing equipment and system, schedule of work, workforce, and heating and cooling facilities as applicable. All deficiencies are to be corrected before concrete repair material is mixed for placement.

The concrete repair material shall be deposited as closely as possible to its final position in the forms and shall be worked into the corners and angles of the forms and around all reinforcement and embedded items in a manner to prevent segregation of aggregates or excessive laitance. The depositing of repair material shall be regulated so that the material can be consolidated with a minimum of lateral movement.

Unless otherwise approved, concrete repair material shall not be dropped from a height greater than recommended by the manufacturer or 5 feet, whichever is less.

Unless otherwise specified, all concrete repair material required for each repair location shall be placed in one continuous operation. Successive layers or batches shall be placed at a rate sufficient to prevent setting of material between successive layers.

At the time of placement of repair material, the existing concrete surface shall be damp and without free water unless otherwise specified or required by the manufacturer of the proprietary repair material being used.

9. Consolidating

Concrete repair material shall be consolidated to ensure positive contact of repair material with all repair surfaces and reinforcing steel, to remove entrapped air pockets and voids, and to maximize the density of the repair material.

Vibration shall not be applied directly to the reinforcing steel or other embedded items, the forms, or to concrete repair material that has hardened to the degree that it is no longer plastic. The use of vibrators to transport concrete repair material in the forms or conveying equipment is not allowed.

Proprietary repair material shall be consolidated in accordance with the manufacturer's recommendations.

Unless otherwise specified in section 18, conventional concrete mix repair material shall be consolidated in the following manner:

- Conventional concrete mix repair material shall be consolidated with internal type mechanical vibrators capable of transmitting vibration to the concrete at frequencies not less than 8,000 impulses per minute. Vibration shall be supplemented by spading, rodding, or hand tamping as necessary to ensure smooth and dense concrete along form surfaces, in corners, and around embedded items.
- The location, manner, and duration of the application of the vibrators shall be such as to secure maximum consolidation of the concrete repair material without causing segregation of the mortar and coarse aggregate and without causing water or cement paste to flush to the surface. Vibration shall compact the concrete repair material and bring it into intimate contact with the forms and embedded items while removing voids and pockets of entrapped air.

  The contractor shall provide sufficient vibrators to properly consolidate the concrete repair material immediately after it is placed. Vibration shall be applied to the freshly deposited concrete repair material by slowly inserting and removing the vibrator at points uniformly spaced and not farther apart than twice the radius of action (i.e., the distance that the concrete repair material is visibly effected by the vibration). The area visibly effected by the vibrator shall overlap the adjacent, just vibrated area. The vibrator shall extend vertically into the previously placed layer of fresh concrete repair material at all points. This ensures an effective bond between layers. In thin slabs the vibrator(s) should be sloped toward the horizontal to allow operations in a fully embedded position.
- The internal vibration of thin slabs (less than 9 inches) may be augmented using surface vibrators when approved by the engineer. Consolidation of the concrete repair material from the top surface down, along with a leveling effect to assist the finishing operation, may be provided by vibrating screeds, plate or grid vibratory tampers, or vibrating roller screeds. The contractor's plan, including equipment selection and specifications, shall be submitted to the contracting officer for approval at lease 5 days before concrete repair material placement using surface vibrating methods.

10. Removal of forms

Unless otherwise approved, forms shall not be removed sooner than the minimum time recommended by the manufacturer of the repair material or 48 hours, whichever is greater.

Forms shall be removed only when the engineer is present. Forms shall be removed in a manner to prevent damage to the concrete repair material. Supports shall be removed in a manner that permits the repair material to take the stresses caused by its own weight, uniformly and gradually.

11. Finishing formed surfaces

All repaired surfaces shall be true and even, and shall be free of open or rough spaces, depressions, or projections. Immediately after the removal of forms:

- All bulges, fins, form marks, or other irregularities that in the judgment of the engineer will adversely affect the appearance or function of the structure shall be removed. All form bolts and ties shall be removed to a minimum depth of 1 inch below the surface of the repair. The cavities produced by form ties and all other holes of similar size and depth shall be thoroughly cleaned. After the interior surface has been kept continuously wet for at least 3 hours, the cavities shall be carefully repaired with a compatible patching mortar or packed with a dry patching mortar mixed not richer than one part cement and three parts sand. Dry patching mortar shall be mixed in advance and allowed to stand without addition of water until it has reached the stiffest consistency that will permit placing. Manipulation of the mortar with a trowel during this period shall be performed as required to ensure the proper consistency.

  Holes resulting from form bolts or straps that pass through the wall shall be entirely filled with mortar to form a dense, well-bonded unit. The mortar shall be tamped into place with a rod slightly smaller than the hole being filled. The hardened mortar shall be sound and free from shrinkage cracks.

  All repaired areas shall be cured as specified in section 13.

12. Finishing unformed surfaces

All exposed surfaces of the concrete repair material shall be accurately screeded to grade and finished to match adjacent surfaces, unless otherwise specified. Water shall not be sprinkled or in any manner added to the surface of conventional concrete mix repair material during finishing operations.

Proprietary repair material shall be finished in accordance with the manufacturer's recommendations.

Joints and edges on unformed surfaces shall be shaped the same as adjacent or similar edges or corners of the structure being repaired.

13. Curing

The repair material shall be protected against premature surface drying, rainfall, and freezing for at lease 72 hours. For proprietary repair material, the manufacturer's recommendations for curing shall be followed. Replacement concrete repair material shall be protected from drying and freezing for 7 days after placement.

If curing compound is used, it shall be nonsolvent type and shall conform to ASTM C309, Type 1-D, Class B, nonpigmented with a fugitive dye, unless otherwise specified. Curing compounds shall not be used if specifically prohibited by the proprietary repair material user guides.

14. Removal or repair

When the repaired area is honeycombed, damaged, or otherwise defective, the contractor shall remove and replace the defective repair. The engineer determines the required extent of removal, replacement, and/or repair. Removal and repair activities shall be performed only when the engineer is present.

15. Concrete repair in cold weather

For proprietary repair material, the manufacturer's recommendation together with the requirements below will be followed.

For conventional concrete mix repair material, the requirements below shall be followed.

Concrete repairing in cold weather shall be performed in accordance with ACI 306, Cold Weather Concreting, of which some specific interpretations are set forth below.

Cold weather concrete repairing shall apply when the 3-day average daily outdoor temperature at the job site is less than 40 degrees Fahrenheit. When cold weather conditions exist on the job site, the following additional provisions shall apply:

a. The temperature of the concrete repair material at the time of placing shall not be less than 55 degrees Fahrenheit or more than 90 degrees Fahrenheit. The temperature of the mixing water shall not exceed 140 degrees Fahrenheit when the cement is added nor shall aggregate temperature exceed 150 degrees Fahrenheit.

b. Concrete structures shall be immediately protected after placement of the concrete repair material. The temperature of the concrete repair material at the concrete surface shall be maintained at not less than 55 degrees Fahrenheit nor more than 90 degrees Fahrenheit during the 7-day protection period.

c. Proper methods of covering, insulating, housing, or heating concrete structures shall be implemented.

d. Exhaust flue gases from combustion heaters shall be vented to the outside of the heating enclosure.

e. Following the completion of the protection period, the concrete repair material shall be allowed to cool gradually. The concrete repair material surface shall not have a temperature decrease of more than 40 degrees Fahrenheit in a 24-hour period.

f. Concrete repair material placed during cold weather not meeting the cold weather definition above shall be protected by proper methods for a minimum of 24 hours after placement.

16. Concrete repair in hot weather

For proprietary repair material, the manufacturer's recommendation together with the requirements below shall be followed.

For replacement concrete repair material, the requirements below shall be followed.

For the purpose of this specification, hot weather is defined as the weather condition at the job site that causes acceleration in the rate of moisture loss or rate of cement hydration of freshly mixed concrete, including an ambient temperature of 80 °F or higher, and an evaporation rate that exceeds 0.2 pound per square foot per hour. The rate of moisture loss and rate of cement hydration may be accelerated if one or a combination of the following conditions exists:

- High ambient temperature
- High concrete temperature
- Low relative humidity
- Wind velocity
- Solar radiation

Whenever these conditions exist or when climatic conditions are such that the temperature of the concrete repair material may reasonably be expected to exceed 90 degrees Fahrenheit at the time of delivery to the work site or during the placement operations, the following provisions shall apply:

a. The contractor shall maintain the temperature of the concrete repair material below 90 degrees Fahrenheit during mixing, conveying, and placing.

b. The exposed concrete repair material surface that tends to dry or set too rapidly shall be continuously moistened using fog sprays or other suitable means to maintain adequate moisture during the period between placement and finishing, and following finishing. Water shall not be sprinkled or added directly to the surface of the concrete repair before or during finishing.

c. Finishing of slabs and other exposed or nonformed surfaces shall be started as soon as the condition of the concrete repair material allows and shall be completed without delay.

d. The formed surface shall be kept completely and continuously moist for the duration of the curing period or until the application of the curing compound is completed.

e. Concrete repair material surface, especially flat-work placed with large surface areas, shall be covered with wet burlap or other similar material as soon as the concrete repair material has sufficiently hardened and shall be kept continuously moist for at least 24 hours for the initial curing period. This protective method shall be continued for the required curing period or until the application of curing compound is completed.

f. Moist curing may be discontinued before the end of the curing period if white, or other color selected in section 18, pigmented curing compound is applied immediately.

g. Under extreme conditions of high ambient temperature, high concrete temperature, low relative humidity, wind velocity, and exposure to solar radiation, the engineer may:

(1) Restrict placement to the most favorable time of day.

(2) Restrict the depth of layers to assure coverage of the previous layer while it will still respond readily to vibration

(3) Suspend placement until conditions improve.

(4) Require removal of forms, repair, patching, and reapplication of wet curing by small areas at a time.

17. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, concrete repair volume is determined by computing the volume to the nearest 0.1 cubic foot between the neatness shown on the drawings and the approved pay limit.

Method 2—For items of work for which specific unit prices are established in the contract, concrete repair volume is determined by counting the number of premeasured, prepackaged units properly used to perform the approved repair. A premeasured, prepackaged unit is defined as a composite of all components and additives required to be mixed together before the repair material can be properly placed.

When only a part of a unit is needed to complete the filling of a repair void, it is counted as one unit. Units required to fill voids outside the approved pay limits are not counted for payment. Units mixed, but not placed in a repair void because of the contractor's improper construction operation or management are not counted.

Method 3—For items of work for which specific unit prices are established in the contract, concrete repair area is determined by measuring the surface treated and computing the area to the nearest 0.1 square foot.

All methods—The following applies to all methods of measurement and payment:

Payment for concrete repair is made at the contract unit price for the item. The payment for repair constitutes full compensation for all labor, material, equipment, transportation, tools, forms, false-work, bracing, and all other items necessary and incidental to the completion of the repair work.

Repair material required to fill voids outside the neatness or pay limits not directed or approved by the engineer and resulting from excessive removal by the contractor, damages caused by the contractor's activities, or improper construction operations as determined by the contracting officer is not measured nor paid for under this item.

Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 18 of this specification.

18. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Bid Item 22 – Concrete Repair, Principal Spillway Riser

1) This item shall include all labor, equipment, materials, shipment, and all other items necessary and incidental to repairing concrete and applying primer and water proofer on the entirety of all principal spillway riser interior wall faces and on the riser weir crest as specified herein.

2) In Section 3 – Preparation of Areas to be Repaired, prepare areas in accordance with recommendations of approved repair material manufacturer.

3) In Section 5 – Selection of Concrete Repair Material:

   a. Proprietary Concrete Repair Material shall be Xypex Megamix II, Eucorepair V100, or approved equal one-component, high early strength, low shrinkage, cementitious repair mortar suitable for the patching and resurfacing of deteriorated concrete. Provide product suitable for the depth of the feature to be repaired. Contractor shall field-verify depth of features to be repaired prior to ordering products. Apply per manufacturer's instructions, including adhering to maximum application thickness recommendations.

   b. The interior of the principal spillway riser shall be coated with Xypex Concentrate, Eucon Vandex AM-10, or approved equal crystalline concrete water proofer. Apply per manufacturer's instructions.

   c. Provide and apply primer as recommended by the manufacturer.

   d. Repair mortar, primer, and water proofer shall be sourced from the same manufacturer.

4) Section 7 – Forms is not required.

5) Section 10 – Removal of Forms is not required.

6) In Section 17 – Measurement and Payment, Method 3 shall be used.

****End of Construction Specification 35****

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CONSTRUCTION SPECIFICATION 36—ROLLER COMPACTED CONCRETE

1. Scope

The work consists of furnishing all materials, tools, equipment, and mixing plant and performing all labor for the mixing, transporting, forming, placing, compacting, and curing of roller compacted concrete (RCC) as required to install the structure(s) as shown on the drawings and designated in section 22 of this specification and the test section designated in the same section.

The following BioPreferred® product category is applicable to this specification:

— Concrete release fluids (a.k.a., form-release agents)

2. Material

Portland cement must conform to the requirements of Material Specification 531, portland cement. Type-III portland cement must not be used.

Pozzolan must conform to the requirements of Material Specification 532, Supplementary Cementitious Materials. Fly ash must be class F unless otherwise specified. The source of pozzolan must consistently supply material with similar chemical and physical properties.

Combined aggregates must conform to the requirements of Material Specification 524, Aggregates for Roller Compacted Concrete, unless otherwise specified.

Water incorporated into the mix or used for curing RCC must be clean and free from injurious amounts of oil, salt, acid, alkali, organic matter, turbidity, or other deleterious substances. Water must conform to the requirements of ASTM C 94 except that wash water may not be used for mixing RCC.

Water-reducing, set-retarding admixture must conform to ASTM C494, type D.

Curing compound must conform to the requirements of Material Specification 534, Concrete Curing Compound. Curing compound must be furnished in containers that have not been previously opened and that have the original manufacturer's labels attached.

Bonding mortar must consist of cement, sand, water, and a water-reducing, set-retarding admixture to retard the set and control the consistency of the mortar. The cement, water, and admixture must be as specified. Sand must comply with ASTM C33 for fine aggregate. The mortar must be mixed in the proportions 1 part cement to 2.5 parts sand, by weight. Water content must be sufficient to provide a spreadable consistency. In combination with the admixture, the maximum water-to-cementitious materials ratio must be 0.45. The mortar slump must be 7 to 9 inches when tested in accordance with ASTM C143. The admixture must be included at the manufacturer's recommended dosage so that the initial set time is retarded at least 3 hours when the ambient air temperature is 95 degrees Fahrenheit.

Material testing—The contractor must test materials or provide certified test results to ensure all materials conform to the specified requirements. All nonconforming materials must be promptly removed from the job site, including those that have been incorporated into the work.

Aggregate sampling must be in accordance with ASTM D75.

Aggregate samples must be taken from stockpiles, belt feeders from bins, the mix plant feed conveyor belts, the mixer feed conveyer belt, or from the pug mill discharge while only aggregate is discharged from the pugmill.

When obtaining aggregate samples from stockpiles, samples must be obtained from various parts of the stockpiles, but never from the perimeter of the lower third of the pile.

The contractor must provide access for material sampling and performance of quality assurance testing activities at material storage sites.

Sampling—The contractor must provide suitable platforms, tools, equipment, and labor necessary for obtaining representative samples of materials to be used for the contractor's quality control testing and for the Government's quality assurance testing. Samples may be taken from stockpiles, aggregate bins and feed belts, entrance to the mixer, mixer discharge, gob hopper discharge, points in transit, or the placement area.

Material handling and processing—Transportation of cement and pozzolan to the batching plant must be accomplished in weather-tight trucks, conveyors, or other means that will completely and thoroughly protect the cementitious materials from exposure to moisture and contaminants.

The temperature of cement and pozzolan when delivered to the job site must not exceed 160 degrees Fahrenheit. The temperature of the cement and pozzolan must be determined by direct insertion of a thermometer into the material in the delivery truck. The temperature of air to transport cement into storage containers or silos must not exceed 180 degrees Fahrenheit. It may be assumed that the temperature of the air in the transfer pipe is the same as the temperature on the outside surface of the transport pipe. The temperature of the air must be determined by measuring the temperature on the outside of the transport pipe with a surface thermometer.

Immediately upon receipt at the job site, cement and pozzolan must be stored in dry, weather-tight, ventilated structures. All storage facilities must permit easy access for inspection and identification. Sufficient cement and pozzolan must be stored onsite at all times to complete a minimum of 24 hours of placement at the planned average production rate, unless otherwise specified. Cement and pozzolan that have been stored at the site for the longest period must be used first, unless otherwise specified.

Aggregates must be transported to the site in two or more components that will be combined in the mix plant to meet the overall aggregate gradation. Aggregate components must be of a gradation that will minimize segregation prior to introduction into the mixer. Aggregates must be stored in stockpiles in the designated contractor use area. Aggregate components must be stockpiled separately. Aggregates must be handled and stockpiled in a manner to prevent intermixing between dissimilar aggregates and to prevent contamination of the aggregate. Coarse and fine aggregates must remain separated until they are introduced into the mixing plant. For plants that mix in discrete batches, the coarse and fine aggregates must be fed separately into the batch hopper. For mix plants that mix continuously, the coarse and fine aggregates must remain separated until they are dropped onto the belt that delivers the aggregates to the mixing compartment. The contractor must develop and utilize methods that reliably and consistently withdraw and transport the aggregates from the stockpile without contamination or segregation. Segregated or contaminated aggregates must not be used in production of the RCC and must be disposed of in locations specified in section 22.

A 2-week supply of aggregates, based on the average planned weekly production rate, must be stockpiled at the mixing plant location or other approved location, prior to RCC production unless otherwise specified.

Sufficient water must be available for mixing and curing to complete a minimum of 24 hours of placement at the average planned production rate.

3. Submittals

Manufacturer's certifications and test reports in no way relieve the contractor of the responsibility for furnishing materials that meet the specified requirements. Manufacturer's certifications and test reports must be produced and dated within the 6 months preceding the delivery of the submittal. The test method used must be noted on all test reports. Any deviation from standard test methods must be detailed in the test report and the reason for the deviation must be given.

Trial mix production submittals—The submittals listed below must be provided, in writing, for approval no later than 30 days before trial mix production, unless otherwise specified. Trial mix production must not proceed before approval of these submittals.

a. The name and qualifications of the laboratory that will perform the mix design.

b. The sources from which the cementitious materials will be obtained along with a certified mill test report for each type of cement, pozzolan, and blended cement that will be used to produce RCC. The certified mill test report must verify that the cement, pozzolan, or blended cement conforms to the applicable material specification.

c. The source from which the aggregate will be obtained and certified test results showing that all aggregates conform to the specification.

d. The source from which the water will be obtained and the certified test results showing that water to be used in the mix conforms to ASTM C 94.

e. The source of the admixture along with certified test results showing that the admixture conforms to the specification.

RCC preproduction submittals—The submittals listed below must be provided, in writing, to the engineer for approval. The submittal for the job mix and bonding mortar must be furnished 30 days before delivery of any RCC or bonding mortar component materials to the site. The submittal for the plant and equipment, personnel, and test section plan must be provided no later than 30 days before delivery of the plant or equipment to the site. RCC materials or equipment must not be delivered to the site before approval of these submittals.

Job mix

a. A certified statement of materials, mix proportions (reported for saturated surface dry aggregate), theoretical air-free density (TAFD), moisture/density curves (wet density only), Vebe time, air content, unit weight of mix in air pot just prior to testing air content, and all compressive strength test results for each of the three mixes required in the development of the RCC job mix.

b. Gradation of each of the aggregate component and combined aggregates used in each mix developed in the mix design program.

c. The compacted bulk density and voids in each of the aggregate components and combined aggregates used in each mix developed in the mix design program.

d. A statement of materials and mix proportions used in each mix developed in the mix design program.

e. A statement of materials and mix proportions proposed to be used in manufacturing the RCC job mix.

Bonding mortar

a. A statement of materials and mix proportions to be used in manufacturing the bonding mortar.

Plant and equipment

a. The planned RCC component material production, transportation, and storage and temperature control procedures. Anticipated peak production capacity, normal production capacity, and onsite storage volumes must be included in the plan.

b. Mixing plant manufacturer's data and operating instructions and the plant layout to include a schematic drawing of the plant and materials storage with a narrative description providing its peak capacity, normal anticipated production rate, and results of the most recent uniformity tests conducted within the previous 12 months. The proposed location of the mixing plant relative to the placement site must be provided.

c. A narrative description and a layout of the equipment and methods to be used for delivering and depositing RCC at the placement site.

d. The type and expected number of pieces of equipment required for all placing, spreading, and compaction of the RCC.

e. The plan for obtaining the specified vertical surfaces.

f. The method and procedure for curing of the in-place RCC, including the type of curing compound if used.

g. The method and procedure that will be implemented to provide protection of RCC from temperature extremes, including the type of external heating equipment and insulating materials to be used.

Personnel

a. The names and qualifications of the onsite quality control person, supervisor, and plant operator who will direct the batching, mixing, and placing of RCC.

Test section plan

a. The contractor's proposed location for the test section and equipment, materials, personnel, and methods to construct the test section as specified. The submittal must include plans for the pre- and post-test section briefings.

Test section submittals—Within 24-hours of completing the tests or test section, the following information must be transmitted to the engineer in writing:

a. Results of moisture and density tests used to compute the apparent maximum density (AMD). Include the results of all density tests made of RCC in the test section.

b. Lift maps of the test section.

c. Results of compressive strength tests.

d. Air content and unit weight of RCC.

e. Production plan that includes RCC production methods, materials, plant, equipment, and personnel as modified based on the results from the performance of the test section that have been documented to produce RCC that meets the requirements of the specification.

Unless otherwise specified, 7 days prior to beginning RCC production, submit a final written plan for RCC production methods, materials, plant, equipment, and personnel that will produce RCC that meets the requirements of this specification.

RCC production submittals—The following submittals must be provided in writing within 24 hours after delivery tickets, records, or test results are produced, unless otherwise specified:

a. Delivery tickets for cement and pozzolan must include the source, date manufactured or produced, type or class, contractor's name, project name, and a certification that the material meets the specification requirements.

b. Delivery tickets for aggregates must include the source, material description, date, and certification that the material meets the specification requirements.

c. Delivery tickets for bonding mortar must include name and location of batch plant, ticket number, load and truck number, date, destination, class of cementitious materials, mix proportions, quantity of bonding mortar, time mixer drum charged with cement, and recording of revolution counter (transit-mixed concrete). If bonding mortar is produced on site, the above required information must be provided as applicable.

d. Records of climatic conditions must be collected on a daily basis and reported on a weekly basis.

e. Mix plant production records and summary of daily material use and RCC produced must be submitted before the start of the next production shift. Production records must include a comparison of actual materials used to the approved job mix.

f. Results of RCC moisture and wet density tests.

g. Results of uniformity tests.

h. Results of compressive strength tests.

i. Results of RCC temperature tests.

j. Lift maps must be submitted before the start of the next production shift.

4. Personnel

There must be a supervisor who is responsible for all aspects of the RCC operation and a plant operator who is solely responsible for batching and mixing. There must be an onsite quality control inspector dedicated to RCC quality control. The supervisor, plant operator, and quality control inspector must have responsible experience on at least one previous RCC job in the same position for which they are being considered for the current job.

There must be at least one person whose sole responsibility is the oversight of the RCC curing activities.

5. RCC mix design

The contractor is responsible for the mix design and selection of all materials to be used in the design mix. The materials and proportions so stated, when approved, constitute the job mix. The job mix must be prepared to meet the quality, consistency, and strength of the RCC specified.

The contractor must conduct the mix design program at a materials testing laboratory staffed by American Concrete Institute (ACI) Certified Grade II Concrete Laboratory Testing Technicians.

Trial mix design parameters—The aggregate gradation must be as specified. The bulk density and voids in each of the aggregate components and the combined aggregate must be determined according to ASTM C 29.

The density, relative density, and absorption must be determined according to ASTM C 127 for coarse aggregate and ASTM C 128 for fine aggregate.

The air content of each mix must be determined according to ASTM C 231. The volume and tare weight of the air pot must be determined according to ASTM C 138. After consolidating the RCC in the air pot and just prior to testing to determine the air content, the weight of the RCC and pot must be determined according to ASTM C 138. The density of the RCC that is consolidated in the pot at the time of testing must be computed.

The minimum compressive strength for the RCC job mix must be as specified in section 22 of this specification.

Unless otherwise specified in section 22—

- A minimum of three separate mixes must be developed in the laboratory.
- Pozzolans must comprise at least 20 percent (by volume) but must not exceed 50 percent (by volume) of the cementitious materials.
- The remainder of the cementitious materials must be comprised of portland cement.

- A compaction curve (wet density only) must be developed for each mix to determine the water content that corresponds to the maximum wet density of each mix. Compaction tests must be performed in accordance with ASTM D 1557, adapted as follows:
  - The mold specified for Method C must be used.
  - All mix components must be included.
  - When the maximum size aggregate in the mix is larger than 3/4 inch, place the material in three layers into the mold and compact each layer with 94 blows of the hammer.
- A Vebe test must be performed on each trial mix design to determine the Vebe consistency time in seconds and the wet density in pounds per cubic foot. The Vebe test must be performed according to ASTM C 1170. The Vebe consistency time must range from a minimum of 15 seconds to a maximum of 30 seconds.

Theoretical air free density—The theoretical air free density (TAFD) must be computed for each of the three laboratory mixes in the mix design program. The TAFD is the maximum wet density that can be attained for a specific mix assuming there is no air (entrapped or entrained) in the mix. The TAFD must be computed by dividing the sum of the individual weights of the mix components by the sum of the individual absolute volumes of the mix components. The absolute volume is the volume of the solid matter in the particles, exclusive of the volume of voids between the particles. The absolute volume of each mix component is determined as per ACI 211. The saturated surface dry weight and density of the aggregate must be used when computing the TAFD.

Laboratory compressive strength—Fifteen compressive strength cylinders from each RCC mixture must be prepared in accordance with ASTM C 1176 or C 1435 and weighed to determine the density of the RCC within each cylinder. Any cylinder that weighs less than 98 percent of the weight of the heaviest cylinder must be discarded and another cylinder prepared and weighed until all 15 cylinders have a weight that is at least 98 percent of that of the heaviest cylinder. The water content of each mixture, from which cylinders are made, must be within 0.5 percent of the water content that corresponds to the maximum wet density determined in accordance with ASTM D 1557. Three cylinders from each RCC mixture must be tested at 7, 14, 28, 90, and 180 days for compressive strength in accordance with ASTM C 39.

The average of the two closest 28-day strength values represent the 28-day compressive strength of the mix. The 28-day compressive strength of at least one of the mix designs must be 75 percent to 100 percent of the specified strength. The 28-day compressive strength of at least one of the mix designs must be 100 percent to 125 percent of the specified strength. The 28-day compressive strength of the remaining mix design must approximate the specified strength.

The cementitious materials content that will be used for the job mix will be based on the results of the 28-day compressive strengths of the three laboratory mix designs. The 28-day compressive strengths of each of the three laboratory mix designs will be plotted to form a curve showing the relationship of the cementitious materials content to the 28-day compressive strength of the laboratory mix designs. A cementitious material content must be selected from this curve corresponding to the 28-day compressive strength specified in section 22. The proposed job mix must be proportioned to contain the selected cementitious materials content and must be submitted for approval.

After the job mix has been approved, neither the source, character, or grading of the aggregates; nor the source mill, type, brand, or quantity of the cement; nor the source, type, or quantity of the pozzolan; nor the type, brand, or quantity of the chemical admixtures used may be changed without approval. Changes to the approved job mix require submittal and approval of a new job mix that complies with the requirements of this specification.

6. Test section

Prior to RCC production, the contractor must construct a test section as part of the RCC placement operations. RCC production is defined as the mixing of RCC to be incorporated into the work and the placing and compacting of RCC, to the specified density, within the specified lines and grades of the structure. Unless otherwise specified in section 22, the test section must be installed at an approved location proposed by the contractor. If the contractor constructs the test section in a location that will be incorporated into the RCC structure, it must be located in a noncritical part of the structure, and it must be removed if it fails to meet the requirements of this specification. If the contractor constructs the test section in a location that will not be incorporated into the structure, the contractor must remove and dispose of the test section upon completion of the testing requirements unless otherwise specified.

All RCC that is incorporated into the structure and placed prior to determining the AMD must be compacted to a density that is at least 96 percent of the TAFD. All RCC incorporated into the structure after the AMD is determined must be compacted to specification requirements.

The test section must be used to demonstrate all techniques, materials, plant and equipment, and personnel to be used for RCC construction and quality control. Additional techniques, materials, equipment, and personnel must be demonstrated in the test section as specified in section 22. Information gained will be used to evaluate the practical effectiveness of all techniques, materials, plant and equipment, and personnel to make minor adjustments to the mix and to determine the AMD of the approved job mix. The contractor must allow for numerous stops and starts to facilitate the testing that is required to determine the AMD.

The test section must be of sufficient size to allow the complete RCC placement and compaction operation to be conducted with the equipment operating at normal operating speeds.

When the test section is placed on soil, a minimum of two 12-inch lifts must be placed, and tests for determining the AMD must be conducted on the uppermost lift.

A section must be constructed to determine the adequacy of the procedures implemented to construct vertical surfaces. Any surface that is not horizontal is, within this specification, considered to be a vertical surface. Unless otherwise specified in section 22, the tolerance of vertical surfaces must conform to the requirements of section 18. The finish and appearance of formed and unformed vertical surfaces must comply with the requirements specified in section 17.

The contractor and engineer must conduct the pre-test section briefing to review the field status related to the preparedness, capability, and readiness of the contractor to construct the test section according to the approved plan. After test section construction and before RCC production, the contractor and engineer must conduct the post-test section briefing to discuss adjustments to the techniques, materials, plant, equipment, and personnel that will be used in RCC production. The contractor must submit in writing a final plan for RCC production methods, materials, plant, equipment, and personnel that will produce RCC that meets the requirements of this specification. Unless otherwise specified, the plan must be submitted no later than 7 days prior to beginning RCC production. Written approval of the plan must be required prior to beginning RCC production.

Apparent maximum density—AMD is the maximum RCC density of the approved job mix that can be attained by compacting the RCC with the production roller defined in section 13 of this specification. The AMD must be greater than or equal to 98 percent of the TAFD. The AMD of the RCC must be determined from the test section.

To determine the AMD, the RCC lift must be compacted by successive passes of the production roller over the entire lift surface. (Note: The act of rolling forward past a point and then rolling in reverse past the same point is considered two passes.) Between passes of the production roller, in-place wet density tests (ASTM C 1040) must be made at a depth of 12 inches. Density tests must be initiated after the second pass of the production roller. A minimum of two density tests must be performed at a depth of 12

inches and at approved locations. Successive passes of the production roller, followed by density tests at the 12-inch depth, must be made until the density of the lift no longer increases. When it appears that continued compaction will not increase the density, make two more passes of the production roller, each followed by a density test to document that the density is no longer increasing. Once it has been determined that the density measurement at the 12-inch depth is no longer increasing, density tests must be taken in two locations at depths of 2, 4, 6, 8, 10, and 12 inches. If the maximum and minimum density values obtained in one test hole vary more than 2 percent of the maximum value obtained at that test hole, the contractor must modify operations until this variation is no more than 2 percent.

When the density of the lift no longer increases and the density measurements taken at the specified depths vary no more than 2 percent of the highest value measured at one location, the density must be measured at the 10-inch depth at six approved locations. If more than one of these density measurements results in values less than 96 percent of the TAFD, the contractor must modify operations and repeat the process for determining the AMD. The AMD is the average of the in-place density test values that are greater than or equal to 96 percent of the TAFD of the job mix. If the AMD is less than 98 percent of the TAFD of the job mix, the contractor must modify operations to attain an AMD that is at least 98 percent of the TAFD.

If a new job mix is approved during production of RCC, a new TAFD will be computed and a new AMD will be determined as previously specified.

Air content and density—The air content of the mix must be determined according to ASTM C231 modified to use an impact hammer and tamping plate for compacting the AERCC in two equal lifts. The compaction of AERCC must be performed as described in ASTM C1435, taking care not to compact each layer more than necessary for the complete mortar ring formation. The tamping plate must have a diameter that is equal to the diameter of the inside of the air pot minus 3/8 to 5/8 inches. The volume and tare weight of the air pot must be determined according to ASTM C138. After consolidating the RCC in the air pot and just prior to testing to determine the air content, the weight of the RCC and pot must be determined according to ASTM C138. The density of the RCC that is consolidated in the pot at the time of testing must be computed.

Compressive strength tests—Fifteen compressive strength cylinders must be prepared from the mix in accordance with ASTM C1176 or C1435 and weighed to determine the density of the RCC within each cylinder. Any cylinder that weighs less than 98 percent of the weight of the heaviest cylinder must be discarded and another cylinder prepared and weighed until all 15 cylinders have a weight that is at least 98 percent of that of the heaviest cylinder. Three cylinders must be tested at 7, 14, 28, 90, and 180 days, respectively, for compressive strength in accordance with ASTM C39.

Unless otherwise specified in section 22 of this specification, the contractor must extract 10 intact vertical core samples, in accordance with ASTM C42, from a portion of the test section that has been placed to the specified density and cured in accordance with this specification. Core specimens must be taken 13 days after the RCC is placed. The contractor must test two samples at 14, 28, 56, 90, and 180 days, respectively, for compressive strength in accordance with ASTM C42. Cores must have a minimum length equal to one lift thickness and a nominal diameter of 6 inches.

7. Mix plant

The plant must either be a batch-type pugmill or a continuous-flow pugmill. The pugmill must be a twin shaft paddle-type mixer and must have adequate capacity to produce a uniform RCC mix at a rate that will conform to the production schedule. The plant must have a minimum capacity of 100 tons per hour.

The plant must have demonstrated satisfactory reliable performance on similar mixes on other RCC projects with little or no down time because of mixer breakdown or other production-related problems, excluding normal maintenance. Satisfactory reliable performance of the proposed plant must be

documented by mixer uniformity tests from recent production work showing that the plant produced a mix of similar proportions that met the requirements for production rate and uniformity set forth in this specification.

The results of uniformity tests that are conducted after the plant is set up and calibrated may be substituted for documentation of reliable past plant performance provided the results of the uniformity testing are in compliance with the requirements of table 36–2. RCC produced during uniformity tests required herein must not be incorporated into the test section or any permanent structure.

The contractor must perform trial runs of the mixing and proportioning equipment, including uniformity tests if required.

Accuracy. Facilities must be provided for the accurate measurement and control of each of the materials entering the RCC mix. Delivery of materials as they are discharged from the mixer and from any gob hoppers must be within the tolerances shown in table 36–1.

Table 36–1 Tolerances in proportioning the various ingredients

Material	Tolerance
Pozzolan, mass	± 2 %
Cement, mass	± 2 %
Aggregate, mass	± 3 %
Water, mass or volume	± 2 %
Chemical admixture, mass or volume	± 3 %

Component monitoring systems. The systems that meter individual mix components must be interlocked with the plant control and must warn the operator and shut down the plant if any component is not feeding into the mixing chamber.

Aggregate bins. A separate bin must be provided for each gradation of aggregate supplied for the RCC job mix. The bins and associated conveyors must be capable of discharging and conveying the aggregates at a uniform rate without clogging, under all conditions.

Portland cement and pozzolan silos. All onsite storage facilities and connection hoses must be properly labeled with readily visible signage. The storage silos must be weather tight to prevent moisture and contaminants from accessing the portland cement and pozzolan. Blended cement/pozzolan products mixed by the cement manufacturer are permitted. Silos must be capable of dispensing at a uniform rate without clogging or bridging of the materials.

Portland cement, pozzolan, and aggregate feed. For a continuous-flow pugmill, the portland cement, pozzolan, and aggregates must be uniformly, continuously, and simultaneously fed into the mixing mechanism at the appropriate ratios. Each bin opening must be provided with a gate that can be maintained at the necessary opening size to consistently provide the correct feed rate. The bins must be of sufficient size to ensure a uniform flow of aggregate at a constant rate. Portland cement and pozzolan must be fed continuously by a feed device that is adjustable to ensure a uniform flow of cement and

pozzolan at a constant rate for proportions established by the approved job mix. Feed devices must be capable of gradual adjustment while in operation.

Water dispenser. A suitable water facility must be provided that is capable of metering and dispensing the mix water within the specified tolerances. The mechanism for delivering water to the mixers must be free from leakage. The meter must measure the weight of water being added in pounds per unit time for continuous-flow pugmills, and weight per batch for batch-type pugmills. The valve must be capable of gradual adjustment during the mixing process to compensate for varying moisture contents in the aggregates.

Admixture dispenser. The liquid admixture dispensing system must be capable of metering and dispensing within the specified tolerances. The dispenser must be designed and installed in such a manner that will permit convenient checking of its accuracy and will assure uniform distribution of the liquid admixture with water to the materials entering the mixer. The system must be leak-free and designed and installed to prevent backflow or siphoning.

Mixing mechanism. The mixing mechanism must be capable of combining the materials into a uniform mixture and discharging this mixture without segregation. The mixing mechanism must produce a mix that meets the uniformity requirements listed in table 36–2.

Uniformity tests. When a continuous-flow pugmill is used, the three samples for obtaining uniformity tests must be taken from RCC produced near the beginning, the middle, and the end of a production run lasting a minimum of 1 minute. When a batch-type pugmill is used, the samples must be taken from RCC produced from three separate batches. Each batch must be similar in size, be produced by charging the mixer in a similar manner, be mixed at the same mixing speed and mix retention time as the other two batches, and be representative of a normal production run.

Table 36–2 Requirements for uniformity

Test	Allowable max. difference 1/	ASTM standard
Water content of full mix (% by weight) (Select one of the ASTM standard tests listed)	10%	C566 D2216 D3017 D4643 D4959
Coarse aggregate content (% by weight)	10%	C685 (annex)
Density (lb/ft^3) of full mix	2%	C1170
Compressive strength at 14 days (lb/in^2)	15%	C39 2/

1/ The allowable maximum difference = 100 multiplied by the (maximum value – minimum value) divided by the average of three tests.
2/ Cylinders must be made in accordance with ASTM Standard C1176 or C1435.

Mix record. The mix plant must be capable of continually producing an RCC mix record. The record must show the weight of portland cement, pozzolan, water, aggregate, and weight or volume of chemical admixture that is processed through the plant during a specific time interval. The time interval must not exceed 30 minutes. The aggregate must be reported in terms of saturated surface dry weight processed through the plant during a specific time interval. The RCC mix record must be produced at all times when

the plant is producing a mix. The aggregate moisture must be tested daily whenever RCC is being produced. The mix plant record must include the aggregate moisture content tests upon which the batch proportions are based.

A summary shift record must be provided. The record must include the total quantity of each constituent in the mix, total quantity of RCC produced, and a comparison of the quantity of each constituent mixed per cubic yard to that of the job mix.

Noise pollution. The plant must be operated to comply with all applicable regulations pertaining to noise pollution.

Pollution control. The plant must be operated to comply with all applicable regulations pertaining to air and water quality.

8. Mixing

The plant must be operated according to the manufacturer's recommendations. The mixing mechanism must be maintained in satisfactory operating condition and must be cleaned after each production run. All supply bins and silos must be kept sufficiently full to ensure a uniform and constant flow of all materials.

All RCC produced from the beginning of startup must be disposed of at the location or locations specified in section 22 of this specification until a uniform mix of the required proportions is consistently being discharged from the mixer.

After a batch-type pugmill has been calibrated and has produced the job mix with the specified uniformity, the mix retention time must not be reduced.

Uniformity—RCC uniformity must be monitored by continuous visual inspection by the plant operator and by periodic visual inspection by contractor quality control personnel. The mix must be visually inspected for uniformity by contractor quality control personnel at the beginning of each production run and at least once each hour during the production run. If it becomes apparent that the mixer is not producing a uniform mix of the proportions specified, RCC production must be promptly discontinued until the problems that caused the uniformity problem are discovered and corrected.

If a uniformity problem is suspected, the contractor must conduct the tests listed in table 36–2, determine the maximum difference and compare to the allowable maximum difference, and take appropriate corrective measures.

Adjustments must be made to the mixing plant as necessary to obtain the required uniformity and consistency of the RCC mix when uniformity test results indicate that the requirements for uniformity are not being met. The production and placement of RCC may proceed without waiting for the compressive strength results if the results of the other three tests listed in table 36–2 are within the allowable maximum difference and the issues that caused a uniformity problem are resolved.

9. Conveying

The RCC mix must be conveyed from mixer to placement area as rapidly as practicable by methods that prevent segregation, contamination, and loss of water. The total length of time from the end of mixing until the RCC has been placed, spread, and compacted must not exceed 45 minutes.

The contractor must provide baffles to limit free fall of mixed RCC to a maximum of 5 feet at the discharge end of conveyors, within hoppers, and at other locations where the potential for segregation may occur. Chutes that tend to cause segregation, such as an inclined chute, will not be permitted.

Communications—Telephone, radio, or other voice communication must be provided between all interim storage hoppers, the batch plant control, and the placement locations. The contractor must provide the Government inspector the same form of communication.

Temporary storage containers—Gob hoppers must be used for storage wherever the mixed RCC is temporarily accumulated prior to being loaded into hauling equipment and when direct conveyor systems do not otherwise provide continuous delivery to the final placement location. Gob hoppers must be configured to allow free flow of RCC without segregation or choking.

Conveyor belts—The conveyor system design and layout must provide for adequate capacity, speed, reach, and pivot points to convey RCC to all placement areas.

Conveyor belts must be designed, erected, operated, and maintained in a manner that meets production requirements and does not segregate materials. RCC must not be exposed on any belt for a period exceeding 5 minutes without being protected from the drying elements of wind and sun. RCC must not be exposed on any belt during rainfall unless it is protected from the rain.

Hauling equipment—Equipment must be maintained in good operating condition and must not be permitted onto the RCC surface when vehicle fluids are leaking or when there is a potential for contamination to the RCC.

RCC may be hauled using trucks, front-end loaders, or scrapers. Hauling equipment that ruts, scores, mars, or indents the RCC surface must not be operated directly on previously compacted RCC surfaces. Hauling equipment must not track mud or other contaminants onto previously placed RCC and must not be operated directly on uncompacted RCC. All hauling vehicles must be operated in a manner that prevents tight turns, sudden stops, or other actions that cause damage or displacement to previously compacted RCC. The contractor must implement necessary measures to prevent contamination or damage of the previously compacted RCC.

10. Weather

Adverse weather—In adverse weather (heavy rain, severe cold, heavy snow, and hot temperature) where the conditions specified herein for RCC construction cannot be maintained, an interruption in placing operations is required.

Weather station—The contractor must install and maintain a weather station onsite at all times during performance of the test section and the production and placement of RCC. The weather station must be located at an approved location near the RCC structure. The weather station must record wind speed, ambient temperature, humidity, and the rate and cumulative volume of rainfall. A record of climatic conditions at the designated location including wind speed, ambient temperature, humidity, and rainfall rate and volume must be recorded daily.

Wet weather placement—RCC must be protected from rainfall-induced erosion and must not be placed during rainfall events at a rate equal to or greater than 0.1 inch in 20 minutes. Placement during a light mist may continue when covered belt conveyors rather than hauling vehicles are used to convey the mix. Placement of RCC will not be permitted when rainwater accumulates on compacted RCC surfaces.

Cold weather placement—RCC must not be placed when the ambient air temperature drops below 35 degrees Fahrenheit or the temperature of the RCC mix is less than 40 degrees Fahrenheit.

Hot weather placement—The maximum temperature of the RCC at time of placement must be as specified in section 22. After placing, but prior to compaction, the temperature of the mix must be determined according to ASTM C 1064. When the RCC temperature is within 2 degrees of the specified limit, it must be measured every hour. Introduction of chilled water and/or ice, shading and/or cooling of

the aggregates, or other measures may be required in the production of RCC to maintain the RCC temperature within the specified requirements. If the RCC temperature exceeds the maximum specified temperature, RCC placement must be suspended until cooler weather or additional measures to reduce the RCC temperature results in a reduction of the placement temperature of the RCC to or below the specified maximum temperature.

11. Foundation preparation

Prior to the start of RCC placement, the foundation must be excavated or filled to the specified lines and grades as shown on the drawings. The foundation must be free of standing water and any organic or loose materials. All surfaces where RCC installation is specified must be damp and have a surface temperature not less than 35 degrees Fahrenheit at time of placement. Placement of RCC on mud, dried earth, uncompacted fill, standing water, or frozen subgrade is not permitted.

Earthen foundations—Earthen foundation surfaces must be prepared by adjusting the moisture content and compacting the foundation. The moisture content, depth, and degree of compaction required must be as specified in section 22. If the earthen foundation is allowed to dry after compaction, it must be moistened prior to placing RCC. The foundation surface must be firm and damp.

Rock foundations—Rock foundations must be cleaned and prepared as specified in Construction Specification 63, Treatment of Rock Surfaces. The slope of the finished foundation surface must not be steeper than one horizontal to one vertical. Rock surfaces must be damp at the time of RCC placement.

12. Placing and spreading

The placement of RCC into the structure must be such that once placement begins, it is performed without interruption until RCC placement and compaction complies with specification requirements within the geometric limits planned for that placement period. The contractor must obtain the concurrence of the engineer when establishing the geometric limits of RCC to be placed and compacted in any placement period.

All equipment used on the RCC fill must be maintained in good operating condition at all times. Equipment must not drip or spill oil or other contaminants onto the RCC. Any equipment that contaminates the RCC mixture must be promptly removed from contact with the RCC and repaired or replaced. Any contaminated RCC mixture must be removed and replaced.

Placing and spreading must be performed with equipment that does not mar or contaminate the surface of the compacted RCC. Track-type equipment must not operate directly on compacted RCC unless the tracks are equipped with rubber pads. Equipment used to deposit, spread, or compact must not turn on previously compacted RCC.

Layout of the placement area—The RCC must be spread in level lifts across the entire area of the structure. The direction of RCC placement must be parallel to the long axis of the structure so that the number of lanes and the number of edge joints are minimized. Transverse joints of adjacent lanes must be offset by no less than 20 feet horizontally.

Placing—RCC mix, bonding mortar, portland cement, neat cement grout, or concrete must not be placed on previously placed layers that have not been compacted to the specified density.

Roller compacted concrete mix must be deposited as near to its final location as possible. When haul vehicle delivery is used, depositing must be accomplished with a dump-spread action while the placing vehicle is moving. Belt placement must discharge with a spreading action that does not segregate the material. RCC must not be deposited directly against formwork or other vertical surfaces. Piles that form when placing RCC must not contact forms or vertical surfaces. Neither the discharge height nor the pile height of RCC must exceed 5 feet.

Spreading—Spreading of the RCC must be completed within 10 minutes following depositing. RCC must be spread into an uncompacted, uniform lift thickness that can be compacted to produce a lift of the specified thickness and density. In areas requiring special compaction, it may be necessary to deposit, spread, and compact the RCC in several layers to produce a lift of the specified thickness and density.

Equipment must not operate directly on any surface that has been cleaned and prepared to receive a subsequent lift of RCC.

Spreading of RCC material must be performed with a track-type bulldozer in a manner that will not cause damage to previously compacted RCC.

With RCC placement at or near its final location, spreading will typically be limited to leveling the RCC into uniform lifts. In isolated or confined placement locations, the RCC may be deposited and spread up to a maximum distance of 50 feet provided segregation does not occur, specified spreading time is not exceeded and the time specified between mixing and a completion of compaction is not exceeded. The contractor must conduct placing and spreading operations in a manner that will prevent segregation of RCC.

If segregation of RCC occurs during the spreading operation, it must be corrected by immediately reworking the RCC. Reworking must be performed using techniques that do not damage previously compacted RCC. This may require removing the RCC from the lift surface to accomplish reworking, then transporting the mix back onto the surface after mix uniformity has been achieved. If reworking the RCC does not produce a uniform mix, or if the specified time between mixing and compaction is exceeded, the segregated RCC must be wasted and replaced.

If a uniformity problem is suspected, uniformity tests must be performed from material taken from the placement area following spreading of the material and/or other points in the RCC production process as required to identify the source of the problem. Three individual samples of the material must be taken at the sample location at intervals of 5 minutes or more. Uniformity tests must be conducted in accordance with table 36–2. The maximum difference between the resulting values must be compared to the allowable maximum difference and appropriate corrective measures be employed.

13. Compaction

The entire surface area of each RCC lift must be compacted to the specified density, as determined from the apparent maximum density (AMD) specified in section 6, with adequate compaction overlap to ensure complete compaction of the RCC.

The in-place wet density of the compacted RCC measured at a depth of 10 inches must not be less than 98 percent of the AMD.

Uniformity of density must be achieved within each lift. The difference between density measurements at any two depths must not exceed 2 percent of the greater of the two values.

The wet density of the compacted RCC must be tested in accordance with ASTM C1040. The moisture content of the compacted RCC must be tested in accordance with ASTM D3017. Unless otherwise specified in section 22, a minimum of three moisture and density tests will be performed on each lift of RCC with no less than one density measurement and moisture measurement for each 100 cubic yards of RCC compacted.

Production compaction must be performed with production rollers as defined in this section. RCC compacted with production rollers must be compacted in single lifts that are 12 inches thick (plus or minus 1 inch) after the specified density has been achieved.

Production rollers must be single or double drum, large, self-propelled vibratory rollers. The rollers transmit a centrifugal force to the surface through smooth steel drum or drums by means of revolving weights, eccentric shafts, or other equivalent methods. Production rollers must impart a centrifugal force of at least 450 pounds per inch of drum width at the operating frequency during compaction. Production rollers must operate at a vibrating frequency of at least 1,500 vibrations per minute and have a drum diameter of 4 to 6 feet and a drum width of 5 to 8 feet. The amplitude of vibration of the roller must be between 0.03 and 0.07 inch. The roller must not travel at greater than 2 feet per second during the compaction operation.

Production rollers must be used in open areas where they can compact RCC to the specified density within the specified time and without damage to the structure, forms, foundation, or appurtenances.

Rollers may only be operated in the vibratory mode while actively compacting the RCC. After the RCC has been deposited and spread, rollers may be operated in static mode to smooth and/or firm up the surface, but must operate in the vibratory mode to compact the RCC to the specified density. Compaction must be completed with the roller operated in the static mode, as necessary, to achieve the specified density near the surface of the lift.

The contractor must select the combination of frequency of vibration, amplitude of vibration, and speed of operation that result in the specified density at the fastest production rate while meeting all other requirements.

Placement and compaction of RCC must be completed without damaging the structure, other structures, forms, foundation, or other embedded appurtenances. Any appurtenance damaged by the compaction process must be repaired or removed and replaced at the contractor's expense.

Special compaction techniques must be performed using special compaction rollers and power tampers in areas where production rollers cannot maneuver or will cause damage to the structure, forms, foundation, or appurtenances. RCC must be deposited, spread, and compacted in 4- or 6-inch-thick layers as required to obtain uniform specified density throughout the 12-inch lift with limited compaction to avoid drying the surface.

The individual layers that compose one lift must be deposited, spread, and compacted within 1 hour from the time the first layer within that lift is placed.

Special compaction rollers must be vibratory rollers that are capable of operating in confined areas and adjacent to forms, foundation, or appurtenances without damage to the RCC structure or appurtenances. Special compaction rollers must produce a centrifugal force of at least 150 pounds per linear inch of drum width for each drum of a double drum unit and 300 pounds per linear inch of drum width for a single drum unit. Special compaction rollers must be operated at a speed less than 2 feet per second during the compaction operation.

Power tampers must develop a force per blow of at least 3,500 pounds per square foot. The maximum layer thickness to be compacted by power tampers must be plus or minus 6 inches after the specified density has been achieved.

The contractor must maintain at least one special compaction roller and two tampers in operating condition at the site during RCC placement.

Manually directed vibratory plate compactors may be used to shape, smooth, and level the surface, but must not be used as a substitute for vibratory rollers and power tampers.

14. Record testing

Unless otherwise specified in section 22, one set of RCC cylinders for compressive strength tests must be obtained for each 1,000 cubic yards of RCC placed to be used for compressive strength testing.

Each set must consist of 15 compressive strength cylinders prepared in accordance with ASTM C 1176 or C 1435 and weighed to determine the density of the RCC within each cylinder. Any cylinder that weighs less than 98 percent of the weight of the heaviest cylinder must be discarded and another cylinder prepared and weighed until all 15 cylinders have a weight that is at least 98 percent of that of the heaviest cylinder. Three cylinders must be tested for compressive strength in accordance with ASTM C 39 at 7, 14, 28, 90, and 180 days, respectively, after the specimens are molded.

Unless otherwise specified in section 22 of this specification, the contractor must extract two sets of vertical core RCC samples in accordance with ASTM C 42. Each set must be sampled from RCC that has been placed in the structure at no less than 1 week apart. Each set must contain eight intact cores taken from the structure at approved locations. Cores must have a minimum length equal to one lift thickness and a nominal diameter of 6 inches. Core specimens must be obtained no earlier than 20 days after placement. The contractor must test two samples at 28, 56, 90, and 180 days, respectively, after placement for compressive strength in accordance with ASTM C 42.

15. Lift joints

The term joint, as used in this specification, applies to all surfaces that will eventually be covered by RCC mix, bonding mortar, portland cement, neat cement grout, or conventional concrete.

The joint treatment method must be as specified in section 22.

Joint condition—Three potential joint conditions will exist during construction: fresh joint, intermediate joint, and cold joint. The condition of a joint is defined on the basis of joint maturity or time of exposure. Joint maturity is defined as the product of the average RCC surface temperature (AST) in degrees Fahrenheit and the time of exposure (TE) in hours. Joint maturity is expressed in degree-hours (deg F-hr) and is calculated as—

———————>

Joint maturity in deg F-hr = (AST) x (TE).

The TE is the period, expressed to the nearest quarter hour, beginning when the compaction of RCC is completed and ending when covered by the subsequent placement of RCC, bonding mortar, portland cement, neat cement grout, or conventional concrete.

Whenever the joint condition is defined on the basis of joint maturity, the AST must be determined hourly during the exposure period by measuring the RCC surface temperature at various locations with a surface thermometer. The temperature must be measured in degrees Fahrenheit and the temperature readings averaged to determine the AST.

A **fresh joint** is defined as a joint having maturity of 400 deg F-hr or less. In lieu of determining the joint maturity, a fresh joint may be defined as a joint with a TE of 4 hours or less.

An **intermediate joint** is defined as a joint having a maturity greater than 400 deg F-hr, but less than or equal to 1,600 deg F-hr. In lieu of determining the joint maturity, an intermediate joint may be defined as a joint with a TE of more than 4 hours, but less than 16 hours.

A **cold joint** is defined as a joint having a maturity of over 1,600 deg F-hr. In lieu of determining the joint maturity, a cold joint may be defined as a joint with a TE of 16 hours or more.

Joint treatment—All joint surfaces must be kept continuously moist, clean, and uncontaminated until placement of succeeding RCC lifts. Water that ponds on a finished surface must be removed prior to placing RCC.

The surface of previously placed RCC must be free of soil, dust, or other contaminants prior to being covered with joint treatment material or another layer or lift of RCC. Cleaning of previously placed RCC lifts must be accomplished by pressurized water and/or air or other methods provided that the surface of the in-place layer is not damaged by the cleaning operation.

The contractor must have a pressure washer and a blowpipe onsite capable of delivering a combined air-water mixture, with the ability to adjust the pressure, volume, and proportion of air and water.

Edge joints that are exposed for more than 30 minutes must be trimmed back no less than 9 inches to an RCC surface, that has been compacted to the specified density and beveled at a slope of one horizontal to one vertical. Immediately before placing RCC against a trimmed surface, the joint condition must be determined and the specified joint treatment must be applied.

Any surface to be covered with RCC, a bonding material or conventional concrete that is damaged to the extent that over 25 percent of the exposed coarse aggregate is undercut must be treated as a cold joint. Coarse aggregate with less than half of it surface area remaining embedded and bonded to the RCC is considered undercut.

All RCC materials removed by cleaning, brooming, smoothing, beveling, or trimming layers must be collected and removed from the structure.

Treatment Method I. Remove any loose materials and contaminants from the lift joint surface. The lift joint surface must be cleaned using moderate-pressure air immediately before spreading the next RCC lift. Maintain the surface in a moistened condition.

Treatment Method II. Perform Treatment Method I. Before the placement of RCC on the joint surface, uniformly distribute a layer of dry portland cement over the surface. The portland cement must be applied at a rate of 0.5 to 1 pound per square foot of surface. The amount of water applied to the lift surface before, during, or after distributing the cement must be of sufficient quantity to dampen all of the cement. The ratio of water to cement must be limited to that which will produce a tacky paste. Water applied after the cement is distributed must be applied in a fine mist to prevent the displacement of cement. The cement must be applied immediately ahead of placing the next layer or lift of RCC. The cement must not be exposed on the surface more than 10 minutes before being covered with RCC. Portland cement paste that does not meet these requirements must be removed from the structure and disposed of, and the treatment method must be repeated.

Treatment Method III. Perform Treatment Method I. Before the placement of RCC, the joint surface must be covered with a layer of the bonding mortar specified in section 2. The thickness of the bonding mortar must be 0.25 to 0.5 inch. The bonding mortar must be covered with the next layer or lift of RCC while the mortar is still fluid. In no case may the bonding mortar remain uncovered for more than 30 minutes. Bonding mortar must be placed in a manner that will avoid segregation. Bonding mortar that does not meet these requirements must be removed from the structure and disposed of, and the treatment method must be repeated.

16. Curing and protection

Curing—Curing of RCC must begin immediately after compaction. All exposed and completed RCC surfaces must be cured for a minimum of 14 days at or above 40 degrees Fahrenheit following placement. All repairs, including those required to fill holes associated with form anchorages and coring, must be cured for a minimum of 7 days at or above 40 degrees Fahrenheit following repair.

If the RCC is wet cured, the RCC must be maintained in a continuously damp condition for the entire curing period. The continuous application of water supplemented by the use of a saturated cover material or an impermeable covering must be required to obtain the continuously damp condition. The application of water or cover material must not erode, mar, or otherwise damage the RCC. Plastic or paper covering must meet the requirements of ASTM C 171. Only white or reflective coverings may be used during hot weather as defined by ACI 305.

In lieu of wet curing, RCC that will not be covered with subsequent joint treatment, RCC, or conventional concrete may be treated with a curing compound as specified in section 2, unless otherwise specified in section 22. Areas to be cured with curing compound must be kept continuously moist until curing compound is applied. Curing compound must be thoroughly mixed before applying and must be agitated during application. A continuously agitating pressure sprayer must be used to apply the curing compound at a uniform rate of not less than double the curing compound manufacturer's recommended rate for conventional concrete curing. Manual hand pump sprayers may not be used. A brush or paint roller must be used in areas that are near unmasked surfaces that will be covered with subsequent joint treatment, RCC, or conventional concrete. The curing compound must form a uniform, continuous, adherent film that will not check, crack, or peel and be free from pinholes or other imperfections. Multiple applications of curing compound may be necessary to achieve the specified coverage. When multiple applications are required, the second application must be applied at a 90 degree angle to the first application. During the curing period, curing compound must be reapplied 7 days after the initial application. In areas where the curing compound is damaged, it must be reapplied immediately.

Curing compound must not be applied to areas that are to be repaired or patched. Areas to be repaired or patched must be kept continuously moist until the repair is made. Curing compound or wet curing must then be implemented to conform to curing requirements specified herein. Any curing compound applied to areas that are to be repaired or patched must be removed prior to applying the repair material.

Regardless of the curing method used, curing activities must not be discontinued or interrupted until the RCC has remained at or above 40 degrees Fahrenheit for a total of 14 days. This will require extending the curing period by the number of days that the RCC temperature drops below 40 degrees Fahrenheit during the curing period.

Protection—The temperature of RCC must be maintained at or above 35 degrees Fahrenheit from the time the RCC is placed until 7 days after the curing period. When ambient temperatures are expected to be below 32 degrees Fahrenheit, measures must be implemented to protect the RCC from freezing. The protection must remain in place until ambient temperatures remain continuously above 35 degrees Fahrenheit for 24 hours. Protective measures must not hinder the specified curing of the RCC.

RCC must be protected from damage by precipitation, vehicular traffic, or other causes.

17. Vertical surfaces

Unless otherwise specified in section 22, all formed RCC vertical surfaces that are subject to exposure must be finished to ensure a minimum of 80 percent of the surface area is free from honeycomb or other voids and is uniform in appearance. Forms must remain in place for a minimum 12 hours after the RCC is installed and until they can be removed without damage to the RCC.

Forming is not required for vertical RCC surfaces that are not subject to permanent exposure.

The finish and appearance of unformed vertical surfaces must comply with the requirements specified in section 22.

18. Tolerances

Any variation in the face or surface of the finished RCC must be within the tolerances stated herein.

The structures must be constructed to the lines and grades depicted on the drawings.

The thickness of compacted lifts of RCC must be 12 inches plus or minus 1 inch.

The allowable tolerance of all exposed formed surfaces must be plus or minus 0.1 foot from specified line. Abrupt changes must not exceed 0.05 foot in any exposed formed surface.

Limit gradual overbuild of exposed unformed RCC faces to 0.5 foot. Under build will not be allowed.

Do not exceed 0.1 foot in 10 feet variation in an unformed, exposed RCC face as measured in a straight line along the length and height of the face, or 0.5 foot over the entire length of the structure. Abrupt changes must be less than 0.1 foot.

The elevation of any horizontal RCC surface must be plus or minus 0.1 foot of the specified grade except that the elevation of a finished top of dam or spillway crest must be no more than 0.1 foot above the specified elevation.

19. Repair of RCC

Repair or replacement—The contractor must repair or replace RCC that does not meet the requirements of this specification. Before starting any repair or replacement work, the contractor must prepare a written plan for the repair or replacement. The primary reference for material and repair methods for the plan must be the appropriate sections of the American Concrete Institute's Manual of Concrete Inspection. The repair plan must be submitted for review and approval at least 10 days before any repair or replacement work.

Patching—All form bolts, metal ties, and similar forming restraints must be removed to a depth of 1 inch below the surface of the RCC and their cavities repaired unless otherwise specifically permitted or specified in section 22. Small cavities, large air holes, minor honeycombed areas, holes created from test coring, and other superficial imperfections that require patching to meet the specified finish requirement must be thoroughly cleaned and filled. Holes left by bolts or straps that passes through the RCC must be filled solid with a dense, well-bonded nonshrink patching material. Dry-pack mortar and replacement concrete must follow the appropriate procedure detailed in the Repair and Maintenance chapter of the Concrete Manual, Bureau of Reclamation, U.S. Department of the Interior. Proprietary patching material must be appropriate for the type of repair used within the manufacturer's recommended limits and applied according to the manufacturer's recommendations.

When proprietary patching material is proposed in the plan, the manufacturer's data sheets and written recommendations must be included in the plan.

Repair material or replacement concrete must have properties, color, and texture similar to and compatible with the concrete being repaired or replaced.

Curing of repaired or replaced concrete must be started immediately after finish work is completed as specified in section 16 or as specified by the manufacturer of proprietary compounds.

20. Cleanup of spillage

All loose gravel and uncompacted RCC material must be removed from the structure for disposal in approved locations or as specified in section 22 and must not be recycled into the RCC mix.

21. Measurement and payment

For items of work for which specific unit prices are established in the contract, the volume of RCC is measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Unless otherwise specified in section 22, no deduction in volume is made for embedded items, such as

(but not limited to) conduits, inlet structures, outlet structures, embankment drains, sand diaphragm and outlet, and their appurtenances.

The volume of RCC must be determined by measuring from the surface of the foundation when approved for RCC placement to the specified neatlines of the completed RCC structures, unless otherwise specified in section 22.

If the test section is not incorporated into the RCC structure, the volume of RCC placed into the construction of the test section will be added to the volume computation of the completed RCC structure to determine the total volume of RCC for payment. If the test section is incorporated into the RCC structure, no addition volume of RCC must be included for payment.

When the test section is paid for under a separate bid item, the test section will not be measured for payment. Payment will be made at the contract lump sum price for the test section and will constitute full compensation for the completion of the test section including any removal and disposal as applicable.

Payment for the RCC, for which a specific unit price is established in the contract, will be computed to the nearest cubic yard. Payment constitutes full compensation for furnishing all labor, materials (except cementitious materials), equipment, tools transportation, and all other items necessary and incidental to the construction and removal of the test section and construction of the RCC structure, including joint treatment, trimming and removal, repair, replacement, patching, curing, protection, site cleanup, and disposal of spillage and waste materials. Payment for treatment of rock foundation surfaces, if any, will not be included in the payment for RCC. Payment will not be made for RCC material that is wasted or rejected for failure to comply with this specification.

Payment for each cementitious component of the RCC, for which a separate bid item is included in the contract, includes the quantity incorporated into the RCC structure and test section. This quantity is computed based on statement of delivery tickets. Payment will not be made for any cementitious materials not incorporated into the structure or test section.

Payment for the cementitious materials for which specific unit prices are established in the contract will be to the nearest 0.1 ton of cementitious materials.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 22.

22. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Roller Compacted Concrete, General

1) In Section 2, Materials, materials shall conform to the referenced Material Specifications and additional requirements specified below:

   a. Portland Cement: ASTM C150, Type II (Moderate Sulfate Resistant), Low Alkali (LA). Type I/II/IL cement satisfying the requirements for both Type I and Type II cement is acceptable for this project. ASTM C595 IP, IS or a Ternary blend is acceptable so long as they meet the total pozzolan requirements stated in 4,b below.

   b. Fly Ash is a required constituent for the RCC Mix Design. Supplemental cementitious materials shall be furnished from the same source and supplier for all concrete. Fly ash shall comply with ASTM C618 Type F and the following requirements:

      i. Loss on ignition shall be less than 2.5 percent.

      ii. Sulfur trioxide content shall be less than 4 percent by weight.

   c. Combined Aggregate: The Contractor's aggregate production stockpiles shall be such that when (by weight) the stockpiled aggregates are combined, the resulting gradation shall be within the limits specified in Table 1 for a wet sieve analysis. Unless otherwise specifically stated, the gradation limits given below and the percentages referred to apply to the total aggregate weight used in a unit volume of RCC, including all size groups. They do not apply to the weight of aggregate in any one size group.

Table 1 – Combined Aggregate Gradation

Sieve Size	Finer by Weight
1-1/2 inches	95 - 100
1 inch	80 - 95
½ inch	60 - 75
No. 4	35 - 50
No. 8	25 - 40
No. 16	18 - 30
No. 30	14 - 26
No. 50	7 - 18
No. 100	5 - 13
No. 200*	4-8

*Fines shall be non-plastic per ASTM D4318

   i. An additional requirement is that a minimum of 20% of the total aggregate shall be retained between the No. 4 and the No. 16 sieves (passes the No. 4 and is retained on the No. 16).

ii. WVDOT Aggr. Class 3 crushed aggregate (Table 704.6.2.A) generally meets the gradation requirements of this specification. If the supplied aggregate does not meet gradation criteria, then supplemental aggregates, such as ASTM C33 fine aggregate, can be added as needed to meet gradation criteria.

iii. Aggregates shall be sourced from aggregate quarries rated "A-1" by WVDOT in accordance with Material Procedure 700.00.52.

iv. As an alternative to the test methods specified in Material Specification 524, Aggregates for Roller Compacted Concrete, accelerated mortar-bar testing performed in accordance with ASTM C1567 may be used at the Contractor's discretion to expedite evaluation of potentially reactive aggregates.

v. Petrographic examination of aggregates shall be performed in accordance with ASTM C295 and include evaluation of iron sulfide minerals. Results shall be submitted to the COR review. Acceptance of proposed aggregates shall be based on the following criteria:

- If sulfur content (S) is less than 0.1%, the aggregate will be considered acceptable.
- If S is between 0.1% and 1.0%, the Contractor shall perform additional chemical testing to determine if iron sulfide minerals exist in the aggregate. Aggregates with iron sulfide will not be accepted.
- If S is greater than 1.0%, the aggregate will not be accepted.

d. Water: The Contractor is responsible for locating an acceptable water source. If non-potable water is used, chemical test results shall be submitted to COR for review prior to RCC placement, weekly during RCC production, and as requested by the COR. Chemical test results shall demonstrate the following limits are met for non-potable water.

i. $6 \leq pH \leq 7.5$

ii. Turbidity (suspended solids) < 2000 ppm

e. High Range Water Reducing Admixture: ASTM C494, Type F.

f. Curing Compound is not allowed.

g. Set Retarder Admixture: ASTM C494, Type B.

h. Air Entrainment Admixture: ASTM C260

i. Set Retarder Admxiture for Bonding Mortar: The admixture must be included at the manufacturer's recommended dosage so that the initial set time is retarded at least 3 hours when the ambient air temperature is 95 degrees Fahrenheit or the temperature of the bonding mortar exceeds 80 degrees Fahrenheit whichever occurs first.

2) In Section 3, Submittals, submittal schedule does not apply, Instead, dates to submit in this section shall override any dates mentioned in Section 3 if applicable:

a. Schedule: Within 30 days following Notice to Proceed, submit a written plan and schedule clearly demonstrating the plan to complete RCC placement within the time period specified.

b. RCC Trial Mix:

i. Portland Cement and Pozzolan: RCC product submittals – at least 45 days before

trial mix production, submit the source of each material and certified mill test reports including laboratory test results indicating chemical and physical properties representative of the cement and fly ash proposed for the project and verifying that each material conforms to the applicable specification requirements.

ii. Aggregates: RCC product submittals – at least 45 days before trial mix production, submit the source of each size group and three representative manufacturer's test reports prepared within the last 6 months verifying that each material conforms to the applicable specification requirements and showing physical properties (including absorption and SSD specific gravity) and gradations. Submit test results as required herein for susceptibility to alkali-aggregate reactivity. Testing for alkali-aggregate reactivity shall be performed specifically for this project and submitted with the mix design. Results from testing performed prior to this project will not be accepted, except petrographic analyses in accordance with ASTM C 295 that were performed on representative samples within the past 6 months may be submitted.

iii. Water: RCC product submittals – at least 45 days before trial mix production, submit the source from which the RCC mixing and curing water will be obtained and the test results as required by ASTM C 1602 verifying that the material conforms to the applicable specification requirements. Submit narrative and supporting diagrams describing the means, methods and equipment to deliver and store RCC mixing and curing water onsite.

iv. Bonding Mortar: RCC product submittals – at least 45 days before trial mix production, submit trial mix batching and testing results in accordance with Section 3 demonstrating that the proposed bonding mortar meets design strength requirement of 3000 psi at 28 days and all specification requirements.

c. RCC Job Mix Preproduction Submittals:

i. RCC Mix: 7-days following conclusions of laboratory mix design 90-day compressive testing, submit trial mix batching and testing results in accordance with Section 3 demonstrating that the proposed RCC mix meets all specification requirements. Additionally, determine initial and final set times for selected job mix at a mix temperature between 75 and 80 degrees. Section 3, Job mix (item a), is modified as follows:

- The contractor shall provide a certified statement of materials, mix proportions, (reported for saturated dry aggregate), theoretical maximum density (TMD), Vebe time, air content, unit weight of mix in air pot prior to testing air content, paste content, paste to mortar ratio, and all compressive strength test results for each of the three mixes required in the development of the RCC job mix. The Contractor will not be required to provide the theoretical air free density (TAFD)

ii. Bonding Mortar: submit at least 45 days prior to on-site material delivery or equipment setup.

iii. Personnel: Within 30 days following Notice to Proceed, submit the names and qualifications of the RCC Placement Foreman/Superintendent, RCC plant operator, and RCC Quality Control Supervisor who will direct and manage the batching, mixing, placing, and quality control operations of RCC.

iv. Transporting and Conveying Plan: At least 45 days prior to RCC test section placement, submit narrative and supporting diagrams describing proposed means, methods, and equipment for RCC transporting and conveyance, including but not limited to control of groundwater, haul routes, and locations of fixed equipment and location of any equipment, such as conveyor belts, that may be relocated during RCC placement. The plan shall describe how the delivery system will reach every portion

of the auxiliary spillway.

v. Plant and Equipment: submit at least 45 days before on-site material delivery or equipment setup.

vi. Test Section Plan: submit at least 45 days prior to on-site material delivery or equipment setup.

vii. Lift Maps: Submit lift maps similar to that shown in the Portland Cement Association publication "Roller-Compacted Concrete Quality Control Manual", Appendix A, Form 3 for all RCC lifts placed. Include annotation indicating the approximate location where samples were taken for record testing and where density tests were performed.

d. A batch ticket shall be submitted for each batch of RCC. The batch ticket shall show the date and time the RCC was batched, and the quantity of each constituent. A copy of the batch ticket shall be given to the COR when the RCC is delivered to the point of placement. If a continuous mixing plant is proposed by the Contractor, a batch ticket will not be required, but the Contractor shall submit a mix record in accordance with Section 7.

e. RCC production submittals:

i. The contractor shall additionally provide the results of RCC air content tests.

3) In Section 4, Personnel:

a. RCC plant operator shall be experienced in production of RCC with at least 1 project of similar quantity and scope within the past 3 years, or 2 jobs of similar quantity and scope within the past 5 years.

b. RCC Quality Control Supervisor shall be experienced in production and placement of RCC with at least 1 project of similar quantity and scope within the past 3 years, or 2 jobs of similar quantity and scope within the past 5 years. RCC Quality Control Supervisor shall be responsible for evaluating RCC proportioning, mixing, and production, and adjusting operations as needed to achieve the specified requirements. Contractor shall engage an independent third party to serve as RCC Quality Control Supervisor.

c. RCC Placement Foreman/Superintendent shall have at least one RCC project of similar quantity and scope in the last 5 years with at least 10 years of experience in earthwork.

4) In Section 5, RCC Mix Design:

a. The RCC mix design will consist of cement, fly ash, aggregate, water and admixtures. The Contractor is responsible for developing the RCC mix design and selecting final mix proportions subject to approval by the COR.

b. The minimum required cement content is 250 lbs/cy and the minimum required fly ash content is 250 lbs/cy. Pozzolans must comprise at least 35 percent (by volume) but must not exceed 60 percent (by volume) of the cementitious materials. The cementitious materials content that will be used for the job mix will be based on the results of the 90-day compressive strengths of the three laboratory mix designs submitted by the Contractor.

c. It is expected that more than 200 lbs per cy of water will be required for the mix. The actual water content will be that necessary to provide a maximum Vebe time of 15 seconds as determined in accordance with ASTM C1170 procedure B. The requirement that the moisture content can only be 0.5 percent over the optimum moisture content is not applicable.

d. Minimum compressive strength is 3,000 psi at 90 days.

e. Minimum unit weight is 145 pcf.

f. Air content shall be 6 percent plus 2.5 percent to minus 1.5 percent and shall be determined in accordance with ASTM C1849 and C231. ASTM C231 must be modified to use an impact hammer and tamping plate for compacting the Air Entrained Roller Compacted Concrete (AERCC) in four equal lifts as specified under Trial Mix Design.

g. Minimum paste content of 22% by volume

h. Minimum paste to mortar ratio of 0,45

i. Minor adjustments to the water content shall be the Contractor's responsibility to maintain design workability during construction. Continual routine visual monitoring of lift surface conditions shall be used as the basis for any adjustment. Cement, fly ash, aggregate and admixture contents shall not be adjusted from the approved job mix without written approval from the COR.

j. Computation relative to theoretical air free density (TAFD) will not be required. The Contractor will be required to compute the Theoretical maximum density (TMD) and is defined as follows:

i. ***Theoretical maximum density***—The theoretical maximum density (TMD) shall be computed for each of the three laboratory mixes in the mix design program. The TMD is the maximum wet density that can be attained for a specific mix containing entrained air within the specified range. The TMD shall be computed by dividing the sum of the individual weights of the mix components by the sum of the individual absolute volumes of the mix components including the absolute volume of air in the mix. The absolute volume is the volume of the solid matter in the particles, exclusive of the volume of voids between the particles. The absolute volume of each mix component is determined as per ACI 211. The volume of air in the mix is determined by multiplying the percentage of air in mix in decimal form (determined by ASTM C1849 and ASTM C231 with ASTM C231 being modified to use an impact hammer and tamping plate for compacting the Air Entrained Roller Compacted Concrete (AERCC) in four equal lifts as specified under Trial Mix Design) by the target mix volume. The saturated surface dry weight and density of the aggregate shall be used when computing the TMD. The TMD will vary with air content and shall be computed for various values of air content within the specified range. The results of the TMD computations for each of the three laboratory mixes shall be presented in a table and plotted to show air content verses TMD for each mix.

5) In Section 6, Test Section:

a. The RCC test section shall be constructed as shown on the drawings prior to RCC production and after pre-production submittals are approved. RCC test section shall not be incorporated into the work.

b. Construct the test section at the location approved by the COR and in accordance with the drawings and this specification. The test section shall not be incorporated in the permanent work. The test section shall be removed and disposed of at an offsite location designated by the Contractor. The disposal location shall conform to all local, state, and federal regulations.

c. Demonstrate the proposed methods for formed steps, forming steps where they intersect the 2H:1V slope, sloping method and compaction for unformed 2H:1V sloped training walls, facing concrete placement, installation of a control joint through multiple lifts and Treatment Method III for a cold lift joint. Demonstrate patching and repair methods anticipated to a uniform finish at the transition between the vertical step and unformed

side slopes. Use the same equipment that is planned for RCC placement. The test section shall include narrow sections matching the specified facing lift width for accurate representation of the permanent work. Demonstrate working on lifts with limited space and elevated access. Perform all testing as required by Section 6, except coring which is not required.

d. Demonstrate the use of various vibratory compaction equipment that can achieve the density requirements in the fewest number of passes. This will require the Contractor to provide more than one size of compactors at the site during the test section. To determine the AMD, the Contractor shall use a smooth 10 ton vibratory roller. After the AMD is determined, the Contractor may demonstrate other compaction equipment that can achieve the AMD. Modifications to Section 6, Apparent Maximum Density (AMD) and Air content and density are as follows:

   i. Section 6, paragraph 2 - All RCC that is to be incorporated into the structure must be compacted to a density that is at least 98 percent of the AMD.

   ii. Section 6, paragraph 8 - The AMD must be greater than or equal to 98 percent of the results of the TMD. The AMD of the RCC must be determined from the test section.

   iii. Section 6, paragraph 10 - When the density of the lift no longer increases and the density measurements taken at the specified depths vary no more than 2 percent of the highest value measured at one location, the density must be measured at the 10-inch depth at six approved locations. If more than one of these density measurements results in values less than 96 percent of the TMD, the contractor must modify operations and repeat the process for determining the AMD. If the AMD is less than 98 percent of the TMD, the contractor must modify operations to attain an AMD that is at least 98 percent of the TMD.

   iv. Section 6, paragraph 11 - If a new job mix is approved during production of RCC, a new TMD will be computed, and a new AMD will be determined as previously specified.

   v. Section 6, paragraph 12 - The air content of the mix must be determined according to ASTM C1849 and ASTM C231. ASTM C231 must be modified to use an impact hammer and tamping plate for compacting the Air Entrained Roller Compacted Concrete (AERCC) in four equal lifts as specified under Trial Mix Design.

e. Install at least one 8-inch diameter non-perforated PVC drain outlet pipe in the RCC test section demonstrating the method of installation proposed for construction. Install in accordance with the details included in the drawings and specifications for drain outlet conduits including encasing the conduit in Miscellaneous Structure Concrete as shown on the Drawings. Demonstrate protection of the pipe during placement of subsequent RCC lifts.

6) In Section 7, Mix Plant:

a. Mixer Uniformity Test shall be performed within 12 months preceding the placement of the Test Section. Prepare cylinders for compressive strength testing in accordance with ASTM C 1435. Uniformity tests for continuous mix pugmills shall be performed using three samples, one each from three separate runs of the mixer

b. The RCC mixing plant shall be located onsite within the limits of work as shown on the Drawings. Modifications to Section 7, Mix plant, are as follows:

   i. Section 7, paragraph 1 - The plant is not required to have a minimum capacity of 100 tons per hour, but must have adequate capacity to produce a uniform RCC mix at a rate that will conform to the proposed production schedule.

c. Delivery of materials as they discharged from the mixer and from any gob hoppers shall be within the limits shown in Table 2.

Table 2 –Tolerances in Proportioning the Various Ingredients

Material	Tolerance Limit (% by Weight)
Cement	-2% to + 5%
Pozzolan	- 2% to + 5%
Water	+/- 3%
Aggregates	+/- 3%
Admixture	+/- 3%

7) In Section 8, Mixing,

a. No payment will be made for disposal of RCC that does not meet the specifications. Removal of wasted RCC shall be the responsibility of the Contractor. No on-site disposal area will be provided.

b. Mixing of frozen material will not be permitted.

c. Modifications to Section 8, Mixing, are as follows:

i. Section 8, paragraph 1 – In addition to the requirements mentioned, the injection of the air entrainment additive and the operation of the mixing sequence must be optimized to meet the air entrainment requirements of the RCC mix.

8) In Section 9, Conveying,

a. Hauling Equipment for RCC is not limited to trucks and front end loaders. Hauling equipment is permitted to transport RCC from the mix plant to the conveyor hopper only. No hauling equipment will be permitted to traverse on uncompacted RCC lifts or previously compacted RCC lifts that have not reached its final set. A conveyor system shall be used to place RCC on to the lift surface.

b. At the start of each RCC shift or any delayed run of the conveyor system, the conveyor system shall be run empty in an area away from the RCC lift surface sufficiently long to remove debris, dried and loose material, rain/snow from the belt immediately prior to delivering RCC to the lift surface.

c. RCC shall not be permitted to drop more than 5 feet from the conveyor or the conveyor chute/trunk during placement of RCC onto the RCC lift surface. If a trunk is used on the end of the conveyor, it shall be equipped with a break away safety device and a safety chain to prevent trunk from falling on the lift surface.

d. Hauling equipment for bonding mortar, conventional concrete and any other RCC related materials, shall not be permitted to operate on the earthen slopes along the training walls or excavated auxiliary spillway slopes above the advancing RCC or spillway underdrain.

e. Contractor shall provide radios for communication purposes during all active RCC placement to the RCC Placement Foreman/Superintendent, RCC Plant Operator, RCC Quality Control Supervisor, and the COR's representative.

9) In Section 10, Weather:

   a. Provide and maintain a weather station by the contractor in the RCC placement area located within 25 feet horizontal of the RCC placement lift and within 6 feet of elevation from the RCC placement lift. The weather station shall record ambient temperature and the rate and accumulative volume of rainfall to the nearest hundredth of an inch. Record shall be kept daily.

   b. Wet weather placement: RCC shall be protected from rainfall induced erosion and general runoff from surrounding areas onto the placement lift. RCC shall not be placed during rain events at a rate to or greater than 0.1 inches in hour (or 0.03 inches in 20 minutes). Placement during light mist may continue when conveyors, hoppers and hauling equipment are covered, but placement of RCC shall stop when rainwater accumulates on compacted RCC surfaces.

   c. RCC surfaces that become contaminated by runoff and/or erosion of surrounding soil or drainfill shall be cleaned before RCC placement can advance.

   d. Cold weather placement: RCC shall not be placed when ambient temperatures drop below 35 degrees F. or the temperature of the RCC mix is less than 40 degrees F. All RCC placement shall stop during snow events. RCC surfaces less than 28 days old shall be covered with blankets, heavy tarps or straw, until ambient temperatures rise to or above 35 degrees F. RCC foundations or the prepared RCC surface to receive RCC shall not be below 35 degrees F.

   e. Hot weather placement: Misting is permitted to maintain uncompacted RCC in a damp condition until compaction can be performed. Maximum RCC "as-placed" temperature shall not exceed 85 degrees, and no single temperature reading shall exceed 90 degrees. Determine the "as-placed" temperature of the RCC by taking an average of the last ten hourly temperature readings. Using a digital thermometer equipped with a surface probe, measure the mix temperature at the point where the RCC is delivered to the lift surface. Introduction of chilled water/ice, shading and/or cooling of stockpiles of aggregates, or other methods (placing during night, early morning hours, or during cloudy days) may be required in the production of RCC to maintain RCC temperature. RCC placement shall be suspended until cooler weather or other methods are performed to reduce the RCC temperature.

10) In Section 11, Foundation Preparation, rock foundations shall be cleaned and prepared as specified in Construction Specification 63, Treatment of Rock Surfaces.

11) In Section 12, Placing and Spreading:

   a. Equipment used to deposit, spread, or compact shall not make abrupt or tight turns on previously compacted RCC that has reached its initial set that cause damage to the RCC surface.

   b. At the beginning of each RCC shift, RCC lift surface to receive additional RCC shall be air blown and pressure washed clean prior to RCC placement. Connection of multiple air hoses to a single compressor will not be permitted.

   c. Spreading of the RCC to lines and grade shall be completed within 10 minutes following the depositing. RCC shall be spread into an uncompacted, uniform lift thickness that can be compacted to produce a lift of the specified thickness and density.

   d. Only the spreading dozer, compactor, and rubber-tired loader used to move bonding mortar and conventional concrete, shall be permitted on the RCC surface during the placement process. Equipment shall be appropriately sized to pass within the lift surface and not traverse off the lift of RCC at any time. Equipment used shall not produce any

twisting and grinding impacts to the lift surface. A small hoe-like piece of equipment with rubber pads may rest on the RCC 2H:1V slopes or the lift surface after compaction, to be used to compact the 2H:1V slopes after RCC lifts are completed per lift or daily. This procedure shall be demonstrated during the test section by the Contractor for approval.

e. No equipment shall be used to spread bonding mortar, or traverse through bonding mortar after it is placed. Bonding mortar shall be covered with RCC within 15 minutes of depositing and spreading. Each batch of bonding mortar shall be placed within 45 minutes from the time cement was added unless a retarder is used. Contractor shall store bonding mortar in a manner that does not adversely affect its workability. If bonding mortar is not well mixed or appears to have lost its workability or plasticity (as determined by the COR), it may be rejected.

f. Care shall be taken with the loader that is used to move bonding mortar and conventional concrete so as to not spill materials onto cleaned RCC surfaces which will require recleaning of that surface. Loader is to be used to deposit, not spread the bonding mortar and conventional concrete.

g. Both the bonding mortar and conventional concrete shall be spread by hand after depositing. Spreading of the RCC shall be performed with a track-type dozer with rubber tracks in a manner that will not cause damage to previous compacted RCC or disturb bonding mortar. The spreading dozer shall track at least one pass over the entire surface prior to compaction of the RCC lift being placed.

h. In isolated or confined areas, the RCC may be deposited and spread up to 25 feet provided it is performed in a manner not to segregate RCC, or to disturb the bonding mortar. If segregation occurs during spreading, segregated RCC shall be removed and reworked until its uniform again, but not to exceed the allowable time specified in Section 13.

i. Care shall be taken when hand spreading RCC as to not segregate the RCC. If segregation occurs during hand spreading, segregated RCC shall be removed and reworked until it is uniform again. Segregated material may also be rejected, at which point the Contractor shall remove segregated RCC from the lift surface.

j. If uniformity problems are suspected, a uniformity test shall be performed from the material sampled from the placement area(s) following spreading and/or other locations along the RCC production process as required to identify the source of the problem. Uniformity tests shall be conducted in accordance with Section 7.

k. It is expected that exposed top surfaces of each step and exposed surfaces of the unformed 2H:1V slope shall be constructed in a manner to prevent standing water, and shall be finished to ensure that a minimum of 90% of the surface is free from honeycomb or other voids as described in Section 17 "Vertical Surfaces", and is uniform in appearance.

12) In Section 13, Compaction:

a. Modification to Section 13, Compaction, paragraph 2, is as follows: The in-place wet density of the compacted RCC measured at a depth of 10 inches must not be less than 98 percent of the AMD the rolling average of the last five tests with no test less than 96% of the AMD. It is the Contractors' responsibility to determine what type and size of compaction equipment best achieves the requirements of these specifications. The selection of the compaction equipment that is proposed to be used during production shall be demonstrated during the test section. Only equipment demonstrated to be successful in meeting all the requirements of these specifications shall be used during production.

b. Production rollers shall produce flat surfaces with roller marks not exceeded ¼ inch offsets on exposed RCC surfaces. Modifications to Section 13, Compaction, are as follows:

i. Section 13, paragraph 5 - Production compaction must be performed with the production rollers used in the test section. It is the Contractor's responsibility to evaluate different compaction equipment during the test section that will meet the density requirement with the fewest number of passes. RCC compacted with production rollers must be compacted in single lifts that are 12 inches thick (plus or minus 1 inch) after the specified density has been achieved. Rollers must not travel at greater than 2 feet per second during the compaction operation.

ii. Section 13, paragraph 6 - The production rollers are not required to be single or double drum, large self-propelled vibratory rollers. The production rollers are also not required to impart a centrifugal force of at least 450 pounds per inch of drum width at the operating frequency during compaction, nor must they operate at a vibrating frequency of at least 1,500 vibrations per minute and have a drum diameter of 4 to 6 feet and a drum width of 5 to 8 feet. The amplitude of vibration of the roller is not required to be between 0.03 and 0.07 inch.

iii. Section 13, paragraph 13 - Special compaction rollers must be vibratory rollers that are capable of operating in confined areas and adjacent to forms, foundation, or appurtenances without damage to the RCC structure or appurtenances. The use of special compaction rollers or plates may require 6 inch lifts to achieve compaction. Special compaction rollers are not required to produce a centrifugal force of at least 150 pounds per linear inch of drum width for each drum of a double drum unit and 300 pounds per linear inch of drum width for a single drum unit. Special compaction rollers must be operated at a speed less than 2 feet per second during the compaction operation.

iv. Section 13, paragraph 14 - Power tampers are not required to develop a force per blow of at least 3,500 pounds per square foot. The maximum layer thickness to be compacted by power tampers is also not required to be plus or minus 6 inches after the specified density has been achieved.

v. Section 13, paragraph 15 - The contractor shall maintain at least one special compaction roller and two tampers in operating condition at the site during RCC placement.

vi. Section 13, paragraph 16 - Manually directed vibratory plate compactors can (not may) be used to shape, smooth, and level the surface, but are not to be used to achieve compaction.

c. Compaction Time Limit: The total length of time from the end of mixing until the RCC has been placed, spread, and compacted shall not exceed the time limits shown in Table 3. Whichever time limit is less for the condition(s) shall apply:

Table 3 – Compaction Time Limits

Ambient Air Temperature	Maximum Time Between End of Mixing and Completion of Compaction	
	Day Placement	Night Placement
≤ 65 °F	60 Minutes	90 Minutes

> 65 and ≤ 75 °F	45 Minutes	90 Minutes
> 75 °F	30 Minutes	60 Minutes

d. Night placement is defined as starting 1 hour after sunset and ending 1 hour after sunrise. Sunset and sunrise shall be the official sunset and sunrise times for Princeton, WV. All other placement is considered day placement. Regardless of the time limits specified in Table 3, all compaction shall be completed prior to the time that either the RCC or bonding mortar begin to set or dry from exposure. This may require shorter time limits than specified above.

e. RCC placed along vertical forms, in large voids revealed after formwork removal, or in areas inaccessible to placement and large compaction equipment shall be placed in two 6-inch-thick layers to make up each 12-inch lift and compacted to the required density for each layer. During the test section, if the Contractor can demonstrate that they can install RCC along formed surfaces with a 12 inch lift and compact with the approved production roller that prevents voids or honeycombs, as specified in Section 17, Vertical Surfaces, 12 inch lifts may be permitted. However, at any point during construction, if excessive voids or honeycomb are discovered with the use of production rollers, compaction in thinner layers as described above will be required. If thinner layers are required to prevent voids and honeycombs along vertical formed surfaces, the finished compacted lift surface shall be passed over with the production roller in static condition to give the top of the lift surface a uniform appearance and to provide positive drainage downstream.

f. Perform hand placement and compaction of RCC in areas where larger equipment cannot access, such as the transition between the vertical steps and unformed side slopes.

g. After RCC compaction, all approved placement equipment that remains on the compacted RCC surface shall not traverse on any portion of the lift thinner than 1 foot in depth.

13) In Section 14, Record Testing, the Contractor shall be responsible for performing the following testing:

a. Perform one gradation test (ASTM C136) during stockpiling per 500 tons of each aggregate type.

b. Perform one air content test (ASTM C1849 and C231) for each 1000 CY of RCC placed. ASTM C231 must be modified to use an impact hammer and tamping plate for compacting the Air Entrained Roller Compacted Concrete (AERCC) in four equal lifts as specified under Trial Mix Design.

c. One set of compressive strength test cylinders (ASTM C1435/ C1435M-06, C1176-05, and C39) (10 Cylinders) shall be taken for each day RCC is placed. Two cylinder shall be tested at 7 days, two cylinders shall be tested at 14 days, two cylinders shall be tested at 28 days, two cylinders shall be tested at 90 days and two cylinders shall be tested at 180 days, in accordance with the specifications.

d. Perform inspection of all foundation surfaces, joints, form work and embedded items, to assure compliance with the design details and specifications. The Contractor's Quality Control Supervisor shall ensure that no RCC is placed until all requirements of the plans and specifications are met. Provide continuous inspection during placement of

RCC to verify placement in accordance with the specifications and design details. Perform Inspection after placement of RCC to verify that curing, and weather protection is in accordance with the specifications and design details. During placement of RCC, each batch ticket shall be examined to verify the correct quantities of ingredients are mixed.

e. Moisture content of the combined aggregates shall be checked at the beginning and middle of the RCC placement shift. Combined gradations of the blended aggregates shall be checked daily at the beginning of each shift and a minus 200 wash shall be checked weekly.

f. Testing of RCC for vebe consistometer times, density (ASTM C1170), moisture content (ASTM D4959), air entrainment (ASTM C1849 and C231), and temperature (ASTM C1064) shall be performed per every 4 hours of production and at any apparent change in appearance or consistency of the RCC. Adjustments to the RCC mix shall be made as needed prior to starting RCC placement. Vebe tests can be requested of the QA or QC team, at any point during the placement process to verify Vebe time.

g. The bonding mortar used between RCC lifts shall be checked for slump (ASTM C143), grout consistency (ASTM C939), and compression (ASTM C31) each time it is placed, 1 set of cylinders (4 cylinders) for each (25) cubic yards placed. Two grout cylinders shall be tested at 7 days and two cylinders shall be tested at 28 days, in accordance with the specifications.

h. Test samples must be collected at the point of discharge. Point of discharge is defined as the final delivery location.

i. The Contractor shall supply a portable concrete cylinder curing container with the following minimum requirements:

   i. Capable of maintaining an internal temperature between 60.0 and 80.0 degrees Fahrenheit. Container shall be capable of maintaining the specified temperature range while containing at least 100 cylinder samples of fresh RCC and being subjected to outside ambient air temperatures. Supplemental heating and cooling of the container will likely be required.

   ii. Lockable hinged access hatch with lock and key.

   iii. Temperature monitoring device capable of continuous monitoring and recording and storing daily high and low temperatures.

   iv. Weather resistant exterior.

j. Specimens shall be transported, cured, and tested for compressive strength as specified above. Compressive strength testing shall be performed at the on-site laboratory specified in Construction Specification 94, Contractor Quality Control, unless otherwise approved by the COR. Results of compressive strength tests shall be provided to the COR within 24 hours of the completion of each test.

k. Determine the in-place wet density and moisture content of the RCC at a depth of 10 inches using a nuclear gage (ASTM C1040) in direct transmission mode with a testing time of one minute. Perform a minimum of four wet density and moisture content tests per lift: two in areas manually compacted with rammers adjacent to formwork and two in areas compacted by production rollers, with a minimum of one test per shift. The in-place wet density of the compacted RCC measured at a depth of 10 inches shall not be less than 98 percent of the AMD.

14) In Section 15, Lift Joints:

a. Treatment Method I shall apply to fresh joints and intermediate joints.

b. Treatment Method III shall apply to cold joints. A cold joint shall be defined as a joint with an exposure time (TE) of 24 hours or more. Treatment Method III shall be modified such that the thickness of the bonding mortar is ½-inch to ¾-inch.

15) In Section 16, Curing,

a. Wet curing of RCC is required. Use of curing compound will not be permitted.

b. Wet cure all RCC for a minimum period of 28 days at or above 35 degrees Fahrenheit or until covered with additional RCC or earthfill.

c. Curing shall begin just after compaction of the RCC and before drying is detected.

d. Curing shall cover all areas of the exposed RCC.

e. Contractor shall maintain a water distribution system at the RCC placement area for curing and cleaning purposes. The water distribution system shall be sized and installed such that the system does not interfere with the RCC production. Hoses shall not be located on the RCC lift surface. The design of the system shall be such that all areas of the lift surface can be reached and enough pressure is available to clean the lift surface. The COR has the authority to require the Contractor to modify the system if it is inadequate in keeping the surfaces moist and does not provide pressure to clean the lift.

f. Contractor shall be prepared with the appropriate equipment and manpower to clean lift surfaces that have become cold joints or have become contaminated.

16) In Section 17, Vertical Surfaces:

a. Formed downstream faces of RCC steps are required as shown on the Drawings.

b. All vertical, exposed step surfaces, and exposed 2H:1V training wall slopes shall be finished to ensure that a minimum of 90 percent of the exposed surface area (surface area equals, each vertical step, each 2H:1V side slope and each flat exposed step surface) is free from honeycomb or other voids and is uniform in appearance.

c. If any exposed surfaces are not 90 percent free from honeycombs and other voids as specified, the Contractor will be responsible for repairing or patching 100 percent of the unapproved areas. Any honeycomb or void areas 1 inch deep or less shall be patched as described in Section 19, Patching and all areas deeper than 1 inch shall be repaired as specified in Section 19, Repair of RCC. The patched and repaired areas shall be kept wet for a minimum of 24 hours prior to the repair or patch. Curing of all repaired or patched areas will have to be cured as stated in Section 16, Curing and Protection.

d. All forms for vertical faces shall be non-yielding metal formwork. If movement is detected during placement, the lift can be rejected and required to be removed at the expense of the Contractor. Form all vertical surfaces using ridged forms. Wood forms will not be allowed except for isolated locations where steel forms do not fit. Vertical forms may not be moved until a minimum of 24 hours after RCC placement and not before they can be removed without damage to the RCC.

e. Stepped edges shall be rounded with an edging tool or a ¾-inch chamfer strip.

f. Refer to the Drawings for compaction elevations on each lift. Compaction of unformed faces is required.

17) In Section 18, Tolerances:

a. Abrupt indentations or offsets in the permanently exposed horizontal and vertical surfaces of the RCC steps or along the sloped face of the training wall and other permanently exposed sloped surfaces shall not exceed 1 inch in 100 feet of the design template.

b. Exposed horizontal surfaces (e.g. spillway crest, step treads, stilling basin) shall be constructed so that water does not pond on finished surface. Adverse slopes on exposed horizontal surfaces will not be permitted, unless otherwise shown on the Drawings.

18) Sloped training walls and other permanently exposed sloped surfaces: the spillway training walls, including the left and right walls near the starter wall and the stilling basin are sloped uniformly as shown on the Drawings. The sloped edges of each lift shall be trimmed and compacted to the required density and tolerances as specified herein. Permanently exposed sloped surfaces including the sloped spillway training walls shall meet the requirements of Section 17 for formed vertical surfaces.

19) In Section 19, Repair of RCC, repair of RCC shall include two methods:

a. Method 1, repair or replacement: Any surface with more than 1 inch honeycomb or other voids or otherwise does not meet the tolerances detailed in Section 18, Tolerances shall be repaired or replaced. For Method 1, the Contractor shall prepare a written plan for repairing or replacing the RCC.

b. Method 2, patching: A honeycomb or other void less than 1 inch in depth small cavities large air holes, minor honeycombed areas, holes created from test coring, and other superficial imperfections. Patching shall meet the specified finish requirement described in Section 17, Vertical Surfaces and Section 18, Tolerances. The areas that require patching shall be thoroughly cleaned and filled solid with a dense, well-bonded non-shrink patching material or dry-pack mortar of similar color of the RCC. "Thoroughly cleaned" consists of sand blasting the area then pressure washing the area to remove all loose material. Before the patch or repairs can be made, the areas shall be continuously wet for a minimum of 24 hours.

B. Bid Item 23, Roller Compacted Concrete

1) This item consists of:

a. Mobilizing and demobilizing the RCC plant and related facilities to produce RCC, including preparing and surfacing areas required for the plant, installing cement, fly ash and water storage facilities, and providing potable water, electrical power and other services required at the plant.

b. Purchasing, transporting and stockpiling aggregate for RCC and bonding mortar.

c. All work required to mix, transport, spread, compact and cure RCC for the auxiliary spillway, including joint cleaning, trimming RCC, and placement of bonding mortar. No separate payment will be made for bonding mortar.

d. Install the dowels into RCC as shown on the Drawings.

2) In Section 21, Measurement and Payment, measurement will be made within the neat lines and grades shown on the Drawings will constitute full compensation for the completion of the RCC. Payment for over-placement, material placed in the test section, and material that is wasted will not be made. Payment will be made at the contract unit price per cubic yard

for this item.

a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control.

3) The Test Section will not be incorporated into the auxiliary spillway cutoff wall, and the volume of RCC placed into the construction of the Test Section will NOT be added to the volume computation of the completed RCC structure to determine the total volume of RCC for payment.

4) Items subsidiary to this Bid Item include:

a. Water for Construction, Construction Specification 10 – Water for Construction

b. Miscellaneous Structure Concrete, Construction Specification 31 – Concrete for Major Structures

c. Steel Reinforcement, Construction Specification 34 – Steel Reinforcement

d. Geotextile, Construction Specification 95 - Geotextile

e. Geomembrane Liner, Construction Specification 97 – Geomembrane Liner

C. *Bid Item 24, Furnishing and Handling Cementitious Material for RCC*

1) This item consists of furnishing and handling all cementitious material (cement and pozzolan) utilized in the production of RCC as described in Bid Item 23. No separate payment will be made for cement used in any other concrete.

2) In Section 21, Measurement and Payment, measurement will be based on the number of cubic yards of RCC placed in the project (excluding the test section) multiplied by the number of pounds of cementitious material per cubic yard of RCC (cementitious content) in the approved job mix. No adjustment will be made if the cementitious content exceeds the approved amount without COR approval. Payment will be made at the contract unit price per 0.1 ton for this bid item.

a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control.

D. *Bid Item 25, Roller Compacted Concrete Test Section*

1) This Bid Item consists of all work required to mix, transport, spread, compact, cure and dispose RCC for the RCC Test Section, including joint cleaning, trimming RCC and placement of bonding mortar. No separate payment will be made for bonding mortar or for furnishing and handling cementitious material (cement and pozzolan) utilized in the construction of the test section.

2) In Section 21, Measurement and Payment, payment will be made at the contract lump sum price for the RCC Test Section and will constitute full compensation for the completion of the test section including removal and disposal as applicable. Up to 60 percent of the lump sum price will be paid following removal and offsite disposal of the test section, and acceptance of all testing through 28 days and reporting. The remainder will be paid following completion and acceptance of all testing and reporting.

a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control.

End of Construction Specification 36

CONSTRUCTION SPECIFICATION 41—REINFORCED CONCRETE PRESSURE PIPE CONDUITS

1. Scope

The work shall consist of furnishing and installing reinforced concrete pressure pipe conduits, fittings, and accessories as shown on the drawings and/or specified herein.

2. Material

Reinforced concrete pressure pipe, fittings, and accessories shall conform to the requirements of Material Specification 541, Reinforced Concrete Pressure Pipe.

Portland Cement Concrete for bedding and cradles shall conform to the requirements of Construction Specification 31 for the specified class of concrete.

Joint sealing compound shall conform to the requirements of Material Specification 536, Sealing Compound for Joints in Concrete and Concrete Pipe.

Preformed expansion joint filler shall conform to the requirements of Material Specification 536,

Sealing Compound for Joints in Concrete and Concrete Pipe.

Filter fabric shall conform to Material Specification 592, Geotextile.

3. Laying the pipe

The pipe shall be set to the specified line and grade and temporarily supported on precast concrete blocks or wedges. Concrete blocks and wedges used to temporarily support the pipe during placement of concrete bedding or cradle, or both, shall be a class of concrete equal to or stronger than the concrete used to construct the bedding or cradle. Bell and spigot pipe shall be laid with the bells or grooves facing upstream unless otherwise specified in section 7 or shown on the drawings. Pipe may be installed by initially placing the upstream section of pipe and progressing with placement of the remaining sections of pipe in the downstream direction; however, care must be taken to avoid contaminating the joint with soil or bedding as the bell end is slid over the spigot of the adjoining pipe.

Just before each joint is connected, the connecting surface of the bell and spigot or spigots and sleeve shall be thoroughly cleaned and dried. Also, the rubber gasket and the inside surface of the bell or sleeve shall be lubricated with a light film of soft vegetable soap compound (flax soap). The rubber gasket shall be stretched uniformly as it is placed in the spigot groove to ensure a uniform volume of rubber around the circumference of the pipe.

Method 1—The joint shall be connected by sliding the bell over the spigot or by sliding the spigot into the bell and applying a pulling or jacking force in a manner that will allow the spigot to enter squarely into the bell.

Method 2—The joint shall be connected in accordance with the manufacturer's instructions.

Use with either method—When the spigot has been seated to within 0.5 inch of its final position, the position of the gasket in the joint shall be checked around the entire circumference of the pipe by means of a metal feeler gauge. In any case where the gasket is found to be displaced, the joint shall be disengaged and properly reconnected. After the position of the gasket has been checked, the spigot shall be completely pulled into the bell and the section of pipe shall be adjusted to line and grade.

4. Filling joints

Before the placement of the bedding or cradle, the exterior annular space between the ends of the pipe sections shall be cleaned and completely filled with joint sealing compound. Before the compound is applied, the surface against which it is to be placed shall be cleaned of all dust, lubricant, and other substances that would interfere with a bond between the compound and the

pipe. If recommended by the manufacturer of the compound, the concrete surface shall be coated with a primer in accordance with the manufacturer's recommendations. Primers shall be applied to the concrete surface only and shall not come in contact with the gasket or gasket sealing surface. Unless the compound or primer is specifically recommended for use on moist concrete, the surface shall be dry when the compound or primer is applied.

The joint sealing compound shall be allowed to cure until it is sufficiently firm to prevent the entry of concrete or earth into the joint. Unless otherwise specified in section 7 of this specification, before placing bedding or earth backfill (excluding concrete) containing particles larger than 0.25 inch in maximum dimension within 6 inches of the joint sealing compound, the compound shall be covered with a strip of 16-gauge to 24-gauge metal at least 2-inches wider than the space between the ends of the pipe sections. Instead of metal strips, the joints shall be covered by a minimum of 2-foot-wide, 4-ply thick filter fabric. Filter fabric shall be wrapped completely around the joint and overlapped a minimum of 12 inches at the top of the pipe. Lap shall be securely fastened to ensure filter fabric fits snugly during backfill operations. Filter fabric is centered on the joint. It shall conform to Material Specification 592, table 2, Nonwoven, class II.

5. Pressure testing

Method 1—Pressure testing of the completed conduit is not required.

Method 2—Before placing any concrete or earthfill around the conduit or filling the pipe joints, the conduit shall be tested for leaks in the following manner:

The ends of the conduits shall be plugged and a standpipe with a minimum diameter of 2 inches shall be attached to the upstream plug. The conduit shall be braced at each end to prevent slippage. The conduit and the standpipe shall be filled with water. The water level in the standpipe shall be maintained at least 10 feet above the invert of the upstream end of the conduit for at least 2 hours. Any leaks shall be repaired, and the conduit shall be tested again as described. The procedure shall be repeated until the conduit is watertight.

The pipe joints shall show no leakage. Damp spots developing on the surface of the pipe are not considered as leakage.

Method 3—Before placing any concrete or earthfill around the conduit or filling the pipe joints, the conduit shall be air tested in accordance with ASTM C924. The conduit shall be braced on each end to prevent slippage. All end plugs used for the air test shall be capable of resisting the internal pressure and must be securely braced.

All testing equipment to be used shall be furnished by the contractor and shall be inspected and approved by the engineer. The pressure gauges used shall be graduated to read in increments of 0.1 pounds per square inch and calibrated to provide accuracy within 10 percent plus or minus of the standard gauge. The contractor has the option of prewetting the conduit or line before testing. Any conduit that fails to pass this test must be repaired by a method satisfactory to the engineer. After the repairs are made, the conduit shall be retested until it passes the test requirements.

Method 4—Before placing concrete or earth backfill around the conduit joint to be tested or filling the pipe joints, the joint shall be tested in accordance to ASTM C 1103, Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Sewer Line. The test pressure shall be as specified in Section 7 of this specification. Any joints showing leaks shall be relaid or repaired, and the joint shall be retested. The procedure shall be repeated until the joint passes the test.

6. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, the quantity of each size, type, and class of pipe is determined to the nearest 0.1 foot by measurement of the laid length of pipe along the invert centerline of the conduit. Payment for each size, type, and class of reinforced concrete pressure pipe is made at the contract unit price for that size, type, and class of pipe. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe complete in place. This includes accessories, such as wall fittings, joint gaskets, coupling bands, sleeves, or collars, and all other items necessary and incidental to the completion of the work except the special fittings and appurtenances listed

separately in the bid schedule. Payment for each special fitting and appurtenance is made at the contract price for that type and size of fitting or appurtenance.

Method 2—For items of work for which specific unit prices are established in the contract, the quantity of each size, type, and class of pipe is determined as the sum of the nominal laying lengths of the pipe sections used. Payment for each size, type, and class of reinforced concrete pressure pipe is made at the contract unit price for that size, type, and class of pipe. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe complete in place. This includes accessories, such as wall fittings, joint gaskets, coupling bands, sleeves or collars, and all other items necessary

and incidental to the completion of the work except the special fittings and appurtenances listed separately in the bid schedule. Payment for each special fitting and appurtenance is made at the contract price for that type and size of fitting and appurtenance.

All Methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

7. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Bid Item 26– Principal Spillway Pipe Extension

1) This item consists of furnishing, installing and testing the 24-inch diameter reinforced concrete pressure pipe (RCPP) for the principal spillway conduit extension as shown on the Drawings. This item also includes preparing the downstream end of the existing principal spillway conduit and furnishing and installing any transition adaptors to connect the new section of principal spillway conduit to the downstream end of the existing principal spillway conduit, as well as all other items necessary and incidental to the completion of the Work. The cast-in-place reinforced concrete pipe cradle is not included in this Bid Item and is instead covered in Construction Specification 31, Concrete for Major Structures, Bid Item 18, Cast-in-Place Reinforced Concrete, PSW Cradle.

2) The Contractor shall submit the following at least 45 days prior to beginning work activity:

   a. Means, methods, and materials to repair damaged concrete pipe sections.

   b. Basic design data on the Pre-stressed Pipe and Shop Drawings of the specials and fittings shall be submitted.

   c. Material certification.

   d. A pipe installation schedule indicating the sequence for installing pipe, fittings, and specials, as well as the elevations and stationing of the line at key points, such as outlets, bends, and changes in grade.

   e. Means and methods to block and brace the new pipe section until the cradle is constructed.

   f. Means and methods to demonstrate the tolerances specified herein are met and are maintained during backfilling around the pipe.

3) Allow the COR to inspect the principal spillway conduit after removal of the impact basin and prior to constructing the conduit extension. Repair damaged concrete pipe sections as required by the COR and in accordance with the requirements in Construction Specification 35, Concrete Repair.

4) Take care when removing the section of principal spillway conduit from the impact basin to avoid damage to sections of conduit or the conduit cradle that are to remain. Any damage by the Contractor to sections that are to remain shall be repaired or replaced at no cost to the Government.

5) Remove mortar covering the spigot at the downstream end of the existing principal spillway conduit that is to remain by mechanical or hydro-blasting methods to thoroughly remove all objectionable residue or obstructions from the existing spigot. Determine all dimensions required to make a smooth transition to connect the new principal spillway conduit section. Submit product data and shop drawings for the transition to the COR for approval prior to installation demonstrating conformance with this specification. Furnish, install, and test the completed installation in place.

6) The Contractor is responsible for performing field measurements and verifying the compatibility between the existing principal spillway conduit and the proposed pipe extension prior to ordering the pipe and accessories.

7) Prior to delivery, submit for approval to the COR the manufacturer's product data for pipe materials and other accessories specified herein.

8) In Section 2 – Material, materials shall conform to the referenced Material Specifications and additional requirements specified below:

a. The pipe shall be inspected by methods prescribed in the Specifications cited herein, except that external crushing strength tests required as a basis for certification shall be performed by the three-edge bearing method described in ASTM Methods C497.

b. Three-edge bearing shall be defined as the minimum external load to produce 0.001-inch crack one-foot long or the load 10 percent greater than the specified three-edge bearing load, whichever occurs first.

c. The material certification will include:

d. The pipe manufacturer's certified statement of the design strength of the pipe, consisting of:

   i. A copy of the appropriate design curve marked to show the resultant concrete core stress and corresponding three-edge bearing load of the pipe furnished; and a specification sheet for the pipe furnished showing all data and dimensions needed to compute the resultant concrete core stress; or

   ii. Results of external crushing strength tests on pipe or pipe specimen (at least 2 feet in length) of equivalent size and design and composed of equivalent materials.

e. The pipe manufacturer's certified statement of results of the hydrostatic tests required by the reference specification appropriate to the type of pipe furnished.

f. The pipe manufacturer's certified statement of current typical test reports on steel and steel wire reinforcing and compression tests of the concrete used in the manufacture of the pipe.

g. Such drawings and descriptions of the pipe joint as may be necessary to show that the joint conforms to the specified requirements.

h. The 24-inch diameter RCPP for the principal spillway conduit extension shall meet the following requirements:

   i. Steel cylinder type, pre-stressed, lined, AWWA Standard C301 for Pre-stressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids.

   ii. Pressure Head = 70 feet.

i. Joint sealant shall meet the requirements of ASTM C920 Type M Grade NS as specified in Material Specification 536 – Sealing Compound for Joints for Concrete and Concrete Pipe.

9) In Section 3 – Laying the Pipe:

a. Method 1 shall apply.

b. The pipe shall be set to the specified line and grade and temporarily supported on precast concrete blocks or wedges. Bell and spigot pipe shall be laid with the bell upstream.

c. Just before each joint is connected, the connecting surfaces of the bell and spigot or spigots and sleeve shall be thoroughly cleaned and dried, and the rubber gasket and the inside surface of the bell or sleeve shall be lubricated with a light film of soft vegetable soap compound (flax soap). The rubber gasket shall be stretched uniformly as it is placed in the spigot groove to ensure a uniform volume of rubber around the circumference of the pipe.

d. When the spigot has been seated to within ½ inch of its final position, the position of the gasket in the joint shall be checked around the entire circumference of the pipe (from inside the pipe) by means of a metal feeler gage. (Manufacturer - supplied blocks can be used to maintain the open joint for this checking operation). In any case where the gasket is found to be displaced, the joint shall be disengaged and properly reconnected.

After the position of the gasket has been checked, the spigot shall be completely pulled into the bell and the section of the pipe shall be adjusted to line and grade.

e. All pipe shall be protected from lateral displacement and possible damage resulting from superimposed backfill loads, impact or unbalanced loading during backfilling operations by being adequately embedded in pipe embedment material. To ensure adequate lateral and vertical stability of the installed pipe during pipe jointing and embedment operations, a sufficient amount of the pipe embedment material to hold the pipe in rigid alignment shall be uniformly deposited and thoroughly compacted on each side, and back of the bell, of each pipe as laid.

f. Concrete cradle shall be installed as shown on the Drawings or directed by the COR. Before any concrete is placed, the pipe shall be securely blocked and braced to prevent movement or flotation. The concrete cradle shall extend the full width of the trench as excavated unless otherwise authorized by the COR. Where concrete is to be placed in a sheeted trench, it shall be placed directly against sheeting to be left in place or against a bond-breaker if the sheeting is to be removed.

g. Embedment materials placed above the centerline of the pipe or above the concrete cradle to a depth of 12 inches above the top of the pipe barrel shall be deposited in such manner as to not damage the pipe.

h. The pipe shall be placed within plus or minus 0.1 foot of the grade shown on the Drawings without any unspecified grade reversals. Slope piping uniformly between elevations shown.

10) In Section 5 – Pressure Testing, Method 3 shall apply. Testing shall be performed using air, and the test pressure shall be 5 psig. Any conduit that fails to pass this test must be repaired by a method satisfactory to the COR. After the repairs are made the conduit shall be retested until it passes the test requirements.

11) In Section 6 – Measurement and Payment, Method 1 shall apply and measured to the nearest 1 foot by measurement of the laid length of pipe along the invert centerline of the conduit.

    a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control.

****End Construction Specification 41****

CONSTRUCTION SPECIFICATION 45—PLASTIC PIPE

1. Scope

The work consists of furnishing and installing plastic pipe (except corrugated polyethylene pipe) and the necessary fittings and appurtenances as shown on the drawings or as specified herein.

2. Material

Pipe, fittings, and gaskets shall conform to the requirements of Material Specification 547, Plastic Pipe, and as specified in Section 14 of this specification or as shown on the drawings.

Perforated pipe shall conform to the requirements of Material Specification 547, Plastic Pipe, and as specified in Section 14 of this specification or as shown on the drawings.

Unless otherwise specified, concrete shall conform to the requirements of Construction Specification 32, Structure Concrete, and Section 8 of this specification.

Unless otherwise specified, earth backfill shall conform to the requirements of Construction Specification 23, Earthfill.

Unless otherwise specified, drainfill shall conform to the requirements of Construction Specification 24, Drainfill.

3. Handling and storage

Pipe shall be delivered to the job site and handled by means that provide adequate support to the pipe and do not subject it to undue stresses or damage. When handling and placing plastic pipe, care shall be taken to prevent impact blows, abrasion damage, and gouging or cutting (by metal edges and/or surface or rocks). The manufacturer's special handling requirements shall be strictly observed. Special care shall be taken to avoid impact when the pipe must be handled at a temperature of 40 degrees Fahrenheit or less.

Pipe shall be stored on a relatively flat surface so that the barrels are evenly supported. Unless the pipe is specifically manufactured to withstand exposure to ultraviolet radiation, it shall be covered with an opaque material when stored outdoors for 15 days or longer.

4. Excavation

Excavation shall be in accordance with Construction Specification 21, Excavation, and Section 14 of this specification or as shown on the drawings.

The pipe foundation shall be excavated a minimum of 4 inches lower than the pipe grade shown on the drawings or staked in the field whenever bedrock, boulders, cobbles, or other material that may cause pipe damage is encountered at planned pipe grade.

5. Laying the pipe

Plastic pipe conduits complete with fittings and other related appurtenances shall be installed to the lines and grades shown on the drawings or specified in Section 14 of this specification. The pipe shall be installed so that there is no reversal of grade between joints unless otherwise shown on the drawings. The pipe shall not be dropped or dumped on the bedding or into the pipe trench. The ground surface near the pipe trench shall be free of loose rocks and stones greater than 1 inch in diameter. This ensures that rock will not be displaced and impact the pipe.

Just before placement, each pipe section shall be inspected to ensure that all foreign material is removed from inside the pipe. The pipe ends and the couplings shall be free of foreign material when assembled. At the completion of a work shift, all open ends of the pipeline shall be temporarily closed off using a suitable cover or plug.

Care shall be taken to prevent distortion and damage during hot or cold weather. During unusually hot weather (daytime high temperature of more than 90 °F), the pipe assembled in the trench shall be lightly backfilled or shaded to keep it as near to ground temperature as possible until final backfill is placed. Backfill operations should be performed during daily construction periods when the ground temperature and the temperature of the pipe do not vary more than 40 degrees Fahrenheit.

Perforated pipe shall be installed with the perforations down and oriented symmetrically about the vertical centerline. Perforations shall be clear of any obstructions on the inside and outside of the pipe when the pipe is approved by the Engineer for backfill.

During installation, the pipe shall be firmly and uniformly bedded throughout its entire length, to the depth and in the manner specified in Section 14 of this specification or as shown on the drawings. Bell-holes shall be placed in bedding material under bells, couplings, and other fittings to assure the pipe is uniformly supported throughout its entire length. Blocking or mounding beneath the pipe to bring the pipe to final grade is not permitted.

6. Pipe embedment

Earth bedding—The pipe shall be firmly and uniformly placed on compacted earthfill bedding or an inplace earth material bedding of ample bearing strength to support the pipe without noticeable settlement. The earth material on which the pipe is placed shall be of uniform density to prevent differential settlement.

Unless otherwise specified, a groove that closely conforms to the outside surface of the pipe shall be formed in the bedding. The depth of the groove shall be equal to or greater than 0.3 of the pipe diameter.

Earth bedding shall be compacted to a density not less than adjacent undisturbed inplace earth material or be compacted earth backfill. Earthfill material used for compacted earth bedding shall be free of rocks or stones greater than 1 inch in diameter and earth clods greater than 2 inches in diameter. The pipe shall be loaded sufficiently during the compaction of bedding under the haunches and around the sides of the pipe to prevent displacement from its final approved placement.

Sand, gravel, or crushed rock bedding—When sand, gravel, or crushed rock bedding is specified, the pipe shall be firmly and uniformly placed on the bedding material. Material for bedding shall not exceed 1 inch in diameter. Unless otherwise specified in Section 14 of this specification or shown on the drawings, the coarse-grained bedding material shall be carefully placed and compacted to a depth equal to or greater than 0.3 of the diameter of the pipe above the bottom of the pipe. The pipe shall be loaded sufficiently during backfilling and compaction around the sides to prevent displacement of the pipe from its final approved placement.

Pipe encased in drainfill—The pipe shall be firmly and uniformly placed on bedding of specified drainfill. Drainfill shall be placed and compacted as specified in Section 14 of this specification or as shown on the drawings to form a continuous uniform support around the entire circumference of the pipe. The pipe shall be loaded sufficiently during backfilling around the sides and during compaction to prevent displacement of the pipe.

7. Backfill

Initial backfill—Unless otherwise specified, initial backfill to 6 inches above the top of the conduit is required. Earth haunching and initial backfill material shall consist of soil material that is free of rocks, stones, or hard clods more than 1 inch in diameter. Coarse backfill material shall be the specified sand, gravel, crushed rock, or drainfill material.

Initial backfill shall be placed in two stages. In the first stage (haunching), backfill is placed to the pipe spring line (center of pipe). In the second stage, it is placed to 6 inches above the top of the pipe.

The first stage material shall be worked carefully under the haunches of the pipe to provide continuous support throughout the entire pipe length. The haunching backfill material shall be placed in layers that have a maximum thickness of about 6 inches and are compacted as specified in Section 14 of this specification or as shown on the drawings. During compaction operations, care shall be taken to ensure

that the tamping or vibratory equipment does not come in contact with the pipe and the pipe is not deformed or displaced.

When pressure testing is not specified, the pipe shall be covered with a minimum of 6 inches of backfill material as soon as possible following assembling of the pipe in the trench, but not later than within the same day that placement has occurred. When pressure testing is specified, sufficient backfill material shall be placed over the pipe to anchor the conduit against movement during pressure testing activities.

Final backfill—Final backfill shall consist of placing the remaining material required to complete the backfill from the top of the initial backfill to the ground surface, including mounding at the top of the trench. Final backfill material within 2 feet of the top of the pipe shall be free of debris or rocks larger than 3 inches nominal diameter. Coarse backfill material shall be the specified sand, gravel, crushed rock, or drainfill. Final backfill shall be placed in approximately uniform, compacted layers. Final backfill compaction requirements shall be as specified in Section 14 of this specification or as shown on the drawings.

Vehicles or construction equipment shall not be allowed to cross the pipe until the minimum earth cover and required density as specified in Section 14 of this specification has been obtained.

8. Pipe encasement in concrete

Concrete encasement shall be carefully placed to form a continuous uniform support around the entire circumference of the pipe as specified in Section 14 of this specification or as shown on the drawings. Pipes encased in concrete shall be securely anchored to prevent movement of the pipe during concrete placement. A clear distance of 1.5 inch shall be maintained between the pipe and the reinforcing steel.

The concrete for the encasement shall conform to the requirements of Construction Specification 32, Structure Concrete, for Class 3000M concrete unless otherwise specified.

9. Joints

Unless otherwise specified in Section 14 of this specification or shown on the drawings, joints shall be either bell and spigot type with elastomeric gaskets, coupling type, solvent cement bell and spigot, or jointed by butt heat fusion. When a lubricant is required to facilitate joint assembly, it shall be a type having no deleterious effect on the gasket or pipe material.

Pipe joints shall be watertight at the pressures specified except where unsealed joints are indicated.

Pipe shall be installed and joined in accordance with the manufacturer's recommendations. Laying deflections and joint fitting or stab depths shall be within the manufacturer's recommended tolerances.

When solvent cement joints are specified for PVC or ABS pipe and fittings, they shall be made in accordance with the following ASTMs and the related appendix of each ASTM; D 2855 for PVC pipe and fittings and D 2235 for ABS pipe and fittings.

Flanged, banded, heat-fusion, or elastomeric-sealed mechanical joints shall be used when joining polyethylene (PE) and high density polyethylene (HDPE) pipe and fittings unless otherwise specified in Section 14 of this specification or as shown on the drawings.

Pipe ends shall be cut square and be deburred to provide a uniform, smooth surface for the jointing process. Reference marks shall be placed on the spigot ends to assist in determining when proper seating depth has been achieved within the joint.

10. Fittings

Unless otherwise specified, steel fittings, valves, and bolted connections shall be painted or coated as recommended by the manufacturer.

Fittings for nonpressure pipe shall be of the same or similar material as the pipe and shall provide the same durability, watertightness, and strength as the pipe unless otherwise specified.

11. Thrust blocks and anchors

When specified, concrete thrust blocks and anchors shall be installed as shown on the drawings or specified in Section 14 of this specification.

The concrete for the thrust blocks and anchors shall conform to the requirements of Construction Specification 32, Structure Concrete, for Class 3000M concrete unless otherwise specified in Section 14 of this specification.

The thrust block cavity shall be hand dug into undisturbed soil or previously placed compacted backfill. The cavity shall be formed with soil or wood to hold the freshly placed concrete without displacement until an initial set has occurred.

When excavation beyond the designated trench widths and depths as shown on the drawings or specified in Section 14 of this specification occurs at locations where installation of concrete thrust blocks is required, the Contractor shall install an alternative thrust block provision. The concrete thrust block shall have a thickness of one pipe diameter and a contact face area that shall be formed against the pipe as shown on the drawings or specified in Section 14 of this specification. Backfill shall be placed on all sides of the thrust block and to the sides of the excavation. It shall be compacted as specified for initial backfill.

12. Pressure testing

Method 1—Pressure testing of the completed conduit is not required.

Method 2—The conduit shall be tested for leaks in the following manner:

a. Before pressure testing:

(1) Joints of the assembled pipeline shall be allowed to cure as recommended by the manufacturer.

(2) Pipeline shall be flushed and cleaned.

(3) All concrete anchors and thrust blocks shall be in place and allowed to cure for a minimum of 3 days.

(4) Earth backfill shall be sufficient to anchor the conduit against movement during the pressure testing and shall be compacted as specified in Section 14 of this specification or as shown on the drawings.

(5) The conduit shall be braced, anchored, or both, at each end to restrict all potential pipe movement.

(6) The ends of the conduit shall be plugged. The upstream plug shall have a standpipe installed vertically having a minimum diameter of 2 inches and shall be equipped with a shutoff valve. All high points in the line shall be vented to evacuate air pockets. The conduit and the standpipe shall be slowly filled with water such that no air is entrapped during the filling operation. After filling is complete, all vents shall be closed.

b. During pressure testing, the water level in the standpipe shall be continuously maintained at a minimum of 10 feet above the highest invert elevation of the conduit for no less than 2 hours unless otherwise specified in section 14 of this specification or as shown on the drawings.

The volume of water leakage in the 2-hour test period shall be recorded. The maximum allowable leakage (L) in gallons per hour shall not exceed 0.02 times the nominal pipe diameter (D) in inches for each 1,000 feet of pipe line, which is about 50 pipe joints ($L = 0.02 \times D$).

c. When observed leakage exceeds the allowable, leaks shall be sealed by replacement of pipe and fittings as necessary. The conduit shall be retested as described above. This procedure shall be repeated until the conduit leakage does not exceed the allowable specified above.

The contractor shall be fully responsible for any and all work required to correct leakage exceeding the amount specified.

Method 3—The conduit shall be tested for leaks in the following manner:

a. Before pressure testing:

(1) Joints of the assembled pipeline shall be allowed to cure as recommended by the manufacturer.

(2) Pipeline shall be flushed and cleaned.

(3) All concrete anchor and thrust blocks shall be in place and allowed to cure for at least 3 days.

(4) Earth backfill shall be sufficient to anchor the conduit against movement during the pressure testing and compacted as specified in section 14 of this specification or as shown on the drawings.

(5) The conduit shall be braced and/or anchored at each end to prevent all potential pipe movement.

(6) The ends of the conduit shall be plugged, and a pressure gauge shall be attached to the upstream and downstream ends. All high points along the pipeline shall be vented to permit the complete removal of all air within the pipeline. The conduit shall be slowly filled with water such that no air is entrapped during the filling operations.

b. The testing pressure specified in section 14 of this specification shall be continuously maintained at the upstream gauge for a minimum of 2 hours. The pressure at the downstream gauge shall not exceed the pressure rating of the pipe.

c. The volume of water leakage for the 2-hour test period shall be recorded. Maximum allowable leakage shall be in accordance with the following:

Allowable leakage for plastic pipe

(gal/hr/1,000 feet, or 50 pipe joints) 1/

Nominal	**Test pressure in the pipeline (lb/in²)**			
pipe size	**50**	**100**	**150**	**200**
(in)	**- - - - - - - - Allowable leakage - - - - - - -**			
4	.19	.27	.33	.38
6	.29	.41	.50	.57
8	.38	.54	.66	.76
10	.48	.68	.83	.96
12	.57	.81	.99	1.15
14	.67	.95	1.16	1.34
15	.72	1.02	1.25	1.44
16	.76	1.07	1.32	1.52
18	.86	1.22	1.49	1.72

1/ Computation basis

$$L = \frac{ND\sqrt{P}}{7,400}$$

where:

L = allowable leakage in gallons per hour

N = number of joints (pipe and fittings)

D = nominal diameter of pipe in inches

P = test pressure in pounds per square inch

d. When observed leakage exceeds the allowable, leaks shall be sealed by replacement of pipe and fittings as necessary. The conduit shall be retested as described in this section. The procedure shall be repeated until the conduit leakage does not exceed the allowable specified above.

The contractor shall be fully responsible for any and all work required to correct leakage exceeding the amount specified.

13. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe is determined to the nearest foot by measurement of the laid length along the crown centerline of the conduit. Payment for each kind, size, and class of pipe is made at the contract unit price for that kind, size, and class. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe including excavation, shoring, backfill, bedding, thrust blocks, and all fittings, appurtenances, and other items necessary and incidental to the completion of the work. Payment for appurtenances listed separately in the bid schedule is made at the contract prices for those items.

Method 2—For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe is determined as the sum of the nominal laying lengths of the sections used. Payment for each kind, size, and class of pipe is made at the contract unit price for the kind, size, and class. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe including excavation, shoring, backfill, bedding, thrust blocks, and all fittings, appurtenances, and other items necessary and incidental to the completion of the work. Payment for appurtenances listed separately in the bid schedule is made at the contract prices for those items.

Method 3—For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe is determined to the nearest foot by measurement of the laid length along the crown centerline of the conduit. Payment for each kind, size, and class of pipe is made at the contract unit price for the kind, size, and class. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe including shoring, all fittings, thrust blocks, appurtenances, and other items necessary and incidental to the completion of the work. Payment for appurtenances listed separately in the bid schedule is made at the contract prices for those items.

Method 4—For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe is determined as the sum of the nominal laying lengths of the pipe sections used. Payment for each kind, size, and class of pipe is made at the contract unit price for that kind, size, and class. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe including shoring, all fittings, thrust blocks, appurtenances, and other items necessary and incidental to the completion of the work. Payment for appurtenances listed separately in the bid schedule is made at the contract prices for those items.

Methods 3 and 4—Excavation, backfill, and bedding are paid separately under their respective bid items.

All measurement and payment methods—Compensation for any items of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and items to which they are made subsidiary are identified in Section 14 of this specification.

14. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Bid Item 27– Toe Drain Piping

1) This item consists of furnishing and installing the embankment toe drain system piping and accessories, including:

   a. Slotted collection pipes and fittings,

   b. Solid outlet pipes and fittings,

   c. Cleanout piping, fittings, and accessories,

   d. Other accessories required for installation of the toe drain piping as shown on the Drawings.

2) The Contractor shall submit a Toe Drain System Installation Schedule and Plan at least 45 days prior to beginning work activity. At a minimum, the Plan shall include:

   a. Schedule for installation;

   b. Material product data sheets;

   c. Planned layout of pipe, fittings, and structures, including pipe penetrations at structures;

   d. Other shop drawings, specification sheets, and test results demonstrating that the proposed materials comply with the requirements of these specifications.

3) Upon completion of toe drain system piping installation and after a minimum of 5 feet of backfill has been placed above the top of the drain pipe, the Contractor shall demonstrate by means of a camera survey that the drain pipes are free of foreign matter and were not damaged during the Work. A copy of the video recorded during the camera survey shall be made available to the COR and to the Government. Cleaning, repair, or replacement of the toe drain system piping as a result of the camera survey shall be at the discretion and direction of the COR and shall be completed at no additional expense to the Government. The Contractor shall notify the COR 5 calendar days in advance of conducting the camera survey.

4) In Section 2 – Material, materials shall conform to the referenced Material Specifications and additional requirements specified below:

   a. Plastic pipe shall be solid wall or slotted (as shown on the Drawings), Schedule 80 PVC meeting the requirements of ASTM D1785. Plastic pipe diameter shall be as shown on the Drawings. Maximum slot length shall be 0.875 inches. The minimum inlet area of the slotted pipe shall be 1.0 square inch per linear foot. Slot pattern and amount shall be approved by the COR prior to placement of the pipe order.

   b. Fittings and couplings shall be PVC meet the requirements of ASTM D2665. Provide elbow bends and wyes at all bent pipe joints.

   c. Cleanout surface enclosures shall be polymer concrete with an open bottom, and gasketed, bolt-on lid. Concrete pads around the surface enclosures shall meet the requirements of Miscellaneous Structure Concrete included in Construction Specification 31, Concrete for Major Structures.

5) In Section 5 – Laying the pipe,

   a. The pipe shall be placed within plus or minus 0.1 foot of the grade shown on the Drawings. Remove and reinstall pipes that are not installed correctly.

   b. Slope piping uniformly between elevations shown.

   c. Keep groundwater level at least 24 inches below bottom of pipe before laying pipe. Do

not lay pipe in water. Maintain dry trench conditions until jointing and backfilling are complete. Keep clean and protect interiors of pipe, fittings, valves, and appurtenances.

d. Start laying pipe at lowest point and proceed towards higher elevations.

e. Place bell and spigot-type pipe so that bells face the direction of laying.

6) In Section 6 - Pipe embedment, earth bedding and pipe encased in drainfill shall apply for pipe installed in earthfill and drainfill materials, respectively.

7) In Section 10 - Fittings, all fittings shall be one-piece injection molded or fabricated from PVC pipe and one-piece injection molded PVC fittings. The fitting shall have a design pressure rating and external load-carrying capacity equal to or exceeding that specified for the pipe to which it is attached. Fittings that are fabricated from one-piece injection molded PVC manufactured for solvent weld construction shall have a maximum 2'-0" stub of spigot or bell, as appropriate, solvent welded in place to permit installation of elastomeric gasket bell and spigot pipe to maintain articulation. The stubs shall be selected to permit the bell to face upstream.

8) In Section 12 – Pressure Testing, Method 1 shall apply.

9) In Section 13 – Measurement and Payment, Method 3 shall apply.

a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control.

10) Items subsidiary to this Bid Item include:

a. Miscellaneous Excavation, Construction Specification 21 – Excavation

b. Miscellaneous Earth Backfill, Construction Specification 23 – Earthfill

c. Miscellaneous Structure Concrete, Construction Specification 31 – Concrete for Major Structures

B. Bid Item 28– Precast Seepage Collection Boxes

1) This item consists of furnishing and installing the Precast Seepage Collection Boxes and accessories for the toe drain system as shown on the Drawings.

2) Prepare foundation subgrade and install Precast Seepage Collection Boxes over leveling course as shown on the Drawings. Leveling course shall meet the requirements for Coarse Drainfill as specified in Construction Specification 24, Drainfill. Install precast seepage collection boxes plumb and level.

3) In Section 2 – Material:

a. Submit Shop Drawings for precast concrete structures and accessories showing, at a minimum, dimension, components, layout, V-notch weir anchor locations, and fabrication requirements.

b. Precast Seepage Collection Boxes shall meet the requirements for precast concrete manholes as specified in "Section 605 – Manholes and Inlets" in the latest version of the West Virginia Department of Transportation Division of Highways (WVDOH) Standard Specifications Roads and Bridges. Bedding below the seepage monitoring box shall be as specified in Construction Specification 24, Drainfill, Subsidiary Item – Coarse Drainfill beneath Concrete Structures.

c. Pipe penetrations through structures shall not be rigid. Contractor to provide flexible, water-tight connectors at structures, such as KOR-N-SEAL 106 Series Pipe-to-Manhole connector with Wedge style stainless steel connectors or approved equal meeting the requirements of ASTM C923. Flexible connectors may be precast into structure or

installed in a field-cored hole. Connectors shall be installed in accordance with the manufacturer's instructions.

d. V-notch weirs shall meet the requirements for Seepage Collection Box Weirs as specified in Construction Specification 81, Metal Fabrication and Installation, Subsidiary Item – Seepage Collection Box Weirs.

e. Provide neoprene seals to go between the V-notch weir and the concrete. Neoprene seals shall have a durometer hardness rating of Shore 40 to 50.

f. Provide Carboline Model Carboguard 690 Epoxy Coating, or equal, for interior base of each seepage collection box. The epoxy coating shall be package color white.

g. Staff gauges for the seepage collection boxes shall be as specified in Construction Specification 93, Identification Markers and Plaques, Subsidiary Item – Staff Gauges, Precast Seepage Collection Boxes.

h. Animal Guard shall be stainless steel meeting the requirements of ASTM A276, Grade 304. Stainless steel bolts, fasteners, and other mounting hardware shall meet the requirements of ASTM F593, Grade 316.

4) In Section 13 – Measurement and Payment, Measurement and Payment Methods do not apply. Payment will be made at the contract lump sum price. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

5) Items subsidiary to this Bid Item include:

a. Coarse Drainfill beneath Concrete Structures, Construction Specification 24 –Drainfill

b. Seepage Collection Box Weirs, Construction Specification 81 – Metal Fabrication and Installation

c. Staff Gauges, Precast Seepage Collection Boxes, Construction Specification 93 – Identification Markers or Plaques

C. Bid Item 29 – ASW Drain Piping

1) This item consists of furnishing and installing the RCC auxiliary spillway underdrainage system piping and accessories, including:

a. Slotted collection pipes and fittings,

b. Solid outlet pipes and fittings,

c. Cleanout piping, fittings, and accessories,

d. Other accessories required for installation of the RCC auxiliary spillway underdrainage piping as shown on the Drawings.

2) Specified requirements for Bid Item 27 – Toe Drain Piping apply to this Bid Item, except as modified below:

a. In Section 2 – Material, Animal Guard shall be stainless steel meeting the requirements of ASTM A276, Grade 304. Stainless steel bolts, fasteners, and other mounting hardware shall meet the requirements of ASTM F593, Grade 316.

b. In Section 8 – Pipe encasement in concrete, encasement concrete for piping where shown on the Drawings shall meet the requirements of Miscellaneous Structure Concrete included in Construction Specification 31.

3) In Section 13 – Measurement and Payment, Method 3 shall apply.

a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control.

4) Items subsidiary to this Bid Item include:

a. Miscellaneous Excavation, Construction Specification 21 - Excavation

b. Miscellaneous Earth Backfill, Construction Specification 23 - Earthfill

c. Miscellaneous Structure Concrete, Construction Specification 31 – Concrete for Major Structures

****End of Construction Specification 45****

CONSTRUCTION SPECIFICATION 61—ROCK RIPRAP

1. Scope

The work consists of the construction of rock riprap revetments and blankets, including filter or bedding where specified.

2. Material

Rock riprap must conform to the requirements of Material Specification 523, Rock for Riprap, or if so specified, must be obtained from designated sources. It must be free from dirt, clay, sand, rock fines, and other material not meeting the required gradation limits.

At least 30 days before rock is delivered from other than designated sources, the Contractor must designate in writing the source from which rock material will be obtained and provide information satisfactory to the Contracting Officer that the material meets contract requirements. The Contractor must provide the responsible Engineer free access to the source for the purpose of obtaining samples for testing. The size and grading of the rock must be as specified in Section 8.

Rock from approved sources must be excavated, selected, and processed to meet the specified quality and grading requirements at the time the rock is installed.

Based on a specific gravity of 2.65 (typical of limestone and dolomite) and assuming the individual rock is shaped midway between a sphere and a cube, typical size/weight relationships are:

Sieve size of rock	Approx. weight of rock	Weight of test pile
16 inches	300 pounds	6,000 pounds
11 inches	100 pounds	2,000 pounds
6 inches	15 pounds	300 pounds

When specified in Section 8 or when it is necessary to verify the gradation of the rock riprap, a particle size analysis must be performed in accordance with ASTM D5519, Test Method A or B. The analysis must be performed at the work site on a test pile of representative rock. The mass of the test pile must be at least 20 times the mass of the largest rock in the pile. The results of the test are compared to the gradation required for the project. Test pile results that do not meet the construction specifications must be cause for the rock to be rejected. The test pile that meets contract requirements must be left on the job site as a sample for visual comparison. The test pile must be used as part of the last rock riprap to be placed.

Filter or bedding aggregates when required must conform to Material Specification 521, Aggregates for Drainfill and Filters, unless otherwise specified. Geotextiles must conform to Material Specification 592, Geotextile.

3. Subgrade preparation

The subgrade surface on which the rock riprap, filter, bedding, or geotextile is to be placed must be cut or filled and graded to the lines and grades shown on the drawings. When fill to subgrade lines is required, it must consist of approved material and must conform to the requirements of the specified class of earthfill.

Rock riprap, filter, bedding, or geotextile must not be placed until the foundation preparation is completed and the subgrade surface has been inspected and approved.

4. Equipment-placed rock riprap

The rock riprap must be placed by equipment on the surface and to the depth specified. It must be installed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying material. The rock for riprap must be delivered and placed in a manner that ensures the riprap in place is reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks. Some hand placing may be required to provide a neat and uniform surface.

Rock riprap must be placed in a manner to prevent damage to structures. Hand placing is required as necessary to prevent damage to any new and existing structures.

5. Hand placed rock riprap

The rock riprap must be placed by hand on the surface and to the depth specified. It must be securely bedded with the larger rocks firmly in contact one to another without bridging. Spaces between the larger rocks must be filled with smaller rocks and spalls. Smaller rocks must not be grouped as a substitute for larger rock. Flat slab rock must be laid on its vertical edge except where it is laid like paving stone and the thickness of the rock equals the specified depth of the riprap course.

6. Filter or bedding

When the contract specifies filter, bedding, or geotextile beneath the rock riprap, the designated material must be placed on the prepared subgrade surface as specified. Compaction of filter or bedding aggregate is not required, but the surface of such material must be finished reasonably smooth and free of mounds, dips, or windrows.

7. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, the quantity of each type of rock riprap placed within the specified limits is computed to the nearest ton by actual weight. The volume of each type of filter or bedding aggregate is measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas. For each load of rock riprap placed as specified, the contractor must furnish to the responsible engineer a statement-of-delivery ticket showing the weight to the nearest 0.1 ton.

Payment is made at the contract unit price for each type of rock riprap, filter, or bedding. Such payment is considered full compensation for completion of the work.

Method 2—For items of work for which specific unit prices are established in the contract, the quantity of each type of rock riprap placed within the specified limits is computed to the nearest 0.1 ton by actual weight. The quantity of each type of filter or bedding aggregate delivered and placed within the specified limits is computed to the nearest 0.1 ton. For each load of rock riprap placed as specified, the contractor must furnish to the engineer a statement-of-delivery ticket showing the weight to the nearest 0.1 ton. For each load of filter or bedding aggregate, the contractor must furnish to the responsible engineer a statement-of-delivery ticket showing the weight to the nearest 0.1 ton.

Payment is made at the contract unit price for each type of rock riprap, filter, or bedding. Such payment is considered full compensation for completion of the work.

Method 3—For items of work for which specific unit prices are established by the contract, the

volume of each type of rock riprap and filter or bedding aggregate is measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas.

Payment is made at the contract unit price for each type of rock riprap, filter, or bedding. Such payment is considered full compensation for completion of the work.

Method 4—For items of work for which specific unit prices are established by the contract, the volume of each type of rock riprap, including filter and bedding aggregate, is measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas.

Payment is made at the contract unit price for each type of rock riprap, including filter and bedding. Such payment is considered full compensation for completion of the work.

Method 5—For items of work for which specific unit prices are established by the contract, the quantity of each type of rock riprap placed within the specified limits is computed to the nearest ton by actual weight. For each load of rock for riprap placed as specified, the contractor must furnish to the responsible engineer a statement-of-delivery ticket showing the weight to the nearest 0.1 ton.

Payment is made at the contract unit price for each type of rock riprap, and includes compensation for any aggregate or geotextile installed as specified for filter or bedding. Such payment is considered full compensation for completion of the work.

Method 6—For items of work for which specific unit prices are established by the contract, the volume of each type of rock riprap is measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas.

Payment is made at the contract unit price for each type of rock riprap and includes compensation for any aggregate or geotextile installed as specified for filter or bedding. Such payment is considered full compensation for completion of the work.

All methods—The following provision applies to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 8.

No separate payment is made for testing the gradation of the test pile. Compensation for testing is included in the appropriate bid item for riprap.

8. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Bid Item 30 - Rock Riprap, PSW Outlet and ASW Entrance

1) This item of work consists of furnishing all labor, materials, and equipment to construct the permanent rock riprap armoring, including bedding and geotextile, in the outlet channel downstream of the impact basin, at the outlet of the precast seepage collection boxes, and for the ASW entrance wave protection as shown on the Drawings. Temporary rock riprap for pollution control and stream diversion is included in Construction Specification 5, Pollution Control.

2) In Section 2 – Material – Submit for approval to the COR written certification from supplier that materials meet the specified requirements. Materials shall conform to the referenced Material Specifications and additional requirements specified below:

   a. Rock Type 2 shall apply.

   b. Riprap shall meet the requirements of West Virginia Department of Transportation Division of Highways Standard Specifications Roads and Bridges Section 704. Riprap gradation shall be as follows: 100% of the stones shall be less than 12 inches, 15 to 50% shall be 6 inches, and 0 to 15% shall be 3 inches. On-site gradation testing is not required. Submit for approval to the COR written certification from the supplier that riprap meets the specified requirements at least five working days before delivery.

   c. Riprap shall be underlain by Bedding and shall have non-woven geotextile placed over subgrade before placement, as shown on the Drawings. Geotextile materials and installation shall meet the requirements of Construction-Specification 95, Geotextile.

   d. Bedding shall meet the gradation requirements of AASHTO No. 3 Coarse Aggregate and meet the requirements of the latest version of the West Virginia Department of Transportation Division of Highways Standard Specifications Roads and Bridges.

3) In Section 5 – Hand Placed Rock Riprap, riprap may be placed by equipment or by hand.

4) After placement, riprap surface shall be stabilized by pushing or moving the protruding rock into the riprap blanket with equipment or hand tools. Due care shall be exercised to prevent damage to the geotextile. Equipment shall not be allowed on the rock during or after placement.

5) Riprap shall not be dropped from a height greater than three (3) feet.

6) In Section 6 – Filter or bedding:

   a. Bedding materials shall be placed in a manner to avoid segregation of particle sizes, and to ensure the continuity and integrity of all zones. No foreign materials shall be allowed to become intermixed with, or otherwise contaminate, bedding materials.

   b. No compaction will be required beyond that resulting from the placing and spreading operations.

7) In Section 7 – Measurement and Payment, Method 6 shall apply.

8) Items subsidiary to this Bid Item include:

   a. Miscellaneous Excavation, Construction Specification 21 - Excavation

   b. Geotextile, Construction Specification 95 - Geotextile

B. Bid Item 31 - Embankment Upstream Stability Berm

1) This item of work consists of furnishing all labor, materials, and equipment to construct the upstream embankment riprap stability berm as shown on the Drawings and while the reservoir is completely drained.

2) At least 45 days prior to beginning work activity, Contractor shall submit an Upstream Stability Berm Installation Plan containing the following, at a minimum:

   a. Description of the Contractor's proposed work sequence and schedule for all work items required under this bid item, side casting sediment, and riprap placement.

   b. Material stockpile locations within the approved staging areas shown on the Drawings.

   c. Plans and diagrams for handling riprap.

   d. Makes, models, and quantities of proposed equipment to perform excavations and place riprap to the lines and grades shown on the Drawings, as well as means and methods to demonstrate that the Work conforms to the lines and grades shown on the Drawings.

   e. Means and methods for protection of structures to remain, including but not limited to the principal spillway riser.

   f. Means and methods for protection of existing embankment fill materials to remain.

   g. Means, methods, and equipment for side casting sediment away from the footprint of the riprap berm as required. It is estimated that 6 to 9 feet of sediment is present in the vicinity of the principal spillway riser, but the Contractor is responsible for verifying the volume of sediment to be moved in order to perform the work. Sediment may not be removed from the reservoir.

3) Survey submittals and records shall be as specified in Construction Specification 7, Construction Surveys. Perform topographic surveys of the following:

   a. Horizontal limits and top of sediment within footprint of riprap prior to side casting.

   b. Horizontal limits and top of riprap subgrade after completion of side casting of sediment and prior to riprap placement.

   c. Horizontal limits and top of riprap after placement.

   d. Sequential work shall not proceed until the survey submittals have been reviewed and approved by the COR.

   e. Additional surveys shall be completed as requested by the COR.

4) Specified requirements for Bid Item 30 – Rock Riprap, PSW Outlet and ASW Entrance apply to this Bid Item, except as modified below:

   a. In Section 2 – Material,

      a. Riprap shall meet the requirements of West Virginia Department of Transportation Division of Highways Standard Specifications Roads and Bridges Section 704. Riprap gradation shall be as follows: 100% of the stones shall be less than 6 inches, 15 to 50% shall be 3 inches, and 0 to 15% shall be 2 inches.

      b. Bedding materials are not required.

   b. In Section 6 – Filter or bedding, bedding materials are not required.

5) In Section 7 – Measurement and Payment, Method 6 shall apply.

   a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control.

6) Items subsidiary to this Bid Item include:

   a. Geotextile, Construction Specification 95 – Geotextile
   b. Water for Construction, Construction Specification 10 – Water for Construction

**** End of Construction Specification 61 ****

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CONSTRUCTION SPECIFICATION 63—TREATMENT OF ROCK SURFACES

1. Scope

This work consists of preparing and cleaning the designated rock surfaces, including the specified dental excavation, and the furnishing and placing of the specified treatment material for either dental or slurry grout.

2. Material

Portland cement shall conform to the requirements of Material Specification 531 for the type specified in Section 10 of this specification.

Pozzolans conforming to the ASTM C 618, Class C or F, may be used in amounts not to exceed 25 percent, based on absolute volume, to substitute for an equal amount of portland cement in the concrete grout mixture, unless otherwise specified in Section 10 of this specification.

Aggregates shall conform to the requirements of Material Specification 522, Aggregates for Portland Cement Concrete, except that the grading for coarse aggregate shall be as specified in Section 10 of this specification.

Water shall be clean and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

Admixtures, when specified, shall be of the type and quality specified in Section 10 of this specification.

Curing compound shall conform to the requirements of Material Specification 534, Concrete Curing Compound.

3. Preparation and cleaning

After excavation of the overburden has been completed, the rock surfaces shall be thoroughly cleaned and dewatered. All loose rock, ledges, and overhangs exposed during preparation of the rock surfaces shall be removed. Surfaces exceeding the slope limitations specified in Section 10 of this specification shall be eliminated by excavation or by filling with concrete as described in Section 7 of this specification.

Dental excavation shall consist of the removal of all soil and soft or loose rock from cracks, fissures, holes, and solution channels exposed during excavation activities. The extent of the dental excavation shall be as shown on the drawings with onsite adjustments as determined by the Engineer.

Rock surfaces shall be cleaned by air-water cutting, water jetting, wire brush scrubbing, or other suitable methods determined necessary to obtain an acceptable surface. No surface treatment material shall be applied until rock surfaces have been inspected and approved.

Rock surfaces shall be free of standing or running water during the placement of surface treatment material.

4. Design of surface treatment material

The treatment material and mix proportions shall be as specified in Section 10 of this specification. During the surface treatment operation, the Engineer may require adjustment of the mix proportions. The mix shall not be altered without the approval of the Engineer.

5. Handling and measurement of material

Material shall be stockpiled and batched by methods that prevent segregation or contamination of aggregates and ensure accurate measurement and proportioning of the mix ingredients.

Except as otherwise provided in Section 10 of this specification, cement and aggregates shall be measured as follows:

a. Cement shall be measured by weight or in bags of 94 pounds each. When cement is measured in bags, no fraction of a bag shall be used unless properly weighed.

b. Aggregates shall be measured by weight. Mix proportions shall be based on saturated, surface-dry weights. The batch weight of each aggregate shall be required saturated, surface-dry weight plus the weight of the surface moisture it contains at the time of batching.

c. Water shall be measured, by volume or weight, to an accuracy within 1 percent of the total quantity of water required for the batch.

d. Admixtures shall be measured within a limit of accuracy of 3 percent.

6. Mixers and mixing

The mixer, when operating at capacity, shall be capable of combining the ingredients of the concrete into a thoroughly mixed and uniform mass and of discharging the mix with a satisfactory degree of uniformity.

The mixer shall be operated within the limits of the manufacturer's guaranteed capacity and speed of rotation.

The time of mixing, after all cement and aggregates are combined in the mixer, shall be a minimum of 1 minute for mixers having a capacity of 1 cubic yard or less. For larger capacity mixers, the minimum time shall be increased 15 seconds for each cubic yard or fraction thereof of additional capacity. The batch shall be so charged into the mixer that some water enters before the cement and aggregates, with the balance of the mixing water introduced into the mixer before a fourth of the total mixing time has elapsed.

No mixing water in excess of the amount required by the approved job mix shall be added to the grout mix during mixing or hauling or after arrival at the delivery point.

7. Conveying and placing

Surface treatment material shall be delivered to the site and placed within 1.5 hours after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to accelerated stiffening of the concrete, the time between the introduction of the cement to the aggregates and complete discharge of the concrete shall be a maximum of 45 minutes. The Engineer may allow a longer period if the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding admixture. In any case concrete shall be conveyed from the mixer to the final placement as rapidly as practical by methods that prevent segregation of the aggregates, loss of mortar, or both.

Concrete shall not be allowed to free fall more than 5 feet unless suitable equipment is used to prevent segregation.

Surface treatment material shall not be placed until the rock surfaces have been inspected and approved by the engineer.

All cracks, fissures, solution channels, and other surfaces within the designated area shall be treated as shown on the drawings. Surfaces to be treated shall be kept moist for at least 2 hours before treatment.

Concrete shall be filled against any specified remaining rock surfaces that exceed the slope limitations and shall be shaped so that no part of the finished surface exceeds these limitations.

Material placed in cracks, fissures, and solution channels shall be consolidated by vibration, spading, or tamping as necessary to assure complete filling of the void.

8. Curing and protection

Method 1—The surface of treatment material shall be prevented from drying for a minimum curing period of 7 days after placement. Exposed surfaces shall be maintained in a moist condition continuously for the 7-day curing period or until curing compound has been applied as specified in this section. Moisture shall be maintained by sprinkling, flooding, or fog spraying or by covering with continuously moistened canvas, cloth mats, straw, sand, or other acceptable material. Water or moist covering shall be used to protect the concrete treatment during the curing process without causing damage to the treatment surface by erosion or other mechanisms that may cause physical damage.

The concrete treatment material may be coated with an approved curing compound as an alternative method to maintaining a continuous moisture condition during the curing period. The compound shall be sprayed on the moist treatment surfaces as soon as free water has disappeared and all surface finishing has been completed. The compound shall be applied at a minimum uniform rate of 1 gallon per 175 square feet of surface and shall form a continuous adherent membrane over the entire treated surface. Curing compound shall not be applied to surfaces requiring bond to subsequently placed grout or concrete. If the membrane is damaged during the curing period, the damaged area shall be resprayed at the rate application specified for the original treatment.

Backfilling operations shall not commence for a minimum period of 24 hours following the placement of concrete treatment unless otherwise specified.

Method 2—A minimum earth cover of 1.5 feet depth shall be placed and compacted before the rock surface treatment material (concrete) has established an initial set. The earth cover may be placed on the concrete with a dragline or hoe, or it can be bladed onto the treated surface by lightweight dozer or similar equipment operating from a covered and compacted surface. Compaction shall be accomplished by pneumatic-tired equipment or by an alternative method that provides an equivalent density.

Use with either method—No backfill material shall be placed until the treated surfaces have been inspected and approved by the Engineer.

Surface treatment material shall not be placed when the daily minimum temperature is less than 40 degrees Fahrenheit unless facilities are provided to ensure that the temperature of the material is maintained at a minimum temperature of 50 degrees Fahrenheit and not greater than 90 degrees Fahrenheit during placement and the curing period. Concrete treatment material shall not be placed on a frozen surface. When freezing conditions prevail, rock surfaces to be treated must be covered and heated to within a range of 50 to 90 degrees Fahrenheit for a minimum period of 24 hours before placing concrete treatment material.

9. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, the area of rock surfaces to be prepared, cleaned, and treated is measured to the nearest square yard within the limits established by the engineer. The volume of surface treatment material placed within the established limits is computed to the nearest 0.1 cubic yard of concrete placed. Payment is made at the contract unit price for surface preparation, cleaning, and installation of surface treatment material. Such payment constitutes full compensation of all labor, equipment, material, and all other items necessary and incidental to the completion of the work.

Method 2—For items of work for which specific unit prices are established in the contract, the area of rock surfaces to be prepared, cleaned, and treated will not be measured. The volume of surface treatment material delivered and properly installed to treat rock surfaces is determined to the nearest 0.1 cubic yard. Areas to be treated are shown on the drawings with the final extent of rock surface treatment to be determined by the engineer. The volume of any waste or otherwise unsuitable material is determined by procedures established by the engineer and deducted from the volume of concrete delivered to the site. Payment is made at the contract unit price for surface preparation, cleaning, and installation of surface treatment material. Such payment constitutes full compensation of all labor,-

equipment, material, and all other items necessary and incidental to the completion of the work.

All methods—For each load of concrete delivered to the site for placement as rock treatment material, the contractor shall furnish to the engineer a delivery ticket at the time of delivery, This ticket shall provide as a minimum: Weights in pounds of cement, aggregates (fine and coarse), pozzolan (if used), and water; weight in ounces of air-entraining agent; time of loading; and, the revolution counter reading at the time batching was started.

Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 10 of this specification.

10. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Bid Item 32 –Rock Foundation Preparation, Embankment

1) This item consists of cleaning and preparation of the rock foundation surface for the following areas and as shown on the Drawings.

Structure/Component	Material Overlying Rock Surface
Impact Basin	Miscellaneous Structure Concrete or Conventional Concrete
Precast Seepage Collection Boxes	Coarse Drainfill
Principal Spillway Conduit Cradle Extension	Miscellaneous Structure Concrete or Conventional Concrete
Embankment Toe Drain	Fine Drainfill

2) At least 45 days prior to beginning work activity, submit a Foundation Preparation Plan detailing the approach, access, sequence, equipment, and methodologies to be used for the cleaning of rock surfaces. The Plan shall include methodologies proposed to maintain and preserve approved surfaces from deterioration due to moisture loss and atmospheric exposure until the placement of RCC, concrete, or earthfill. The Plan shall also include the proposed test section location and schedule. The Contractor will only be required to provide one test section for the embankment work and one test section for the ASW Work. The test section for the embankment must be representative of the embankment toe drain conditions. This test section may also be incorporated into the permanent work. The ASW test section is included below in Bid Item 33 – Rock Foundation Preparation, ASW.

3) In Section 2, Material:

   a. Miscellaneous Structure Concrete shall be as specified in Construction Specification 31 – Concrete for Major Structures.

   b. Fine Drainfill and Coarse Drainfill shall be as specified in Construction Specification 24 – Drainfill.

4) In Section 3, Preparation and cleaning:

   a. Cleaning equipment: use suitable equipment to clean the rock surfaces as required for the various operations. At a minimum, foundation cleaning equipment shall include:

      i. Drills, hoe rams, excavators, and/or backhoes with a bucket of two feet or less in width and fitted with steel bar welded across the teeth to form a flat cutting surface ("butter bar"), pneumatic hammers and chisels, hand tools, wedging, and splitting equipment may be used for rock trimming as necessary. Blasting is not permitted for rock trimming.

      ii. Water jet: 1-inch pipe and nozzle with supply hose, connected to a water supply that is capable of providing up to 30 psi at 10 gpm (gallons per minute). The water supply shall be controllable using a valve within three feet of the discharge nozzle.

      iii. Vacuum system: An industrial vacuum loader system shall be on site during foundation preparation, treatment of exposed rock features in the dam foundation, and placement of concrete. The industrial vacuum loader shall be capable of removing water and loose soil and rock of at least 4 inches in diameter from all rock foundation locations.

      iv. Air jets are not permitted unless otherwise approved by the COR.

      v. The foundation rock may be too erodible to clean with a water jet operated under high pressures. The Contractor is required to perform a test section to demonstrate the effectiveness of the water jet, as specified for Bid Item 33 – Rock Foundation

Preparation, ASW below. However, if excessive erosion of the foundation rock is observed, the COR may limit or reject the use of high-pressure water to clean the rock foundation surface. The COR will be the sole judge of whether the foundation rock is too erodible for cleaning with high-pressure water. Water jets may be used in areas that do not cause erosion or degradation of the dam foundation, after approval by the COR.

b. The foundation cleaning and preparation of exposed rock surfaces in excavations shall consist of:

   i. Fine grading of the excavation subgrades. Fine grading shall conform to the lines and grades shown on the Drawings.

   ii. Operating cleaning equipment and hand tools to expose and remove undisturbed natural material.

   iii. Cleaning of exposed surfaces and rock discontinuities, sheared or deteriorated rock zones, vertical faces, overhangs, depressions, and other anomalies, as required by the COR. Additional excavation and re-cleaning may be required.

   iv. Providing the COR an opportunity to observe the exposed rock foundation and recommend additional rock excavation and foundation cleaning as needed.

   v. Treating zones of highly weathered rock, shears, discontinuities, or other anomalies as directed by the COR. Notify the COR at least 5 calendar days in advance of any area being prepared for inspection.

   vi. Shaping of the rock surface, such as trimming rock overhangs, placement of concrete without overhangs, or as directed by the COR.

   vii. Filling depressions in the rock surface with the materials shown in Item 10.A.1., or as directed by the COR.

   viii. Placing concrete at the locations shown on the Drawings or as directed by the COR.

c. Foundation cleaning shall be accomplished in multiple operations, as described below:

   i. Rough Cleaning: Remove all debris, loose rock, mud coatings, standing water, and other objectionable material from the excavated surface as directed by the COR. Use cleaning equipment, as specified herein. The Contractor shall utilize a vacuum system to assist in cleaning the foundation. The cleaned surfaces should be in such a condition that all features and irregularities associated with the foundation are readily visible.

   ii. Allow COR to observe the rock surface, discontinuities, and surface defects and to define areas requiring additional excavation or cleaning and placement of drainfill or concrete.

   iii. Additional Excavation and Cleaning:

      1. If the COR determines that additional excavation is required to remove unsuitable material after Rough Cleaning due to the Contractor's inadequate cleaning operations, additional excavation shall be performed, and the newly exposed surface shall be re-cleaned at the Contractor's expense and at no additional cost to the Owner.

      2. If the COR determines that additional excavation is required to remove unsuitable material after Rough Cleaning and that the Contractor has followed the specification requirements and the Foundation Preparation Plan, additional excavation shall be performed, and the newly exposed surface shall be re-cleaned. Measurement and payment will be in accordance with Measurement and Payment terms specified herein.

3. The cleaned surface shall undergo inspection by the COR and this step shall repeated, as needed, until a suitable surface is exposed and approved.

5) In Section 4, Design of surface treatment material:

   a. Contractor shall protect rock surfaces from deterioration due to stress relief, atmospheric exposure, or moisture loss.

   b. Dental excavation shall be backfilled with Fine Drainfill, Coarse Drainfill, Miscellaneous Structure Concrete, or other materials as directed by the COR.

6) In Section 8, Curing and protection, Method 1 shall apply. In addition:

   a. The Contractor shall maintain all cleaned surfaces until inspection has been completed. After conclusion of foundation cleaning operations and inspection, the Contractor shall protect the foundation from siltation and runoff, and maintain it in a moist condition.

   b. The Contractor shall take all necessary precautions to preserve the approved foundation in a condition suitable for placement of concrete, earthfill, or drainfill materials. Rock surfaces that exhibit deterioration due to, but not limited to, loss of moisture and atmospheric exposure shall be removed and replaced as directed by the COR at the Contractor's expense and at no additional cost to the Owner.

   c. Any damage or deterioration to the approved foundation due to the Contractor's operations, including damage of the material beyond the required excavation lines, shall be repaired as directed by the COR at the Contractor's expense and at no additional cost to the Owner.

   d. Repair of damaged or deteriorated foundation surfaces shall include excavating the loosened, shattered, or deteriorated rock and backfilling with materials as directed by the COR.

   e. Drainfill placed on top of the rock foundation surface shall be kept moist until earthfill is placed as shown on the Drawings.

7) In Section 9, Measurement and Payment, Method 1 will apply, except measurement of the volume of surface treatment material is not included in this Bid Item. Measurement and payment for drainfill placement is addressed in Construction Specification 24, Drainfill.

8) Items subsidiary to this Bid Item include:

   a. Water for Construction, Construction Specification 10 – Water for Construction

   b. Miscellaneous Structure Concrete, Construction Specification 31 - Concrete for Major Structures

B. Bid Item 33–Rock Foundation Preparation, ASW

1) This item consists of cleaning and preparation of the rock foundation surface for the following areas and as shown on the Drawings.

Structure/Component	Material Overlying Rock Surface
RCC Spillway Underdrain	Fine Drainfill
Tailwater Weir Wall	Mudmat

2) This item also includes preparation of a rock foundation preparation test section to demonstrate the Contractor's proposed cleaning and protection procedures are adequate. The Contractor will only be required to perform one test section for the ASW work and one test section for the embankment work This test section may also be incorporated into the

permanent work. The Embankment test section is included above in Bid Item 32 – Rock Foundation Preparation, Embankment.

3) Specified requirements for Bid Item 32 –Rock Foundation Preparation, Embankment apply to this Bid Item, as well as the following additional requirements:

   a. In Section 2, Material, Mudmat shall be as specified in Construction Specification 31 – Concrete for Major Structures. If the mudmat thickness would exceed 10 inches, backfill the feature with material as directed by the COR.

   b. In Section 3, Preparation and cleaning:

      i. Foundation Cleaning Test Section

         1. Prior to the start of any excavations, contractor shall prepare a cleaning test section, which shall be used to determine the most appropriate and productive methods for cleaning the foundation. The test section may be incorporated into the Work. The test section shall be a minimum of 40 square yards and shall be completed in an area that includes each of the anticipated foundation materials and conditions. Separate areas may be required to include each of the anticipated foundation materials and conditions.

         2. Cleaning of the test section shall be performed prior to any other cleaning work so that specific foundation cleaning methods described in this specification can be exhibited and their use be approved by the COR. The Contractor shall re-clean the test area until the test section cleaning meets the requirements of this specification and has been approved by the COR.

         3. Contractor shall use the approved cleaning procedure for subsequent cleaning work. The Contractor shall modify the approved cleaning methods in any portion of the foundation if they are found to be inadequate by the COR. In such cases, foundation surfaces shall be re-cleaned until they are approved by the COR at the Contractor's expense and at no additional cost to the Owner.

         4. Test section shall include placement of the drainfill as specified herein after the cleaned rock surface is approved by the COR. Test section may be incorporated into the RCC test section required in Construction Specification 36, Roller Compacted Concrete, provided the requirements of this specification, Construction Specification 36, and shown on the Drawings are met.

      ii. Foundation cleaning shall be accomplished in multiple operations, as described above in Section 10.A.4.c. and shall include the following additional operation after rough cleaning and inspection by the COR:

         1. Final Surface Cleaning: a final surface cleaning shall be performed to remove any remaining loose rock, sand, silt, shattered or disintegrated material, mud coatings, standing water, and other objectionable material. Allow COR to inspect and approve the cleaned surface prior to placement of the mudmat. No additional payment will be made for Final Surface Cleaning.

   c. In Section 8, Curing and protection, drainfill shall be kept moist until the mudmat is placed as shown on the Drawings.

4) In Section 9, Measurement and Payment, Method 1 will apply, except measurement of the volume of surface treatment material is not included in this Bid Item. Measurement and payment for drainfill placement is addressed in Construction Specification 24, Drainfill. Measurement and payment for placement of Mudmat is addressed in Construction Specification 31 – Concrete for Major Structures. If the COR directs placement of Miscellaneous Structure Concrete instead of Mudmat as specified for this Bid Item, Miscellaneous Structure Concrete will be measured and paid as specified for Mudmat in Construction Specification 31 – Concrete for Major Structures.

5) Items subsidiary to this Bid Item include:

   a. Water for Construction, Construction Specification 10 – Water for Construction

****End of Construction Specification 63****

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CONSTRUCTION SPECIFICATION 71—WATER CONTROL GATES

1. Scope

The work consists of furnishing and installing water control gates including gate stems, hoists, lifts, and other appurtenances.

2. Material

The gates furnished shall conform to the requirements of Material Specifications 571, 572, and 573, as appropriate, and as specified in Section 8 of this specification and on the drawings. All gates shall be furnished complete with hoisting equipment and other specified appurtenances.

3. Installing gates

The Contractor shall install the gates in a manner that prevents leakage around the seats and binding of the gates during normal operation.

Surfaces of metal against which concrete will be placed shall be free from oil, grease, loose mill scale, loose paint, surface rust, and other debris or objectionable coatings.

Anchor bolts, thimbles, and spigot frames shall be secured in true position within the concrete forms and maintained in alignment during concrete placement.

Concrete surfaces against which rubber seals will bear or against which flat frames or plates are to be installed shall be finished to provide a smooth and uniform contact surface.

When a flat frame is installed against concrete, a layer of concrete mortar shall be placed between the gate frame and the concrete.

When a gate is attached to a wall thimble, a mastic or resilient gasket shall be applied between the gate frame and the thimble in accordance with the recommendations of the gate manufacturer.

Wall plates, sills, and pin brackets for radial gates shall be adjusted and fastened by grouting and bolting after the gates have been completely assembled in place.

4. Installing hoists and lifts

Gate stems, stem guides, and gate lifts shall be carefully aligned so that the stem shall be parallel to the guide bars or angles on the gate frame following installation.

5. Radial gate seals

The rubber seals for radial gates shall be installed so that the seals contact the walls or wall plates throughout the entire gate length when the gate is in the closed position.

6. Operational tests

After the gate(s) and hoist(s) (or lifts) have been installed, they shall be cleaned, lubricated, and otherwise serviced by the Contractor in accordance with the manufacturer's instructions. The contractor shall test the gate and hoist by operating the system several times throughout its full range of operation. The Contractor shall make any changes or adjustments necessary to ensure satisfactory operation of the complete gate system.

7. Measurement and payment

The number of each type, size, and class of gate is counted. Payment for furnishing and installing each type, size, and class of gate shall be made at the contract unit price for that type, size, and class of gate. Such payment constitutes full compensation for all labor, equipment, material, and all other items necessary and incidental to the completion of the work including furnishing and installing anchor bolts and all specified appurtenances and fittings.

Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and items to which they are made subsidiary are identified in Section 8 of this specification.

8. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. The Contractor is required to perform the work specified herein early in the project so as to reduce potential for delays in obtaining materials. The Contractor may submit a request for schedule extension if the gate manufacturer indicates the lead time exceeds 6 months. The schedule extension request will be subject to review and approval by the Government.

B. The dimensions and locations of the gates are indicated on the Drawings. The Contractor shall field verify all dimensions and existing conditions prior to procuring materials and shall note field measurements on associated shop drawings. Notify the COR of any discrepancies or of any proposed variance from the Drawings prior to submittal of associated Shop Drawings and fabrication.

C. Bid Item 35 –Removal of Pond Drain Gate

1) This item consists of the removal of the existing Pond Drain Gate and frame, removal of the actuator, and removal and disposal of gate stem and stem guides while the reservoir is drained as shown on the Drawings and as specified herein. Disposal of the existing Pond Drain Gate and actuator and installation of any gate components are not included under this Bid Item.

2) The Pond Drain Gate, gate frame, and accessories shall be removed without damaging the principal spillway riser and existing gate thimble. Any damage shall be repaired as directed by the COR at the Contractor's expense and at no additional cost to the Government.

3) The Contractor shall submit a Pond Drain Gate Removal Plan to the COR for review and approval at least 45 calendar days prior to starting the work. The Plan shall include at least the following:

   a. Narrative describing methods, materials, and qualifications of personnel for removal of the existing Pond Drain Gate, gate frame and accessories, as well as side casting sediment away from the riser as required for removal of the existing Pond Drain Gate. It is estimated that 6 to 9 feet of sediment is present around the Pond Drain Gate, but the Contractor is responsible for verifying the volume of sediment to be moved in order to perform the work. Sediment may not be removed from the reservoir unless the Contractor obtains permitting and agency approval from all authorities having jurisdiction, in which case the Contractor shall be responsible for all permitting, handling, testing, and disposal costs.

   b. Health and safety plan that meets applicable OSHA requirements, including a confined space entry safety plan for accessing the riser interior. The confined space entry plan shall include, at a minimum, personal protective equipment, emergency contact information, and two-way manual communication devices.

4) Sections 2, 3, 4, 5 and 6 do not apply.

5)In Section 7 – Measurement and Payment, Measurement and Payment is for the lump sum price established by the Contract. Such payment constitutes full compensation for all labor, equipment, material, and all other items necessary and incidental to the completion of the work.

D. Bid Item 34 - Installation of New Pond Drain Gate, Gate Stem, and Stem Guides

1) This item consists of the design, materials, fabrication, furnishing, installation, and testing a replacement Pond Drain Gate below the minimum water supply elevation as shown on the Drawings.

2) In Section 2 – Materials

a. Pond Drain Gate shall be 18-inch square Hydro Gate HG560, non-self-contained, cast-iron gate or approved equal as shown on the Drawings and specified herein.

b. Slide Gate Type: Heavy Duty Type MHS-1 as specified in Material Specification 571 – Slide Gates. Pond Drain Gate components shall meet the following material requirements:

   i. Castings for frame, slide, stem guide brackets, wall brackets, and other miscellaneous items: Cast Iron, ASTM A126, Class B

   ii. Castings for wedges: Manganese Bronze, ASTM B584< Alloy 862

   iii. Seat faces in frame and slide: Silicon Bronze, ASTM B98, Alloy 651

   iv. Castings for stem block and lift nut: Manganese Bronze, ASTM B584, Alloy 865

   v. Castings for stem guide collars: Silicon Bronze, ASTM B584, Alloy 873

   vi. Stems and retainer bars: Stainless Steel, ASTM A276, Type 316, fabricated to be compatible with Pond Drain Gate and actuator.

   vii. Fasteners: Stainless Steel, ASTM F593/F594, Alloy Group 2 (Type 316)

   viii. Epoxy for Anchor Bolts: Hilti HIT-RE-500-V3 or approved equal epoxy for use in cracked concrete and suitable for underwater application with a 48-hour cure bond strength (as defined in ASTM C882-13A of at least 1,500 psi.

   ix. Flush Bottom Seal: Neoprene or EPDM, ASTM D2000, 60 Durometer

c. Slide Gate Class: Class 57-0 as defined in Material Specification 571 – Slide Gates.

d. Frame Type: Flat Frame or Frame Flanged. Field verify frame type and bolt pattern to be compatible with existing wall thimble.

e. Lift: Existing Handwheel Operator, reinstalled

f. Pond Drain Gate shall be manufactured in accordance with AWWA C560.

g. Pond Drain Gate and appurtenances shall be shop primed and finish painted in accordance with the following requirements:

   i. Coating shall be Ameron Amerlock 400, medium gray color or approved equal high-solids epoxy coating suitable for potable water use. Coating shall be approved for contact with drinking water by the NSF, EPA or other appropriate governing agencies.

   ii. All coatings shall conform to VOC Emission Regulations in effect at the manufacturing shop.

   iii. Submerged surfaces shall be cleaned to SSPC SP10, dry and grease-free prior to painting. Non-submerged surfaces shall be cleaned to SSPC SP6.

   iv. Primer and finished coats shall be applied in the manufacturer's shop. Number of coats and thickness shall be in accordance with the paint manufacturer's recommendations for the proposed application.

3) Submit Shop Drawings to the COR for review and approval at least 21 calendar days prior to manufacturing the materials, but not limited to, the following:

   a. Certification of compliance with all provisions of the Contract Drawings and Specifications.

   b. Dimensions and clearances, profiles, sizes, attachments, connections, size and type of fasteners, and accessories. Bill of material must include the number, kind, size, length, weight, and assembly mark of each member, including bolts and fittings.

   c. Dimensions of gates, flanges, mounting bolts and holes, frames, boxout requirements, and their relation to relevant existing site features.

d. Detailed attachment means, methods, and details proposed to mount the gate frames to mounting frames, flanges, or walls, as required, including as-built drawings of existing wall thimbles and coordination for new equipment to match the existing openings and connection details.

e. Calculations sealed by a Professional Engineer registered in the State of West Virginia justifying the size of gates, frames, and other related features.

4) Submit the Leakage Testing Plan to the COR for review and approval at least 45 days prior to beginning work activity. Plan must conform to AWWA C560. Test results shall be submitted to the COR within 24 hours of completion.

5) Submit the Pond Drain Gate Installation Plan to the COR for review and approval at least 45 days prior to beginning work activity that includes, but not limited to, the following:

a. Narrative describing methods, materials, and qualifications of personnel for installation and testing of the new Pond Drain Gate as shown on the Drawings and specified herein.

b. Installation procedures and materials (may include mounting and installation plan identified above)

c. Operation procedures and materials

d. Maintenance procedures and materials

e. A list of recommended spare parts

f. Frequency of specific maintenance tasks

g. Recommended products for use during maintenance and cleaning

h. Troubleshooting guide

i. Contact information for Manufacturer's representative in case technical support or replacement parts are required.

6) In Section 3 – Installing Gates,

a. Field verify existing conditions prior to preparing Shop Drawings and prior to installing Pond Drain Gate.

b. Coordinate location of new anchors to avoid existing embedded anchors.

c. Prepare existing concrete surfaces by:

i. Chipping, grinding, or otherwise removing concrete or buildup to produce a uniform, planar, level or vertical surface (as required) free of concrete fins, protrusions, biologic or mineral buildup. Rubber or other compressible gasket sealed frames must be mounted to planar surfaces.

ii. Complete final cleaning of the surface using a high-pressure (3,000 psi to 5,000 psi) washer with a rotary (turbo) nozzle. For rubber or other compressible gasket-sealed frames, surface irregularities greater than 1/16 inch must be ground or filled with cementitious or epoxy filler as recommended by the Manufacturer.

iii. Mating surfaces shall be free of all materials that would inhibit bonding.

d. Rehabilitation of the existing wall thimble:

i. Provide minimum SSPC-SP6 or SSPC-SP3 surface preparation of the existing wall thimble.

ii. Wall thimble studs shall be thoroughly inspected. Stud threads shall be chased with an appropriately sized die. Studs that cannot be cleaned and their threads repaired shall be replaced with new stainless steel studs, size and length to match existing parts. Chase all threads in tapped holes and coat with same product as specified

herein for new components. Do not coat machined surfaces. All stainless steel fasteners shall be installed with an anti-seize lubricant suitable for the intended service.

iii. Provide new mastic to seal surface between thimble and gate frame.

e. Install components plumb and level in accordance with the Manufacturer's installation Procedures.

f. Install epoxy anchors:

i. Drill anchor holes. Hole size shall be determined by the Contractor in accordance with epoxy grout manufacturer's recommendations.

ii. Immediately after drilling, clean holes by flushing with compressed air and wire brush three times and in accordance with manufacture's recommendations. Plug hole tightly if not immediately installing anchor.

iii. If the period between drilling and anchor installation exceeds 24-hrs, clean hole again by flushing with compressed air and wire brush. Holes shall be dry before setting anchors.

iv. Final cleaning and anchor installation shall be performed under the observation of the COR. The Contractor shall provide the COR with 24-hours notice of final cleaning and anchoring installation.

v. Install anchors in accordance with manufacturer's recommendations.

vi. Set anchors in each hole so that grout completely surrounds the dowel bar. Anchors shall not rest on the side of the hole.

vii. Use extension tube and/or supplemental hose to start injection of epoxy grout from the bottom (back) of hole. Remove hose gradually while injecting epoxy to avoid creating air pockets.

g. The existing Pond Drain Gate that was removed shall become the property of the Contractor and shall be removed from the site and salvaged or disposed of in accordance with all applicable federal, state, and local regulations.

7) In Section 6 – Operational Tests,

a. Prior to performing operational tests, Contractor shall inspect the Pond Drain Gate and accessories using appropriate video equipment. The video inspection footage shall be provided to the COR for review prior to operating the gate.

b. Perform gate operational tests in the presence of the COR.

c. Cycle through at least three full cycles, open to close, and ensure smooth and satisfactory travel of the gate through the entire range of operation with no binding or damage to the components.

d. Perform leakage test after installation. Manufacturer's representative shall be onsite during leakage test to assist with gate adjustments if needed.

e. Repair and adjust gate as needed to achieve satisfactory test results.

f. Provide a Warranty for a duration of not less than 1 year from the substantial completion date. The Warranty shall guarantee the equipment and installation are free of defects in material and workmanship. Contractor agrees to repair or replace all defective parts, materials, or installations during the Warranty period at no additional cost to the Government.

8) In Section 7 – Measurement and Payment

a. Measurement and Payment is for the lump sum price established by the Contract. Such payment constitutes full compensation for all labor, equipment, material, and all other items necessary and incidental to the completion of the work.

b. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control.

9) Items subsidiary to this Bid Item include:

a. Diving Services, Construction Specification 402 – Diving Services (if utilized to verify existing conditions)

****End of Construction Specification 71****

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CONSTRUCTION SPECIFICATION 81—METAL FABRICATION AND INSTALLATION

1. Scope

The work consists of furnishing, fabricating, and erecting metalwork, including the metal parts and fasteners of the composite structures.

2. Material

Unless otherwise specified, material shall conform to the requirements of Material Specification 581, Metal. Steel shall be structural quality unless otherwise specified. Castings shall be thoroughly cleaned and subjected to careful inspection before installation. Finished surfaces shall be smooth and true to assure proper fit. Galvanizing shall conform to the requirements of Material Specification 582, Galvanizing.

3. Fabrication

Fabrication of structural steel shall conform to the requirements of Specification for the Design, Fabrication and Erection of Structural Steel for Buildings (Riveted, Bolted and Arc-Welded Construction), American Institute of Steel Construction.

Fabrication of structural aluminum shall conform to the requirements in the Aluminum Design Manual available from The Aluminum Association.

4. Erection

The frame of metal structures shall be installed true and plumb. Temporary bracing shall be placed wherever necessary to resist all loads to which the structure may be subjected, including those applied by the installation and operation of equipment. Such bracing shall be left in place as long as may be necessary for safety.

As erection progresses the work shall be securely bolted up, or welded, to resist all dead load, wind, and erection stresses. The contractor shall furnish such installation assisting bolts, nuts, and washers as may be required.

No riveting or welding shall be performed until the structure is stiffened and properly aligned.

Rivets driven in the field shall be heated and driven with the same care as those driven in the shop.

All field welding shall be performed in conformance to the requirements for shop fabrication except those that expressly apply to shop conditions only.

5. Protective coatings

Items specified to be galvanized shall be completely fabricated for field assembly before the application of the zinc coatings. Galvanized items shall not be cut, welded, or drilled after the zinc coating is applied.

Items specified to be painted shall be painted in conformance to the requirements of Construction Specification 82 for the specified paint systems.

6. Measurement and payment

Method 1—The work is not measured. Payment for metal fabrication and installation is made at the contract lump sum price in the contract. Such payment constitutes full compensation for all labor, equipment, material, and all other items necessary and incidental to the completion of the work including connectors and appurtenances, such as rivets, bolts, nuts, pins, studs, washers, hangers, and weld metal.

Method 2—The weight of metal installed complete in place shall be determined to the nearest pound. Unless otherwise specified, the weight of metal shall be computed by the method specified in section 3 of the Code of Standard Practice for Steel Buildings and Bridges, American Institute of Steel Construction, except that the following unit weights shall also be used, as appropriate, as the basis of computation:

Material	Unit weight (lb/ft^3)
Aluminum alloy	173
Bronze or copper alloy	536
Iron, malleable	470
Iron, wrought	487

Payment for furnishing, fabricating, and installing metalwork is made at the contract unit price for the specified types of labor, material, equipment, and all other items necessary and incidental to the completion of the work.

Method 3—The work is not measured. Payment for furnishing, fabricating, and installing each item of metalwork is made at the contract price for that item. Such payment constitutes full compensation for all labor, equipment, material, and all other items necessary and incidental to the completion of the work including connectors and appurtenances, such as rivets, bolts, nuts, pins, studs, washers, hangers, and weld metal.

All methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

7. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Bid Item 36– Stainless Steel Metalwork

1) This item includes furnishing, fabricating, and erecting the Pond Drain Gate, Water Supply Gates (2), and high stage trash racks and other metal components, including metal parts and fasteners as shown on the Drawings. The work for the Pond Drain Gate and Water Supply Gates trash racks (3) will be performed while the reservoir is drained.

2) In Section 2 – Material, materials shall conform to the referenced Material Specifications and additional requirements specified below:

   a. Stainless steel members shall meet the requirements of ASTM A276, Grade 304.

   b. Stainless steel bolts, anchors, fasteners, and other mounting hardware shall meet the requirements of ASTM F593, Grade 304. ASTM B98, C651 silicone bronze nuts shall be used for all stainless steel bolts and embedded anchors. Use anti-seize lubricant for all stainless steel fasteners.

   c. Epoxy Grout for Anchor Bolts: Hilti HIT-RE 500 V3 or approved equal epoxy for use in cracked concrete and suitable for underwater application with a 48-hour cure bond strength (as defined in ASTM C882-13A of at least 1,500 psi.

3) In Section 3 – Fabrication:

   a. Submit Shop Drawings showing dimension, components, layout, and fabrication requirements at least 21 calendar days prior to fabricating the materials.

   b. Submit copies of current welding certificates for each welder assigned to perform welding indicating compliance with testing specified by AWS.

   c. Submit welder qualification data and prequalified procedures.

   d. Before fabrication, check actual locations of walls and openings, and other construction to which the trash racks must fit, by accurate field measurements. Show recorded measurements on Shop Drawings.

   e. All welding shall be in accordance with AWS D1.6. Welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook".

   f. Inspect shop welding in accordance with AWS D1.6 code and including the following non-destructive testing:

      i. Visually inspect all welds.

      ii. In addition to visual inspection, test 50 percent of full penetrative welds and 20 percent of fillet welds with liquid dye penetrant.

4) In Section 4 – Erection, install epoxy anchors:

   a. Drill anchor holes. Hole size shall be determined by the Contractor in accordance with epoxy grout manufacturer's recommendations. Provide the minimum embedment as recommended by manufacturer or specified on the Contract Drawings, whichever is larger. Notify COR if required depth of embedment cannot be achieved at a particular bolt location.

   b. Follow manufacturer's recommendations for installation and as follows:

      i. Immediately after drilling, clean holes using wire brush and in accordance with manufacture's recommendations. Plug hole tightly if not immediately installing anchor.

      ii. If the period between drilling and anchor installation exceeds 24-hrs, clean hole again by wire brush.

iii. Final cleaning and anchor installation shall be performed under the observation of the COR. The Contractor shall provide the COR with 24-hours notice of the final cleaning and anchor installation.

iv. Install anchors in accordance with manufacturer's recommendations.

v. Set anchors in each hole so that grout completely surrounds the dowel bar. anchors shall not rest on the side of the hole.

vi. Use extension tube and/or supplemental hose to start injection of epoxy grout from the bottom (back) of hole. Remove hose gradually while injecting epoxy to avoid creating air pockets.

5) In Item 6 – Measurement and Payment, Method 3 shall apply.

6) Items subsidiary to this Bid Item include:

a. Diving Services, Construction Specification 402 – Diving Services (If utilized to verify existing conditions).

B. Bid Item 37– Principal Spillway Fatigue Platform

1) This item includes furnishing, fabricating, and erecting the fatigue platform, including metal parts and fasteners as shown on the Drawings.

2) In Section 2 – Material, materials shall conform to the referenced Material Specifications and additional requirements specified below:

a. Steel angles and plates shall be ASTM A36.

b. Steel bolts, anchors, fasteners, and other mounting hardware shall meet the requirements of ASTM A307, Grade A.

c. Epoxy Grout for Anchor Bolts: as specified for Bid Item 36 - Stainless Steel Metalwork.

3) In Section 3 – Fabrication:

a. Submit Shop Drawings showing dimension, components, layout, and fabrication requirements at least 21 calendar days prior to fabricating the materials.

b. Submit copies of current welding certificates for each welder assigned to perform welding indicating compliance with testing specified by AWS.

c. Submit welder qualification data and prequalified procedures.

d. Before fabrication, check actual locations of walls and openings, and other construction to which the fatigue platform must fit, by accurate field measurements. Show recorded measurements on Shop Drawings.

e. Hot-dip galvanize all members after fabrication in accordance with MS 582.

f. All welding shall be in accordance with AWS D1.1. Welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook".

g. Inspect shop welding in accordance with AWS D1.1 code and including the following non-destructive testing:

i. Visually inspect all welds.

ii. In addition to visual inspection, test 50 percent of full penetrative welds and 20 percent of fillet welds with liquid dye penetrant.

4) In Section 4 – Erection, install anchors and bolts:

   a. Drill anchor holes. Hole size shall be determined by the Contractor in accordance with epoxy grout manufacturer's recommendations. Provide the minimum embedment as recommended by manufacturer or specified on the Contract Drawings, whichever is larger. Notify COR if required depth of embedment cannot be achieved at a particular bolt location.

   b. Follow manufacturer's recommendations for installation and as follows:

   c. Immediately after drilling, clean holes using wire brush and in accordance with manufacture's recommendations. Plug hole tightly if not immediately installing anchor.

   d. If the period between drilling and anchor installation exceeds 24-hrs, clean hole again by wire brush.

   e. Final cleaning and anchor installation shall be performed under the observation of the COR. The Contractor shall provide the COR with 24-hours notice of the final cleaning and anchor installation.

   f. Install anchors in accordance with manufacturer's recommendations.

   g. Set anchors in each hole so that grout completely surrounds the dowel bar. Anchors shall not rest on the side of the hole.

   h. Use extension tube and/or supplemental hose to start injection of epoxy grout from the bottom (back) of hole. Remove hose gradually while injecting epoxy to avoid creating air pockets.

5) In Item 6 – Measurement and Payment, Method 3 shall apply.

6) Items subsidiary to this Bid Item include:

   a. Diving Services, Construction Specification 402 – Diving Services (if utilized to verify existing conditions).

C. Bid Item 38 – Principal Spillway Guardrail

1) This item includes furnishing, fabricating, and installing guardrail for the principal spillway riser, including metal parts and fasteners as shown on the Drawings.

2) In Section 2 – Material, materials shall conform to the referenced Material Specifications and additional requirements specified below:

   a. Rails and Posts: Fabricate all guardrail top rails using 1-1/2in nominal DIA Schedule 40 galvanized steel pipe. Fabricate all guardrail vertical posts using 1-1/2in nominal DIA Schedule 80 pipe. All intermediate rails shall be fabricated using minimum 1-1/2in nominal DIA Schedule 40 pipe.

   b. Toe Boards: Toe Boards shall be ASTM A36.

   c. Anchor Bolts: Stainless steel meeting the requirements of ASTM F593, Grade 316 for depth shown on Drawings.

   d. Epoxy Grout for Anchor Bolts: as specified for Bid Item 36 - Stainless Steel Metalwork.

3) In Section 3 – Fabrication:

   a. Submit Shop Drawings showing dimension, components, layout, and fabrication requirements at least 21 calendar days prior to fabricating the materials.

   b. Before fabrication, check actual locations of walls and openings, and other construction to which railings must fit, by accurate field measurements. Show recorded measurements on Shop Drawings.

c. Remove blemishes by grinding and buffing or by welding and grinding, prior to cleaning, treating and application of surface finishes.

d. Where details are not indicated, set intermediate rails to requirements of the Building Code or OSHA, whichever requires the more restrictive design.

e. Provide ¼ x 4in high toe boards at elevated walkways and platforms, where indicated on the Drawings, or as required by OSHA Standards. Clearance between bottom of toe board and walking surface shall not exceed 1/4in.

f. Fit exposed ends of guardrails with solid terminations.

g. Design railing assembly, wall rails, and attachments to resist a concentrated lateral force of 200 lbs at any point, or a uniform load of 50 lbs per ft and a uniform load of 100plf vertical, without damage or permanent set.

h. Continuously seal non-bolted joined pieces in shop by continuous welds. Splice connectors shall be used in the field. No field welding will be permitted. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.

i. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

j. Accurately form components to suit steps and slopes.

k. Accommodate for expansion and contraction of members without damage to connections or members. Expansion joints shall be used at all concrete contraction joints.

l. Hot-dip galvanize after fabrication in accordance with MS 582. Provide air expansion vent holes for all closed sections.

m. All welding to be continuous in accordance with AWS D1.1. All welded railing joints shall have full penetration welds. All exposed welds shall be ground and buffed smooth and flush to match and blend with adjoining surfaces. No ragged edges, surface defects, or undercutting of adjoining surfaces will be acceptable.

4) In Section 4 – Erection:

a. Install components plumb and level, accurately fitted, free from distortion or defects.

b. Assemble with spigots and sleeves to accommodate tight joints and secure installation.

c. Anchor railing to concrete with minimum 1/2in stainless steel adhesive anchors with stainless steel bolts, nuts and washers unless noted overwise in the Contract documents.

d. Drill concrete, clean anchor hole, inject epoxy grout, and anchor bolt in accordance with manufacturer's recommendations.

e. Install grounding electrode.

5) In Section 6 – Measurement and Payment, Method 3 shall apply.

D. Bid Item 39 – Impact Basin Guardrail

1) This item includes furnishing, fabricating, and installing guardrail for the impact basin, including metal parts and fasteners as shown on the Drawings.

2) The requirements for Bid Item 38, Principal Spillway Riser Guardrail apply to this Bid Item.

3) In Section 6 – Measurement and Payment, Method 3 shall apply.

E. Bid Item 40 – Impact Basin Grating

1) This item includes furnishing, fabricating, and installing safety grating, including metal parts and fasteners as shown on the Drawings.

2) In Section 2 – Material, materials shall conform to the referenced Material Specifications and additional requirements specified below:

   a. Grating and support members shall be as indicated on the Drawings.

   b. Anchor Bolts: As indicated on the Drawings.

   c. Spacers: As indicated on the Drawings.

3) In Section 3 – Fabrication:

   a. Submit Shop Drawings showing dimension, components, layout, and fabrication requirements at least 21 calendar days prior to fabricating the materials.

   b. Before fabrication, check actual locations of walls and openings, and other construction to which railings must fit, by accurate field measurements. Show recorded measurements on Shop Drawings.

   c. Grating shall be completely banded.

4) In Section 4 – Erection:

   a. Install components plumb and level, accurately fitted, and free from distortion or defects.

   b. Drill concrete, clean anchor hole, and anchor bolt in accordance with manufacturer's recommendations.

5) In Section 6 – Measurement and Payment, Method 3 shall apply.

F. Bid Item 41– Principal Spillway Ladder

1) This item includes furnishing, fabricating, and erecting the Principal Spillway Ladder, including metal parts, fasteners, and accessories, as shown on the Drawings.

2) In Section 2 – Material, materials shall conform to the referenced Material Specifications and additional requirements specified below:

   a. Galvanized steel ladder members shall meet the requirements of ASTM A36.

   b. Stainless steel bolts, anchors, fasteners, and other mounting hardware shall meet the requirements of ASTM F593, Grade 304.

   c. All welding shall be in accordance with AWS D1.1.

   d. Epoxy Grout for Anchor Bolts: as specified for Bid Item 36 - Stainless Steel Metalwork.

   e. Fall Arrest System shall be the system shown on the Drawings or approved equal vertical rail style fall arrest system. Cable style systems are not acceptable.

3) In Section 3 – Fabrication:

   a. Submit Shop Drawings showing dimension, components, layout, and fabrication requirements at least 21 calendar days prior to fabricating the materials.

   b. Before fabrication, check actual locations of walls and openings, and other construction to which the ladder must fit, by accurate field measurements. Show recorded measurements on Shop Drawings.

4) In Section 4 – Erection, install epoxy anchors:

   a. Drill anchor holes. Hole size shall be determined by the Contractor in accordance with epoxy grout manufacturer's recommendations.

   b. Immediately after drilling, clean holes by flushing with compressed air and wire brush three times and in accordance with manufacture's recommendations. Plug hole tightly if not immediately installing anchor.

c. If the period between drilling and anchor installation exceeds 24-hrs, clean hole again by flushing with compressed air and wire brush. Holes shall be dry before setting anchors.

d. Final cleaning and anchor installation shall be performed under the observation of the COR. The Contractor shall provide the COR with 24-hours notice of the final cleaning and anchor installation.

e. Install anchors in accordance with manufacturer's recommendations.

f. Set anchors in each hole so that grout completely surrounds the dowel bar. Anchors shall not rest on the side of the hole.

g. Use extension tube and/or supplemental hose to start injection of epoxy grout from the bottom (back) of hole. Remove hose gradually while injecting epoxy to avoid creating air pockets.

5) In Item 5 – Protective Coatings, provide hot-dipped zinc coating in accordance with Material Specification 582 – Galvanization.

6) In Item 6 – Measurement and Payment, Method 3 shall apply.

7) Items subsidiary to this Bid Item include:

a. Diving Services, Construction Specification 402 – Diving Services (if utilized to verify existing conditions).

G. Subsidiary Item – Precast Seepage Collection Box Weirs

1) This item includes furnishing, fabricating, and erecting the V-notch weir and fasteners in each Precast Seepage Collection Boxes as shown on the Drawings.

2) In Section 2 – Material, materials shall conform to the referenced Material Specifications and additional requirements specified below:

a. Seepage Collection Box Weirs shall be Stainless Steel Grade 316 and shall meet the requirements of ASTM A276.

b. Stainless steel bolts, anchors, fasteners, and other mounting hardware shall meet the requirements of ASTM F593, Grade 304.

c. Epoxy Grout for Anchor Bolts: as specified for Bid Item 36 - Stainless Steel Metalwork.

3) In Section 3 – Fabrication:

a. Seepage Collection Box Weirs shall be machined to the dimensions shown on the Drawings.

b. Before fabrication, check actual locations of walls and openings, and other construction to which the Weirs must fit, by accurate field measurements. Show recorded measurements on Shop Drawings.

4) In Section 4 – Erection, install epoxy anchors:

a. Drill anchor holes. Hole size shall be determined by the Contractor in accordance with epoxy grout manufacturer's recommendations.

b. Immediately after drilling, clean holes by flushing with compressed air and wire brush three times and in accordance with manufacture's recommendations. Plug hole tightly if not immediately installing anchor.

c. If the period between drilling and anchor installation exceeds 24-hrs, clean hole again by flushing with compressed air and wire brush. Holes shall be dry before setting anchors.

d. Final cleaning and anchor installation shall be performed under the observation of the COR. The Contractor shall provide the COR with 24-hours notice of the final cleaning and anchor installation.

e. Install anchors in accordance with manufacturer's recommendations.

f. Set anchors in each hole so that grout completely surrounds the dowel bar. Anchors shall not rest on the side of the hole.

g. Use extension tube and/or supplemental hose to start injection of epoxy grout from the bottom (back) of hole. Remove hose gradually while injecting epoxy to avoid creating air pockets.

5) In Item 6 – Measurement and Payment, no separate payment will be made for Seepage Collection Box Weirs. Compensation for Seepage Collection Box Weirs will be included in the payment for Bid Item 28, Precast Seepage Collection Boxes, Construction Specification 45 – Plastic Pipe.

****End of Construction Specification 81****

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CONSTRUCTION SPECIFICATION 93—IDENTIFICATION MARKERS OR PLAQUES

1. Scope

The work consists of furnishing and installing identification markers or plaques at the designated locations.

2. Material

The markers or plaques shall be constructed of the specified material, and shall meet all requirements for lettering, painting, finishing, and related items as shown on the drawings or as specified in Section 6 of this specification.

3. Construction methods

The markers or plaques shall be installed at location(s) as shown on the drawings and in the manner or condition specified in Section 6.

4. Monuments

Unless otherwise specified, the markers or plaques shall be mounted on concrete monuments, on existing structures, or on structures proposed for installation under this contract.

5. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, payment for each type, kind, and size of marker or plaque complete in place is made at the contract unit price for that type, kind, and size. Such payment constitutes full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Method 2—For items of work for which specific lump sum prices are established in the contract, payment for identification markers or plaques is made at the contract lump sum price. Such payment constitutes full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

All methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 6 of this specification.

6. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Bid Item 42 – Staff Gauge, Principal Spillway Riser

1) This item includes furnishing, fabricating, and erecting the Staff Gauge for the Principal Spillway Riser as shown on the Drawings and specified herein.

2) In Section 2, Material:

   a. Staff Gauge for Principal Spillway Riser shall be Style "S" level gauge by Plasti-Fab or approved equal with dimensions and elevation ranges as shown on the Drawings. Numerals and other markings shall be black with a white background. Imperial numbers shall be as shown on the Drawings, with block lines in tenths of a foot.

   b. Staff Gauge shall be manufactured from corrosion resistant, composite, fiberglass reinforced plastic (FRP). The exterior surfaces shall be finished with premium grade gelcoat to protect against weathering and discoloration. Staff gauge surface shall be resin rich to a depth of 0.010 to 0.020 inches and reinforced with C-glass and/or polymeric fiber surfacing material. The resin and gelcoat shall be UV inhibited. The exterior surface shall be smooth to facilitate cleaning and maintenance.

   c. Anchor Bolts: The size and length of the mounting bolts for the gauge and foot markings shall be as recommended by the manufacturer, except that the material shall be Stainless Steel, ASTM F593/F594, Type 316. Rubber grommets shall be placed under the screw/bolt head, as recommended by the manufacturer.

   d. Epoxy for Anchor Bolts: Hilti HIT-RE-500-V3 or approved equal

3) In Section 3, Construction Methods:

   a. Install all Staff Gauges plum, level, and in accordance with manufacturer's instructions.

   b. Principal Spillway Riser Staff Gauge shall be installed such that elevation markers are tied to vertical survey control for this project.

4) In Section 5, Measurement and Payment, Method 2 shall apply.

B. Subsidiary Item – Staff Gauges, Precast Seepage Collection Boxes

1) This item includes furnishing, fabricating, and erecting the Precast Seepage Collection Box Staff Gauges as shown on the Drawings and specified herein.

2) In Section 2, Material:

   a. Staff Gauges for Precast Seepage Collection Boxes shall be Style "P" level gauge by Plasti-Fab or approved equal with dimensions as shown on the Drawings. Numerals and other markings shall be black with a white background. The staff gauges shall have a range from zero to 2.0 feet. Imperial numbers shall be as shown on the Drawings, with block lines in tenths of a foot.

   b. Staff Gauge shall be manufactured from corrosion resistant, composite, fiberglass reinforced plastic FRP. The exterior surfaces shall be finished with premium grade gelcoat to protect against weathering and discoloration. Staff gauge surface shall be resin rich to a depth of 0.010 to 0.020 inches and reinforced with C-glass and/or polymeric fiber surfacing material. The resin and gelcoat shall be UV inhibited. The exterior surface shall be smooth to facilitate cleaning and maintenance.

   c. Anchor Bolts: The size and length of the mounting bolts for the gauge and foot markings shall be as recommended by the manufacturer, except that the material shall be Stainless Steel, ASTM F593/F594, Type 316. Rubber grommets shall be placed under the screw/bolt head, as recommended by the manufacturer.

d. Epoxy for Anchor Bolts: Hilti HIT-RE-500-V3 or approved equal

3) In Section 3, Construction Methods:

   a. Install all Staff Gauges plum, level, and in accordance with manufacturer's instructions.

   b. Seepage Collection Boxes Staff Gauges shall be installed such that the zero reading on the gauge is level with the invert of the v-notch weir, to a tolerance of 1/16 inch.

4) In Section 5, Measurement and Payment, no separate measurement and payment will be made for Staff Gauges, Precast Seepage Collection Boxes. Compensation for Staff Gauges, Precast Seepage Collection Boxes will be included in the payment for Bid Item 28, Precast Seepage Collection Boxes, Construction Specification 45 – Plastic Pipe.

C. Bid Item 43 – Project Monument

1) This item consists of furnishing all labor, materials, and equipment required to install the project monument as shown on the Drawings. This item also includes preserving the existing plaque and re-installing the existing plaque with the new project monument as shown on the Drawings.

2) The new and existing plaques shall be installed on the concrete base at the location shown on the Drawings and shall read as shown on the Drawings. The Contractor shall prepare a detailed layout of the new plaque from the general layout shown on the Drawings and submit a proof to the COR for approval at least 21 days prior to casting.

3) In Section 2, Material,

   a. The new plaque shall be bronze alloy and shall be cast as one integral unit free of pits, holes, or other defects. Lettering and raised portions shall have a bright satin finish with a dark contrasting background. After rubbing, the plaque shall be thoroughly cleaned and lacquered.

   b. The Contractor shall furnish a material specification stating the types of metals and the proportions used in the bronze alloy at least 21 days prior to casting.

   c. The new plaque shall be cast to conform to the dimensions shown on the Drawings. The minimum thickness shall be ¼ inch. The letters, figures, and border shall be raised a minimum of 1/8 inch from the front face. The height of the letters and the line spacing shall be as shown on the drawings. The lettering font shall be Arial or other similarly styled font.

   d. Epoxy for Anchor Bolts: Hilti HIT-RE-500-V3 or approved equal

4) In Section 5, Measurement and Payment, Method 2 shall apply.

5) Items of work subsidiary to this Bid Item include:

   a. Miscellaneous Structure Concrete, Construction Specification 31 – Concrete for Major Structures

   b. Steel Reinforcement, Construction Specification 34 – Steel Reinforcement

****End of Construction Specification 93****

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CONSTRUCTION SPECIFICATION 94—CONTRACTOR QUALITY CONTROL

1. Scope

The work consists of developing, implementing, and maintaining a quality control system to ensure that the specified quality is achieved for all materials and work performed.

2. Equipment and materials

Equipment and material used for quality control shall be of the quality and condition required to meet the test specifications cited in the contract. Testing equipment shall be properly adjusted and calibrated at the start of operations and the calibration maintained at the frequency specified. Records of equipment calibration tests shall be available to the Engineer at all times. Equipment shall be operated and maintained by qualified operators as prescribed in the manufacturer's operating instructions, the references specified, and as specified in Section 10 of this specification. All equipment and materials used in performing quality control testing shall be as prescribed by the test standards referenced in the contract or in Section 10.

All equipment and materials shall be handled and operated in a safe and proper manner and shall comply with all applicable regulations pertaining to their use, operation, handling, storage, and transportation.

3. Quality control system

Method 1—The contractor shall develop, implement, and maintain a system of quality control to provide the specified material testing and verification of material quality before use. The system activities shall include procedures to verify adequacy of completed work, initiate corrective action to be taken, and document the final results. The identification of the quality control personnel and their duties and authorities shall be submitted to the contracting officer in writing within 15 calendar days after notice of award.

Method 2—The Contractor shall develop, implement, and maintain a system adequate to achieve the specified quality of all work performed, material incorporated, and equipment furnished before use. The system established shall be documented in a written plan developed by the Contractor and approved by the Contracting Officer. The system activities shall include the material testing and inspection needed to verify the adequacy of completed work and procedures to be followed when corrective action is required. Daily records to substantiate the conduct of the system shall be maintained by the Contractor. The quality control plan shall cover all aspects of quality control and shall address, as a minimum, all specified testing and inspection requirements. The plan provided shall be consistent with the planned performance in the Contractor's approved construction schedule. The plan shall identify the Contractor's onsite quality control manager and provide an organizational listing of all quality control personnel and their specific duties. The written plan shall be submitted to the Contracting Officer within 15 calendar days after notice of award. The Contractor shall not proceed with any construction activity that requires inspection until the written plan is approved by the Contracting Officer.

All methods—The quality control system shall include, but not be limited to, a rigorous examination of construction material, processes, and operation, including testing of material and examination of manufacturer's certifications as required, to verify that work meets contract requirements and is performed in a competent manner.

4. Quality control personnel

Method 1—Quality control activities shall be accomplished by competent personnel. A competent person is: One who is experienced and capable of identifying, evaluating, and documenting that materials and processes being used will result in work that complies with the contract; and, who has authority to take prompt action to remove, replace, or correct such work or products not in compliance. Off-site testing laboratories shall be certified or inspected by a nationally recognized entity. The Contractor shall submit to the Contracting Officer, for approval, laboratory certification or inspection information. The Contractor shall submit to the Contracting Officer, for approval, the names, qualifications, authorities, certifications,

and availability of the competent personnel who will perform the quality control activities.

Method 2—Quality control activities shall be accomplished by competent personnel who are separate and apart from line supervision and who report directly to management. A competent person is one who is experienced and capable of identifying, evaluating, and documenting that material and processes being used will result in work that complies with the contract, and who has authorization to take prompt action to remove, replace, or correct such work or products not in compliance. Offsite testing laboratories shall be certified or inspected by a nationally recognized entity. The Contractor shall submit to the Contracting Officer, for approval, laboratory certification or inspection information. The Contractor shall submit to the Contracting Officer, for approval, the names, qualifications, authorities, certifications, and availability of the competent personnel who will perform the quality control activities.

5. Post-award conference

The Contractor shall meet with the Contracting Officer before any work begins and discuss the Contractor's quality control system. The Contracting Officer and the Contractor shall develop a mutual understanding regarding the quality control system, including procedures for correcting quality control issues.

6. Records

The Contractor's quality control records shall document both acceptable and deficient features of the work and corrective actions taken. All records shall be on forms approved by the Contracting Officer, be legible, and be dated and signed by the competent person creating the record.

Unless otherwise specified in Section 10 of this specification, records shall include:

a. Documentation of shop drawings including date submitted to and date approved by the contracting officer, results of examinations, any need for changes or modifications, manufacturer's recommendations and certifications, if any, and signature of the authorized examiner.

b. Documentation of material delivered including quantity, storage location, and results of quality control examinations and tests.

c. Type, number, date, time, and name of individual performing quality control activities.

d. The material or item inspected and tested, the location and extent of such material or item, and a description of conditions observed and test results obtained during the quality control activity.

e. The determination that the material or item met the contract provisions and documentation that the Engineer was notified.

f. For deficient work, the nature of the defects, specifications not met, corrective action taken, and results of quality control activities on the corrected material or item.

7. Reporting results

The results of Contractor quality control inspections and tests shall be communicated to the Engineer immediately upon completion of the inspection or test. Unless otherwise specified in Section 10, the original plus one copy of all records, inspections, tests performed, and material testing reports shall be submitted to the Engineer within one working day of completion. The original plus one copy of documentation of material delivered shall be submitted to the Engineer before the material is used.

8. Access

The Contracting Officer and the Engineer shall be given free access to all testing equipment, facilities, sites, and related records for the duration of the contract.

9. Payment

Method 1—For items of work for which lump sum prices are established in the contract, payment is made

as the work proceeds, after presentation by the contractor of invoices showing related costs and evidence of charges by suppliers, subcontractors, and others for furnishing supplies and work performed. If the total of such payments is less than the lump sum contract price for this item, the remaining balance is included in the final contract payment. Payment of the lump sum contract price constitutes full compensation for completion of the work.

Payment is not made under this item for the purchase cost of material and equipment having a residual value.

Method 2—For items of work for which lump sum prices are established in the contract, payment is prorated and paid in equal amounts on each monthly estimate. The number of months used for prorating shall be the number estimated to complete the work. The final month's prorate amount is made with the final payment. Payment as described above constitutes full compensation for completion of the work.

Payment is not made under this item for the purchase cost of material and equipment having a residual value.

All methods—Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 10.

10. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Bid Item 44 – Construction Quality Control

1) This item consists of developing, implementing, and maintaining a quality control system to ensure that the specified quality is achieved for the following Bid Items, as required in individual specification sections, and in accordance with the requirements in this section. This item includes providing third-party construction materials testing, technician oversight, and documentation.

   a. Bid Item 3 – Trench Drain Abandonment

   b. Bid Item 9 – Stream Diversion

   c. Bid Item 10 – Embankment, Common Excavation and Bid Item 11 – Auxiliary Spillway, Common Excavation

   d. Bid Item 12 – Earthfill

   e. Bid Item 13 – Fine Drainfill

   f. Bid Item 14 – Coarse Drainfill

   g. Bid Item 17– Cast-in-Place Reinforced Concrete, Impact Basin

   h. Bid Item 18 – Cast-in-Place Reinforced Concrete, PSW Cradle

   i. Bid Item 19 – Cast-in-Place Reinforced Concrete, ASW Starter Wall

   j. Bid Item 20 – Cast-in-Place Reinforced Concrete, ASW Tailwater Weir and Baffle Blocks

   k. Bid Item 21 - Mudmat

   l. Bid Item 23 – Roller Compacted Concrete, Bid Item 24 – Furnishing and Handling Cementitious Material, Bid Item 25 – Roller Compacted Concrete Test Section

   m. Bid Item 26 – Principal Spillway Pipe Extension

   n. Bid Item 27 – Toe Drain Piping

   o. Bid Item 29 – ASW Drain Piping

   p. Bid Item 31 - Embankment Upstream Stability Berm

   q. Bid Item 34 - Installation of New Pond Drain Gate, Gate Stem, and Stem Guides

2) This item shall also include providing a laboratory building/trailer at the construction site for use by the Contractor's quality control personnel and the COR's quality assurance personnel. The laboratory shall be an insulated, watertight structure located adjacent to the RCC batch plant and shall have sufficient space for the Contractor's and COR's testing equipment. The Contractor shall provide a submittal of the proposed building geometry, concrete floor apron, utility locations, curing facilities, and list of all equipment needed to perform all quality control and quality assurance testing and to meet the Contract requirements within ASTM guidelines for COR approval prior to supplying all needed equipment. The building shall meet the following requirements and shall be removed in its entirety at the end of construction.

   a. A joint use building/trailer inside area shall be a minimum of 800 square feet, and the area designated for the COR shall be a minimum of 400 square feet. A separate building/trailer for COR use only requires a minimum of 400 square feet. The size of a separate building/trailer for Contractor use only is as Contractor determines necessary to perform Contractor's quality control.

   b. Clear ceiling height of 9 feet.

   c. One-man door (36 inches wide x 80 inches high) and one garage door (12 feet wide x 8 feet high).

d. Hard trowel finish concrete floor sloping into a 6-inch minimum drain located in the center of the floor.

e. One ventilation vent provided through the roof at a location approved by the COR.

f. High-speed hard-wired internet access within the laboratory connected to Testing Laboratory Office printer for the duration of the project.

g. Heating to maintain comfortable conditions between 70 and 75 degrees F.

h. Insulated water line with one spigot located on an interior wall and one freeze-proof spigot located on an exterior wall near the apron. Utility sink with water supply and drainage adequate to handle laboratory testing.

i. Lighted in accordance with applicable building codes.

j. Minimum of four 20-amp receptacles (having no more than two receptacles per 20-amp breaker) placed at locations approved by the COR.

k. Contractor shall provide transportation and disposal of discarded test specimens to a suitable disposal site on a weekly basis. Contractor shall provide a bin or dumpster for the sole purpose of collecting discarded test specimens.

l. Contractor shall provide necessary safety equipment including first aid kit, eye wash kit, and fire extinguisher at a minimum.

m. A concrete apron 20 feet by 8 feet wide by 6 inches thick shall be located adjacent to the laboratory building. This apron shall be covered with a watertight roof, and located in front of the garage door. Lighting shall be provided so that work can be conducted in and around the apron at night.

n. The Contractor shall provide a curing facility and any necessary accessories for initial cure of concrete and RCC cylinders as prescribed by ACI/ASTM to ensure proper temperatures and handling. The facility shall have sufficient capacity to handle approximately 150 6"x12" RCC cylinders plus the conventional concrete cylinders required for quality control testing by the Contractor. Power for automated temperature control and a high low thermometer shall be supplied and the cure box shall be large enough to handle cylinders generated by Contractor's QC testing. Any claim of improper initial curing of cylinders shall be the sole responsibility of the contractor and any test results of the concrete will be considered valid and appropriate for acceptance or rejection as called for in the contract.

o. Provide a minimum 200-lb block of concrete near or on the apron area for soil proctor molds to be performed on and meet the requirements of ASTM D698.

p. The Contractor shall furnish one electric forced air laboratory oven for the field office, such as Humboldt H-30125 or equal. The laboratory oven shall be thermostatically controlled with a readout thermometer, 115 volt, 1,500 watt (minimum), capable of maintaining a constant temperature of 110 (plus or minus 5) degrees Celsius throughout the drying chamber with a minimum chamber size of 2 cubic feet and at least 2 adjustable shelves.

3) The burden of proof that work performed meets contract requirements and has been performed in a workmanlike manner is the Contractor's. Quality assurance inspections and tests by the Government are for the sole benefit of the Government. The use of such words as "as approved by the COR" and words of like import in the specifications or drawings which refer to approval by the COR are considered to be a part of the Government's Quality Assurance program and do not relieve the Contractor in any part for the Contractor's quality control responsibilities as specified.

4) Quality control is defined as a rigorous examination and inspection of construction materials, processes and operations to verify that the work being performed meets contract

requirements and shall be performed by a qualified Inspector employed by or under contract to the Contractor.

5) All mention of inspection or Inspector is referring to work performed by the Contractor's quality control personnel unless otherwise noted.

6) The degree of quality control specified shall be defined as:

   a. Intermittent review or inspection is defined as the intermittent presence of the Inspector to observe construction operations and/or perform tests and take measurements as needed to determine and document that the work being performed complies with the specifications.

   b. Continuous inspection is defined as the continuous presence of the Inspector to observe one or more construction operations and/or perform tests and take measurements at critical points in the operation to determine and document that the work being performed complies with the specifications and to be immediately available for consultation in case of emergency or changes in work conditions.

7) In Section 3 – Quality Control System, Method 2 will apply, except that the written plan shall be submitted to the COR within 15 calendar days after notice of award.

8) The Contractor's quality control system shall be approved and operational before commencement of work. The Contractor's quality control personnel shall submit to the COR the on-site Inspector Daily Quality Control Reports, for each day the Contractor is on site performing work. Daily Quality Control Reports shall include photographs as outlined below, the results and locations of all tests performed, and corrective measures if any tests fail.

9) Revisions to the Contractor's quality control system may be required during the course of the Work based on observed field conditions, contract modifications, or requests by the COR.

10) Quality control tests shall be conducted in accordance with the standard test methods identified in the specifications or construction drawings. The Contractor shall provide all equipment required to perform all quality control and quality assurance tests. Testing equipment shall meet the requirements as specified by ASTM test methods and be properly calibrated and serviced.

11) The Contractor's quality control system shall include, but is not limited to, the following minimum requirements. Provide continuous and/or intermittent inspection(s) for each of the items identified listed below. Provide additional inspection, testing and support personnel as needed, particularly during periods of concurrent construction activities that require continuous inspection. Any item of work not listed below shall be performed or constructed as shown on the drawings and as specified in the construction and material specifications.

    a. The Contractor's inspection on all items not listed in below shall consist of periodic review of those items to assure that all contract specifications are being met and that the items are being properly installed or carried out.

    b. Clearing and Grubbing - Intermittent inspection of removal methods to assure prevention of damage to adjacent property, utilities, trees not marked for removal, and other improvements. Inspection of subgrades to determine that all roots, stumps, and other woody debris have been removed from the foundation area. Inspection of disposal to assure that burning meets specified time and weather conditions and that burial of materials is within authorized areas and meets minimum cover requirements.

c. Structure Removal - Intermittent inspection to verify that: structures are removed to the specified depth and extent; care is taken in removing materials to be salvaged; salvaged materials are placed as specified; and refuse material is disposed of as specified.

d. Pollution Control - Intermittent inspection of the installation, operation, and maintenance of all pollution control measures throughout the term of the contract to assure compliance with all specified conditions. Inspection of the condition and need for repairs shall be made after each significant runoff event.

e. Seeding, Sprigging, and Mulching - Inspection prior to application of any materials to verify that: the work is within specified dates; the finish of the work area is suitable for application of protective cover; all seed is of the specified varieties and meets the requirements of state law as to germination, purity, testing dates, and each container is tagged; lime and fertilizer meet the specified requirements and material certifications are on hand; mulch is of the specified type and quality and weight tickets or other means of determining weight of mulch are provided. Continuous inspection shall be provided during application of the work to verify that: the seedbed is prepared as specified; lime, fertilizer, seed and mulch are applied at the specified rates and incorporated as specified. Seed tags, weight tickets, and certifications shall be provided to the COR for all materials incorporated in the work.

f. Construction Surveys - Inspection to verify that: all surveys are performed in a timely manner and to the specified accuracy; records of surveys are maintained in accordance with the specifications; staking and marking of surveys is in accordance with specifications.

g. Removal of Water - Intermittent inspection of stream flow, cofferdam, the dewatering of the foundation areas, and dewatering of the reservoir to verify compliance with specifications and approved plans and that no adverse effects are occurring.

h. Excavation - Intermittent inspection to verify that: all excavation is performed as specified and meets the required lines and grades; all materials selected for use in earthfill are free of undesirable materials and are placed in designated stockpile areas; stockpile areas are graded and drained.

i. Earthfill - Continuous inspection during placement and testing in accordance with Construction Specification 23, Earthfill.

j. Drainfill - Verification that the materials are obtained from an approved source. Continuous inspection during placement and testing in accordance with Construction Specification 24, Drainfill.

k. Topsoil - Intermittent inspection to verify that the topsoil is obtained from the specified source, is placed to the specified thickness, and is compacted as specified.

l. Concrete - Continuous inspection during placement and testing in accordance with Construction Specification 31, Concrete for Major Structures.

m. Roller Compacted Concrete – Continuous inspection during placement and testing in accordance with Construction Specification 36, Roller Compacted Concrete.

n. Steel Reinforcement - Inspection to verify that the reinforcement is: of the specified quality; clean; and is placed in accordance with the drawings as to the specified size, shape, spacing and cover, and location.

o. Pipes - Inspection to verify that the pipe is of the specified quality and size, and joints are as specified. Continuous inspection during pipe installation to verify placement to lines and grades and connection in accordance with plans and specifications. Camera inspection as specified in Construction Specification 45, Plastic Pipe.

p. Metalwork - Inspection to verify that the metalwork is of the specified quality, materials, and is placed in accordance with the drawings. Confirm that bolts and embedded items are properly installed and tightened to appropriate torque.

q. Slide Gates - Inspection to verify that the slide gate is of the specified quality, materials, and is placed in accordance with the drawings. Confirm that bolts and fasteners are properly installed and tightened to appropriate torque. Confirm smooth operation of the installed gate and proper adjustment of wedges and stem guides. See Construction Specification 71 for additional requirements.

r. Geotextile - Quality control shall consist of continuous inspection during installation of the geotextile. The Inspector shall determine and document that the geotextile complies with the specifications, that the subgrade has been excavated and smoothed to grade, that the geotextile is installed in accordance with the plans and specifications, and that the geotextile is not punctured, damaged or caked with mud during installation.

s. Rock Riprap and Riprap Bedding - Inspection to verify that: the rock riprap and riprap bedding are obtained from an approved source; they meet the quality requirements; the gradations furnished meets the specified limits; segregation of particle sizes has not occurred during delivery and placement. Continuous inspection during placing of rock riprap and riprap bedding to verify placement to the lines and thickness specified and that rock is free of contamination. Maintain records of approximate placement locations for each workday (station, offset, elevation, etc.).

12) In Section 4 – Quality Control Personnel, Method 2 will apply.

a. Requirements for Contractor Quality Control Personnel also apply to subcontractors.

b. Approved Quality Control Personnel cannot be changed without written approval of the COR.

13) The Contractor's Quality Control Supervisor shall meet and/or possess the following minimum requirements for knowledge, abilities and experience:

a. Knowledge of construction staking and grade control and have the ability to interpret survey notes and prepare quantity computations.

b. Documentation of previous job experience will be required.

c. Must have knowledge of form construction and bracing for construction of concrete structures

d. Knowledge of sampling of soils, and determination of density of in place soils.

e. Knowledge of checking placement of steel reinforcement and have the ability to interpret steel requirements and placement details from construction drawings.

f. Knowledge of soils and earthwork, including foundations and soil classifications.

g. Must have knowledge and a minimum of 5 years of experience in Roller Compacted Concrete (RCC) production and construction as well as quality control testing of RCC in accordance with Specification 36 – Roller Compacted Concrete.

h. Must have knowledge of pipe construction and proper treatment of pipe joints for water-tightness.

i. Ability to maintain adequate files and records of construction inspection

j. Have a minimum of 5 years of experience related to construction inspection.

k. Personnel performing tests of fresh concrete and preparing test cylinders shall have certification from the American Concrete Institute (ACI) as a Concrete Field Technician and furnish a copy of the certification to the COR.

l. Personnel performing laboratory tests shall have certification from the American Concrete Institute (ACI) as a Concrete Laboratory Testing Technician.

m. Must have the ability to maintain communications with the landowners, the COR and the Contractor.

n. Quality Control Supervisor shall also be responsible for maintaining a record of progress with photographs. Construction activities shall be documented with 3 megapixels or greater digital photography in a JPEG file format. Photographs of daily construction work, problems encountered, and unique construction practices shall be taken to ensure full coverage of all work performed. The photographs shall be numbered, date and time imprinted and indexed with documentation explaining construction activities shown, and must be submitted with the request for final payment.

14) The skills, knowledge, abilities and experience needed by the Contractor's quality control personnel to perform the quality control shall be as follows:

a. Must have the ability to maintain communications with the Quality Control Supervisor.

b. Knowledge of cut and grade staking and earthwork installations.

c. Knowledge of form construction and bracing for construction of concrete structures.

d. Knowledge of soils, including foundation conditions, density and classifications.

e. Knowledge of sampling of soils and determination of density of in-place soils.

f. Knowledge of sampling RCC and the bedding mix, as well as placing, moisture determination, gradation, compacting and determination of the density of the RCC. They should also be knowledgeable in curing and surface treating of RCC.

g. Knowledge of checking placement of steel reinforcement and have the ability to interpret steel requirements and placement details from construction drawings.

h. When applicable, must have knowledge of acceptable moisture-density test methods and the ability to satisfactorily perform the tests.

i. Knowledge of sampling, testing, and curing fresh concrete and the ability to satisfactorily perform the tests.

j. Knowledge of curing and testing hardened concrete and the ability to satisfactorily perform the tests.

k. Knowledge of pipe construction and proper treatment of pipe joints for water-tightness.

l. Have the ability to interpret survey notes and to prepare quantity computations.

m. Have the ability to maintain adequate files and records of construction inspection work.

n. Have the ability to interpret construction drawings and specifications.

o. Must have knowledge of the United Soil Classification System and the ability to interpret soil classification requirements from the construction drawings.

15) Quality control personnel shall be responsible for maintaining a record of progress with photographs. Construction activities shall be documented with 3 megapixels or greater digital photography in a JPEG file format. Photographs of daily construction work, problems encountered, and unique construction practices shall be taken to ensure full coverage of all

work performed. The photographs shall be numbered, date and time imprinted, and indexed with documentation explaining construction activities shown, and must be submitted with the request for final payment.

16) In Section 9 – Payment, Method 2 shall apply.

****End of Construction Specification 94****

CONSTRUCTION SPECIFICATION 95—GEOTEXTILE

1. Scope

This work consists of furnishing all material, equipment, and labor necessary for the installation of geotextiles.

2. Quality

Geotextiles shall conform to the requirements of Material Specification 592 and this specification.

3. Storage

Before use, the geotextile shall be stored in a clean, dry location out of direct sunlight, not subject to extremes of either hot or cold temperatures, and with the manufacturer's protective cover undisturbed. Receiving, storage, and handling at the job site shall be in accordance with the requirements listed in ASTM D 4873.

4. Surface preparation

The surface on which the geotextile is to be placed shall be graded to the neat lines and grades as shown on the drawings. It shall be reasonably smooth and free of loose rock and clods, holes, depressions, projections, muddy conditions, and standing or flowing water (unless otherwise specified in Section 7 of this specification).

5. Placement

Before the geotextile is placed, the soil surface will be reviewed for quality assurance of the design and construction. The geotextile shall be placed on the approved prepared surface at the locations and in accordance with the details shown on the drawings and specified in Section 7 of this specification. It shall be unrolled along the placement area and loosely laid, without stretching, in such a manner that it conforms to the surface irregularities when material or gabions are placed on or against it. The geotextile may be folded and overlapped to permit proper placement in designated area(s).

Method 1—The geotextile shall be joined by machine sewing using thread material meeting the chemical requirements for the geotextile fibers or yarn. Thread shall be polypropylene, polyester, or Kevlar™ aramid thread, unless a specific thread type is specified. The thread shall consist of two parallel stitched rows at a spacing of about 1 inch and shall not cross (except for any required re-stitching). The stitching shall be a lock-type stitch. Each row of stitching shall be located a minimum of 2 inches from the geotextile edge. Unless otherwise specified, the seam tensile strength as measured according to ASTM D4884 shall be a minimum of 90 percent of the geotextile tensile strength in the weakest principal direction as measured according to ASTM D4632.

The geotextile shall be temporarily secured during placement of overlying material to prevent slippage, folding, wrinkling, or other displacement of the geotextile. Unless otherwise specified, methods of securing shall not cause punctures, tears, or other openings to be formed in the geotextile.

Method 2—The geotextile shall be joined by overlapping a minimum of 18 inches (unless otherwise specified) and secured against the underlying foundation material. Securing pins, approved and provided by the geotextile manufacturer, shall be placed along the edge of the panel or roll material to adequately hold it in place during installation. Pins shall be steel or fiberglass formed as a **U**, **L**, or **T** shape or contain "ears" to prevent total penetration through the geotextile. Steel washers shall be provided on all but the U-shaped pins. The upstream or upslope geotextile shall overlap the abutting downslope geotextile. At vertical laps, securing pins shall be inserted through the bottom layers along a line through approximately the mid-point of the overlap. At horizontal laps and across slope labs, securing shall be inserted through the bottom layer only. Securing pins shall be placed along a line about 2 inches in from the edge of the placed geotextile at intervals not to exceed 12 feet unless otherwise specified. Additional pins shall be installed as necessary and where appropriate to prevent any undue slippage or movement of the

geotextile. The use of securing pins will be held to the minimum necessary. Pins are to remain in place unless otherwise specified.

Should the geotextile be torn or punctured, or the overlaps or sewn joint disturbed, as evidenced by visible geotextile damage, subgrade pumping, intrusion, or grade distortion, the backfill around the damaged or displaced area shall be removed and restored to the original approved condition. The repair shall consist of a patch of the same type of geotextile being used and overlaying the existing geotextile. When the geotextile seams are required to be sewn, the overlay patch shall extend a minimum of 1 foot beyond the edge of any damaged area and joined by sewing as required for the original geotextile except that the sewing shall be a minimum of 6 inches from the edge of the damaged geotextile. Geotextile panels joined by overlap shall have the patch extend a minimum of 2 feet from the edge of any damaged area.

Geotextile shall be placed in accordance with the following applicable specification according to the use indicated in Section 7:

Slope protection—The geotextile shall not be placed until it can be anchored and protected with the specified covering within 48 hours or protected from exposure to ultraviolet light. In no case shall material be dropped on uncovered geotextile from a height of more than 3 feet.

Subsurface drains—The geotextile shall not be placed until drainfill or other material can be used to provide cover within the same working day. Drainfill material shall be placed in a manner that prevents damage to the geotextile. In no case shall material be dropped on uncovered geotextile from a height of more than 5 feet.

Road stabilization—The geotextile shall be unrolled in a direction parallel to the roadway centerline in a loose manner permitting conformation to the surface irregularities when the roadway fill material is placed on its surface. In no case shall material be dropped on uncovered geotextile from a height of more than 5 feet. Unless otherwise specified, the minimum overlap of geotextile panels joined without sewing shall be 24 inches. The geotextile may be temporarily secured with pins recommended or provided by the manufacturer, but they shall be removed before the permanent covering material is placed.

6. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, the quantity of geotextile for each type placed within the specified limits is determined to the nearest specified unit by measurements of the covered surfaces only, disregarding that required for anchorage, seams, and overlaps. Payment is made at the contract unit price. Such payment constitutes full compensation for the completion of the work.

Method 2—For items of work for which specific unit prices are established in the contract, the quantity of geotextile for each type placed with the specified limits is determined to the nearest specified unit by computing the area of the actual roll size or partial roll size installed. The computed area will include the amount required for overlap, seams, and anchorage as specified. Payment is made at the contract unit price. Such payment constitutes full compensation for the completion of the work.

Method 3—For items of work for which specific lump sum prices are established in the contract, the quantity of geotextile is not measured for payment. Payment for geotextiles is made at the contract lump sum price and constitutes full compensation for the completion of the work.

All methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

7. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Subsidiary Item – Geotextile

1) This item consists of furnishing all material, equipment, and labor necessary for the installation of geotextiles as shown on the Drawings. Geotextiles shall be installed on top of aggregates for earthwork in the Auxiliary Spillway, except where mudmat is shown.

2) Submit manufacturer's product data to the COR for approval.

3) In Section 2 – Quality, materials shall conform to the referenced Material Specifications and additional requirement specified below:

   a. Geotextile: Nonwoven needle-punched Class IV geotextile shall be used. Heat-bonded and resin-bonded geotextiles are not acceptable. The Apparent Opening Size shall be a minimum of 0.150 mm (or #100 sieve).

4) In Section 5 – Placement, Method 2 will apply.

   a. No riprap, bedding, or RCC shall be dropped on geotextile from a height greater than three (3) feet. No other material shall be dropped on uncovered geotextile.

   b. The geotextile shall be placed immediately prior to the placement of the rock riprap, bedding, or RCC. The placement of the geotextile shall be approved by the COR before rock riprap, bedding, or RCC is installed.

5) In Section 6 – Measurement and Payment, no separate payment will be made for geotextile. Compensation for geotextile will be included in the payment under:

   a. Bid Item 7, Mobilization and Demobilization, Construction Specification 8 – Mobilization and Demobilization

   b. Bid Item 23, Roller Compacted Concrete, Construction Specification 36 – Roller Compacted Concrete

   c. Bid Item 30, Rock Riprap, PSW Outlet and ASW Entrance, Construction Specification 61 – Rock Riprap

   d. Bid Item 31, Embankment Upstream Stability Berm, Construction Specification 61 – Rock Riprap

****End of Construction Specification 95****

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CONSTRUCTION SPECIFICATION 96—FIELD OFFICE

1. Scope

This work shall consist of furnishing and maintaining a field office for the exclusive use of the Engineer and other employees of the owner.

2. Logistics

The approximate location of the office shall be as shown on the drawings. Office space provided under this contract item shall be separated from any space used by the Contractor for other purposes.

The field office and appurtenances shall be set up, equipped, and made ready for use within 20 days of the receipt of the written Notice to Proceed, unless otherwise specified in Section 5. The field office and appurtenances shall remain the property of the Contractor and shall be maintained in good condition and appearance until completion of the contract work.

When a mobile field office facility is furnished, it shall be leveled, blocked, and anchored in accordance with Standard A 225.1 of Manufactured Home Installations, 1987 of the National Conference of States on Building Codes and Standards, Inc., or the requirements of the local government that has jurisdiction.

The Contractor shall install, provide, and maintain all utilities except telephone service as outlined in Section 5. Contractor shall provide access to the telephone company and authorization for the installation of telephone service for the use of NRCS and their agents. Utility service maintenance may include heating fuel, electricity, water, and sewer. Contractor shall provide a sanitary facility (toilet) in accordance with the minimum OSHA Safety and Health Requirements for use by NRCS and their agents (see table 96–1, footnote 1).

The Contractor shall provide and maintain a reasonable access road to the field office location together with parking for a minimum of four vehicles in the proximity of the field office site.

Upon completion and acceptance of the project work, the Contractor shall remove the field office from the project site and, unless otherwise directed, shall restore all areas affected by the field office installation, including the entrance road and parking areas, to a condition equal to or better than existed before installation of the field office.

3. Materials and furnishings

The Contractor shall furnish all materials and furnishings as set forth below:

a. Provide the type of field office as specified in Section 5 of this specification.

b. The field office shall include, or possess as a minimum, the features shown below and as specified in table 96–1 for the office type specified:

   (1) Be provided with all items in a clean, usable condition.

   (2) Be structurally sound, entirely enclosed, secure, and waterproof.

   (3) Have a ceiling height of not less than 7 feet.

   (4) Be attractively painted on the outside with a finished interior.

   (5) Be provided with two exterior doors except type C office shall have one door. The doors shall be equipped with dead-bolt type cylinder locks, including four keys for each lock. Exterior lock and hasps, or equivalent, shall also be provided for each door.

   (6) Windows shall be equipped with screens and with provisions for opening and closing. Latches or other approved locking provisions to secure the windows shall be provided.

   (7) Window blinds shall be available and provided for all windows.

   (8) Be provided with adequate artificial lighting to provide an average of 50 candlepower to all

work areas within the office. Overhead lamps for each desk and drafting table shall be provided. Electric service shall be continuous for the period the field office is being used to service this contract. Electric lights and power service shall be supplied with at least four grounded duplex convenience outlets installed in each room.

(9) Be provided with an approved heating system capable of maintaining a temperature of at least 70 degrees Fahrenheit throughout the office during the periods of cold weather that can be expected to occur during the construction period.

(10) Be provided with an approved air conditioner(s) with a minimum capacity of 15,000 BTUs for each office room.

(11) Be provided with an electric or gas water heater with a 5-gallon minimum capacity.

c. The field office shall be furnished with the following listed minimum equipment in good condition and as specified in table 96–1:

(1) Desk(s) shall have a minimum of two drawers on each side and have minimum surface dimension of 30 inches by 60 inches. A standard office chair with arm rests and casters shall be provided with each desk.

(2) A slant-top adjustable height drafting table, with approximate dimensions of 36 inches wide by 60 inches long and a 36-inch height, and an adjustable height drafting stool.

(3) Work table with the approximate dimensions of 30 inches wide by 60 inches long and 30 inches high, a portable meeting table with approximate dimensions of 36 inches wide by 72 inches long and 30 inches high, and at least six folding or stacking office chairs.

(4) Closets with a minimum clear height of 7 feet and approximately 24 inches by 30 inches equipped with two adjustable and removable shelves.

(5) Bookcases or built-in shelving equivalent to five 4-foot-long shelves, each 10-inches wide and 12-inches high, suitably located to reflect an office environment.

(6) One two-burner propane or natural gas stove or electric grill that can accommodate two 12-inch diameter pans. Heating capacity shall be adequate to remove soil moisture to meet the requirements of the ASTM quick-dry method.

(7) Underwriters Laboratory approved wall-mounted fire extinguisher with a minimum rating of 10 ABC.

(8) Minimum of one 16-unit first aid kit approved or certified by the American Red Cross or equivalent.

(9) Four-drawer, locking, fireproof metal file cabinet with two keys provided.

(10) Electrical refrigerated cold water drinking equipment supplied with potable drinking water and disposable cups for the duration of the contract.

(11) Racks for hanging drawings, together with holders or clamps, to accommodate 24- by 36-inch maximum size sheets.

(12) Nonskid steps and landing platform with safety handrail for each entrance.

(13) One inside and usable sanitary facility (flush type) located within a private room.

(14) One utility sink approximately 24 inches by 24 inches equipped with hot and cold running water.

(15) One microwave oven with specifications as listed in footnote 2 to table 96–1.

d. Before mobilizing and setting up the field office, the Contractor shall prepare and submit detailed plans of the office to the Engineer.

e. The Contractor shall provide access to the engineer for visual verification that the office and equipment meet contract requirements before mobilizing the field office to the work site.

4. Payment

This item is not measured, but is paid at the contract lump sum price established for this bid item in the contract, including mobilization and demobilization. The following progress payment schedule applies unless other provisions are outlined in Section 5 of this specification:

- 40 percent of the lump sum price bid will be payable for the first monthly progress payment following satisfactory delivery and setup complete with full service installed.
- 20 percent of payment will be retained to cover the removal of service and demobilization following completion of the work and will be included in the final payment.
- 40 percent remaining will be prorated over the balance of the contract in accordance with the planned construction schedule.

Payment as described herein is full compensation for all labor, material, supplies, equipment, rental fees, utility charges (excluding telephone service charges), and incidentals required to provide, equip, maintain, insure, and cleanup the site following demobilization of the field office unit.

Table 96–1 Equipment for field office types

Equipment	Field office type		
	A	B	C
Floor space (ft^2)	480 (2 rooms)	360 (2 rooms)	120 (1 room)
Window space (ft^2)	66	50	30
Air conditioning	Yes	Yes	Yes
Desk and chair	3	2	1
Rack for drawings	1	1	---
Work tables	2	1	1
Meeting table	1	1	---
Drafting table and stool	2	1	---
4-drawer file (D label) metal file cabinet	2	1	---
Folding/office chairs	10	8	4
Electric water cooler	1	1	1
Inside sanitary facility	1 1/	1 1/	1 1/
Oven, microwave	1 2/	1 2/	---
Cupboards, closets, etc.	3/	3/	3/
2-burner stove	1	1	---
Fire extinguisher	1	1	1
First aid kit (16 unit)	1	1	1
Utility sink	1	1	---
Window blinds	Yes	Yes	No
Electrical service	Yes	Yes	4/
Desk and table lamps	Yes	Yes	No

1/ Exterior self-contained sanitary facilities within 100 feet of the office with maintenance service is an option.

2/ A variable power microwave oven with minimum inside dimensions of 12 inch by 10 inch by 10 inch. The maximum power setting on the microwave oven shall operate at approximately 650 watts. The microwave oven shall have at least one power setting that operates at between 300 and 400 watts.

3/ Reasonable number for the size of the office.

4/ A generator to provide electric service for heating, lighting, and calculators is sufficient. Contractor is responsible for maintenance, fuel supplies, and service.

5. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Bid Item 45 – Field Office

1) This item includes furnishing and maintaining one (1) Type B field office in accordance with Table 96-1 for the exclusive use of the COR and other employees of the Government separate from the Contractor's office space.

2) In Section 2 – Logistics, provide the field office in an acceptable staging area identified by the COR. The Contractor shall provide, install, and maintain utilities that include cellular phone service, high-speed internet service with WiFi, electricity, heating, air conditioning, and water. The Contractor shall make every reasonable effort to provide reliable cell phone service at the site, including, but not limited to, providing, installing, and maintaining an appropriately sized cell phone signal booster(s) at the field office. If cell phone service is not consistently reliable after every reasonable effort by the Contractor, the Contractor shall provide a satellite phone for the sole purpose of contacting emergency responders if necessary.

3) In Section 3 – Materials and Furnishing:

   a. The requirements for propane or natural gas stove or electric grill are waived.

   b. Provide a mini-refrigerator.

   c. The Contractor shall be responsible for housekeeping of the COR's field office and shall provide and pay for weekly janitorial services for the duration of the project. Provide required sanitary facility supplies, including but not limited to soap, toilet paper, and paper towels, as needed.

   d. In addition to the first aid kit called for in Paragraph 3.C.8 of this specification, the Contractor shall provide a first responder bag and automated external defibrillator (AED) at the start of the project to be kept in the field office. The AED shall be a Defibtech Lifeline with 5-year warranty, 2 sets of adult pads, 5-year battery, fast responder kit, and slim soft carrying case or approved equal. The first responder bag shall be soft-sided and contain a minimum of 150 pieces of general first aid oriented towards supporting a construction site.

   e. The Contractor shall furnish and install electrical service to the COR's field office. The electrical service shall be a minimum of 110-120 volt, 60 amp, and alternating current. The Contractor shall be responsible for supply of power to the COR's field office throughout the contract period. If a portable generator is used to supply electrical power, the Contractor shall be responsible for the complete operation and maintenance of the generator. The generator shall remain in an operating condition 24 hours per day and shall be located a minimum of 100 feet from the field office and shielded so as to minimize the noise in the field office and adjacent residences.

   f. The COR's field office shall also be equipped with a wireless weather station capable of providing real-time air temperature, rainfall amount, wind speed, humidity levels, and other pertinent items. The weather station shall be Davis Vantage Pro2 or approved equivalent. The location of the weather station shall be approved by the COR prior to installation.

   g. The Contractor shall be responsible for providing delivery of bottled water, office supplies, and a coffee maker with coffee, sugar, and powdered creamer to the field office as needed.

   h. The Contractor shall be responsible for providing a printer for the exclusive use of the COR. The printer shall be network ready for use as a network printer with scanning capabilities. The printer shall be capable of copying on 8 1/2" × 11", 8 1/2" × 14", and 11" × 17" size paper. The printer shall have collating capability. The Contractor shall furnish all necessary toners, chemicals, or other materials required for proper operation of the printer for the duration of the project.

i. The Contractor shall provide outside lighting near the entrance to the field office from dusk to dawn.

j. The Contractor shall provide an exterior project identification sign near the proximity of the field office. Sign shall be in color and display Project name, Contractor's name and logo, COR's representative name and logo, USDA-NRCS logo, and Project Sponsors' names and logos. The maximum size of sign shall be four feet by eight feet. Sign shall be durable, weatherproof, and suitable for long-term exposure to sunlight for the duration of the Project. Sign layout, including text and graphics, and location shall be approved by the COR prior to erection.

k. The Contractor shall provide cameras for real-time remote monitoring of construction activities and meeting the following requirements:

   i. Cameras shall be EarthCam Model ECCS09200 Mobile Trailercam, or approved equal.

   ii. The cameras shall be a trailer-mounted design to allow relocation of the cameras during construction.

   iii. Mobile camera system shall include a mast to allow camera mounting height of 30 feet.

   iv. Camera system shall include a battery system as specified by the camera manufacturer. The battery system shall be rechargeable by solar panels.

   v. Cameras shall be housed in NEMA-6P and IP67 weather-resistant domed enclosures pressurized to 8 psig, or as specified by camera manufacturer. Camera enclosures shall have solid state internal temperature, pressure, and dew point sensors for enclosure environmental status monitoring.

   vi. Cameras shall have 360-degree continuous pan and +2 degree to -92 degree tilt.

   vii. Cameras and weather-resistant enclosure shall have an operational temperature range of -40 degrees F to +122 degrees F.

   viii. Cameras shall have the ability to take digital still images, as well as live video.

   ix. Cameras shall transmit digital still images and videos using line-of-site radio links to a base station located at the site construction trailers. If cellular service is consistently reliable, units can be operated using cellular data and do not need a base station.

   x. The image and video content shall be sent to a secure, password-protected website. The website shall feature an interface and online software provided by the camera system supplier. Contractor shall be responsible for all costs associated with setup, operation, software subscriptions, and user fees associated with this system. Contractor shall pay these costs until the end of construction and as directed by the COR.

   xi. The secure website shall provide capable viewing of live video and allow robotic pan, tilt, and zoom control of the camera systems.

   xii. Provide access to the website to all users requested by COR.

   xiii. Contractor is responsible for moving the camera around the site as requested by the COR.

   xiv. Contractor shall provide the cameras from the Trailercams to the Government at completion of the project. Trailercams, with cameras removed, shall be removed from the site at the end of construction.

****End of Construction Specification 96****

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CONSTRUCTION SPECIFICATION 97—GEOMEMBRANE LINER

1. Scope

The work consists of furnishing and installing a geomembrane liner, including appurtenances, cover soil, and concrete pads.

2. Material

The liner, welding rod, vent covers, pipe boots, gaskets, metal battens, clamps, bolts, embed channel, adhesive, and sealant shall conform to the requirements of Material Specification 594, the applicable provisions in this specification, and details as shown on the drawings.

3. Shipping and storage

Liner material shall be delivered, handled, and stored according to the manufacturer's recommendations. Liner material shall be stored and protected from puncture, dirt, grease, excessive heat, exposure to ultraviolet radiation, or other damage.

Damaged liner material shall be repaired or replaced. Liner material that cannot be satisfactorily repaired to comply with the requirements of Material Specification 594 shall be removed from the job site.

4. Subgrade preparation

Subgrade soils shall be compacted to provide a smooth, firm, and unyielding foundation. All subgrade surfaces shall be free of organic material, rocks larger than 3/8 inch, angular rocks, or other sharp objects. Surface deformations shall not exceed 1 inch. Standing water, mud, and snow shall be removed prior to liner placement.

The liner shall not be placed until the subgrade has been approved by the engineer.

5. Anchor trench

The anchor trench provides permanent anchoring for the liner and shall be constructed in accordance with the drawings. The trench corners shall be slightly rounded to prevent sharp bends in the liner.

If sloughing of the trench occurs, the sloughed soils shall be removed and necessary repairs shall be made to provide a smooth trench wall. Standing water, mud, and snow shall be removed prior to liner placement and trench backfill.

Soil material used for backfilling the trench shall meet the requirements specified in section 4 of this specification. The trench shall be backfilled in two equal lifts and compacted by rolling with rubber-tired equipment or manually directed compaction equipment.

6. Liner placement

The liner shall be installed with a minimum of handling by using a spreader bar assembly attached to a front-end loader, track-hoe bucket, or by other methods recommended by the liner manufacturer. The liner shall be placed parallel to the direction of maximum slope. During installation, the liner shall be secured with sandbags to protect it from wind uplift forces. The liner shall be seamed and secured by the end of each workday.

Construction equipment shall not be allowed to operate directly on the liner except for all terrain vehicles that produce ground pressure less than 5 pounds per square inch.

The liner shall not be placed during foggy conditions, precipitation events, or in the presence of excessive winds. High-Density Polyethylene (HDPE) and Linear Low-Density Polyethylene (LLDPE) liners shall not be placed when the temperature is less than 50 degrees Fahrenheit. Polypropylene (PP) liners shall not be placed when the temperature is less than 40 degrees Fahrenheit. Polyvinyl Chloride (PVC) liners shall not be placed when the temperature is less than 40 degrees Fahrenheit or greater than 105 degrees Fahrenheit. Ethylene Propylene Diene Monomer (EPDM) liners shall not be placed when the temperature is less than zero degrees Fahrenheit or greater than 120 degrees Fahrenheit.

The liner shall be loosely laid over the subgrade with sufficient slack to accommodate thermal expansion and contraction. Each panel shall be laid out and positioned to minimize the number and length of liner seams and in accordance with the manufacturer's recommendations. The methods used to place panels shall minimize wrinkles especially along field seams. Wrinkles shall not exceed 6 inches in height or "fold over" during soil cover placement or other load application. When specified in section 16 of this specification or recommended by the manufacturer, a geosynthetic rub sheet shall be used under the liner when dragging or moving the panels.

Seam overlap—Liner panels shall have a minimum seam overlap of 4 inches for hot wedge welding, hot air welding, chemical fusion welding, adhesive seams, inseam tape, and cover strip seams. A minimum seam overlap of 3 inches shall be used for extrusion-welded seams. Upslope panels shall overlap downslope panels to produce a shingle effect for drainage.

7. Seaming methods

HDPE, LLDPE, PP—The primary method of seaming shall be hot wedge fusion welding. Fillet extrusion welding shall be used for repairs, T-seams, and detail work. Hot air fusion or chemical fusion welding may be used for PP. Seaming shall not be performed when the ambient sheet temperature is below 45 degrees Fahrenheit or above 90 degrees Fahrenheit.

PVC—Seams shall be joined using hot wedge fusion welding, hot air fusion welding, chemical fusion welding, or an adhesive. Special precautions, as recommended by the manufacturer, shall be taken for seam joining if the ambient sheet temperature is above 105 degrees Fahrenheit. Seam joining shall not be performed when the ambient sheet temperature is below 40 degrees Fahrenheit or above 140 degrees Fahrenheit.

EPDM—Seams shall be joined using double-faced inseam tape or a cover strip recommended by the manufacturer. Seaming shall not be performed when the ambient sheet temperature is below zero degrees Fahrenheit or above 120 degrees Fahrenheit.

8. Seaming procedures

Seaming shall extend to the outside edge of the liner to be placed in the anchor trenches. Seaming shall not be conducted in the presence of moisture, dust, dirt, standing water, or soft subgrade. Seaming procedures shall be in accordance with the liner manufacturer's recommendations.

Hot wedge welding—Hot wedge welding shall be accomplished by a double-wedge fusion welder that produces a double track weld. Welding equipment and accessories shall be in accordance with the liner manufacturer's recommendations. The welder shall be calibrated at least once per day at the beginning of each seaming period.

Fillet extrusion welding—Extrusion welding equipment and accessories shall be in accordance with the liner manufacturer's recommendations. The extrusion welder shall be calibrated at least once per day at the beginning of each seaming period. To ensure proper bonding of the extrusion weld, edges of the patch material and the adjacent liner shall be properly abraded by a light grinding. This operation shall be done no more than 15 minutes before the welding operation. The abrasion process shall remove no more than 10 percent of the material thickness.

Hot air welding—Hot air welding shall be accomplished by a single- or double-tracked fusion welder. Welding equipment and accessories shall be in accordance with the liner manufacturer's recommendations. The welder shall be calibrated at least once per day at the beginning of each seaming period.

Chemical fusion welding—The chemical fusion agent shall be applied to both panels by a squeeze bottle or paintbrush. The width of application shall be a minimum of 2 inches. Pressure shall be applied to the seam in accordance with the liner manufacturer's recommendations to provide adequate contact between the panels. Excess agent extruded from the seam shall be immediately removed.

Adhesive—Adhesive shall be approved by the manufacturer and consist of material with a life expectancy similar to that of the liner material. The adhesive shall be applied to both panels by a paintbrush or other approved method. The adhesive shall cover the entire seam overlap. Pressure shall be applied to the seam in accordance with the liner manufacturer's recommendations to provide adequate contact between the panels. Excess adhesive extruded from the seam shall be immediately removed.

Inseam tape—A primer shall be applied to both panels by a scrub pad or other approved method recommended by the manufacturer. The primer shall cover the entire seam overlap. As soon as the primer has flashed, install the tape on the bottom sheet, remove tape backing, lap the top sheet over the tape, and roll with sufficient pressure to provide adequate contact between the panels.

Cover strip—A primer shall be applied to both panels by a scrub pad or other approved method recommended by the manufacturer. The top sheet shall be lapped over the bottom sheet and rolled to provide contact between the panels. Additional primer shall be applied to cover the entire seam overlap. As soon as the primer has flashed, install the cover strip and roll it with sufficient pressure to provide adequate contact between the cover strip and the panels.

9. Seam testing

Field seams shall be nondestructively tested over their full length. Seam testing shall be performed as the work progresses.

Nondestructive seam testing—Air pressure tests shall be performed in accordance with ASTM D 5820 on all double-track fusion seams. The air pressure test equipment and procedures shall conform to this specification and the liner manufacturer's recommendations. Pressurize the air channel to 25 to 30 pounds per square inch for HDPE, LLDPE, and PP liners, 15 to 25 pounds per square inch for 30 mil PVC liners, and 20 to 30 pounds per square inch for 40 mil PVC liners.

Monitor any pressure drops for 5 minutes. A loss of pressure in excess of 4 pounds per square inch for HDPE, LLDPE, and PP liners, 5 pounds per square inch for 30 mil PVC liners, 4 pounds per square inch for 40 mil PVC liners, or a continuous loss of pressure is an indication of a leak. The location of all defective seams shall be marked and repaired.

Vacuum box tests shall be performed in accordance with ASTM D 5641 on all seams and repairs made by extrusion welds and may be used on PP chemical fusion welds. Vacuum box tests shall not be used on PVC liner seams. The location of all defective seams shall be marked and repaired.

Air lance tests shall be performed in accordance with ASTM D 4437 on single-track fusion welds, chemical fusion welds, and on adhesive PVC seams and EPDM seams, and may be used on PP chemical fusion seams. The location of all defective seams shall be marked and repaired.

Destructive seam testing—If specified in section 16 of this specification, seam samples shall be cut at no more than one sample per 500 feet of weld for destructive seam testing. All destructive seam samples shall be tested in shear and peel modes in accordance with ASTM D 6392 to verify seams meet the requirements of Material Specification 594.

10. Repairs

All defective liner areas and failed seams shall be repaired and retested.

Tears, punctures, material defects—All tears, punctures, and material defects in the liner shall be repaired by installing a patch over the defective area. Surfaces of the liner to be patched shall be cleaned before the repair. All patches shall be of the same liner material and extend a minimum of 6 inches beyond the edges of the defect area. All patches shall have rounded corners and shall be seamed to the liner. Holes that are less than 0.25 inch in diameter on HDPE, LLDPE, and PP liners shall be repaired by a bead of extrudent.

Seam repair—Failed seams shall be repaired by installing a cap strip over the entire length of failed seam. The cap strip shall be of the same liner material and shall extend beyond the failed seam a minimum of 6 inches in all directions. Alternatively, the upper flap may be extrusion welded to the liner along the entire length of the failed seam.

11. Appurtenances

The liner shall be mechanically attached to pipe, concrete, or steel structures as shown in the drawings and according to liner the manufacturer's recommendations.

Pipe boots—Factory fabricated pipe boots shall be used as specified in section 16 of this specification. Pipe boots fabricated in the field shall be from the same material as the liner. The boots shall be welded and clamped to pipes of the same material as the liner. They shall be clamped to other types of pipe as shown in the drawings, or as recommended by the manufacturer, to provide a leak-free attachment.

Metal battens—Metal battens shall meet the requirements of Material Specification 594 and shall be installed according to the drawings and the liner manufacturer's recommendations. The battens shall be bolted to concrete by bolts on 6-inch intervals to create a leak-free connection under submerged conditions. Bolt spacing may be increased to 12 inches for connections above the fluid level.

Embed channel—Embed channel shall meet the requirements of Material Specification 594 and be installed according to drawings and the liner manufacturer's recommendations. The embed channel shall be prefabricated to the dimensions shown on the drawings. All sections of the channel shall be continuously welded to subsequent sections before installation in the concrete forms. All corners shall be miter cut and welded on all sides.

12. Gas vents and drainage

Gas vent flaps vent pipes, and drainage systems shall be installed as specified in section 16 of this specification and as shown on the drawings.

13. Cover soil

If specified in section 16 of this specification, cover soil and placement method shall be in accordance to the drawings and shall conform to this specification and the liner manufacturer's recommendations. Cover soils shall meet the same requirements as specified for subgrade soils in section 4 of this specification. Cover soil placement shall be performed by a loader or bulldozer with ground pressure of less than 8 pounds per square inch. Cover soil shall not be dropped onto the liner from a height of more than 3 feet. Following construction of an access ramp, the soil shall be placed from the bottom of the slope upward. Construction equipment or machinery shall not operate directly on the liner. Cover soil shall be placed during the coolest part of the day.

14. Placement of concrete

Concrete placement for ramps and other appurtenances shall be in accordance with the drawings and as specified in section 16 of this specification. All reinforcing steel shall be placed on flat-footed plastic rebar chairs. All rebar splices shall be fully tied. On slopes, concrete shall be placed from the bottom of the slope to the top and have a slump as specified in section 16 of this specification. Internal vibrators shall be used to consolidate concrete. Metal shovels and rodding shall not be used to consolidate or place the concrete. Concrete forms shall be held in place by methods that avoid damaging the liner.

15. Measurement and payment

For work for which specific unit prices are established in this contract, the quantity of liner installed shall be determined to the nearest square foot by measurement of the covered surfaces only, disregarding that for anchorage, seams, and overlaps. Payment for items listed separately in the contract bid schedule shall be made at the contract price for those items. Such payment shall constitute full compensation for furnishing, shipping, and installing the liner including all pipe boots or shirts, mechanical attachments to pipes and structures, and other items necessary and incidental to the completion of the work.

Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 16 of this specification.

16. Items of work and construction details

Items of work to be performed in conformance with this specification and the construction details are:

A. Subsidiary Item, Geomembrane Liner

1) This item shall consist of furnishing all materials and labor to install the geomembrane liner used beneath the contraction joints and drains on the RCC spillway, as shown on the drawings.
2) Geomembrane liner shall comply with Material Specification 594, Geomembrane Liner for a 60 mil HDPE smooth liner, as shown in Table 594-1.
3) In Section 15, Measurement and Payment, no separate payment shall be made for this item of work. Compensation for this item will be included in the payment under the following bid items:
    a) Bid Item 23, Roller Compacted Concrete, Construction Specification 36, Roller Compacted Concrete

****End of Construction Specification 97****

CONSTRUCTION SPECIFICATION 401 – GEOTECHNICAL INSTRUMENTATION

1. Scope

The work consists of providing all labor, materials, equipment, and incidentals, as specified herein, and furnishing, installing, calibrating, testing, adjusting, and placing into satisfactory operation the instrumentation shown on the Drawings, including Open Standpipe Piezometers, Vibrating Wire Piezometers (VWPs), Barometric Pressure Indicator, Surface Monuments, and accessories. This work also consists of abandoning the existing open standpipe piezometers as indicated on the Drawings.

2. Submittals

A. Manufacturers' Data

1) Within five (5) days after receipt of each instrument at the site, and prior to installing the instrument, submit to the COR a copy of factory calibration, manufacturer's test equipment certification, instruction manuals, and completed final quality assurance inspection checklist, and completed copy of Contractor's quality control checklist for each instrument. In addition, provide warranty for the Portable Readout Device.
2) Submit manufacturers' product data describing all specified instruments to the COR, including requests for consideration of substitutions, if any, together with product data and instruction manuals for requested substitutions.

B. Instrumentation Installation Plan

1) At least 45 days prior to work activity, whichever occurs first, submit an Instrumentation Installation Plan to the COR for review and approval. The Instrumentation Installation Plan shall contain the following information at a minimum:

   a. Types and locations of instrumentation, as per the Drawings or as directed by the COR.

   b. Manufacturers and part numbers for all required components, including but not limited to cables, vibrating wire instrumentation, and accessories as needed.

   c. Shop drawings illustrating installation details.

   d. Detailed step by step procedures for abandonment of existing open-standpipe piezometers, protection of existing open-standpipe piezometers to remain, and installation of new instrumentation, including how installation will be coordinated with other work and methods for protecting instruments from damage. The narrative shall include, at a minimum, a description of installation details, drilling equipment, drilling procedures, and backfill procedures.

   e. Methods for protecting existing open standpipe piezometers to remain from damage, including but not limited to damage by construction equipment, throughout the course of the Work.

   f. A Gantt chart indicating the proposed time sequence of instrument installation.

   g. Quality control process and checklist.

C. Portable Readout Device

1) At least seven (7) days prior to the start of installation of the first instrument, provide the COR with specified Portable Readout Device, together with associated calibration devices and software.

D. Pre-Installation Acceptance Test Checklist

1) Within five (5) days after receipt of each instrument at the site and prior to installing the instrument, submit to the COR the completed pre-installation acceptance test checklist for that instrument.

E. Instrumentation Personnel

1) Within 21 days after the Notice to Proceed, the Contractor shall submit to the COR for approval the qualifications of the drilling firm and the foreman designated for this project. The foreman shall have experience drilling and installing vibrating wire piezometers at a minimum of three different embankment dam sites within the past five years that are similar to this Project.
2) Instrumentation personnel shall also include an Instrumentation Specialist, a registered Professional Land Surveyor currently licensed in the State of West Virginia, and a qualified field survey crew. The Instrumentation Specialist shall be ether a registered Professional COR or registered Professional Geologist currently licensed in the State of West Virginia who is experienced with the installation of the instrumentation types specified herein.
3) The COR may reject any of the personnel listed above based on their lack of qualifications.

F. Instrumentation Installation Records

1) Within five (5) days after installing each instrument and performing Formal Initial Readings, submit to the COR the installation record sheet for that instrument, including the following:
    a. Project name.
    b. Contract name and number.
    c. Instrument type and serial number, including Portable Readout Device model and serial number.
    d. Planned location of instrument (Northing, Easting, and elevation).
    e. Personnel responsible for installation.
    f. Date and time of start and completion of installation.
    g. Zero reading and barometric pressure reading at time of installation of each VWP.
    h. Initial readings, Formal Initial Reading, and associated barometric pressure reading for each VWP.
    i. Spaces on record sheet for necessary measurements or readings required at hold points during installation to ensure that all previous steps have been followed correctly, including instrument readings made during installation.
    j. Log of subsurface data indicating the elevations of strata changes encountered in the borehole, if installed in a borehole.
    k. Surveyed as-built location of the instrument (Northing, Easting, and elevation).
    l. Results of post-installation acceptance test.
    m. Weather conditions at the time of installation.
    n. A space on record sheet for notes, including problems encountered, delays, unusual features of the installation, and details of any events that may have a bearing on instrument behavior.
2) As part of closeout of the Project, provide in the Record Documents summary tables of all measurements completed during construction, operation and maintenance manuals for all instrumentation, and any remaining spare parts, supplies, and accessories.

3. Material

A. General

1) The Contractor shall be responsible for calculation of and procurement of the required quantity and volume of each material based on Drawings, experience with similar materials, and other factors as identified by the Contractor.
2) All instrumentation materials shall be new.

3) The Contractor shall be responsible for all costs associated with delays or material quantity or volume shortfalls due to miscalculation, or required rework resulting from not meeting material or placement specifications.
4) When specific manufacturers and models are specified for an instrument, the intent is to identify at least one product that meets the requirements of these Specifications. Alternate manufacturers and models may be submitted to the COR for review and approval. If the listed model has been discontinued prior to the Contractor procuring the instrument during construction, then the manufacturer's replacement model shall be proposed as a substitution subject to approval by the COR.
5) Any request from the Contractor for consideration of a substitution shall clearly state the nature of the deviation from the product specified.
6) Vibrating Wire Piezometers, vibrating wire instrument cables, Barometric Pressure Indicator, and Portable Readout Device shall be procured from the same commercial source.
7) The components of all grout mixes specified herein shall be mixed with a high shear mixer, by circulation from the mixing tank through a progressive cavity (Moyno style) pump at high speed, or with equipment specifically manufactured for mixing grout.

B. Open Standpipe Piezometers

1) Open Standpipe Piezometers shall be solid wall plastic pipe shall be 2-inch I.D., Schedule 40, flush joint PVC pipe.
2) Well screen shall be PVC Schedule 40 commercially-slotted well screen, 2-inch I.D., 5-foot-long section with 0.01-inch slots and at least one square inch of open area per linear foot of screen.
3) Filter sand pack shall consist of clean, uniformly-graded, natural sand with a gradation that allows no more than 5 percent of the filter material to pass through the well screen slots.
4) Cement-bentonite grout shall be a mixture of Portland cement, pulverized bentonite, and water. The mixture shall contain 30 gallons of water and 25 pounds of powdered dry sodium bentonite for each 94-pound sack of Type I Portland cement, consistent with Slope Indicator recommendations for hard to medium soil conditions. Cement shall be mixed with water before bentonite is added. The amount of bentonite may vary by ± 50% based upon mixing conditions. The grout shall be mixed in a manner resulting in a smooth slurry. The proportions of the various materials may be varied in the field, if approved by the COR.
5) Sodium bentonite shall be a natural occurring clay containing no additives. Pulverized bentonite (for bentonite cement grout) shall be ground to pass a No. 200 sieve. Three-eighths-inch bentonite chips are acceptable for sealing the screened zone; coated bentonite chips or pellets are required for screened zones located below groundwater.
6) Provide all accessories required to install the Open Standpipe Piezometers, including but not limited to PVC couplings, caps, and pressure caps.
7) The concrete mix design for the new concrete pads shall meet the requirements of Miscellaneous Structure Concrete included in Construction Specification 31 – Concrete for Major Structures.

C. Vibrating Wire Piezometers (VWPs)

1) VWPs shall be standard (non-vented) 3.5 bar (50 psi) vibrating wire pressure transducers, manufactured by GEOKON (4500 Series), or approved equal. VWPs shall include standard low-air-entry filter tips.
2) Vibrating Wire Piezometers shall have the properties specified in the table below.

Property	Requirement
Over-Range	1.5 x Rated Pressure
Accuracy	± 0.1% Full Scale
Resolution	0.025% Full Scale

Thermal Drift	< ± 0.5% Full Scale
Linearity	< ± 0.5% Full Scale

3) Cable shall be 4 conductor, 22 gauge, with two shielded twisted pairs; a common drain wire and a sheath of 0.065- inch thick, pressure extruded vinyl, with an outside diameter of 0.25 inch, such as the Geokon 02-250P4 cable or acceptable equivalent. Instrument designations as shown on the Drawings and serial numbers shall be clearly marked on the wires at 15-ft intervals along the last 30 feet of the cable (opposite end from transducer). Cable lengths shall be sufficient to allow an additional 5 feet of cable to be neatly coiled within the enclosures.

D. Stick-Up Enclosures

1) Stick-Up Enclosures shall be as shown on the Drawings.

E. Portable Readout Device

1) Portable Readout Device for reading the vibrating wire instruments, shall be the Geokon GK-404 or approved equal.
2) The Portable Readout Device shall be capable of displaying piezometer frequency readings in units of Hertz and temperature readings in units of degrees Celsius.
3) Provide the manufacturer's warranty for each Portable Readout Device.
4) The Portable Readout Device shall be provided for the Government at the end of construction.

F. Barometric Pressure Indicator

1) Barometric Pressure Indicator shall be non-vented vibrating wire barometer manufactured by GEOKON, Model 4580-1, or approved equal.
2) Barometric Pressure Indicator shall have a range of 200 Mbar, an over-range rating of twice the rated pressure, plus or minus 0.1% full range accuracy and 0.025% full scale resolution.
3) Cable shall be from the same commercial source as the VWPs and shall be 4- conductor, 22 gauge, with two shielded twisted pairs, a common drain wire and a sheath of 0.065 inch thick, pressure-extruded vinyl with an outside diameter of 0.25 inch, or acceptable equivalent. Provide waterproof, vented enclosure of sufficient size to house Barometric Pressure Indicator and cabling as recommended by the manufacturer, such as GEOKON Model 4580-1-ENCL Standard Enclosure for the Model 4580-1 Barometer. Provide 2-inch-diameter, extra-strong (XS), ASTM A53, Grade B, 35 ksi, galvanized steel posts with end caps to support Barometric Pressure Indicator and associated enclosure. Concrete used to install steel posts shall be Miscellaneous Structure Concrete as specified in Construction Specification 31 – Concrete for Major Structures

G. Surface Monuments

1) The 1-inch diameter brass rod required for the Surface Monuments shall conform to the requirements of American Society for Testing Materials; B-36 Brass Plate, Sheet, Strip and Rolled Bar. Copper alloy no. 210, three quarters hard; or copper alloy no. 220 half hard; or approved equal.
2) The 4.5" O.D. steel casing used to case the Surface Monuments located in the ground surface shall be Schedule 80 and conform to the requirements of American Society for Testing Materials; ASTM A-53 Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless for Ordinary Uses.
3) Cement-Bentonite Grout shall be as specified above for Open Standpipe Piezometers.

4. Installation

A. Field Quality Control

1) Instrumentation Specialist shall perform pre-installation acceptance tests and complete checklists to verify that the instruments and Portable Readout Device are functioning correctly prior to installation.
2) Complete a pre-installation acceptance test and checklist for each instrument, and submit the completed checklist to the COR in accordance with the submittal requirements above. The pre-installation acceptance test and checklist shall include the following:
    a. Check that quantities received correspond to quantities ordered.
    b. Check all components for signs of damage in transit.
    c. Check, by comparing with procurement document, that model, dimensions, and materials are correct.
    d. Examine factory calibration curve and tabulated data to verify completeness.
    e. Examine manufacturer's final quality assurance inspection checklist to verify completeness.
    f. Check serial number on each instrument and confirm the associated calibration data sheet shipped with the instrument.
    g. Check cable length.
    h. Bend cable back and forth at point of connection to the instrument, while reading the instrument, to verify connection integrity.
    i. Perform resistance and insulation testing, in accordance with criteria provided by the instrument manufacturer, using a gage insulation or circuit tester that applies two volts or less for resistance testing and 15 volts or less for insulation testing.
    j. Verify that all components fit together in the correct configuration.
3) An instrument that fails the specified pre-installation acceptance test shall be repaired such that it passes a subsequent pre-installation acceptance test, or shall be replaced by an identical instrument at no additional cost to the Government.

B. General

1) Contractor's Instrumentation Specialist shall:
    a. Have at least 5 years of experience with installing and monitoring the types of instruments specified herein and in interpreting instrumentation data. The Instrumentation Specialist shall have formal training in engineering or engineering geology and in instrumentation, and shall be a Professional Engineer or Professional Geologist registered in the State of West Virginia.
    b. Be on-site to supervise at least the first installation of each type of instrument, including a Vibrating Wire Piezometer that is installed in foundation rock, and to confirm that the instrument is installed in accordance with the approved Instrumentation Installation Plan.
    c. Perform the pre-installation and post-installation acceptance tests for at least the first VWP.
    d. Review and approve the results of all pre-installation and post-installation tests performed by instrumentation personnel, if not performed by the Instrumentation Specialist.

2) Instruments shall be installed in accordance with the guidelines included in the manufacturer's instruction manuals, the approved Instrumentation Installation Plan and associated Shop Drawings, the Drawings and these Specifications, and as directed by the COR. Any alternate means and methods for instrumentation installation proposed by the Contractor than those specified in the Contract Documents shall be submitted in writing to the COR for review and approval.
3) Notify the COR at least 48 hours prior to installing each instrument.
4) An instrument that fails the specified post-installation acceptance test shall be repaired such that it passes a subsequent post-installation acceptance test, or shall be replaced by an identical instrument at no additional cost to the Government.

C. Inspection

1) A factory calibration shall be performed on all instruments prior to shipment.
2) Certification shall be provided to indicate that the test equipment used for this purpose is calibrated and maintained in accordance with the test equipment manufacturer's calibration requirements and that, where applicable, calibrations are traceable to the National Institute of Standards and Technology.
3) A final quality assurance inspection by the instrumentation supplier shall be made prior to shipment. During the final quality assurance inspection, a checklist shall be completed to indicate each inspection and test detail. A completed copy of the checklist shall be supplied with each instrument.

D. Protection

1) Any damage to previously completed permanent works caused by installation of instrumentation shall be repaired by the Contractor at no cost to the Government.
2) The Contractor is responsible for protecting instruments, instrument cables, and other equipment associated with instrumentation during delivery, storage at the site, and installation, and subsequent construction activities.
3) All instrumentation materials, after receipt at the site and prior to installation, shall be stored in an indoor, clean, dry, and secure storage space.
4) Instruments shall not be exposed to temperatures outside the manufacturer's stated working temperature range.
5) Protect all instruments and appurtenant fixtures, leads, connections, and other components of instrumentation systems from damage due to construction operations, weather, traffic, and vandalism.
6) If an instrument is damaged, inoperative, stolen, or otherwise does not function properly, the Contractor shall repair or replace the instrument, in accordance with manufacturer recommendations, within 72 hours at no additional cost to the Government and to the satisfaction of the COR. The COR will be the sole judge of whether repair or replacement is required. Notify the COR in writing at least 24 hours prior to repairing or replacing an instrument.
7) Existing open standpipe piezometers to remain and to be abandoned are shown on the Drawings. The existing piezometers shall be abandoned prior to beginning excavation activities. Each piezometer shall be flushed to the bottom with water and then tremie-grouted from bottom to top using a 1-inch diameter tremie pipe and a cement-bentonite grout mix consisting of 2 lbs of powdered bentonite to 6.5 gallons of water to one, 94-lb bag of Type I or II cement meeting the requirements of ASTM C150. Allow the grout to harden for a minimum of 24 hours. If the top of hardened grout is more than one foot from excavation subgrade, then add additional grout using methods described above. Repeat until hardened grout is within one foot of excavation subgrade. Piezometers shall be removed to a depth of one foot below the excavation subgrade prior to placement of fill. Dispose of removed surface completions, including concrete, outer protective steel casing, and any removed PVC casing, in accordance with the requirements of Construction Specification 3, Structure Removal. The grout mix materials proposed for piezometer abandonment shall be submitted to the COR for approval at least 14 days prior to abandonment.

8) The Contractor is responsible for protection of the existing open standpipe piezometers that are designated to remain. Install a 2-foot-tall precast concrete manhole section for surface protection of the existing open standpipe piezometers. The top of the piezometer PVC casing shall be exposed as the excavation proceeds and protected by the precast manhole section. The manhole section shall be lowered as the excavation proceeds. Existing open standpipe piezometers that are damaged due to the Contractor's operations shall be repaired to the satisfaction of the COR at no cost to the Government. If replacement is required, the existing open standpipe piezometer shall be drilled out and grouted and a new open standpipe piezometer shall be installed in accordance with these Specifications at no cost to the Government. Placement of earthfill materials adjacent to the piezometers shall be performed in accordance with the requirements for Miscellaneous Earth Backfill as specified in Construction Specification 23, Earthfill.

E. Open Standpipe Piezometer Installation

1) Open Standpipe Piezometers shall be installed at the locations indicated and according to the details shown on the drawings. Drilling and installation of Open Standpipe Piezometers shall be performed in the presence of the COR.
2) Boreholes shall be advanced though soil materials using 4-1/2-inch-inside diameter (ID) hollow stem augers. Drilling methods which introduce air, water, or other drilling fluids to advance the borings will not be permitted. Cutting a bench into the embankment to access the VWP locations will not be permitted. Drilling shall be conducted in accordance with applicable laws.
3) Standard Penetration Testing (SPT) and soil sampling shall be performed at 5-foot intervals in accordance with the latest revision of ASTM D1586. In addition, perform one SPT at the planned elevation of the Vibrating Wire Piezometer. COR shall oversee SPTs and log the borings. Contractor's drilling subcontractor shall provide SPT data to COR. Soil samples from drilling shall be provided to the COR as they are retrieved from the borings. Provide jars, lids, and jar boxes for soil samples.
4) Fine Drainfill for Open Standpipe Piezometers shall meet the requirements of Fine Drainfill specified in Construction Specification 24, Drainfill.
5) If the bentonite seal interval is in the unsaturated zone, the bentonite shall be hydrated with at least two gallons of distilled water (grocery store grade is sufficient) and allowed to expand for at least one hour prior to grouting the annular space. The seal shall be sodium bentonite, either as 3/8-inch chips or as pellets.
6) Installation of the Open Standpipe Piezometers shall include development of the Open Standpipe Piezometers. Contractor shall develop the installed piezometers by pumping and surging until clear water is obtained, or until 9 well volumes are removed, whichever comes first. Contractor shall provide a whale pump to develop the installed piezometers.
7) After completion of the installation of the piezometers, the Contractor shall determine the as-built location of the top of the riser in horizontal position to an accuracy of +/- 0.01 foot, and in elevation to an accuracy of +/- 0.01 foot. Indicate the reference point selected to determine the horizontal and vertical positions on the installation record form.

F. Vibrating Wire Piezometer Installation

1) The VWPs shall be installed in both existing and new Open Standpipe Piezometers as shown on the Drawings.
2) Installation of VWPs shall be performed in the presence of the COR.
3) Prior to preparing the piezometer for installation, obtain and record a zero reading at the proposed installation location, per the manufacturer's guidance. A barometric pressure reading and reservoir water level elevation shall be obtained and recorded within 15 minutes of obtaining the zero reading.
4) Prior to insertion of the VWP in the Open Standpipe Piezometer, the porous stone and the cavity between the porous stone and the diaphragm shall be saturated with clean water. Saturation shall be maintained throughout the installation.

5) If the installation depth is greater than 25 feet below the ground surface, the VWP shall be lowered to between 24 and 26 feet above its installation depth, allowed to achieve thermal equilibrium by waiting for a sufficient time as stated by the manufacturer, and a reading taken of piezometer pressure and temperature, barometric pressure, and reservoir water level elevation. Corrections shall be applied in accordance with factory calibration data. The actual water head over the piezometer diaphragm, if any, shall be determined by direct depth measurement. The piezometer shall then be lowered to between 4 and 6 feet above its specified installation depth, allowed to achieve thermal equilibrium, and readings taken and corrections made as specified herein. The calibration of the piezometer shall be checked by comparing the actual difference in water head with the difference between the two piezometer readings. If the two values differ by more than 1.0 percent of the specified range of the piezometer, the piezometer shall be replaced by an identical instrument at no additional cost to the Government. If the two values agree to within 1.0 percent of the specified range of the piezometer, the piezometer shall be lowered to the specified installation depth and the elevation of the diaphragm shall be recorded.
6) Prior to VWP installation, the cables shall be clearly labeled in 15-foot increments along the last 30 feet of the cable (opposite end from transducer). The labels shall include the instrument serial numbers and assigned transducer instrument identification numbers as provided on the Drawings. Ensure that enough length of the cable is available to route the cabling as shown on the Drawings. Extra cable length shall be coiled and neatly placed within the Sick-Up Enclosure.
7) After completion of the installation of all vibrating wire instruments, the Contractor's Professional Land Surveyor shall determine the as-built location of each VWP in horizontal position to an accuracy of +/- 0.1 foot. The elevation of the VWP diaphragm shall be determined to an accuracy of +/- 0.1 foot.

G. Stick-Up Enclosures

1) Install Stick-Up Enclosures where shown on the Drawings.
2) Stick-Up Enclosures shall be clearly labeled and numbered with the unique identification numbers of the corresponding VWPs provided on the Drawings.

H. Barometric Pressure Indicator

1) Barometric Pressure Indicator shall be installed for use with the VWPs at least 14 days prior to the start of any related installation activities.
2) Permanent installation of Barometric Pressure Indicator will be in the specified enclosure as shown on the Drawings and in accordance with the manufacturer's instructions.
3) Provide all hardware necessary to firmly connect the Barometric Pressure Indicator inside of the enclosure and to mount to the enclosure to the galvanized steel post, as shown on the Drawings and in accordance with manufacturer recommendations.
4) After completion of installation a post-installation acceptance test shall be performed to verify that the Barometric Pressure Indicator functions correctly.

I. Surface Monument Installation

1) Surface Monuments shall be constructed at the locations shown on the Drawings. Construct the monuments as shown on the Drawings.

J. Additional Instrumentation Installed by the Contractor

1) The Contractor may install additional instrumentation separate from that shown on the Drawings if needed to confirm the adequacy of their construction means and methods at no additional cost to the Government. If additional vibrating wire instrumentation or water quality instrumentation is planned to be installed, the Contractor shall inform the COR in writing.
2) Additional instrumentation installed by the Contractor shall be installed in accordance with the applicable requirements specified herein.
3) Damage to the instrumentation specified herein resulting from activities associated with the Contractor's instrumentation shall be replaced by the Contractor at no cost to the Government.

4) The Contractor shall remove their instrumentation after it has served its purpose.

5. Data Collection

A. *Initial Instrument Readings*

1) The Contractor shall perform initial readings of all instruments, including, but not limited to, vibrating wire instruments and Surface Monuments. The Contractor shall determine the Formal Initial Reading for each instrument as defined below.
2) For vibrating wire instruments, initial readings are defined as three separate sets of readings or as defined by the COR. Each set of readings shall be completed within one hour. The Formal Initial Reading for each instrument is the average of the three sets of readings, provided that the instruments are confirmed to be working properly.
3) For Surface Monuments, record the number of the monument, the date the monument was installed, the coordinates of the monument, the elevation of the top of the brass rod immediately after installation, the elevation of the bottom of the borehole, and the length of the grout zone.
4) All sets of initial readings for the determination of the Formal Initial Reading shall be completed within seven (7) days after installation.
5) Submit the initial readings and recommended Formal Initial Reading to the COR in accordance with the submittal requirements herein.
6) Installation will be considered complete when all required materials have been installed and the instrument has been approved by the COR.

B. *Data Collection by the Contractor*

1) Collect barometric pressure readings and reservoir water level elevations within 15 minutes of obtaining any vibrating wire instrument readings.
2) Data collection by the Contractor, either from additional instruments installed by the Contractor or from instruments specified by the Contract Documents, shall be performed by the approved instrumentation personnel.

C. *Disclosure of Data*

1) The Contractor shall not disclose any instrumentation data to third parties nor publish data without prior written consent of the Government.

6. Coordination Between Contractor and COR

1) The Contractor shall provide and facilitate safe access to the work area at all times for data collection from the specified instruments.
2) Safe access includes, but is not limited to, cessation of work activities, temporary relocation of obstructing materials and equipment, and any other needs that, in the opinion of the COR, are necessary to ensure the safety of the data collection personnel.
3) The Contractor shall collect additional data as requested by the COR to ensure the safety of the facilities at no additional cost to the Government.
4) Where data collected by the COR and Contractor conflict, every effort shall be made by all parties to resolve discrepancies.
5) The Contractor shall coordinate instrumentation suppliers, Instrumentation Specialist, and installation of all instrumentation.

7. Measurement and Payment

Measurement and payment shall be made at the contract lump sum price for Geotechnical Instrumentation. Such payment constitutes full compensation for all labor, equipment, material, and all other items necessary and incidental to the completion of the Geotechnical Instrumentation as shown on the Drawings and required by the Specifications.

Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 8.

8. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. *Bid Item 46 – Geotechnical Instrumentation*

1) This item consists of furnishing all materials, equipment, and labor necessary to complete the following as shown on the Drawings and specified herein.
   a. Protect Piezometer GF-2 during earthwork activities and trim and replace riser pipe as needed.
   b. Abandon Piezometer B-651 and install Piezometer PZ-2 after the embankment toe drain is installed.
   c. Install Piezometer PZ-1 on the embankment stability berm.
   d. Install VWPs in all open standpipe piezometers, including the existing open standpipe piezometers.
   e. Install the Barometric Pressure Indicator.
   f. Install the Surface Monuments.
2) In Section 7 – Measurement and Payment such payment will constitute full compensation for the following related subsidiary items:
   a. Geotechnical Instrumentation Surveys, Construction Specification 7 – Construction Surveys
   b. Miscellaneous Excavation, Construction Specification 21 – Excavation
   c. Miscellaneous Earth Backfill, Construction Specification 23 – Earthfill
   d. Miscellaneous Structure Concrete, Construction Specification 31 – Concrete for Major Structures

****End of Construction Specification 401****

Construction Specification 402—Diving Services

1. Scope

The work shall consist of performing diving services for verification of existing conditions required for completion of the work. The Contractor shall determine whether this work is necessary based on their schedule, means and methods to complete the related work items, and other factors determined by the Contractor.

2. Submittals

Contractor shall submit resumes of all diver personnel scheduled for the work to the COR for review no later than 45 days prior to work activity. The diver personnel shall meet the approval of the COR. Any substitutions of personnel prior to and during the work shall meet the approval of the COR prior to enacting a substitution.

At least 45 days prior to work activity, Contractor shall submit a Diving Plan to include the details and procedures for each aspect of the work to be performed. At a minimum, the Plan shall discuss the means and methods for completing the work, detailed description and schedule of the work, personnel, equipment, supplies, safety procedures, emergency procedures, and an assessment of risk.

A. Personnel Minimum Experience Requirements

All Contractor diver personnel working on the project shall meet OSHA requirements for current certification from an approved diver training school, for CPR, and First Aid. All diver personnel shall be certified commercial divers by the Association of Diving Contractors International (ADCI).

All Contractor diver personnel shall have a minimum of two (2) years of professional diving experience, including at least one year with the Contractor, except as otherwise approved by the COR. Personnel shall have prior experience relevant to the task to which they are assigned.

B. Supervisory Personnel Additional Experience Requirements

Each diving crew foreman shall have a minimum of five (5) years professional diving experience, including experience on similar projects. The foreman shall be a certified supervisor by the ADCI.

The overall diving supervisor shall have a minimum of ten (10) years professional diving experience, including significant underwater construction experience.

3. Materials

A. Air supply

Contractor shall supply surface-supplied-air from compressed air bottles or from air compressors. The diving rigs shall include air line, intercom line, pneumo hose, and video line.

B. Intercom and pneumo gauge

Contractor shall supply the dive station with diver intercom equipment for communication with the diver. The intercom shall be connected to the video recorder so that the diver's verbal descriptions and on-board comments are recorded simultaneously with the diver's video footage. A pneumo gauge shall be attached to the diver's pneumo line to obtain bottom depths at the beginning of each dive and then as needed during the dive.

4. Underwater Video and Still Camera

The Contractor shall supply the diving station with helmet-mounted, auto-focus, color or silicon-intensified video cameras, DVD, or other digital recorder, color monitor for viewing diver activities, and enclosed, weatherproof trailer for viewing video and audio. Provide two-way communication between the diver and COR. Each video shall be interfaced with a time-date generator and a video character generator that will allow messages keyed in by the on-board personnel to be displayed on the video monitor and recorded. The video system will include an amplifier if necessary to increase the level of the diver's audio output for audible recording. Videos and audio shall be high definition, 1080p quality. Camera shall have the ability to adjust focus, clarity, and sharpness of video images.

The Contractor shall also provide an underwater still camera to document existing conditions. Photographs shall be digital and shall include a list indicating the date, name of project, and a brief description of the image(s), including the location and direction the images where taken.

All digital photos and videos shall be provided to the COR in an agreed upon file format at the conclusion of the work.

5. Measurement and Payment

Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

6. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Subsidiary Item – Diving Services

1) This item consists of furnishing all materials, equipment, and labor necessary to verify existing conditions for the principal spillway riser improvements and in accordance with this specification. This includes the Pond Drain Gate work as specified in Construction Specification 71, Water Control Gates and the metalwork specified in Construction Specification 81, Metal Fabrication and Installation.

2) Perform dive activities in the presence of the COR.

3) All dive activities shall be performed in accordance with OSHA standards.

4) In Section 5 – Measurement and Payment, no separate payment will be made for Diving Services. Compensation for Diving Services will be included in the payment under:

   i. Bid Item 34, Installation of New Pond Drain Gate, Gate Stem, and Stem Guides, Construction Specification 71 – Water Control Gates

   ii. Bid Item 36, Stainless Steel Metalwork, Construction Specification 81 – Metal Fabrication and Installation

   iii. Bid Item 37, Principal Spillway Fatigue Platform, Construction Specification 81 – Metal Fabrication and Installation

   iv. Bid Item 41, Principal Spillway Ladder, Construction Specification 81 – Metal Fabrication and Installation

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MATERIAL SPECIFICATIONS

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Part 642 – Specifications

Chapter 3 – National Standard Material Specifications

Material Specification 521—Aggregates for Drainfill and Filters

A. Scope

This specification covers the quality of mineral aggregates for the construction of drainfill and filters.

B. Quality

(1) Drainfill and filter aggregates shall be sand, gravel, or crushed stone or mixtures thereof. Aggregates shall be composed of clean, hard, durable, mineral particles free from organic matter, clay balls, soft particles, or other substances that would interfere with the free-draining properties of the aggregates.

(2) Coarse aggregate may be crushed limestone or other material that has limestone particles included. Aggregates from crushed limestone shall be thoroughly washed and screened to remove limestone dust, limestone fines, and fine soil particles. Limestone shall not be used for fine aggregates except in combination with other material, such that not more than 5 percent of the portion finer than the No. 4 sieve shall be limestone.

(3) Aggregates shall be tested for soundness according to ASTM C88 and shall have a weighted average loss in 5 cycles of not more than 12 percent when sodium sulfate is used or 18 percent when magnesium sulfate is used.

C. Grading

Drainfill and filter aggregates shall conform to the specified grading limits after being placed or after being compacted when compaction is specified. Grading shall be determined by ASTM C136. The percentage of material finer than the No. 200 sieve shall be determined by the method in ASTM C117.

D. Storing and Handling

Drainfill and filter aggregates shall be stored and handled by methods that prevent segregation of particle sizes or contamination by mixing with other material.

Part 642 – Specifications

Chapter 3 – National Standard Material Specifications

Material Specification 522—Aggregates for Portland Cement Concrete

A. Scope

This specification covers the quality of fine aggregate and coarse aggregate for use in the manufacture of Portland cement concrete.

B. Quality

Aggregate shall conform to the requirements of ASTM C33 for the specified sizes. Aggregates that fail to meet any requirement may be accepted only when either:

(i) The specified alternate conditions of acceptance can be proven before the aggregates are used on the job and within a period such that no work under the contract will be delayed by the requirements of such proof or,

(ii) The specification for concrete expressly contains a provision of special mix requirements to compensate for the effects of the deficiencies.

C. Reactivity with alkalies

(1) The potential reactivity of aggregates with the alkalies in cement shall be evaluated by petrographic examination as per ASTM C295, or by the results of previous tests or service records of concrete made from similar aggregates from the same source. The standards for evaluating potential reactivity shall be as described in ASTM C1778

(2) Aggregates indicated by any of the above to be potentially reactive shall not be used except under one of the following conditions:

(i) Applicable test results of mortar bar tests made according to ASTM Method C 1567 are available which indicate an expansion of less than 0.10 percent at 16 days.

(ii) The concrete mixture complies with the appropriate testing procedures and mitigations measures established in ASTM C1778.

(iii) Concrete made from similar aggregates from the same source has been demonstrated to be sound after 3 years or more of service under conditions of exposure to moisture and weather similar to those anticipated for the concrete under these specifications.

(3) Aggregates indicated to be potentially reactive, but within acceptable limits as determined by mortar bar test results or service records, shall be used only with low alkali cement, containing less than 0.60 percent alkalies expressed as sodium oxide.

D. Sulfur in Aggregate

(1) There is currently not an ASTM standard on the acceptable level of sulfur in concrete aggregate.

(2) To prevent concrete cracking from iron sulfide expansion, perform petrographic testing per ASTM C295 and use the following limits for sulfur (S) in aggregate based on the American Concrete Institute Technical Paper 113-M31 and the Concrete Society BS EN 12620:

(i) When S is less than 0.1 percent, the aggregate is acceptable.

(ii) When S is between 0.1 and 1.0 percent, perform further testing to determine if iron sulfide minerals such as pyrrhotite, gypsum, pyrite, or marcasite are present:

- If the additional testing shows pyrrhotite, gypsum, pyrite, or marcasite are present, reject the aggregate and use an acceptable aggregate.

- If the additional testing shows pyrrhotite, gypsum, pyrite, or marcasite are not present, the aggregate is acceptable.

(iii) Aggregate with S greater than 1 percent is not acceptable.

E. Storing and Handling

Aggregates of each class and size shall be stored and handled by methods that prevent segregation of particles sizes or contamination by intermixing with other material.

Part 642 – Specifications

Chapter 3 – National Standard Material Specifications

Material Specification 523—Rock for Riprap

A. Scope

This specification covers the quality of rock to be used in the construction of rock riprap.

B. Quality

(1) Individual rock fragments must be dense, sound, and free from cracks, seams, and other defects conducive to accelerated weathering. Except as otherwise specified, the rock fragments must be angular to subrounded. The least dimension of an individual rock fragment must be not less than one-third the greatest dimension of the fragment. ASTM D4992 provides guidance on selecting rock from a source.

(2) Except as otherwise provided, the rock must be tested and must have the following properties:

(i) Rock type 1

- Bulk specific gravity (saturated surface-dry basis)—Not less than 2.5 when tested in accordance with ASTM D6473 on samples prepared as described for soundness testing.
- Absorption—Not more than 2 percent when tested in accordance with ASTM D6473 on samples prepared as described for soundness testing.
- Soundness—The weight loss in 5 cycles must not be more than 10 percent when sodium sulfate is used or more than 15 percent when magnesium sulfate is used.

(ii) Rock type 2

- Bulk specific gravity (saturated surface-dry basis)—Not less than 2.5 when tested in accordance with ASTM D6473 on samples prepared as described for soundness testing.
- Absorption—Not more than 2 percent when tested in accordance with ASTM D6473 on samples prepared as described for soundness testing.
- Soundness—The weight loss in 5 cycles must be not more than 20 percent when sodium sulfate is used or more than 25 percent when magnesium sulfate is used.

(iii) Rock type 3

- Bulk specific gravity (saturated surface-dry basis)—Not less than 2.3 when tested in accordance with ASTM D6473 on samples prepared as described for soundness testing.
- Absorption—Not more than 4 percent when tested in accordance with ASTM D6473 on samples prepared as described for soundness testing.
- Soundness—The weight loss in 5 cycles must be not more than 20 percent when sodium sulfate is used or more than 25 percent when magnesium sulfate is used.

C. Methods of Soundness Testing

(1) Rock cube soundness—

(i) The sodium or magnesium sulfate soundness test for all rock types (1, 2, or 3) must be performed on a test sample of 5,000 ± 300 grams of rock fragments, reasonably uniform in size and cubical in shape, and weighing, after sampling, about 100 grams each. They must be obtained from rock samples that are representative of the total rock mass, as noted in ASTM D4992, and that have been sawed into slabs as described in ASTM

D5121. The samples must further be reduced in size by sawing the slabs into cubical blocks. The thickness of the slabs and the size of the sawed fragments must be determined by the size of the available test apparatus and as necessary to provide, after sawing, the approximate 100-gram samples. The cubes must undergo five cycles of soundness testing in accordance with ASTM C88.

(ii) Internal defects may cause some of the cubes to break during the sawing process or during the initial soaking period. Do not test any of the cubes that break during this preparatory process. Such breakage, including an approximation of the percentage of cubes that break, must be noted in the test report.

(iii) After the sample has been dried following completion of the final test cycle and washed to remove the sodium sulfate or magnesium sulfate, the loss of weight must be determined by subtracting from the original weight of the sample the final weight of all fragments that have not broken into three or more fragments.

(iv) The test report must show the percentage loss of the weight and the results of the qualitative examination.

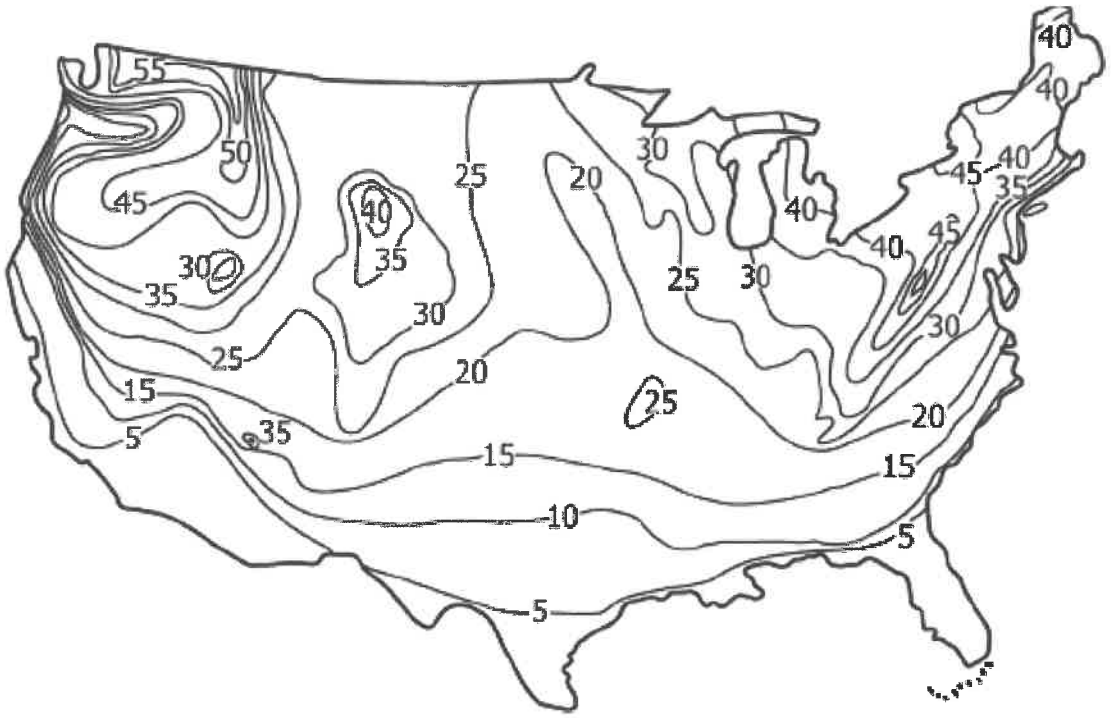
(2) Rock slab soundness—

(i) When specified, the rock must also be tested in accordance with ASTM D5240. Deterioration of more than 25 percent of the number of blocks must be cause for rejection of rock from this source. Rock must also meet the requirements for average percent weight loss stated below.

(ii) For projects located north of the Number 20 Freeze-Thaw Severity Index Isoline (fig. 523–1 below), unless otherwise specified, the average percent weight loss for Rock Type 1 must not exceed 20 percent when sodium sulfate is used or 25 percent when magnesium sulfate is used. For Rock Types 2 and 3, the average percent weight loss must not exceed 25 percent for sodium sulfate soundness or 30 percent for magnesium sulfate soundness.

(iii) For projects located south of the Number 20 Freeze-Thaw Severity Index Isoline, unless otherwise specified, the average percent weight loss for Rock Type 1 must not exceed 30 percent when sodium sulfate is used or 38 percent when magnesium sulfate is used. For Rock Types 2 and 3, the average percent weight loss must not exceed 38 percent for sodium sulfate soundness or 45 percent for magnesium sulfate soundness.

Figure 523–1 Isoline Map of the Freeze-Thaw Severity Index for Contiguous 48 United States (map is from ASTM D5312)



D. Field Durability Inspection

(1) Rock that fails to meet the material requirements stated above (if specified), may be accepted only if similar rock from the same source has been demonstrated to be sound after 5 years or more of service under conditions of weather, wetting and drying, and erosive forces similar to those anticipated for the rock to be installed under this specification.

(2) A rock source may be rejected if the rock from that source deteriorates in less than 5 years under similar use and exposure conditions expected for the rock to be installed under this specification, even though it meets the testing requirements stated above.

(3) Deterioration is defined as the loss of more than one-quarter of the original rock volume, or severe cracking that would cause a block to split. Measurements of deterioration are taken from linear or surface area particle counts to determine the percentage of deteriorated blocks. Deterioration of more than 25 percent of the pieces must be cause for rejection of rock from the source.

E. Grading

The rock must conform to the specified grading limits after it has been placed within the matrix of the rock riprap. Grading tests must be performed, as necessary, according to ASTM D5519, Method A, B, or C, as applicable.

Part 642 – Specifications

Chapter 3 – National Standard Material Specifications

Material Specification 524—Aggregates for Roller Compacted Concrete

A. Scope

This specification covers the quality of aggregate for use in the manufacture of roller compacted concrete (RCC).

B. Quality

Aggregate shall conform to the quality requirements of ASTM C33.

C. Gradation

(1) Aggregate gradation shall be within the limits provided below for the total aggregate weight in a unit volume of RCC. For the sieve sizes shown below that are larger than #4, no more than 20 percent of the total aggregate shall be retained on an individual sieve. For sieve sizes smaller than 3/8 inch, at least 3 percent of the total aggregate shall be retained on each sieve.

Sieve size	Percent passing
2"	100
1-1/2"	85-100
1"	70-100
3/4"	60-84
1/2"	50-70
3/8"	40-60
#4	32-50
#8	26-42
#16	20-35
#30	14-28
#50	8-22
#100	4-15
#200	0-7

(2) Unless otherwise specified, the fines (material passing the #200 sieve) shall have a plasticity index less than four.

(3) Particle shape—The amount of flat and elongated particles with a length-to-width or width-to-thickness ratio greater than 3:1, as determined by ASTM D4791, shall not exceed 25 percent on any individual sieve size group nor a weighted average of 20 percent for all of the sieve sizes in the total gradation.

D. Reactivity with Alkalies

(1) The potential reactivity of aggregates with the alkalies in cement shall be evaluated by petrographic examination as per ASTM C295, or by the results of previous tests or service records of concrete made from similar aggregates from the same source. The standards for evaluating potential reactivity shall be as described in ASTM C1778

(2) Aggregates indicated by any of the above to be potentially reactive shall not be used except under one of the following conditions:
  (i) Applicable test results of mortar bar tests made according to ASTM Method C 1567 are available which indicate an expansion of less than 0.10 percent at 16 days.
  (ii) The concrete mixture complies with the appropriate testing procedures and mitigations measures established in ASTM C1778.
  (iii) Concrete made from similar aggregates from the same source has been demonstrated to be sound after 3 years or more of service under conditions of exposure to moisture and weather similar to those anticipated for the concrete under these specifications.

(3) Aggregates indicated to be potentially reactive, but within acceptable limits as determined by mortar bar test results or service records, shall be used only with low alkali cement, containing less than 0.60 percent alkalies expressed as sodium oxide.

E. Sulfur in Aggregate

(1) There is currently not an ASTM standard on the acceptable level of sulfur in concrete aggregate.

(2) To prevent concrete cracking from iron sulfide expansion, perform petrographic testing perASTM C295 and use the following limits for sulfur (S) in aggregate based on the American Concrete Institute Technical Paper 113-M31 and the Concrete Society BS EN 12620:
  (i) When S is less than 0.1 percent, the aggregate is acceptable.
  (ii) When S is between 0.1 and 1.0 percent, perform further testing to determine if iron sulfide minerals such as pyrrhotite, gypsum, pyrite, or marcasite are present:
    - If the additional testing shows pyrrhotite, gypsum, pyrite, or marcasite are present, reject the aggregate and use an acceptable aggregate.
    - If the additional testing shows pyrrhotite, gypsum, pyrite, or marcasite are not present, the aggregate is acceptable.
  (iii) Aggregate with S greater than 1 percent is not acceptable.

F. Acceptance

Aggregates that fail to meet any requirement may be accepted only when the specification for RCC expressly contains either:
  (i) special provisions for acceptance that can be proven before the aggregates are used on the job and within a period such that no work under the contract will be delayed by the requirements of such proof; or
  (ii) special provisions for specific mix requirements to compensate for the effects of the deficiencies.

G. Storing and Handling

Aggregates shall be stored in stockpiles at specified storage areas. Separators, such as timbers, boards, or pre-cast concrete panels, shall be used between adjacent stockpiles to prevent the contamination and intermixing of dissimilar materials. The contractor shall be responsible for providing a system that reliably and consistently stockpiles the aggregates and allows the withdrawal of the aggregates from the stockpiles without contamination or segregation. Segregated or contaminated aggregates will not be allowed in production of RCC.

Part 642 – Specifications

Chapter 3 – National Standard Material Specifications

Material Specification 531—Portland Cement

A. Scope

This specification covers the quality of Portland cement.

B. Quality

(1) Portland cement shall conform to the requirements of ASTM C150 for the specific types of cement such as Type I, IA, II, IIA, II(MH), II(MH)A, III, IIIA, IV, and V Portland cement.
(2) Type IS Portland blast-furnace slag cement, Type IP Portland-pozzolan cement, or Type IL Portland-limestone cement shall conform to the requirements of ASTM C595 and may be used unless prohibited by the specifications.
(3) When air-entraining cement is required, the contractor shall furnish the manufacturer's written statement providing the source, amount, and brand name of the air-entraining component.

C. Storage at the Construction Site

Cement shall be stored and always protected from weather, dampness, or other destructive elements. Cement that is partly hydrated or otherwise damaged will not be accepted.

Part 642 – Specifications

Chapter 3 – National Standard Material Specifications

Material Specification 532—Supplementary Cementitious Materials

A. Scope

This specification covers the quality of supplementary cementitious materials for concrete.

B. Quality

(1) Fly ash used as a partial substitution of Portland cement shall conform to the requirements of ASTM C618, Class C or F except the loss on ignition shall not exceed 3 percent, unless otherwise specified. Lot-to-lot variation in the loss on ignition shall not exceed 1 percent. When specified, fly ash shall conform to one or more of the supplementary optional physical requirements listed in ASTM C618.

(2) Natural pozzolan used as a partial substitution of Portland cement shall conform to the requirements of ASTM C618, Class N including the optional requirements for uniformity and effectiveness in controlling ASR. Class N pozzolan for the use in mitigating Alkali-Silica Reactivity shall have a Calcium Oxide (CaO) content of less than 13 percent and total equivalent alkali content less than 3 percent.

(3) Blast-furnace slag used as a partial substitution of Portland cement shall conform to ASTM C989 for ground granulated blast-furnace slag.

(4) Silica fume used as a partial substitution of Portland Cement shall conform to ASTM C1240.

Part 642 – Specifications

Chapter 3 – National Standard Material Specifications

Material Specification 533—Chemical Admixtures for Concrete

A. Scope

This specification covers the quality of chemical ad-mixtures for manufacturer of Portland cement concrete.

B. Quality

(1) Air-entraining admixtures shall conform to the requirements of ASTM C260.
(2) Water-reducing and/or retarding admixtures shall conform to the requirements of ASTM C494, Types A, B, D, F, or G.
(3) Plasticizing or plasticizing and retarding admixtures shall conform to ASTM C494, Types F or G.
(4) Accelerating or water-reducing and accelerating ad-mixtures shall be noncorrosive and conform to the requirements of ASTM C494, Types C and E. The manufacturer shall provide long-term test data results from an independent laboratory verifying that the product is noncorrosive when used in concrete exposed to continuously moist conditions.

Part 642 – Specifications

Chapter 3 – National Standard Material Specifications

Material Specification 534—Concrete Curing Compound

A. Scope

This specification covers the quality of liquid membrane-forming compounds suitable for spraying on concrete surfaces to retard the loss of water during the concrete curing process.

B. Quality

This specification covers the quality of liquid membrane-forming compounds suitable for spraying on concrete surfaces to retard the loss of water during the concrete curing process.

C. Delivery and Storage

All curing compounds shall be delivered to the site of the work in the original container bearing the name of the manufacturer and the brand name. The compound shall be stored in a manner that prevents damage to the container and protects water-emulsion types from freezing.

Part 642 – Specifications

Chapter 3 – National Standard Material Specifications

Material Specification 535—Preformed Expansion Joint Filler

A. Scope

This specification covers the quality of preformed expansion joint fillers for concrete.

B. Quality

Preformed expansion joint filler shall conform to the requirements of ASTM D1752, Type I, Type II, Type III, or Type IV unless bituminous type is specified. Bituminous type preformed expansion joint filler shall conform to the requirements of ASTM D994, or ASTM D1751.

Part 642 – Specifications

Chapter 3 – National Standard Material Specifications

Material Specification 536—Sealing Compound for Joints for Concrete and Concrete Pipe

A. Scope

This specification covers the quality of sealing compound for filling joints in concrete pipe and concrete structures.

B. Type

The compound must be a cold-application material unless otherwise specified.

C. Quality

The sealing compound must conform to the requirements of one of the following specifications:

(i) ASTM C990—Joints for concrete pipe, manholes, and precast box sections using preformed flexible joint sealants.

(ii) ASTM C877—External sealing bands for concrete pipe, manholes, and precast box sections.

(iii) ASTM D6690—Standard specification for joint and crack sealants, hot applied, for concrete and asphalt pavements.

(iv) ASTM C920—Elastomeric joint sealants for cold applied sealing and caulking of joints on mortar and concrete structures not subject to fuel spills. Use Type S or M, or Grade NS for vertical joints; Type S or M, Grade P or NS for horizontal joints. For Class 25, use Type M.

(v) The sealing compound if used with other joint material, such as fillers or gaskets, must be compatible.

Part 642 – Specifications

Chapter 3 – National Standard Material Specifications

Material Specification 537—Nonmetallic Waterstops

A. Scope

This specification covers nonmetallic waterstops for use in joints of concrete structures.

B. Classification

(1) Classes—Nonmetallic waterstops shall be of the following classes, as specified:
(i) Class I shall be fabricated of either natural or synthetic rubber.
(ii) Class II shall be fabricated of vinyl chloride polymer or copolymer.

(2) Types—Nonmetallic waterstops may be either split or solid and shall conform to the following types, as specified (see Fig. 537–1):
(i) Type A shall have ribbed anchor flanges and a smooth web. Flanges may be of uniform thickness or may have either a converging or a diverging taper toward the edges.
(ii) Type B shall have ribbed anchor flanges and a smooth web containing a hollow tubular center bulb having a wall thickness equal to at least one-half the web thickness, and the inside diameter (D) specified in the specifications or shown on the drawings. Flanges may be of uniform thickness or may have either a converging or a diverging taper toward the edges.
(iii) Type C shall have a single, circular bulb-type anchor flange at each edge and a smooth web.
(iv) Type D shall have a single, circular bulb-type anchor flange at each edge and a smooth web containing a hollow tubular center bulb having a wall thickness equal to a least one-half the thickness of the web, and the inside diameter (D) specified in the contract.
(v) Type E shall have ribbed anchor flanges and a web molded or extruded in the form of a round or U-shaped bulb of the dimensions specified in the contract or shown on the drawings. The web bulb shall be connected at the open-end of the U by a thin membrane having a minimum thickness of 1/64 inch and a maximum thickness of 1/5 of the web thickness and design to prevent infiltration of wet concrete into the bulb and to tear when expansion of the joint occurs. Flanges may be of uniform thickness or may have either a converging or a diverging taper toward the edges. Auxiliary positioning or nailing flanges may be provided as long as the functioning of the web bulb is not altered.
(vi) Type F shall have ribbed anchor flanges with at least two extra heavy ribs designed to resist displacement of the waterstop during concrete placement on each flange, and a smooth web having a positioning or nailing flange attached at the center.
(vii) Type G shall be of special design conforming to the details shown on the drawings.

(3) Sizes—Waterstops of types A through F shall be of the sizes specified in the specifications or shown on the drawings and listed in Table 537–1 of this specification. Type G waterstops shall have the dimensions shown on the drawings.

Figure 537–1 Types of Nonmetallic Waterstops

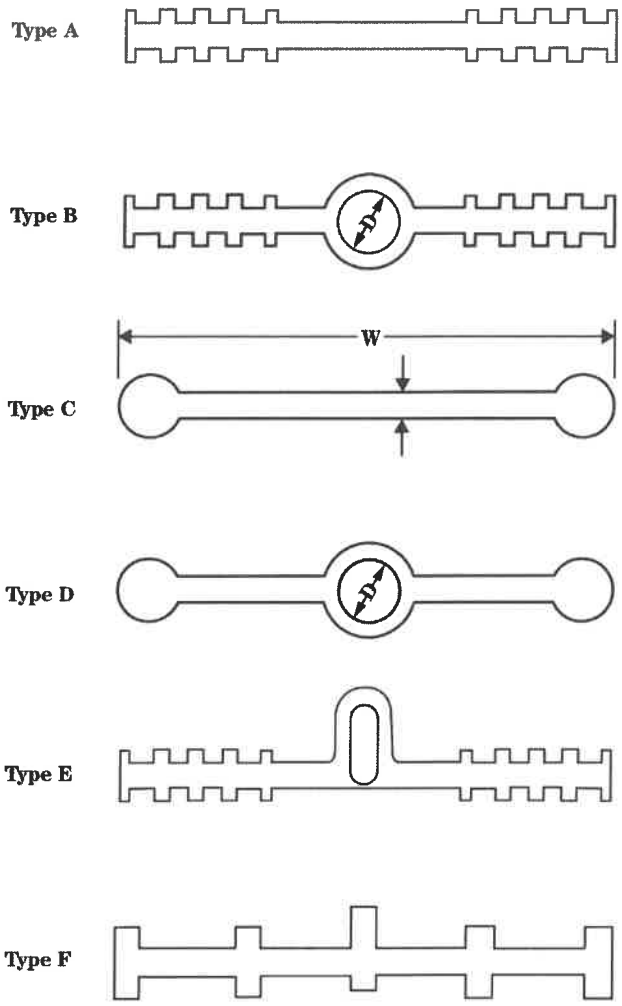


Table 537-1 Sizes of Waterstops

Size designation	Web thickness (T) (inches)	Width (W) (inches)
1	1/16	5 1/4
2	3/32	3 3/4
3	3/32	4
4	3/32	5 1/4
5	3/32	6
6	1/8	4
7	1/8	5 1/4
8	1/8	6
9	5/32	4
10	5/32	4 1/2
11	5/32	9
12	3/16	4
13	3/16	5
14	3/16	6
15	3/16	9
16	1/4	6
17	1/4	9
18	3/8	5
19	3/8	6
20	3/8	9
21	1/2	6
22	1/2	9
23	1/2	12

C. Physical Requirements

The extruded or molded material shall exhibit the properties specified herein when tested by the methods specified in section 4 of this specification.

D. Class I Waterstops

(1) Hardness as determined by the Shore A durometer method shall be a minimum of 60.
(2) Specific gravity shall be a maximum of 1.2.
(3) Tensile strength shall be a minimum of 2,500 pounds per square inch.
(4) Ultimate elongation shall be a minimum of 450 percent.
(5) Compression set shall be a maximum of 30 percent.
(6) Water absorption in weight measurements shall not exceed 5 percent.
(7) Decrease in tensile strength and ultimate elongation after aging shall not exceed 20 percent.
(8) There shall be no sign of failure due to brittleness at a temperature of minus 35 degrees Fahrenheit.

E. Class II Waterstops

(1) Hardness as determined by the Shore A durometer method shall be a minimum of 60. Specific gravity shall be a maximum of 1.4.
(2) Tensile strength shall be a minimum of 1,400 pounds per square inch.
(3) Ultimate elongation of the web shall be a minimum of 280 percent, and the flanges shall be a minimum of 200 percent.
(4) There shall be no sign of failure due to flange brittleness at a temperature of 0 degrees Fahrenheit nor of web brittleness at a temperature of minus 35 degrees Fahrenheit.
(5) Decrease in either tensile strength or ultimate elongation after accelerated extraction shall not exceed 15 percent.
(6) Results of alkali exposure:
  (i) After immersion for 7 days, the sample shall exhibit no loss of weight and a maximum weight gain of 0.25 percent, and the hardness measured by the Shore A durometer method shall not vary more than 5 points either plus or minus from the untreated sample.
  (ii) After immersion for 30 days, the sample shall exhibit no loss of weight and a maximum weight gain of 0.40 percent, and the dimensions of the treated sample shall not vary by more than 1 percent from the untreated sample.

F. Test Methods

(1) Testing shall be conducted by the methods cited herein. All cited test methods are included in ASTM as follows:
  (i) Hardness shall be determined by ASTM D2240.
  (ii) Specific gravity shall be determined by ASTM D792.
  (iii) Tensile strength shall be determined by ASTM D412 for Class I waterstops and ASTM D638 for Class II waterstops.
  (iv) Ultimate elongation shall be determined by ASTM D412 for Class I waterstops and ASTM D638 for Class II waterstops.
  (v) Compression set shall be determined by ASTM D395.
  (vi) Water absorption shall be determined by ASTM D570.
  (vii) Tensile strength and ultimate elongation after aging shall be determined by ASTM D412 for Class I waterstops and ASTM D638 for Class II waterstops.
  (viii) Brittleness shall be determined by ASTM D746 for Class II waterstops.
(2) Accelerated extraction shall be accomplished by procedures outlined by United States Army Corps of Engineers (USACE), Concrete Research Division (CRD) C572 under the following conditions:

(i) Samples shall not be less than 1/16 inch nor more than 1/8 inch in thickness.
(ii) The immersion medium shall be a solution prepared by dissolving 5 grams of chemically pure sodium hydroxide and 5 grams of chemically pure potassium hydroxide in 1 liter of water.
(iii) The samples shall be immersed in the medium for 14 days at a temperature of 145 degrees Fahrenheit, plus or minus 5 degrees Fahrenheit.
(iv) During the period of immersion, air shall be gently bubbled through the medium from a 0.25-inch diameter glass tube at an approximate rate of one bubble per second.
(v) Fresh medium shall be provided each day.
(vi) Samples need not be dipped in acetone.

(3) The effects of alkalis shall be determined by USACE CRD C572 under the following conditions:
(i) Sample shall have a maximum thickness of 0.25 inch.
(ii) The immersion medium shall be as described for accelerated extraction above.
(iii) Fresh medium shall be provided every 7 days.
(iv) The samples shall be immersed in the medium for 30 days.
(v) Samples need not be dipped in acetone.

G. Condition

Waterstops shall be extruded or molded in such a manner that the material is dense and homogeneous throughout and free from voids, tears, thins, indentations, or other imperfections. Unless otherwise specified, waterstops shall be symmetrical in shape and uniform in dimensions and shall be furnished in continuous strips a minimum length of 50 feet. Factory splices shall have a minimum tensile strength of 50 percent of the unspliced section.

H. Packing and Storing

Waterstops shall be packaged and stored by methods that provide protection from prolonged exposure to direct sunlight and/or excessive heat.

Part 642 – Specifications

Chapter 3 – National Standard Material Specifications

Material Specification 539—Steel Reinforcement (for concrete)

A. Scope

This specification covers the quality of steel reinforcement for reinforced concrete.

B. Quality

(1) All reinforcement shall be free from loose or flaky rust, soil, oil, grease, paint, or other deleterious matter.
(2) Steel bars for concrete reinforcement shall be grade 40, 50, or 60 deformed bars conforming to one of the following specifications:
  (i) Deformed and plain billet-steel bars for concrete reinforcement—ASTM A615.
  (ii) Rail-steel deformed bars for concrete reinforcement—ASTM A996.
  (iii) Axle-steel deformed bars for concrete reinforcement—ASTM A996.
(3) Dowels shall be plain round bars conforming to the same specifications listed above for steel bars.
(4) Fabricated deformed steel bar mats for concrete reinforcement shall conform to the requirements of ASTM A184.
(5) Deformed and plain steel welded wire reinforcement shall conform to the requirements of ASTM A1064.
(6) Epoxy-coated steel bars for concrete reinforcement shall conform to the requirements of ASTM A775.

C. Dimensions of Welded Wire Reinforcement

Gauges, diameters, spacing, and arrangement of wires for welded steel wire fabric shall be as defined for the specified style designations.

D. Storage

Steel reinforcement inventories at the site of the work shall be stored above the ground surface on platforms, skids, or other supports and shall be kept clean and protected from mechanical injury and corrosion.

Part 642 – Specifications

Chapter 3 – National Standard Material Specifications

Material Specification 541—Reinforced Concrete Pressure Pipe

A. Scope

This specification covers the quality of reinforced concrete pressure pipe and fittings.

B. Manufacture and Fabrication

(1) The pipe, the material used in its manufacture, and the methods of fabrication shall conform to the requirements of the following specifications applicable to the specified type of pipe.
(2) Steel cylinder type, pre-stressed—AWWA Standard C301for Pre-stressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids.
(3) Steel cylinder type, not pre-stressed—AWWA Standard C300 for Reinforced Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids.
(4) Noncylinder type, not pre-stressed—AWWA Standard C302 for Reinforced Concrete Pressure Pipe, Non-Cylinder Type, for Water and Other Liquids.
(5) Steel cylinder type, pre-tensioned—AWWA Standard C303 for Concrete Pressure Pipe, Bar-Wrapped, Steel Cylinder Type for Water and Other Liquids.
(6) Low head pressure pipe—ASTM C361.
The following specification sections shall not apply:
AWWA C302 and C303, sections 4.2 and 4.3.

C. Design

The actual pipe and fittings shall be designed by the manufacturer to withstand the specified external loads and internal pressures. Designs shall be by Indirect design, Direct design, or Standard design as applicable to the type of pipe specified:

(i) Indirect design—ASTM C497 for Standard Test Method for Concrete Pipe, Manhole Sections, or Tile. Pipe design shall be based on the results of external crushing strength tests on a minimum 2-foot length of pipe or a specimen of equivalent size, design, and material. The test shall demonstrate the following bearing loads:
- For pipe manufactured according to ASTM C361, AWWA C300, or AWWA C302, the load required to produce a 0.01-inch crack 1 foot long.
- For pipe manufactured according to AWWA C301, the load required to produce a 0.001-inch crack 1 foot long or the load 10 percent greater than the specified three-edge bearing strength, whichever occurs first.
- In lieu of actual testing for this contract, pipe design may be based on design curve previously approved and published by the Natural Resources Conservation Service.

(ii) Direct design—AWWA C304 for Design of Pre- Stressed Concrete Cylinder Pipe or AWWA Manual M9 3rd ED for Concrete Pressure Pipe. Pipe design shall be based on structural analysis and design calculations.

(iii) Standard design—ASTM C361 for Reinforced Concrete Low Head Pressure Pipe. Pipe design shall be as published in the standard.

D. Steel Reinforcement

The steel reinforcements shall conform to the requirements of the specifications cited in section B for the specified type of pipe except that elliptical reinforcing cages or other reinforcements that require special orientation of the pipe during placement are not allowed.

E. Joints

(1) The pipe joints shall conform to the requirements of the applicable specification for the pipe. They shall be bell-and-spigot type or double-spigot-and-sleeve type and shall have a positive groove in the spigot to contain the rubber gasket. The size and shape of the groove shall be such that it prevents displacement of the gasket by either internal or external water pressure when the joint is in any position within the required range of movement capability. Joint sleeves, also referred to as collars or coupling bands, shall conform to the requirements for bell rings in the applicable pipe specification.

(2) The joints shall be constructed to permit relative movement of the adjoining pipe sections with no reduction of watertightness. The joint length and the limiting angle defining the required capability of relative movement at each joint shall be no less than specified.

(3) Joint length refers to the permissible axial movement in the joint. It is defined as the maximum distance through which the spigot can move, relative to the bell or sleeve, from the fully engaged to the fully extended condition of the joint when the adjoining pipe sections are in parallel, concentric alignment. The joint is considered to be fully engaged when the spigot is inserted as far as it will go into the bell or sleeve and is fully extended when it is inserted the least amount that will ensure full confinement of the gasket and complete watertightness.

(4) Joint length specified for double-spigot joints refers to the permissible movement in each of the spigot-to-sleeve connections, not the sum of the two.

(5) The limiting angle of the joint is defined as the maximum deflection angle between adjoining pipe sections the joint will permit before the outer surface of the spigot comes into direct contact with inside of the mating bell or sleeve. If both spigot-to-sleeve connections of a double-spigot joint permit angular movement, the limiting angle of the joint is the sum of the two deflection angles permitted by the two connections.

F. Gaskets

The pipe joint gaskets shall conform to the requirements of the specifications cited in section B of this specification. They shall be endless rubber gaskets having circular cross section. The cross-sectional diameter of the gaskets shall conform to the pipe manufacturer's recommendation for the type and size of pipe furnished.

G. Marking

All pipe sections and special fittings shall be marked by the manufacturer with the manufacturer's name or trademark, the date of manufacture, the nominal size, design head, design external load, and the structure site for which it was designed and manufactured.

H. Certification

(1) All component material and actual pipe fabrication shall be tested, inspected, and documented as prescribed in the manufacturing specifications for the type of pipe specified. All documentation as noted in the manufacturing specifications shall be submitted to the engineer. Documentation shall include current test reports on steel

and steel wire reinforcing and compression tests of concrete used in the manufacture of the furnished pipe. Current tests are those that have been conducted within the last year.

(2) For pipe design based on actual external crushing strength tests, the engineer shall witness the actual test.

(3) For pipe design based on published design curves, a copy of the appropriate design curve marked to show the resultant concrete core stress and corresponding three-edge bearing load and a specification sheet showing all data and dimensions necessary to calculate the resultant core stress for the pipe furnished shall be submitted to the engineer.

(4) For pipe design based on structural analysis and calculations, such analysis and calculations shall be submitted to the engineer. Printouts of such calculations by computer programs shall be sufficiently detailed to enable comparison with standardized procedures and methods.

(5) Drawings, details, and descriptions of the pipe joints as necessary to show that the joint conforms to the specified requirements shall also be submitted.

Part 642 – Specifications

Chapter 3 – National Standard Material Specifications

Material Specification 547—Plastic Pipe

A. Scope

This specification covers the quality of Poly Vinyl Chloride (PVC), Polyethylene (PE), High Density Polyethylene (HDPE), and Acrylonitrile-Butadiene-Styrene (ABS) plastic pipe, fittings, and joint materials.

B. Material

(1) Pipe—The pipe must be as uniform as commercially practicable in color, opaqueness, density, and other specified physical properties. It must be free from visible cracks, holes, foreign inclusions, or other defects. The dimensions of the pipe must be measured as prescribed in ASTM D2122. Unless otherwise specified, the pipe must conform to the requirements listed in this specification and the applicable reference specifications in Figure 547–2, the requirements specified in Construction Specification 45, Plastic Pipe, and the requirements shown on the drawings.

(2) Fittings and joints—Fittings and joints must be of a schedule, SDR or DR, pressure class, external load carrying capacity, or pipe stiffness that equals or exceeds that of the plastic pipe. The dimensions of fittings and joints must be compatible with the pipe and measured in accordance with ASTM D2122. Joint and fitting material must be compatible with the pipe material. The joints and fittings must be as uniform as commercially practicable in color, opaqueness, density, and other specified physical properties. It must be free from visible cracks, holes, foreign inclusions, or other defects. Fittings and joints must conform to the requirements listed in this specification, the requirements of the applicable specification referenced in the ASTM or AWWA specification for the pipe, the requirements specified in Construction Specification 45, and the requirements shown on the drawings.

(3) Solvents—Solvents for solvent-welded pipe joints must be compatible with the plastic pipe used and must conform to the requirements of the applicable specification referenced in the ASTM or AWWA specification for the pipe, fitting, or joint.

(4) Gaskets—Rubber gaskets for pipe joints must conform to the requirements of ASTM F477, Elastomeric Seals (Gaskets) for Jointing Plastic Pipe.

C. Perforations

When perforated pipe is specified, perforations must conform to the following requirements unless otherwise specified in Construction Specification 45 or shown on the drawings:

(1) Perforations must be either circular or slots.

(2) Circular perforations must be 1/4 ± 1/16-inch diameter holes arranged in rows parallel to the axis of the pipe.

(3) Perforations must be evenly spaced along each row such that the center-to-center distance between perforations is not less than eight times the perforation diameter. Perforations may appear at the ends of short and random lengths. The minimum perforation opening per foot of pipe must be as shown in Figure 547–1.

Figure 547-1 Perforations

Nominal pipe size	Minimum number of rows		Minimum opening/foot (in^2)
	circular	slot	
4	2	2	0.22
6	4	2	0.44
8	4	2	0.44
10	4	2	0.44
12	6	2	0.66

(4) Rows must be arranged in two equal groups at equal distance from the bottom on each side of the vertical centerline of the pipe. The lower-most rows of perforations must be separated by an arc of not less than 60 degrees or more than 125 degrees. The uppermost rows of perforations must be separated by an arc not to exceed 166 degrees. The spacing of rows between these limits must be uniform. The minimum number of rows must be as shown in Figure 547–1.

(5) Slot perforations must be symmetrically located in two rows, one on each side of the pipe centerline. Slot perforations must be located within the lower quadrants of the pipe with slots no wider than 1/8 inch and spaced not to exceed 11 times the perforation width. Minimum perforation opening per lineal foot of pipe must be as shown in Figure 547–1.

(6) On both the inside and outside of the pipe, perforations must be free of cuttings or frayed edges and of any material that would reduce the effective opening.

Figure 547-2 Pipe Specifications

Pipe	Specification
Poly vinyl chloride (PVC) pipe	
Plastic pipe - Schedules 40, 80, 120	ASTM D1785 ASTM D2466
Pressure rated pipe - SDR Series	AWWA C900 ASTM D2241
Plastic drain, waste, and vent pipe and fittings	ASTM D2665
Joints for IPS PVC pipe using solvent weld cement	ASTM D2672
Composite sewer pipe	ASTM D2680
Type PSM PVC sewer pipe and fittings	ASTM D3034
Large-diameter gravity sewer pipe and fittings	ASTM F679
Smooth-Wall Underdrain Systems for Highway, Airport, and Similar Drainage	ASTM F758
Profile gravity sewer pipe and fittings based on controlled inside diameter	ASTM F794
Corrugated sewer pipe with a smooth	ASTM F949

Pipe	Specification
interior and fittings	
Pressure pipe, 4-inch through 60-inch for water distribution	AWWA C900
Polyethylene (PE) plastic pipe	
12- to 60-inch annular corrugated profile-wall polyethylene (PE) pipe and fittings	ASTM F2306
SIDR-PR based on controlled inside diameter	ASTM D2239
SDR-PR based on controlled outside diameter	ASTM D3035
High density polyethylene (HDPE) plastic pipe	
Plastic pipe and fittings	ASTM D3350
SDR-PR based on controlled outside diameter	ASTM F714
Heat joining polyolefin pipe and fittings	ASTM D2657
Acrylonitrile-butadiene-styrene (ABS) pipe	
Composite sewer pipe	ASTM D2680

Part 642 – Specifications

Chapter 3 – National Standard Material Specifications

Material Specification 571—Slide Gates

A. Scope

This specification covers the quality of metal slide gates for water control.

B. Class and Type of Gate

The class of gate is expressed as an alpha numerical symbol composed of the seating head (L = Light, M = Moderate, H = Heavy, and unseating head (1,2,3). The two are separated by a hyphen with the seating head listed first. For this purpose, the unseating head must be expressed in terms of feet of water. Gates must be of the specified types as defined:

Light duty	
Type MLS-1	Cast iron with cast iron seat facings.
Type MLS-2	Fabricated metal.
Moderate duty	
Type MMS-1	Cast iron with bronze seat facings, cast iron or galvanized structural steel guides, and galvanized steel, bronze, or stainless steel fasteners.
Type MMS-2	Cast iron with bronze seat facings, cost iron or stainless steel guides, and bronze or stainless steel fasteners. Guides and fasteners are stainless steel, when specified.
Heavy duty	
Type MHS-1	Have gray cast iron slides, frames, guides, and yokes, and are fitted with bronze seat facings, bronze wedges and wedge blocks or wedge seat facings, and bronze stem blocks or thrust nuts; bronze or stainless steel fasteners; and cold rolled steel stems except where stainless steel stems are specified.
Type MHS-2	Have gray cast iron slides, frames, guides, and yokes, and are fitted with stainless steel seat facings, wedges, wedge seat facings, stems and fasteners; and austenitic cast iron stem blocks or thrust nuts.
Type MHS-3	Have austenitic gray cast iron slides, frames, guides, and yokes, and are fitted with nickel-copper alloy seat facings, wedges, wedge seat facings, stems and fasteners; and austenitic cast iron stem blocks or thrust nuts.

C. Quality of Material

(1) Material for slide gates and appurtenances must conform to the requirements of the applicable specifications listed below for the alloy, grade, type, or class of material and the condition and finish appropriate to the structural and operational requirements.

(2) Galvanizing (zinc coating) must conform to the requirements of Material Specification 582.

Material	ASTM specification
Cast iron and gray cast iron	A48 Class 30, A126 Class B
Austenitic cast iron	A436
Structural steel shapes, plates, and bars	A36
Cold rolled steel	A108
Carbon steel bars	A108 or A575
Stainless steel	A240, A276, A269, A582; Type 302, 303, 304, or 304L
Castings, nickel and nickel alloy	A494
Carbon steel sheets and strips	A1011
Zinc-coated carbon steel sheets	A653 or A924
Bronze bar, rods, and shapes	B21 or B98
Naval bronze	B21
Phosphor bronze	B103 or B139
Manganese bronze	B138 or B584
Silicon bronze	B98 or B584
Cast bronze	B584
Nickel-copper alloy plate, sheet, or strip	B127
Nickel-copper alloy rod or bar	B164
Rubber for gaskets and seals	D395, D412, D471, D572, or D2240

D. Fabricated Metal Gates (Light Duty Gates)

Fabricated metal gates must be built to withstand the seating head expressed by the gate class designation. Unless otherwise specified, the gates must be galvanized steel with flat-back frames.

E. Cast Iron Gates (Light Duty Gates)

(1) The frame must be cast iron of the specified type. The front face must be machined to receive the gate guides.

(2) The gate slide must be cast iron and be fabricated to withstand the seating and unseating heads expressed by the gate class designation as defined in section 2 of this specification.

(3) Grooves must be cast on the vertical sides of the slide to match the guide angles.
(4) The gate guides must be galvanized structural steel or stainless steel and be fabricated to withstand the total thrust of the gate slide from water pressure and wedge action under maximum operating conditions.
(5) Wedges and wedge seats must have smooth bearing surfaces. Wedges may be cast as integral parts of the slide. Removable wedges and wedge seats must be fastened to the slide, frame, or guides by means of suitable studs, screws, or bolts and be firmly locked in place after final adjustment. Each interacting set of wedge and wedge seat must be adjustable as needed to ensure accurate and effective contact. Adjusting bolts or screws must be bronze or galvanized steel.
(6) Seat facings must be machined to a smooth finish to ensure proper watertight contact.

F. Frame or Seat (Moderate and Heavy Duty Gates)

The frame must be cast iron and of the specified type. The front face must be machined to receive the gate guides, and the rear face must be machined as required to match the specified attaching means. For heavy duty gates, a dovetailed groove must be machined on the perimeter of the front face to receive the seat facing.

G. Gate Slide (Moderate and Heavy Duty Gates)

(1) The gate slide must be cast iron, rectangular in shape, and have horizontal and vertical stiffening ribs of sufficient section to withstand the seating and unseating heads expressed by the gate class designation as defined in section 2 of this specification. For heavy duty gates, a dovetailed groove must be machined on the perimeter of the slide face to receive the seat facing.
(2) Tongues must be machined on the vertical sides of the slide along its entire height to match the guide grooves and angles with a maximum clearance of 1/16 inch for gates smaller than 54 inches by 54 inches, and 1/8 inch for larger gates.
(3) A nut pocket with reinforcing ribs must be integrally cast on the vertical centerline and above the horizontal centerline of the slide. The pocket must be of a shape adequate to receive a flat-backed thrust nut or stem block and be built to withstand the opening and closing thrust of the stem.

H. Gate Guides (Moderate and Heavy Duty Gates)

(1) The gate guides must be built to withstand the total thrust of the gate slide from water pressure and wedge action. The gate guides must be cast iron for heavy duty gates.
(2) Grooves must be machine-in cast iron guides to receive the tongue on the gate slide throughout the entire length of the guide.
(3) The guides must be of adequate length to retain a minimum of one-half the height of the gate slide when the gate is fully opened.

I. Wedges and Wedge Seats (Moderate and Heavy Duty Gates)

(1) Pads for supporting wedges, wedge seats (or blocks), and wedge loops (or stirrups) must be cast as integral parts of the gate frame, slide, or guides and be accurately machined to receive those parts.
(2) Wedges and wedge seats must have smooth bearing surfaces for moderate duty gates and have machine finish bearing surfaces for heavy duty gates. Removable wedges may be cast as integral part of the slide for moderate duty gates. Wedges must be fastened to the gate slide, frame, or guides with suitable studs, screws, or bolts and be firmly locked in place after final adjustment. Each interacting set of wedge and wedge seat must be adjustable as needed to ensure accurate and effective contact.

J. Seat Facing

(1) Moderate duty gates—Seat facings must be machined to a smooth finish to ensure proper watertight contact. Bronze facings must be securely attached by welding or other approved methods.

(2) Heavy duty gates—Seat facings must be pressed or impacted into the machined dovetailed grooves on the gate slide and frame and machined to a smooth finish to ensure proper watertight contact.

K. Yoke

When a self-contained gate is specified, the yoke must be of such design as to withstand the loads resulting from normal operation of the gate. For moderate and heavy duty gates, cast iron yokes must be provided with machined pads for connecting to the ends of gate guides and to receive the stem thrust cap or handwheel lift.

L. Flush Bottom Seal (Heavy Duty Gate)

When a flush bottom sealing gate is specified, a solid, square-corner type rubber seal must be provided at the bottom of the gate opening. It must be securely attached either to the bottom of the slide or to the frame. Metal surfaces bearing on the rubber seal must be smooth and rounded as necessary to prevent cutting of the seal during gate operation.

M. Gate Stem and Lift (or Hoist)

(1) The gate stem and lift/hoist must be of the specified type, size, and capacity and, if hand operated, must be capable of moving the gate slide under normal conditions, following unseating from the wedging device, with a pull on the handwheel or crank of not more than 25 pounds with the specified seating and/or unseating head of water against the gate.

(2) Unless otherwise specified, the stem must be carbon steel and be furnished in sections as necessary to permit reasonable ease in installation. Couplings must be bolted, pinned, or keyed to the stem. The stem must be furnished with rolled or machine-cut 29 degree Acme threads of sufficient length to completely open the gate. The threads must be smooth and of uniform lead and cross-section, such that the nut can travel the full length without binding or excessive friction. For moderate and heavy duty gates, the stem must be threaded for connection to the stem block or thrust nut on the gate slide.

(3) The lift must be compatible with the type of stem furnished. Unless otherwise specified, the lift nut must be cast bronze for light and moderate duty gates and cast manganese bronze for heavy duty gates and be fitted with ball or roller thrust bearings designed to withstand the normal thrust developed during opening and closing of the gate at the maximum operating heads. All gears, sprockets, and pinions must be machine-cut, with ratios and strength adequate to withstand expected operating loads. Sufficient grease fittings must be provided to allow lubrication of all moving parts. An arrow and the word "open" must be cast on the rim of the handwheel or on the lift housing to indicate the direction of gate opening. Unless otherwise specified, the lift for the nonrising-stem gate must be provided with an indicator capable of showing both when the gate is fully open and when it is fully closed for the moderate and heavy duty gates.

(4) Provisions must be made to prevent stem rotation within the stem block or thrust nut or at the connection of the gate slide.

(5) Stop collars must be provided to prevent overtravel in opening and closing the gate.

N. Stem Guides

Unless otherwise specified, stem guides must be cast iron for light duty gates and cast iron with bronze bushed collars for moderate and heavy duty gates. They must be fully adjustable in two directions.

O. Wall Thimble (Moderate and Heavy Duty Gates)

(1) When a wall thimble is specified, it must be of the same cast iron used in the gate frame and of the section, type, and depth specified. The front flange must be machined to match the gate frame and drilled and tapped to accurately receive the gate attachment studs.
(2) Gaskets or mastic to be installed between the thimble and the gate frame must conform to the recommendations of the gate manufacturer and be furnished with the thimble.

P. Fasteners

Unless otherwise specified, all anchor bolts and other fasteners must be galvanized steel or bronze for light duty gates; galvanized steel or stainless steel or bronze for moderate duty gates; and, of the quality and size as recommended by the gate manufacturer for heavy duty gates. All anchor bolts, assembly bolts, screws, nuts, and other fasteners must be of ample section to withstand the forces created by operation of the gate while subjected to the specified seating and unseating heads. Anchor bolts must be furnished with two nuts to facilitate installation.

Q. Installation Instructions

Before installation, provide the engineer with the manufacturer's complete installation data, instructions for adjustments, and drawings or templates showing the location of all anchor bolts for each gate.

R. Painting

When specified, gates and accessories must be painted by the designated paint system.

S. Certification

The supporting data submitted to the engineer must include the name of the manufacturer, the manufacturer's model number (for standard catalogue items), or the seating and unseating heads for which the gate is designed together with such drawings and specifications as may be necessary to show that the gate conforms to the requirements of this specification.

Part 642 – Specifications

Chapter 3 – National Standard Material Specifications

Material Specification 581—Metal

A. Scope

This specification covers the quality of steel, stainless steel, and aluminum alloys.

B. Structural Steel

(1) Structural steel must conform to the requirements of ASTM A36.
(2) High-strength low-alloy structural steel must conform to ASTM A242 or A588.
(3) Carbon steel plates of structural quality to be bent, formed, or shaped cold must conform to ASTM A283, Grade C.
(4) Carbon steel sheets of structural quality must conform to ASTM A1011, Grade 40, or A1008, Grade 40.
(5) Carbon steel strip of structural quality must conform to ASTM A1011, Grade 36.
(6) Stainless steel must conform to ASTM A240, A320, A276, A269, A582; Type 302, 303, 304, or 304L.

C. Commercial or Merchant Quality Steel

Commercial or merchant quality steel must conform to the requirements of the applicable ASTM listed below:

Product	ASTM standards
Carbon steel bars	A575, Grade M 1015 to Grade M 1031
Carbon steel sheets	A1011
Carbon steel strips	A1011
Zinc-coated carbon steel sheets	A653 or A924

D. Aluminum Alloy

Aluminum alloy products must conform to the requirements of the applicable ASTM standard listed below. Unless otherwise specified, alloy 6061-T6 must be used.

Product	ASTM standards
Standard structural shape	B308
Extruded structural pipe and tube	B429
Extruded bars, rods, shapes, and tubes	B221
Drawn seamless tubes	B210
Rolled or cold-finished bars, rods, and wire	B211
Sheet and plate	B209

E. Bolts

(1) Steel bolts must conform to the requirements of ASTM A307. If high-strength bolts are specified, they must conform to the requirements of ASTM F3125.
(2) When galvanized or zinc-coated bolts are specified, the zinc coating must conform to the requirements of ASTM A153, except that bolts 0.5 inch or less in diameter may be coated with electro-deposited zinc or cadmium coating conforming to the requirements of ASTM B633, Service Condition SC 3, or ASTM B766, unless otherwise specified.
(3) Stainless steel bolts must conform to ASTM A320.

F. Rivets

Unless otherwise specified, steel rivets must conform to the requirements of ASTM A31, Grade B. Unless otherwise specified, aluminum alloy rivets must be Alloy 6061 conforming to the requirements of ASTM B316.

G. Welding Electrodes

(1) Steel welding electrodes must conform to the requirements of American Welding Society Specification AWS A5.1, "Specification for Mild Steel Covered Arc-Welding Electrodes," except that they must be uniformly and heavily coated (not washed) and must be of such a nature that the coating does not chip or peel while being used with the maximum amperage specified by the manufacturer.
(2) Aluminum welding electrodes must conform to the requirements of American Welding Society Specification AWS A5.10, "Specification for Aluminum and Aluminum-Alloy Welding Rods and Bare Electrodes."
(3) Stainless steel electrodes must conform to the requirements of AWS A5.22/ A5.22M:2012 Specification for Stainless Steel Electrodes for Flux Cored Arc Welding and Stainless Steel Flux Cored Rods for Gas Tungsten Arc Welding.

Part 642 – Specifications

Chapter 3 – National Standard Material Specifications

Material Specification 582—Galvanizing

A. Scope

This specification covers the quality of zinc coatings applied to iron and steel productions.

B. Quality

(1) Zinc coatings shall conform to the requirements of ASTM A123 for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products or as otherwise specified in the items of work and construction details of the Construction Specification.

(2) ASTM A123 covers both fabricated and nonfabricated products; e.g., assembled steel products, structural steel fabrications, large tubes already bent or welded before galvanizing, and wire work fabricated from noncoated steel wire. It also covers steel forgings and iron castings incorporated into pieces fabricated before galvanizing or which are too large to be centrifuged (or otherwise handled to remove excess galvanizing bath metal).

(3) Items to be centrifuged or otherwise handled to remove excess zinc shall meet the requirements of ASTM A153, except bolts, screws, and other fasteners 0.5 inch or less in diameter may be coated with electro-deposited zinc or cadmium coating conforming to the requirements of ASTM B766, coating thickness Class 5, Type III, or ASTM B633, Service Condition SC-3, unless otherwise specified.

Part 642 – Specifications

Chapter 3 – National Standard Material Specifications

Material Specification 592—Geotextile

A. Scope

This specification covers the quality of geotextile, including geotextile for temporary silt fence.

B. General Requirements

(1) Fibers (threads and yarns) used in the manufacture of geotextile must consist of synthetic polymers composed of a minimum of 85 percent by weight polypropylene, polyester, polyamide, polyethylene, polyolefin, or polyvinylidene-chloride. The fiber must be formed into a stable network of filaments retaining dimensional stability relative to each other. The geotextile must be free of defects, such as holes, tears, and abrasions. The geotextile must be free of any chemical treatment or coating that significantly reduces its porosity. Fibers must contain stabilizers, inhibitors, or both to enhance resistance to ultraviolet light. Geotextile other than for temporary silt fence must conform to the requirements in Figure 592-1 or 592-2, as applicable. Geotextile for temporary silt fence must conform to ASTM D6461.

(2) Thread used for factory or field sewing must be of a color contrasting to the color of the fabric and made of high-strength polypropylene, polyester, or polyamide material. It must be as resistant to ultraviolet light as the geotextile being sewn.

C. Classification

(1) There are two geotextile classifications, woven and nonwoven. Geotextile for temporary silt fence may be either woven or nonwoven. Silt film woven geotextile may not be used except for temporary silt fence.

(2) Woven geotextiles are made from fabric that is formed by the uniform and regular interweaving of the threads or yarns in two directions. Woven fabrics must be manufactured from monofilament yarn formed into a uniform pattern with distinct and measurable openings, retaining their position relative to each other. The fabric must have a selvedge edge or otherwise be finished to prevent unraveling.

(3) Nonwoven geotextiles are made from fabric that is formed by a random placement of threads in a mat and bonded by needle punching, heat bonding, or resin bonding. Nonwoven geotextiles must have distinct but variable small openings, retaining their position relative to each other when bonded. The use of heat- or resin-bonded nonwovens is restricted as specified in note 2 of Figure 592-2.

D. Sampling and Testing

The geotextile must conform to Figure 592-1 or 592-2 or ASTM D6461, as applicable, for the product type shown on the label. Documentation described in either (i) or (ii) below is required to verify the product meets the specified requirements:

(i) Product properties as listed in the latest edition of the "Specifiers Guide," Geosynthetics (Industrial Fabrics Association International, 1801 County Road B, West Roseville, MN 55113-4061 or at http://www.geosindex.com), and that represent average roll values, are acceptable.

(ii) Test data from the geotextile production run for each of the specified tests listed in Figure 592-1 or 592-2 or ASTM D6461, as applicable.

E. Shipping and Storage

Each roll of geotextile must be labeled or tagged to clearly identify the brand, class, and individual production run in accordance with ASTM D4873. The geotextile must be shipped and transported in rolls wrapped with a cover for protection from moisture, dust, dirt, debris, and ultraviolet light. The cover must be maintained undisturbed to the maximum extent possible before placement.

Figure 592-1 Requirements for Woven Geotextiles [1/]

Property	Test method	Class I	Class II	Class III	Class IV
Grab tensile strength (lb)	ASTM D4632	247 minimum	180 minimum	180 minimum	315
Elongation at failure (%)	ASTM D4632	<50	<50	<50	<50
Trapezoidal tear strength (lb)	ASTM D4533	90 minimum	67 minimum	67 minimum	112 minimum
Puncture strength (lb)	ASTM D6241	495 minimum	371 minimum	371 minimum	618 minimum
Ultraviolet stability (% retained strength)	ASTM D4355	50 minimum	50 minimum	50 minimum	70 minimum
Permittivity (sec^{-1})	ASTM D4491	as specified			
Apparent opening size (AOS) [2/]	ASTM D4751	as specified			
Percent open area (POA) (%)	USACE [3/]CWO-02215-86	as specified			

[1/] All values are minimum average roll values (MARV) in the weakest principal direction, unless otherwise noted.

[2/] Maximum average roll value.

[3/] Note: CWO is a USACE reference.

Figure 592-2 Requirements for Non-Woven Geotextiles [1/]

Property	Test method	Class I [2/]	Class II [2/]	Class III [2/]	Class IV [2/]
Grab tensile strength (lb)	ASTM D4632 grab test	202 minimum	157 minimum	112 minimum	202 minimum
Elongation at failure (%)	ASTM D4632	50 minimum	50 minimum	50 minimum	50 minimum
Trapezoidal tear strength (lb)	ASTM D4533	79 minimum	56 minimum	40 minimum	79 minimum
Puncture strength (lb)	ASTM D6241	433 minimum	309 minimum	223 minimum	433 minimum
Ultraviolet light (% retained strength)	ASTM D4355	50 minimum	50 minimum	50 minimum	50 minimum
Permittivity sec^{-1}	ASTM D4491	0.70 minimum or as specified			
Apparent opening size (AOS) (mm) [3/]	ASTM D4751	0.22 maximum or as specified			

[1/] All values are minimum average roll values (MARV) in the weakest principal direction, unless otherwise noted.

[2/] Needle punched geotextiles may be used for all classes. Heat-bonded or resin-bonded geotextiles may be used for class IV only.

[3/] Maximum average roll value.

Part 642 – Specifications

Chapter 3 – National Standard Material Specifications

Material Specification 594—Geomembrane Liner

A. Scope

This specification covers the quality of high-density polyethylene (HDPE), linear low-density polyethylene (LLDPE), ethylene propylene diene terpolymer (EPDM), poly vinyl chloride (PVC), flexible polypropylene (fPP), and coated tape polyethylene (cPE) geomembrane liners and seams, gaskets, metal battens, bolts, embed channels, clamps, and sealant.

B. Material

(1) Liner—The liner must have a nominal thickness as specified. The liner must be manufactured to be suitable for use in the specified exposed or buried conditions. It must conform to the requirements of this specification, Construction Specification 97, and the requirements shown on the drawings.

(2) Gaskets, metal battens, clamps, bolts, embed channels, welding rod, adhesive, and sealant—Gasket material must be neoprene, closed-cell medium, 0.25 inch thick, with adhesive on one side, or other gasket material as approved by the liner manufacturer. Metal battens must be 0.25-inch-thick by 2-inch-wide stainless steel. Clamps must be 0.5-inch-wide stainless steel. Bolts must be stainless steel. The embed channel and welding rod must be compatible with the liner, as recommended by the manufacturer. Adhesive must be approved by the manufacturer and must consist of material with a life expectancy similar to the liner material. Sealant must be as recommended by the manufacturer. Silicone sealant may not be used with PVC liner materials.

(3) Vents and pipe boots—Vents and pipe boots must be compatible with the liner, as recommended by the liner manufacturer.

C. Liner Properties

(1) The liner must be manufactured from virgin polymers and other compounding materials. Regrind, reworked, or trim materials must be from the same manufacturer and the same formulation as the liner. Recycled materials will not be allowed. The liner must be uniform in color, thickness, and surface texture. The liner must be resistant to fungal or bacterial attack and free of cuts, abrasions, holes, blisters, contaminants, and other imperfections.

(2) HDPE—The HDPE liner must meet the requirements specified in Geosynthetics Research Institute (GRI) Test Method GM13. Selected property values are reproduced in Figures 594-1 and 594-2 for smooth and textured HDPE, respectively.

(3) LLDPE—The LLDPE liner must meet the requirements specified in GRI Test Method GM17 (smooth and textured LLDPE) and GM25 (reinforced LLDPE). Selected property values are reproduced in Figures 594-3 through 594-5 for smooth, textured, and reinforced LLDPE, respectively.

A reinforced LLDPE liner consists of one ply of reinforcing polyester (scrim) between two sheets of LLDPE. The polyester scrim must be of an open weave that permits strike-through of the LLDPE.

(4) EPDM—The EPDM liner must meet the requirements specified in GRI Test Method GM21. Selected property values are reproduced in Figures 594-6 and 594-7 for nonreinforced and reinforced EPDM, respectively.

(5) PVC—The PVC liner must meet the requirements specified in ASTM D7176. Selected property values are reproduced in Figure 594-8.

(6) fPP and fPP-R—The fPP and fPP-R liners must meet the requirements specified in ASTM D7613. Selected property values are reproduced in Figures 594-9 and 594-10 for nonreinforced (fPP) and reinforced (fPP-R), respectively.

A reinforced fPP-R liner consists of one ply of reinforcing polyester (scrim) between two sheets of fPP. The polyester scrim must be of an open weave that permits strike-through of the fPP.

(7) cPE—The cPE liner must meet the requirements specified in GRI Test Method GM30 and in Figure 594-11. The cPE liner is manufactured from woven HDPE scrim (tape) with a PE coating on both sides.

Figure 594-1 Requirements for Smooth HDPE Liner

Property	Test methods	Requirements* Nominal thickness		
		30 mil	40 mil	60 mil
Density, g/cc	ASTM D1505, D792	0.940	0.940	0.940
Tensile properties:				
Yield strength, lb/in	ASTM D6693 (Type IV)	63	84	126
Break strength, lb/in		114	152	228
Yield elongation, %		12	12	12
Break elongation, %		700	700	700
Tear resistance, lb	ASTM D1004	21	28	42
Puncture resistance, lb	ASTM D4833	54	72	108
Carbon black content, %	ASTM D1603	2.0-3.0	2.0-3.0	2.0-3.0
Seam properties**:				
shear strength, lb/in	ASTM D6392	57	80	120
peel strength, lb/in		45	60	91

* All values, unless otherwise specified, are minimum average roll values as reported for each test method.

** Break must occur with an acceptable break code as specified in GRI Test Method GM19a.

Figure 594-2 Requirements for Textured HDPE Liner

Property	Test methods	Requirements* Nominal thickness		
		30 mil	40 mil	60 mil
Density, g/cc	ASTM D1505, D792	0.940	0.940	0.940
Asperity height, mills	ASTM D7466	10	10	10
Tensile properties:				
yield strength, lb/in	ASTM D6693 (Type IV)	63	84	126
break strength, lb/in		45	60	90
yield elongation, %		12	12	12
break elongation, %		100	100	100
Tear resistance, lb	ASTM D1004	21	28	42
Puncture resistance, lb	ASTM D4833	45	60	90
Carbon black content, %	ASTM D1603	2.0-3.0	2.0-3.0	2.0-3.0
Seam properties**:				
shear strength, lb/in	ASTM D6392	57	80	120
peel strength, lb/in		45	60	91

* All values, unless otherwise specified, are minimum average roll values as reported for each test method.

** Break must occur with an acceptable break code as specified in GRI Test Method GM19a.

Figure 594-3 Requirements for Smooth LLDPE Liner

Property	Test methods	Requirements* Nominal thickness		
		30 mil	40 mil	60 mil
Density, g/cc	ASTM D1505, D792	0.939	0.939	0.939
Tensile properties:				
break strength, lb/in	ASTM 6693 (Type IV)	114	152	228
break elongation, %		800	800	800
Tear resistance, lb	ASTM D1004	16	22	33
Puncture resistance, lb	ASTM D4833	42	56	84
Carbon black content, %	ASTM D1603	2.0-3.0	2.0-3.0	2.0-3.0
Seam properties**:				
shear strength, lb/in	ASTM D6392	45	60	90
peel strength, lb/in		38	50	75

* All values, unless otherwise specified, are minimum average roll values as reported for each test method.

** Break must occur with an acceptable break code as specified in GRI Test Method GM19a.

Figure 594-4 Requirements for Textured LLDPE Liner

Property	Test methods	Requirements* Nominal thickness		
		30 mil	40 mil	60 mil
Density, g/cc	ASTM D1505, D792	0.939	0.939	0.939
Asperity height, mills	ASTM D7466	10	10	10
Tensile properties:				
break strength, lb/in	ASTM D6693 (Type IV)	45	60	90
break elongation, %		250	250	250
Tear resistance, lb	ASTM D1004	16	22	33
Puncture resistance, lb	ASTM D4833	42	56	84
Carbon black content, %	ASTM D1603	2.0-3.0	2.0-3.0	2.0-3.0
Seam properties**:				
shear strength, lb/in	ASTM D6392	45	60	90
peel strength, lb/in		38	50	75

* All values, unless otherwise specified, are minimum average roll values as reported for each test method.

** Break must occur with an acceptable break code as specified in GRI Test Method GM19a.

Figure 594-5 Requirements for Reinforced LLDPE Liner

Property	Test methods	Requirements* Nominal thickness		
		24 mil	36 mil	45 mil
Mass per unit area, lb/ft^2	ASTM D5261	0.10	0.15	0.19
Grab tensile properties:				
Strength, lb	ASTM D7004	150	200	250
Elongation, %		22	22	22
Tear resistance, lb	ASTM D5884	55	55	55
Puncture resistance, lb	ASTM D4833	65	75	85
Ply adhesion, lb	ASTM D6636	20	20	20
Coating thickness over scrim, mil	Manufacturer's data	7	10	12
Seam properties: **				
Shear strength, lb/in	ASTM D7747	60***	75	90
Peel strength, lb/in		30***	30	30

* All values, unless otherwise specified, are minimum average roll values as reported for each test method.

** Break must occur with an acceptable break code as specified in GRI Test Method GM19b.

*** 24 mil geomembrane nominal thickness shear and peel values are not listed in GRI GM 19b Table 1(a) so are interpolated from 36 and 45 mil values.

Figure 594-6 Requirements for Nonreinforced EPDM Liner

Property	Test methods	Requirements* Nominal thickness	
		45 mil	60 mil
Tensile properties:			
Tensile strength, lb/in^2	ASTM D412, Die C	1305	1305
Ultimate elongation, %		300	300
Tear resistance, lb/in	ASTM D624, Die C	150	230
Puncture resistance, lb	ASTM D4833	30	40
Brittleness point, °F	ASTM D2137	< -49	< -49
Seam properties:			
Shear strength, lb/in	ASTM D7272	35	35
Peel strength, lb/in		8	8

* All values, unless otherwise specified, are minimum average roll values as reported for each test method.

Figure 594-7 Requirements for Reinforced EPDM Liner

Property	Test methods	Requirements nominal thickness*	
		45 mil	60 mil
Grab tensile strength, lb	ASTM D7004	90	90
Tearing strength, lb	ASTM D5884	130	170
Puncture resistance, lb	ASTM D4833	60	80
Brittleness point, °F	ASTM D2137	< -49	< -49
Seam properties:			
Shear strength, lb/in	ASTM D7272	35	35
Peel strength, lb/in		8	8

* All values, unless otherwise specified, are minimum average roll values as reported for each test method.

Figure 594-8 Requirements for PVC Liner

Property	Test methods	Requirements* Nominal thickness	
		30 mil	40 mil
Specific gravity	ASTM D792	1.2	1.2
Tensile properties:			
Break strength, lb/in	ASTM D882	73	97
Break elongation, %		380	430
Tear strength, lb	ASTM D1004	8	10
Low temperature impact, °C	ASTM D1790	< -29	< -29
Dimensional stability, % (maximum)	ASTM D1204	3	3
Hydrostatic resistance, lb/in^2	ASTM D751	100	120
Seam properties:			
Shear strength, lb/in	ASTM D7408	58	77
Peel strength, lb/in		15	15

* All values, unless otherwise specified, are minimum average roll values as reported for each test method.

Figure 594-9 Requirements for Nonreinforced fPP Liner

Property	Test methods	Requirements* Nominal thickness		
		30 mil	40 mil	60 mil
Thickness, in.	ASTM D5199	0.027	0.035	0.054
Tensile properties:				
Tensile strength, lb/in	ASTM D6693	60	60	96
Ultimate elongation, %		700	600	600
Tear resistance, lb	ASTM D1004	10	10	18
Puncture resistance, lb	ASTM D4833	25	25	40
Low temperature bend, °C	ASTM D2136	-40	-40	-40
Seam properties**:				
Shear strength, lb/in	ASTM D6392, D6214***	25	30	40****
Peel strength, lb/in		20	25	35****

* All values, unless otherwise specified, are minimum average roll values as reported for each test method.

** Break must occur with an acceptable break code as specified in GRI Test Method GM19a.

*** ASTM D 6392 is used for thermally welded seams and D 6214 for chemically welded seams.

**** 60 mil geomembrane nominal thickness shear and peel values are not listed in GRI GM 19a Table 3(a) so are interpolated from 30 and 40 mil values.

Figure 594-10 Requirements for Reinforced fPP Liner

Property	Test methods	Requirements* Nominal thickness			
		30 mil	36 mil	45 mil	60 mil
Thickness, in.	ASTM D5199	0.027	0.032	0.040	0.054
Tensile properties:					
Grab tensile strength, lb.	ASTM D7004	170	200	250	250
Grab elongation, %		15	15	15	15
Tearing strength, lb	ASTM D5884	50	55	70	70
Puncture resistance, lb	ASTM D4833	50	75	85	90
Ply adhesion, lb/in.	ASTM D6636	15	15	15	15
Low temperature bend, °C	ASTM D2136	-40	-40	-40	-40
Coating thickness over scrim, mil	ASTM D7613 (Annex A1)	8	10	13	18
Seam properties**:					
Shear strength, lb/in.	ASTM D7747	40***	50	60	70
Peel strength, lb/in.		25***	25	25	25

* All values, unless otherwise specified, are minimum average roll values as reported for each test method.

** Break must occur with an acceptable break code as specified in GRI Test Method GM19b.

*** 30 mil geomembrane nominal thickness shear and peel values are not listed in GRI GM 19b Table 4(a) so are interpolated from 36, 45, and 60 mil values.

Figure 594-11 Requirements for cPE Liner

Property	Test methods	Requirements* nominal thickness		
		24 mil	30 mil	40 mil
Thickness, in.	ASTM D751	0.022	0.027	0.036
Weight, oz/yd^2		10	15	18
Tensile properties:				
Strip tensile strength, lb.	ASTM D7003	200	225	250
Strip tensile elongation, %		20	20	20
Tongue Tear, lb.	ASTM D5884	50	50	50
CBR puncture, lb.	ASTM D6241	400	700	1000
Pin puncture, lb.	ASTM D4833	160	180	220
Hydrostatic resistance, lb./in^2	ASTM D751	300	500	700
Dimensional stability, % change (maximum)	ASTM D1204	3	3	3
Water vapor transmission, g/m^2-day (maximum)	ASTM E96	0.5	0.4	0.3
Seam properties**:				
Shear strength, lb/in.	ASTM D7747	30	60	90
Peel strength, lb/in.		10	10	10

* All values, unless otherwise specified, are minimum average roll values as reported for each test method.

** Break must occur with an acceptable break code as specified in GRI Test Method GM19b.

BC 15 Construction Contract Sequencing

The Contractor shall develop a construction schedule consistent with the contract documents and the following sequencing criteria that satisfies the project's water supply and dam safety requirements. A detailed Gantt construction schedule with logic, tasks, task dependencies, critical path, float, resources, and costs identified shall be submitted following contract award.

Anticipated Schedule Overview

Task	Start	Finish
Award of Contract	Approximately November / December 2025	
Preconstruction Activities	Approximately November / December 2025	February 2026
Construction Season 1	Approximately March 2, 2026	December 30, 2026
Construction Season 2	January 1, 2027	December 30, 2027
Project Substantial Completion		December 30, 2027

General Notes

- The Green Valley Glenwood Public Service District (PSD) utilizes Site 15 and the reservoir immediately downstream, Site 14 as their primary water supply reservoirs.
- Typical operation of these reservoirs by the PSD includes withdrawing raw water from Site 14 from the beginning of December to the end of May and withdrawing raw water from Site 15 from the beginning of June to the end of November.
- The PSD withdraws about 1.5 million gallons daily from either Site 14 or Site 15 with the treatment plant operating about 18 hours per day (1400gpm).
- The time limits and sequencing criteria identified below are intended to maintain water supply with typical weather and inflow conditions.
- Liquidated damages noted below are based on the completion of contracted work activities and are not based on reservoir pool levels or refilling durations. (i.e. the contractor is responsible for completing the work items necessary to allow refilling of the reservoir to begin, but is not responsible if the duration of refilling is delayed due to drought).
- The construction sequencing shown in the erosion and sediment (E&S) control plan is provided as the basis of design and was used to obtain the projects NPDES permit. If the contractor's construction schedule and erosion and sediment control plan differ from the basis of design and NPDES permit, the contractor shall request a contract modification from the Contracting Officer, provide the amended E&S sequence and plan changes, and assist the owner with obtaining an amendment to the NPDES permit as necessary. The contractor is responsible for all costs associated with amending the approved E&S Plan, construction sequence, and NPDES permit.
- Work Plans - Contractors must prepare, submit, and receive approval of all work plans, product and material submittals, and shop drawings outlined in the contract documents prior to initiation of work or ordering materials included in the submittals. The contractor should plan for a 14-calendar day review of the initial submission, time for contractor revision & resubmission, & a 14-calendar day review of the revision. Additional revisions & reviews will be required as needed until approval. No additional contract time or delays will

be incurred for additional reviews and revisions of inadequate work plans. A summary of the work plans to be submitted is included in attachment 2.

- Preconstruction activities include any work necessary to prepare for construction such as developing, submitting, and approval of the construction schedule, work plans, shop drawings, and product submittals. The contractor is also permitted to setup office trailers, quality control testing facilities, associated utilities, and order and delivery of construction materials and other supplies during the preconstruction activities period once the respective work plans have been approved.

Time Limits

- All project work shall be substantially complete by December 30, 2027.
  - Liquidated Damages (LD15A) – If all Site 15 work is not completed by December 30, 2027, liquidated damages may be enforced.
  - A winter shutdown is not required for the project, however contractors should anticipate that winter weather conditions will impact the ability to perform work activities. Refer to the solicitation for the limited work period timeframe. The contractor must notify the Contracting Officer and seek approval for any work activities they plan to complete during the limited work period. The specifications and quality control requirements will be strictly adhered to and may limit the work that can be performed during the limited work period.
- Upstream riprap berm installation and riser work
  - The contractor may drain the reservoir starting August 1st of the construction season indicated by the construction contractor, per the approved schedule.
  - The reservoir drain gate may remain open from August 1st to December 1st of the same year.
  - The new reservoir drain gate shall be closed on or before December 1st to begin refilling the reservoir.
  - In December, water supply gate II at elevation 2454.47 may remain open.
  - All gates must be closed by December 30th to facilitate complete refilling the reservoir to normal pool elevation.
  - Reservoir draining and all upstream riprap berm installation and riser work shall be completed between August and December 30th of the same year. The reservoir may be drained once during the contract.
  - The contractor is permitted to work multiple shifts to complete the upstream berm work within the specified time period.
  - Liquidated Damages (LD15B) – If the Site 15 reservoir draining, upstream riprap berm installation, and riser work is not completed by December 30th of the season in which the work is being performed, liquidated damages may be enforced.
- Downstream Embankment work
  - To support the Impact Basin and PSW conduit extension work, the reservoir may be lowered up to 10' from normal pool elevation per CS11. The contractor is encouraged to lower the reservoir only by the amount and duration necessary to perform the work.
  - Lowering the reservoir for this purpose shall be limited to a duration of 3-months.
  - This applies if the Impact basin and PSW conduit extension work is not completed during the period when the Site 15 reservoir is drained for the upstream riprap berm installation and riser work from August to December.

Water Supply

- The Site 15 pool can be lowered and drained for specific construction purposes in accordance with Construction Specification 11 and the time limits noted above.
    - The contractor shall maintain normal pool level when possible and only lower the amount necessary for construction to maintain the maximum available water supply.
    - The Site 15 pool can be drained only to perform the upstream riprap berm installation and riser work.
- The contractors schedule should include time in the construction schedule for draining the reservoir.
    - Time for draining the reservoir should be consistent with the contractor's stream diversion and dewatering plan. The maximum drawdown rate shall be 1' in pool elevation per day.
    - The reservoir stage storage data is included in attachment 3.

Dam Safety - construction must always maintain an adequate level of dam safety. The criteria below are divided into upstream, downstream, and ASW work areas. These areas are depicted on the work area illustration at the end of this section. The upstream embankment work is considered work upstream of the dam centerline, which would include upstream embankment grading, riser work, embankment upstream stability berm, and wave protection work. The downstream embankment work would include downstream embankment grading, PSW pipe extension, impact basin construction, and toe drain installation. The ASW work includes excavation, RCC placement, and backfill within the auxiliary spillway areas.

- During Site 15 Upstream Embankment work:
    - The pool must be drained per CS11 to perform the upstream riprap berm installation and riser work.
    - See the Time Limits section above for Site 15 draining requirements.
    - The Site 15 ASW shall not be excavated.
- During Site 15 Downstream Embankment work:
    - The reservoir pool shall be operated at normal pool level (all gates closed), but may be lowered up to 10-feet from below the normal pool elevation to support the Impact Basin and PSW conduit extension work, per CS11 and the time limits noted above.
    - The Site 15 ASW shall not be excavated.
    - All downstream embankment work shall be completed within the same calendar year. Open excavations in the downstream embankments are not permitted during the limited work period. All embankment work needs to be completed, backfilled, and stabilized prior to December.
    - The contractor should consider performing the downstream embankment work in the same construction season as the upstream embankment work to take advantage of the pool being drained during a portion of this season.
- During Site 15 ASW work:
    - The reservoir may not be lowered or dewatered to support this work.
    - The Site 15 embankment shall be in its original or proposed condition and shall not be modified during ASW work.
    - The ASW shall not be excavated during the limited work period.

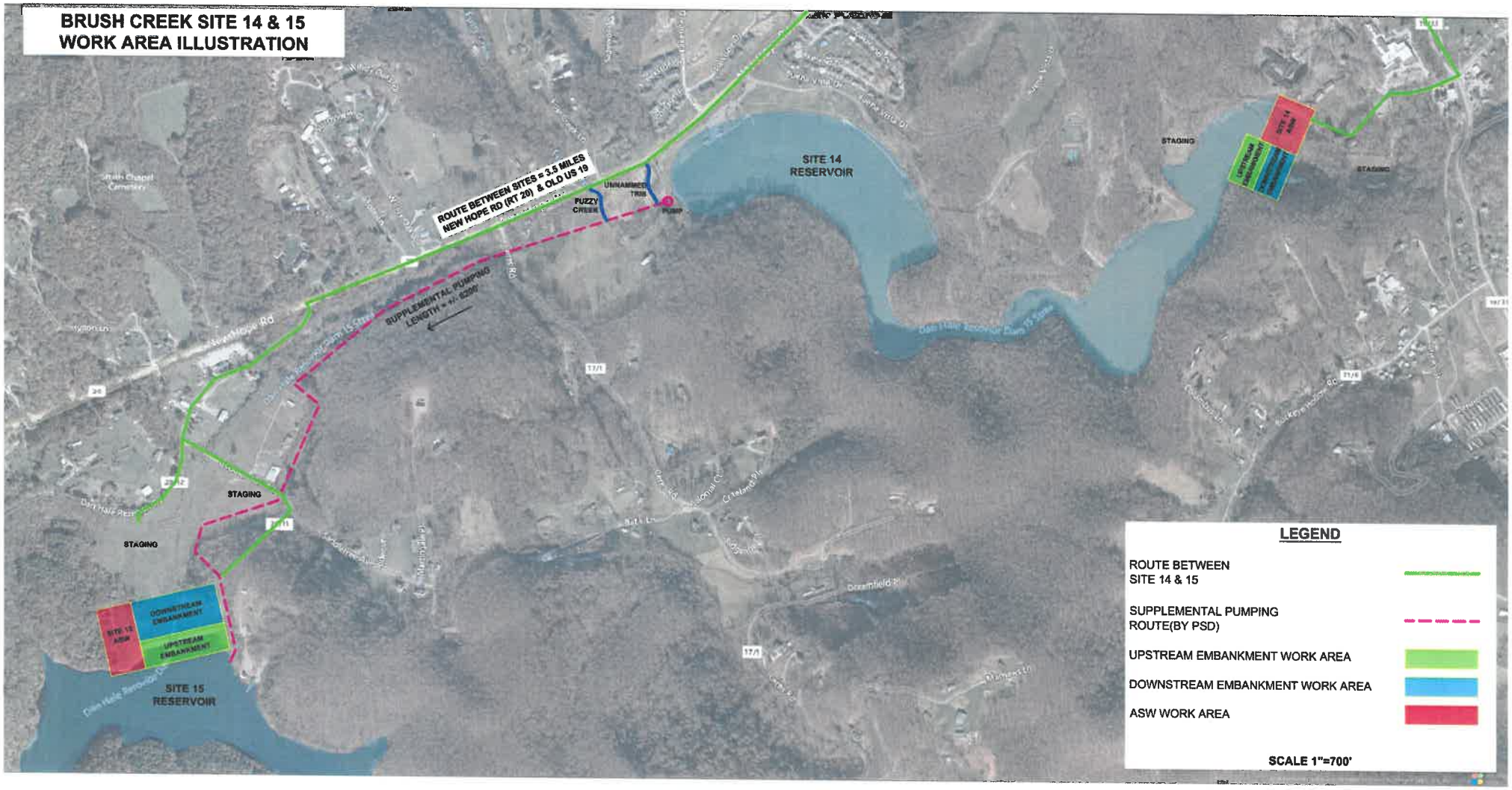
Considerations

- Site 14 is designed with imported fill from Site 15. The contractor shall stockpile 9,220 cy of Earthfill materials, in accordance with CS 23, 10., A., 3), in the Site 15 staging area accessible from the public roadway for use by a future Site 14 contractor. The proposed stockpile location shall be shown on the contractor's Staging and Stockpiling Plan. This stockpile shall be permanently stabilized in accordance with Construction Specification 6 – Seeding, Sprigging, and Mulching.
- Supplemental Pumping may be performed by the PSD to facilitate water supply and/or reservoir refilling. The anticipated pumping location and pipeline route is shown on the work area illustration, see attachment 1. The contractor shall accommodate and protect the pipeline route through the Site 15 work area. The PSD is responsible for all supplemental pumping work.
- No tree cutting shall be performed between June 1st and July 31st at Site 15.
- WVDNR Right of Entry Permit does not allow in-stream work to be performed during the cold-water fish spawning season (September 15-March 31) and warm-water fish spawning season (April 1 – June 30). Spawning waivers may be obtained from the WVDNR Environmental Coordination Unit. The owner will obtain a waiver for Site 15 once the contractor's schedule is approved.
- The WVCA Contracting Officer can authorize adjustments to the requirements in this document to facilitate dam safety or water supply needs of the project.
- WVCA Contracting Officer approval is required for all contractor-imposed reservoir changes in pool level or gate operation.
- Regarding restoration of Staging Areas that have been regraded for the contractor's operations. Following removal of any temporary geotextile, crushed stone, or other aggregate surfacing, staging areas that were graded to suit the contractor's operations shall be restored to approximate original conditions/slopes prior to restoration with topsoil, seed, and mulch. The contractor shall include initial ground surveys for staging areas before excavation commences, reference CS 8.
- At Site 15 to facilitate access from the proposed RCC staging area (downstream left side) to the upstream portion of the ASW, a temporary access road could be proposed by the contractor as a part of their Staging and Stockpiling Plan (refer to CS8). Any changes to the limits of disturbance would require a contract modification to be issued by the Contracting Officer and the contractor would be responsible to work with sponsors to obtain an amendment to any appliable permitting impacted by the modification such as the NPDES permit or Army Corp of Engineers permit. The contractor would also be responsible for all work and costs to permit, install, remove, and restore any additional disturbed areas to original or better conditions.
- At Site 15 to facilitate access to the upstream slope stability berm, installation of a temporary access road could be proposed on the dam's embankment by the contractor as a part of their Staging and Stockpiling Plan (refer to CS8). The contractor must verify that any work associated with installation of an access road does not extend into or cause damage below the planned embankment excavation limits; no embankment excavation will be permitted in the installation of temporary access roads.

Attachments

1. Site 15 Work Area Illustration

2. Site 15 Work Plan Summary
3. Site 15 Stage Storage Curve


BRUSH CREEK SITE 14 & 15
WORK AREA ILLUSTRATION
ROUTE BETWEEN SITES = 3.5 MILES
NEW HOPE RD (RT 20) & OLD US 19
SUPPLEMENTAL PUMPING
LENGTH = +/- 6200'
UNNAMED TRIB
PUZZY CREEK
PUMP
SITE 14
RESERVOIR
STAGING
STAGING
STAGING
SITE 15
RESERVOIR
DOWNSTREAM EMBANKMENT
UPSTREAM EMBANKMENT
SITE 15 ASW
SITE 14 ASW
LEGEND
ROUTE BETWEEN SITE 14 & 15
SUPPLEMENTAL PUMPING ROUTE(BY PSD)
UPSTREAM EMBANKMENT WORK AREA
DOWNSTREAM EMBANKMENT WORK AREA
ASW WORK AREA
SCALE 1"=700'

Brush Creek 15
Work Plan Summary

The purpose of this list is to summarize the required Work Plans to be developed by the contractor and highlight the importance of submitting these well in advance of the work activity to allow for review and approval. Upon submission of a work plan, the Contractor should plan for a 14-calendar day review of the initial submission, time for contractor revision & resubmission, & a 14-calendar day review of the revision. Additional revisions & reviews will be required as needed until approval. No additional contract time or delays will be incurred for additional reviews and revisions of inadequate work plans. No work identified in the respective plan may proceed until the work plan is approved by the CO.

The contractor shall follow the minimum dates in this chart, but are encouraged to submit even earlier to facilitate review and approvals.

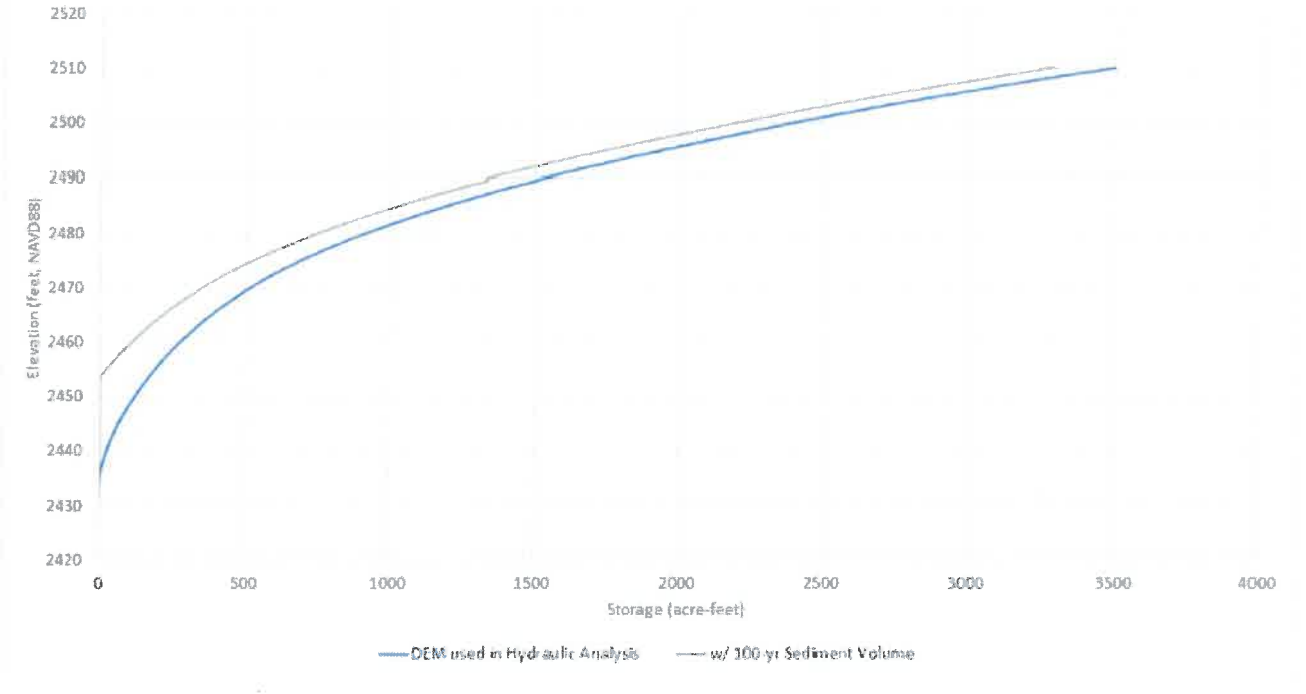
Note - 'prior to beginning work activity' - shall also include ordering materials for the work included.

Note - this is not a complete list of shop drawings or product submittals, refer to specifications for these requirements.

CS	Section	Plan Title	Specification Section Due Date
n/a	n/a	Construction Schedule	Refer to Construction Sequencing Criteria, submit within 21-days of contract award and prior to beginning work.
NRCS OSHA	1.1	Safety Program	submit before the start of construction
2	7.A.2	Clearing and Grubbing Plan	within 21 days of contract award and prior to beginning the work.
3	7.A.4	Demolition Plan	45 days prior to beginning work activity
3	7.B.2	Trench Drain Abandonment Plan	45 days prior to beginning work activity
5	8.A.2	Stormwater Pollution Prevention Plan (SWPPP)	within 21 days of contract award and prior to beginning the work.
5	8.A.3	Pollution Control Plan + Spill Prevention and Response Plan	within 21 days of contract award and prior to beginning the work.
8	4.A.7	Staging and Stockpiling Plan	within 21 days of contract award and prior to beginning the work.
11	8.A.3	Excavation Dewatering Plan	45 days prior to beginning work activity
11	8.B.9	Stream Diversion Plan	45 days prior to beginning work activity
21	10.A.1	Excavation Plan	45 days prior to beginning work activity
23	10.A.2	Fill Placement Plan	45 days prior to beginning work activity
31	25.A.7.b	batching and mixing plan (if used)	45 days prior to beginning work activity
31	25.A.1	Concrete Placement Plan	45 days prior to beginning work activity
34	10.A.4	Reinforcing Plans	45 days prior to beginning work activity
36	22.A.2.b	Trial mix production submittals	45 days before trial mix production
36	22.A.2.c	RCC preproduction submittals	45 days before on-site material delivery or equipment setup
36	22.A.2.a	RCC Placement Plan & Schedule	within 30 days following Notice to Proceed

36	22.A.2.c.iv	RCC Transporting and Conveying Plan	45 days prior to RCC test section placement
36	22.A.2.c.i.	RCC Mix	7-days following conclusion of laboratory mix design 90-day compressive testing
36	22.A.2.c.iii.	RCC Personnel	Within 30 days following Notice to Proceed
41	7.A.2	Principal Spillway Pipe Extension - means & methods	45 days prior to beginning work activity
45	14.A.2	Toe Drain System Installation Schedule and Plan	45 days prior to beginning work activity
61	8.B.2	Upstream Stability Berm Installation Plan	45 days prior to beginning work activity
63	10.A.2	Foundation Preparation Plan	45 days prior to beginning work activity
71	8.C.3	Pond Drain Gate Removal Plan	at least 45 calendar days prior to starting the work
71	8.D.4	Leakage Testing Plan	45 days prior to beginning work activity
71	8.D.5	Pond Drain Gate Installation Plan	45 days prior to beginning work activity
94	10.A.7	Contractor Quality Control System	within 15 calendar days after notice of award
401	2.B.1	Instrumentation Installation Plan	45-days prior to work activity
402	2	Diving Plan	45-days prior to work activity

Brush Creek Site 15 Stage Storage Curve



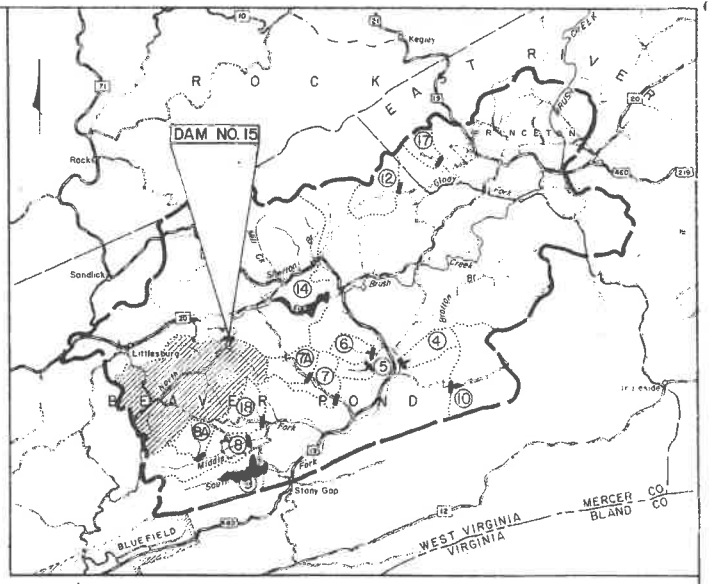
BRUSH CREEK WATERSHED PROJECT

MULTIPLE PURPOSE DAM NO. 15
NORTH FORK OF BRUSH CREEK
WATER SUPPLY FOR THE CITY OF PRINCETON AND FLOOD PREVENTION

DRAINAGE AREA	1768	Acres
FLOOD STORAGE TO EMERGENCY SPILLWAY CREST	558	Acre Ft.
WATER SURFACE AREA AT PERMANENT POOL	72	Acres
HEIGHT OF DAM	74	Feet
VOLUME OF FILL	236,100	Cubic Yards

BUILT UNDER THE WATERSHED PROTECTION AND
FLOOD PREVENTION ACT
by
BRUSH CREEK WATERSHED IMPROVEMENT DISTRICT
MERCER COUNTY COURT AND CITY OF PRINCETON
with the assistance of the
SOIL CONSERVATION SERVICE
of the
U. S. DEPARTMENT OF AGRICULTURE
1964

"AS BUILT"



LOCATION MAP
SCALE 1" = 1 62500

INDEX

SHEET 1 - COVER SHEET
SHEET 2 - PLAN OF DAMSITE AND STORAGE AREAS
SHEET 3 - PLAN OF BORROW AND STORAGE AREAS
SHEET 4 - PLAN OF BORROW AND STORAGE AREAS
SHEET 5 - PLAN OF BORROW AND STORAGE AREAS
SHEET 6 - PLAN OF BORROW AND STORAGE AREAS
SHEET 7 - PROFILES
SHEET 8 - EMERGENCY SPILLWAY DETAILS
SHEET 9 - SEEPAGE DRAIN DETAILS
SHEET 10 - PLAN-PROFILE OF PRINCIPAL SPILLWAY
SHEET 11 - LOGS OF TEST PITS
SHEET 12 - LOGS OF DRILL HOLES
SHEET 13 - LOGS OF DRILL HOLES
SHEET 14 - RISER - STRUCTURAL DETAILS
SHEET 15 - RISER - REINF. STEEL DETAILS
SHEET 16 - RISER - REINF. STEEL DETAILS
SHEET 17 - TRASH RACKS, LADDER AND MISC. DETAILS
SHEET 18 - CRADLE, COLLAR, AND STEEL SCHEDULE
SHEET 19 - IMPACT BASIN DETAILS

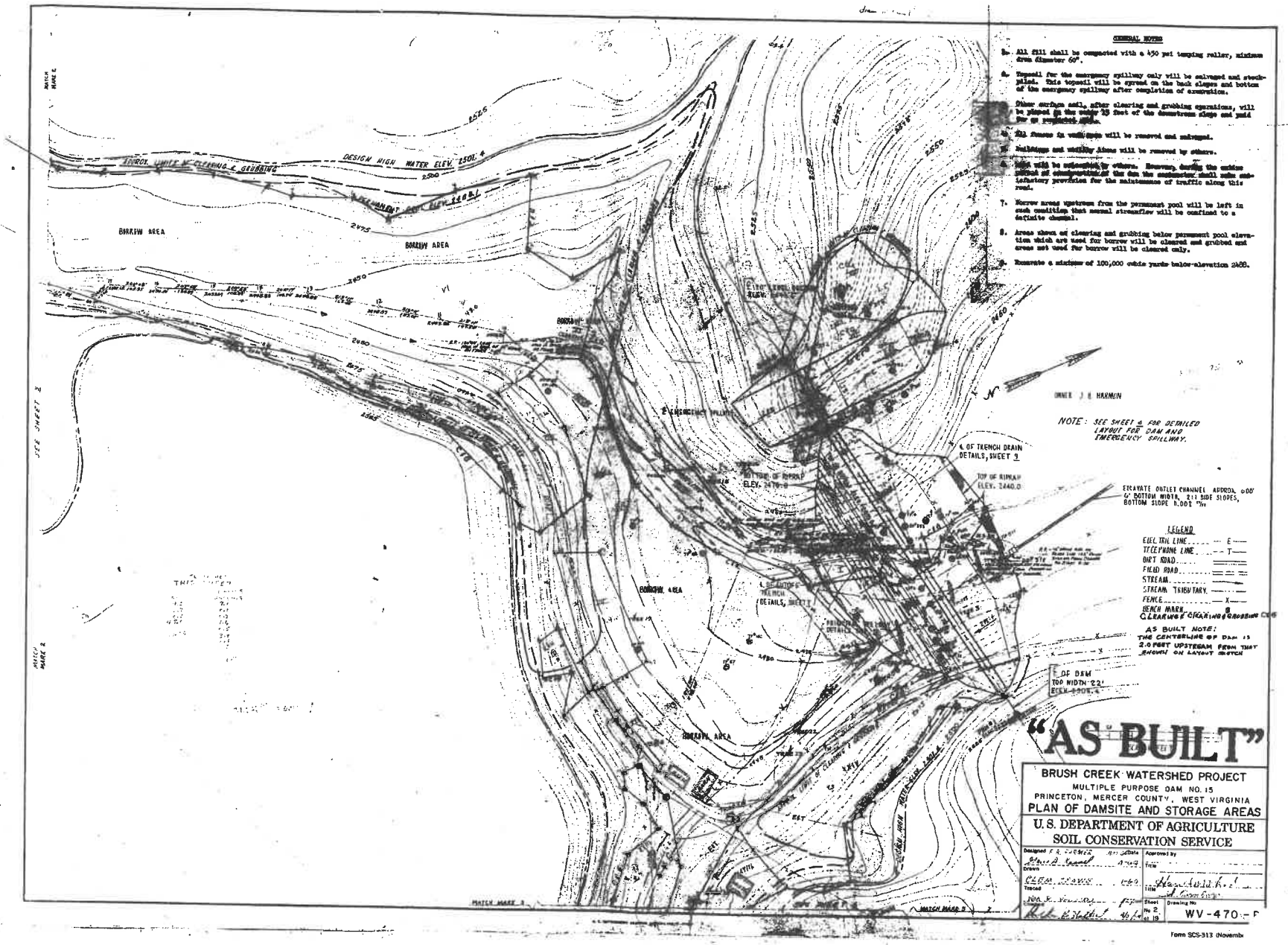
"AS BUILT"
1967

BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
COVER SHEET

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

F.K. FARMER	JULY 64	HEAD, E.N. WV-INT	
M. NIKOLICH		STATE CONSERVATION ENG'R	
F.M. WYSONG	AUG. 64	SHEET NO. 1 OF 19	WV-470-P

FORM SCS-31 - NOTICE 1355

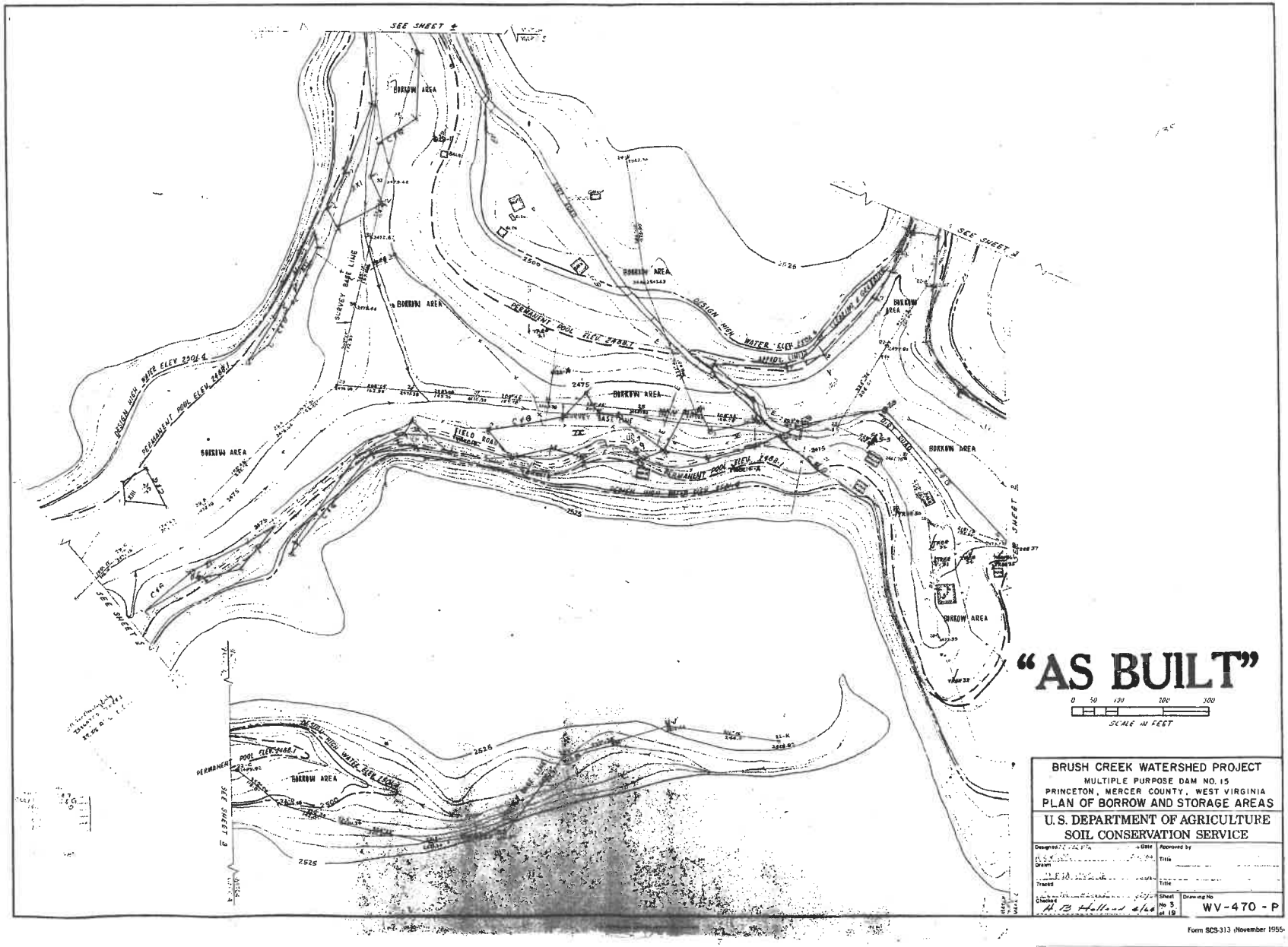


GENERAL NOTES

1. All fill shall be compacted with a 4/50 pot tamping roller, minimum drum diameter 60".
2. Topsoil for the emergency spillway only will be salvaged and stockpiled. This topsoil will be spread on the back slopes and bottom of the emergency spillway after completion of excavation.

   Other surface soil, after clearing and grubbing operations, will be placed on the upper 25 feet of the downstream slope and yard for an irregular width.
3. All fences in work areas will be removed and salvaged.
4. Mailboxes and existing fences will be removed by others.
5. Road will be relocated by others. However, during the entire period of construction of the dam the contractor shall make satisfactory provision for the maintenance of traffic along this road.
7. Borrow areas upstream from the permanent pool will be left in such condition that normal streamflow will be confined to a definite channel.
8. Areas shown as clearing and grubbing below permanent pool elevation which are used for borrow will be cleared and grubbed and areas not used for borrow will be cleared only.
9. Excavate a minimum of 100,000 cubic yards below elevation 2468.

Form SCS-313 (Novemb



"AS BUILT"

0 50 100 200 300

SCALE IN FEET

BRUSH CREEK WATERSHED PROJECT

MULTIPLE PURPOSE DAM NO. 15

PRINCETON, MERCER COUNTY, WEST VIRGINIA

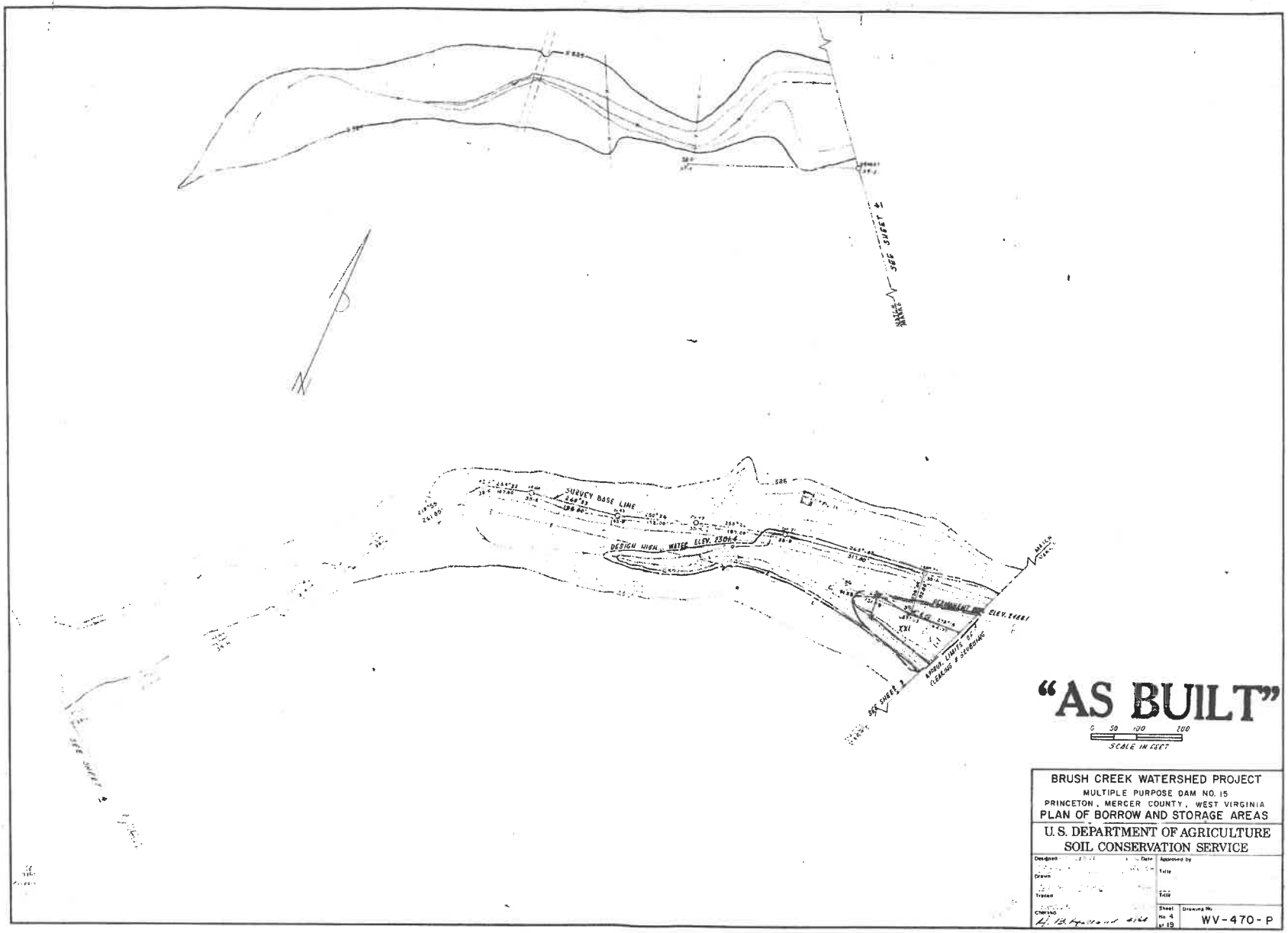
PLAN OF BORROW AND STORAGE AREAS

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Designed	Date	Approved by	
Drawn		Title	
Traced		Title	
Checked H. B. Holland 6/64		Sheet No. 5 of 19	Drawing No. WV-470-P

Form SCS-313 (November 1955)



"AS BUILT"

0 50 100 200
SCALE IN FEET

BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
PLAN OF BORROW AND STORAGE AREAS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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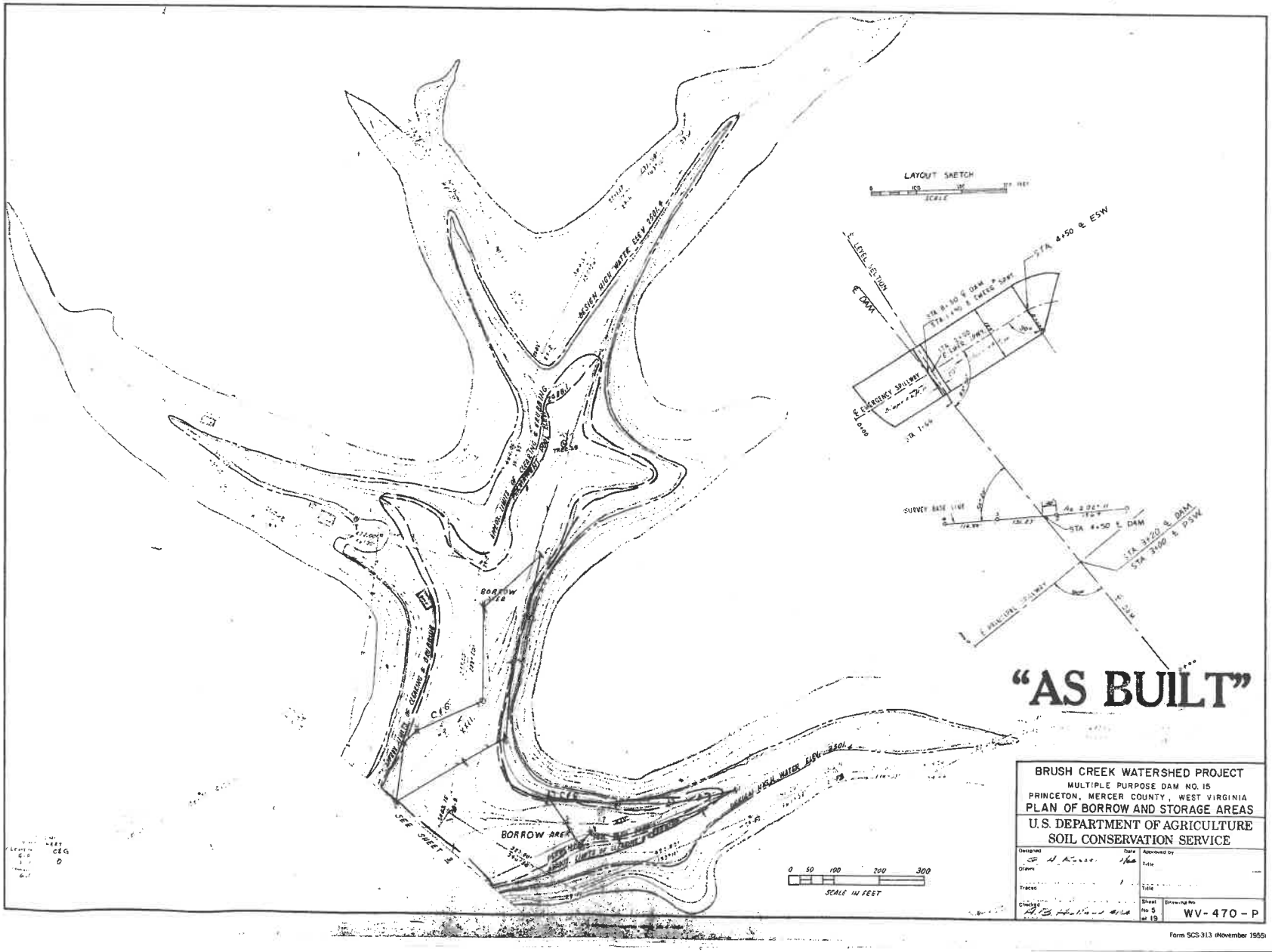
Drawn		Title	
Traced		Title	
Checked		Sheet No. 4 of 19	Drawing No. WV-470-P

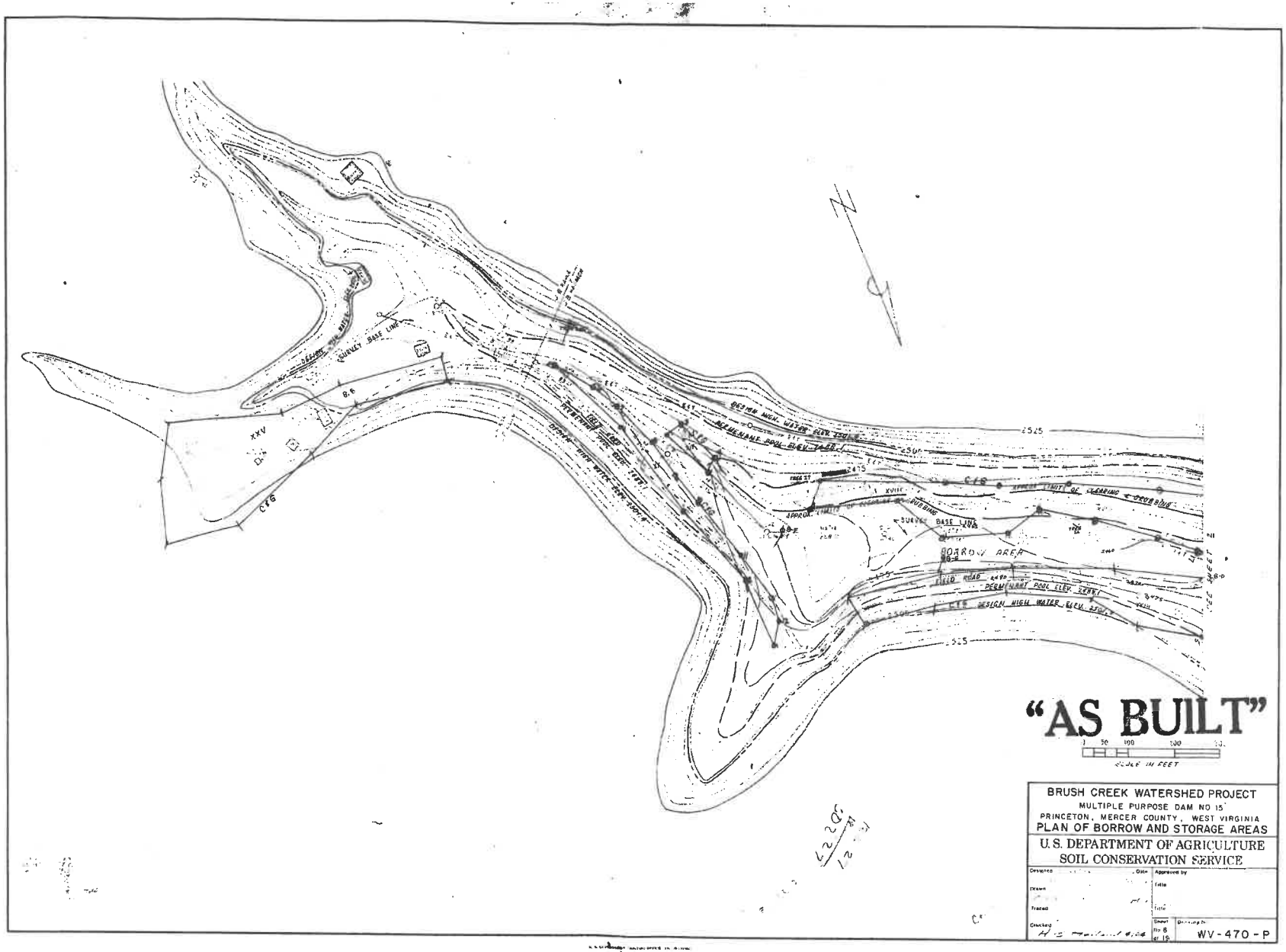


"AS BUILT"

BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
PLAN OF BORROW AND STORAGE AREAS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed CF	Date	Approved by	
Drawn		Title	
Traced		Title	
Checked		Sheet No 5 of 19	Drawing No. WV-470-P

Form SCS-313 (November 1955)


SURVEY BASE LINE
DESIGN HIGH WATER ELEV. 2550
PERMANENT POOL ELEV. 2490
DESIGN SILTING LEVEL ELEV. 2485
APPROX. LIMITS
BORROW AREA
FIELD ROAD
PERMANENT POOL ELEV. 2490
DESIGN HIGH WATER ELEV. 2550
2525
2475
2440
2460
2480
2500
2520
2540
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2580
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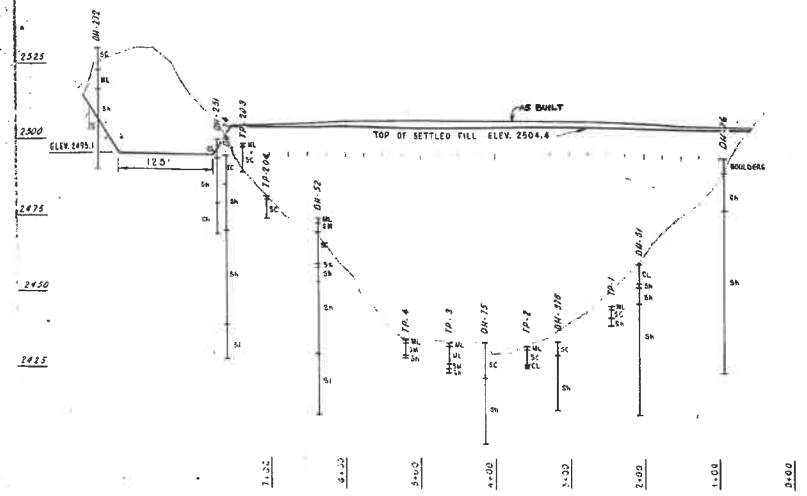
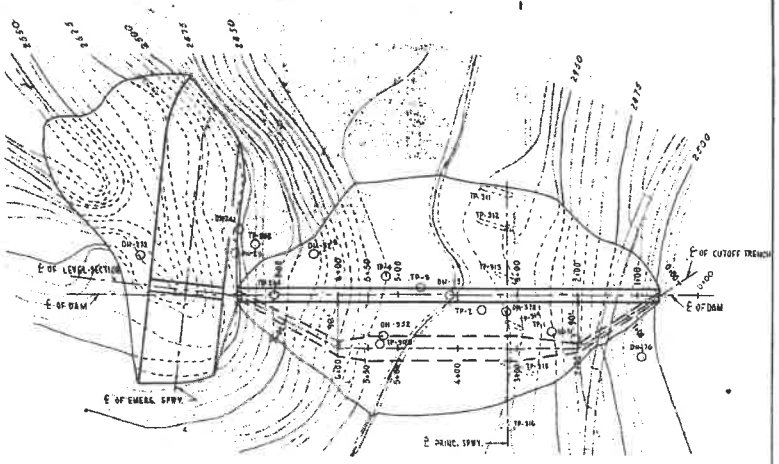
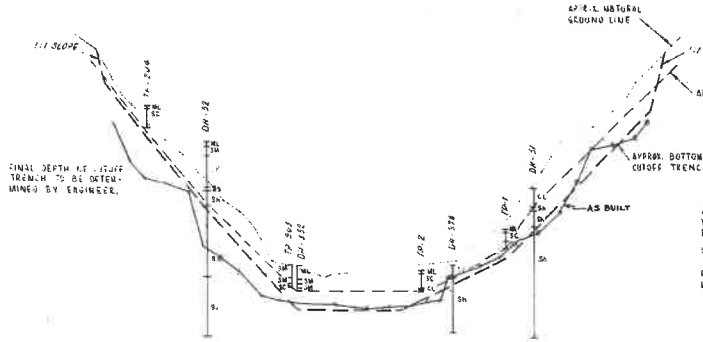
3200
3220



PROFILE ALONG ℄ OF DAM & LEVEL SECTION OF EMERGENCY SPILLWAY
(LOOKING DOWNSTREAM)

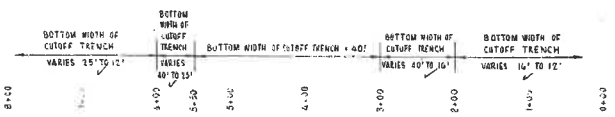


PLAN OF DAM
SHOWING LOCATION OF CUTOFF TRENCH

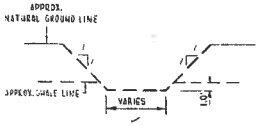


ANY REQUIRED FOUNDATION EXCAVATION WILL BE PAID FOR AS CUTOFF TRENCH EXCAVATION.

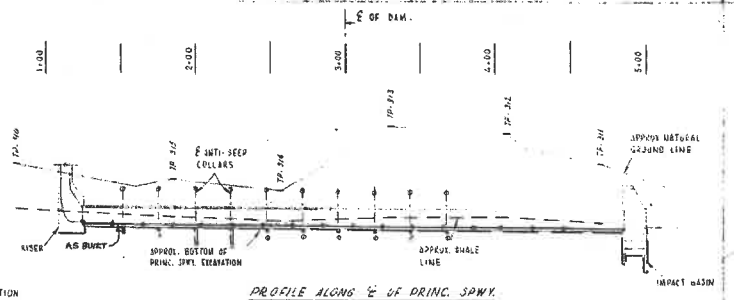
UNSUITABLE FOUNDATION SOIL (DRY DENSITY LESS THAN 85 PCF) IS TO BE EXCAVATED AND REPLACED WITH FINE GRAINED, CLAYEY (CL) MATERIAL, REPRESENTED BY TEST HOLES
106 FROM 1' TO 7'
107 FROM 2' TO 8'



PROFILE ALONG ℄ OF CUTOFF TRENCH (LOOKING DOWNSTREAM)



TYPICAL SECTION OF
CUTOFF TRENCH EXCAVATION



PROFILE ALONG ℄ OF PRINC. SPWY.

"AS BUILT"

NOTE: TEST PITS 5B TO 5G ARE EXPLORATORY ONLY & ARE NOT LOGGED.
SEE SHEETS 11, 12 & 13 FOR LOGS OF TEST PITS AND DRILL HOLES.

TYPICAL SECTION OF
PRINC. SPWY EXCAVATION

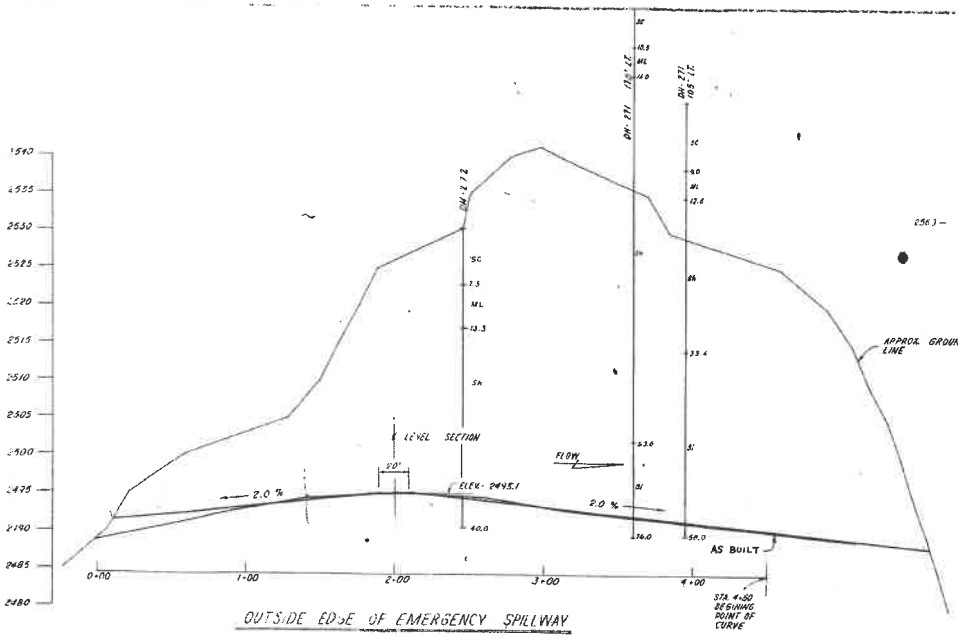
BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
PROFILES

DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

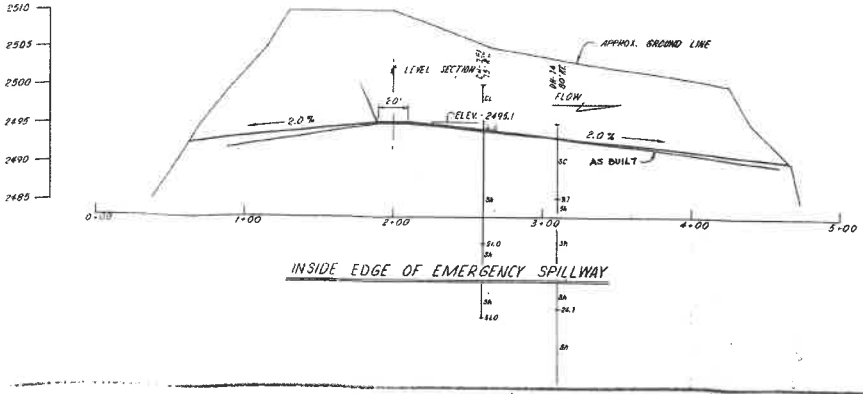
F R FARMER JULY '64
H.T. BROWNING JR. JULY '64
E. M. WYSONG AUG. '64

7
19

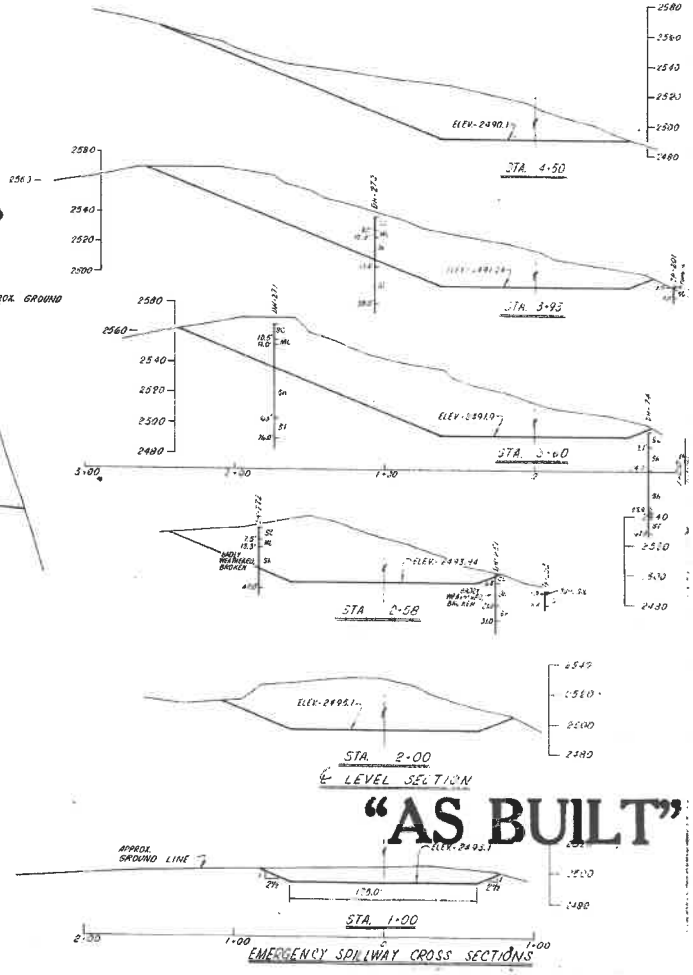
WV-470-P



OUTSIDE EDGE OF EMERGENCY SPILLWAY



INSIDE EDGE OF EMERGENCY SPILLWAY



"AS BUILT"

NOTE:
SEE SHEETS 4, 12 & 13 FOR LOGS OF TEST PITS AND DRILL HOLES.

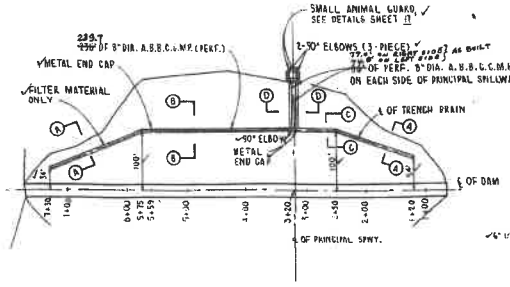
BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
EMERGENCY SPILLWAY DETAILS

F. B. FARMER APR '64
C. B. FORD AUG '64
F. M. WYSONG MAR '64

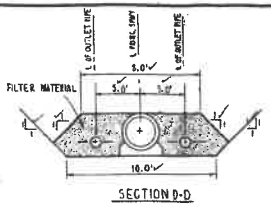
8
15

WV-470-P

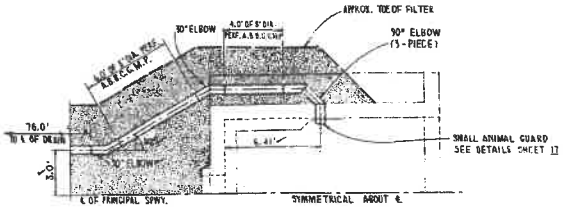
NOTE:
THE SEEPAGE DRAIN PIPES SHALL BE 8" DIA. PERFORATED ANNULAR OR SPIRAL 16 GAUGE ASBESTOS BONDED BITUMINOUS COATED CORRUGATED METAL PIPE.



PLAN OF SEEPAGE DRAIN

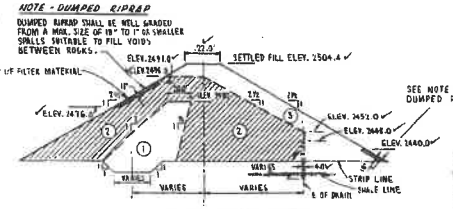


SECTION D-D

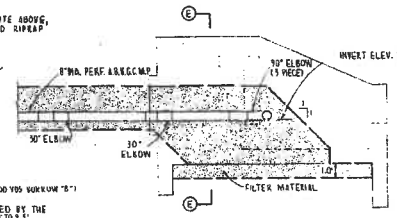


PLAN OF OUTLET DRAIN PIPE
AS BUILT
IN PLACE MEASUREMENT RIGHT SIDE = 18.2'
LEFT SIDE = 18.6'

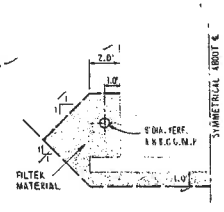
NOTE - DUMPED RIPRAP
DUMPED RIPRAP SHALL BE WELL GRADED FROM A MAX. SIZE OF 18" TO 1" OR SMALLER SPALLS SUITABLE TO FILL VOIDS BETWEEN ROCKS.



TYPICAL SECTION OF DAM



TYPICAL SECTION ALONG OUTLET DRAIN PIPE



SECTION E-E

PLACEMENT OF FILL

SECTION 1 - COMPACTED FILL, CLASS S-1, FINE GRAINED CLAYEY (CL) MATERIAL REPRESENTED BY TEST HOLES 106 FROM 1'-7' AND 107 FROM 2'-8' (90,000 YDS BORROW "B")

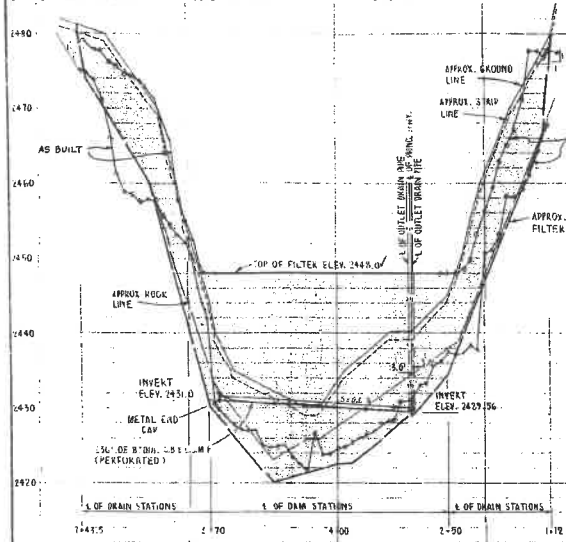
SECTION 2 - COMPACTED FILL, CLASS S-1, CLAYEY AND SILTY SAND (SC, ML-CL) REPRESENTED BY THE FOLLOWING TEST HOLES 204, 5.0 TO 7.0', 201, 1.0' TO 9.0', 202, 1.0' TO 8.0', 105, 1.0' TO 9.5', 104, 2.0' TO 3.0', 103, 1.0' TO 7.5', 101, 4.0' TO 7.0', 101, 1.0' TO 5.0', AND 105, 1.0' TO 4.0' 000,000 YDS. EMERGENCY SPILLWAY AND BORROW "A")

SECTION 3 - CLASS "C" FILL - SHALE AND SILTSTONE REPRESENTED BY DRILL HOLE 213, 10.0' TO 27.0' AND 45.0' TO 50.0' COMPACT TO OBTAIN A MINIMUM DRY DENSITY OF 120 LBS./FT³ FOR MATERIAL FINER THAN 1½" 56,100 CU YDS. - EMERGENCY SPILLWAY.

SECTION A-A
STA. 1+72 TO 2+50 & 5+60 TO 7+55

SECTION B-B
STA. 5+25 TO 5+60

SECTION C-C
STA. 2+50 TO 5+17



PROFILE ALONG ℄ OF SEEPAGE DRAIN (LOOKING DOWNST EAM)

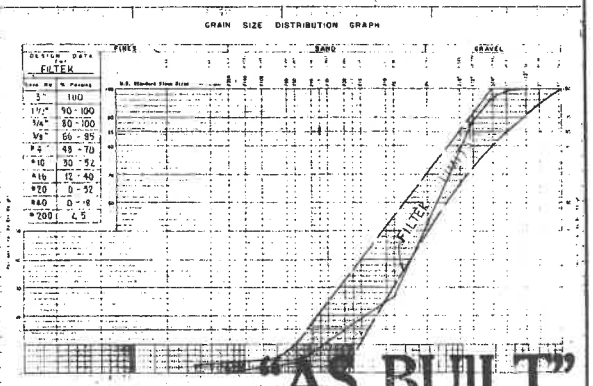
BILL OF MATERIALS

(4)	30° ELBOWS
(2)	90° ELBOWS (3 PIECE)
(1)	90° ELBOW (2 PIECES)
(2)	METAL END CAPS
45400	OR 8" DIA. PERF. A.B.B.C.C.M.P.
	SMALL ANIMAL GUARDS
1756	CU.YDS. FILTER MATERIAL

NOTE:
IF FILTER GRADATION REQUIREMENTS ARE SUCH THAT SAND MUST BE MIXED WITH GRAVEL TO MEET THE LIMITS SHOWN ON THESE PLANS, THE FILTER MATERIAL WILL BE THOROUGHLY MIXED & THEN DAMPENED WITH WATER, PRIOR TO PLACEMENT.

GRAIN SIZE DISTRIBUTION GRAPH

GRADATION OF FILTER	
Sieve No.	% Passing
3"	100
1½"	90 - 100
¾"	80 - 100
⅜"	66 - 85
#4	48 - 70
#10	30 - 52
#16	12 - 40
#70	0 - 12
#80	0 - 8
#200	4.5



"AS BUILT"

BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
SEEPAGE DRAIN DETAILS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	Date	Approved by	
J. ZURLO	AUG. 64	Title	
Drawn			
W.H. MORGAN	AUG. 64	Title	
Traced			
Checked		Sheet No. 9 of 19	Drawing No. WV-470-P
F.M. NYSONG	AUG. 64		

Form SCS-317 (November 1955)

JOINT	DISTANCE FROM RISER WALL	INVERT ELEV. OF 24" DIA. PIPE	SLOPE
J-1	0.33	2430.20	ALTERNATE "A" SLOPE = 0.002 FT/FT.
J-2	20.33	2430.15	
J-3	40.33	2430.11	
J-4	60.33	2430.06	
J-5	80.33	2430.01	
J-6	100.33	2429.97	
J-7	120.33	2429.92	
J-8	140.33	2429.87	
J-9	160.33	2429.83	
J-10	180.33	2429.78	
J-11	200.33	2429.73	
J-12	220.33	2429.69	
J-13	240.33	2429.64	
J-14	260.33	2429.59	
J-15	280.33	2429.55	
J-16	300.33	2429.50	
J-17	320.33	2429.45	
J-18	340.33	2429.41	
OUTLET	360.33	2429.36	

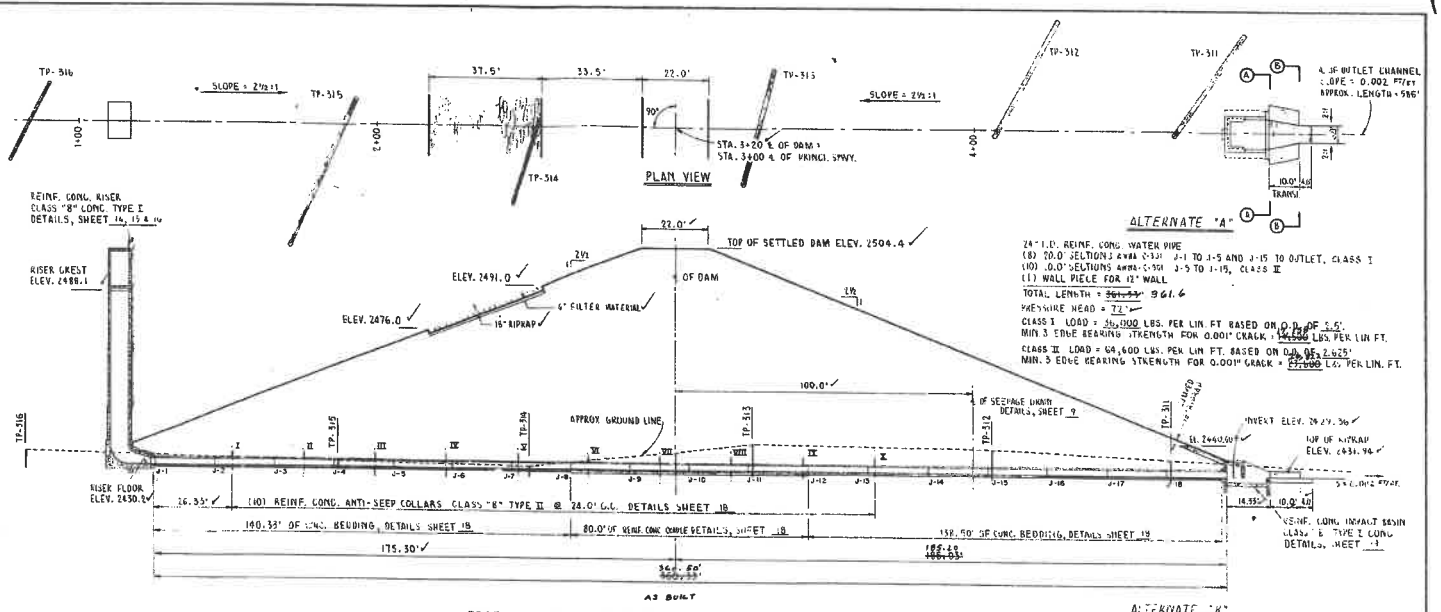
NOTE: ABOVE DIMENSIONS FOR LENGTHS OF PIPE ARE BASED ON NOMINAL LENGTHS AND DO NOT INCLUDE CREEP.

JOINT	DISTANCE FROM RISER WALL	INVERT ELEV. OF 24" DIA. PIPE	SLOPE
	0.33	2430.20	ALTERNATE "B" SLOPE = 0.002.33 FT/FT.
	16.33	2430.16	
	32.33	2430.14	
J-4	40.33	2430.11	
J-5	56.33	2430.07	
J-6	72.33	2430.05	
J-7	88.33	2429.99	
J-8	104.33	2429.96	
J-9	120.33	2429.93	
J-10	136.33	2429.88	
J-11	152.33	2429.85	
J-12	168.33	2429.81	
J-13	184.33	2429.77	
J-14	200.33	2429.73	
J-15	216.33	2429.70	
J-16	232.33	2429.66	
J-17	248.33	2429.62	
J-18	264.33	2429.58	
J-19	280.33	2429.55	
J-20	296.33	2429.51	
J-21	312.33	2429.47	
J-22	328.33	2429.43	
J-23	344.33	2429.40	
OUTLET	360.33	2429.36	

NOTE: ABOVE DIMENSIONS FOR LENGTHS OF PIPE ARE BASED ON NOMINAL LENGTHS AND DO NOT INCLUDE CREEP.

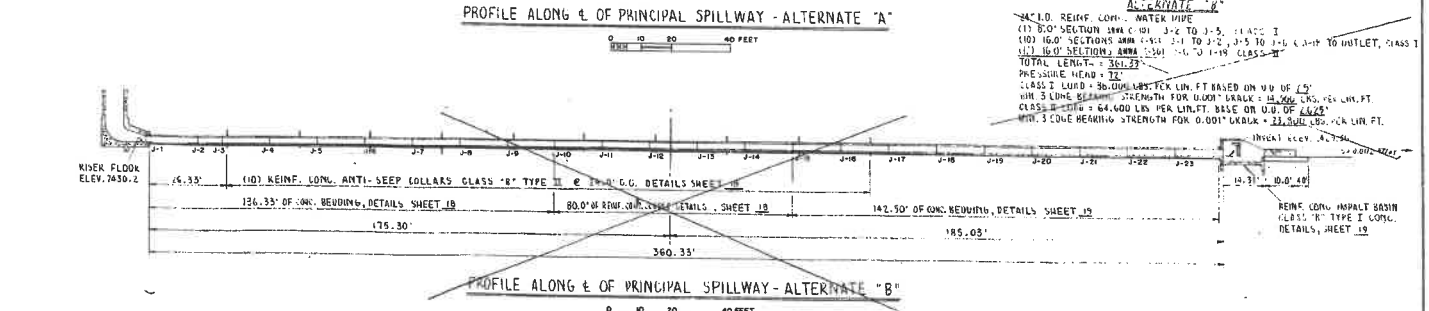
LOCATION	DISTANCE FROM RISER WALL	INVERT ELEV. OF 24" DIA. PIPE	"A" AND "B"
	26.33	2430.14	
II	50.33	2430.08	
III	74.33	2430.03	
IV	98.33	2429.97	
V	122.33	2429.91	
VI	146.33	2429.86	
VII	170.33	2429.80	
VIII	194.33	2429.75	
IX	218.33	2429.69	
X	242.33	2429.64	

JOINT	INVERT ELEV. OF 24" DIA. PIPE	GAP TOP	GAP BOTTOM
J-0	2430.50	0	1
J1	2430.20	1.0	1.0
J2	2430.15	1.5	4
J3	24 30.11	4	4
J4	24 30.06	3.5	2
J5	24 30.01	2	1
J6	24 29.97	0	1
J7	24 29.92	0	1
J8	24 29.87	1	0
J9	24 29.83	1	0
J10	24 29.78	1.5	0
J11	24 29.73	2	2
J12	24 29.69	0	0
J13	24 29.64	1	0
J14	24 29.59	0	4
J15	24 29.55	4	4
J16	24 29.50	1	0
J17	24 29.45	1	1.5
J18	24 29.41	0	1
OUTLET	24 29.36	-	



ALTERNATE "A"

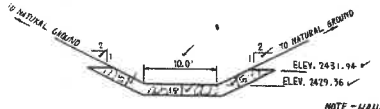
24" I.D. REINF. CONC. WATER PIPE
(8) 20.0' SECTIONS AWWA C-302 J-1 TO J-5 AND J-15 TO OUTLET, CLASS I
(10) 16.0' SECTIONS AWWA C-302 J-5 TO J-15, CLASS II
(1) WALL PIECE FOR 12" WALL
TOTAL LENGTH = ~~361.33'~~ 361.6
PRESSURE HEAD = 72'
CLASS I LOAD = 36,000 LBS. PER LIN. FT. BASED ON O.D. OF 5.5'
MIN. 3 EDGE BEARING STRENGTH FOR 0.001" CRACK = ~~54,000~~ LBS. PER LIN. FT.
CLASS II LOAD = 64,600 LBS. PER LIN. FT. BASED ON O.D. OF 2.625'
MIN. 3 EDGE BEARING STRENGTH FOR 0.001" CRACK = ~~97,000~~ LBS. PER LIN. FT.



Not Applicable

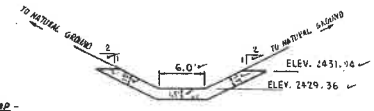
PIPE SUPPLIERS NOTE:
CAST OUTSIDE OF SPIGOT JOINT RING WITH CONCRETE ON ONE 16' SECTION OR ONE 20' SECTION.

NOTE:
THE NEAT LINES OF THE BOTTOM OF THE CRADLE AND RISER WILL BE ESTABLISHED AFTER THE PRINCIPAL SPILLWAY EXCAVATION IS COMPLETED.



SECTION A-A

NOTE - HAND PLACED RIPRAP -
RIPRAP SHALL BE WELL GRADED FROM A MAX. SIZE OF 18" TO A MIN. SIZE OF 6" AND SHALL BE PLACED WITH ITS LONGEST DIMENSION PERPENDICULAR TO THE LINE OF FLOW.



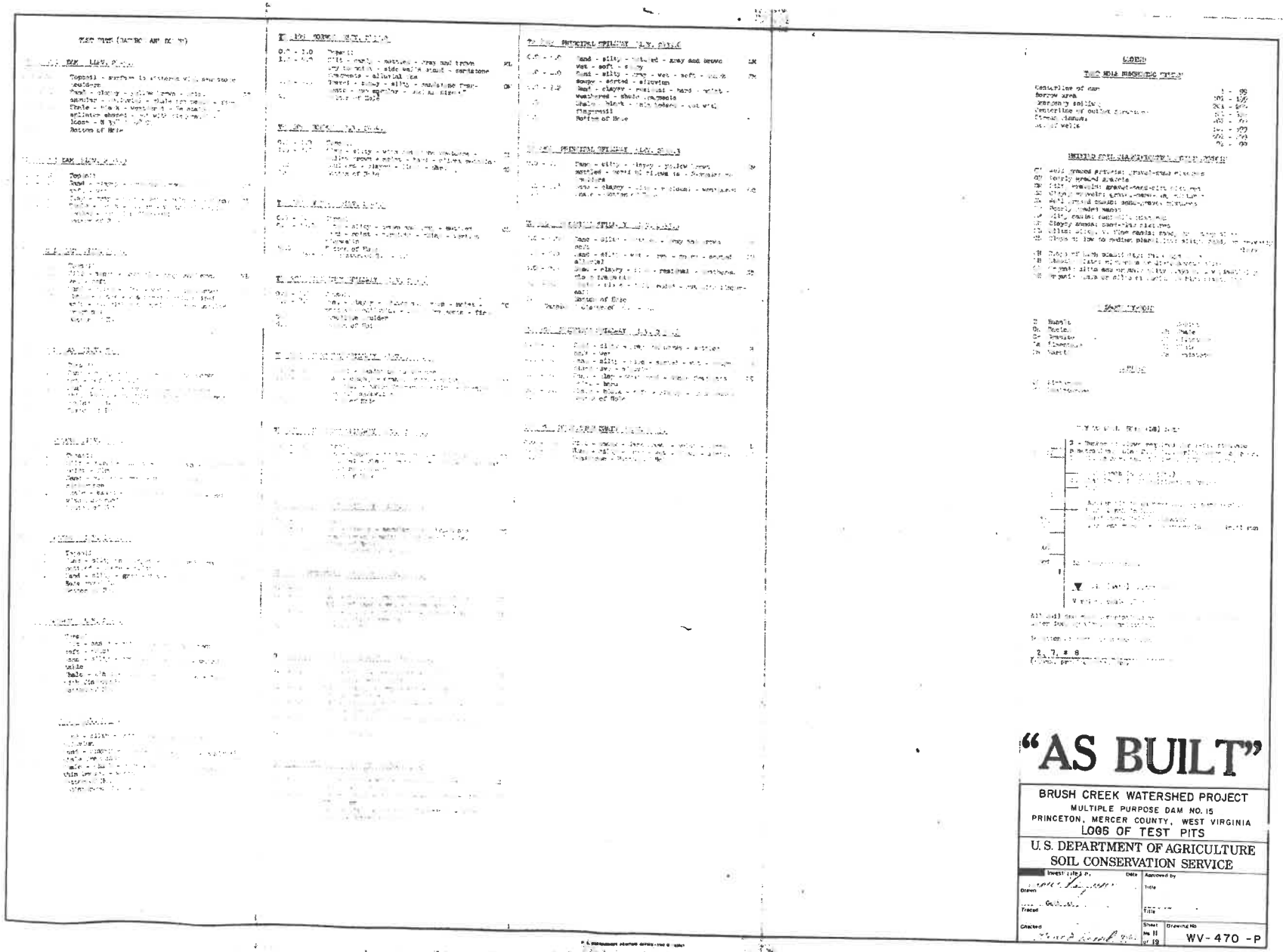
SECTION B-B

"AS BUILT"

BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
PLAN-PROFILE OF PRINCIPAL SPILLWAY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	Date	Approved by
F. R. FARMER	JULY '64	Title
Drawn W. H. MORGAN	AUG. 64	
Traced		
Checked F. M. WYSONG	AUG. '64	Sheet No. 10 of 19 — Drawing No. WV-470 - P

Form SCS 313 (November 1955)



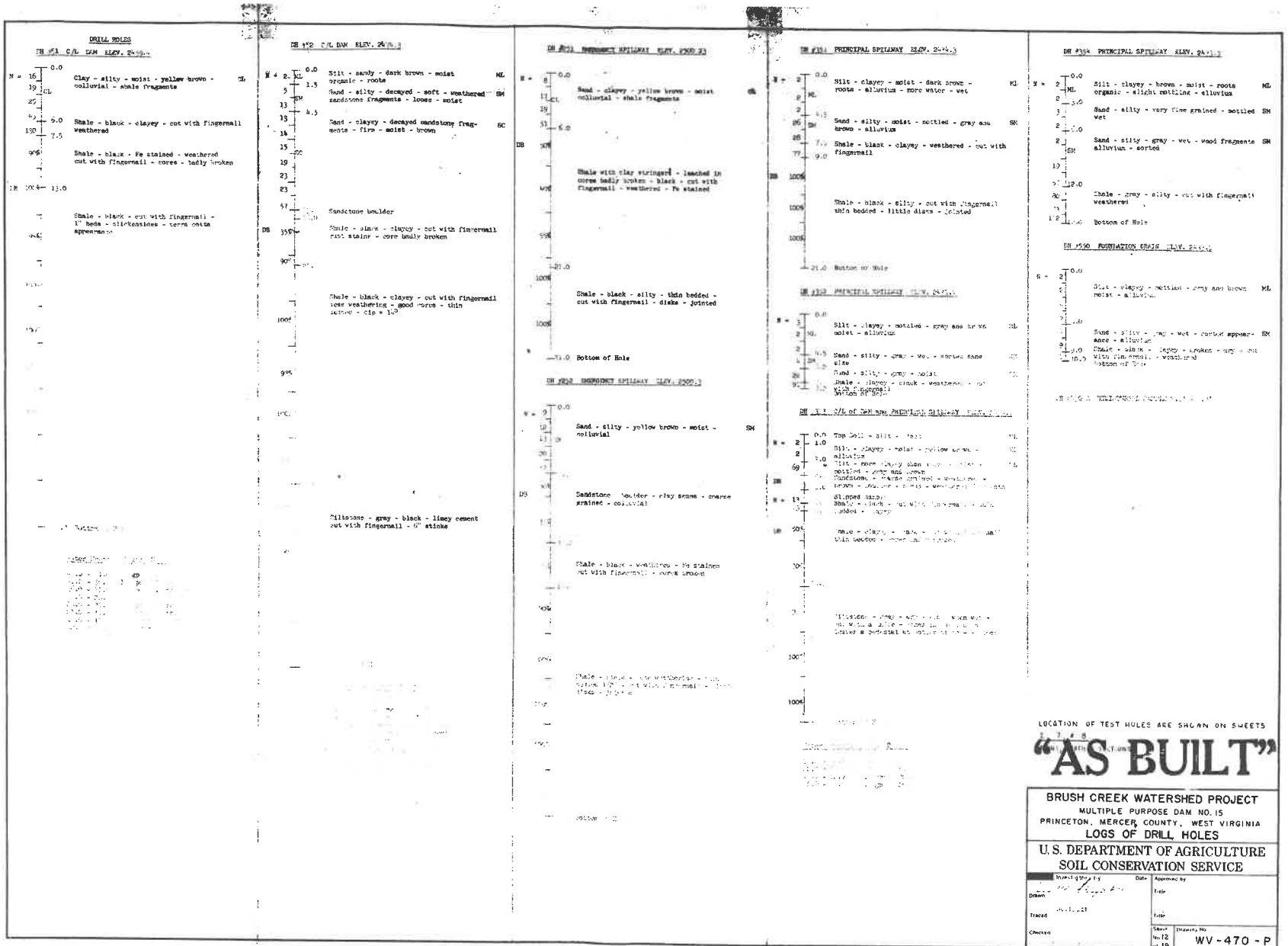
"AS BUILT"

BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
LOGS OF TEST PITS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Investigated by | Date | Approved by
Drawn | Title
Traced | Title
Checked | Sheet No. 11 of 19 | Drawing No. WV-470-P

Form SCS-313 (November 1955)


DRILL HOLES
DH #1 C/L DAM ELEV. 24[illegible]
Clay - silty - moist - yellow brown - colluvial - shale fragments
Shale - black - clayey - cut with fingernail weathered
Shale - black - Fe stained - weathered cut with fingernail - core - badly broken
Shale - black - cut with fingernail - 1" beds - slickensides - terra cotta appearance
DH #2 C/L DAM ELEV. 24[illegible]
Silt - sandy - dark brown - moist organic - roots
Sand - silty - decayed - soft - weathered sandstone fragments - loose - moist
Sand - clayey - decayed sandstone fragments - firm - moist - brown
Sandstone boulder
Shale - black - clayey - cut with fingernail rust stains - core badly broken
Shale - black - clayey - cut with fingernail - core weathering - good core - thin bedded - dip = 10°
Siltstone - gray - black - limey cement cut with fingernail - 6" sticks
DH #3 EMERGENCY SPILLWAY ELEV. 2400.3
Sand - clayey - yellow brown - moist colluvial - shale fragments
Shale with clay stringers - leached in cores badly broken - black - cut with fingernail - weathered - Fe stained
Bottom of Hole
DH #3A EMERGENCY SPILLWAY ELEV. 2400.3
Sand - silty - yellow brown - moist - colluvial
Sandstone boulder - clay seams - coarse grained - colluvial
Shale - black - weathered - Fe stained cut with fingernail - cores broken
DH #4 PRINCIPAL SPILLWAY ELEV. 24[illegible]
Silt - clayey - moist - dark brown - roots - alluvium - more water - wet
Sand - silty - moist - mottled - gray and brown - alluvium
Shale - black - clayey - weathered - cut with fingernail
Shale - black - silty - cut with fingernail thin bedded - little disks - jointed
Bottom of Hole
DH #5 PRINCIPAL SPILLWAY ELEV. 24[illegible]
Silt - clayey - mottled - gray and brown moist - alluvium
Sand - silty - gray - wet - sorted sand size
Sand - silty - gray - moist
Shale - clayey - black - weathered - cut with fingernail
Bottom of Hole
DH #6 C/L of DAM and PRINCIPAL SPILLWAY [illegible]
Top Soil - silt - [illegible]
Silt - clayey - moist - yellow brown - alluvium
Silt - more clayey than [illegible] - mottled - gray and brown
Sandstone - [illegible] - brown - [illegible]
Sloped sandy Shale - black - cut with fingernail - [illegible] - bedded - clayey
Shale - clayey - [illegible] - thin bedded - [illegible]
Siltstone - gray - [illegible] - [illegible] - jointed - [illegible]
DH #7 PRINCIPAL SPILLWAY ELEV. 24[illegible]
Silt - clayey - brown - moist - roots organic - slight mottling - alluvium
Sand - silty - very fine grained - mottled wet
Sand - silty - gray - wet - wood fragments alluvium - sorted
Shale - gray - silty - cut with fingernail weathered
Bottom of Hole
DH #8 FOUNDATION CRACK ELEV. 24[illegible]
Silt - clayey - mottled - gray and brown moist - alluvium
Sand - silty - gray - wet - sorted appearance - alluvium
Shale - black - clayey - broken - cut with fingernail - weathered
Bottom of Hole
LOCATION OF TEST HOLES ARE SHOWN ON SHEETS [illegible]
"AS BUILT"
BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
LOGS OF DRILL HOLES
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Investigated by
Date
Drawn
Traced
Checked
Approved by
Title
Sheet No. 12 of 19
Drawing No. WV-470-P
Form SCS 313 (November 1955)

DRILL HOLES

DH #71 EMERGENCY SPILLWAY ELEV. 2565.5±

0.0
N = 21 14 19 24 15 10 16 47 50
SC — Sandy clay - brown - moist
10.5
ML — Silty clay - gray brown - moist
14.0
DB = 50%
60%
30%
30%
Shale - clay seams - gray - soft to medium hard
50%
25%
25%
30%
50%
50%
63.0
95%
Siltstone - blue- cut with fingernail
100%
100%
76.0 Bottom of Hole

DH #72 EMERGENCY SPILLWAY ELEV. 2530.0±

0.0
N = 2 4 4 12 13 16 33 46
SC — Sandy clay - brown - moist
7.5
ML — Silty clay - gray brown - moist
13.3
DB = 60%
30%
Shale - badly weathered - broken cores - clay in joints and bedding planes - dark gray
90%
65%
40%
40%
40.0 Bottom of Hole

DH #73 EMERGENCY SPILLWAY ELEV. 2547.5±

0.0
N = 6 7 8 9 8 12 30 68
SC — Sandy clay - brown - moist
9.0
ML — Silty clay - gray brown - moist
12.8
DB = 65%
Shale - badly weathered - broken cores - clay in joints and bedding planes - dark gray
95%
60%
55%
33.4
90%
Siltstone - gray black - hard - cut with fingernail - 6" sticks
100%
100%
100%
58.0 Bottom of Hole

DH #74 C/L DAM ELEV. 2497.0

0.0
N = 6 10 11 19 23 22 62 60
SC — Sandy clay - brown - moist
9.7
DB = 35%
Shale - black - clayey - soft weathered - cores badly broken
75%
80%
24.7
100%
Shale - black - clayey - moderately hard - thin bedded - good cores
100%
95%
100%
Lost drill water at 37.5'
100%
100%
55.9
Siltstone - gray black - moderately hard
100%
95%
67.0 Bottom of Hole

Water Pressure Tests DH #74

65.0 - 67.0 = 11.25 gpm @ 16 psi
60.0 - 65.0 = 13.25 gpm @ 4 psi
55.0 - 60.0 = 0 gpm @ 24 psi
50.0 - 55.0 = 0 gpm @ 14 psi
45.0 - 50.0 = 0 gpm @ 15 psi
40.0 - 45.0 = 13.75 gpm @ 10 psi
35.0 - 40.0 = 13.75 gpm @ 10 psi
30.0 - 35.0 = 0 gpm @ 35 psi
25.0 - 30.0 = water leaking through casing
20.0 - 25.0 = 3.5 gpm @ 14 psi
15.0 - 20.0 = 2.0 gpm @ 11 psi
10.0 - 15.0 = 13.75 gpm @ 12 psi (water leaking)

DH #75 C/L DAM ELEV. 2433.66

0.0
N = 2 WL 4-10-64 2432.5 2 2 1 17 25 31 28
SC — Sandy clay - gray - wet
12.0
DB = 80%
95%
Shale - black - clayey - moderately hard - thin bedded good cores
95%
100%
100%
34.0 Bottom of Hole

Water Pressure Tests DH #75

25.0 - 34.0 = 0 gpm @ 30 psi
20.0 - 25.0 = 4.3 gpm @ 30 psi
15.0 - 20.0 = water leaking through casing
10.0 - 34.0 = 0 gpm @ 30 psi

DH #76 C/L DAM ELEV. 2495.0

0.0
Boulders - no sample
5.0
DB = 65%
Shale - black - soft - weathered cores badly broken
85%
60%
17.0
45%
WL 4-9-64 2471.7
100%
100%
100%
100%
100%
100%
100%
90%
100%
100%
71.0 Bottom of Hole

Water Pressure Tests DH #76

45.0 - 70.0 = 0 gpm @ 12 psi
40.0 - 45.0 = 0 gpm @ 12 psi
35.0 - 40.0 = 0.5 gpm @ 15 psi
30.0 - 35.0 = 0 gpm @ 18 psi
25.0 - 30.0 = 0 gpm @ 12 psi
20.0 - 25.0 = 0.1 gpm @ 20 psi
15.0 - 20.0 = water leaking through casing
5.0 - 70.0 = 6.5 gpm @ 18 psi

NOTE:
HOLES LOGGED BY DRILLER

LOCATION OF TEST HOLES ARE SHOWN ON SHEETS 2, 7, & 8.
(PLANS, PROFILES SECTIONS)

DH #77 PRINCIPAL SPILLWAY ELEV. 2436.88

0.0
N = 6 15 14 39 73
SC — Sandy clay - brown - wet
6.0
SC — Sandy clay with shale fragments
8.5
DB = 60%
90%
Shale - black - cut with fingernail clay in beds and joints - 1/4" disks - more massive with depth
100%
100%
23.5 Bottom of Hole

DH #78 PRINCIPAL SPILLWAY ELEV. 2433.72

0.0
N = 8 20 83
SC — Sandy clay - brown - wet
4.5
DB= 60%
80%
Shale - black - cut with fingernail clay in beds and joints - 1/4" disks more massive with depth
90%
90%
100%
22.5 Bottom of Hole

DH #79 PRINCIPAL SPILLWAY ELEV. 2437.06

0.0
N = 5 8 17 27 48
SC — Sandy clay - brown - wet
6.0
SC — Sandy clay with shale fragments
7.5
DB= 85%
Shale - black - cut with fingernail clay in beds and joints - 1/4" disks more massive with depth
100%
100%
22.5 Bottom of Hole

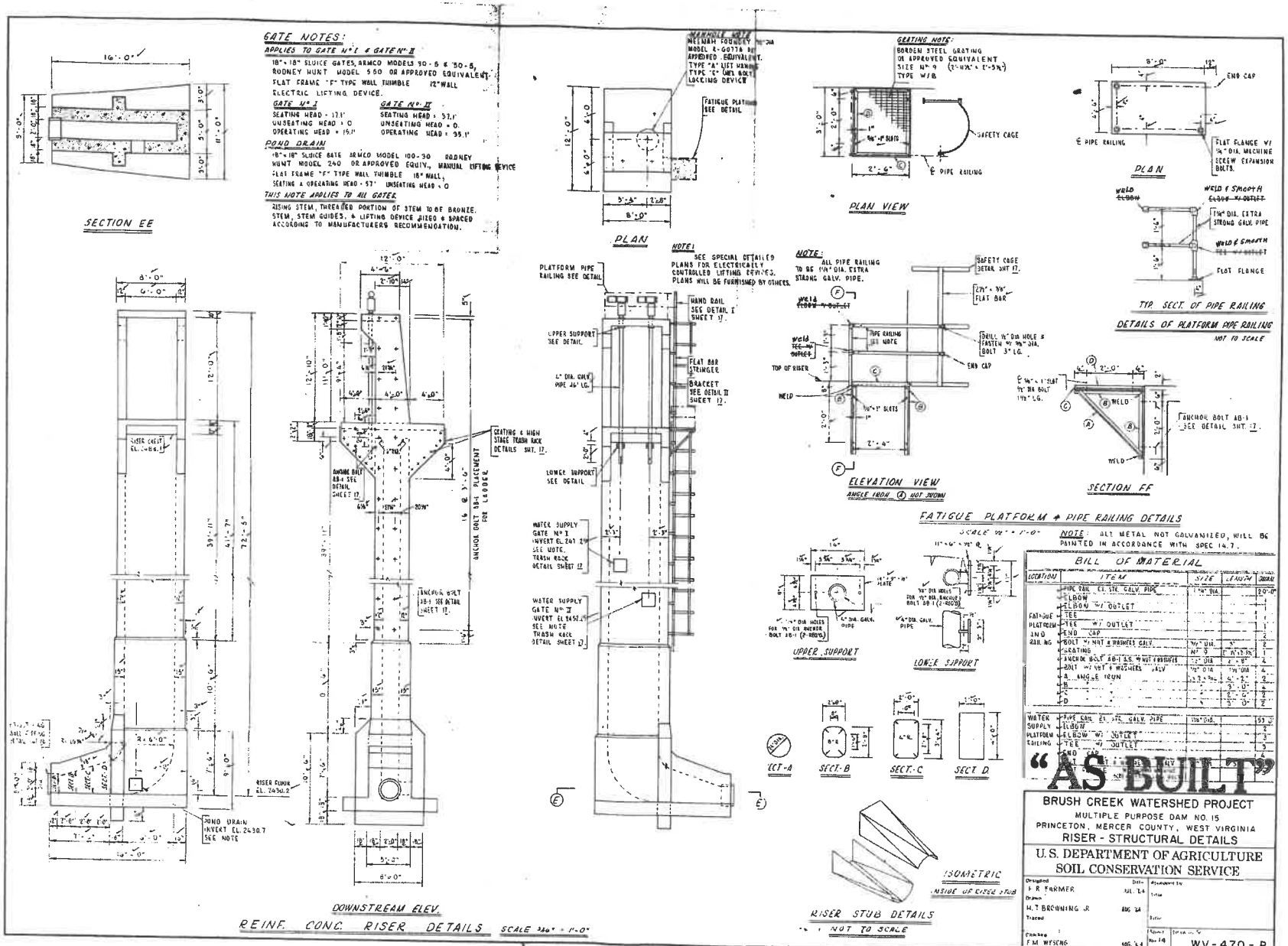
"AS BUILT"

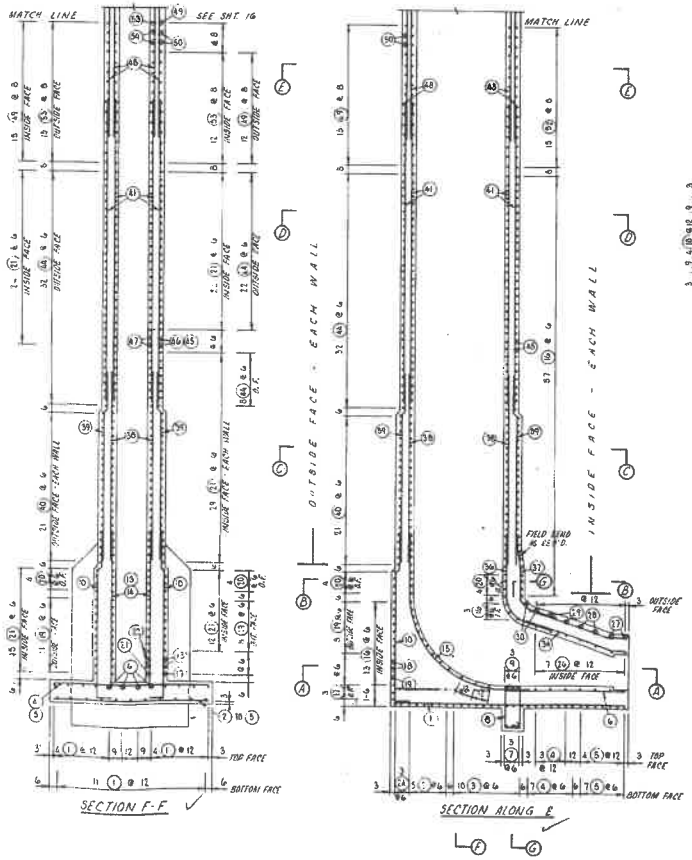
BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
LOGS OF DRILL HOLES
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Investigated by	JAMES FERGUSON	MAR, '64	Approved By
	L. MULLINS	APR, '64	Title
Typed by	L. McCLAIN	APR. '64	
Checked	G. A. KESSEL	APR. '64	Sheet No. 13 of 19

WV - 470 - P

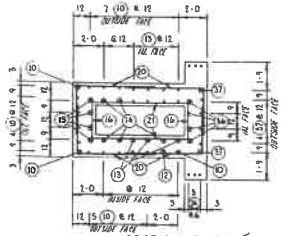
Form SCS-31.1 - November 1945


GATE NOTES:
APPLIES TO GATE N° I & GATE N° II
18" × 18" SLUICE GATES, ARMCO MODELS 30-5 & 30-8, ROONEY HUNT MODEL 550 OR APPROVED EQUIVALENT. FLAT FRAME "F" TYPE WALL THIMBLE 12" WALL ELECTRIC LIFTING DEVICE.
GATE N° I
SEATING HEAD - 17.1'
UNSEATING HEAD = 0
OPERATING HEAD = 19.1'
GATE N° II
SEATING HEAD = 37.1'
UNSEATING HEAD = 0.
OPERATING HEAD = 39.1'
POND DRAIN
18" × 18" SLUICE GATE ARMCO MODEL 100-30 ROONEY HUNT MODEL 240 OR APPROVED EQUIV., MANUAL LIFTING DEVICE FLAT FRAME "F" TYPE WALL THIMBLE 18" WALL, SEATING & OPERATING HEAD = 57' UNSEATING HEAD = 0
THIS NOTE APPLIES TO ALL GATES.
RISING STEM, THREADED PORTION OF STEM TO BE BRONZE. STEM, STEM GUIDES, & LIFTING DEVICE SIZED & SPACED ACCORDING TO MANUFACTURERS RECOMMENDATION.
SECTION EE
MANHOLE NOTE
NEENAH FOUNDRY MODEL R-6077/8 OR APPROVED EQUIVALENT. TYPE "A" LIST MARK TYPE "C" CAM BOLT LOCKING DEVICE
FATIGUE PLATFORM SEE DETAIL
PLAN
GRATING NOTE:
BORDEN STEEL GRATING OR APPROVED EQUIVALENT SIZE N° 9 TYPE W/8
SAFETY CAGE
℄ PIPE RAILING
PLAN VIEW
END CAP
℄ PIPE RAILING
FLAT FLANGE W/ ¾" DIA. MACHINE SCREW EXPANSION BOLTS.
PLAN
WELD ELBOW
WELD & SMOOTH
ELBOW W/ OUTLET
1¼" DIA. EXTRA STRONG GALV. PIPE
WELD & SMOOTH
FLAT FLANGE
TYP. SECT. OF PIPE RAILING
DETAILS OF PLATFORM PIPE RAILING
NOT TO SCALE
PLATFORM PIPE RAILING SEE DETAIL
HAND RAIL SEE DETAIL I SHEET 17.
UPPER SUPPORT SEE DETAIL
4" DIA. GALV. PIPE 46" LG.
FLAT BAR STRINGER
BRACKET SEE DETAIL II SHEET 12.
LOWER SUPPORT SEE DETAIL
WATER SUPPLY GATE N° I INVERT EL. 2417.2 SEE NOTE. TRASH RACK DETAIL SHEET 17
WATER SUPPLY GATE N° II INVERT EL. 2452.2 SEE NOTE TRASH RACK DETAIL SHEET 17
NOTE:
SEE SPECIAL DETAILED PLANS FOR ELECTRICALLY CONTROLLED LIFTING DEVICES. PLANS WILL BE FURNISHED BY OTHERS.
NOTE:
ALL PIPE RAILING TO BE 1¼" DIA. EXTRA STRONG GALV. PIPE.
SAFETY CAGE DETAIL SHT. 17.
2½" × ⅜" FLAT BAR
WELD ELBOW W/ OUTLET
PIPE RAILING SEE NOTE
DRILL ¾" DIA HOLE & FASTEN W/ ¾" DIA. BOLT 3" LG.
WELD TEE W/ OUTLET
END CAP
TOP OF RISER
WELD
¾"ø SLOTS
ELEVATION VIEW
ANGLE IRON (A) NOT SHOWN
℄ ¾" ø x 1'-0" LG. ¾" DIA BOLT 1½" LG.
WELD
ANCHOR BOLT AB-1 SEE DETAIL SHT. 17.
WELD
SECTION FF
FATIGUE PLATFORM & PIPE RAILING DETAILS
SCALE ¾" = 1'-0"
NOTE: ALL METAL NOT GALVANIZED, WILL BE PAINTED IN ACCORDANCE WITH SPEC 14.7.
UPPER SUPPORT
LOWER SUPPORT
SECT-A
SECT-B
SECT-C
SECT D
BILL OF MATERIAL
LOCATION | ITEM | SIZE | LENGTH | QUAN.
CATWALK PLATFORM AND RAILING
PIPE RAIL EL STR. GALV. PIPE 1¼" DIA. 20'-0"
ELBOW
ELBOW W/ OUTLET
TEE
TEE W/ OUTLET
END CAP
BOLT W/ NUT & WASHERS GALV. ¾" DIA. ¾"
GRATING N° 9 2'-6" × 3'-3"
ANCHOR BOLT AB-1 LS "B" NOT PROVIDED ¾" DIA 2'-8"
ZINC W/ NUT & WASHERS GALV ¾" DIA ¾" DIA
A ANGLE IRON 2½ × 2½ 4'-2"
B 4'-2"
C 3'-0"
D 3'-0"
WATER SUPPLY PLATFORM & RAILING
PIPE RAIL EL STR. GALV. PIPE 1¼" DIA. 55'-0"
ELBOW
ELBOW W/ OUTLET
TEE
TEE W/ OUTLET
END CAP
"AS BUILT"
ISOMETRIC
INSIDE OF RISER STUB
RISER STUB DETAILS
NOT TO SCALE
DOWNSTREAM ELEV.
REINF. CONC. RISER DETAILS SCALE ¾" = 1'-0"
BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
RISER - STRUCTURAL DETAILS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed F. R. FARMER JUL. '64
Drawn M. T. BROWNING JR AUG. '64
Traced
Checked F. M. WYSONG AUG. '64
Sheet No. 14 of 19
WV-470-P
Form SCS-313 (November 1954)

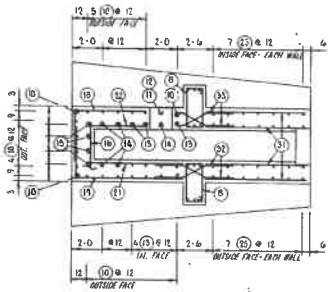


SECTION F-F

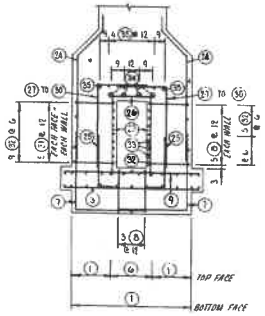
SECTION ALONG E



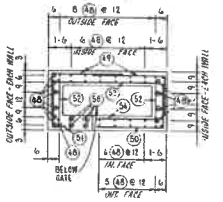
SECTION B-B



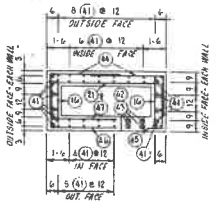
SECTION A-A



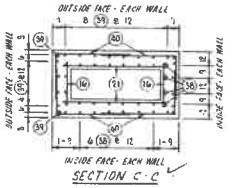
SECTION G-G



SECTION E-E



SECTION D-D



SECTION C-C

NOTE:
BAR TYPES, REINF. STEEL SCHEDULE, SEE SHEET 18

"AS BUILT"

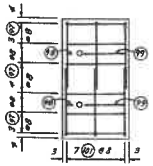
SCALE

BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
RISER-REINF. STEEL DETAILS

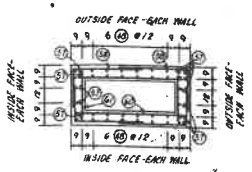
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed F.R. FARMER	Date JULY '66	Approved by Title	
Drawn M. NINOLICH	AUG. 66	Title	
Traced			
Checked F.R. FARMER	SEPT. 66	Sheet No. 15 of 19	Drawing No. WV-470-P

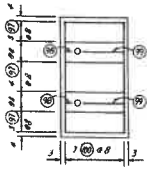
Form SCS-313 (November 1955)



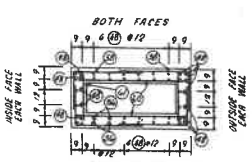
TOP FACE OF PLATFORM



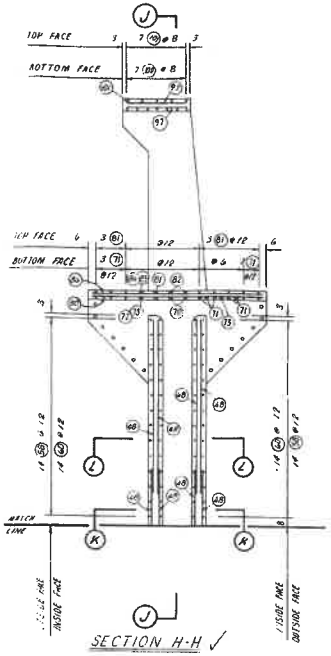
SECTION L-L



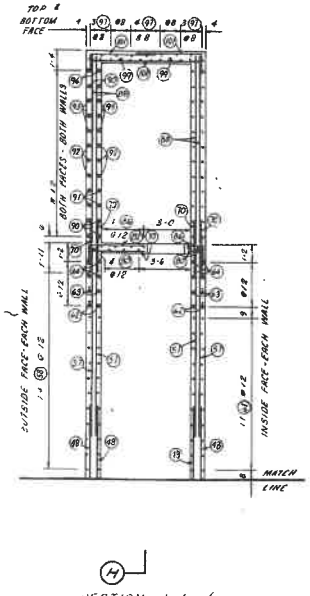
BOTTOM FACE OF PLATFORM



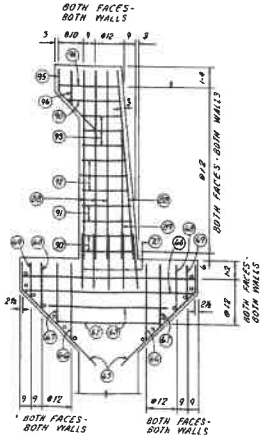
SECTION K-K



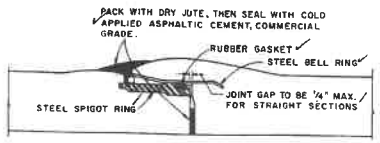
SECTION H-H



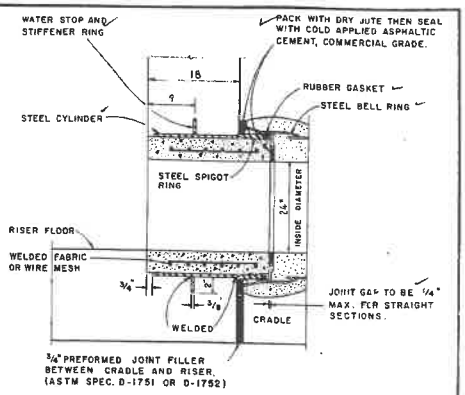
SECTION J-J



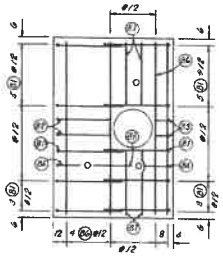
PLATFORM AND TOP SLAB SUPPORTS



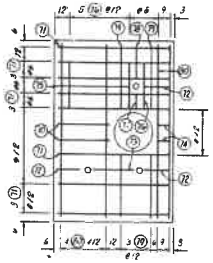
DETAIL OF REINFORCED CONCRETE WATER PIPE JOINT



SPIGOT RING WALL FITTING



TOP FACE OF TOP SLAB



BOTTOM FACE OF TOP SLAB

GENERAL NOTES:

1. ALL CONCRETE SHALL BE CLASS "B" & OF THE TYPE NOTED.
2. PORTLAND CEMENT TYPE IA ~~OR TYPE I WITH AN AIR-ENTRAINING ADMIXTURE~~ SHALL BE USED
3. ALL REINF. STEEL TO BE LAPPED A MIN. OF 30 BAR DIA.
4. ALL REINF STEEL PLACED IN CONCRETE POURED AGAINST THE GROUND SHALL HAVE A MIN. OF 3" CLEAR. WHERE FORMS ARE USED BARS SHALL HAVE A MIN. OF 2" CLEAR COVER.
5. ALL EXPOSED EDGES OF CONCRETE TO HAVE A 3/4" CHAMFER UNLESS OTHERWISE NOTED.

NOTES:

BAR TYPES, STEEL SCHEDULE, REFER TO SHEET 12.

"AS BUILT"

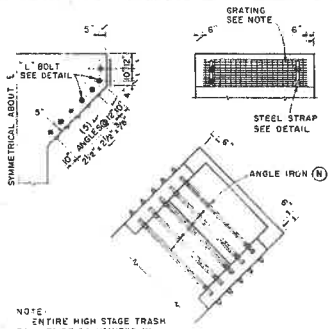
SCALE

BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
RISER - REINF. STEEL DETAILS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

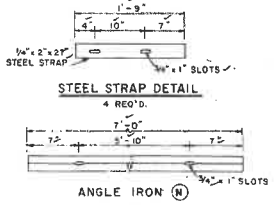
Designed F.R. FARMER	Date JULY 1964	Approved by	
Drawn C.B. FOND		Title	
Traced		Date	
Checked F.R. FARMER	SEP 64	Sheet No. 14 of 19 sheets	Drawing No. WV-470-P

Form SCS 313 (November 1955)

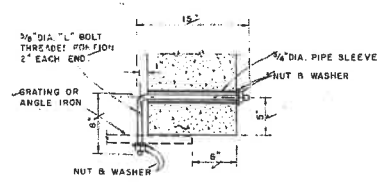


NOTE:
ENTIRE HIGH STAGE TRASH RACK TO BE GALVANIZED IN ACCORDANCE WITH SPEC 119

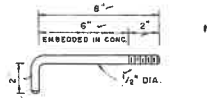
GRATING NOTE:
BORDEN STEEL GRATING OR APPROVED EQUIV.
1. TYPE WB
2. SIZE NO. 7, 21⅛" x 7'-0"
3. HORIZONTAL BEARING BARS



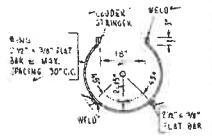
STEEL STRAP DETAIL
4 REQ'D.



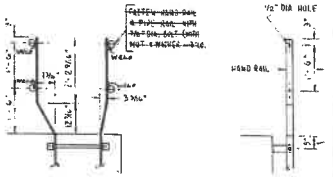
"L" BOLT DETAIL
NOT TO SCALE



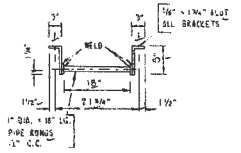
STAINLESS STEEL ANCHOR BOLT AB-1
SUPPLY WITH NUT & WASHER



DETAILS OF LADDER SAFETY CAGE
FROM ELEV 2449.7 TO ELEV. 2502.87



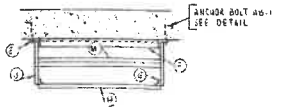
DETAIL I



DETAIL II

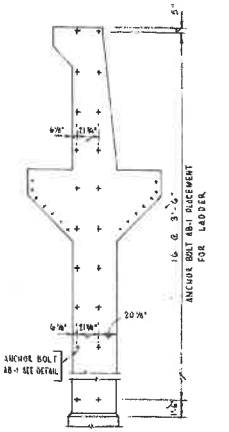
LADDER DETAILS
NOT TO SCALE

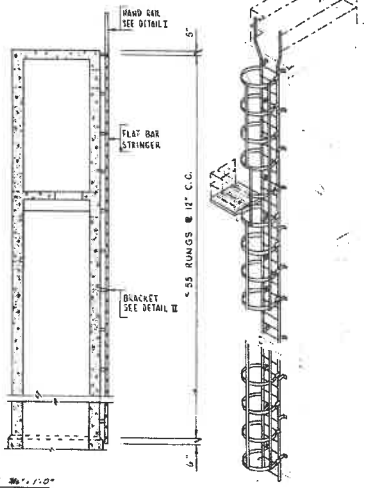
HIGH STAGE TRASH RACK DETAILS



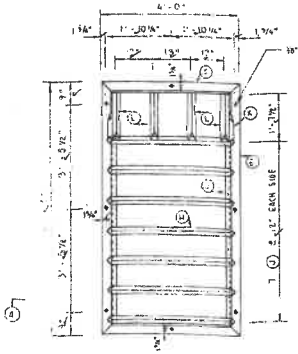
SECTION A-A

NOTE:
WELD ALL POINTS OF CONTACT BETWEEN ANGLE IRONS.
ENTIRE LOW STAGE TRASH RACK TO BE GALV. IN ACCORDANCE WITH SPEC. 119.

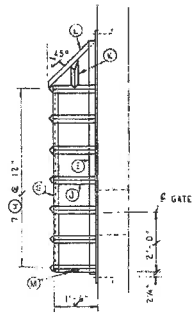




LADDER DETAILS SCALE ¾" = 1'-0"



ELEVATION VIEW



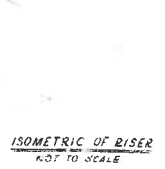
SIDE VIEW

WATER SUPPLY TRASH RACK DETAILS
NOT TO SCALE
2 REQ'D.

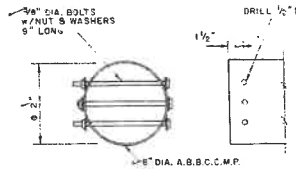
BILL OF MATERIAL

LOCATION	ITEM	SIZE	LENGTH	QUAN.
WATER SUPPLY TRASH RACK 2 REQ'D	⅝"-11 BOLT AB-1 S.S. 7 NUT & WASHER	⅝" DIA.	2'-0"	12
	(E) ANGLE IRON	4½" x ⅜"	8'-5"	2
	(F)	"	4'-0"	4
	(G)	7½" x ¼"	2'-4¾"	14
	(H)	"	1'-10"	28
	(J)	"	2'-4"	4
	(K)	"	1'-0"	2
	(L)	"	7'-3⅝"	8
	(M)	"	3'-1⅜"	2
HIGH STAGE TRASH RACK	GRATING	No. 7	21⅛"-7'-0"	3
	STEEL STRAP	2" x ¼"	2'3"	4
	(N) ANGLE IRON	1½"x1½"x⅛"	7'-0"	10
	"L" BOLT W/NUT & WASHER GALV.	⅝" DIA.	15" x 8"	28
	PIPE SLEEVE GALV. PIPE	¾" DIA.	12"	28
LADDER AND SAFETY CAGE	BRACKETS	2½" x ⅜"	2'-0"	28
	ANCHOR BOLT AB-1 S.S. 7 NUT & WASHER	⅝" DIA.	2'-6"	28
	PIPE RUNGS	1" DIA.	1'-6"	55
	FLAT BAR STRINGER	2½" x ⅜"	55'-0"	2
	HAND RAIL	"	5'-4"	2
	BOLT W/NUT & WASHERS GALV.	⅜" DIA.	8"	4
	"Z" RING	2½" x ⅜"	1'-3"	1
	FLAT BAR	2½" x ⅜"		106
	RING	"	1'-0"	1

NOTE: ALL METAL NOT GALVANIZED OR BRONZE WILL BE PAINTED IN ACCORDANCE WITH SPEC. 14.7.



ISOMETRIC OF RISER
NOT TO SCALE



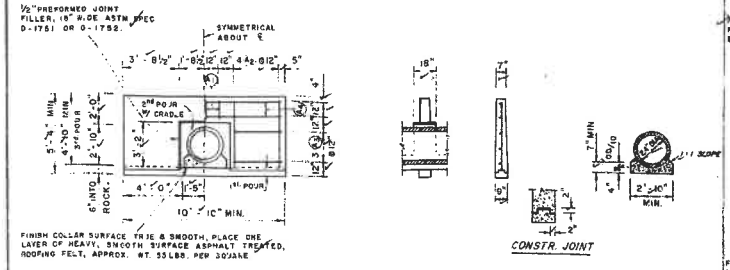
SMALL ANIMAL GUARD DETAILS

"AS BUILT"

BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
TRASH RACKS, LADDER & MISC. DETAILS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

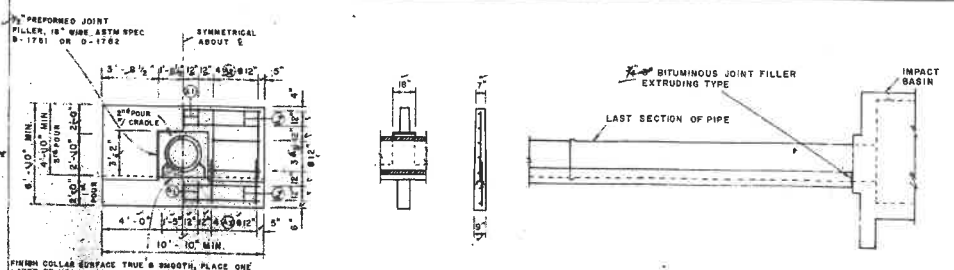
Designed	Date	Approved	
Drawn H.T. BROWN-JR. 3-66 Traced		Title	
Checked C.M. WYSONG 3-66		Title	
		Sheet No. 17 of 19	Drawing No. WV-470-P

Form SCS-313 (November 19



REINFORCED CONCRETE ANTI-SEEP COLLAR DETAILS - ALTERNATE "A"
4 COLLARS WITH BEDDING
~~ALTERNATE "B"~~
~~4 COLLARS WITH BEDDING~~

SCALE 0 1 2 3 4 5 6 FEET

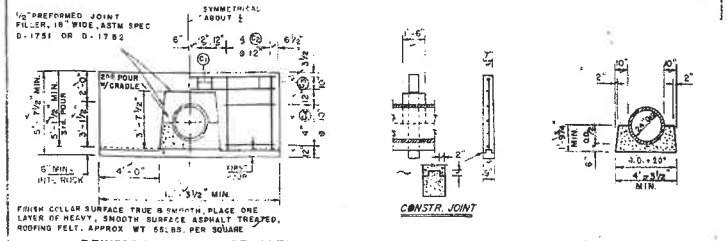


REINFORCED CONCRETE ANTI-SEEP COLLAR DETAILS
ALTERNATE "A" or "B"
2 - REQUIRED

SCALE 0 1 2 3 4 5 6 FEET

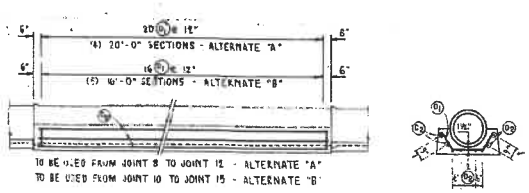
CONCRETE BEDDING DETAILS

SCALE 0 1 2 3 4 5 6 FEET



REINFORCED CONCRETE ANTI-SEEP COLLAR DETAILS - ALTERNATE "A"
4 COLLARS WITH CRADLE
ALTERNATE "B"
~~5 COLLARS WITH CRADLE~~

SCALE 0 1 2 3 4 5 6 FEET



REINF. CONCRETE CRADLE DETAILS

SCALE 0 1 2 3 4 5 6 FEET

PROJECT QUAN. - ALTERNATE "A"

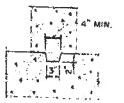
STEEL QUAN.			CONC. QUAN.
N° 4 BAR	~~1,000.0~~ 1,054.1 LIN. FT.	~~1,000.0~~ 1,054.1 LBS.	CLASS "B" TYPE I ~~70.0~~ 70.6 C.Y.
N° 5 BAR	~~2,000.00~~ 2,222.5 LIN. FT.	~~2,000.00~~ 2,222.5 LBS.	CLASS "B" TYPE II ~~300.0~~ 302.6 C.Y.
N° 6 BAR	~~2,000.00~~ 2,126.4 LIN. FT.	~~2,000.00~~ 2,126.4 LBS.	CLASS "B" TYPE III ~~180.0~~ 180.9 C.Y.
N° 7 BAR	~~3,000.00~~ 3,182.3 LIN. FT.	3,182.3 LBS.	
N° 8 BAR	210.50 LIN. FT.	312.9 LBS.	
TOTAL	~~20,000.00~~ 20,544 LBS.		

PROJECT QUAN. - ALTERNATE "B"

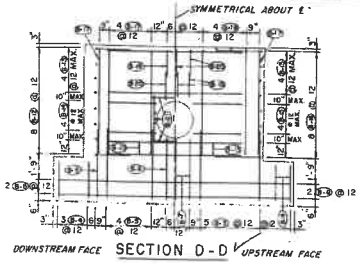
STEEL QUAN.			CONC. QUAN.
N° 4 BAR	1536.63 LIN. FT.	1706.4 LBS.	CLASS "B" TYPE I 114.1 C.Y.
N° 5 BAR	8502.71 LIN. FT.	8657.7 LBS.	CLASS "B" TYPE II 576.8 C.Y.
N° 6 BAR	4,[illegible] LIN. FT.	7382.1 LBS.	CLASS "B" TYPE III 491.6 C.Y.
N° 7 BAR	154.91 LIN. FT.	214.3 LBS.	
N° 8 BAR	73.65 LIN. FT.	[illegible] LBS.	
TOTAL	20,461 LBS.		

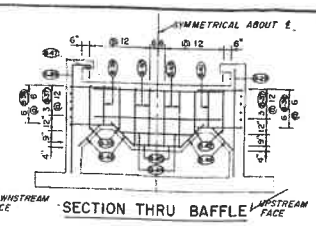
STEEL SCHEDULE

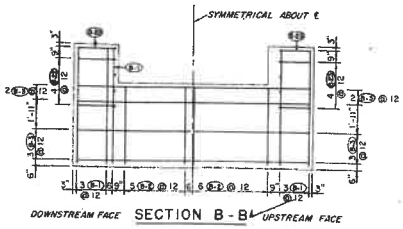
MARK	LOCATION	QUAN	SIZE	LENGTH	TYPE	A	B	C	D	TOTAL FT.
					ALTERNATE "A"					
D-1	CRADLE	20	4	[illegible]	1	1-3	5-0	1-3		360.00
					ALTERNATE "B"					
					RISER					

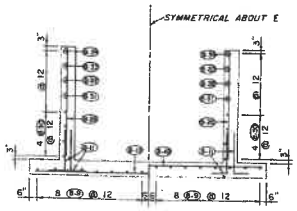


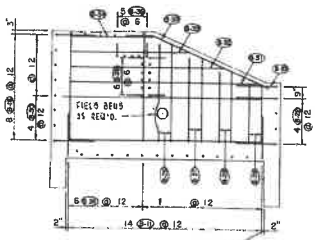
CONSTR. JOINT DETAILS

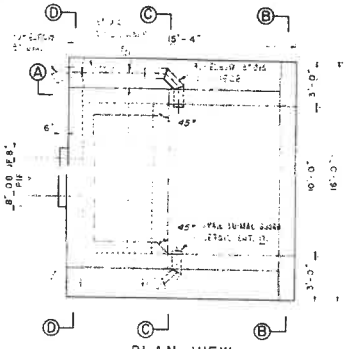


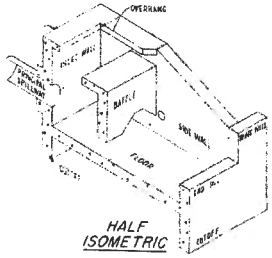


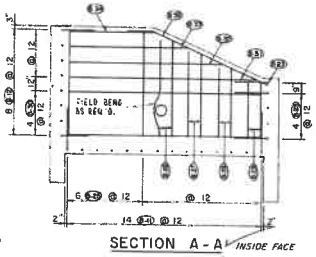


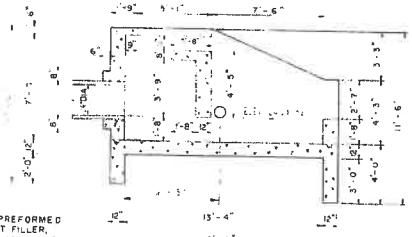


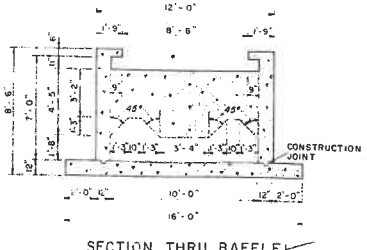


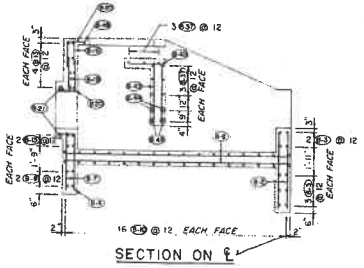






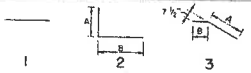






STEEL SCHEDULE

MARK	LOCATION	QUAN	SIZE	LENGTH	TYPE	A	B	TOTAL FT.
B-1	CUTOFF	14	5	7-9	1			108.50
2		21	5	5-3	1			110.25
3		10	5	15-6	1			155.00
4		10	5	2-7	1			25.83
B-5		20	5	4-6	1			90.00
6		2	5	5-0	2	4-0	1-0	10.00
7		3	5	4-0	1			12.00
8		4	5	15-6	1			62.00
9	FLOOR	32	5	15-0	1			480.00
B-10		32	5	15-6	1			496.00
11		16	5	3-9	2	2-9	1-0	210.00
12	INLET WALL	16	5	4-3	2	2-3	2-0	68.00
13		12	5	9-0	1			108.00
14		8	5	4-3	2	3-3	1-0	34.00
B-15		16	5	3-3	1			26.00
16		16	5	5-9	2	3-0	2-9	92.00
17		12	5	7-0	1			84.00
18		8	5	8-3	2	7-0	1-3	66.00
19		5	5	1-9	1			8.75
B-20		5	5	3-0	2	1-9	1-3	15.00
21		4	5	3-0	1			12.00
22	WING WALLS	10	5	5-3	2	2-6	2-9	52.50
23		10	5	4-3	2	2-0	2-3	42.50
24	SIDE WALLS	12	5	8-3	2	7-0	1-3	99.00
25		12	5	7-0	1			84.00
26		8	5	6-6	1			52.00
27		8	5	5-9	1			46.00
28		8	5	4-9	1			38.00
29		8	5	3-9	1			30.00
B-30		16	5	13-0	1			208.00
31		4	5	12-6	1			50.00
32		4	5	10-3	1			41.00
33		4	5	8-0	1			32.00
34		4	5	5-9	1			23.00
35		4	5	10-1	3	8-6	1-7	40.33
36	BAFFLE	34	5	4-0	2	3-0	1-0	136.00
37		9	5	8-6				76.50
38		1	5	4-9	2	2-6	2-3	9.50
39		4	5	5-1	2	2-10	2-3	20.33
B-40		4	5	6-1	2	3-10	2-3	24.33
41		2	5	2-6	1			5.00
42		4	5	2-9	1			11.00
43		4	5	3-9	1			15.00
44		2	5	5-0	1			10.00
B-45		2	5	3-3	1			6.50
46		8	5	2-6	1			18.00
47	OVERHANG	2	5	4-6	1			9.00
48		1	5	9-0	1			9.00



BAR TYPES

QUANTITIES THIS SHEET ONLY

REINFORCING STEEL
NO. 5 BARS 3461.8 LIN FT 3610.7 LBS

CONCRETE
CLASS "B" TYPE I 25.9 / 25.58 CU YDS

"AS BUILT"

SCALE 0 1 2 3 4 8 FEET

MAX ALLOWABLE DISCHARGE	INSIDE DIA OF PIPE
100 C.F.S.	24"

GENERAL NOTES SEE SHEET ___.

BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
IMPACT BASIN DETAILS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Engr. & Surveyor
M. NIKOLICH
W.H. MORGAN

J.R. FARMER SEPT 64 15 19 WV-470-P

FINAL GEOTECHNICAL INVESTIGATION REPORT, REVISION 1

Brush Creek Site 15 Dam Rehabilitation
Mercer County, West Virginia

Prepared For:
NRCS – West Virginia

Aterra-Schnabel Reference 18proj007
Schnabel Reference 18C35013.04
June 19, 2019
Revised October 28, 2021

ATERRA SOLUTIONS | Schnabel ENGINEERING | NRCS

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June 19, 2019
Revised October 28, 2021

Jonathan M. Pittman, PE
WV Professional Engineer No. 23485

October 28, 2021

Mr. Derrick Crane, PE
Contracting Officer's Representative
NRCS – West Virginia
1550 Earl L. Core Road, Suite 200
Morgantown, WV 26505

Subject: **Final Geotechnical Investigation Report, Revision 1**
Brush Creek Site 15 Dam Rehabilitation Design, Mercer County, West Virginia
Contract #12SPEC18D0023 / Task Order #12SPEC18F0053

Dear Mr. Crane:

Aterra-Schnabel JV is pleased to submit our revised Final Geotechnical Investigation Report for this project. This report includes tables, figures, and appendices with relevant data collected for this study. This study was performed in accordance with the approved Plan of Work dated December 28, 2018. The organization of this report follows the Geologic Investigation Report outline presented in NEH Part 631.0205(e) to the extent practical. The previous final version of this report, which was dated June 19, 2019, was revised to remove our interpretations and conclusions based on your email request on September 15, 2021.

We appreciate the opportunity to be of service for this project. Please call us if you have any questions regarding this report.

Sincerely,

Aterra-Schnabel JV

Jonathan M. Pittman, PE
Principal

Evan Binder, PE

CDS:SMB:EBB:ARB:JMP:PIW:vm

Distribution:
NRCS – West Virginia
Attn: Mr. Derrick Crane and Mr. Andy Deichert

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FINAL GEOTECHNICAL INVESTIGATION REPORT, REVISION 1
BRUSH CREEK SITE 15 DAM REHABILITATION DESIGN
NRCS – WEST VIRGINIA
MERCER COUNTY, WEST VIRGINIA

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I. INTRODUCTION

A. General

1. *Background*

The Brush Creek Watershed Site 15 Dam is located in Mercer County, West Virginia, about 9.5-miles northeast of the City of Bluefield and about 6-miles southwest of the City of Princeton, on the North Fork of Brush Creek. The site can be accessed via Dan Hale Reservoir Lake Road and Gobbler Run Road. The latitude and longitude of the approximate midpoint of the embankment centerline are 37.3246° N and 81.1848° W, respectively. A Site Location Map is provided on Figure 1, and a Site Vicinity Map is provided on Figure 2.

The Site 15 Dam is categorized as a High Hazard dam by both West Virginia Dam Safety and NRCS and is subject to both West Virginia Dam Safety and NRCS requirements. In 2017, the West Virginia Conservation Agency (WVCA), with support from Gannett Fleming, completed the *Draft Supplemental Watershed Plan – Environmental Assessment for the Rehabilitation of Brush Creek Site 15 Watershed Dam* (Plan-EA) (Gannett Fleming, 2017b). The Plan-EA process included an assessment of the condition of the dam and its compliance with current West Virginia Dam Safety and NRCS standards. The results of engineering analyses performed by NRCS (2013) and Gannett Fleming (2017a) demonstrated that the dam did not meet current West Virginia Dam Safety and/or NRCS criteria for auxiliary spillway integrity and stability, filter compatibility between the existing drain materials and adjacent embankment fill materials, embankment rapid drawdown and seismic slope stability, and principal spillway riser seismic stability.

The Plan-EA includes the following rehabilitation design concepts to bring the dam into compliance with NRCS requirements and West Virginia Dam Safety requirements:

- Installing a roller-compacted concrete cutoff wall in the auxiliary spillway.
- Constructing stability berms on the upstream and downstream slopes of the embankment.
- Constructing a new embankment toe drain system.
- Extending the principal spillway conduit and reconstructing the impact basin.
- Seismic retrofitting of the principal spillway riser.
- Repairing the existing sluice gates.

Aterra-Schnabel JV was selected by NRCS in September 2018 to develop the rehabilitation design for Site 15.

2. *Purpose*

This report presents the results of the geotechnical investigation performed by Aterra-Schnabel JV at Brush Creek Watershed Site 15. The purpose of the geotechnical investigation was to:

- Perform field testing and sampling of soil and rock materials to provide geologic, hydrogeologic, and geotechnical information to serve as a basis for the rehabilitation design.
- Characterize the embankment and foundation materials to analyze embankment stability and evaluate seepage.

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- Characterize the auxiliary spillway soils and rock to evaluate auxiliary spillway integrity and stability.
- Evaluate the potential for dispersive soils at the site.

3. *Scope of Services*

The *Specifications for Engineering Services – Dam Rehabilitation Design, Mercer County, West Virginia* (Design Specifications), dated September 2018, and the *Plan of Work – Dam Rehabilitation Design, Brush Creek Sites 9, 14, and 15, Mercer County, West Virginia,* dated December 28, 2018, outline 12 tasks (items) for engineering services associated with the Brush Creek Site 15 dam rehabilitation. Item 4 includes the geotechnical investigation required to support the evaluation of the dam and subsequent rehabilitation design. This report is limited to the presentation of data gathered as a part of Item 4. The scope of services for Item 4 generally included:

- Development of Preliminary and Final Geotechnical Investigation Plans
- Geotechnical investigation to include:
  - Drilling 5 test borings through the embankment and foundation
  - Drilling 5 test borings in the auxiliary spillway and foundation
  - Drilling 1 test boring through the right auxiliary spillway training dike and 1 test boring on the slope to the right of the auxiliary spillway training dike
  - Drilling up to 2 auger probes near the principal spillway outlet
  - Installing up to 3 permanent piezometers in the embankment
  - Standard penetration testing (SPTs) and undisturbed sampling of soil
  - In situ hydraulic conductivity testing in soil and rock
  - Backfilling the test borings and auger probes, and site restoration
  - Drilling oversight
- Preparation of Preliminary and Final Geotechnical Investigation Reports to, at a minimum, include:
  - The investigation findings, geologic interpretations, and the geotechnical engineer's professional conclusions and opinions pertaining to design, construction, and performance of works
  - Test boring logs, field test data, and photographs
  - Maps, profiles, and cross-sections

Item 5 of the Plan of Work includes laboratory testing of select soil and rock samples collected during the investigation. The laboratory test results are not included in this report but will be included in the Final Soil and Rock Laboratory Testing Report.

4. *Land Surveying and Control*

Gannett Fleming performed a topographic survey of the site between March 7 and 9, 2016. NRCS provided the results of that survey to us for use in this study. Survey control points were established by a static GPS session processed by the NGS-OPUS website (Gannett Fleming, 2017a). Based on these reference points from the Gannett Fleming survey, we used an unmanned aerial vehicle (UAV or drone) and 3DR's aerial surveying software, *Site Scan,* to obtain horizontal coordinates of the as-drilled test boring locations. 3DR's online *Site Scan* processing engine developed the orthophotograph and DEM

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used to obtain the as-drilled test boring elevations. Additional details on the results of the drone flight will be provided in the Aerial Photography and Mapping Report.

Horizontal coordinates in the Gannett Fleming survey reference NAD83, GEOID 12A, West Virginia State Plane Coordinate System, South Zone. Elevations in the Gannett Fleming survey and in this report are in feet and reference the North American Vertical Datum of 1988 (NAVD88). Elevations on the As-Built Drawings reference the National Geodetic Vertical Datum of 1929 (NGVD29). Locations and elevations should be considered no more accurate than the methods used to determine them.

5. *Terminology*

Descriptive nomenclature for dams is based upon one looking downstream in the direction of flow. "Right" and "left" are referenced in this manner. The reservoir side is known as the upstream side with the opposite slope referred to as the downstream slope.

The abbreviation "EL" in this report represents elevation in feet.

6. *Site Description*

The Brush Creek Watershed Site 15 Dam is a multiple-purpose dam designed by the West Virginia SCS (now NRCS) and constructed in 1967, and is used for flood control, recreation, and municipal water supply. The contributing watershed is 1,719 acres (2.7 sq mi). The dam impounds an approximately 75-acre reservoir with a capacity of 1,516 acre-feet at its normal pool of EL 2489.5. At normal pool, the depth of water at the upstream toe of the embankment is about 53 ft. The top of dam storage capacity is approximately 3,080 acre-feet.

The dam is a 692-ft long zoned earthen embankment with a top width of about 22 ft, and a maximum height of about 76 ft measured from the invert of the principal spillway conduit to the low point on the crest of the dam. The embankment fill volume is approximately 236,100 cubic yards (Gannett Fleming, 2017b). According to the 2016 survey by Gannett Fleming, the minimum crest elevation of the dam is EL 2506.3. The upstream slope of the embankment ranges from about 2.5H:1V to 2H:1V. The downstream slope is approximately 2.5H:1V. The embankment consists of a low-permeability core (Section No. 1) located upstream of the embankment centerline, an upstream shell and transition zone downstream of the core (both designated as Section No. 2), and a downstream shell (Section No. 3).

A 4-ft wide seepage collection drain system is located 100-ft downstream of the embankment centerline at the downstream edge of Section No. 2. The As-Built Drawings provided by NRCS (USDA-SCS, 1967, Appendix E) indicate the filter material is a blend of sand and gravel that extends up to 4 ft into rock. The seepage collection drain system includes an 8-inch diameter perforated CMP that outlets downstream of the principal spillway outlet.

According to the As-Built Drawings, the principal spillway consists of a covered-top reinforced concrete riser that is about 72-ft tall. The inside dimensions of the riser are about 2 ft by 6 ft. The invert of the riser crest is at the normal pool elevation of the reservoir: EL 2489.5. The riser conveys flows from the reservoir through the embankment via an approximately 368-ft long, 24-inch diameter RCP that outlets into a reinforced concrete impact basin. The invert of the principal spillway outlet is EL 2430.4. The principal spillway conduit was constructed with a concrete cradle founded on rock and includes reinforced

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concrete anti-seep collars along its length. The reservoirs drain release are controlled by using an 18-inch slide gate located at the base of the riser.

The auxiliary spillway is a 125-ft wide vegetated earth auxiliary spillway constructed in the left abutment. The auxiliary spillway has a 20-ft long (upstream to downstream) control section at EL 2496.3, approximately 10 ft below the minimum top of the dam elevation. Both the approach channel and exit channel of the auxiliary spillway slope away from the control section at about a 2 percent grade. Auxiliary spillway flows drain into the North Fork of Brush Creek.

7. *Previous Subsurface Explorations by Others*

The following subsurface explorations have been performed at Site 15:

- **1963 Investigation by SCS:** Numerous test pits and test borings were performed across the site in 1963 to support the original design of the dam. Results and findings are summarized in a memorandum dated June 27, 1963, and the soil mechanics memorandum dated August 23, 1963. Test pit and test boring logs are included on the 1967 As-Built Drawings.

- **2013–2014 Investigation by NRCS:** This investigation was performed to support a planning level evaluation of the existing structure. Four test borings were performed in the dam along a section near the principal spillway conduit, and 3 test borings were performed within the auxiliary spillway. Borings were advanced with hollow-stem augers and NX rock coring. Soil sampling intervals in the embankment ranged from 5 ft to continuous. The borings drilled in the auxiliary spillway included continuous soil sampling. Rock coring was performed only in the auxiliary spillway borings and included continuous sampling. The locations of these borings are shown on the Boring Location Plan on Figure 3, and the Boring Logs are included in Appendix F.

- **2016 Investigation by Gannett Fleming:** Three test borings were performed along a section of the embankment near the left abutment to obtain additional geotechnical data to support the planning level study. Borings were advanced with hollow-stem augers and NX rock coring. Continuous sampling was performed in both soil and rock. Piezometers were installed in each boring upon completion of sampling and testing. The locations of these borings/piezometers are shown on Figure 3, and the Boring Logs are included in Appendix F.

8. *Geotechnical Investigation Program*

We performed a geotechnical investigation and field-testing programs between February 26 and March 20, 2019, to further characterize the subsurface conditions at the site in support of the rehabilitation design. This program included subsurface drilling, sampling, and in situ testing. The subsurface investigation methods are presented in the subsections below, and the investigation results are discussed in Section II.

Prior to beginning the subsurface exploration, we presented the proposed exploration and field-testing approach and procedures in the *Geotechnical Investigation Plan, Brush Creek Sites 9, 14, and 15, Mercer County West Virginia.* This plan was reviewed and approved by the NRCS and finalized on March 28, 2019.

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a) Subcontractors

Our drilling subcontractor, Horn and Associates, Inc. (H&A) of Winchester, Kentucky, performed subsurface drilling. Drilling was completed using track-mounted CME-55 and Diedrich D-50 drill rigs. To access the embankment slope borings, the drill rig was anchored to a John Deere 650K XLT bulldozer positioned at the embankment crest, and the drill rig mast was mechanically locked at the complementary angle to produce a vertical boring. The drilling, sampling, and in-situ testing were performed in general accordance with current, applicable ASTM procedures, as described in the following subsections.

b) Subsurface Drilling and Sampling

(1) General

The geotechnical investigation program included the following test borings:

- Two borings drilled from the crest of the dam to target embankment Section Nos. 2 and 3 (Borings B-51 and B-52).
- One auger probe drilled from the crest of the dam for piezometer installation (B-51A).
- Two borings drilled in the downstream toe of the embankment (B-651 and B-652).
- One boring drilled in the upstream slope of the dam to target embankment Section No. 1 and the interface between embankment Section Nos. 1 and 2 (B-653).
- One auger probe drilled on the left side of the principal spillway outlet (AP-351).
- Five borings drilled in the auxiliary spillway (B-251, B-252, B-254, B-255, and B-257).
- Two borings drilled in the right auxiliary spillway training dike (B-253 and B-256).

Test borings were numbered as follows:

- Centerline of embankment: B-5x
- Auxiliary spillway: B-25x
- Principal spillway outlet: AP-35x
- Embankment slopes and toes: B-65x

The locations, depths, and termination information for the borings are summarized in Table 1. Boring locations are shown on Figure 3.

A licensed professional geologist from Aterra-Schnabel JV either observed or supervised the drilling, sampling, and borehole logging. Additional support personnel included experienced geotechnical engineers. A geologist from NRCS was also present during portions of the investigation.

(2) Test Borings

Soil drilling was performed using 4¼-inch inside diameter (ID) hollow-stem augers. Soil samples were obtained with either a 2-inch outside diameter (OD) split-barrel sampler, 3-inch OD split-barrel sampler, or 3-inch ID Shelby tube. At select locations, where low recoveries were due to the presence of gravel particles, the 2-inch and 3-inch OD samplers were used in an alternating sequence. In general, each Shelby tube sampling interval consisted of pushing two Shelby tubes to increase the likelihood of obtaining sufficient relatively undisturbed samples for laboratory testing.

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Auger Probe AP-351 was performed by drilling without sampling until auger refusal using 2¼-inch OD solid-stem augers.

Due to concerns of heaving sands in the embankment foundation, water was added to Boring B-51 prior to advancing beyond 10 ft above the estimated top of foundation soils. The water level in the test boring was generally maintained above the estimated pre-drilling piezometric surface to develop a slight downward gradient.

Rock coring and sampling were performed using an HQ triple-tube wireline system, diamond rotary coring bit, and tube core barrel.

Test boring backfill material consisted of cement/bentonite grout mixed with about 30 gallons of water to one bag (94 pounds) of Type I/II Portland cement and about 25 pounds of bentonite powder. This material was selected in order to reduce the potential for vertical movement of water along the borehole sidewalls and to reduce the potential for settlement at the top of the test boring. The grout was placed by tremie pipe to the bottom of test borings. After allowing time for the backfill materials to settle, the test borings were topped off as necessary with additional grout or bentonite chips. Backfill methods for each test boring are shown on the test boring logs and borehole backfill records included in Appendix A.

Areas disturbed by the drilling equipment were strawed and seeded in accordance with NRCS requirements upon completion of the investigation.

Aterra-Schnabel JV personnel logged the borings and described the materials using the Unified Soil Classification System and Schnabel's Descriptive Criteria for Rock (Appendix A), in general accordance with ASTM D2488. Rock Quality Designation (RQD) and Recovery (REC) for each rock core run were recorded prior to sample transport.

Appendix A includes additional details on subsurface exploration procedures, sampling protocols, soil identification, rock core descriptions, test boring logs, undisturbed sampling records, and rock core photographs.

c) Piezometer Installation and Development

(1) 2019 Geotechnical Investigation Piezometers

H&A installed two permanent piezometers at Site 15. One open standpipe piezometer was installed in Boring B-51A in the embankment fill material (Section No. 2), and one capped open standpipe piezometer was installed in Boring B-651 in bedrock. Each piezometer was constructed with 2-inch diameter Schedule 40 PVC pipe and one 5-ft, 0.01-inch well screen. Global Drilling Suppliers, Inc. #5 sand was placed around the riser pipe to about 1 to 2 ft above the well screen. Then, a 2-ft seal of ¼-inch coated bentonite pellets was placed above the sand. Cement/bentonite grout, with a mixture of about 30 gallons of water to one bag (94 pounds) of Portland Type I/II cement and about 25 pounds of bentonite powder, was placed by tremie pipe from the top of the bentonite seal to about 1.3 to 2 ft bgs. A concrete pad encasing a flush-mount steel monitoring well cover was installed at the ground surface. A glycerin-filled pressure gage was installed on the Boring B-651 piezometer due to artesian conditions observed after drilling.

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The Boring B-51A piezometer was developed by bailing until the piezometer ran dry. Development of Piezometer B-51A was terminated after the observed water was clear to light brown after bailing 20 well volumes. One well volume of clear water with silt was bailed from the Boring B-651 piezometer; however, the Boring B-651 piezometer was not completely developed by bailing due to artesian flow from the top of the piezometer.

Details of piezometer installation and development are included in Appendix B.

(2) 2016 Gannett Fleming Subsurface Investigation Piezometers

Gannett Fleming (2017a) installed three sets of piezometers in the embankment during the 2016 subsurface investigation. Two nested piezometers were installed in the embankment crest and downstream slope borings (GF-1 and GF-2, respectively), and a single piezometer was installed at the embankment toe (GF-3). The upper piezometer screen in Boring GF-1 (GF-1S) was installed in embankment fill from 51 to 53 ft below ground surface (bgs), and the lower piezometer screen in Boring GF-1 (GF-1D) was installed in bedrock from 91.5 to 93.5 ft bgs. The upper piezometer screen in Boring GF-2 (GF-2S) was installed in embankment fill from 32 to 34 ft bgs, and the lower piezometer screen in Boring GF-2 (GF-2D) was installed in bedrock from 53.5 to 55.5 ft bgs. The piezometer screen in Boring GF-3 was installed in alluvial soils from 8 to 10 ft bgs.

The piezometers were constructed with 1-inch diameter PVC pipe and 2-ft long well screen. A sand filter pack was placed around the well screen. Then, a bentonite seal was placed above the sand. Cement/bentonite grout was placed from the top of the bentonite seal to the surface. A steel riser encasing the piezometer(s) was also installed. Piezometer construction logs are provided in Appendix F, and additional details are included in the Gannett Fleming report (2017a). We were not present during the installation of these piezometers and cannot confirm that the piezometers were constructed as recorded. It is not clear whether these piezometers were developed during the 2016 investigation.

d) Water Level Observations

Aterra-Schnabel JV field staff measured water levels in the test borings using an electronic water level meter. Water levels were typically measured several times in each boring, including during drilling, after completion of drilling, at the beginning and end of each day, and immediately prior to grouting. Water levels in the Aterra-Schnabel JV and Gannett Fleming permanent piezometers were measured multiple times after the completion of drilling activities. Select water level observations are included on the test boring logs in Appendix A, and all water level observations are included in Table 2. Additional discussion on the water level observations is included in Section II.

Aterra-Schnabel JV field staff also recorded water levels in the existing 2016 Gannett Fleming piezometers several times during the geotechnical investigation. The recorded water levels are given in Table 2.

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e) Field and In Situ Testing

(1) Summary

The testing performed in the field on in situ materials is presented in the following subsections and includes:

- 139 SPTs in soil
- 1 hydraulic conductivity test using piezometers in soil (slug and well recovery tests)
- 6 hydraulic conductivity pressure tests in rock (packer tests)
- 1 hydraulic conductivity test in rock (falling head test)

An Aterra-Schnabel JV representative observed the sampling and testing, and recorded the data presented herein.

(2) Standard Penetration Tests

H&A performed the SPTs in soil using a 24-inch long, 2-inch OD split-spoon sampler or a 3-inch OD split-spoon sampler to collect soil samples and to measure the relative penetration resistance of soils. Samples taken from the embankment were collected continuously during drilling, and samples taken from the auxiliary spillway were collected at 5-ft intervals. The number of blows required to drive the split-spoon sampler four consecutive 6-inch increments using a 140-pound hammer falling 30 inches was recorded. These SPT "N-values," which are shown on the test boring logs in Appendix A, are defined as the sum of the second and third 6-inch blow count intervals. Additional details on the SPTs are provided in Appendix A.

(3) Hydraulic Conductivity Testing Using Piezometers (Slug Tests)

Hydraulic conductivity testing of soil (slug and well recovery testing) was completed in the Boring B-51A piezometer. Due to slow static water level recovery in this piezometer after well development, one falling head test with a water slug was performed to calculate the hydraulic conductivity of the soil. A summary of the results is included in Section II. Additional details and test results are included in Appendix C.

(4) Hydraulic Conductivity Testing in Rock

Hydraulic conductivity testing in rock included packer testing and falling head testing in select borings. Both methods are presented and summarized in Section II. Additional details and test results are included in Appendix D.

B. Surface Geology and Physiography

1. *Physiographic Area*

The project site is located within the Appalachian Plateau Physiographic Province of West Virginia. The Appalachian Plateau spans the majority of the western part of the state and is bounded by the Valley and Ridge Province to the east. The Appalachian Plateau is generally characterized by flat-lying sedimentary rocks and rugged topography carved by streams (WVGES, 2017).

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2. *Topography*

According to the 2016 Gannett Fleming survey, the left abutment slope above the auxiliary spillway ranges from approximately 3H:1V to 2.5H:1V, and the slope of the right abutment ranges from approximately 3.5H:1V to 5H:1V. The floodplain is about 310-ft wide immediately downstream of the embankment and widens to roughly 450-ft downstream of the auxiliary spillway exit channel.

3. *Geologic Formations and Surficial Deposits*

a) Regional Geology

Several regional geology maps, at different scales, have been completed for the Bluefield, Mercer County, West Virginia area:

1) Reger, D.B. and Price P.H. (1925). Map II Mercer County showing General and Economic Geology, West Virginia Geological Survey, scale 1:62,500.

2) Cardwell, D.H., Erwin, R.B., and Woodward, H.P. (1968). Geologic Map of West Virginia. West Virginia Geological and Economic Survey, Map 1, scale 1:250,000 (Figure 4).

3) Beuthin, J.D., Blake Jr., B.M., and Rader, E. (2000). Bedrock Geologic Map of the Bluefield 7.5' Quadrangle, West Virginia – Virginia. West Virginia Geological and Economic Survey Open File Publication OF-0003, scale 1:24,000 (Figure 5).

The regional underlying geology in the vicinity of the project is described below using geologic formation names from Cardwell et al. (1968), and Beuthin et al. (2000). The regional geology consists of upper Mississippian-aged sedimentary rock of the Mauch Chunk Group, detailed below from youngest to oldest with approximate unit thickness.

The Mauch Chunk Group is subdivided into four formations:

- Bluestone Formation (400–800 ft) is a variable sequence of mudstone, shale, siltstone, and sandstone, with discontinuous beds of limestone and siderite (iron) nodules.
    - Unnamed upper layer consists of red and green mudstone, siltstone, shale, and very fine-grained sandstone capped by a claystone.
    - The Glady Fork Sandstone is a light gray to light brown, weathering light brown to brown and greenish brown, fine to coarse grained silty, massive, and may contain carbonaceous films and flakes.
    - The Pride Shale is dark gray to tan shale, siltstone, and sandstone with some lenses of siderite nodules.
- Princeton Formation (20–50 ft) is a sequence of sandstone, conglomerate, silty shales, and silty mudstone, and may contain a massive basal sandstone.
- Hinton Formation (800–1,350 ft) is red, green, and medium-gray mudstone, sandstone, and limestone, including the Avis Formation, with limited occurrences of coal.

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b) Site Geology

The shales and sandstones of the Bluestone Formation are present at Site 15. The 1963 SCS geology report states that the primary rock type is shale, which was characterized as dark, soft, iron stained, and clayey. The general orientation of the shale bedding (strike and dip) is about N35°E, 9°SE on the right abutment to dipping at 14°SE on the left abutment. Outcrops of the overlying Glady Fork Sandstone are present on the right abutment, upslope of the dam (USDA-SCS, 1963a).

c) Soil Survey Mapping

A portion of the NRCS Soil Survey Map for Mercer County, West Virginia, within the vicinity of the site (NRCS 2017), is shown on the Soils Map (Figure 6). According to this map, the primary series of soils at the site are the Cateache-Berks soils, which consist of well drained soils formed in residual shale, sandstone, and siltstone. At the site, there are three Cateache-Berks sub-units:

- Cateache-Berks channery silt loam (map unit CeD3) – 15 to 35 percent slopes, found along slopes, ridges, and structural benches
- Cateache-Berks channery silt loam (map unit CeF) – 35 to 70 percent slopes, found along slopes and ridges
- Cateache-Berks channery silt loam (map unit CeF3) – 35 to 70 percent slopes, found along slopes and ridges

Orrville-Lobdell soils (map unit Ol) are found within the floodplain downstream of the dam. This unit consists of silty alluvium derived from sandstone, shale, limestone, and siltstone.

4. *Structure*

According to Reger and White (1926), severe folding of the Mississippian-aged strata has occurred in the project area. The Hurricane Ridge Syncline is a long, deep basin that spans from northeast to southwest across the southern part of Mercer County (Figure 4). The basin is generally asymmetrical where the northwest limb slopes gently compared to the steep and often overturned southeastern limb. Site 15 is located on the northwest limb roughly 1.5-miles northwest of the Hurricane Ridge Syncline fold axis (Figure 5).

The 1963 SCS geology report noted the project site structural geology using shale bedrock orientations. The general orientation of the shale bedrock was measured striking N35°E, and dipping between 9°SE and 14°SE. This orientation correlates to the structural measurements shown on the Beuthin et al. (2000) geology map who mapped nearby Bluestone Formation bedrock with strikes trending northeast-southwest, with dips ranging between 8 and 10 degrees to the southeast (Figure 5).

5. *Evidence of Landslides, Seepage, or Springs*

Based on our review of the USGS (2016) *Bluefield Quadrangle* at a scale of 1:24,000, as well as our observations, there is no evidence of landslides at the site.

We did not observe any seepage or springs during the geotechnical investigation. Slight artesian conditions were observed in one of the borings drilled at the downstream toe of the embankment (B-651), which are discussed in Section II. Gannett Fleming observed wet areas along the downstream toe of the

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embankment during their March 2016 inspection (Gannett Fleming, 2017a), but these wet areas were not observed during our investigation.

6. *Sediment and Erosion*

An evaluation of reservoir sedimentation and erosion was not included in this geotechnical investigation.

7. *Downstream Channel Stability*

Evaluation of the downstream channel was not included in this investigation. Although the proposed replacement outlet structure is expected to have a slightly larger footprint than the existing outlet structure, it is not expected to negatively impact the downstream channel. Additionally, the principal spillway conduit diameter is not expected to be modified at this time; therefore, discharge characteristics will essentially remain the same as the existing conditions.

8. *Seismicity*

The seismicity at Brush Creek Site 15 is typical of the Central and Eastern United States (CEUS). The CEUS is a stable, intraplate region that is not nearly as active as the Western United States (WUS) that borders a plate boundary; however, much less attenuation occurs with CEUS earthquakes compared to those in the WUS because of the thick, denser crust in the CEUS. Therefore, earthquakes of similar magnitude will impact a much larger region in the CEUS (USGS, 2018).

A literature review of regional seismicity was performed to identify seismogenic sources in the area and locations of significant past earthquakes. Figure 7 shows the locations of magnitude 4 (M4.0) or greater earthquakes within a 100-km radius of the project site that are part of the CEUS Seismic Source Characterization Model earthquake catalog (CEUS-SSCn, 2012). These events include:

- Mb4.9 – 4/29/1852 – Wytheville, Virginia
- Mb4.6 – 5/3/1897 – Pulaski County, Virginia
- Mb5.8 – 5/31/1897 – Pearisburg, Virginia
- Mb4.3 – 11/5/1898 – Pulaski County, Virginia
- Mb4.3 – 11/25/1898 – Pulaski County, Virginia
- Mb4.4 – 2/13/1899 – Pulaski County, Virginia
- Mb4.3 – 11/20/1969 – Mercer County, West Virginia
- Mb4.7 – 6/19/1976 – Welch, West Virginia
- Mb 4.1 to 4.3 – 4/14/1988 to 11/23/2006 – Mining Collapse/Blasting Events

Most of these earthquakes occurred before the creation of the modern-day seismic network; therefore, there is a great degree of uncertainty associated with their location and magnitude. Additionally, the body wave magnitude for events prior to 1976 was estimated from the intensity of shaking that was reported in the area.

Brush Creek Site 15 is located in an area of moderate seismicity for the CEUS and is near several seismic source zones as shown in Figure 8. In areas where active faults cannot be identified such as the CEUS, seismic source zones are developed to capture the seismicity of the region. Brush Creek Site 15 is in the vicinity of the Eastern Tennessee Seismic Zone, Central Virginia Seismic Zone, and the Giles

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County Seismic Zone. The Giles County Seismic Zone is within 100 km of the site and is believed to be the source of the 1897, 1898, 1899, and 1969 events. Following the May 3, 1897, foreshock, the May 31, 1897, event was one of the largest observed in the CEUS. The earthquake was felt from Georgia to Pennsylvania, and from the coast to Indiana. Chimneys fell and the flow in springs changed during the event (VDEM, 2018).

The USGS Quaternary Fault and Fold Database identifies the Giles County Seismic Zone as the Pembroke Faults; however, the Pembroke Faults are defined as Class B faults. Class B faults have geologic evidence that either demonstrates the existence of a fault or suggests Quaternary deformation, but either: (1) the fault might not extend deeply enough to be a potential source of significant earthquakes, or (2) the evidence is not strong enough to assign it to Class A. Class A faults are either exposed for mapping or can be inferred from liquefaction or other deformational features.

Bollinger and Wheeler (1998) first theorized that the seismicity in the Giles County Seismic Zone was potentially caused by the reactivation of faults that developed in the Late Proterozoic or early Paleozoic era. Faults were then discovered during excavations for landfill material in 1992, but it is unclear whether the faults are tectonic or the result of solution collapse. Regardless of the specific tectonic mechanism, the Giles County Seismic Zone contributes to the seismic hazard at Brush Creek Site 15 (Wheeler, 1998).

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II. SUBSURFACE GEOLOGY

Several distinct geologic material units were identified at the site during the geotechnical investigation program. Project-specific "stratum" names have been assigned to these materials based on visual descriptions and the results of field testing in order to characterize the materials in terms of their general geologic and engineering properties.

The geologic materials observed at the site include:

- Fill material placed during construction of the embankment dam (Section Nos. S1 through S3 and Stratum F)
- Alluvial material transported by the stream and deposited in and near the former stream channel (Stratum A)
- Residual soil formed from chemical weathering of in-place rock (Stratum R)
- Disintegrated Rock formed by the near-complete weathering of in-place rock, but still maintaining a relatively high density and relict structure of the parent rock (Stratum D)
- Bedrock (Stratum B).

The characteristics of the geologic materials encountered in the test borings are discussed in the following sections. Detailed descriptions of these materials and strata designations are also included on the test boring logs in Appendix A. The Standard Penetration Test results (N-values) listed below and on the test borings logs are the values recorded in the field.

The geologic material descriptions given below and elsewhere in this report are based on field classifications. The test boring logs included in this report are considered draft logs. The field classifications will be revised based on laboratory test results, and updated test boring logs will be submitted with the final geotechnical engineering report. Detailed laboratory test results are included in the *Final Soil and Rock Laboratory Testing Report* dated June 19, 2019.

Subsurface profiles and sections of the embankment and auxiliary spillway are included on Figures 9 through 11.

A. Embankment and Foundation

1. *Test Borings*

Borings B-51 and B-52 were drilled vertically from the embankment crest through the transition zone and shell (Section Nos. 2 and 3, respectively). The borings were drilled up to 77 ft through embankment fill and up to 8 ft through foundation soils before encountering bedrock. The borings were then advanced up to 57 ft into rock. In addition, one vertical auger probe, B-51A, was drilled approximately 5 ft to the right of Boring B-51 for the installation of an open standpipe piezometer. The total depth of these borings ranged from 76 ft (B-51A) to approximately 142 ft (B-51).

Borings B-651 and B-652 were drilled near the downstream toe of the embankment. The borings were drilled up to about 8 ft through fill material and up to about 9 ft through foundation soils before encountering bedrock. The two borings were then advanced 10 ft into rock. The total depths of these borings were 26 ft (B-651) and approximately 18 ft (B-652).

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Boring B-653 was drilled vertically through the embankment core and upstream shell (Section Nos. 1 and 2, respectively). This boring was drilled through 69 ft of embankment fill material and 7 ft of foundation soils before encountering bedrock. The boring was then advanced 10 ft into rock. The total depth of this boring was 86 ft.

2. *Generalized Subsurface Stratigraphy*

The following subsections provide a brief description of the subsurface soil and rock strata encountered in the embankment and foundation.

a) Embankment Fill (Sections S1 through S3)

These soils generally include variable amounts of clay, silt, sand, and gravel, and may contain rock fragments, root fragments, organics, and coal. These materials were divided into three sub-strata corresponding to their section number shown on the As-Built Drawings (1967). The materials encountered in each embankment section are described in more detail in the following paragraphs.

S1 Section No. 1, Core – Described as "clayey material (CL)" on the As-Built Drawings. This material was sampled primarily as fine grained soils (material with >50% passing No. 200 sieve) classifying as LEAN CLAY (CL) with varying amounts of sand and gravel. Samples were moist with varying shades of brown, and included rock, root, and coal fragments. Section No. 1 materials were encountered in Boring B-653 between approximately 22 and 69 ft bgs. These depths correspond to a top elevation of EL 2486 and a bottom elevation of EL 2439. SPT N-values ranged from 11 blows per foot to 28 blows per foot, with an average value of 19 blows per foot.

S2 Section No. 2, Transition and Upstream Shell – Described as "clayey sand and silty sand (SC, ML-CL)" on the As-Built Drawings. These materials were sampled as both fine grained and coarse grained (material with <50% passing No. 200 sieve) soils. Fine grained soils were sampled as LEAN CLAY (CL), Gravelly LEAN CLAY (CL), Sandy LEAN CLAY (CL), and FAT CLAY (CH), each with varying amounts of sand and gravel. The samples were moist with varying shades of brown and gray and included rock fragments. Coarse grained soils were predominantly sampled as Clayey GRAVEL (GC) and Clayey SAND (SC), each with varying amounts of fines, sand, and gravel. The samples were moist to wet with varying shades of brown and gray and included rock fragments. SPT N-values ranged from 9 blows per foot to 32 blows per foot, with an average value of 17 blows per foot. Thin layers of Well Graded SAND (SW) and Well Graded SAND with Clay (SW-SC) were observed in Boring B-51.

Section No. 2 materials were encountered in Borings B-51 and B-52 to depths of approximately 65 to 77 ft below the crest of the dam. These depths correspond to bottom elevations of EL 2443 and EL 2431, respectively. Based on our observations during drilling, the Section No. 2 and Section No. 3 materials are very similar. We estimate the top of Section No. 2 is just below the crest of the dam (EL 2508) in Boring B-51 and 4 ft below the crest of the dam (EL 2504) in Boring B-52. According to the As-Built Drawings, the top of Section No. 2 is about 8 ft below the crest of the dam (EL 2500).

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Section No. 2 materials were also encountered in Boring B-653 from the ground surface to approximately 22 ft bgs (EL 2478). The observed depth to the bottom of the Section No. 2 materials in Boring B-653 generally agrees with the anticipated depth to the bottom of the Section No. 2 materials based on the As-Built Drawings.

S3 Section No. 3, Downstream Shell – Described as "shale and siltstone" on the As-Built Drawings. These materials were sampled as both fine grained and coarse grained soils. Fine grained soils were sampled as LEAN CLAY (CL) with sand and containing gravel. Coarse grained soils were sampled as Poorly Graded GRAVEL with Silt and Sand (GP-GM). The samples were moist with varying shades of brown and gray and included rock fragments. SPT N-values ranged from 9 blows per foot to 17 blows per foot, with an average value of 13 blows per foot. Section No. 3 materials were encountered in Boring B-52 to a depth of approximately 4 ft below the crest of the dam (EL 2504). Materials matching the Section No. 3 description on the As-Built Drawings were not observed in Boring B-51.

b) General Fill (Stratum F)

This stratum includes fill material observed downstream of the embankment in Borings B-651 and B-652. These materials were sampled as both fine grained and coarse grained soils. Fine grained soils were sampled as Sandy SILT (ML) containing gravel. Coarse grained soils were sampled as Clayey SAND (SC) and Silty SAND (SM) with varying amounts of fines and gravel. The samples were moist with varying shades of brown and gray and included rock fragments. These materials were encountered from the ground surface to depths ranging from approximately 6 to 8 ft bgs. SPT N-values ranged from 3 to 33 blows per foot, with an average value of 10 blows per foot.

c) Alluvium (Stratum A)

Alluvial soils were encountered below the embankment fill soils in Borings B-51 and B-653 at a depth of approximately 77 ft below the crest of the dam, with thicknesses ranging from approximately 4 to 6 ft. Alluvium was also observed below the general fill soils in Boring B-651 approximately 8 ft bgs, with a thickness of approximately 3 ft. These materials were sampled as both fine grained and coarse grained soils. Fine grained soils were sampled as Sandy LEAN CLAY (CL). Coarse grained soils were sampled as Clayey SAND (SC), Poorly Graded SAND (SP), and Poorly Graded SAND with Silt (SP-SM), with varying amounts of fines. The samples were wet with varying shades of gray and included rock fragments and organics. SPT N-values ranged from 6 to 21 blows per foot, with an average value of 14 blows per foot.

d) Residuum (Stratum R)

Residual soils were encountered in all embankment borings, with the exception of Boring B-51A, beneath the fill and/or alluvial soils. The residual soils were encountered between approximately 65 to 83 ft below the crest of the dam (EL 2425 to EL 2443), with thicknesses ranging from approximately 2 to 6 ft. These materials were sampled as both fine grained and coarse grained soils. Fine grained soils were sampled as LEAN CLAY (CL), Sandy LEAN CLAY (CL), and FAT CLAY (CH), with varying amounts of sand and gravel. Coarse grained soils were sampled as Clayey GRAVEL (GC). The samples were typically moist with varying shades of brown and gray and included rock fragments. SPT N-values ranged from 8 to 100 blows per foot, with an average value of 39 blows per foot.

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e) Disintegrated Rock (Stratum D)

The boundary between soil and rock is typically not sharply defined. A transitional zone of disintegrated rock material is normally found overlying bedrock and is a product of in-place chemical weathering of the parent material. The material in this zone typically retains the texture and structure of the parent rock. Disintegrated Rock is defined as residual material with a SPT N-value between 60 blows per foot and SPT refusal. The contact between the disintegrated rock and rock can be quite irregular and erratic, even over short horizontal distances. Lenses and boulders of hard rock and zones of disintegrated rock are commonly present within the residual soil above the general bedrock level. Disintegrated rock or soil seams may be present beneath relatively unweathered bedrock, which is commonly developed by weathering along bedrock fractures.

Disintegrated rock was observed in all embankment borings, with the exception of Boring B-51A, beneath the residual soils, with thicknesses ranging from less than 1 ft to almost 3 ft.

f) Bedrock (Stratum B)

SPT refusal (50 blows for 6 inches or less penetration) was used to define top of rock. Shale was the primary rock type encountered below the embankment fill and foundation soils in all borings. Claystone was also observed in Boring B-652 at a depth of approximately 10 ft (EL 2429) and was approximately 4-ft thick. The shale and claystone are believed to be part of the Bluestone Group.

Shale was sampled as gray to dark gray, fresh to severely weathered, strong to very weak, and slightly to intensely fractured. Rock core recoveries (REC) ranged from 38 to 100 percent. Rock Quality Designation (RQD) ranged from 0 to 93 percent and generally increased with depth, although zones of relatively low RQD were observed between zones of relatively high RQD. The bedding was generally very thin and dipping approximately 0 to 10 degrees. Two primary discontinuity sets were identified: one near-horizontal bedding joint set and one near-vertical joint set. Additional joints dipping between approximately 20 and 60 degrees were also identified. Severely to highly weathered zones were observed near bedding joints. The shale was also highly susceptible to slaking along bedding planes.

Claystone was sampled as gray, fresh to slightly weathered, weak to very weak, and moderately to intensely fractured. REC ranged from 73 to 100 percent, and RQD ranged from 42 to 50 percent.

3. *Hydrogeologic Conditions*

a) Water Level Observations

Several water level readings were recorded in the open boreholes during the field investigation. Recorded water levels are presented in Table 2, and select water level measurements are shown on the test boring logs in Appendix A. The water level readings were generally within the expected range. However, the water levels observed in the B-51A piezometer were deeper than expected, but this may be the result of the slow recharge rate from the low-permeability embankment fill material adjacent to the well screen. We will continue to monitor the water levels in the piezometers following the investigation to obtain longer-term water level readings to support analyses and design.

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Reported water levels should not be considered globally representative. It is anticipated that the observed water levels could have been affected by drilling procedures, and would be expected to fluctuate due to variations in precipitation, surface runoff, reservoir levels, and other factors.

b) Artesian Conditions

Artesian conditions were observed in Boring B-651 after piezometer installation, but were not encountered during soil drilling and rock coring. Water was encountered at 11.4 ft bgs during SPT sampling, and the water level was measured at 0.2 ft bgs the morning after rock coring was completed. Artesian flow from B-651 was not observed during packer testing in B-652. An Aterra-Schnabel JV representative returned to the site about two weeks after piezometer installation and recorded a water level in the piezometer of approximately 1 ft above ground surface (ags). Subsequent artesian head measurements ranged from 1.5 to 2.4 ft ags.

During their 2016 subsurface investigation, Gannett Fleming (2017a) observed artesian flow in the downstream toe boring (GF-3) during packer testing and recorded water levels of 2.6 to 3.6 ft ags. Long-term piezometer measurements ranged from 0.3 ft ags to 0.3 ft bgs.

c) Hydraulic Conductivity Testing Using Piezometers (Slug Tests)

One slug test was performed in the Boring B-51A piezometer where the screened interval was installed in Section No. 2 between 70 and 75 ft bgs. The samples obtained from the depth of the well screen interval were visually classified as CLAY with gravel (CH). The estimated hydraulic conductivity from the falling head test method was 4.1×10^{-6} cm/s (1.3×10^{-7} ft/s). Details of the slug test method are presented in Appendix C.

After the first two hours of the falling head test, however, the water level in the piezometer was rising instead of falling, potentially due to recovery of the piezometer after well development. The calculated hydraulic conductivity based on the well recovery was 2.2×10^{-5} cm/s (7.2×10^{-7} ft/s).

d) Hydraulic Conductivity Testing in Rock

Falling head and packer tests were performed in rock in Borings B-51, B-651, and B-652. Both methods are presented in the following subsections. Additional details and test results are presented in Appendix D, and a summary of the results is listed in Table 3.

(1) Packer Testing

H&A performed packer testing in rock in Borings B-51, B-651, and B-652. Testing was performed at depths ranging from 9.7 to 141.8 ft bgs using either single or double packer assemblies.

The minimum recorded transmissivity value was 0 Lugeons, which was recorded in Boring B-51 in three out of five test stages, indicating that the tested stages did not accept any water under the applied pressures. The maximum recorded transmissivity value of 324 Lugeons was observed in Boring B-652 from 9.7 to 17.7 ft bgs. The packer tests in Borings B-651 and B-652 consisted of only one pressure step due to near-surface water levels and potential artesian conditions in B-651.

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(2) Falling Head Testing

Due to concerns of hydrofracturing the embankment/foundation interface, falling head testing was performed immediately beneath the embankment in Boring B-51 in lieu of packer testing. This test was completed between 87 and 97.7 ft bgs.

The hydraulic conductivity interpreted from the falling head test was 1.6E-7 ft/sec (4.8E-6 cm/sec). The displacement-time curve, however, exhibited multiple inflection points. Early observations are possibly the result of filling the void space in the test stage and are not considered representative of the rock mass. Accordingly, these points were removed from the hydraulic conductivity evaluation.

B. Centerline of Outlet Structure

1. *Auger Probe*

One auger probe (AP-351) was performed near the left upstream edge of the existing principal spillway outlet structure to evaluate the depth to top of rock. The auger probe was drilled through fill material and foundation soils before encountering auger refusal at approximately 11 ft bgs.

2. *Generalized Subsurface Stratigraphy*

The following subsections provide a brief description of the subsurface soils encountered near the outlet structure. Soil descriptions and strata breaks are based on auger cuttings observed during drilling.

a) General Fill (Stratum F)

General Fill was encountered in Auger Probe AP-351. These materials were classified as moist Clayey SAND (SC), with varying shades of brown. The fill materials were encountered from the ground surface to approximately 7 ft bgs.

b) Residuum (Stratum R)

Residuum was encountered in Auger Probe AP-351 beneath the General Fill. These soils were classified as moist, orangish brown Clayey SAND (SC). The residual soils were approximately 1-ft thick.

c) Disintegrated Rock (Stratum D)

Disintegrated rock was encountered in Auger Probe AP-351 beneath the residual soils with a thickness of approximately 3 ft.

3. *Hydrogeologic Conditions*

Table 2 includes several water level readings recorded in Auger Probe AP-351 during the field investigation. Water level readings are also shown on the test boring logs in Appendix A.

Hydraulic conductivity testing in Auger Probe AP-351 was excluded from this program.

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C. Auxiliary Spillway

1. *Test Borings*

Five borings (B-251, B-252, B-254, B-255, and B-257) were drilled in the auxiliary spillway, and two borings (B-253 and B-256) were drilled through the right auxiliary spillway training dike.

The auxiliary spillway borings were drilled up to about 3 ft through fill material and then between 3 ft and 19 ft through natural soils before encountering bedrock. The borings were then advanced up to approximately 45 ft into rock. The total depth of these borings ranged from about 14 ft (B-254) to 50 ft (B-257).

The auxiliary spillway training dike borings (B-253 and B-256) were drilled up to approximately 5 ft through fill material and then up to approximately 29 ft through natural soils before encountering bedrock. The borings were then advanced 5 ft into rock. The total depth of the auxiliary spillway training dike borings was approximately 39 ft (B-253) and 25 ft (B-256).

2. *Generalized Subsurface Stratigraphy*

The following subsections provide a brief description of the subsurface soil and rock strata encountered in the auxiliary spillway and in the auxiliary spillway training dike.

a) General Fill (Stratum F)

General Fill was observed in the auxiliary spillway in Borings B-252, B-254, B-255, and B-257. These materials were sampled as fine grained soils with classifications of LEAN CLAY (CL), Gravelly LEAN CLAY (CL), and SILT (ML), each with varying amounts of sand and gravel. The samples were moist with varying shades of brown and gray and included rock fragments. These materials were encountered from the ground surface to depths ranging from approximately 1 to 5 ft bgs. SPT N-values ranged from 8 to 17 blows per foot, with an average value of 11 blows per foot.

According to the As-Built Drawings, the auxiliary spillway was excavated from the previous hillslope, and there is no indication that fill was placed in the auxiliary spillway.

General Fill was also observed in the auxiliary spillway training dike borings. These materials were sampled as fine grained soils with classifications of LEAN CLAY (CL) and Sandy SILT (ML), with varying amounts of sand and gravel. The samples were moist, primarily brown, and included rock fragments. These materials were encountered from the ground surface to depths ranging from less than 1 ft to approximately 3 ft bgs. SPT N-values ranged from 6 to 12 blows per foot, with an average value of 9 blows per foot.

b) Residuum (Stratum R)

Residual soils were encountered in all auxiliary spillway borings, either beneath the fill soils or near the ground surface. The thickness of residual soils ranged from approximately 3 to 19 ft. These materials were sampled as coarse grained soils with classifications of Clayey SAND (SC); Clayey GRAVEL (GC); Well Graded GRAVEL with Clay (GW-GC); and Well Graded GRAVEL with Clay (GW-GC) with varying amounts of fines, sand, and gravel. The samples were typically moist with varying shades of brown and

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gray and included rock fragments. SPT N-values ranged from 9 to 72 blows per foot, with an average value of 31 blows per foot.

Residual soils were also encountered in the auxiliary spillway training dike borings beneath the fill soils. The thickness of residual soils ranged from approximately 16 to 29 ft. These materials were sampled as both fine grained and coarse grained soils. Fine grained soils were sampled as Sandy FAT CLAY (CH), SILT (ML), and Sandy SILT (ML) with varying amounts of sand and gravel. Coarse grained soils were sampled as Silty SAND (SM), Clayey GRAVEL (GC), Silty GRAVEL (GM), and Poorly Graded GRAVEL with Silt (GP-GM), each with varying amounts of fines, sand, and gravel. Both fine and coarse grained samples were typically moist with varying shades of brown and gray, and included rock fragments. SPT N-values ranged from 11 to 48 blows per foot, with an average value of 23 blows per foot.

c) Disintegrated Rock (Stratum D)

Disintegrated rock was observed in Borings B-253, B-254, B-256, and B-257, beneath the residual soils with thicknesses up to approximately 1 ft.

d) Bedrock (Stratum B)

Shale was the only rock type observed in the auxiliary spillway and beneath the training dike. It was sampled as dark gray, fresh to severely weathered, very strong to very weak, and slightly to intensely fractured. REC ranged from 50 to 100 percent. RQD ranged from 25 to 100 percent. RQD, bedding, and discontinuity sets had similar trends to those observed in the embankment borings. Calcareous shale was observed in Boring B-257 at approximately 35.8 ft.

3. *Hydrogeologic Conditions*

Table 2 includes several water level readings recorded in the auxiliary spillway borings during the field investigation. Water level readings are also shown on the test boring logs in Appendix A.

Hydraulic conductivity testing was not performed in the auxiliary spillway borings.

D. Borrow Area

A potential borrow area investigation was excluded from this program. The need for and scope of a borrow area investigation program will be evaluated during the preliminary design phase.

E. Toe Drain

Investigation of the existing toe drain was excluded from this program.

F. Water Supply

The reservoir was at or near its normal pool of EL 2489.5 at the time of the investigation. An evaluation of reservoir water quality was excluded from this program.

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III. LOGS

Boring logs from the geotechnical investigation are included in Appendix A.

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IV. LIMITATIONS

The data provided in this report are based on the information obtained from the subsurface exploration and does not include the results of laboratory testing. However, conditions on the site may vary between the discrete locations observed at the time of our subsurface exploration. The nature and extent of variations may not become evident until during construction.

We have endeavored to complete the services identified herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions as this project. No other representation, express or implied, is included or intended, and no warranty or guarantee is included or intended in this report or any other instrument of service.

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B. General

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FIGURES

Figure 1: Site Location Map
Figure 2: Site Vicinity Map
Figure 3: Boring Location Plan
Figure 4: Geologic Map
Figure 5: Structural Geology Map
Figure 6: Soils Map
Figure 7: Earthquakes Within 100 km
Figure 8: Local Seismic Sources
Figure 9: Geologic Profiles and Sections – Sheet 1 of 3
Figure 10: Geologic Profiles and Sections – Sheet 2 of 3
Figure 11: Geologic Profiles and Sections – Sheet 3 of 3

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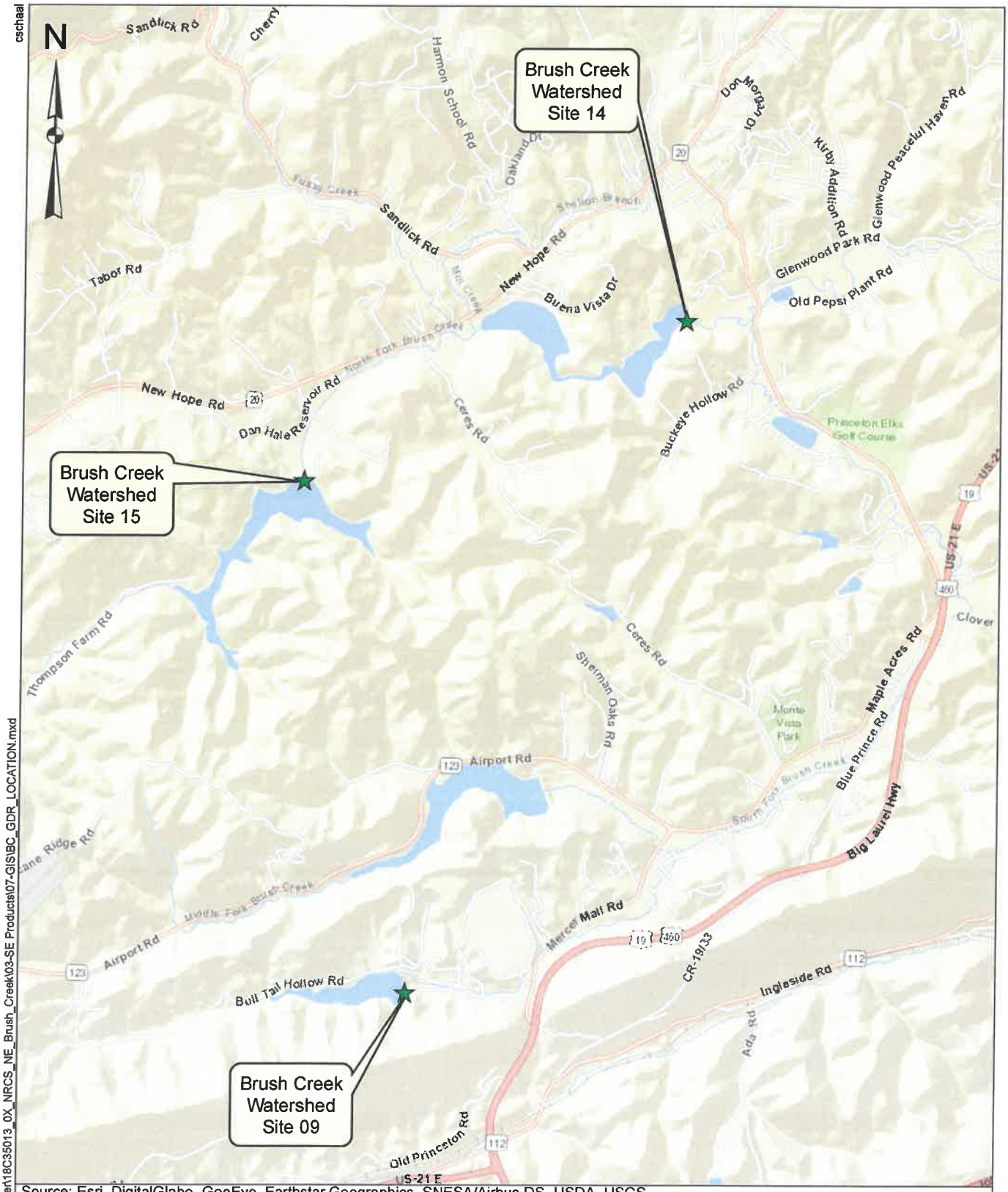

Source: Esri, DigitalGlabe, GeoEye, Earthstar Geographics, SNESA/Airbus DS, USDA, USGS, AeroGRID, IGN, HERE, Garmin, Intermap, INCREMENT P, METI, Open StreetMap Contriutors, and GIS USer Community.
Projection: NAD 1983 StatePlane Virginia North FIPS 4501 Feet

3,000 1,500 0 3,000 Feet

Scale: 1:36,000

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BRUSH CREEK SITE 15
NRCS - WEST VIRGINIA
MERCER COUNTY, WEST VIRGINIA
PROJECT NO. 18C35013.04

SITE LOCATION MAP

FIGURE 1

4/23/2019 G:\2018\West Chester\18C35013_0X_NRCS_NE_Brush_Creek\03-SE Products\07-GIS\BC_GDR_LOCATION.mxd cschaal

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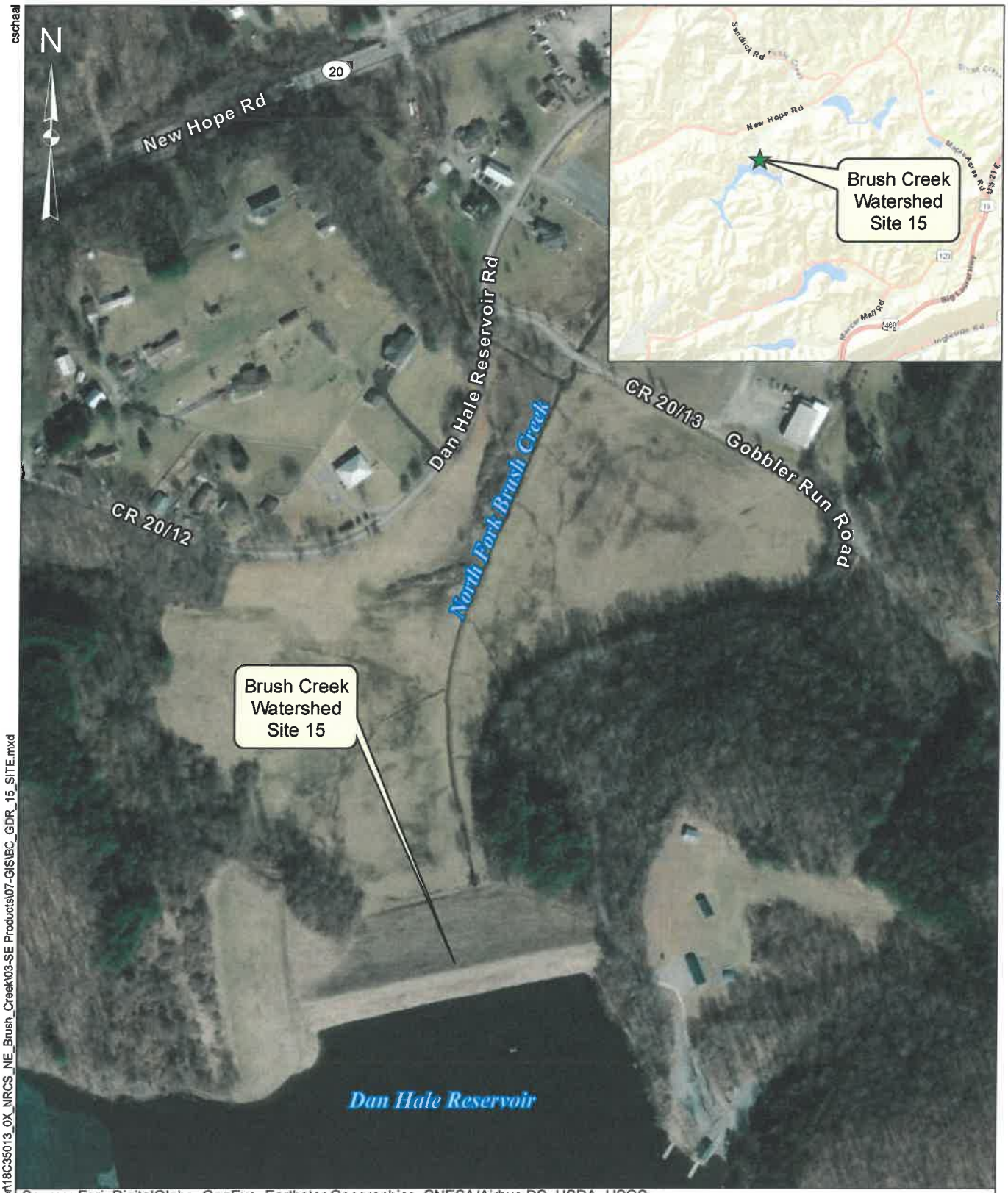

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Projection: NAD 1983 StatePlane Virginia North FIPS 4501 Feet

300 150 0 300 Feet

Scale: 1:3,600

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BRUSH CREEK SITE 15
NRCS - WEST VIRGINIA
MERCER COUNTY, WEST VIRGINIA
PROJECT NO. 18C35013.04

SITE VICINITY MAP

FIGURE 2

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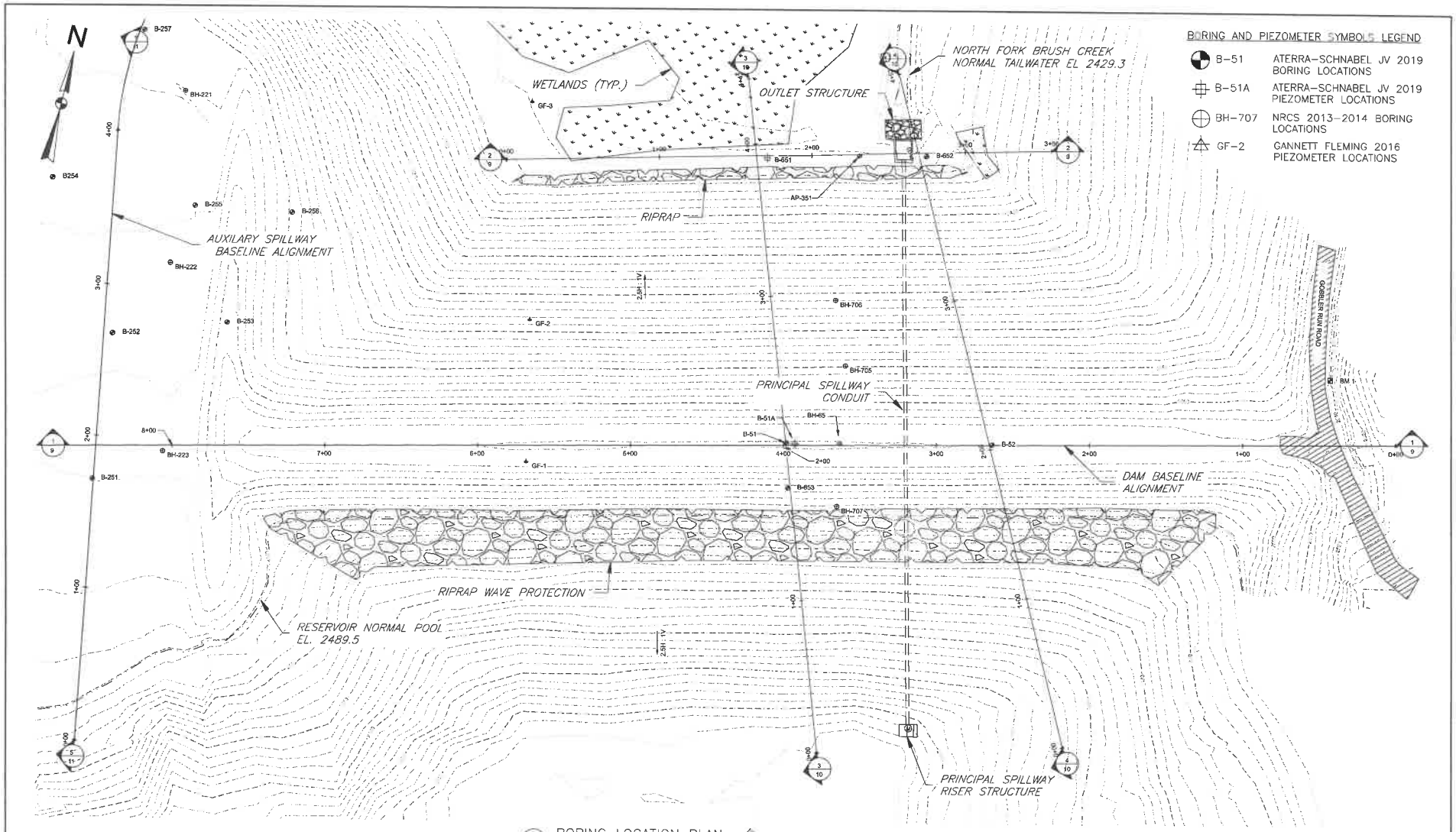

1 BORING LOCATION PLAN

NOTES:

1. BORING LOCATIONS OBTAINED BY SCHNABEL DRONE FLIGHT ON APRIL 22, 2019.
2. TOPOGRAPHIC AND BATHYMETRIC DATA WAS PROVIDED BY NRCS ON MAY 15, 2019. TOPOGRAPHIC DATA AND EXISTING SITE FEATURES ARE BASED ON THE GANNETT FLEMING SURVEY PERFORMED IN MARCH 2016. BATHYMETRIC DATA IS BASED ON THE GANNETT FLEMING SURVEY PERFORMED IN MAY 2016.
3. THE REFERENCED COORDINATE SYSTEM IS THE NAVD88 VERTICAL DATUM AND NAD83 (2011) HORIZONTAL DATUM, WEST VIRGINIA STATE PLANE SOUTH COORDINATE SYSTEM.
4. DAM BASELINE ALIGNMENT BASED ON CENTERLINE ALIGNMENT SHOWN ON 1957 AS-BUILT DRAWINGS.

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BRUSH CREEK SITE 15
NRCS – WEST VIRGINIA
MERCER COUNTY, WEST VIRGINIA
PROJECT NO. 18C35013.04

BORING LOCATION PLAN
FIGURE 3

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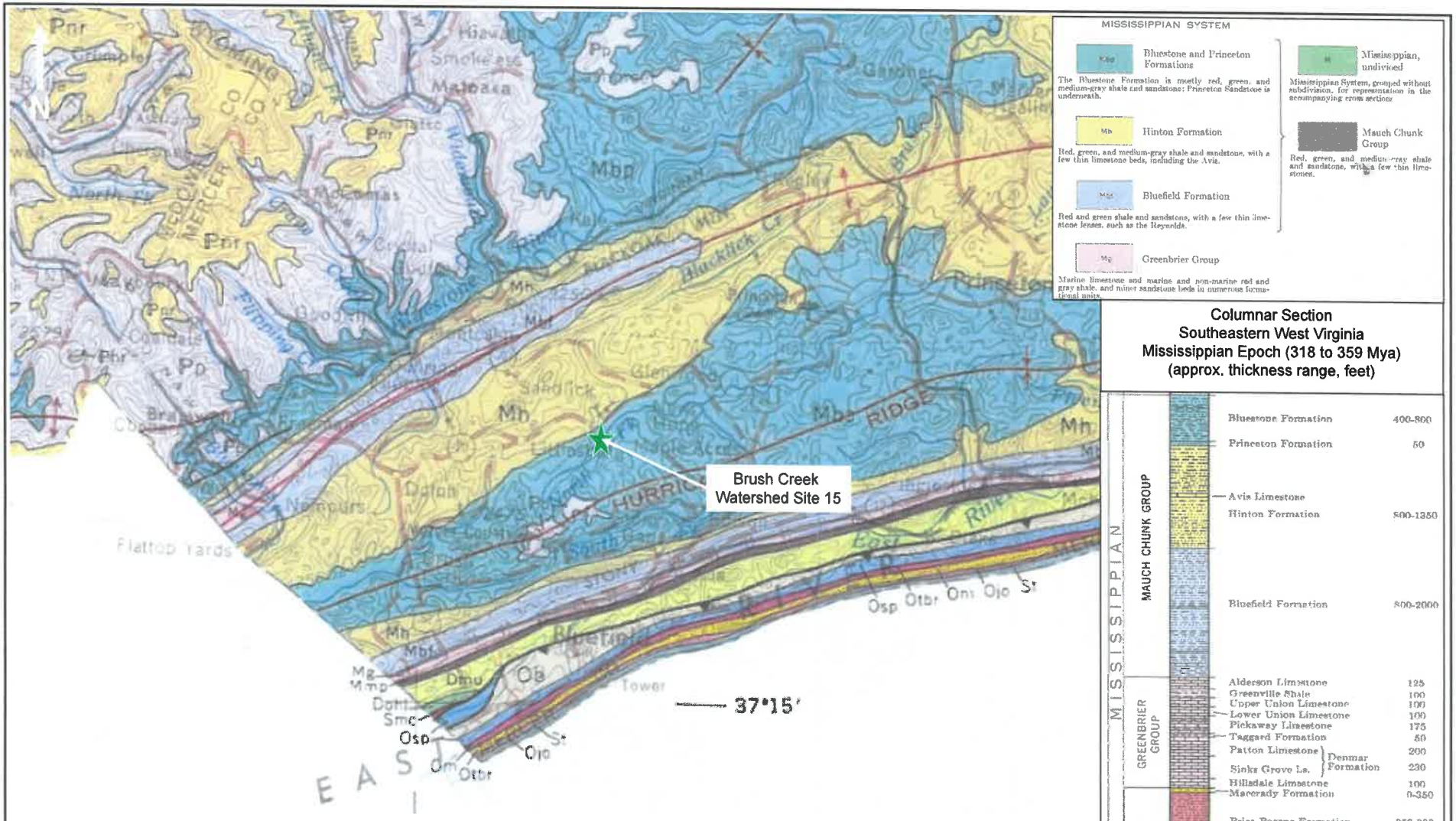

Source: Cardwell., D.H., Erwin, R.B., and H.P. Woodward. (1968). Geologic Map of West Virginia. West Virginia Geological and Economic Survey, Map 1, scale 1:250,000.

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BRUSH CREEK SITE 15
NRCS – WEST VIRGINIA
MERCER COUNTY, WEST VIRGINIA
PROJECT NO. 18C35013.04

GEOLOGIC MAP

FIGURE 4

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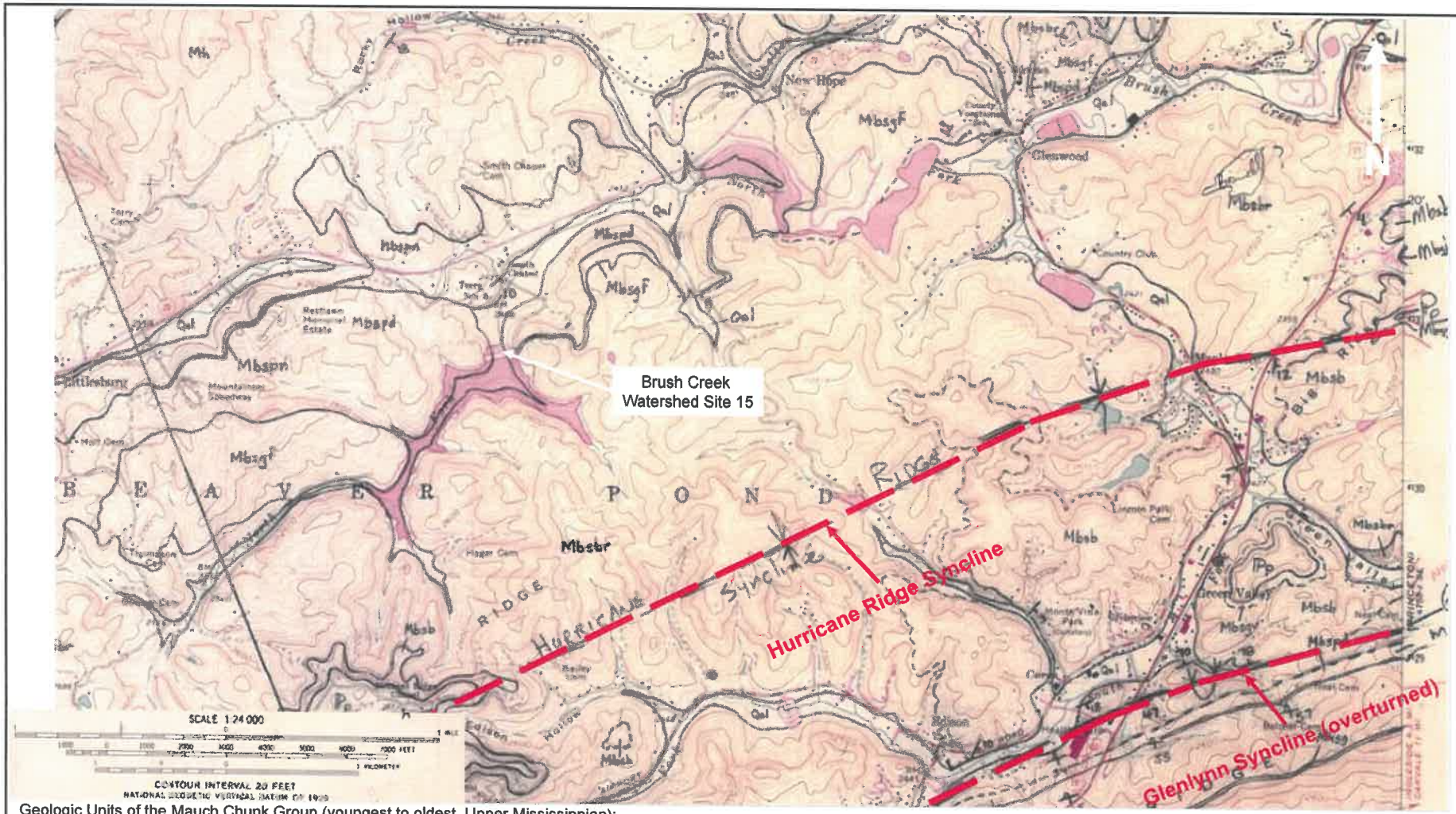

Geologic Units of the Mauch Chunk Group (youngest to oldest, Upper Mississippian):
Mbsb = Bluestone Formation (Member ID not identified in source)
Mbsbr = Bluestone Formation (Member ID not identified in source)
Mbsgf = Bluestone Formation (Member ID not identified in source)
Mbspd = Bluestone Formation, Pride Shale Member
Mbspn = Bluestone Formation (Member ID no identified in source)
Mh = Hinton Formation
Mhsg = Hinton Formation, Stony Gap Sandstone Member

Source: Beuthin, J.D., Blake Jr., B.M., and Rader, E. (2000). Bedrock Geologic Map of the Bluefield 7.5' Quadrangle, West Virginia – Virginia. West Virginia Geological and Economic Survey Open File Publication OF-0003, scale 1:24,000.

Schnabel ENGINEERING	BRUSH CREEK SITE 15 NRCS - WV MERCER COUNTY, WEST VIRGINIA PROJECT NO. 16C35013.04	STRUCTURAL GEOLOGY MAP FIGURE 5

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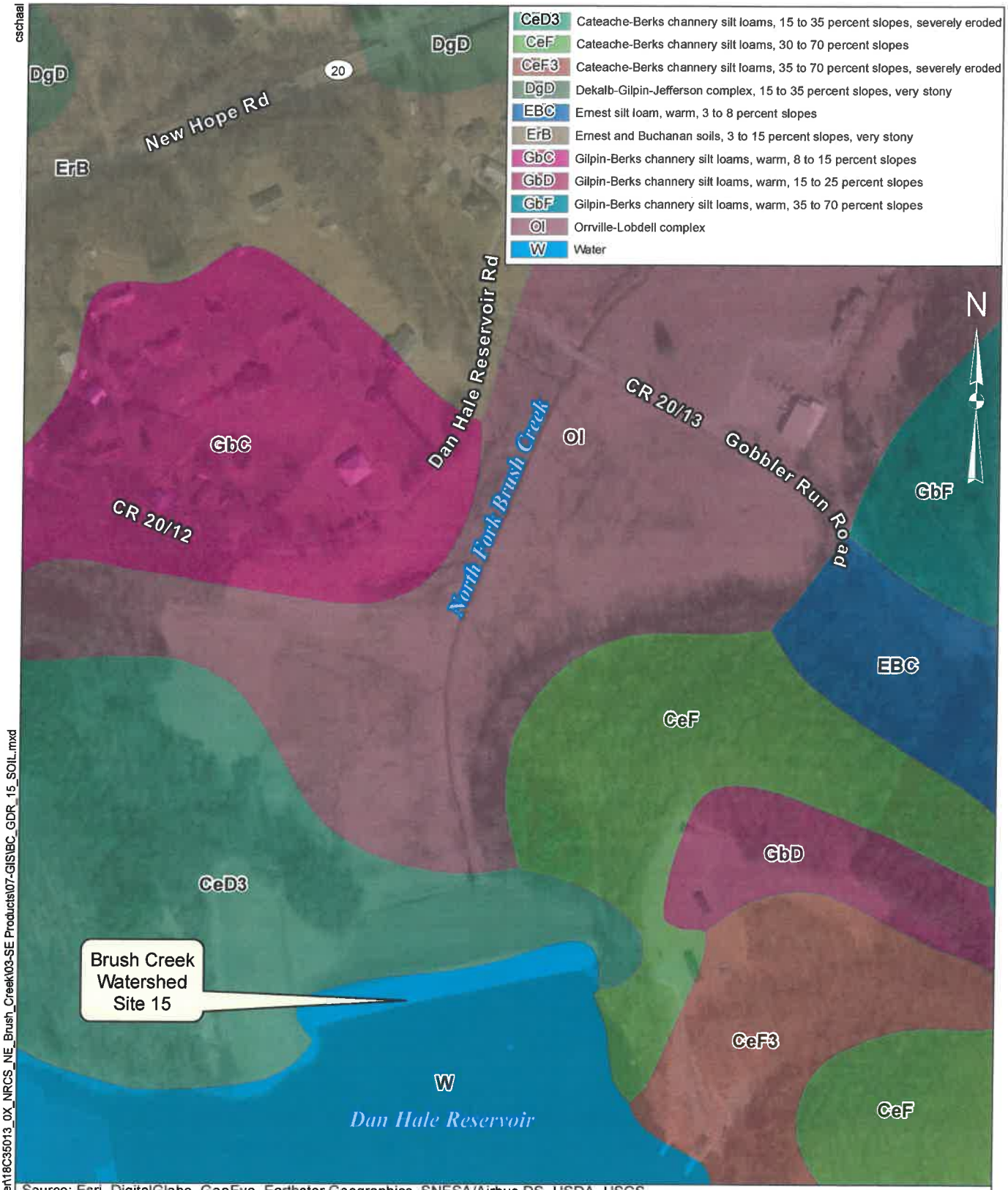

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Projection: NAD 1983 StatePlane Virginia North FIPS 4501 Feet

300 150 0 300 Feet

Scale: 1:3,600

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BRUSH CREEK SITE 15
NRCS - WEST VIRGINIA
MERCER COUNTY, WEST VIRGINIA
PROJECT NO. 18C35013.04

SOILS MAP

FIGURE 6

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cschaal
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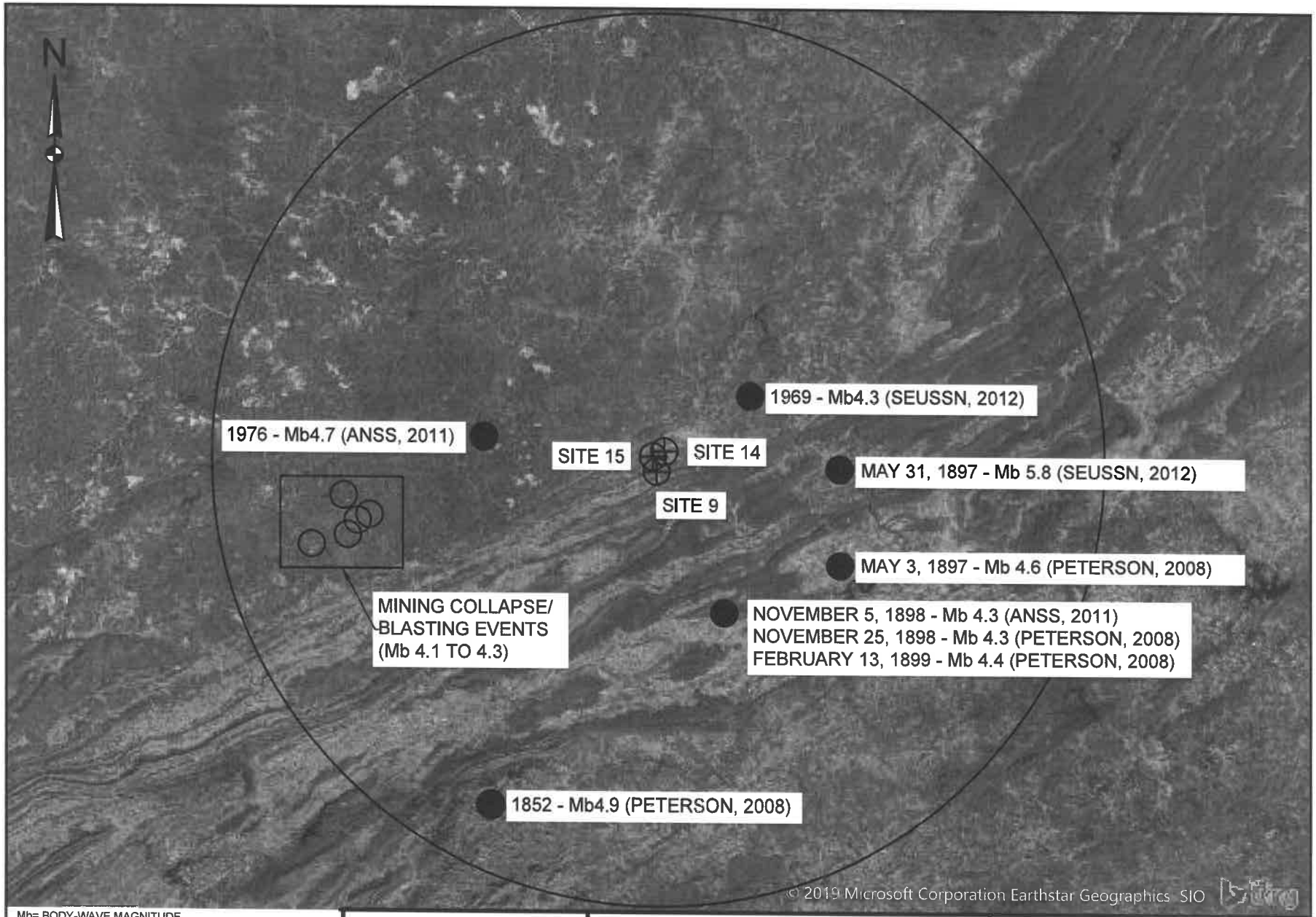

Mb= BODY-WAVE MAGNITUDE

EVENTS ARE SELECTED FROM THE COMPILED CEUS SSC EARTHQUAKE CATALOG (EPRI, 2012). SPECIFIC EVENTS ARE REFERENCED BY THEIR ORIGINAL SOURCE AND DETAILED CITATION INFORMATION CAN BE FOUND IN THE REFERENCES SECTION OF THIS REPORT.

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BRUSH CREEK SITES 9, 14, AND 15
MERCER COUNTY, WEST VIRGINIA
PROJECT NO. 18C15013

EARTHQUAKES WITHIN 100 KM

FIGURE 7

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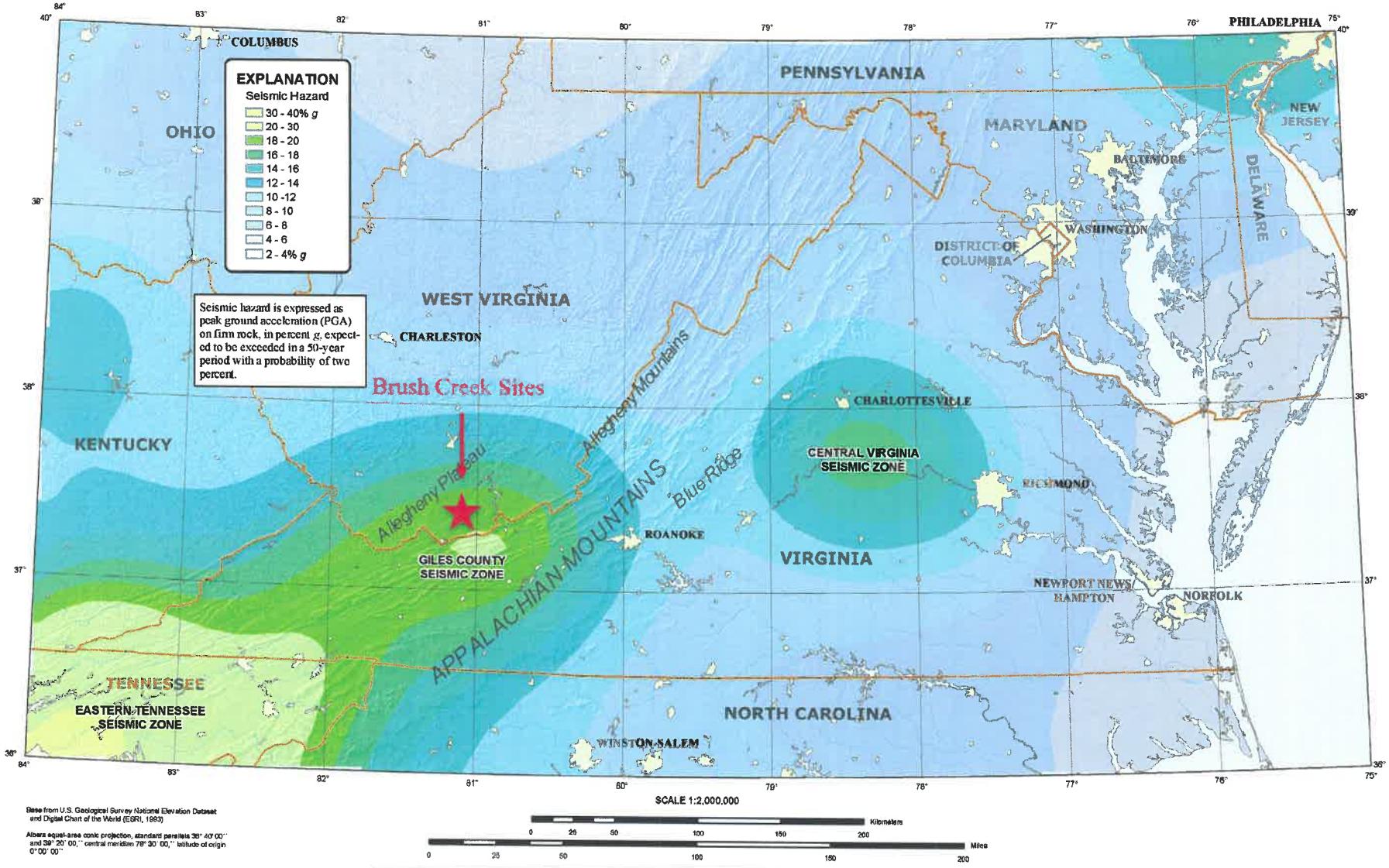
Generalized Seismic Hazard



Base from U.S. Geological Survey National Elevation Dataset and Digital Chart of the World (ESRI, 1993)

Albers equal-area conic projection, standard parallels 36° 40' 00" and 39° 20' 00," central meridian 78° 30' 00," latitude of origin 0° 00' 00"

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BRUSH CREEK SITES 9, 14, AND 15
MERCER COUNTY, WEST VIRGINIA
PROJECT NO. 18C35013

LOCAL SEISMIC SOURCES

FIGURE 8

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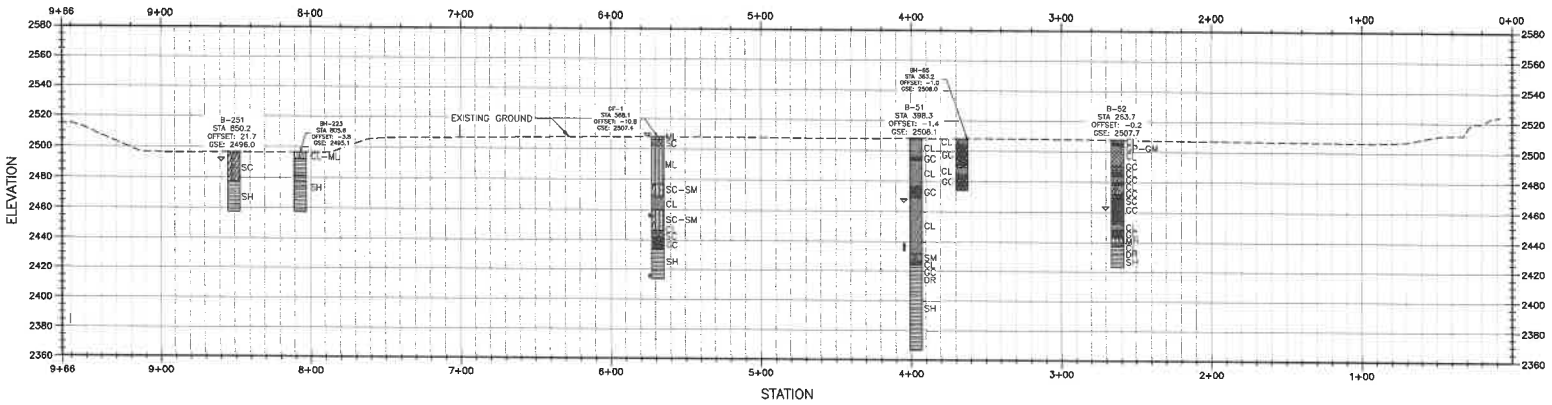
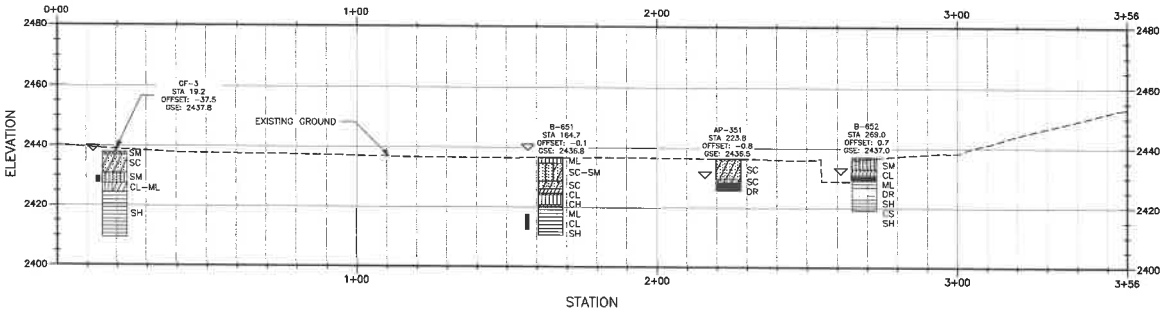
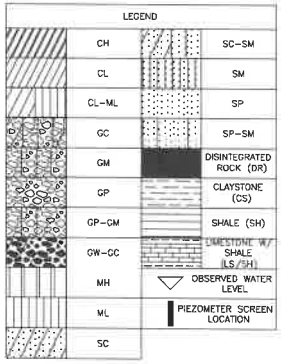


1 PROFILE ALONG DAM BASELINE ALIGNMENT



2 PROFILE ALONG DOWNSTREAM EMBANKMENT TOE



NOTES:

1. BORING LOCATIONS OBTAINED BY SCHNABEL DRONE FLIGHT ON APRIL 22, 2019. BORING GROUND SURFACE ELEVATIONS DERIVED FROM GANNETT FLEMING SURVEY DATED MARCH 2016.
2. STRATIGRAPHY AND WATER LEVELS OBSERVED IN THE BORINGS MAY NOT BE REPRESENTATIVE OF SUBSURFACE CONDITIONS BETWEEN BORINGS. GROUNDWATER LEVELS SHOWN ARE THE LAST READING BEFORE GROUTING OR WERE MEASURED IN PIEZOMETERS, IF INSTALLED.
3. BORING DATA OBTAINED BY OTHERS IS BASED ON DATA PRESENTED IN THE SUPPLEMENTAL WATERSHED PLAN – ENVIRONMENTAL ASSESSMENT FOR THE REHABILITATION OF BRUSH CREEK SITE 15 WATERSHED DAM DATED FEBRUARY 2017.

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BRUSH CREEK SITE 15
NRCS – WEST VIRGINIA
MERCER COUNTY, WEST VIRGINIA
PROJECT NO. 18C35013.04

GEOLOGIC PROFILES AND SECTIONS
SHEET 1 OF 3
FIGURE 9

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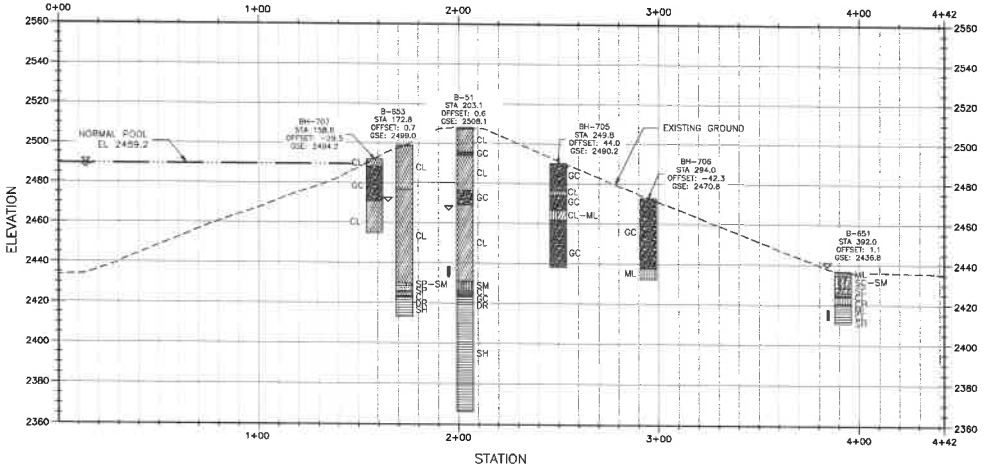
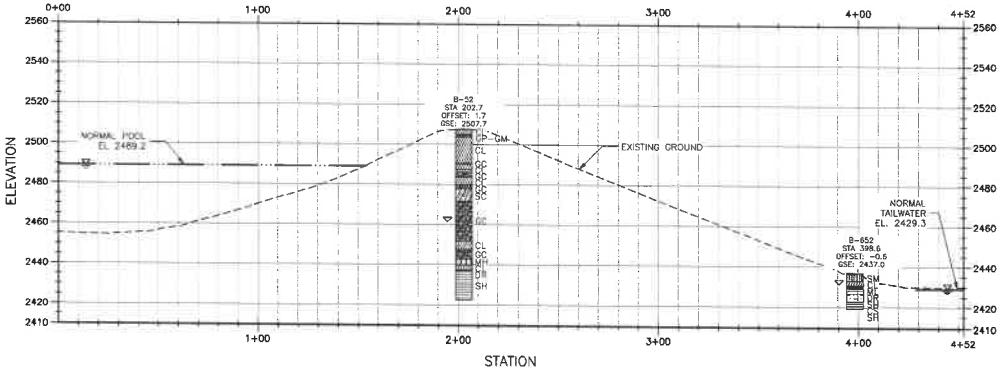


FLOW 3 EMBANKMENT SECTION AT STATION 4+00



FLOW 4 EMBANKMENT SECTION AT STATION 2+65

LEGEND

CH	SC-SM
CL	SM
CL-ML	SP
GC	SP-SM
GM	DISINTEGRATED ROCK (DR)
GP	CLAYSTONE (CS)
GP-GM	SHALE (SH)
GW-GC	LIMESTONE W/ SHALE (LS/SH)
MH	OBSERVED WATER LEVEL
ML	PIEZOMETER SCREEN LOCATION
SC	

NOTES:

1. BORING LOCATIONS OBTAINED BY SCHNABEL DRONE FLIGHT ON APRIL 22, 2019. BORING GROUND SURFACE ELEVATIONS DERIVED FROM GANNETT FLEMING SURVEY DATED MARCH 2018.
2. STRATIGRAPHY AND WATER LEVELS OBSERVED IN THE BORINGS MAY NOT BE REPRESENTATIVE OF SUBSURFACE CONDITIONS BETWEEN BORINGS. GROUNDWATER LEVELS SHOWN ARE THE LAST READING BEFORE GROUTING OR WERE MEASURED IN PIEZOMETERS, IF INSTALLED.
3. BORING DATA OBTAINED BY OTHERS IS BASED ON DATA PRESENTED IN THE SUPPLEMENTAL WATERSHED PLAN – ENVIRONMENTAL ASSESSMENT FOR THE REHABILITATION OF BRUSH CREEK SITE 15 WATERSHED DAM DATED FEBRUARY 2017.

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BRUSH CREEK SITE 15
NRCS – WEST VIRGINIA
MERCER COUNTY, WEST VIRGINIA
PROJECT NO. 18C35013.04

GEOLOGIC PROFILES AND SECTIONS
SHEET 2 OF 3
FIGURE 10

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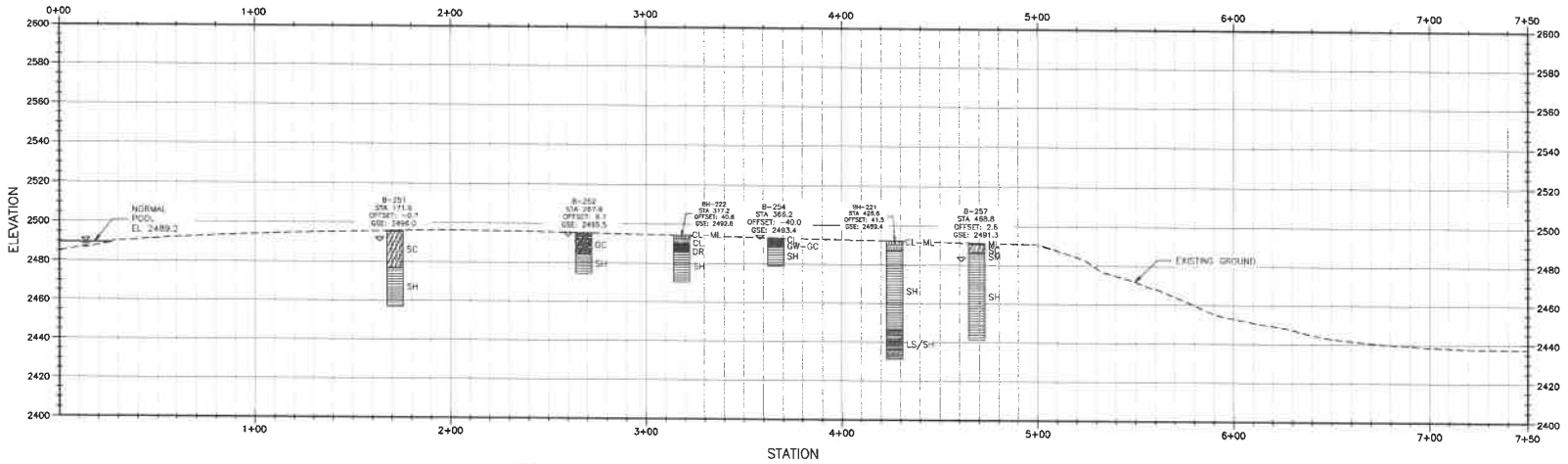

5 PROFILE ALONG AUXILIARY SPILLWAY BASELINE ALIGNMENT

0 30' 60'

LEGEND

CH	SC-SM
CL	SM
CL-ML	SP
GC	SP-SM
GM	DISINTEGRATED ROCK (DR)
GP	CLAYSTONE (CS)
GP-GM	SHALE (SH)
GW-GC	LIMESTONE W/ SHALE (LS/SH)
MH	OBSERVED WATER LEVEL
ML	PIEZOMETER SCREEN LOCATION
SC	

NOTES:

1. BORING LOCATIONS OBTAINED BY SCHNABEL DRONE FLIGHT ON APRIL 22, 2019. BORING GROUND SURFACE ELEVATIONS DERIVED FROM GANNETT FLEMING SURVEY DATED MARCH 2016.
2. STRATIGRAPHY AND WATER LEVELS OBSERVED IN THE BORINGS MAY NOT BE REPRESENTATIVE OF SUBSURFACE CONDITIONS BETWEEN BORINGS. GROUNDWATER LEVELS SHOWN ARE THE LAST READING BEFORE GROUTING OR WERE MEASURED IN PIEZOMETERS, IF INSTALLED.
3. BORING DATA OBTAINED BY OTHERS IS BASED ON DATA PRESENTED IN THE SUPPLEMENTAL WATERSHED PLAN – ENVIRONMENTAL ASSESSMENT FOR THE REHABILITATION OF BRUSH CREEK SITE 15 WATERSHED DAM DATED FEBRUARY 2017.

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BRUSH CREEK SITE 15
NRCS – WEST VIRGINIA
MERCER COUNTY, WEST VIRGINIA
PROJECT NO. 18C35013.04

GEOLOGIC PROFILES AND SECTIONS
SHEET 3 OF 3
FIGURE 11

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TABLES

Table 1: Summary of Boring Locations, Depths, and Termination Information
Table 2: Summary of Water Levels in Observations (2 sheets)
Table 3: Summary of Hydraulic Conductivity Testing in Rock

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Table 1
Summary of Boring Locations, Depths, and Termination Information

Boring ID	Northing (ft)	Easting (ft)	General Location	Ground Surface Elevation (ft)	Total Depth (ft)	Bottom Elevation (ft)	Depth to Rock (ft)	Elevation of Top of Rock (ft)	Reason For Termination
AP-351	118464.1	1914777.3	Principal Spillway Outlet	2436.5	10.8	2425.7	10.8	2425.7	Boring terminated at auger refusal.
B-251	118138.4	1914346.2	Auxiliary Spillway	2496.0	39.1	2456.9	19.1	2476.9	Boring terminated at selected depth.
B-252	118234.6	1914337.3	Auxiliary Spillway	2495.5	20.9	2474.6	10.9	2484.6	Boring terminated at selected depth.
B-253	118259.3	1914408.8	Auxiliary Spillway Training Dike	2501.3	39.4	2461.9	34.4	2466.9	Boring terminated at selected depth.
B-254	118324.1	1914275.8	Auxiliary Spillway	2493.4	14.4	2479.0	4.4	2489.0	Boring terminated at selected depth.
B-255	118328.2	1914370.9	Auxiliary Spillway	2493.9	25.8	2468.1	15.8	2478.1	Boring terminated at selected depth.
B-256	118339.1	1914433.4	Auxiliary Spillway Training Dike	2489.5	24.7	2464.8	19.7	2469.8	Boring terminated at selected depth.
B-257	118432.1	1914311.7	Auxiliary Spillway	2491.3	49.9	2441.4	5.3	2486.0	Boring terminated at selected depth.
B-51	118269.7	1914781.9	Center of Embankment Crest	2508.1	141.8	2366.3	85.0	2423.1	Boring terminated at selected depth.
B-51A	118270.7	1914787.3	Center of Embankment Crest	2508.1	76.0	2432.1	N/A	N/A	Boring terminated at selected depth.
B-52	118300.7	1914912.6	Center of Embankment Crest	2507.7	85.2	2422.5	71.0	2436.7	Boring terminated at selected depth.
B-651	118448.3	1914720.3	D/S Embankment Toe	2436.8	26.0	2410.8	16.5	2420.3	Boring terminated at selected depth.
B-652	118474.1	1914821.4	D/S Embankment Toe	2437.0	17.7	2419.3	7.7	2429.3	Boring terminated at selected depth.
B-653	118241.1	1914792.1	U/S Embankment Slope	2499.0	86.0	2413.0	76.0	2423.0	Boring terminated at selected depth.

Table 2
Summary of Water Levels in Observations

Boring ID	Ground Surface Elevation (ft)	Depth to Water (ft)	Elevation of Water (ft)	Date of Water Level Reading	Date of Boring Completion	Notes	Event
AP-351	2436.5		2436.5	3/20/2019 7:54	3/20/2019 7:51	Dry	Completion
AP-351	2436.5	6.5	2430.0	3/20/2019 10:13	3/20/2019 7:51		After Drilling
B-251	2496.0		2496.0	3/12/2019 12:20	3/12/2019 13:54	Dry	During Drilling
B-251	2496.0	5.5	2490.5	3/12/2019 14:20	3/12/2019 13:54		After Drilling
B-252	2495.5	3.4	2492.1	3/12/2019 9:33	3/12/2019 10:42		During Drilling
B-252	2495.5	2.0	2493.5	3/12/2019 14:14	3/12/2019 10:42		After Drilling
B-253	2501.3	33.5	2467.8	3/6/2019 8:50	3/6/2019 10:40		Completion
B-253	2501.3	15.0	2486.3	3/6/2019 10:40	3/6/2019 10:40		After Drilling
B-254	2493.4		2493.4	3/11/2019 16:46	3/12/2019 8:52	Dry	After Drilling
B-254	2493.4	0.7	2492.7	3/12/2019 14:10	3/12/2019 8:52		After Drilling
B-255	2493.9	15.1	2478.8	3/11/2019 14:50	3/11/2019 15:46		During Drilling
B-255	2493.9		2493.9	3/11/2019 14:52	3/11/2019 15:46	Dry	After Drilling
B-255	2493.9	5.7	2488.2	3/11/2019 16:17	3/11/2019 15:46		Casing Pulled
B-256	2489.5	19.0	2470.5	2/26/2019 15:36	2/26/2019 16:20		During Drilling
B-256	2489.5	4.1	2485.4	2/26/2019 16:20	2/26/2019 16:20		Completion
B-256	2489.5	6.5	2483.0	2/27/2019 9:17	2/26/2019 16:20		After Drilling
B-257	2491.3	16.3	2475.0	2/26/2019 13:51	2/26/2019 13:35		Completion
B-257	2491.3	7.0	2484.3	2/26/2019 15:48	2/26/2019 13:35		After Drilling
B-257	2491.3	9.4	2481.9	2/27/2019 9:21	2/26/2019 13:35		After Drilling
B-51	2508.1	67.3	2440.8	3/14/2019 11:35	3/15/2019 9:40		During Drilling
B-51	2508.1	70.0	2438.1	3/15/2019 7:30	3/15/2019 9:40		Start of Day
B-51	2508.1	38.3	2469.8	3/15/2019 10:19	3/15/2019 9:40		Completion
B-51	2508.1	42.1	2466.0	3/15/2019 11:06	3/15/2019 9:40		After Drilling
B-51	2508.1	42.2	2465.9	3/16/2019 7:52	3/15/2019 9:40		After Drilling
B-51A	2508.1	68.7	2439.5	3/20/2019 11:24	3/18/2019 10:43		Observation Well
B-51A	2508.1	56.7	2451.4	4/3/2019 11:20	3/18/2019 10:43		Observation Well
B-51A	2508.1	62.0	2446.1	4/17/2019 15:57	3/18/2019 10:43		Observation Well
B-51A	2508.1	70.9	2437.2	5/1/2019 11:25	3/18/2019 10:43		Observation Well
B-51A	2508.1	71.6	2436.5	5/6/2019 12:20	3/18/2019 10:43		Observation Well
B-51A	2508.1	72.8	2435.3	5/9/2019 12:15	3/18/2019 10:43		Observation Well
B-51A	2508.1	72.4	2435.7	5/13/2019 12:14	3/18/2019 10:43		Observation Well
B-52	2507.7		2507.7	3/4/2019 16:50	3/5/2019 11:30	Dry	End of Day
B-52	2507.7	46.2	2461.5	3/5/2019 7:40	3/5/2019 11:30		Start of Day
B-651	2436.8	11.4	2425.4	3/18/2019 14:37	3/18/2019 16:45		Encountered
B-651	2436.8	0.0	2436.8	3/18/2019 17:02	3/18/2019 16:45		Completion
B-651	2436.8	0.2	2436.6	3/19/2019 7:30	3/18/2019 16:45		After Drilling
B-651	2436.8	-0.7	2437.5	3/19/2019 11:39	3/18/2019 16:45	Artesian	Casing Pulled
B-651	2436.8	-1.1	2437.9	4/3/2019 12:00	3/18/2019 16:45	Artesian	After Drilling
B-651	2436.8	-1.5	2438.3	4/17/2019 15:44	3/18/2019 16:45	Artesian	Observation Well
B-651	2436.8	-2.4	2439.2	5/6/2019 13:14	3/18/2019 16:45	Artesian	Observation Well
B-651	2436.8	-2.1	2438.9	5/6/2019 17:15	3/18/2019 16:45	Artesian	Observation Well
B-651	2436.8	-2.1	2438.9	5/9/2019 14:00	3/18/2019 16:45		Observation Well
B-651	2436.8	-2.7	2439.5	5/13/2019 11:57	3/18/2019 16:45	Artesian	Observation Well
B-652	2437.0	6.1	2430.9	3/19/2019 16:07	3/19/2019 15:55		After Drilling
B-652	2437.0	5.6	2431.4	3/20/2019 7:21	3/19/2019 15:55		After Drilling
B-653	2499.0		2499.0	2/27/2019 16:50	3/1/2019 14:30	Dry	End of Day
B-653	2499.0	42.5	2456.5	2/28/2019 7:10	3/1/2019 14:30		Start of Day
B-653	2499.0	6.0	2493.0	3/1/2019 15:10	3/1/2019 14:30		End of Day
B-653	2499.0	28.8	2470.2	3/2/2019 8:16	3/1/2019 14:30		Start of Day
GF-1D	2507.4	33.5	2473.9	3/11/2019 17:40	3/9/2016		Observation Well
GF-1D	2507.4	33.4	2474.0	3/16/2019 13:50	3/9/2016		Observation Well

Table 2
Summary of Water Levels in Observations

Boring ID	Ground Surface Elevation (ft)	Depth to Water (ft)	Elevation of Water (ft)	Date of Water Level Reading	Date of Boring Completion	Notes	Event
GF-1D	2507.4	33.7	2473.7	3/19/2019 8:22	3/9/2016		Observation Well
GF-1D	2507.4	34.6	2472.8	4/3/2019 13:18	3/9/2016		Observation Well
GF-1D	2507.4	33.9	2473.5	4/17/2019 15:30	3/9/2016		Observation Well
GF-1D	2507.4	32.8	2474.6	5/6/2019 12:54	3/9/2016		Observation Well
GF-1S	2507.4	47.2	2460.2	3/11/2019 17:40	3/9/2016		Observation Well
GF-1S	2507.4	47.6	2459.8	3/16/2019 13:51	3/9/2016		Observation Well
GF-1S	2507.4	48.5	2458.9	3/19/2019 8:28	3/9/2016		Observation Well
GF-1S	2507.4	47.8	2459.6	4/3/2019 13:14	3/9/2016		Observation Well
GF-1S	2507.4	21.4	2486.0	4/17/2019 15:30	3/9/2016		Observation Well
GF-1S	2507.4	30.5	2476.9	5/6/2019 12:57	3/9/2016		Observation Well
GF-2D	2476.5	33.1	2443.4	3/11/2019 17:50	3/9/2016		Observation Well
GF-2D	2476.5	33.3	2443.2	3/16/2019 13:53	3/9/2016		Observation Well
GF-2D	2476.5	33.2	2443.3	3/19/2019 9:10	3/9/2016		Observation Well
GF-2D	2476.5	33.0	2443.5	4/3/2019 12:20	3/9/2016		Observation Well
GF-2D	2476.5	33.3	2443.2	4/17/2019 15:35	3/9/2016		Observation Well
GF-2D	2476.5	33.1	2443.4	5/6/2019 13:04	3/9/2016		Observation Well
GF-2S	2476.5	31.0	2445.5	3/11/2019 17:50	3/9/2016		Observation Well
GF-2S	2476.5		2476.5	3/16/2019 13:54	3/9/2016	Dry	Observation Well
GF-2S	2476.5		2476.5	3/19/2019 9:15	3/9/2016	Dry	Observation Well
GF-2S	2476.5		2476.5	4/3/2019 12:25	3/9/2016	Dry	Observation Well
GF-2S	2476.5		2476.5	4/17/2019 15:35	3/9/2016	Dry	Observation Well
GF-2S	2476.5	31.3	2445.2	5/6/2019 13:01	3/9/2016		Observation Well
GF-3	2437.8	0.3	2437.5	3/11/2019 18:00	3/9/2016		Observation Well
GF-3	2437.8	-0.5	2438.3	3/16/2019 13:56	3/9/2016	Artesian	Observation Well
GF-3	2437.8	-0.2	2438.0	4/3/2019 12:16	3/9/2016	Artesian	Observation Well
GF-3	2437.8	-0.8	2438.6	4/17/2019 15:40	3/9/2016	Artesian	Observation Well
GF-3	2437.8	-1.3	2439.1	5/6/2019 13:08	3/9/2016	Artesian	Observation Well

Table 3
Summary of Hydraulic Conductivity Testing in Rock

Boring ID	Ground Surface Elevation	Depth (ft bgs)		Elevation (ft)		Water Level Before Test (ft bgs)	Test Type	Lugeons	Permeability		Maximum Effective Pressure (psi)	Test Interpretation	Description of Test Section	Comments
		Top	Bottom	Top	Bottom				ft/sec	cm/sec				
B-51	2508.1	87.0	97.8	2421.1	2410.3	70.0	Falling Head	N/A	1.6E-07	4.8E-06	N/A	N/A	SHALE, highly weathered, intensely fractured, RQD: 14 to 50, Recovery: 67 to 85	
B-51	2508.1	97.0	107.8	2411.1	2400.3	42.2	Packer	0	N/A	N/A	61	No take	SHALE, moderately weathered, highly fractured, RQD: 50 to 87, Recovery: 67 to 100	
B-51	2508.1	107.0	117.8	2401.1	2390.3	42.2	Packer	0	N/A	N/A	70	No take	SHALE, moderately weathered, highly fractured, RQD: 78 to 93, Recovery: 92 to 98	
B-51	2508.1	117.0	127.8	2391.1	2380.3	42.2	Packer	0	N/A	N/A	79	No take	SHALE, moderately weathered, highly fractured, RQD: 45 to 83, Recovery: 92 to 100	
B-51	2508.1	127.0	141.8	2381.1	2366.3	70.0	Packer	8	3.3E-06	9.9E-05	84	Fracture filling	SHALE, moderately weathered, highly fractured, RQD: 45 to 62, Recovery: 93 to 100	
B-651	2436.8	18.5	26.0	2489.6	2482.1	0.2	Packer	147	5.3E-05	1.6E-03	7	Inconclusive	SHALE, slightly weathered, moderately fractured, RQD: 54 to 78, Recovery: 98 to 100	Due to previous artesian conditions, only one step was tested. No flowing water or bubbling was observed during the test.
B-652	2437.0	9.7	17.7	2498.4	2490.4	6.1	Packer	324	1.2E-04	3.8E-03	9	Inconclusive	SHALE AND CLAYSTONE, slightly weathered, highly fractured, RQD: 42 to 50, Recovery: 73 to 100	Due to previous artesian conditions, only one step was tested. No flowing water or bubbling was observed during the test. No flow in B-651 during test. When pump was turned off at end of test in B-652, bubbles were observed in B-651.

APPENDIX A

SUBSURFACE DRILLING AND SAMPLING DATA

Subsurface Exploration Procedures
General Notes for Subsurface Exploration Logs
Identification of Soil
Descriptive Criteria for Rock Core Logging
Supplemental Rock Descriptive Terms
Rock Discontinuity Description Criteria
Test Boring Logs
Borehole Backfill Records
Undisturbed Sampling Records
Rock Core Box Photographs

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SUBSURFACE EXPLORATION PROCEDURES

Test Borings – Hollow Stem Augers

The borings are advanced by turning an auger with a center opening of 4¼ inches. A plug device is used to block off the center opening while augers are advanced. Cuttings are brought to the surface by the auger flights. Sampling is performed through the center opening in the hollow stem auger, by standard methods, after removal of the plug.

Standard Penetration Test Results

The numbers in the "Blow Counts" column of the boring logs represent Standard Penetration Test (SPT) results. Each number represents the blows needed to drive a 2-inch O.D., 1⅜-inch I.D. split-barrel sampler 6 inches, using a 140-pound hammer falling 30 inches. The sampler is typically driven a total of 18 or 24 inches. The first 6 inches are considered a seating interval. The total of the number of blows for the second and third 6-inch intervals is the SPT "N value." The Standard Penetration Test is conducted according to ASTM D1586.

The SPT samples were obtained using an automatic trip hammer (ATH) rather than the standard safety hammer. The energy applied to the split-spoon sampler using the ATH is about 33 percent greater than that applied using the standard safety hammer. The hammer blows shown on the boring logs are uncorrected for the higher energy. However, we correct SPT N values for the higher energy when using N values in our analyses.

Soil Classification Criteria

The group symbols on the logs represent the Unified Soil Classification System Group Symbols (ASTM D2487) based on visual observation and limited laboratory testing of the samples. Criteria for visual identification of soil samples are included in this appendix. Some variation can be expected between samples visually classified and samples classified in the laboratory.

Rock Core Drilling

The rock was drilled using core bits set with carbide steel or diamond, depending upon the rock texture. The bit was fitted onto a triple-tube, swivel-type core barrel in which an exterior tube and bit rotate, and an interior barrel remains stationary to receive the rock core. Drillers circulated water between the barrels and across the bit face to provide cooling and to flush away cuttings. The size of bits is indicated on individual boring logs.

The length of rock core recovered expressed as a percentage of the total length cored is shown on the logs. Rock Quality Designation (RQD) is also given. RQD is defined as the total length of rock fragments recovered that are greater than 4 inches in length, discounting drilling breaks and unsound rock, expressed as a percentage of the total length cored.

GENERAL NOTES FOR SUBSURFACE EXPLORATION LOGS

1. Numbers in the "Blow Counts" column indicate blows required to drive a 2-inch O.D., 1⅜-inch I.D. sampling spoon 6 inches using a 140 pound hammer falling 30 inches. The Standard Penetration Test (SPT) N value is the number of blows required to drive the sampler 12 inches, after a 6-inch seating interval. The Standard Penetration Test is performed in general accordance with ASTM D1586.
2. Visual classification of soil is in accordance with terminology set forth in "Identification of Soil." The ASTM D2487 group symbols (e.g., CL) shown in the classification column are based on visual observations.
3. Estimated water levels indicated on the logs are only estimates from available data and may vary with precipitation, porosity of the geologic material, site topography, and other factors.
4. Refusal at the surface of rock, boulder, or other obstruction is defined as an SPT resistance of 50 blows for 6 inches or less of penetration.
5. The logs and related information depict subsurface conditions only at the specific locations and at the particular time when drilled or excavated. Soil conditions at other locations may differ from conditions occurring at these locations. In addition, the passage of time may result in a change in the subsurface soil and water level conditions at the subsurface exploration location.
6. The stratification lines represent the approximate boundary between soil and rock types as obtained from the subsurface exploration. Some variation may also be expected vertically between samples taken. The soil profile, water level observations, and penetration resistances presented on these logs have been made with reasonable care and accuracy and must be considered only an approximate representation of subsurface conditions to be encountered at the particular location.
7. Key to symbols and abbreviations:

	SPT S-1, 24 in 0.0-2.0 ft	Standard Penetration Test Sample No., Sample Length Sampling Interval
	ST ST-1, 24 in 0.0-2.0 ft	Shelby Tube Sample Sample No., Sample Length Sampling Interval
	SS S-1, 24 in 0.0-2.0 ft	3" Split-Barrel Sampler Sample No., Sample Length Sampling Interval
	CORE C-1, 60 in 0.0-5.0 ft	Rock Core Sample Run No., Sample Length Sampling Interval

Rec	Sample recovery (inches and percent)
MC	Moisture Content (percent)
LL	Liquid Limit
PL	Plastic Limit
<#200	Percent by weight passing a No. 200 Sieve
RQD	Rock Quality Designation (percent)

IDENTIFICATION OF SOIL

I. DEFINITION OF SOIL GROUP NAMES (ASTM D2487)

			SYMBOL	GROUP NAME
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels – More than 50% of coarse fraction retained on No. 4 sieve Coarse, ¾" to 3" Fine, No. 4 to ¾"	Clean Gravels Less than 5% fines	GW	WELL GRADED GRAVEL
			GP	POORLY GRADED GRAVEL
		Gravels with fines More than 12% fines	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	Sands – 50% or more of coarse Fraction passes No. 4 sieve Coarse, No. 10 to No. 4 Medium, No. 40 to No. 10 Fine, No. 200 to No. 40	Clean Sands Less than 5% fines	SW	WELL GRADED SAND
			SP	POORLY GRADED SAND
		Sands with fines More than 12% fines	SM	SILTY SAND
			SC	CLAYEY SAND
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays – Liquid Limit less than 50 Low to medium plasticity	Inorganic	CL	LEAN CLAY
			ML	SILT
		Organic	OL	ORGANIC CLAY
				ORGANIC SILT
	Silts and Clays – Liquid Limit 50 or more Medium to high plasticity	Inorganic	CH	FAT CLAY
			MH	ELASTIC SILT
		Organic	OH	ORGANIC CLAY
				ORGANIC SILT
Highly Organic Soils	Primarily organic matter, dark in color and organic odor		PT	PEAT

II. DEFINITION OF SOIL COMPONENT PROPORTIONS (ASTM D2487)

			Examples
Adjective Form	GRAVELLY SANDY	>30% to <50% coarse grained component in a fine-grained soil	GRAVELLY LEAN CLAY
	CLAYEY SILTY	>12% to <50% fine grained component in a coarse-grained soil	SILTY SAND
"With"	WITH GRAVEL WITH SAND	>15% to <30% coarse grained component in a fine-grained soil	FAT CLAY WITH GRAVEL
	WITH GRAVEL WITH SAND	>15% to <50% coarse grained component in a coarse-grained soil	POORLY GRADED GRAVEL WITH SAND
	WITH SILT WITH CLAY	>5% to <12% fine grained component in a coarse-grained soil	POORLY GRADED SAND WITH SILT

III. GLOSSARY OF MISCELLANEOUS TERMS

SYMBOLS ..... Unified Soil Classification Symbols are shown above as group symbols. A dual symbol "-" indicates the soil belongs to two groups. A borderline symbol "/" indicates the soil belongs to two possible groups.

FILL ..... Man-made deposit containing soil, rock, and often foreign matter.

PROBABLE FILL ..... Soils that contain no visually detected foreign matter but which are suspect with regard to origin.

DISINTEGRATED ROCK (DR) ..... Residual materials with a standard penetration resistance (SPT) between 60 blows per foot and refusal. Refusal is defined as an SPT of 50 blows for 6" or less penetration.

BOULDERS & COBBLES ..... Boulders are considered rounded pieces of rock larger than 12 inches, while cobbles range from 3 to 12-inch size.

LENSES ..... 0 to ½-inch seam within a material in a test pit.

LAYERS ..... ½ to 12-inch seam within a material in a test pit.

POCKET ..... Discontinuous body within a material in a test pit.

MOISTURE CONDITIONS ..... Wet, moist or dry to indicate visual appearance of specimen.

COLOR ..... Overall color, with modifiers such as light to dark or variation in coloration.

DESCRIPTIVE CRITERIA FOR ROCK CORE LOGGING

Rock is defined as natural subsurface material yielding SPT blow counts of N ≥ 100/2 inches (Martin, 1977). Rock descriptions may include the following descriptive elements, as applicable, generally in the order indicated. Supplemental descriptors may also be used, depending on project performance objectives and available information.

ROCK TYPE, strength, weathering, fracturing, color, recovery, RQD

Rock Type General terms are used following the NRCS (2001) rock type classification chart based on visual identification. Some of the NRCS rock types common to our geographic area of practice are listed below. Mineralogical modifiers may be added where they help define distinct units (e.g., Garnet-Muscovite Schist).

Sedimentary:	Conglomerate, Sandstone, Mudstone, Siltstone, Claystone, Shale, Limestone, Dolomite, Coal, Chert
Igneous:	Pegmatite, Granite, Diorite, Gabbro, Diabase, Rhyolite, Monzonite, Andesite, Basalt
Metamorphic:	Gneiss, Schist, Phyllite, Slate, Quartzite, Marble, Amphibolite, Hornfels

Strength (modified from Hoek, 2001) The estimated Uniaxial Compressive Strength associated with each rock strength term is based on the field strength index test for intact rock samples as follows.

• Extremely Strong	>36,000 psi	Specimen can only be chipped with a geological hammer.
• Very Strong	15,000 - 36,000 psi	Specimen requires many blows of a geological hammer to fracture it.
• Strong	7,500 - 15,000 psi	Specimen requires more than one blow of a geological hammer to fracture it.
• Medium Strong	3,500 - 7,500 psi	Specimen cannot be peeled with a pocketknife; can be fractured with one blow from a geological hammer.
• Weak	700 - 3,500 psi	Specimen can be peeled with a pocketknife with difficulty; shallow indentation made by firm blow with point of a geological hammer.
• Very Weak	150 - 700 psi	Material crumbles under firm blows with point of a geological hammer; can be peeled with a pocketknife.

Weathering (modified from ACOE, 1994; and USBR, 2001)

- Fresh Mineral crystals appear bright and show no discoloration. Fractures show little or no staining on their surfaces. Discoloration does not extend into intact rock.
- Slightly Weathered Rock is generally fresh except along fractures. Some fractures are stained and discoloration may extend up to 0.5 inches into rock.
- Moderately Weathered Significant portions of rock appear dull and discolored. Rock may be significantly weaker than in its fresh state near fractures. Soil zones of limited extent may occur along some fractures.
- Highly WeatheredRock appears dull and discolored throughout. Majority of rock mass is significantly weaker than in its fresh state. Isolated zones of stronger rock and/or soil may occur throughout.
- Severely Weathered Significant portions of rock mass essentially weathered to soil. Rock fabric may still be discernable (i.e., saprolite). Isolated zones of stronger rock may occur locally. Quartz may be present as hard, fractured dikes or veins.

Fracturing (from ACOE, 1994)

Very Slightly Fractured	> 6.5 ft
Slightly Fractured	2 ft - 6.5 ft
Moderately Fractured	8 in - 2 ft
Highly Fractured	2.5 in - 8 in
Intensely Fractured	< 2.5 in

Color (from Munsell Color System; and GSA, 1995) Color descriptions include a primary color and up to two shade or secondary color modifiers, and may also include a color pattern term to define the relationship between multiple colors.

Shade: Light, Dark

Secondary: Blackish, Brownish, Grayish, Greenish, Reddish, Yellowish, Orangeish

Primary: Black, Brown, Gray, Green, Red, Yellow, Orange, White

Pattern: and, to, with mottles of, with speckles of, with streaks of, with bands of

- **Recovery** is defined as the total length of recovered core in a core run divided by the total length of the core run, times 100 percent. A core run may be any depth interval of concern. Only natural fractures are considered for determining the length of core pieces. Mechanical breaks formed during or after coring do not count against the length determination. The length of recovered core pieces is measured along the core axis, between fracture midpoints.
- **RQD** (ASTM D6032, Deere & Deere, 1988, 1989) is defined as the total length of core pieces at least four inches long recovered from a core run divided by the total length of the core run, times 100 percent. A core run may be any depth interval of concern. Only natural fractures are considered for determining the length of core pieces. Mechanical breaks formed during or after coring do not count against the length determination. The length of recovered core pieces should be measured along the core axis, between fracture midpoints. Core pieces that are highly to severely weathered, very weak, or contain numerous pores should not count toward RQD.

SUPPLEMENTAL ROCK DESCRIPTIVE TERMS

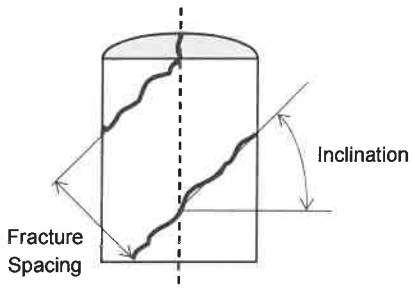
In addition to the basic rock descriptive elements provided on the preceding Descriptive Criteria for Rock Core Logging sheet, rock descriptions may include the following supplemental descriptive elements depending on project performance objectives and available information.

Bedding Thickness & Inclination Bedding is defined as the layered arrangement of sediment deposits in sedimentary rock. Bedding thickness is the average perpendicular distance between bedding surfaces. Bedding thickness intervals follow Bieniawski (1989). Inclination is measured in degrees from a plane perpendicular to the core axis (see Inclination Measurement Figure shown below).

Very Thickly Bedded	> 6.5 ft
Thickly Bedded	2 ft - 6.5 ft
Medium Bedded	8 in - 2 ft
Thinly Bedded	2.5 in - 8 in
Very Thinly Bedded	< 2.5 in

Foliation Character & Inclination Foliation is defined as the planar arrangement of textural features in metamorphic rock. Inclination is measured in degrees from a plane perpendicular to the core axis (see Inclination Measurement Figure).

Strongly Foliated	Foliation is easily discernable throughout.
Moderately Foliated	Foliation is discernable with some difficulty.
Poorly Foliated	Foliation is generally not discernable.



Inclination Measurement Figure

Fracture Set Data Individual fractures or fracture sets may be characterized by the following descriptive elements, when applicable and discernable: fracture type, inclination (as per Inclination Measurement Figure above), average spacing, roughness and infilling condition. An example fracture set data description for an individual stratum is: *4 joints at 80-90°, moderately spaced, slightly rough, with spotty iron staining and partially filled with pyrite.* If fractures are rare, they can be described individually by listing the depth, followed by the descriptive terms in this section.

FRACTURE TYPE

Fracture	Any natural break in rock; 'Fracture' is the general term used for individual breaks that do not fall into any of the following fracture-type categories
Joint	A relatively planar fracture without shear displacement; occurs with other similarly oriented joints generally at regularly spaced intervals
Shear	A fracture along which differential movement has taken place parallel to the surface (i.e., shear displacement) sufficient to produce slickensides or polishing
Fault	A major fracture along which there has been appreciable shear displacement accompanied by gouge and/or a severely fractured zone
Bedding Fracture	A fracture along a bedding plane
Foliation Fracture	A fracture along a foliation plane
Vein Fracture	A fracture along the contact of an intrusive vein

Average Spacing (NRCS, 2001)

Very Widely Spaced	> 6.5 ft
Widely Spaced	2 ft - 6.5 ft
Moderately Spaced	8 in - 2 ft
Closely Spaced	2.5 in - 8 in
Very Closely Spaced	< 2.5 in

Infilling Condition

Coverage	*Type*
Spotty Filling of (≤ 50% coverage)	Calcite
Partially Filled with (50 to 100% coverage)	Chlorite
Filled with (100% coverage)	Clay
	Gypsum
	Iron Staining
	Manganese
	Mica
	Pyrite
	Quartz
	Talc

Roughness (Bieniawski, 1989)

Very Rough	- Most surface asperities extend > 2 mm from the average planar surface.
Rough	- Most surface asperities extend 0.5 to 2 mm from the average planar surface.
Slightly rough	- Most surface asperities extend < 0.5 mm from the average planar surface.
Smooth	- Generally smooth to touch with few surface asperities.
Slickensided	- Infilling material contains slickensides.

ROCK DISCONTINUITY DESCRIPTION CRITERIA

Discontinuity Type:
(J) Joint
(C) Contact
(Fo) Foliation
(FJ) Foliation Joint
(L) Lineation
(Fa) Fold Axis
(Fv) Vein Fracture
(Ft) Fault
(S) Shear
(B) Bedding
(Jb) Joint on Contact
(Z) Fault Zone
(FrZ) Fracture Zone

Infilling:
(Cn) Clean
(S) Surface Staining
(G) Granular Soil
(C) Clay Soil / Matrix
(Ch) Chlorite
(GT) Gypsum/Talc
(I) Iron / Iron Oxide
(Mn/Mg) Black minerals
(Ct) Calcite
(Q) Quartz
(P) Pyrite
(B) Breccia
(GB) Gouge and Breccia
(SR) Sheared Rock
(IR) Intensely Fractured Rock
(O) Other

Surface Roughness:
(Vr) Very Rough
(R) Rough
(Sr) Slightly Rough
(Sm) Smooth
(Slk) Slickensided

Water Condition:
(1) Dry with no evidence of water flow
(2) Dry with evidence of past water flow
(3) Damp with no free water
(4) Seepage without continuous flow
(5) Seepage with continuous flow

Infilling Coverage:
(S) Spotty (<50%)
(P) Partially Filled (50-99%)
(F) Filled / Healed / Cemented (100%)

Surface Shape:
(S) Stepped
(P) Planar
(W) Wavy

Termination:
(0) Neither End Visible
(1) One End Visible
(2) Both Ends Visible

Infilling Thickness Description	Thickness/Openness	Discontinuity Openness Description
(Cn) Clean	No film or coating	
	No visible separation	(T) Tight
(VTn) Very Thin	<1 mm	(SO) Slightly Open
(MTn) Moderately Thin	1 - 3 mm	(MO) Moderately Open
(Tn) Thin	3 - 10 mm	(O) Open
(MTh) Moderately Thick	10 - 30 mm	(MW) Moderately Wide
(Th) Thick	>30 mm	(W) Wide

(Source: USBR, 1998)

Joint Wall Compressive Strength (JCS):
"(R1) Very Weak (150-700 PSI): Material crumbles under firm blows with point of a geological hammer, can be peeled with a pocket knife."
"(R2) Weak (700-3,500 PSI): Specimen can be peeled with a pocketknife with difficulty, shallow indentation made by firm blow with point of a geological hammer."
"(R3) Medium Strong (3,500-7,500 PSI): Specimen cannot be peeled with a pocketknife, can be fractured with one blow from a geological hammer."
"(R4) Strong (7,500-15,000 PSI): Specimen requires more than one blow of a geological hammer to fracture it."
"(R5) Very Strong (15,000-36,000 PSI) : Specimen requires many blows of a geological hammer to fracture it."
"(R6) Extremely Strong (>36,000 PSI): Specimen can only be chipped with a geological hammer."

TEST BORING LOGS

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Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-51
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal
Equipment: CME-55 (Track)
Method: HQ Triple Tube
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/13/2019 **Date Ended:** 03/15/2019
X: 1914781.5 ft **Y:** 118271.2 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2508.0 ft
Total Depth: 141.8 ft

Ground Water Levels
Start of Day 70.0 ft 03/15/2019
Completion 38.3 ft 03/15/2019
After Drilling 42.1 ft 03/15/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
		0.0 - 0.6 ft: Topsoil											0.0 ft: Gravel-sized component generally refers to shale rock fragments.
1	2507	0.6 - 12.5 ft: FILL, sampled as LEAN CLAY WITH SAND, moist, orangish brown with dark gray, estimated 15 - 25% sand, estimated 5 - 10% rock fragments				SPT S-1, 24 in 0.0-2.0 ft	14 (58)	2-5-5-6					0.0 ft: Embankment Section No. 3 not discernable from Section No. 2
2	2506												
3	2505					ST ST-1A, 24 in 2.0-4.0 ft	23 (96)						0.0 - 77.0 ft: Embankment Section No. 2.
4	2504												
5	2503					ST ST-1B, 24 in 4.0-6.0 ft	24 (100)						
6	2502	6.0 ft: Change to estimated 30 - 45% rock fragments, estimated 5 - 10% sand	CL		S2								
7	2501					SPT S-2, 24 in 6.0-8.0 ft	19 (79)	3-6-7-9					
8	2500												
9	2499					SPT S-3, 24 in 8.0-10.0 ft	20 (83)	3-6-8-11					
10	2498	10.0 ft: Change to estimated 15 - 25% sand											
11	2497					SPT S-4, 24 in 10.0-12.0 ft	18 (75)	3-6-8-9					
12	2496												
13	2495	12.5 - 14.2 ft: FILL, sampled as CLAYEY GRAVEL WITH SAND, moist, orangish brown and light brown, estimated 30 - 45% fines, estimated 15 - 25% sand	GC		S2	SPT S-5, 24 in 12.0-14.0 ft	14 (58)	4-9-8-12					
14	2494	13.6 ft: Change to gray to dark gray											14.0 - 16.0 ft: 3" ID split spoon sampler.
		14.2 - 32.0 ft: FILL, sampled as SANDY LEAN CLAY WITH GRAVEL,											

Bottom of boring at 141.8 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING	TEST BORING LOG	Project: Brush Creek Site 15 NRCS - West Virginia Mercer County, West Virginia	Boring Number: **B-51** Contract Number: **18C35013.04**

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Contractor Foreman: T. Jenkins
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4-1/4" ID Hollow Stem Auger
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16	2492	14.2 - 32.0 ft: FILL, sampled as SANDY LEAN CLAY WITH GRAVEL, moist, orangish brown with light brown, estimated 30 - 45% sand, estimated 15 - 25% rock fragments	CL		S2	SS S-6, 24 in 14.0-16.0 ft	17 (71)	12-16-18-16					22.0 - 24.0 ft: 3" ID split spoon sampler. 22.0 ft: Augered through hard material
17	2491	16.0 ft: Change to orangish brown and grayish brown, estimated 30 - 45% gravel, estimated 15 - 25% sand				SPT S-7, 24 in 16.0-18.0 ft	21 (88)	3-9-8-8					
18	2490	18.0 ft: Change to estimated 30 - 45% sand, estimated 5 - 10% rock fragments											
19	2489					SPT S-8, 24 in 18.0-20.0 ft	22 (92)	3-7-7-10					
20	2488	20.0 ft: Change to estimated 30 - 45% rock fragments, estimated 5 - 10% sand											
21	2487					SPT S-9, 24 in 20.0-22.0 ft	23 (96)	4-6-11-11					
22	2486												
23	2485					SS S-10, 24 in 22.0-24.0 ft	21 (88)	6-12-15-18					
24	2484	24.0 ft: Change to estimated 15 - 25% sand, estimated 15 - 25% rock fragments											
25	2483					SPT S-11, 24 in 24.0-26.0 ft	19 (79)	2-7-10-12					
26	2482												
27	2481					SPT S-12, 24 in 26.0-28.0 ft	16 (67)	4-6-9-12					
28	2480												
29	2479					SPT S-13, 24 in 28.0-30.0 ft	13 (54)	5-8-12-13					

Bottom of boring at 141.8 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

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31	2477	14.2 - 32.0 ft: FILL, sampled as SANDY LEAN CLAY WITH GRAVEL, moist, orangish brown with light brown, estimated 30 - 45% sand, estimated 15 - 25% rock fragments				SS S-14, 24 in 30.0-32.0 ft	17 (71)	5-12-12-18					30.0 - 32.0 ft: 3" ID split spoon sampler.
32	2476	31.0 ft: Change to estimated 30 - 45% rock fragments, estimated 15 - 25% sand											
33	2475	32.0 - 39.0 ft: FILL, sampled as CLAYEY GRAVEL WITH SAND, moist, orangish brown and gray, estimated 30 - 45% fines, estimated 15 - 25% sand				SPT S-15, 24 in 32.0-34.0 ft	16 (67)	6-6-11-12					
34	2474	34.3 - 35.3 ft: Change to estimated > 50% sand, weathered sandstone and shale rock fragments											34.0 - 36.0 ft: 3" ID split spoon sampler.
35	2473	35.3 - 35.5 ft: Change to wet	GC		S2	SS S-16, 24 in 34.0-36.0 ft	24 (100)	8-10-12-15					34.0 ft: Augered through hard material.
36	2472												
37	2471					SPT S-17, 24 in 36.0-38.0 ft	23 (96)	6-11-11-15					
38	2470												
39	2469	39.0 - 41.0 ft: FILL, sampled as CLAYEY SAND moist, orangish brown and gray, estimated 30 - 45% fines, estimated 5 - 10% rock fragments				ST ST-2A, 24 in 38.0-40.0 ft	23 (96)						
40	2468		SC		S2								
41	2467	41.0 - 64.0 ft: FILL, sampled as GRAVELLY LEAN CLAY moist, grayish brown and dark gray, estimated 30 - 45% rock fragments, estimated 5 - 10% sand				ST ST-2B, 24 in 40.0-42.0 ft	24 (100)						
42	2466	42.5 - 44.3 ft: Change to estimated 30 - 45% sand, estimated 5 - 10% rock fragments											42.0 - 44.0 ft: Added approx. 2 gallons of water to help bring cuttings to surface.
43	2465					SPT S-18, 24 in 42.0-44.0 ft	19 (79)	5-11-12-13					
44	2464	44.3 ft: Change to estimated 15 - 25% sand											

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Schnabel ENGINEERING

TEST BORING LOG

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Hammer Type: Auto Hammer (140 lb)

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46	2462	41.0 - 64.0 ft: FILL, sampled as GRAVELLY LEAN CLAY moist, grayish brown and dark gray, estimated 30 - 45% rock fragments, estimated 5 - 10% sand	CL		S2	SPT S-19, 24 in 44.0-46.0 ft	16 (67)	4-9-10-12					
47	2461					SPT S-20, 24 in 46.0-48.0 ft	24 (100)	4-7-8-13					
48	2460												
49	2459	48.6 - 49.8 ft: Change to estimated > 50% sand, estimated 5 - 10% rock fragments				SPT S-21, 24 in 48.0-50.0 ft	24 (100)	4-9-11-12					
50	2458	49.8 ft: Change to estimated 15 - 25% sand											
51	2457	50.7 - 51.0 ft: Change to Well-Graded Sand (SW), estimated 5 - 10% rock fragments				SPT S-22, 24 in 50.0-52.0 ft	21 (88)	9-19-13-16					
52	2456												
53	2455					SPT S-23, 24 in 52.0-54.0 ft	16 (67)	7-10-8-10					53.0 ft: Added approx. 2 gallons of water to help bring cuttings to surface.
54	2454												
55	2453					SPT S-24, 24 in 54.0-56.0 ft	24 (100)	3-5-9-9					
56	2452	55.3 - 55.6 ft: Change to Well-Graded Sand with Clay (SW-SC), estimated 5 - 10% rock fragments 55.6 - 58.0 ft: Change to estimated 5 - 10% sand											
57	2451					SPT S-25, 24 in 56.0-58.0 ft	24 (100)	4-10-13-15					
58	2450	58.0 ft: Change to estimated 15 - 25% rock fragments											
59	2449					SPT S-26, 24 in 58.0-60.0 ft	24 (100)	6-6-8-11					

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61	2447	41.0 - 64.0 ft: FILL, sampled as GRAVELLY LEAN CLAY moist, grayish brown and dark gray, estimated 30 - 45% rock fragments, estimated 5 - 10% sand				SPT S-27, 24 in 60.0-62.0 ft	20 (83)	4-8-12-10					
		61.0 - 62.0 ft: Change to estimated >50% rock fragments											
62	2446	62.0 ft: Change to estimated 5 - 10% sand											
63	2445					SPT S-28, 24 in 62.0-64.0 ft	24 (100)	3-7-10-18					
64	2444	64.0 - 77.0 ft: FILL, sampled as GRAVELLY FAT CLAY moist, brownish orange and light gray, estimated 30 - 45% rock fragments, estimated 5 - 10% sand											64.0 ft: Water added to develop downward gradient, water level at 48.5 ft.
65	2443					SPT S-29, 24 in 64.0-66.0 ft	24 (100)	5-11-13-16					
66	2442												
67	2441					SPT S-30, 24 in 66.0-68.0 ft	19 (79)	5-10-13-17					
68	2440	68.0 ft: Change to gray with brownish orange											68.0 ft: End of drilling for the day, 03/13/19. Water level at 57.0 ft at end of day. Water level at 57.0 ft the following morning. 68.0 ft: Water added, water level at 48.3 ft.
69	2439		CH		S2	SPT S-31, 24 in 68.0-70.0 ft	17 (71)	5-11-12-19					
70	2438			▽									
71	2437					SPT S-32, 24 in 70.0-72.0 ft	18 (75)	6-9-12-15					
72	2436												
73	2435					SPT S-33, 24 in 72.0-74.0 ft	14 (58)	3-8-11-12					
74	2434												74.0 ft: Water added, water level at 42.9 ft.

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Schnabel ENGINEERING

TEST BORING LOG

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76	2432	64.0 - 77.0 ft: FILL, sampled as GRAVELLY FAT CLAY moist, brownish orange and light gray, estimated 30 - 45% rock fragments, estimated 5 - 10% sand				ST ST-3A, 24 in 74.0-76.0 ft	22 (92)						
77	2431	75.0 ft: Change to orangish brown with gray				ST ST-3B, 24 in 76.0-78.0 ft	16 (66)						
78	2430	77.0 - 81.6 ft: CLAYEY SAND fine to medium grained sand, wet, gray to dark gray, estimated 30 - 45% fines, estimated 5 - 10% rock fragments, contains roots, alluvial	SC		A								78.0 ft: Added approx. 15 gallons of water, water level at 40.1 ft.
79	2429					SPT S-34, 24 in 78.0-80.0 ft	24 (100)	5-10-11-9					
80	2428												80.0 ft: Added approx. 5 gallons of water t, water level at 45.5 ft.
81	2427					SPT S-35, 24 in 80.0-82.0 ft	21 (88)	6-8-7-10					
82	2426	81.6 - 82.6 ft: SANDY LEAN CLAY wet, gray, estimated 30 - 45% sand, alluvial	CL		A								82.0 ft: Added approx. 1 gallon of water, water level at 41.7 ft.
83	2425	82.6 - 84.5 ft: CLAYEY GRAVEL moist, dark gray, estimated 15 - 25% fines, residual	GC		R	SPT S-36, 24 in 82.0-84.0 ft	24 (100)	7-13-26-48					
84	2424												
85	2423	84.5 - 85.0 ft: DISINTEGRATED	GC		D	SPT S-37, 12 in 84.0-85.0 ft	10 (84)	30-50/6"					
86	2422	ROCK, sampled as CLAYEY GRAVEL moist, dark gray, estimated 15 - 25% fines 85.0 - 141.8 ft: SHALE, very weak to weak, highly weathered, intensely fractured (< 2.5 in) to highly fractured (2.5 - 8 in), N3 (dark gray), very thin bedded (<2.5 in), 0° to 10°											85.0 ft: Gray return water.
87	2421					CORE C-1, 60 in 85.0-90.0 ft	51 (85)	17 (28)	2.1				
88	2420												
89	2419												*85.0 - 93.7 ft: Bedding joint, 10°, spotty*

RQD(%)	DRILL RATE	PACKER	DISCONTINUITIES

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Plunge: 90° **Bearing:** NA
Hole Elevation: 2508.0 ft
Total Depth: 141.8 ft

Ground Water Levels
Start of Day 70.0 ft 03/15/2019
Completion 38.3 ft 03/15/2019
After Drilling 42.1 ft 03/15/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	RQD (in., %)	DRILL RATE (ft/min)	PACKER (Lugeons)	REMARKS DISCONTINUITIES
91	2417	85.0 - 141.8 ft: SHALE, very weak to weak, highly weathered, intensely fractured (< 2.5 in) to highly fractured (2.5 - 8 in), N3 (dark gray), very thin bedded (<2.5 in), 0° to 10°			CORE C-2, 36 in 90.0-93.0 ft	25 (69)	5 (14)	2.5		*(<50%), clay infilling, slightly rough, planar, severely weathered to highly weathered, Zone of fractures, shale severely weathered near bedding joints* *88.0 - 91.1 ft: Joint, 45°, spotty (<50%), clay infilling, slightly rough, planar, fresh to slightly weathered, Zone of fractures* **87.0 - 97.7 ft: Falling head test performed.** *94.2 - 96.4 ft: Joint, 80°, no infilling, slightly rough, undulating, slightly weathered* **95.5 ft: Partial loss of return water.**
92	2416									
93	2415									
94	2414									
95	2413				CORE C-3, 60 in 93.0-98.0 ft	40 (67)	30 (50)	1.7		
96	2412									
97	2411	96.5 ft: Change to moderately weathered, highly fractured (2.5 - 8 in) to moderately fractured (8 in - 2 ft).								
98	2410									
99	2409									*98.1 - 99.9 ft: Joint, 80°, no infilling, rough, undulating, slightly weathered*
100	2408									
101	2407				CORE C-4, 60 in 98.0-103.0 ft	60 (100)	44 (73)	2.2		
102	2406								97.0-107.8 ft: 0	**97.0 - 107.8 ft: Packer test performed.** *102.5 - 102.9 ft: Joint, 80°, no infilling, rough, undulating, slightly weathered*
103	2405									
104	2404									

Bottom of boring at 141.8 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-51
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal
Equipment: CME-55 (Track)
Method: HQ Triple Tube
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/13/2019 **Date Ended:** 03/15/2019
X: 1914781.5 ft **Y:** 118271.2 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2508.0 ft
Total Depth: 141.8 ft

Ground Water Levels
Start of Day 70.0 ft 03/15/2019
Completion 38.3 ft 03/15/2019
After Drilling 42.1 ft 03/15/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	RQD (in., %)	DRILL RATE (ft/min)	PACKER (Lugeons)	REMARKS DISCONTINUITIES
106	2402	85.0 - 141.8 ft: SHALE, very weak to weak, highly weathered, intensely fractured (< 2.5 in) to highly fractured (2.5 - 8 in), N3 (dark gray), very thin bedded (<2.5 in), 0° to 10°		B	CORE C-5, 60 in 103.0-108.0 ft	59 (98)	52 (87)	2.0	107.0-117.8 ft: 0	107.0 - 117.8 ft: Packer test performed.
107	2401									
108	2400									
109	2399									
110	2398				CORE C-6, 60 in 108.0-113.0 ft	59 (98)	56 (93)	1.5		
111	2397									
112	2396									
113	2395									
114	2394				CORE C-7, 60 in 113.0-118.0 ft	60 (100)	55 (92)	1.9		
115	2393									
116	2392									
117	2391									
118	2390									
119	2389									

Bottom of boring at 141.8 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING	TEST BORING LOG	Project:	Brush Creek Site 15 NRCS - West Virginia Mercer County, West Virginia	Boring Number:	B-51
				Contract Number:	18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal
Equipment: CME-55 (Track)
Method: HQ Triple Tube
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/13/2019 **Date Ended:** 03/15/2019
X: 1914781.5 ft **Y:** 118271.2 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2508.0 ft
Total Depth: 141.8 ft

Ground Water Levels
Start of Day 70.0 ft 03/15/2019
Completion 38.3 ft 03/15/2019
After Drilling 42.1 ft 03/15/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	RQD (in., %)	DRILL RATE (ft/min)	PACKER (Lugeons)	REMARKS DISCONTINUITIES
121	2387	85.0 - 141.8 ft: SHALE, very weak to weak, highly weathered, intensely fractured (< 2.5 in) to highly fractured (2.5 - 8 in), N3 (dark gray), very thin bedded (<2.5 in), 0° to 10°			CORE C-8, 58 in 118.0-122.8 ft	56 (97)	48 (83)	2.4	117.0-127.8 ft: 0	117.0 - 127.8 ft: Packer test performed.
122	2386									
123	2385	123.2 ft: Change to highly weathered to moderately weathered, intensely fractured (< 2.5 in).								
124	2384									*123.8 - 124.5 ft: No infilling, slightly rough, planar, severely weathered to highly weathered*
125	2383	124.5 ft: Change to moderately weathered, highly fractured (2.5 - 8 in) to moderately fractured (8 in - 2 ft).			CORE C-9, 48 in 122.8-126.8 ft	48 (100)	32 (67)	1.8		
126	2382									
127	2381									
128	2380	127.8 ft: Change to severely weathered to moderately weathered, highly fractured (2.5 - 8 in) to intensely fractured (< 2.5 in).								*127.8 ft: Bedding joint, 10°, spotty (<50%), clay infilling, slightly rough, planar, severely weathered to highly weathered, Zone of fractures*
129	2379				CORE C-10, 60 in 126.8-131.8 ft	60 (100)	27 (45)	1.9		
130	2378									
131	2377									*127.8 - 133.8 ft: Bedding joint, 10°, partial (50 - 100%), clay infilling, slightly rough, planar, severely weathered to highly weathered, Zone of fractures*
132	2376									**131.8 ft: End of drilling for the day, 03/14/19.**
133	2375							1.5		
134	2374	133.8 ft: Change to moderately weathered, highly fractured (2.5 - 8 in) to moderately fractured (8 in - 2 ft).			CORE C-11, 60 in 131.8-136.8 ft	60 (100)	37 (62)		127.0-141.8 ft: 8	**127.0 - 141.8 ft: Packer test performed.**

Bottom of boring at 141.8 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING	TEST BORING LOG	Project:	Brush Creek Site 15 NRCS - West Virginia Mercer County, West Virginia	Boring Number:	B-51
				Contract Number:	18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal
Equipment: CME-55 (Track)
Method: HQ Triple Tube
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/13/2019 **Date Ended:** 03/15/2019
X: 1914781.5 ft **Y:** 118271.2 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2508.0 ft
Total Depth: 141.8 ft

Ground Water Levels
Start of Day 70.0 ft 03/15/2019
Completion 38.3 ft 03/15/2019
After Drilling 42.1 ft 03/15/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	RQD (in., %)	DRILL RATE (ft/min)	PACKER (Lugeons)	REMARKS DISCONTINUITIES
136	2372	85.0 - 141.8 ft: SHALE, very weak to weak, highly weathered, intensely fractured (< 2.5 in) to highly fractured (2.5 - 8 in), N3 (dark gray), very thin bedded (<2.5 in), 0° to 10°								
137	2371									
138	2370	137.6 ft: Change to severely weathered to moderately weathered, intensely fractured (< 2.5 in).								
139	2369				CORE C-12, 60 in 136.8-141.8 ft	56 (93)	33 (55)	1.9		*137.6 - 140.0 ft: Bedding joint, 10°, partial (50 - 100%), clay infilling, slightly rough, planar, severely weathered to highly weathered, Zone of fractures*
140	2368	140.0 ft: Change to moderately weathered, highly fractured (2.5 - 8 in) to moderately fractured (8 in - 2 ft).								
141	2367									
142	2366									
143	2365									
144	2364									
145	2363									
146	2362									
147	2361									
148	2360									
149	2359									

Bottom of boring at 141.8 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-51A
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal / Sue Buchanan
Equipment: Diedrich D-50 (ATV)
Method: 4-1/4" ID Hollow Stem Auger
Hammer Type: NA

Date Started: 03/17/2019 **Date Ended:** 03/18/2019
X: 1914807.2 ft **Y:** 118282.3 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2508.0 ft
Total Depth: 76.0 ft

Ground Water Levels

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	SAMPLE DATA REC (in., %)	SAMPLE DATA BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
1	2507	0.0 - 70.0 ft: Auger probe, no samples collected, see boring B-51 for material descriptions.											0.0 ft: Piezometer installed. See piezometer installation sketch for additional details. 0.0 ft: Brown cuttings.
2	2506												
3	2505												
4	2504												
5	2503												
6	2502												
7	2501												
8	2500												
9	2499												
10	2498												
11	2497												
12	2496												
13	2495												13.0 ft: Grayish brown cuttings.
14	2494												

Bottom of boring at 76 ft. Boring terminated at selected depth.
Piezometer installed upon completion.

Schnabel ENGINEERING	TEST BORING LOG	Project: Brush Creek Site 15 NRCS - West Virginia Mercer County, West Virginia	Boring Number: B-51A Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal / Sue Buchanan
Equipment: Diedrich D-50 (ATV)
Method: 4-1/4" ID Hollow Stem Auger
Hammer Type: NA

Date Started: 03/17/2019 **Date Ended:** 03/18/2019
X: 1914807.2 ft **Y:** 118282.3 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2508.0 ft
Total Depth: 76.0 ft

Ground Water Levels

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	SAMPLE DATA REC (in., %)	SAMPLE DATA BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
16	2492	0.0 - 70.0 ft: Auger probe, no samples collected, see boring B-51 for material descriptions.											
17	2491												
18	2490												
19	2489												
20	2488												
21	2487												
22	2486												
23	2485												
24	2484												
25	2483												
26	2482												
27	2481												
28	2480												
29	2479												

Bottom of boring at 76 ft. Boring terminated at selected depth.
Piezometer installed upon completion.

Schnabel ENGINEERING	TEST BORING LOG	Project: Brush Creek Site 15 NRCS - West Virginia Mercer County, West Virginia	Boring Number: **B-51A** Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal / Sue Buchanan
Equipment: Diedrich D-50 (ATV)
Method: 4-1/4" ID Hollow Stem Auger
Hammer Type: NA

Date Started: 03/17/2019 **Date Ended:** 03/18/2019
X: 1914807.2 ft **Y:** 118282.3 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2508.0 ft
Total Depth: 76.0 ft

Ground Water Levels

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	SAMPLE DATA REC (in., %)	SAMPLE DATA BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
31	2477	0.0 - 70.0 ft: Auger probe, no samples collected, see boring B-51 for material descriptions.											
32	2476												
33	2475												
34	2474												
35	2473												
36	2472												
37	2471												
38	2470												
39	2469												
40	2468												
41	2467												
42	2466												
43	2465												
44	2464												

Bottom of boring at 76 ft. Boring terminated at selected depth.
Piezometer installed upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-51A
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal / Sue Buchanan
Equipment: Diedrich D-50 (ATV)
Method: 4-1/4" ID Hollow Stem Auger
Hammer Type: NA

Date Started: 03/17/2019 **Date Ended:** 03/18/2019
X: 1914807.2 ft **Y:** 118282.3 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2508.0 ft
Total Depth: 76.0 ft

Ground Water Levels

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	SAMPLE DATA REC (in., %)	SAMPLE DATA BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
46	2462	0.0 - 70.0 ft: Auger probe, no samples collected, see boring B-51 for material descriptions.											
47	2461												
48	2460												
49	2459												
50	2458												
51	2457												
52	2456												
53	2455												
54	2454												54.0 ft: End of drilling for the day, 03/17/19.
55	2453												
56	2452												
57	2451												
58	2450												
59	2449												

Bottom of boring at 76 ft. Boring terminated at selected depth.
Piezometer installed upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-51A
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal / Sue Buchanan
Equipment: Diedrich D-50 (ATV)
Method: 4-1/4" ID Hollow Stem Auger
Hammer Type: NA

Date Started: 03/17/2019 **Date Ended:** 03/18/2019
X: 1914807.2 ft **Y:** 118282.3 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2508.0 ft
Total Depth: 76.0 ft

Ground Water Levels

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	SAMPLE DATA REC (in., %)	SAMPLE DATA BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
61	2447	0.0 - 70.0 ft: Auger probe, no samples collected, see boring B-51 for material descriptions.											
62	2446												
63	2445												
64	2444												
65	2443												
66	2442												
67	2441												
68	2440												
69	2439												
70	2438	70.0 - 72.0 ft: FILL, sampled as FAT CLAY WITH GRAVEL, moist, brownish orange and light gray, estimated 15 - 25% rock fragments, estimated 5 - 10% fine grained sand, medium plasticity	CH			ST ST-1, 24 in 70.0-72.0 ft	24 (100)						
71	2437												
72	2436	72.0 - 76.0 ft: Auger probe, no samples taken, see boring B-51 for material descriptions.											
73	2435												
74	2434												

Bottom of boring at 76 ft. Boring terminated at selected depth.
Piezometer installed upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-51A
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal / Sue Buchanan
Equipment: Diedrich D-50 (ATV)
Method: 4-1/4" ID Hollow Stem Auger
Hammer Type: NA

Date Started: 03/17/2019 **Date Ended:** 03/18/2019
X: 1914807.2 ft **Y:** 118282.3 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2508.0 ft
Total Depth: 76.0 ft

Ground Water Levels

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	SAMPLE DATA REC (in., %)	SAMPLE DATA BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
76	2432	72.0 - 76.0 ft: Auger probe, no samples taken, see boring B-51 for material descriptions.											
77	2431												
78	2430												
79	2429												
80	2428												
81	2427												
82	2426												
83	2425												
84	2424												
85	2423												
86	2422												
87	2421												
88	2420												
89	2419												

Bottom of boring at 76 ft. Boring terminated at selected depth.
Piezometer installed upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-52
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Robin Reed
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/02/2019 **Date Ended:** 03/05/2019
X: 1914913.5 ft **Y:** 118305.4 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2508.0 ft
Total Depth: 85.2 ft

Ground Water Levels
Start of Day 46.2 ft 03/05/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
1	2507	0.0 - 0.1 ft: Topsoil 0.1 - 2.5 ft: FILL, sampled as LEAN CLAY WITH SAND, moist, yellowish brown, estimated 5 - 10% gravel, estimated <5% roots	CL		S3	SPT S-1, 24 in 0.0-2.0 ft	24 (100)	3-4-5-5					0.0 ft: Gravel-sized component generally refers to shale rock fragments 0.0 - 4.0 ft: Embankment Section No. 3. 2.5 - 3.5 ft: Augered through hard material. 4.0 - 65.0 ft: Embankment Section No. 2.
2	2506												
3	2505	2.5 - 4.0 ft: FILL, sampled as POORLY GRADED GRAVEL WITH SILT AND SAND, fine to coarse grained sand, moist, gray, estimated 15 - 25% fine to medium sand	GP-GM		S3	SPT S-2, 24 in 2.0-4.0 ft	21 (88)	3-7-10-8					
4	2504												
5	2503	4.0 - 17.0 ft: FILL, sampled as SANDY LEAN CLAY WITH GRAVEL, fine to coarse grained sand, subangular particles; moist, orangish brown and gray				SPT S-3, 24 in 4.0-6.0 ft	19 (79)	3-4-5-7					
6	2502	6.0 ft: Change to yellowish											
7	2501					SPT S-4, 24 in 6.0-8.0 ft	21 (88)	3-5-7-8					
8	2500												
9	2499		CL		S2	SPT S-5, 24 in 8.0-10.0 ft	22 (92)	4-5-7-8					
10	2498												
11	2497					SPT S-6, 24 in 10.0-12.0 ft	18 (75)	7-9-7-8					
12	2496												
13	2495					SPT S-7, 24 in 12.0-14.0 ft	22 (92)	3-5-9-10					
14	2494	14.0 ft: Change to orangish brown											

Bottom of boring at 85.2 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-52
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Robin Reed
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/02/2019 **Date Ended:** 03/05/2019
X: 1914913.5 ft **Y:** 118305.4 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2508.0 ft
Total Depth: 85.2 ft

Ground Water Levels
Start of Day 46.2 ft 03/05/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
16	2492	4.0 - 17.0 ft: FILL, sampled as SANDY LEAN CLAY WITH GRAVEL, fine to coarse grained sand, subangular particles; moist, orangish brown and gray				SPT S-8, 24 in 14.0-16.0 ft	19 (79)	4-8-10-9					
17	2491	17.0 - 17.5 ft: FILL, sampled as CLAYEY GRAVEL WITH SAND, medium to coarse grained sand, moist, orangish brown and gray	GC		S2	SPT S-9, 24 in 16.0-18.0 ft	20 (83)	2-5-4-5					
18	2490	17.5 - 20.0 ft: FILL, sampled as SANDY LEAN CLAY WITH GRAVEL, moist, yellowish brown	CL		S2								
19	2489					SPT S-10, 24 in 18.0-20.0 ft	22 (92)	2-4-5-7					
20	2488	20.0 - 21.5 ft: FILL, sampled as LEAN CLAY WITH SAND, moist, yellowish brown and gray	CL		S2								
21	2487					SPT S-11, 24 in 20.0-22.0 ft	22 (92)	2-5-8-12					
22	2486	21.5 - 24.0 ft: FILL, sampled as CLAYEY GRAVEL WITH SAND, fine to coarse grained sand, subangular particles; moist, yellowish brown and gray	GC		S2								
23	2485					SPT S-12, 24 in 22.0-24.0 ft	21 (88)	5-6-11-10					
24	2484	24.0 - 28.0 ft: FILL, sampled as SANDY LEAN CLAY WITH GRAVEL, moist, brown and yellowish brown											
25	2483					SPT S-13, 24 in 24.0-26.0 ft	24 (100)	4-7-9-12					
26	2482		CL		S2								
27	2481					SPT S-14, 24 in 26.0-28.0 ft	24 (100)	5-7-10-16					
28	2480	28.0 - 30.0 ft: FILL, sampled as CLAYEY GRAVEL WITH SAND, fine to coarse grained sand, subangular particles; moist, orangish brown and yellowish brown											28.0 ft: End of drilling for the day, 03/02/19.
29	2479		GC		S2	SPT S-15, 24 in 28.0-30.0 ft	22 (92)	5-6-13-12					

Bottom of boring at 85.2 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-52
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Robin Reed
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/02/2019 **Date Ended:** 03/05/2019
X: 1914913.5 ft **Y:** 118305.4 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2508.0 ft
Total Depth: 85.2 ft

Ground Water Levels
Start of Day 46.2 ft 03/05/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
31	2477	30.0 - 36.0 ft: FILL, sampled as SANDY LEAN CLAY moist, orangish brown, estimated 5 - 10% gravel	CL		S2	SPT S-16, 18 in 30.0-31.5 ft	24 (100)	5-8-8					
32	2476												
33	2475					ST ST-1, 24 in 32.0-34.0 ft	23 (96)						
34	2474												34.0 ft: Gravel in end of tube.
35	2473					ST ST-2, 24 in 34.0-36.0 ft	21 (86)						
36	2472	36.0 - 56.0 ft: FILL, sampled as CLAYEY GRAVEL WITH SAND, fine to coarse grained sand, moist, orangish brown and orange											36.0 ft: Shale rock fragment in bottom of sample, side of tube flattened slightly.
37	2471					SPT S-17, 24 in 36.0-38.0 ft	24 (100)	6-7-10-11					
38	2470												
39	2469					SPT S-18, 24 in 38.0-40.0 ft	21 (88)	7-6-9-11					
40	2468												
41	2467					SPT S-19, 24 in 40.0-42.0 ft	24 (100)	4-6-9-14					
42	2466												
43	2465					SPT S-20, 24 in 42.0-44.0 ft	24 (100)	5-11-15-18					
44	2464												

Bottom of boring at 85.2 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-52
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Robin Reed
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/02/2019 **Date Ended:** 03/05/2019
X: 1914913.5 ft **Y:** 118305.4 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2508.0 ft
Total Depth: 85.2 ft

Ground Water Levels
Start of Day 46.2 ft 03/05/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
46	2462	36.0 - 56.0 ft: FILL, sampled as CLAYEY GRAVEL WITH SAND, fine to coarse grained sand, moist, orangish brown and orange				SPT S-21, 24 in 44.0-46.0 ft	24 (100)	7-9-12-12					
47	2461					SPT S-22, 24 in 46.0-48.0 ft	24 (100)	5-9-11-13					
48	2460												48.0 ft: Augers binding, added approx.1 gallon of water.
49	2459					SPT S-23, 24 in 48.0-50.0 ft	24 (100)	4-6-8-11					
50	2458		GC		S2								50.0 ft: Top of sample wet, potentially from adding water at 48 ft.
51	2457					SPT S-24, 24 in 50.0-52.0 ft	19 (79)	4-7-8-11					
52	2456												
53	2455					SPT S-25, 24 in 52.0-54.0 ft	19 (79)	4-6-9-16					
54	2454												
55	2453					SPT S-26, 18 in 54.0-55.5 ft	24 (100)	5-7-8					
56	2452	56.0 - 60.0 ft: FILL, sampled as SANDY LEAN CLAY WITH GRAVEL, moist, brown and light reddish brown											
57	2451					SPT S-27, 24 in 56.0-58.0 ft	24 (100)	4-10-15-18					
58	2450		CL		S2								
59	2449					SPT S-28, 24 in 58.0-60.0 ft	24 (100)	7-8-8-12					

Bottom of boring at 85.2 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-52
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Robin Reed
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/02/2019 **Date Ended:** 03/05/2019
X: 1914913.5 ft **Y:** 118305.4 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2508.0 ft
Total Depth: 85.2 ft

Ground Water Levels
Start of Day 46.2 ft 03/05/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
61	2447	60.0 - 65.0 ft: FILL, sampled as CLAYEY GRAVEL fine to coarse grained sand, moist, orangish brown and grayish brown	GC		S2	SPT S-29, 24 in 60.0-62.0 ft	24 (100)	2-7-12-10					60.0 ft: Augers binding, added approx.1 gallon of water.
62	2446												
63	2445					SPT S-30, 24 in 62.0-64.0 ft	24 (100)	6-10-13-14					
64	2444												
65	2443	65.0 - 68.0 ft: LEAN CLAY moist, light orangish brown, residual	CL		R	SPT S-31, 24 in 64.0-66.0 ft	24 (100)	4-10-13-14					65.0 ft: Possible residual soil at 65 ft.
66	2442	66.0 ft: Change to mottles of gray											66.0 ft: Small amount of auger cuttings at top tube is wet, sample moist.
67	2441					ST ST-3, 24 in 66.0-68.0 ft	17 (71)						
68	2440	68.0 - 70.5 ft: LEAN CLAY WITH SAND, moist, orangish brown and brown, contains weathered shale rock fragments, residual	CL		R								67.0 ft: Only pushed tube 1.6 ft at 1000 psi, driller concerned about crushing tube.
69	2439					SPT S-32, 24 in 68.0-70.0 ft	24 (100)	5-12-20-30					
70	2438												
71	2437	70.5 - 71.0 ft: DISINTEGRATED	SP-SM		D	SPT S-33, 12 in 70.0-71.0 ft	12 (100)	28-50/6"					71.0 ft: Swelled in barrel, disintegrated rock.
72	2436	ROCK, sampled as POORLY GRADED SAND WITH SILT, fine and coarse grained sand, angular particles; grayish brown and orangish brown											
73	2435	71.0 - 85.2 ft: SHALE, very weak, highly weathered to moderately weathered, slightly fractured (2 - 6.5 ft), N3 (dark gray) to N1 (black), very thin bedded (<2.5 in), 0° to 10°, very fine grained				CORE C-1, 50 in 71.0-75.2 ft	50 (99)	0 (0)	1.9				*73.6 - 74.0 ft: Joint, 60°, slightly rough, planar, fresh*
74	2434												
								RQD(%)	DRILL RATE	PACKER			DISCONTINUITIES

Bottom of boring at 85.2 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING	TEST BORING LOG	Project:	Brush Creek Site 15 NRCS - West Virginia Mercer County, West Virginia	Boring Number:	B-52
				Contract Number:	18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Robin Reed
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/02/2019 **Date Ended:** 03/05/2019
X: 1914913.5 ft **Y:** 118305.4 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2508.0 ft
Total Depth: 85.2 ft

Ground Water Levels
Start of Day 46.2 ft 03/05/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	RQD (in., %)	DRILL RATE (ft/min)	PACKER (Lugeons)	REMARKS DISCONTINUITIES
76	2432	71.0 - 85.2 ft: SHALE, very weak, highly weathered to moderately weathered, slightly fractured (2 - 6.5 ft), N3 (dark gray) to N1 (black), very thin bedded (<2.5 in), 0° to 10°, very fine grained		B	CORE C-2, 60 in 75.2-80.2 ft	60 (100)	30 (50)	1.8		*71.0 - 85.2 ft: Bedding joint, 0°, smooth, planar, fresh* *76.5 - 80.2 ft: Joint, 90°, slightly rough, curved*
77	2431									
78	2430									
79	2429									
80	2428									
81	2427									
82	2426									
83	2425				CORE C-3, 60 in 80.2-85.2 ft	60 (100)	45 (75)	2.0		
84	2424									
85	2423									
86	2422									
87	2421									
88	2420									
89	2419									

Bottom of boring at 85.2 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-251
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal
Equipment: CME-55 (Track)
Method: HQ Triple Tube
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/12/2019 **Date Ended:** 03/12/2019
X: 1914339.2 ft **Y:** 118145.7 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2496.0 ft
Total Depth: 39.1 ft

Ground Water Levels
After Drilling 5.5 ft 03/12/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	SAMPLE DATA REC (in., %)	SAMPLE DATA BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
0	2496	0.0 - 0.4 ft: Topsoil											
1	2495	0.4 - 19.1 ft: CLAYEY GRAVEL moist, brownish gray with orangish brown, estimated 30 - 45% fines, estimated 5 - 10% sand, residual, weathered shale rock fragments	GC		R	SPT S-1, 24 in 0.0-2.0 ft	21 (88)	1-4-5-5					
2	2494												
3	2493	3.0 ft: Change to estimated 15 - 25% fines, estimated 5 - 10% sand											
4	2492												
5	2491					SPT S-2, 24 in 4.0-6.0 ft	22 (92)	15-25-0-3 8					
6	2490												
7	2489												
8	2488												
9	2487												
10	2486					SPT S-3, 24 in 9.0-11.0 ft	24 (100)	27-29-43-41					
11	2485												
12	2484												
13	2483												
14	2482												

Bottom of boring at 39.1 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-251
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal
Equipment: CME-55 (Track)
Method: HQ Triple Tube
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/12/2019 **Date Ended:** 03/12/2019
X: 1914339.2 ft **Y:** 118145.7 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2496.0 ft
Total Depth: 39.1 ft

Ground Water Levels
After Drilling 5.5 ft 03/12/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
16	2480	0.4 - 19.1 ft: CLAYEY GRAVEL moist, brownish gray with orangish brown, estimated 30 - 45% fines, estimated 5 - 10% sand, residual, weathered shale rock fragments				SPT S-4, 24 in 14.0-16.0 ft	20 (83)	8-12-20-23					
17	2479												
18	2478												
19	2477					SPT	1	50/1"					
20	2476	19.1 - 39.1 ft: SHALE, very weak to weak, severely weathered to highly weathered, intensely fractured (< 2.5 in) to highly fractured (2.5 - 8 in), N3 (dark gray), very thin bedded (<2.5 in), 0° to 10°				S-5, 1 in 19.0-19.0 ft	(100)						19.1 ft: Gray return water.
21	2475												
22	2474					CORE C-1, 60 in 19.1-24.1 ft	60 (100)	29 (48)	1.4				*21.7 - 22.4 ft: 60°, spotty (<50%), clay infilling, smooth, planar, slightly weathered*
23	2473												
24	2472				B								
25	2471												
26	2470												
27	2469					CORE C-2, 60 in 24.1-29.1 ft	53 (88)	30 (50)	1.2				
28	2468												
29	2467	29.3 ft: Change to highly weathered to moderately weathered, highly fractured (2.5 - 8											*19.1 - 39.1 ft: Bedding joint, 10°, spotty (<50%), clay infilling,*

RQD(%)	DRILL RATE	PACKER	DISCONTINUITIES

Bottom of boring at 39.1 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-251
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal
Equipment: CME-55 (Track)
Method: HQ Triple Tube
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/12/2019 **Date Ended:** 03/12/2019
X: 1914339.2 ft **Y:** 118145.7 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2496.0 ft
Total Depth: 39.1 ft

Ground Water Levels
After Drilling 5.5 ft 03/12/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	RQD (in., %)	DRILL RATE (ft/min)	PACKER (Lugeons)	REMARKS DISCONTINUITIES
31	2465	19.1 - 39.1 ft: SHALE, very weak to weak, severely weathered to highly weathered, intensely fractured (< 2.5 in) to highly fractured (2.5 - 8 in), N3 (dark gray), very thin bedded (<2.5 in), 0° to 10°								*slightly rough, planar, severely weathered to highly weathered, Shale severely weathered near bedding joints*
32	2464	29.3 ft: Change to highly weathered to moderately weathered, highly fractured (2.5 - 8 in) to moderately fractured (8 in - 2 ft).			CORE C-3, 60 in 29.1-34.1 ft	59 (98)	39 (65)	1.2		*31.1 - 31.6 ft: 45°, no infilling, smooth, planar, fresh to slightly weathered*
33	2463	32.7 ft: Change to severely weathered to highly weathered, intensely fractured (< 2.5 in) to highly fractured (2.5 - 8 in).								*32.7 - 33.3 ft: Bedding joint, 10°, clay infilling, severely weathered, Zone of severe weathering, weathered into soil.*
34	2462									
35	2461									
36	2460	35.8 ft: Change to highly weathered, moderately fractured (8 in - 2 ft).								*33.4 - 34.0 ft: 60°, no infilling, slightly rough, curved, fresh to slightly weathered*
37	2459				CORE C-4, 60 in 34.1-39.1 ft	52 (87)	32 (53)	1.3		
38	2458									
39	2457									
40	2456									
41	2455									
42	2454									
43	2453									
44	2452									

Bottom of boring at 39.1 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-252
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal
Equipment: CME-55 (Track)
Method: HQ Triple Tube
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/12/2019 **Date Ended:** 03/12/2019
X: 1914321.4 ft **Y:** 118242.3 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2495.0 ft
Total Depth: 20.9 ft

Ground Water Levels
After Drilling 2.0 ft 03/12/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	SAMPLE DATA REC (in., %)	SAMPLE DATA BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
0	2495	0.0 - 0.4 ft: Topsoil											
1	2494	0.4 - 1.4 ft: FILL, sampled as GRAVELLY LEAN CLAY moist, orangish brown with dark gray, estimated 30 - 45% rock fragments, estimated 5 - 10% fine and coarse sand, weathered shale rock fragments	CL		F	SPT S-1, 24 in 0.0-2.0 ft	21 (88)	0-3-6-8					
2	2493												
3	2492	1.4 - 10.9 ft: CLAYEY GRAVEL WITH SAND, moist, brownish gray with orangish brown, estimated 15 - 25% fines, estimated 15 - 25% sand, residual, weathered shale rock fragments											
4	2491												
5	2490	3.6 ft: Change to wet, estimated 30 - 45% fines, estimated 5 - 10% sand, severely weathered shale				SPT S-2, 24 in 4.0-6.0 ft	23 (96)	16-10-8-5					
6	2489		GC		R								
7	2488												
8	2487												
9	2486												
10	2485	10.3 ft: Change to moist				SPT S-3, 23 in 9.0-10.9 ft	20 (88)	2-4-10-50 /5"					
11	2484	10.9 - 20.9 ft: SHALE, very weak to weak, highly weathered to moderately weathered, highly fractured (2.5 - 8 in) to moderately fractured (8 in - 2 ft), N3 (dark gray), very thin bedded (<2.5 in), 0° to 10°											10.9 ft: Gray return water. *11.2 ft: Bedding joint, 10°, spotty (<50%), clay infilling, slightly rough, planar, severely weathered to highly weathered, Shale severely weathered near bedding joints*
12	2483												
13	2482								1.1				
14	2481					CORE C-1, 60 in 10.9-15.9 ft	59 (98)	48 (80)					

RQD(%)	DRILL RATE	PACKER	DISCONTINUITIES

Bottom of boring at 20.9 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-252
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal
Equipment: CME-55 (Track)
Method: HQ Triple Tube
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/12/2019 **Date Ended:** 03/12/2019
X: 1914321.4 ft **Y:** 118242.3 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2495.0 ft
Total Depth: 20.9 ft

Ground Water Levels
After Drilling 2.0 ft 03/12/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	RQD (in., %)	DRILL RATE (ft/min)	PACKER (Lugeons)	REMARKS DISCONTINUITIES
16	2479	10.9 - 20.9 ft: SHALE, very weak to weak, highly weathered to moderately weathered, highly fractured (2.5 - 8 in) to moderately fractured (8 in - 2 ft), N3 (dark gray), very thin bedded (<2.5 in), 0° to 10°								
17	2478	15.7 ft: Change to moderately weathered to slightly weathered, slightly fractured (2 - 6.5 ft).								
18	2477			B	CORE C-2, 60 in 15.9-20.9 ft	60 (100)	60 (100)	1.0		
19	2476									
20	2475									
21	2474									
22	2473									
23	2472									
24	2471									
25	2470									
26	2469									
27	2468									
28	2467									
29	2466									

Bottom of boring at 20.9 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-253
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Robin Reed
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/05/2019 **Date Ended:** 03/06/2019
X: 1914405.0 ft **Y:** 118255.6 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2501.0 ft
Total Depth: 39.4 ft

Ground Water Levels
Completion 33.5 ft 03/06/2019
After Drilling 15.0 ft 03/06/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	SAMPLE DATA REC (in., %)	SAMPLE DATA BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
0	2501	0.0 - 0.2 ft: Topsoil											
1	2500	0.2 - 4.8 ft: FILL, sampled as SANDY SILT moist, brown mottles of gray	ML		F	SPT S-1, 24 in 0.0-2.0 ft	18 (75)	2-3-5-6					
2	2499												
3	2498												
4	2497												
5	2496	4.8 - 10.2 ft: LEAN CLAY moist, light orangish brown and gray, residual	CL		R	SPT S-2, 24 in 4.0-6.0 ft	21 (88)	3-5-7-8					
6	2495												
7	2494												
8	2493												
9	2492												
10	2491	10.2 - 14.0 ft: SILT moist, light grayish brown, residual	ML		R	SPT S-3, 24 in 9.0-11.0 ft	21 (88)	4-4-7-8					
11	2490												
12	2489												
13	2488												
14	2487	14.0 - 19.5 ft: SILT WITH SAND, angular particles; moist, light grayish brown, residual											

Bottom of boring at 39.4 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-253
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Robin Reed
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/05/2019 **Date Ended:** 03/06/2019
X: 1914405.0 ft **Y:** 118255.6 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2501.0 ft
Total Depth: 39.4 ft

Ground Water Levels
Completion 33.5 ft 03/06/2019
After Drilling 15.0 ft 03/06/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	SAMPLE DATA REC (in., %)	SAMPLE DATA BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
16	2485	14.0 - 19.5 ft: SILT WITH SAND, angular particles; moist, light grayish brown, residual	ML		R	SPT S-4, 24 in 14.0-16.0 ft	24 (100)	3-6-8-12					
17	2484												
18	2483												
19	2482												
20	2481	19.5 - 24.0 ft: POORLY GRADED GRAVEL WITH SILT, angular particles; moist, gray, estimated 5 - 10% fine to medium sand, residual	GP-GM		R		24 (100)	14-21-27-33					
21	2480												21.0 ft: End of drilling for the day, 03/05/19.
22	2479												
23	2478												
24	2477	24.0 - 29.5 ft: CLAYEY GRAVEL WITH SAND, fine to coarse, angular particles; moist, orangish brown streaks of grayish brown, residual	GC		R	SPT S-6, 24 in 24.0-26.0 ft	24 (100)	8-9-8-14					
25	2476												
26	2475												
27	2474												
28	2473												
29	2472												
		29.5 - 33.5 ft: POORLY GRADED											

Bottom of boring at 39.4 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-253
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Robin Reed
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/05/2019 **Date Ended:** 03/06/2019
X: 1914405.0 ft **Y:** 118255.6 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2501.0 ft
Total Depth: 39.4 ft

Ground Water Levels
Completion 33.5 ft 03/06/2019
After Drilling 15.0 ft 03/06/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
31	2470	29.5 - 33.5 ft: POORLY GRADED GRAVEL WITH SAND, moist, grayish brown streaks of orange, residual	GP		R	SPT S-7, 24 in 29.0-31.0 ft	24 (100)	18-23-24-22					
32	2469												
33	2468												
34	2467	33.5 - 34.4 ft: DISINTEGRATED ROCK, sampled as POORLY GRADED GRAVEL WITH SAND, fine to coarse, angular particles; gray streaks of orange	GP		D	SPT S-8, 5 in 34.0-34.4 ft	5 (99)	50/5"					
35	2466												
36	2465	34.4 - 39.4 ft: SHALE, very weak to very strong, fresh to slightly weathered, N3 (dark gray), very thin bedded (<2.5 in), 0° to 10° very fine grained, intensely fractured from 34.4 to 35.9 feet.			B	CORE C-1, 60 in 34.4-39.4 ft	59 (98)	31 (52)					*34.4 - 39.4 ft: Joint, 60°, slightly rough, planar, fresh* *34.4 - 39.4 ft: Joint, 90°, slightly rough, planar, slightly weathered*
37	2464												
38	2463												
39	2462												
40	2461												
41	2460												
42	2459												
43	2458												
44	2457												

RQD(%)	DRILL RATE	PACKER	DISCONTINUITIES

Bottom of boring at 39.4 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-254
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal
Equipment: CME-55 (Track)
Method: HQ Triple Tube
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/11/2019 **Date Ended:** 03/12/2019
X: 1914269.6 ft **Y:** 118325.8 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2493.0 ft
Total Depth: 14.4 ft

Ground Water Levels
After Drilling 03/11/2019 Dry

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
0		0.0 - 0.4 ft: Topsoil											
1	2492	0.4 - 1.2 ft: FILL, sampled as LEAN CLAY WITH GRAVEL, moist, brown, estimated 15 - 25% rock fragments, weathered shale rock fragments	CL		F	SPT S-1, 24 in 0.0-2.0 ft	23 (96)	0-3-14-32					
2	2491												
3	2490	1.2 - 4.4 ft: WELL GRADED GRAVEL WITH CLAY AND SAND, moist, gray with orangish brown, estimated 15 - 25% fines, estimated 15 - 25% sand, residual, weathered shale rock fragments	GW-GC		R								
4	2489	4.0 ft: Change to wet				SPT S-2, 5 in 4.0-4.4 ft	5 (99)	50/5"					
5	2488	4.4 - 14.4 ft: SHALE, very weak to weak, severely weathered to moderately weathered, highly fractured (2.5 - 8 in) to moderately fractured (8 in - 2 ft), N3 (dark gray), very thin bedded (<2.5 in), 0° to 10°											4.4 ft: End of drilling for the day, 03/11/19. 4.4 ft: Gray return water.
6	2487												
7	2486					CORE C-1, 60 in 4.4-9.4 ft	59 (98)	42 (70)	1.7				*4.4 - 8.7 ft: Bedding joint, 10°, spotty (<50%), clay infilling, slightly rough, planar, severely weathered to highly weathered, Shale highly weathered near bedding joints*
8	2485												
9	2484				B								
10	2483												*9.6 - 10.3 ft: Joint, 60°, spotty (<50%), iron-oxide staining, smooth, planar, slightly weathered*
11	2482												
12	2481					CORE C-2, 60 in 9.4-14.4 ft	55 (92)	44 (73)	1.4				*10.7 - 14.0 ft: Joint, 80°, clay infilling, slightly rough, undulating, slightly weathered*
13	2480												
14	2479												14.0 ft: Unable to retrieve appox. 5 inches of core at bottom of boring.

RQD(%)	DRILL RATE	PACKER	DISCONTINUITIES

Bottom of boring at 14.4 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-255
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal
Equipment: CME-55 (Track)
Method: HQ Triple Tube
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/11/2019 **Date Ended:** 03/11/2019
X: 1914365.0 ft **Y:** 118335.2 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2493.0 ft
Total Depth: 25.8 ft

Ground Water Levels
After Drilling 03/11/2019
Dry

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
		0.0 - 0.5 ft: Topsoil											
1	2492	0.5 - 3.3 ft: FILL, sampled as GRAVELLY LEAN CLAY moist, light gray and orangish brown, estimated 30 - 45% rock fragments, estimated 5 - 10% fine to medium sand, weathered shale rock fragments	CL		F	SPT S-1, 24 in 0.0-2.0 ft	22 (92)	0-3-5-6					
2	2491												
3	2490					ST ST-1A, 16 in 2.0-3.3 ft	15 (94)						3.3 ft: Tube refusal.
4	2489	3.3 - 15.8 ft: WELL GRADED GRAVEL WITH CLAY AND SAND, moist, gray with orangish brown, estimated 15 - 25% fines, estimated 15 - 25% sand, residual, weathered shale rock fragments											
5	2488					SPT S-2, 24 in 4.0-6.0 ft	22 (92)	25-37-24-29					
6	2487												
7	2486												
8	2485												
9	2484		GW-GC		R								
10	2483					SPT S-3, 24 in 9.0-11.0 ft	22 (92)	9-7-11-13					
11	2482												
12	2481												
13	2480												
14	2479						21 (101)	12-15-19-50/3"					

Bottom of boring at 25.8 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-255
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal
Equipment: CME-55 (Track)
Method: HQ Triple Tube
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/11/2019 **Date Ended:** 03/11/2019
X: 1914365.0 ft **Y:** 118335.2 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2493.0 ft
Total Depth: 25.8 ft

Ground Water Levels
After Drilling 03/11/2019 Dry

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	SAMPLE DATA REC (in., %)	SAMPLE DATA BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
		3.3 - 15.8 ft: WELL GRADED GRAVEL WITH CLAY AND SAND,				SPT S-4, 21 in 14.0-15.8 ft							15.1 ft: Outside of sampler wet.
16	2477	moist, gray with orangish brown, estimated 15 - 25% fines, estimated 15 - 25% sand, residual, weathered shale rock fragments											15.8 ft: Gray return water.
17	2476	15.1 ft: Change to wet											
18	2475	15.8 - 25.8 ft: SHALE, very weak to weak, severely weathered to slightly weathered, highly fractured (2.5 - 8 in) to moderately fractured (8 in - 2 ft), N3 (dark gray), very thin bedded (<2.5 in), 0° to 10°				CORE C-1, 60 in 15.8-20.8 ft	59 (98)	27 (45)	1.5				*17.2 - 20.7 ft: Joint, 80°, slightly rough, planar, slightly weathered*
19	2474												
20	2473												
21	2472				B								*15.8 - 25.8 ft: Bedding joint, 0°, spotty (<50%), clay soil/ matrix infilling, slightly rough, planar, severely weathered to highly weathered, Shale severely weathered near bedding joints*
22	2471												
23	2470					CORE C-2, 60 in 20.8-25.8 ft	54 (90)	36 (60)	1.7				
24	2469												
25	2468												
26	2467												
27	2466												
28	2465												
29	2464												

RQD(%)	DRILL RATE	PACKER	DISCONTINUITIES

Bottom of boring at 25.8 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-256
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: R. Carver
Schnabel Representative: Corey Schaal
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 02/26/2019 **Date Ended:** 02/26/2019
X: 1914433.1 ft **Y:** 118345.3 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2485.0 ft
Total Depth: 24.7 ft

Ground Water Levels
Completion 4.1 ft 02/26/2019
After Drilling 6.5 ft 02/27/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	SAMPLE DATA REC (in., %)	SAMPLE DATA BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
		0.0 - 0.5 ft: Topsoil											
1	2484	0.5 - 3.2 ft: FILL, sampled as SILT WITH SAND, moist, brown, estimated 15 - 25% sand, estimated <5% rock fragments, weathered shale rock fragments	ML		F	SPT S-1, 24 in 0.0-2.0 ft	19 (79)	0-3-3-4					
2	2483												
3	2482												
4	2481	3.2 - 7.8 ft: SILTY SAND moist, brown to reddish brown, estimated 15 - 25% fines, estimated <5% rock fragments, residual, weathered shale rock fragments	SM		R	SPT S-2, 24 in 4.3-6.3 ft	24 (100)	6-8-8-9					
5	2480												
6	2479												
7	2478												
8	2477	7.8 - 12.8 ft: SILTY SAND moist, orangish brown mottles of dark brown, residual	SM		R	SPT S-3, 24 in 9.3-11.3 ft	21 (88)	5-8-8-12					
9	2476												
10	2475												
11	2474												
12	2473												
13	2472	12.8 - 15.8 ft: SANDY SILT moist, orangish brown mottles of dark brown, residual	ML		R								
14	2471												

Bottom of boring at 24.7 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-256
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: R. Carver
Schnabel Representative: Corey Schaal
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 02/26/2019 **Date Ended:** 02/26/2019
X: 1914433.1 ft **Y:** 118345.3 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2485.0 ft
Total Depth: 24.7 ft

Ground Water Levels
Completion 4.1 ft 02/26/2019
After Drilling 6.5 ft 02/27/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
16	2469	12.8 - 15.8 ft: SANDY SILT moist, orangish brown mottles of dark brown, residual				SPT S-4, 18 in 14.3-15.8 ft	22 (92)	4-4-14-22					
		15.8 - 19.3 ft: SILTY GRAVEL moist, gray, residual				SPT S-5, 6 in 15.8-16.3 ft							
17	2468		GM		R								
18	2467												
19	2466	19.3 - 19.7 ft: DISINTEGRATED	GM		D	SPT S-6, 5 in 19.3-19.7 ft	5 (99)	50/5"					
20	2465	ROCK, sampled as SILTY GRAVEL wet, gray to dark gray											
21	2464	19.7 - 24.7 ft: SHALE, very weak to weak, fresh to slightly weathered, intensely fractured (< 2.5 in) to highly fractured (2.5 - 8 in), N3 (dark gray), very thin bedded (<2.5 in), 0° to 10°											19.7 - 22.2 ft: Gray return water. *19.7 - 23.3 ft: Joint, clay soil/matrix infilling, slightly rough, planar, slightly weathered to moderately weathered*
22	2463				B	CORE C-1, 60 in 19.7-24.7 ft	30 (50)	15 (25)	2.0				
23	2462												
24	2461	23.4 ft: Change to moderately fractured (8 in - 2 ft).											
25	2460												
26	2459												
27	2458												
28	2457												
29	2456												

RQD(%)	DRILL RATE	PACKER	DISCONTINUITIES

Bottom of boring at 24.7 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-257
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: R. Carver
Schnabel Representative: Corey Schaal
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 02/26/2019 **Date Ended:** 02/26/2019
X: 1914306.9 ft **Y:** 118440.3 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2491.0 ft
Total Depth: 49.9 ft

Ground Water Levels
Completion 16.3 ft 02/26/2019
After Drilling 7.0 ft 02/26/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	SAMPLE DATA REC (in., %)	SAMPLE DATA BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
1	2490	0.0 - 0.1 ft: Topsoil 0.1 - 0.5 ft: FILL, sampled as SILT WITH SAND, moist, grayish brown, estimated 15 - 25% sand, estimated <5% rock fragments, weathered shale rock fragments	ML			SPT S-1, 24 in 0.0-2.0 ft	16 (67)	1-5-19-32					
2	2489	0.5 - 5.0 ft: POORLY GRADED GRAVEL WITH SILT AND SAND, moist, gray to, residual	GP-GM		R								
3	2488												
4	2487												
5	2486		SM		D	SPT	4	50/4"					
6	2485	5.0 - 5.3 ft: DISINTEGRATED ROCK, sampled as SILTY SAND moist, gray, estimated 15 - 25% fines, estimated <5% rock fragments, weathered shale rock fragments				S-2, 4 in 5.0-5.3 ft	(100)						5.3 ft: Gray return water.
7	2484	5.3 - 49.9 ft: SHALE, very weak, fresh to slightly weathered, slightly fractured (2 - 6.5 ft) to very slightly fractured (> 6.5 ft), N3 (dark gray), very thin bedded (<2.5 in), 0° to 10°											
8	2483	7.1 - 7.6 ft: Change to intensely fractured (< 2.5 in), highly to severely weathered.				CORE C-1, 60 in 5.3-10.3 ft	43 (72)	36 (60)	1.9				*8.1 - 8.6 ft: Joint, iron-oxide staining infilling, smooth, planar*
9	2482												
10	2481												
11	2480												
12	2479												
13	2478					CORE C-2, 60 in 10.3-15.3 ft	57 (95)	57 (95)	1.8				*10.0 - 15.0 ft: Joint, 80°, iron-oxide staining infilling, smooth, planar, slightly weathered*
14	2477												

RQD(%)	DRILL RATE	PACKER	DISCONTINUITIES

Bottom of boring at 49.9 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING	TEST BORING LOG	Project:	Brush Creek Site 15 NRCS - West Virginia Mercer County, West Virginia	Boring Number:	B-257
				Contract Number:	18C35013.04

Contractor: Horn & Associates
Contractor Foreman: R. Carver
Schnabel Representative: Corey Schaal
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 02/26/2019 **Date Ended:** 02/26/2019
X: 1914306.9 ft **Y:** 118440.3 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2491.0 ft
Total Depth: 49.9 ft

Ground Water Levels
Completion 16.3 ft 02/26/2019
After Drilling 7.0 ft 02/26/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	RQD (in., %)	DRILL RATE (ft/min)	PACKER (Lugeons)	REMARKS DISCONTINUITIES
16	2475	5.3 - 49.9 ft: SHALE, very weak, fresh to slightly weathered, slightly fractured (2 - 6.5 ft) to very slightly fractured (> 6.5 ft), N3 (dark gray), very thin bedded (<2.5 in), 0° to 10°								
17	2474									
18	2473				CORE C-3, 55 in 15.3-19.9 ft	55 (100)	55 (100)	3.2		
19	2472									
20	2471									
21	2470									*19.5 - 22.5 ft: Joint, 80°, iron-oxide staining infilling, smooth, planar, slightly weathered, Potentially same joint as above.* **22.1 ft: Core barrel blocked off.**
22	2469			B						
23	2468				CORE C-4, 60 in 19.9-24.9 ft	55 (92)	32 (53)	2.3		
24	2467									
25	2466									
26	2465									*25.7 - 26.4 ft: Joint, 80°, iron-oxide staining infilling, smooth, planar, slightly weathered* *27.2 - 27.6 ft: Joint, 80°, iron-oxide staining infilling, smooth, planar, highly weathered* **28.0 ft: No return water.**
27	2464				CORE C-5, 60 in 24.9-29.9 ft	55 (92)	23 (38)	1.7		
28	2463									
29	2462									

Bottom of boring at 49.9 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-257
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: R. Carver
Schnabel Representative: Corey Schaal
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 02/26/2019 **Date Ended:** 02/26/2019
X: 1914306.9 ft **Y:** 118440.3 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2491.0 ft
Total Depth: 49.9 ft

Ground Water Levels
Completion 16.3 ft 02/26/2019
After Drilling 7.0 ft 02/26/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	RQD (in., %)	DRILL RATE (ft/min)	PACKER (Lugeons)	REMARKS DISCONTINUITIES
31	2460	5.3 - 49.9 ft: SHALE, very weak, fresh to slightly weathered, slightly fractured (2 - 6.5 ft) to very slightly fractured (> 6.5 ft), N3 (dark gray), very thin bedded (<2.5 in), 0° to 10°								*29.3 - 29.9 ft: Joint, smooth, planar, severely weathered*
32	2459	32.0 ft: Change to intensely fractured (< 2.5 in) to highly fractured (2.5 - 8 in), slickensides, spotty clay coating on some bedding planes.			CORE C-6, 60 in 29.9-34.9 ft	53 (88)	42 (70)	2.8		**32.8 ft: Core barrel blocked off.** *32.0 - 35.2 ft: Joint, 30°, smooth, undulating*
33	2458									
34	2457									
35	2456									
36	2455	35.8 ft: Change to weak to medium strong, calcareous								*35.8 ft: Bedding joint, 10°, calcite infilling, smooth, planar*
37	2454				CORE C-7, 60 in 34.9-39.9 ft	60 (100)	56 (93)	1.5		
38	2453									
39	2452									
40	2451									
41	2450									
42	2449				CORE C-8, 60 in 39.9-44.9 ft	60 (100)	55 (92)	1.8		*42.1 - 42.3 ft: Bedding joint, 10°, planar, highly weathered*
43	2448									
44	2447									

Bottom of boring at 49.9 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-257
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: R. Carver
Schnabel Representative: Corey Schaal
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 02/26/2019 **Date Ended:** 02/26/2019
X: 1914306.9 ft **Y:** 118440.3 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2491.0 ft
Total Depth: 49.9 ft

Ground Water Levels
Completion 16.3 ft 02/26/2019
After Drilling 7.0 ft 02/26/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	RQD (in., %)	DRILL RATE (ft/min)	PACKER (Lugeons)	REMARKS DISCONTINUITIES
46	2445	5.3 - 49.9 ft: SHALE, very weak, fresh to slightly weathered, slightly fractured (2 - 6.5 ft) to very slightly fractured (> 6.5 ft), N3 (dark gray), very thin bedded (<2.5 in), 0° to 10°								
47	2444									
48	2443				CORE C-9, 60 in 44.9-49.9 ft	56 (93)	56 (93)	1.7		
49	2442									
50	2441									
51	2440									
52	2439									
53	2438									
54	2437									
55	2436									
56	2435									
57	2434									
58	2433									
59	2432									

Bottom of boring at 49.9 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-651
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Sue Buchanan
Equipment: Diedrich D-50 (ATV)
Method: HQ Triple Tube
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/18/2019 **Date Ended:** 03/18/2019
X: 1914720.3 ft **Y:** 118446.8 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2439.0 ft
Total Depth: 26.0 ft

Ground Water Levels
Completion 0.0 ft 03/18/2019
After Drilling 0.2 ft 03/19/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
0	2439	0.0 - 0.2 ft: Topsoil											0.0 ft: Piezometer installed. See piezometer installation sketch for additional details. 0.0 ft: Artesian conditions were not encountered during soil drilling or rock coring, but were observed after piezometer installation.
1	2438	0.2 - 2.0 ft: FILL, sampled as SANDY SILT moist, orangish brown and light gray, estimated 30 - 45% fine to medium sand, estimated 5 - 10% fine to coarse gravel, contains roots, low plasticity	ML		F	SPT S-1, 24 in 0.0-2.0 ft	16 (67)	0-2-1-1					
2	2437												
3	2436	2.0 - 8.0 ft: FILL, sampled as CLAYEY SAND fine to medium grained sand, moist, gray with light greenish gray, estimated 30 - 45% fines, contains pockets of Lean Clay (CL)				SPT S-2, 24 in 2.0-4.0 ft	16 (67)	1-2-2-4					
4	2435												
5	2434		SC		F	ST ST-1, 24 in 4.0-6.0 ft	21 (88)						
6	2433												
7	2432					ST ST-2, 24 in 6.0-8.0 ft	0 (0)						
8	2431	8.0 - 10.5 ft: CLAYEY SAND fine to medium grained sand, wet, light gray, estimated 30 - 45% fines, estimated 5 - 10% fine to coarse gravel, alluvial				ST ST-2, 24 in 6.0-8.0 ft							
9	2430		SC		A	SPT S-3, 24 in 8.0-10.0 ft	14 (58)	4-4-2-3					
10	2429												
11	2428	10.5 - 12.0 ft: LEAN CLAY moist, gray, low to medium plasticity, residual	CL		R	SPT S-4, 24 in 10.0-12.0 ft	23 (96)	1-3-5-11					
12	2427	12.0 - 12.6 ft: FAT CLAY wet, gray, medium to high plasticity, residual	CH		R	SPT S-5, 7 in 12.0-12.6 ft	21 (88)	5-14-15-19					
13	2426	12.6 - 16.0 ft: LEAN CLAY wet, gray, low to medium plasticity, residual											
14	2425		CL		R	SPT S-6, 17 in 12.6-14.0 ft							

Bottom of boring at 26 ft. Boring terminated at selected depth.
Piezometer installed upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-651
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Sue Buchanan
Equipment: Diedrich D-50 (ATV)
Method: HQ Triple Tube
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/18/2019 **Date Ended:** 03/18/2019
X: 1914720.3 ft **Y:** 118446.8 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2439.0 ft
Total Depth: 26.0 ft

Ground Water Levels
Completion 0.0 ft 03/18/2019
After Drilling 0.2 ft 03/19/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
16	2423	12.6 - 16.0 ft: LEAN CLAY wet, gray, low to medium plasticity, residual				SPT S-7, 24 in 14.0-16.0 ft	24 (100)	8-14-18-19					
		16.0 - 16.5 ft: DISINTEGRATED	CL		D	SPT S-8, 6 in 16.0-16.5 ft	6 (100)	50/6"					
17	2422	ROCK, sampled as LEAN CLAY wet, gray, low plasticity											16.5 ft: Gray return water.
18	2421	16.5 - 26.0 ft: SHALE, strong to medium strong, fresh to slightly weathered, moderately fractured (8 in - 2 ft) to highly fractured (2.5 - 8 in), N3 (dark gray) to N1 (black), thin bedded (2 - 8 in), 0° to 10°, argillaceous, weak HCL reaction											*18.4 ft: Bedding joint, 5°, smooth, planar*
19	2420	17.0 - 17.5 ft: Change to severely weathered, very weak, intensely fractured.				CORE C-1, 54 in 16.5-21.0 ft	54 (100)	29 (54)	1.3				
20	2419	19.5 - 19.9 ft: Change to severely weathered, very weak, intensely fractured.											*20.6 ft: Bedding joint, 5°, smooth, planar*
21	2418				B								21.0 ft: Core barrel blocked off, barrel full from soil fall-in.
22	2417									18.5-26.0 ft: 147			18.5 - 26.0 ft: Packer test performed, one step only.
23	2416												
24	2415					CORE C-2, 60 in 21.0-26.0 ft	59 (98)	47 (78)	1.1				
25	2414												*25.4 ft: Bedding joint, 5°, smooth, planar*
26	2413												
27	2412												
28	2411												
29	2410												

RQD(%)	DRILL RATE	PACKER	DISCONTINUITIES

Bottom of boring at 26 ft. Boring terminated at selected depth.
Piezometer installed upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-652
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Sue Buchanan
Equipment: Diedrich D-50 (ATV)
Method: HQ Triple Tube
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/19/2019 **Date Ended:** 03/19/2019
X: 1914821.4 ft **Y:** 118483.6 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2439.0 ft
Total Depth: 17.7 ft

Ground Water Levels
After Drilling 6.1 ft 03/19/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
1	2438	0.0 - 0.1 ft: Topsoil 0.1 - 4.0 ft: FILL, sampled as SILTY SAND WITH GRAVEL, fine to medium grained sand, moist, orangish brown and gray, estimated 30 - 45% roots, estimated 15 - 25% fine to coarse gravel	SM		F	SPT S-1, 24 in 0.0-2.0 ft	2 (8)	1-3-2-4					0.0 ft: Artesian conditions not observed.
2	2437												
3	2436					SPT S-2, 24 in 2.0-4.0 ft	14 (58)	2-3-3-3					
4	2435	4.0 - 6.0 ft: FILL, sampled as CLAYEY SAND fine to medium grained sand, moist, light orangish brown mottles of light bluish gray, estimated 30 - 45% fines, estimated <5% fine to coarse gravel	SC		F								
5	2434					SPT S-3, 24 in 4.0-6.0 ft	13 (54)	2-10-23-1 1					
6	2433		ML		R	SS S-4a, 6 in 6.0-6.5 ft							6.0 - 7.3 ft: 3" ID split spoon sampler
7	2432	6.0 - 6.5 ft: SILT WITH SAND, moist, dark gray to black, estimated 5 - 10% fine grained sand, nonplastic to low plasticity, residual	ML		D	SS S-4b, 10 in 6.5-7.3 ft	15 (94)	12-41-50 /4"					
8	2431	6.5 - 7.7 ft: DISINTEGRATED ROCK, sampled as SILT moist, dark gray to black, estimated 5 - 10% fine grained sand, nonplastic to low plasticity, Iron staining on weathered surfaces			B								7.7 ft: Black return water. *8.1 ft: Bedding joint, 10°, spotty (<50%), iron-oxide staining, slightly rough, planar, slightly weathered* *9.2 ft: Bedding joint, 20°, smooth, planar, fresh* *10.0 ft: Contact joint, 15°, healed/cemented infilling* *11.8 ft: Bedding joint, 20°, spotty (<50%), quartz infilling, smooth, planar, fresh* 13.0 ft: Brownish gray return water. 9.7 - 17.7 ft: Packer test performed, one step only.
9	2430												
10	2429	7.7 - 10.0 ft: SHALE, medium strong, fresh to slightly weathered, moderately fractured (8 in - 2 ft) to highly fractured (2.5 - 8 in), N2 (grayish black), thin bedded (2 - 8 in), 10° to 20°, argillaceous, weak HCL reaction				CORE C-1, 60 in 7.7-12.7 ft	60 (100)	30 (50)	0.9				
11	2428												
12	2427	10.0 - 14.0 ft: CLAYSTONE, weak to very weak, fresh to slightly weathered, moderately fractured (8 in - 2 ft) to intensely fractured (< 2.5 in), N4 (medium dark gray), thin bedded (2 - 8 in), 10° to 20°, weak HCL reaction			B					9.7-17.7 ft: 324			
13	2426												
14	2425	14.0 - 17.7 ft: SHALE, medium strong, fresh to slightly weathered, moderately fractured (8 in - 2 ft), N2 (grayish black),											
								RQD(%)	DRILL RATE	PACKER			DISCONTINUITIES

Bottom of boring at 17.7 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-652
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Sue Buchanan
Equipment: Diedrich D-50 (ATV)
Method: HQ Triple Tube
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 03/19/2019 **Date Ended:** 03/19/2019
X: 1914821.4 ft **Y:** 118483.6 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2439.0 ft
Total Depth: 17.7 ft

Ground Water Levels
After Drilling 6.1 ft 03/19/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	RQD (in., %)	DRILL RATE (ft/min)	PACKER (Lugeons)	REMARKS DISCONTINUITIES
16	2423	14.0 - 17.7 ft: SHALE, medium strong, fresh to slightly weathered, moderately fractured (8 in - 2 ft), N2 (grayish black), thin bedded (2 - 8 in), 10° to 20°, argillaceous, weak HCL reaction		B	CORE C-2, 60 in 12.7-17.7 ft	44 (73)	25 (42)	1.2		*14.0 ft: Contact joint, 30°, healed/cemented infilling, undulating* *16.3 ft: Joint, 30°, healed/cemented infilling, smooth, planar, fresh* *16.4 ft: Joint, 40°, smooth, planar, fresh*
17	2422									
18	2421									
19	2420									
20	2419									
21	2418									
22	2417									
23	2416									
24	2415									
25	2414									
26	2413									
27	2412									
28	2411									
29	2410									

Bottom of boring at 17.7 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-653
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal / Robin Reed
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 02/27/2019 **Date Ended:** 03/01/2019
X: 1914792.1 ft **Y:** 118241.0 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2500.0 ft
Total Depth: 86.0 ft

Ground Water Levels
Start of Day 42.5 ft 02/28/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	SAMPLE DATA REC (in., %)	SAMPLE DATA BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
		0.0 - 0.4 ft: Topsoil											0.0 - 22.4 ft: Embankment Section No. 2.
1	2499	0.4 - 22.4 ft: FILL, sampled as SANDY LEAN CLAY WITH SAND, moist, orangish brown with gray, estimated 30 - 45% sand, contains roots				SPT S-1, 24 in 0.0-2.0 ft	18 (75)	1-2-2-5					
2	2498	2.0 ft: Change to estimated 15 - 25% gravel											
3	2497					SPT S-2, 24 in 2.0-4.0 ft	20 (83)	3-5-7-9					
4	2496												
5	2495					ST ST-1A, 24 in 4.0-6.0 ft	23 (96)						
6	2494												
7	2493												
8	2492		CL		S2	ST ST-1B, 24 in 6.5-8.5 ft	13 (54)						
		8.5 ft: Change to no roots											
9	2491												
10	2490					SPT S-3, 24 in 8.5-10.5 ft	13 (54)	3-6-5-8					
		10.5 ft: Change to light brown and light gray, estimated 15 - 25% sand, estimated 5 - 10% rock fragments											11.0 ft: Outside of sampler wet.
11	2489												
12	2488	12.0 ft: Change to estimated 5 - 10% sand, estimated <5% rock fragments				SPT S-4, 24 in 10.5-12.5 ft	19 (79)	3-5-8-17					
13	2487												
14	2486					SPT S-5, 24 in 12.5-14.5 ft	23 (96)	6-5-8-10					
		14.5 ft: Change to estimated 15 - 25% sand, estimated 15 - 25% rock											14.5 ft: Outside of sampler dry.

Bottom of boring at 86 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-653
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal / Robin Reed
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 02/27/2019 **Date Ended:** 03/01/2019
X: 1914792.1 ft **Y:** 118241.0 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2500.0 ft
Total Depth: 86.0 ft

Ground Water Levels
Start of Day 42.5 ft 02/28/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
16	2484	0.4 - 22.4 ft: FILL, sampled as SANDY LEAN CLAY WITH SAND, moist, orangish brown with gray, estimated 30 - 45% sand, contains roots				SPT S-6, 24 in 14.5-16.5 ft	22 (92)	4-8-10-11					
17	2483	14.5 ft: Change to estimated 15 - 25% sand, estimated 15 - 25% rock fragments											
18	2482					SPT S-7, 24 in 16.5-18.5 ft	23 (96)	4-7-8-11					
19	2481	18.5 ft: Change to estimated 30 - 45% sand, estimated 5 - 10% rock fragments											
20	2480					SPT S-8, 24 in 18.5-20.5 ft	19 (79)	4-6-10-11					
21	2479												
22	2478					SPT S-9, 24 in 20.5-22.5 ft	24 (100)	4-6-9-13					
23	2477	22.4 - 69.0 ft: FILL, sampled as LEAN CLAY moist, brown				SPT S-10, 24 in 22.5-24.5 ft	24 (100)	3-5-9-11					22.4 - 69.0 ft: Embankment Section No. 1.
24	2476												
25	2475												
26	2474					SPT S-11, 24 in 24.5-26.5 ft	24 (100)	3-5-6-9					
27	2473												
28	2472					ST ST-2A, 24 in 26.5-28.5 ft	20 (84)						
29	2471												
						ST ST-2B, 24 in 28.5-30.5 ft	16 (66)						

Bottom of boring at 86 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-653
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal / Robin Reed
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 02/27/2019
X: 1914792.1 ft
Plunge: 90°
Hole Elevation: 2500.0 ft
Total Depth: 86.0 ft

Date Ended: 03/01/2019
Y: 118241.0 ft
Bearing: NA

Ground Water Levels
Start of Day 42.5 ft 02/28/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
31	2469	22.4 - 69.0 ft: FILL, sampled as LEAN CLAY moist, brown				ST ST-2C, 24 in 30.5-32.5 ft	24 (100)						
32	2468												
		32.5 ft: Change to brown and gray											
33	2467					SPT S-12, 24 in 32.5-34.5 ft	24 (100)	4-8-9-12					
34	2466												
		34.2 - 34.5 ft: Change to estimated 15 - 25% sand, estimated 5 - 10% rock fragments											
35	2465	34.5 ft: Change to orangish brown, estimated 5-10% sand, estimated <5% rock fragments				SPT S-13, 24 in 34.5-36.5 ft	24 (100)	3-5-7-10					
36	2464												
37	2463												
		37.4 ft: Change to orangish brown with gray, estimated 15 - 25% sand, contains root gragments and coal				SPT S-14, 24 in 36.5-38.5 ft	24 (100)	3-7-10-10					
38	2462												
		38.5 ft: Change to estimated 5 - 10% gravel, no coal											38.5 ft: Gravel-sized fraction refers to weathered shale and/or sandstone rock fragments
39	2461												
40	2460					SPT S-15, 24 in 38.5-40.5 ft	24 (100)	4-8-9-12					
		40.5 ft: Change to yellowish brown, estimated 30 - 45% sand, estimated 15 - 25% rock fragments, no root fragments											
41	2459												41.0 ft: Material looks more like Section No. 2 material.
42	2458					SPT S-16, 24 in 40.5-42.5 ft	24 (100)	4-8-14-17					
		42.5 ft: Change to contains root/wood fragments											
43	2457												
		43.5 - 45.5 ft: Change to orangish brown, wet, contains gray rock fragments				SPT S-17, 24 in 42.5-44.5 ft	24 (100)	5-12-16-18					
44	2456												

Bottom of boring at 86 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-653
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal / Robin Reed
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 02/27/2019 **Date Ended:** 03/01/2019
X: 1914792.1 ft **Y:** 118241.0 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2500.0 ft
Total Depth: 86.0 ft

Ground Water Levels
Start of Day 42.5 ft 02/28/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
46	2454	22.4 - 69.0 ft: FILL, sampled as LEAN CLAY moist, brown				SPT S-18, 24 in 44.5-46.5 ft	24 (100)	5-9-11-12					
47	2453	47.0 ft: Change to purplish brown, contains root fragments				SPT S-19, 24 in 46.5-48.5 ft	24 (100)	4-12-10-16					
48	2452												
49	2451					SPT S-20, 24 in 48.5-50.5 ft	24 (100)	5-9-10-16					
50	2450												
51	2449					SPT S-21, 24 in 50.5-52.5 ft	24 (100)	6-12-15-19					
52	2448	52.2 ft: Change to brown	CL		S1								
53	2447					SPT S-22, 24 in 52.5-54.5 ft	22 (92)	3-5-12-14					54.0 - 58.0 ft: Cuttings wet.
54	2446												
55	2445					SPT S-23, 24 in 54.5-56.5 ft	24 (100)	5-8-10-15					
56	2444												56.5 ft: Outside of sampler dry.
57	2443	56.5 ft: Change to purplish brown and brown, estimated 15 - 25% sand, estimated <5% rock fragments				SPT S-24, 24 in 56.5-58.5 ft	24 (100)	5-10-12-22					58.0 ft: Cuttings balling up but not wet.
58	2442												
59	2441					SPT S-25, 24 in 58.5-60.5 ft	24 (100)	7-11-12-17					

Bottom of boring at 86 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-653
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal / Robin Reed
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 02/27/2019 **Date Ended:** 03/01/2019
X: 1914792.1 ft **Y:** 118241.0 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2500.0 ft
Total Depth: 86.0 ft

Ground Water Levels
Start of Day 42.5 ft 02/28/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
61	2439	22.4 - 69.0 ft: FILL, sampled as LEAN CLAY moist, brown				SPT S-26, 24 in 60.5-62.5 ft	24 (100)	5-10-12-15					
62	2438												
63	2437					SPT S-27, 24 in 62.5-64.5 ft	24 (100)	3-7-11-13					
64	2436												
65	2435					SPT S-28, 24 in 64.5-66.5 ft	24 (100)	2-6-10-10					
66	2434												
67	2433	66.5 ft: Change to estimated 30 - 45% rock fragments				SPT S-29, 24 in 66.5-68.5 ft		3-6-11-14					68.5 ft: Cuttings wet.
68	2432												
69	2431	69.0 - 70.5 ft: POORLY GRADED SAND WITH SILT, fine, wet, gray, contains organics, alluvial	SP-SM		A	SPT S-30, 24 in 68.5-70.5 ft	20 (83)	2-5-10-10					
70	2430												
71	2429	70.5 - 73.0 ft: POORLY GRADED SAND fine, wet, gray, alluvial	SP		A	SPT S-31, 24 in 70.5-72.5 ft	24 (100)	7-5-7-6					
72	2428												
73	2427	73.0 - 73.3 ft: SANDY LEAN CLAY moist, bluish green mottles of purplish brown, residual	CL		R	SPT S-32, 12 in 72.5-73.5 ft	12 (100)	12-18					73.5 - 75.5 ft: No SPT sample taken.
74	2426	73.3 - 75.5 ft: LEAN CLAY WITH SAND, moist, purplish brown, estimated <5% weathered shale	CL		R								

Bottom of boring at 86 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: B-653
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Corey Schaal / Robin Reed
Equipment: CME-55 (Track)
Method: HQ Double Barrel
4-1/4" ID Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)

Date Started: 02/27/2019 **Date Ended:** 03/01/2019
X: 1914792.1 ft **Y:** 118241.0 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2500.0 ft
Total Depth: 86.0 ft

Ground Water Levels
Start of Day 42.5 ft 02/28/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	REC (in., %)	BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
76	2424	73.3 - 75.5 ft: LEAN CLAY WITH SAND, moist, purplish brown, estimated <5% weathered shale rock fragments, residual	GP-GM		D	SPT S-33, 6 in 75.5-76.0 ft	6 (100)	50/6"					75.5 ft: Start of day 3/1/19.
77	2423	75.5 - 76.0 ft: DISINTEGRATED ROCK, sampled as POORLY GRADED GRAVEL WITH SILT, moist, dark gray											76.0 ft: Pieces of wire wrapped around tooling.
78	2422	76.0 - 86.0 ft: SHALE, very weak to weak, severely weathered to highly weathered, slightly fractured (2 - 6.5 ft), N3 (dark gray), very thin bedded (<2.5 in), 0° to 10°, no HCL reaction				CORE C-1, 60 in 76.0-81.0 ft	30 (50)	26 (43)	2.6				*76.0 - 81.0 ft: Bedding joint, 0°, smooth, planar*
79	2421												
80	2420												
81	2419				B								81.0 ft: Core barrel half-full of sand, only recovered 30 of 60 inches. 82.0 ft: Core barrel blocked off.
82	2418												
83	2417												
84	2416					CORE C-2, 60 in 81.0-86.0 ft	23 (38)	10 (17)	2.9				83.8 ft: Core barrel blocked off, piece of wire lodged between shoe and core.
85	2415												
86	2414												
87	2413												
88	2412												
89	2411												

RQD(%)	DRILL RATE	PACKER	DISCONTINUITIES

Bottom of boring at 86 ft. Boring terminated at selected depth.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

Schnabel ENGINEERING

TEST BORING LOG

Project: Brush Creek Site 15
NRCS - West Virginia
Mercer County, West Virginia

Boring Number: AP-351
Contract Number: 18C35013.04

Contractor: Horn & Associates
Contractor Foreman: T. Jenkins
Schnabel Representative: Sue Buchanan
Equipment: Diedrich D-50 (ATV)
Method: 2 1/4" Solid Stem Augers
Hammer Type: NA

Date Started: 03/20/2019 **Date Ended:** 03/20/2019
X: 1914777.3 ft **Y:** 118473.7 ft
Plunge: 90° **Bearing:** NA
Hole Elevation: 2439.0 ft
Total Depth: 10.8 ft

Ground Water Levels
Completion 03/20/2019 - Dry
After Drilling 6.5 ft 03/20/2019

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATUM USCS	STRATUM SYMBOL	STRATUM UNIT	SAMPLE DATA DESCRIPTION	SAMPLE DATA REC (in., %)	SAMPLE DATA BLOW COUNTS	MC	LL	PL	< #200 (%)	REMARKS
0	2439	0.0 - 0.2 ft: Topsoil											0.0 - 10.8 ft: No samples collected, cuttings used to classify soils.
1	2438	0.2 - 7.0 ft: FILL, sampled as CLAYEY SAND moist, brown and orangish brown, estimated 30 - 45% fines	SC		F								
2	2437												
3	2436												
4	2435												
5	2434												
6	2433												
7	2432	7.0 - 8.0 ft: CLAYEY SAND moist, orangish brown, estimated 30 - 45% fines, contains fine to coarse gravel, residual	SC		R								
8	2431	8.0 - 10.8 ft: DISINTEGRATED ROCK, sampled as SANDY SILT moist, light gray, estimated 30 - 45% fines, contains fine gravel	ML		D								8.0 - 8.5 ft: Augers grinding/ scraping.
9	2430												
10	2429												
11	2428												10.8 ft: Driller notes 1000 psi of down pressure, slow penetration, coreable rock.
12	2427												
13	2426												
14	2425												

Bottom of boring at 10.8 ft. Boring terminated at auger refusal.
Boring backfilled with cement/bentonite grout through tremie pipe upon completion.

BOREHOLE BACKFILL RECORDS

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Schnabel ENGINEERING

BOREHOLE BACKFILL FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-51
Location:	Mercer Co, WV	**Date:**	3/16/2019
Schnabel Project No:	18C35013.04	**By:**	DDS **Date:** 3/16/2019
Client Name:	WV-NRCS	**Checked:**	EBB **Date:** 5/7/19

Drilling and Borehole Volume Information	
Method(s) of Drilling: 4-1/4" ID HSA HQ	Diameter of Borehole (inches) (A): 8"x85' · 4"x56.8'
Completion Date of Drilling: 3/15/2019	Total Depth of Borehole After Drilling (ft): 141.8'
Depth of Borehole at Start of Backfilling (ft) (B): 141.8'	Depth of Water at Start of Backfilling (ft): 52.7', overnight w.l. = 42.2
Calculated Volume of Borehole [~~0.041 * A² * B~~] = 259	gal * 0.134 = 34.6 feet³

Backfill Record for Solid Materials				
Method:	☐ **Alternating Layers**		☐ **Single Material Type**	
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft³):
			Bag Vol (ft³):	Est Thickness / Layer (ft):
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft³):
			Bag Vol (ft³):	Est Thickness / Layer (ft):

Backfill Record for Liquid Materials (Grout)			
Grout Mix Components (per batch):	Portland Cement (# of bags): 2	Weight of bag (lb): 94	Water (gal): 60
	Bentonite (lb): 50	Grout Mixing Method:	
Grout backfilled with tremie method?	(Yes) / No		

Placement Volumes

Grouting	Date/Time	Start Depth (feet)	Tremie Depth (feet)	Calculated Volume to be Placed (gal)	Estimated Volume Placed (gal)
Initial Filling	3/16 15:45		141.8'	311	180
Top Off #1	3/17 7:00	4.0		10.5	
Top Off #2					
Top Off #3					
Top Off #4					
			Total Estimated Volume Placed (gal):		

Was a stake placed and labeled to indicate boring location and ID after backfill was completed? Yes / No

Comments: Assume phreatic surface at water level recorded at start of day (42.2'). Stage 1 theoretical vol. = 259 · 1.2 = 311 gal

Observed grout at surface after ~180 gal placed during initial filling

Schnabel ENGINEERING

BOREHOLE BACKFILL FIELD FORM

Project:	BRUSH CREEK NO. 15	**Boring ID:**	B-52
Location:	PRINCETON, MERCER CO, WV	**Date:**	03/05/2019
Schnabel Project No:	18C35013.04	**By:**	RZ **Date:** 03/05/2019
Client Name:	NRCS	**Checked:**	EBB **Date:** 5/7/19

Drilling and Borehole Volume Information	
Method(s) of Drilling: 4-¼" HSA / HQ TRIPLE TUBE	Diameter of Borehole (inches) (A): 7I x9" / 14.2x4"
Completion Date of Drilling: 03/05/2019	Total Depth of Borehole After Drilling (ft): 89.2
Depth of Borehole at Start of Backfilling (ft) (B): 89.2	Depth of Water at Start of Backfilling (ft): 46.2
Calculated Volume of Borehole [0.041 * A^2 * B] = 23 + 9 = 245 gal * 0.134 = 32.8 feet^3	245 gal

Backfill Record for Solid Materials				
Method:	☐ **Alternating Layers**		☐ **Single Material Type**	
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft^3):
			Bag Vol (ft^3):	Est Thickness / Layer (ft):
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft^3):
			Bag Vol (ft^3):	Est Thickness / Layer (ft):

Backfill Record for Liquid Materials (Grout)			
Grout Mix Components:	Portland Cement (# of bags): 1	Weight of bag (lb): 94	Water (gal): 30
	Bentonite (lb): 25	Grout Mixing Method: TRASH PUMP CIRC	
Grout backfilled with tremie method?	Yes / No		

Placement Volumes

Grouting	Date/Time	# of Bags (Portland)	Start Depth (feet)	Tremie Depth (feet)	Estimated Volume Placed (gal)
Initial Filling	03/05/2019 12:08	5	85.2	84.2	255
Top Off #1					
Top Off #2					
Top Off #3					
Top Off #4					
				Total Estimated Volume Placed (gal):	

Was a stake placed and labeled to indicate boring location and ID after backfill was completed? Yes / No

Comments:

Schnabel ENGINEERING

BOREHOLE BACKFILL FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-52
Location:		**Date:**	3/16/2019
Schnabel Project No:		**By:**	CDS **Date:** 3/16/2019
Client Name:		**Checked:**	EBB **Date:** 5/7/19

Drilling and Borehole Volume Information	
Method(s) of Drilling: 4-1/4" ID HSA	Diameter of Borehole (inches) (A): 8"
Completion Date of Drilling:	Total Depth of Borehole After Drilling (ft):
Depth of Borehole at Start of Backfilling (ft) (B):	Depth of Water at Start of Backfilling (ft):
Calculated Volume of Borehole [0.041 * A^2 * B] =	gal * 0.134 = $feet^3$

Backfill Record for Solid Materials				
Method:	☐ **Alternating Layers**		☐ **Single Material Type**	
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft^3):
			Bag Vol (ft^3):	Est Thickness / Layer (ft):
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft^3):
			Bag Vol (ft^3):	Est Thickness / Layer (ft):

Backfill Record for Liquid Materials (Grout)			
Grout Mix Components (per batch):	Portland Cement (# of bags): 2	Weight of bag (lb): 94	Water (gal): 60
	Bentonite (lb): 50	Grout Mixing Method:	
Grout backfilled with tremie method? Yes / No			

Placement Volumes

Grouting	Date/Time	Start Depth (feet)	Tremie Depth (feet)	Calculated Volume to be Placed (gal)	Estimated Volume Placed (gal)
Initial Filling					
Top Off #1	3/16 16:24	2.9'	✓	7.6	8
Top Off #2					
Top Off #3					
Top Off #4					
			Total Estimated Volume Placed (gal):		

Was a stake placed and labeled to indicate boring location and ID after backfill was completed? Yes / No

Comments:

Schnabel ENGINEERING

BOREHOLE BACKFILL FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-251
Location:	Mercer Co WV	**Date:**	3/12/19
Schnabel Project No:	18C35013.04	**By:**	CDS **Date:** 3/12/19
Client Name:	WV - NRCS	**Checked:**	EBB **Date:** 5/7/19

Drilling and Borehole Volume Information	
Method(s) of Drilling: 4-1/4" ID HSA, HQ	Diameter of Borehole (inches) (A): 8" x 19.1' ; 4" - 20'
Completion Date of Drilling: 3/12/19	Total Depth of Borehole After Drilling (ft): 39.1'
Depth of Borehole at Start of Backfilling (ft) (B):	Depth of Water at Start of Backfilling (ft): 5.5'
Calculated Volume of Borehole [~~0.041 * A² * B~~] = 63.2	gal * 0.134 = 8.5 feet³

Backfill Record for Solid Materials				
Method:	☐ **Alternating Layers**		☐ **Single Material Type**	
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft³):
			Bag Vol (ft³):	Est Thickness / Layer (ft):
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft³):
			Bag Vol (ft³):	Est Thickness / Layer (ft):

Backfill Record for Liquid Materials (Grout)			
Grout Mix Components (per batch):	Portland Cement (# of bags): 2	Weight of bag (lb): 94 -	Water (gal): 60
	Bentonite (lb): 50	Grout Mixing Method:	
Grout backfilled with tremie method?	(Yes) / No		

Placement Volumes

Grouting	Date/Time	Start Depth (feet)	Tremie Depth (feet)	Calculated Volume to be Placed (gal)	Estimated Volume Placed (gal)
Initial Filling	3/12 14:45		39.1	63	85
Top Off #1					
Top Off #2					
Top Off #3					
Top Off #4					
			Total Estimated Volume Placed (gal):		

Was a stake placed and labeled to indicate boring location and ID after backfill was completed? Yes / No

Comments:

Schnabel ENGINEERING

BOREHOLE BACKFILL FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-252
Location:	Mercer Co, WV	**Date:**	3/12/19
Schnabel Project No:	18C35013.04	**By:**	CDS **Date:** 3/12/19
Client Name:	WV-NRCS	**Checked:**	EBB **Date:** 5/7/19

Drilling and Borehole Volume Information	
Method(s) of Drilling: 4-1/4" ID HSA, HQ	Diameter of Borehole (inches) (A): 8" x 10.9'; 4" x 10'
Completion Date of Drilling: 3/12/19	Total Depth of Borehole After Drilling (ft): 20.9'
Depth of Borehole at Start of Backfilling (ft) (B):	Depth of Water at Start of Backfilling (ft): 2.0
Calculated Volume of Borehole ~~[0.041 * A² * B]~~ = 35.0 gal * 0.134 = 4.7 feet³	

Backfill Record for Solid Materials				
Method:	☐ **Alternating Layers**		☐ **Single Material Type**	
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft³):
			Bag Vol (ft³):	Est Thickness / Layer (ft):
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft³):
			Bag Vol (ft³):	Est Thickness / Layer (ft):

Backfill Record for Liquid Materials (Grout)			
Grout Mix Components (per batch):	Portland Cement (# of bags): 2	Weight of bag (lb): 94	Water (gal): 60
	Bentonite (lb): 50	Grout Mixing Method:	
Grout backfilled with tremie method?	(Yes) / No		

Placement Volumes

Grouting	Date/Time	Start Depth (feet)	Tremie Depth (feet)	Calculated Volume to be Placed (gal)	Estimated Volume Placed (gal)
Initial Filling	3/12 15:15		20.9	35	40
Top Off #1					
Top Off #2					
Top Off #3					
Top Off #4					
			Total Estimated Volume Placed (gal):		

Was a stake placed and labeled to indicate boring location and ID after backfill was completed? Yes / No

Comments:

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BOREHOLE BACKFILL FIELD FORM

Project:	BRUSH CREEK NO. 15	**Boring ID:**	B-253
Location:	PRINCETON, MERCER CO, WV	**Date:**	03/06/2019
Schnabel Project No:	18C35013.04	**By:**	RZ **Date:** 03/06/2019
Client Name:	NRCS	**Checked:**	EBB **Date:** 5/7/19

Drilling and Borehole Volume Information	
Method(s) of Drilling: 4-1/4" HSA / HQ TRIPLE TUBE	Diameter of Borehole (inches) (A): 3x4.4x9" / 5x4"
Completion Date of Drilling: 03/06/2019	Total Depth of Borehole After Drilling (ft): 39.4
Depth of Borehole at Start of Backfilling (ft) (B): 39.4	Depth of Water at Start of Backfilling (ft): 15.0
Calculated Volume of Borehole [0.041 * A^2 * B] = 114 + 3.3 gal * 0.134 = 15.7 feet^3	117 gal

Backfill Record for Solid Materials				
Method:	☐ **Alternating Layers**		☐ **Single Material Type**	
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft^3):
			Bag Vol (ft^3):	Est Thickness / Layer (ft):
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft^3):
			Bag Vol (ft^3):	Est Thickness / Layer (ft):

Backfill Record for Liquid Materials (Grout)			
Grout Mix Components:	Portland Cement (# of bags): 1	Weight of bag (lb): 94	Water (gal): 30
	Bentonite (lb): 25	Grout Mixing Method: TRASH PUMP CIRC	
Grout backfilled with tremie method?	Yes / No		

Placement Volumes

Grouting	Date/Time	# of Bags (Portland)	Start Depth (feet)	Tremie Depth (feet)	Estimated Volume Placed (gal)
Initial Filling	03/06/2019/11:00	2	39.4	38.4	102
Top Off #1					
Top Off #2					
Top Off #3					
Top Off #4					
				Total Estimated Volume Placed (gal):	

Was a stake placed and labeled to indicate boring location and ID after backfill was completed? Yes / No

Comments:

114 + 23 = 137

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BOREHOLE BACKFILL FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-253
Location:		**Date:**	3/12/19
Schnabel Project No:		**By:**	CDS **Date:** 3/12/19
Client Name:		**Checked:**	EBB **Date:** 5/7/19

Drilling and Borehole Volume Information	
Method(s) of Drilling: 4-1/4" ID HSA	Diameter of Borehole (inches) (A): 8"
Completion Date of Drilling:	Total Depth of Borehole After Drilling (ft):
Depth of Borehole at Start of Backfilling (ft) (B):	Depth of Water at Start of Backfilling (ft):
Calculated Volume of Borehole [0.041 * A^2 * B] =	gal * 0.134 = feet^3

Backfill Record for Solid Materials				
Method:	☐ **Alternating Layers**		☐ **Single Material Type**	
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft^3):
			Bag Vol (ft^3):	Est Thickness / Layer (ft):
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft^3):
			Bag Vol (ft^3):	Est Thickness / Layer (ft):

Backfill Record for Liquid Materials (Grout)			
Grout Mix Components (per batch):	Portland Cement (# of bags):	Weight of bag (lb):	Water (gal):
	Bentonite (lb):	Grout Mixing Method:	
Grout backfilled with tremie method? Yes / No			

Placement Volumes

Grouting	Date/Time	Start Depth (feet)	Tremie Depth (feet)	Calculated Volume to be Placed (gal)	Estimated Volume Placed (gal)
Initial Filling					
Top Off #1	3/12 16:00	3.0	—	8	8
Top Off #2					
Top Off #3					
Top Off #4					
			Total Estimated Volume Placed (gal):		

Was a stake placed and labeled to indicate boring location and ID after backfill was completed? Yes / No

Comments:

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BOREHOLE BACKFILL FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-254
Location:	Mercer Co WV	**Date:**	3/12/19
Schnabel Project No:	18C35013.04	**By:**	CDS **Date:** 3/12/19
Client Name:	WV-NRCS	**Checked:**	EBB **Date:** 5/7/19

Drilling and Borehole Volume Information	
Method(s) of Drilling: 4-1/4" ID HSA, HQ	Diameter of Borehole (inches) (A): 8" x 4.4' ; 4" x 10'
Completion Date of Drilling: 3/12/19	Total Depth of Borehole After Drilling (ft): 14.4'
Depth of Borehole at Start of Backfilling (ft) (B):	Depth of Water at Start of Backfilling (ft): 0.7'
Calculated Volume of Borehole ~~[0.041 * A² * B]~~ = 18.0 gal * 0.134 = 2.4 feet³	

Backfill Record for Solid Materials				
Method:	☐ **Alternating Layers**		☐ **Single Material Type**	
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft³):
			Bag Vol (ft³):	Est Thickness / Layer (ft):
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft³):
			Bag Vol (ft³):	Est Thickness / Layer (ft):

Backfill Record for Liquid Materials (Grout)			
Grout Mix Components (per batch):	Portland Cement (# of bags): 2	Weight of bag (lb): 94	Water (gal): 60
	Bentonite (lb): 50	Grout Mixing Method:	
Grout backfilled with tremie method?	Yes / No		

Placement Volumes

Grouting	Date/Time	Start Depth (feet)	Tremie Depth (feet)	Calculated Volume to be Placed (gal)	Estimated Volume Placed (gal)
Initial Filling	3/12 15:50		14.4'	18	25
Top Off #1					
Top Off #2					
Top Off #3					
Top Off #4					
			Total Estimated Volume Placed (gal):		

Was a stake placed and labeled to indicate boring location and ID after backfill was completed? Yes / No

Comments:

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BOREHOLE BACKFILL FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-255
Location:	Mercer Co, WV	**Date:**	3/12/19
Schnabel Project No:	18C35013.04	**By:**	CDS **Date:** 3/12/19
Client Name:	WV-NRCS	**Checked:**	EBB **Date:** 5/7/19

Drilling and Borehole Volume Information	
Method(s) of Drilling: 4-1/4" ID HSA, HQ	Diameter of Borehole (inches) (A): 8" x 15.8' ; 4" x 10'
Completion Date of Drilling: 3/11/19	Total Depth of Borehole After Drilling (ft): 25.8'
Depth of Borehole at Start of Backfilling (ft) (B):	Depth of Water at Start of Backfilling (ft): 7.0'
Calculated Volume of Borehole ~~[0.041 * A² * B]~~ = 47.8 gal * 0.134 = 6.4 feet³	

Backfill Record for Solid Materials				
Method:	☐ **Alternating Layers**		☐ **Single Material Type**	
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft³):
			Bag Vol (ft³):	Est Thickness / Layer (ft):
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft³):
			Bag Vol (ft³):	Est Thickness / Layer (ft):

Backfill Record for Liquid Materials (Grout)			
Grout Mix Components (per batch):	Portland Cement (# of bags): 2	Weight of bag (lb): 94	Water (gal): 60
	Bentonite (lb): 50	Grout Mixing Method:	
Grout backfilled with tremie method?	(Yes) / No		

Placement Volumes

Grouting	Date/Time	Start Depth (feet)	Tremie Depth (feet)	Calculated Volume to be Placed (gal)	Estimated Volume Placed (gal)
Initial Filling	3/12 15:45		25.8	48	55
Top Off #1					
Top Off #2					
Top Off #3					
Top Off #4					
			Total Estimated Volume Placed (gal):		

Was a stake placed and labeled to indicate boring location and ID after backfill was completed? Yes / No

Comments:

Schnabel ENGINEERING

BOREHOLE BACKFILL FIELD FORM

Project:	BRUSH CREEK NO. 15	**Boring ID:**	B-256
Location:	PRINCETON, MERCER CO, WV	**Date:**	03/06/2019
Schnabel Project No:	18C35013.04	**By:**	RZ **Date:** 03/06/2019
Client Name:	NRCS	**Checked:**	EBB **Date:** 5/7/19

Drilling and Borehole Volume Information	
Method(s) of Drilling: 4-1/4" HSA / HQ TRIPLE TUBE	Diameter of Borehole (inches) (A): 9" x 14.7' / 4" x 5'
Completion Date of Drilling: 02/26/2019	Total Depth of Borehole After Drilling (ft): 24.7
Depth of Borehole at Start of Backfilling (ft) (B): 24.7	Depth of Water at Start of Backfilling (ft): 7.4'
Calculated Volume of Borehole [0.041 * A^2 * B] = 49.3 = 51 gal * 0.134 =	6.8 feet^3 50 gal

Backfill Record for Solid Materials

Method: ☐ Alternating Layers ☐ Single Material Type

Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft^3):
			Bag Vol (ft^3):	Est Thickness / Layer (ft):
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft^3):
			Bag Vol (ft^3):	Est Thickness / Layer (ft):

Backfill Record for Liquid Materials (Grout)

Grout Mix Components:	Portland Cement (# of bags): 1	Weight of bag (lb): 94	Water (gal): 30
	Bentonite (lb): 25	Grout Mixing Method: TRASH PUMP CIRC	

Grout backfilled with tremie method? (Yes) / No

Placement Volumes

Grouting	Date/Time	# of Bags (Portland)	Start Depth (feet)	Tremie Depth (feet)	Estimated Volume Placed (gal)
Initial Filling	03/06/2019 11:33	1	24.7	23.7	51
Top Off #1					
Top Off #2					
Top Off #3					
Top Off #4					
				Total Estimated Volume Placed (gal):	

Was a stake placed and labeled to indicate boring location and ID after backfill was completed? Yes / No

Comments:

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BOREHOLE BACKFILL FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-257
Location:		**Date:**	3/12/19
Schnabel Project No:		**By:**	CDS **Date:**
Client Name:		**Checked:**	EBB **Date:** 5/7/19

Drilling and Borehole Volume Information	
Method(s) of Drilling:	Diameter of Borehole (inches) (A): 8"
Completion Date of Drilling:	Total Depth of Borehole After Drilling (ft):
Depth of Borehole at Start of Backfilling (ft) (B):	Depth of Water at Start of Backfilling (ft):
Calculated Volume of Borehole [0.041 * A^2 * B] =	gal * 0.134 = feet^3

Backfill Record for Solid Materials				
Method:	☐ **Alternating Layers**		☐ **Single Material Type**	
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft^3):
			Bag Vol (ft^3):	Est Thickness / Layer (ft):
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft^3):
			Bag Vol (ft^3):	Est Thickness / Layer (ft):

Backfill Record for Liquid Materials (Grout)			
Grout Mix Components (per batch):	Portland Cement (# of bags):	Weight of bag (lb):	Water (gal):
	Bentonite (lb):	Grout Mixing Method:	
Grout backfilled with tremie method? Yes / No			

Placement Volumes

Grouting	Date/Time	Start Depth (feet)	Tremie Depth (feet)	Calculated Volume to be Placed (gal)	Estimated Volume Placed (gal)
Initial Filling					
Top Off #1	3/12 16:00	1.8	—	4.7	5
Top Off #2					
Top Off #3					
Top Off #4					
			Total Estimated Volume Placed (gal):		

Was a stake placed and labeled to indicate boring location and ID after backfill was completed? Yes / No

Comments:

Schnabel ENGINEERING

BOREHOLE BACKFILL FIELD FORM

Project:	BRUSH CREEK NO. 15	**Boring ID:**	B-257
Location:	PRINCETON, MERCER CO, WV	**Date:**	02/26/2019
Schnabel Project No:	18C35013.04	**By:**	KZ **Date:** 03/06/2019
Client Name:	NRCS	**Checked:**	EBB **Date:** 5/7/19

Drilling and Borehole Volume Information	
Method(s) of Drilling: 4-¼" HSA / HQ TRIPLE TUBE	Diameter of Borehole (inches) (A): 15.3×9" / 34.6×4"
Completion Date of Drilling: 02/26/2019	Total Depth of Borehole After Drilling (ft): 49.9
Depth of Borehole at Start of Backfilling (ft) (B): 49.9	Depth of Water at Start of Backfilling (ft): 7.0
Calculated Volume of Borehole [0.041 * A^2 * B] = 50.8 + 22.7 gal * 0.134 =	9.8 feet^3

Backfill Record for Solid Materials				
Method:	☐ **Alternating Layers**		☐ **Single Material Type**	
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft^3):
			Bag Vol (ft^3):	Est Thickness / Layer (ft):
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft^3):
			Bag Vol (ft^3):	Est Thickness / Layer (ft):

Backfill Record for Liquid Materials (Grout)			
Grout Mix Components:	Portland Cement (# of bags): 1	Weight of bag (lb): 94	Water (gal): 30
	Bentonite (lb): 25	Grout Mixing Method: TRASH PUMP CIRC	
Grout backfilled with tremie method?	(Yes) / No		

Placement Volumes

Grouting	Date/Time	# of Bags (Portland)	Start Depth (feet)	Tremie Depth (feet)	Estimated Volume Placed (gal)
Initial Filling	03/06/19, 12:01	2	49.9	48.9	102
Top Off #1					
Top Off #2					
Top Off #3					
Top Off #4					
				Total Estimated Volume Placed (gal):	

Was a stake placed and labeled to indicate boring location and ID after backfill was completed? (Yes) / No

Comments:

Schnabel ENGINEERING

BOREHOLE BACKFILL FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-652
Location:	Bluefield, WV	**Date:**	3/20/19
Schnabel Project No:	18C35013.04	**By:**	SMB **Date:** 3/20/19
Client Name:	WV-NRCS	**Checked:**	EBB **Date:** 5/7/19

Drilling and Borehole Volume Information

Method(s) of Drilling: 4 1/4" ID HSA/HQ Rods	Diameter of Borehole (inches) (A): 8/3.5
Completion Date of Drilling: 3/19/19	Total Depth of Borehole After Drilling (ft): 17.7
Depth of Borehole at Start of Backfilling (ft) (B): 17.7	Depth of Water at Start of Backfilling (ft): 5.6
Calculated Volume of Borehole [0.041 * A^2 * B] = 25.23	gal * 0.134 = 3.38 feet^3

Backfill Record for Solid Materials

Method: ☐ Alternating Layers ☐ Single Material Type

Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft^3):
			Bag Vol (ft^3):	Est Thickness / Layer (ft):
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft^3):
			Bag Vol (ft^3):	Est Thickness / Layer (ft):

Backfill Record for Liquid Materials (Grout)

Grout Mix Components:	Portland Cement (# of bags): 1	Weight of bag (lb): 94	Water (gal): 30
	Bentonite (lb): 25	Grout Mixing Method: circulation through	
Grout backfilled with tremie method? (Yes) / No		Succution hoses	

Placement Volumes

Grouting	Date/Time	# of Bags (Portland)	Start Depth (feet)	Tremie Depth (feet)	Estimated Volume Placed (gal)
Initial Filling	3/20/19 / 10:23a	1	17.7	17.7	30
Top Off #1					
Top Off #2					
Top Off #3					
Top Off #4					
				Total Estimated Volume Placed (gal):	

Was a stake placed and labeled to indicate boring location and ID after backfill was completed? (Yes) / No

Comments:

1.25" Auger = 9" Auger Head
1/2 = 4" REAMING HEAD

Schnabel ENGINEERING

BOREHOLE BACKFILL FIELD FORM (3 25/32)

Project:	BRUSH CREEK NO 15	**Boring ID:**	B-653
Location:	PRINCETON, MERCER CO, WV	**Date:**	03/01/2019
Schnabel Project No:	18C3503.04	**By:**	R REED **Date:** 03/01/2019
Client Name:	NRCS	**Checked:**	EBB **Date:** 5/7/19

Drilling and Borehole Volume Information 252.8 0.873	
Method(s) of Drilling: 4-1/4" HSA / HQ TRIPLETUBE	Diameter of Borehole (inches) (A): 9" @ 76' 4" @ 10'
Completion Date of Drilling: 03/01/2019	Total Depth of Borehole After Drilling (ft): 86
Depth of Borehole at Start of Backfilling (ft) (B): 86	Depth of Water at Start of Backfilling (ft): 6
Calculated Volume of Borehole [0.041 * A² * B] = 252 + 6.56 gal * 0.134 = 1 34.16 feet³ (258 gal)	

Backfill Record for Solid Materials				
Method:	☐ **Alternating Layers**		☐ **Single Material Type**	
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft³):
			Bag Vol (ft³):	Est Thickness / Layer (ft):
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft³):
			Bag Vol (ft³):	Est Thickness / Layer (ft):

Backfill Record for Liquid Materials (Grout)			
Grout Mix Components:	Portland Cement (# of bags): 1	Weight of bag (lb): 94	Water (gal): 30
	Bentonite (lb): 25	Grout Mixing Method: TREMIE PUMP GRC.	
Grout backfilled with tremie method?	Yes / No		

Placement Volumes

Grouting	Date/Time	# of Bags (Portland)	Start Depth (feet)	Tremie Depth (feet)	Estimated Volume Placed (gal)
Initial Filling	03/01/2019	3	86	85	153
Top Off #1	03/01/2019 *	1	86	85	51
Top Off #2					
Top Off #3					
Top Off #4					
				Total Estimated Volume Placed (gal):	203

Was a stake placed and labeled to indicate boring location and ID after backfill was completed? Yes / No

Comments:

* PLACED 3 BATCHES THRU TREMIE PIPE WITH AUGERS IN BOREHOLE. PULLED AUGERS AND PLACED 1 ADDITIONAL BATCH. CHECK TO SEE IF BOREHOLE NEEDS TO BE TOPPED OFF.

DRILLER REPORTED MUCH ON AUGERS WAS LIKELY FALLING INTO HOLE DURING AUGER REMOVAL.

Schnabel ENGINEERING

BOREHOLE BACKFILL FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	AP-351
Location:	Bluefield WV	**Date:**	3/20/19
Schnabel Project No:	18C350 13.04	**By:**	SMB **Date:** 3/20/19
Client Name:	WV-NRCS	**Checked:**	EBB **Date:** 5/7/19

Drilling and Borehole Volume Information	
Method(s) of Drilling: 2 1/4" ID SSA	Diameter of Borehole (inches) (A): 4
Completion Date of Drilling: 3/20/19	Total Depth of Borehole After Drilling (ft): 10.8
Depth of Borehole at Start of Backfilling (ft) (B): 9	Depth of Water at Start of Backfilling (ft): 6.5
Calculated Volume of Borehole [0.041 * A^2 * B] = 5.904 gal * 0.134 = 4.67 feet^3	

Backfill Record for Solid Materials

Method: ☐ Alternating Layers ☐ Single Material Type

Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft^3):
			Bag Vol (ft^3):	Est Thickness / Layer (ft):
Type:	Size:	# of Bags:	Bag Wt (lb):	Total Vol Placed (ft^3):
			Bag Vol (ft^3):	Est Thickness / Layer (ft):

Backfill Record for Liquid Materials (Grout)

Grout Mix Components:	Portland Cement (# of bags): 1	Weight of bag (lb): 94	Water (gal): 30
	Bentonite (lb): 25	Grout Mixing Method: Circulation of grout through succution hoses	
Grout backfilled with tremie method? Yes (No)			

Placement Volumes

Grouting	Date/Time	# of Bags (Portland)	Start Depth (feet)	Tremie Depth (feet)	Estimated Volume Placed (gal)
Initial Filling	3/20/19 / 10:25a	1	9.0	—	6
Top Off #1					
Top Off #2					
Top Off #3					
Top Off #4					
				Total Estimated Volume Placed (gal):	

Was a stake placed and labeled to indicate boring location and ID after backfill was completed? (Yes) No

Comments:

UNDISTURBED SAMPLING RECORDS

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Schnabel ENGINEERING

UNDISTURBED SAMPLING FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-51
Location:	Mercer Co WV	**Sample ID:**	ST-1A
Schnabel Project No.:	18C35013.04	**By:** CDS	**Date:** 3/13/19
Client Name:	WV-NRCS	**Checked:** EBB	**Date:** 5/7/19

Sampler advanced from 2.0 feet below ground surface to 4.0 feet bgs

Sampler Information

Tube Material: New	Type of coating on Tube: none
Tube Diameter and Length (inches): 3" x 30"	Condition of Tube Before Use: new

Drilling Information

Method of Drilling: 4-1/4" ID HSA	Type of Casing: augers
Diameter of Borehole (inches): 8"	Drilling Fluid: none added

Sampling Checklist (Not applicable for Pitcher Sampler)

1) Was sampler advanced in one uniform, continuous push without rotation? Comments:	Yes / No
2) Was downward force provided through the drill rods using the hydraulic drive mechanism on the drill rig? Comments:	Yes / No
3) Was liquid level in the borehole at or above ground water level during the drilling and sampling operation? Comments: N/A no water encountered, no water added	Yes / No
4) Was sample driven? If yes, record weight and fall of the hammer in comments. Comments:	Yes / No
5) Was the withdrawl of the sampler delayed a minimum of 5 minutes after push? Comments (record rest time): 9 min	Yes / No
6) Was the tube slowly rotated to shear the material at the end of the tube prior to extraction? Comments (record number of rotations or amount of rotation): too stiff to rotate	Yes / No

Sample Measurement, Sealing and Labeling

Sampler Penentration (inches): 24"	Sample Recovery (inches): 23"

Sample Length Preserved in Tube (after bottom ~1" removed) (inches): 23"

Sample Tube Tip Condition (undamaged, bent, nicked, crimped, etc): undamaged

Sample Description:

orangish brown Sandy CL, contains rock frags

7) Were both ends of exposed soil sample sealed? Comments and type of seal:	Yes / No
8) Was packing material placed between sealed sample and ends of tube? Comments:	Yes / No
9) Were both ends of tube capped and taped? Comments and type of capping:	Yes / No
10) Were the tube and cap appropriately labeled (project name, boring number, sample number, sample depth interval, sample recovery, date sample was taken, and arrow on tube labeled "TOP" pointing toward top of sample)?	Yes / No

Supplemental Comments: Sampled w/ ball valve head, 1" missing from bottom upon extraction from boring

Schnabel ENGINEERING

UNDISTURBED SAMPLING FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-51
Location:	Mercer Co, WV	**Sample ID:**	ST-1B
Schnabel Project No.:	18C3501B.04	**By:** CDS	**Date:** 3/12/19
Client Name:	WV-NRCS	**Checked:** EBB	**Date:** 5/7/19

Sampler advanced from 4' feet below ground surface to 6.1' feet bgs

Sampler Information

Tube Material: steel	Type of coating on Tube: none
Tube Diameter and Length (inches): 3" x 30"	Condition of Tube Before Use: new

Drilling Information

Method of Drilling: 4-1/4" ID HSA	Type of Casing: augers
Diameter of Borehole (inches): 8"	Drilling Fluid: none added

Sampling Checklist (Not applicable for Pitcher Sampler)

1) Was sampler advanced in one uniform, continuous push without rotation? Comments:	Yes / No
2) Was downward force provided through the drill rods using the hydraulic drive mechanism on the drill rig? Comments:	Yes / No
3) Was liquid level in the borehole at or above ground water level during the drilling and sampling operation? Comments: N/A, no water encountered, no water added	Yes / No
4) Was sample driven? If yes, record weight and fall of the hammer in comments. Comments:	Yes / No
5) Was the withdrawl of the sampler delayed a minimum of 5 minutes after push? Comments (record rest time): 10 min	Yes / No
6) Was the tube slowly rotated to shear the material at the end of the tube prior to extraction? Comments (record number of rotations or amount of rotation): too stiff	Yes / No

Sample Measurement, Sealing and Labeling

Sampler Penentration (inches): 25"	Sample Recovery (inches): 25"
Sample Length Preserved in Tube (after bottom ~1" removed) (inches): 24"	
Sample Tube Tip Condition (undamaged, bent, nicked, crimped, etc): slightly bent	

Sample Description:

grayish brown CL w/ sand + gravel

7) Were both ends of exposed soil sample sealed? Comments and type of seal:	Yes / No
8) Was packing material placed between sealed sample and ends of tube? Comments:	Yes / No
9) Were both ends of tube capped and taped? Comments and type of capping:	Yes / No
10) Were the tube and cap appropriately labeled (project name, boring number, sample number, sample depth interval, sample recovery, date sample was taken, and arrow on tube labeled "TOP" pointing toward top of sample)?	Yes / No

Supplemental Comments: Sampled w/ ball valve head

Schnabel ENGINEERING

UNDISTURBED SAMPLING FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-5
Location:	Mercer Co WV	**Sample ID:**	ST-2A
Schnabel Project No.:	18C35013.04	**By:** CDS **Date:**	3/13/19
Client Name:	WV-NRCS	**Checked:** EBB **Date:**	5/7/19

Sampler advanced from 38' feet below ground surface to 40' feet bgs

Sampler Information

Tube Material: steel	Type of coating on Tube: none
Tube Diameter and Length (inches): 3" x 30"	Condition of Tube Before Use: new

Drilling Information

Method of Drilling: 4-1/4" HSA	Type of Casing: augers
Diameter of Borehole (inches): 8"	Drilling Fluid: none added

Sampling Checklist (Not applicable for Pitcher Sampler)

1) Was sampler advanced in one uniform, continuous push without rotation? Comments:	(Yes) / No
2) Was downward force provided through the drill rods using the hydraulic drive mechanism on the drill rig? Comments:	(Yes) / No
3) Was liquid level in the borehole at or above ground water level during the drilling and sampling operation? Comments: N/A, no water encountered, no water added	Yes / No
4) Was sample driven? If yes, record weight and fall of the hammer in comments. Comments:	Yes / (No)
5) Was the withdrawl of the sampler delayed a minimum of 5 minutes after push? Comments (record rest time): 9 min	(Yes) / No
6) Was the tube slowly rotated to shear the material at the end of the tube prior to extraction? Comments (record number of rotations or amount of rotation): too stiff to rotate	Yes / (No)

Sample Measurement, Sealing and Labeling

Sampler Penentration (inches): 24"	Sample Recovery (inches): 23"
Sample Length Preserved in Tube (after bottom ~1" removed) (inches): 23"	
Sample Tube Tip Condition (undamaged, bent, nicked, crimped, etc): undamaged	

Sample Description:

orangish brown sandy CL, contains rock fragments

7) Were both ends of exposed soil sample sealed? Comments and type of seal: wax	(Yes) / No
8) Was packing material placed between sealed sample and ends of tube? Comments: sand, top only	(Yes) / No
9) Were both ends of tube capped and taped? Comments and type of capping:	(Yes) / No
10) Were the tube and cap appropriately labeled (project name, boring number, sample number, sample depth interval, sample recovery, date sample was taken, and arrow on tube labeled "TOP" pointing toward top of sample)?	(Yes) / No

Supplemental Comments: sampled w/ ball valve head

Schnabel ENGINEERING

UNDISTURBED SAMPLING FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-51
Location:	Mercer Co, WV	**Sample ID:**	ST - 2B
Schnabel Project No.:	18635013.04	**By:** CDS	**Date:** 3/13/19
Client Name:	WV-NRCS	**Checked:** EBB	**Date:** 5/7/19

Sampler advanced from 40' feet below ground surface to 42' feet bgs

Sampler Information

Tube Material: steel	Type of coating on Tube: none
Tube Diameter and Length (inches): 3" x 30"	Condition of Tube Before Use: new

Drilling Information

Method of Drilling: 4-1/4" ID HSA	Type of Casing: augers
Diameter of Borehole (inches): 8"	Drilling Fluid: none added

Sampling Checklist (Not applicable for Pitcher Sampler)

1) Was sampler advanced in one uniform, continuous push without rotation? Comments: difficult push	Yes / No
2) Was downward force provided through the drill rods using the hydraulic drive mechanism on the drill rig? Comments:	Yes / No
3) Was liquid level in the borehole at or above ground water level during the drilling and sampling operation? Comments: N/A, no water encountered, no water added	Yes / No
4) Was sample driven? If yes, record weight and fall of the hammer in comments. Comments:	Yes / No
5) Was the withdrawl of the sampler delayed a minimum of 5 minutes after push? Comments (record rest time): 10 min	Yes / No
6) Was the tube slowly rotated to shear the material at the end of the tube prior to extraction? Comments (record number of rotations or amount of rotation): too stiff to rotate	Yes / No

Sample Measurement, Sealing and Labeling

Sampler Penentration (inches): 24"	Sample Recovery (inches): 24"

Sample Length Preserved in Tube (after bottom ~1" removed) (inches): 23"

Sample Tube Tip Condition (undamaged, bent, nicked, crimped, etc): undamaged

Sample Description:

grayish brown gravelly CL, contains sand

7) Were both ends of exposed soil sample sealed? Comments and type of seal: wax	Yes / No
8) Was packing material placed between sealed sample and ends of tube? Comments: sand	Yes / No
9) Were both ends of tube capped and taped? Comments and type of capping:	Yes / No
10) Were the tube and cap appropriately labeled (project name, boring number, sample number, sample depth interval, sample recovery, date sample was taken, and arrow on tube labeled "TOP" pointing toward top of sample)?	Yes / No

Supplemental Comments: sampled w/ ball valve head

Schnabel ENGINEERING

UNDISTURBED SAMPLING FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-51
Location:	Mercer Co WV	**Sample ID:**	ST-3A
Schnabel Project No.:	18C35013.04	**By:** COS **Date:**	3/14/2019
Client Name:	WV-NRCS	**Checked:** EBB **Date:**	5/7/19

Sampler advanced from 74 feet below ground surface to 76 feet bgs

Sampler Information

Tube Material: steel	Type of coating on Tube: none
Tube Diameter and Length (inches): 3" x 30"	Condition of Tube Before Use: new

Drilling Information

Method of Drilling: 4-¼" ID HSA	Type of Casing: augers
Diameter of Borehole (inches): 8"	Drilling Fluid: water

Sampling Checklist (Not applicable for Pitcher Sampler)

1) Was sampler advanced in one uniform, continuous push without rotation? Comments:	Yes / No
2) Was downward force provided through the drill rods using the hydraulic drive mechanism on the drill rig? Comments:	Yes / No
3) Was liquid level in the borehole at or above ground water level during the drilling and sampling operation? Comments: Added water to augers prior to sampling, depth = 42.4 ft	Yes / No
4) Was sample driven? If yes, record weight and fall of the hammer in comments. Comments:	Yes / No
5) Was the withdrawl of the sampler delayed a minimum of 5 minutes after push? Comments (record rest time): 12 min	Yes / No
6) Was the tube slowly rotated to shear the material at the end of the tube prior to extraction? Comments (record number of rotations or amount of rotation): too stiff to rotate	Yes / No

Sample Measurement, Sealing and Labeling

Sampler Penentration (inches): 24	Sample Recovery (inches): 22
Sample Length Preserved in Tube (after bottom ~1" removed) (inches): 21	
Sample Tube Tip Condition (undamaged, bent, nicked, crimped, etc): undamaged	

Sample Description:

orangish + grayish brown CH, gravelly, w/ sand

7) Were both ends of exposed soil sample sealed? Comments and type of seal: wax	Yes / No
8) Was packing material placed between sealed sample and ends of tube? Comments: Sand	Yes / No
9) Were both ends of tube capped and taped? Comments and type of capping:	Yes / No
10) Were the tube and cap appropriately labeled (project name, boring number, sample number, sample depth interval, sample recovery, date sample was taken, and arrow on tube labeled "TOP" pointing toward top of sample)?	Yes / No

Supplemental Comments: Sampled w/ ball valve head, shale cobble in bottom of sample

Schnabel ENGINEERING

UNDISTURBED SAMPLING FIELD FORM

Project:	Branch Creek Site 15	**Boring ID:**	B-51
Location:	Mercer Co, WV	**Sample ID:**	ST-3B
Schnabel Project No.:	18C3503.04	**By:** CDS	**Date:** 3/21/2019
Client Name:	WV-NRCS	**Checked:** EBB	**Date:** 5/7/19

Sampler advanced from 76 feet below ground surface to 78 feet bgs

Sampler Information

Tube Material: steel	Type of coating on Tube: none
Tube Diameter and Length (inches): 3" x 30"	Condition of Tube Before Use: new

Drilling Information

Method of Drilling: 4-1/4" ID HSA	Type of Casing: augers
Diameter of Borehole (inches): 8"	Drilling Fluid:

Sampling Checklist (Not applicable for Pitcher Sampler)

1) Was sampler advanced in one uniform, continuous push without rotation? Comments:	Yes / No
2) Was downward force provided through the drill rods using the hydraulic drive mechanism on the drill rig? Comments:	Yes / No
3) Was liquid level in the borehole at or above ground water level during the drilling and sampling operation? Comments: water added to boring prior to sampling ST-3A, depth = 42.4'	Yes / No
4) Was sample driven? If yes, record weight and fall of the hammer in comments. Comments:	Yes / No
5) Was the withdrawl of the sampler delayed a minimum of 5 minutes after push? Comments (record rest time): 11 min	Yes / No
6) Was the tube slowly rotated to shear the material at the end of the tube prior to extraction? Comments (record number of rotations or amount of rotation):	Yes / No

Sample Measurement, Sealing and Labeling

Sampler Penentration (inches): 24	Sample Recovery (inches): 14"
Sample Length Preserved in Tube (after bottom ~1" removed) (inches): 13"	
Sample Tube Tip Condition (undamaged, bent, nicked, crimped, etc): bent	

Sample Description:
Top - brown CL w/ sand + rock frags, fill
Bottom - GRAY SC, alluvium

7) Were both ends of exposed soil sample sealed? Comments and type of seal: wax	Yes / No
8) Was packing material placed between sealed sample and ends of tube? Comments: sand	Yes / No
9) Were both ends of tube capped and taped? Comments and type of capping:	Yes / No
10) Were the tube and cap appropriately labeled (project name, boring number, sample number, sample depth interval, sample recovery, date sample was taken, and arrow on tube labeled "TOP" pointing toward top of sample)?	Yes / No

Supplemental Comments: sampled w/ ball valve head

Schnabel ENGINEERING

UNDISTURBED SAMPLING FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-51A
Location:	Bluefield, WV	**Sample ID:**	UD-1
Schnabel Project No.:	18C35013.04	**By:**	SMB **Date:** 3/18/19
Client Name:	WV-NRCS	**Checked:**	EBB **Date:** 5/7/19

Sampler advanced from 70' feet below ground surface to 72' feet bgs

Sampler Information

Tube Material: Shelby Tube	Type of coating on Tube: Zinc
Tube Diameter and Length (inches): 3/30	Condition of Tube Before Use: Good / New

Drilling Information

Method of Drilling: 4 1/4" ID HSA	Type of Casing: None
Diameter of Borehole (inches): 8"	Drilling Fluid: None

Sampling Checklist (Not applicable for Pitcher Sampler)

1) Was sampler advanced in one uniform, continuous push without rotation? Comments:	(Yes) / No
2) Was downward force provided through the drill rods using the hydraulic drive mechanism on the drill rig? Comments: 8000psi	(Yes) / No
3) Was liquid level in the borehole at or above ground water level during the drilling and sampling operation? Comments: rat	Yes / No
4) Was sample driven? If yes, record weight and fall of the hammer in comments. Comments:	Yes / (No)
5) Was the withdrawl of the sampler delayed a minimum of 5 minutes after push? Comments (record rest time): 9:41am - 9:49am	(Yes) / No
6) Was the tube slowly rotated to shear the material at the end of the tube prior to extraction? Comments (record number of rotations or amount of rotation):	Yes / (No)

Sample Measurement, Sealing and Labeling

Sampler Penentration (inches): 24	Sample Recovery (inches): 24
Sample Length Preserved in Tube (after bottom ~1" removed) (inches): 23	
Sample Tube Tip Condition (undamaged, bent, nicked, crimped, etc): Good, No bending / Dents	
Sample Description: Gravelly CH, Fat Clay, Orangish brown-gray, 15-25 % Fi-C Gravel, moist Fill, medium plasticity	
7) Were both ends of exposed soil sample sealed? Comments and type of seal: Wax	(Yes) / No
8) Was packing material placed between sealed sample and ends of tube? Comments: Sand	(Yes) / No
9) Were both ends of tube capped and taped? Comments and type of capping:	(Yes) / No
10) Were the tube and cap appropriately labeled (project name, boring number, sample number, sample depth interval, sample recovery, date sample was taken, and arrow on tube labeled "TOP" pointing toward top of sample)?	(Yes) / No

Supplemental Comments: 5.25 tsf = torvane

Schnabel ENGINEERING

UNDISTURBED SAMPLING FIELD FORM

Project:	BRUSH CREEK NO. 15	**Boring ID:**	B-52
Location:	MERCER COUNTY, WV	**Sample ID:**	ST-1
Schnabel Project No.:	19C35013	**By:** RR	**Date:** 03/03/2019
Client Name:	NRCS	**Checked:** EBB	**Date:** 5/7/19

Sampler advanced from 32 feet below ground surface to 34 feet bgs

Sampler Information

Tube Material: GALVANIZED	Type of coating on Tube: N/A
Tube Diameter and Length (inches): 3" x 30"	Condition of Tube Before Use: NEW

Drilling Information

Method of Drilling: 4-1/4 HSA / HQ DOUBLE TUBE	Type of Casing: 4-1/4 HSA
Diameter of Borehole (inches): 4-1/4	Drilling Fluid: N/A

Sampling Checklist (Not applicable for Pitcher Sampler)

1) Was sampler advanced in one uniform, continuous push without rotation? Comments:	Yes / No
2) Was downward force provided through the drill rods using the hydraulic drive mechanism on the drill rig? Comments:	Yes / No
3) Was liquid level in the borehole at or above ground water level during the drilling and sampling operation? Comments:	Yes / No
4) Was sample driven? If yes, record weight and fall of the hammer in comments. Comments:	Yes / No
5) Was the withdrawl of the sampler delayed a minimum of 5 minutes after push? Comments (record rest time):	Yes / No
6) Was the tube slowly rotated to shear the material at the end of the tube prior to extraction? Comments (record number of rotations or amount of rotation):	Yes / No

Sample Measurement, Sealing and Labeling

Sampler Penentration (inches): 24	Sample Recovery (inches): 23

Sample Length Preserved in Tube (after bottom ~1" removed) (inches): GRAVEL IN BOTTOM

Sample Tube Tip Condition (undamaged, bent, nicked, crimped, etc): N/A

Sample Description:
UNKNOWN, LIKELY SANDY CL OR CLAYEY GRAVEL
GR

7) Were both ends of exposed soil sample sealed? Comments and type of seal: WAX	Yes / No
8) Was packing material placed between sealed sample and ends of tube? Comments: SAND	Yes / No
9) Were both ends of tube capped and taped? Comments and type of capping: PLASTIC CAPS / GORILLA TAPE	Yes / No
10) Were the tube and cap appropriately labeled (project name, boring number, sample number, sample depth interval, sample recovery, date sample was taken, and arrow on tube labeled "TOP" pointing toward top of sample)?	Yes / No

Supplemental Comments:

Schnabel ENGINEERING

UNDISTURBED SAMPLING FIELD FORM

Project:	BRUSH CREEK NO. 15	**Boring ID:**	B-52
Location:	MERCER CO, WV	**Sample ID:**	ST-2
Schnabel Project No.:	16C35013	**By:** RR **Date:**	03/03/2019
Client Name:	NRCS	**Checked:** EBB **Date:**	5/7/19

Sampler advanced from 34 feet below ground surface to 36 feet bgs

Sampler Information

Tube Material: GALVANIZED	Type of coating on Tube: NONE
Tube Diameter and Length (inches): 3" x 30"	Condition of Tube Before Use: NEW

Drilling Information

Method of Drilling: 4-1/4" HSA / HQ DOUBLE TUBE	Type of Casing: 4-1/4" HSA
Diameter of Borehole (inches): 4-1/4	Drilling Fluid: N/A

Sampling Checklist (Not applicable for Pitcher Sampler)

1) Was sampler advanced in one uniform, continuous push without rotation? Comments:	Yes / No
2) Was downward force provided through the drill rods using the hydraulic drive mechanism on the drill rig? Comments:	Yes / No
3) Was liquid level in the borehole at or above ground water level during the drilling and sampling operation? Comments:	Yes / No
4) Was sample driven? If yes, record weight and fall of the hammer in comments. Comments:	Yes / No
5) Was the withdrawl of the sampler delayed a minimum of 5 minutes after push? Comments (record rest time):	Yes / No
6) Was the tube slowly rotated to shear the material at the end of the tube prior to extraction? Comments (record number of rotations or amount of rotation):	Yes / No

Sample Measurement, Sealing and Labeling

Sampler Penentration (inches): 24	Sample Recovery (inches): 20.5
Sample Length Preserved in Tube (after bottom ~1" removed) (inches): ± 20	
Sample Tube Tip Condition (undamaged, bent, nicked, crimped, etc): BENT / FLATTENED @ BOTTOM	

Sample Description:

LIKELY SHALE BOULDER @ BOTTOM OF TUBE

7) Were both ends of exposed soil sample sealed? Comments and type of seal:	Yes / No
8) Was packing material placed between sealed sample and ends of tube? Comments: SAND	Yes / No
9) Were both ends of tube capped and taped? Comments and type of capping: PLASTIC CAPS / GORILLA TAPE	Yes / No
10) Were the tube and cap appropriately labeled (project name, boring number, sample number, sample depth interval, sample recovery, date sample was taken, and arrow on tube labeled "TOP" pointing toward top of sample)?	Yes / No

Supplemental Comments:

Schnabel ENGINEERING

UNDISTURBED SAMPLING FIELD FORM

Project:	BRUSH CREEK No. 15	**Boring ID:**	B-52
Location:	MERCER CO, WV	**Sample ID:**	ST-3
Schnabel Project No.:	18C35013	**By:**	RR **Date:** 03/03/2019
Client Name:	NRCS	**Checked:**	EBB **Date:** 5/7/19

Sampler advanced from 66 feet below ground surface to 67.6 feet bgs

Sampler Information

Tube Material: GALVANIZED	Type of coating on Tube: N/A
Tube Diameter and Length (inches): 3" x 30"	Condition of Tube Before Use: NEW

Drilling Information

Method of Drilling: 4-1/4 HSA / HQ DOUBLE TUBE	Type of Casing: 4-1/4 HSA
Diameter of Borehole (inches): 4-1/4	Drilling Fluid: N/A

Sampling Checklist (Not applicable for Pitcher Sampler)

1) Was sampler advanced in one uniform, continuous push without rotation? Comments:	(Yes) / No
2) Was downward force provided through the drill rods using the hydraulic drive mechanism on the drill rig? Comments:	(Yes) / No
3) Was liquid level in the borehole at or above ground water level during the drilling and sampling operation? Comments: NOT SURE, VERY TOP OF SAMPLE APPEARED WET, SAMPLE MOIST	(Yes) / No
4) Was sample driven? If yes, record weight and fall of the hammer in comments. Comments:	Yes / (No)
5) Was the withdrawl of the sampler delayed a minimum of 5 minutes after push? Comments (record rest time):	(Yes) / No
6) Was the tube slowly rotated to shear the material at the end of the tube prior to extraction? Comments (record number of rotations or amount of rotation):	(Yes) / No

Sample Measurement, Sealing and Labeling

Sampler Penentration (inches): 19:2	Sample Recovery (inches): 19
Sample Length Preserved in Tube (after bottom ~1" removed) (inches): 18	
Sample Tube Tip Condition (undamaged, bent, nicked, crimped, etc):	

Sample Description:

CL W/ SAND, CONTAINS WEATHERED SHALE & TRACE

7) Were both ends of exposed soil sample sealed? Comments and type of seal:	(Yes) / No
8) Was packing material placed between sealed sample and ends of tube? Comments: SAND	(Yes) / No
9) Were both ends of tube capped and taped? Comments and type of capping: PLASTIC CAPS / GORILLA TAPE	Yes / No
10) Were the tube and cap appropriately labeled (project name, boring number, sample number, sample depth interval, sample recovery, date sample was taken, and arrow on tube labeled "TOP" pointing toward top of sample)?	(Yes) / No

Supplemental Comments: REFUSED @ 67.6' @ 1000 PSI

Schnabel ENGINEERING

UNDISTURBED SAMPLING FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-255
Location:	Mercer Co WV	**Sample ID:**	ST-1A
Schnabel Project No.:	18C3501304	**By:** CDS	**Date:** 3/11/2019
Client Name:	WV-NRCS	**Checked:** EBB	**Date:** 5/7/19

Sampler advanced from 2.0 feet below ground surface to 3.3 feet bgs

Sampler Information

Tube Material: steel	Type of coating on Tube: none
Tube Diameter and Length (inches): 3"	Condition of Tube Before Use: new

Drilling Information

Method of Drilling: 4-1/4" ID HSA	Type of Casing: augers
Diameter of Borehole (inches): 8"	Drilling Fluid: none

Sampling Checklist (Not applicable for Pitcher Sampler)

1) Was sampler advanced in one uniform, continuous push without rotation? Comments:	(Yes) / No
2) Was downward force provided through the drill **rods using the hydraulic drive mechanism** on the drill rig? Comments:	(Yes) / No
3) Was liquid level in the borehole at or above ground water level during the drilling and sampling operation? Comments: N/A no water encountered, no water added	Yes / No
4) Was sample driven? If yes, record weight and fall of the hammer in comments. Comments:	Yes / (No)
5) Was the withdrawl of the sampler delayed a minimum of 5 minutes after push? Comments (record rest time): 8 min.	(Yes) / No
6) Was the tube slowly rotated to shear the material at the end of the tube prior to extraction? Comments (record number of rotations or amount of rotation): 1 rotation	(Yes) / No

Sample Measurement, Sealing and Labeling

Sampler Penentration (inches): 16"	Sample Recovery (inches): 15"

Sample Length Preserved in Tube (after bottom ~1" removed) (inches): 14"	
Sample Tube Tip Condition (undamaged, bent, nicked, crimped, etc): slightly bent	
Sample Description: Brown CL, w/ rock fragments, moist	
7) Were both ends of exposed soil sample sealed? Comments and type of seal: wax	(Yes) / No
8) Was packing material placed between sealed sample and ends of tube? Comments: some (top only)	(Yes) / No
9) Were both ends of tube capped and taped? Comments and type of capping:	(Yes) / No
10) Were the tube and cap appropriately labeled (project name, boring number, sample number, sample depth interval, sample recovery, date sample was taken, and arrow on tube labeled "TOP" pointing toward top of sample)?	(Yes) / No

Supplemental Comments: weathered shale in bottom of sample

Schnabel ENGINEERING

UNDISTURBED SAMPLING FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-651
Location:	Bluefield, WV	**Sample ID:**	UD-1
Schnabel Project No.:	18C3501B.04	**By:** SMB	**Date:** 3/18/19
Client Name:	WV-NRCS	**Checked:** EBB	**Date:** 5/7/19

Sampler advanced from 4 feet below ground surface to 6 feet bgs

Sampler Information

Tube Material: Shelby Tube	Type of coating on Tube: Zinc
Tube Diameter and Length (inches): 3/30	Condition of Tube Before Use: New

Drilling Information

Method of Drilling: 4'1/4" ID HSA	Type of Casing: None
Diameter of Borehole (inches): 8"	Drilling Fluid: None

Sampling Checklist (Not applicable for Pitcher Sampler)

1) Was sampler advanced in one uniform, continuous push without rotation? Comments:	(Yes) / No
2) Was downward force provided through the drill rods using the hydraulic drive mechanism on the drill rig? Comments: 400	(Yes) / No
3) Was liquid level in the borehole at or above ground water level during the drilling and sampling operation? Comments: GA	Yes / No
4) Was sample driven? If yes, record weight and fall of the hammer in comments. Comments:	Yes / (No)
5) Was the withdrawl of the sampler delayed a minimum of 5 minutes after push? Comments (record rest time): 1:51p - 2:00p	(Yes) / No
6) Was the tube slowly rotated to shear the material at the end of the tube prior to extraction? Comments (record number of rotations or amount of rotation):	Yes / (No)

Sample Measurement, Sealing and Labeling

Sampler Penentration (inches): 24"	Sample Recovery (inches): 21"
Sample Length Preserved in Tube (after bottom ~1" removed) (inches): 20"	
Sample Tube Tip Condition (undamaged, bent, nicked, crimped, etc): Good	
Sample Description: Clayey Sand, gray, moist, f-m sand,	

7) Were both ends of exposed soil sample sealed? Comments and type of seal: Duct Tape, Wax	(Yes) / No
8) Was packing material placed between sealed sample and ends of tube? Comments: Sand	(Yes) / No
9) Were both ends of tube capped and taped? Comments and type of capping:	(Yes) / No
10) Were the tube and cap appropriately labeled (project name, boring number, sample number, sample depth interval, sample recovery, date sample was taken, and arrow on tube labeled "TOP" pointing toward top of sample)?	(Yes) / No

Supplemental Comments:

Schnabel ENGINEERING

UNDISTURBED SAMPLING FIELD FORM

Project:	Brush Creek-Site 15	**Boring ID:**	B-651
Location:	Bluefield, WV	**Sample ID:**	UD-2
Schnabel Project No.:	18C35013.04	**By:** SMB	**Date:** 3/18/19
Client Name:	WV-NRCS	**Checked:** EBB	**Date:** 5/7/19

Sampler advanced from 6 feet below ground surface to 8 feet bgs

Sampler Information

Tube Material: Shelby Tube	Type of coating on Tube: Zinc
Tube Diameter and Length (inches): 3/30	Condition of Tube Before Use: New

Drilling Information

Method of Drilling: 4 1/4" ID HSA	Type of Casing: None
Diameter of Borehole (inches): 8	Drilling Fluid: None

Sampling Checklist (Not applicable for Pitcher Sampler)

1) Was sampler advanced in one uniform, continuous push without rotation? Comments:	(Yes) / No
2) Was downward force provided through the drill rods using the hydraulic drive mechanism on the drill rig? Comments: 600 psi	(Yes) / No
3) Was liquid level in the borehole at or above ground water level during the drilling and sampling operation? Comments: at	Yes / No
4) Was sample driven? If yes, record weight and fall of the hammer in comments. Comments:	Yes / (No)
5) Was the withdrawl of the sampler delayed a minimum of 5 minutes after push? Comments (record rest time): 2:05p-2:13p	(Yes) / No
6) Was the tube slowly rotated to shear the material at the end of the tube prior to extraction? Comments (record number of rotations or amount of rotation):	Yes / (No)

Sample Measurement, Sealing and Labeling

Sampler Penentration (inches):	Sample Recovery (inches):
Sample Length Preserved in Tube (after bottom ~1" removed) (inches):	
Sample Tube Tip Condition (undamaged, bent, nicked, crimped, etc):	
Sample Description: No Recovery	

7) Were both ends of exposed soil sample sealed? Comments and type of seal:	Yes / No
8) Was packing material placed between sealed sample and ends of tube? Comments:	Yes / No
9) Were both ends of tube capped and taped? Comments and type of capping:	Yes / No
10) Were the tube and cap appropriately labeled (project name, boring number, sample number, sample depth interval, sample recovery, date sample was taken, and arrow on tube labeled "TOP" pointing toward top of sample)?	Yes / No

Supplemental Comments:

Schnabel ENGINEERING

UNDISTURBED SAMPLING FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-603
Location:	Mercer Co WV	**Sample ID:**	ST-1A
Schnabel Project No.:	18C35013.04	**By:** CDS	**Date:** 2/27/19
Client Name:	WV - NRCS	**Checked:** EBB	**Date:** 5/7/19

Sampler advanced from 4.0 feet below ground surface to 6.0 feet bgs

Sampler Information

Tube Material: Steel	Type of coating on Tube:
Tube Diameter and Length (inches): 3"	Condition of Tube Before Use: New

Drilling Information

Method of Drilling: 4-1/4" HSA	Type of Casing: Augers
Diameter of Borehole (inches): 8"	Drilling Fluid: none

Sampling Checklist (Not applicable for Pitcher Sampler)

1) Was sampler advanced in one uniform, continuous push without rotation? Comments:	(Yes) / No
2) Was downward force provided through the drill rods using the hydraulic drive mechanism on the drill rig? Comments:	(Yes) / No
3) Was liquid level in the borehole at or above ground water level during the drilling and sampling operation? Comments: N/A, no water encountered, no water in augers	Yes / (No)
4) Was sample driven? If yes, record weight and fall of the hammer in comments. Comments:	Yes / (No)
5) Was the withdrawl of the sampler delayed a minimum of 5 minutes after push? Comments (record rest time):	(Yes) / No
6) Was the tube slowly rotated to shear the material at the end of the tube prior to extraction? Comments (record number of rotations or amount of rotation):	(Yes) / No

Sample Measurement, Sealing and Labeling

Sampler Penentration (inches): 24	Sample Recovery (inches): 23

Sample Length Preserved in Tube (after bottom ~1" removed) (inches): ~ 22

Sample Tube Tip Condition (undamaged, bent, nicked, crimped, etc): undamaged

Sample Description:

Sandy CL w/ gravel, brown, moist

7) Were both ends of exposed soil sample sealed? Comments and type of seal: wax	(Yes) / No
8) Was packing material placed between sealed sample and ends of tube? Comments: Sand	(Yes) / No
9) Were both ends of tube capped and taped? Comments and type of capping:	(Yes) / No
10) Were the tube and cap appropriately labeled (project name, boring number, sample number, sample depth interval, sample recovery, date sample was taken, and arrow on tube labeled "TOP" pointing toward top of sample)?	(Yes) / No

Supplemental Comments: sampled w/ ball valve head

Schnabel ENGINEERING

UNDISTURBED SAMPLING FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-653
Location:	Mercer Co WV	**Sample ID:**	ST-1B
Schnabel Project No.:	18C35013.04	**By:**	CDS **Date:** 2/27/19
Client Name:	WV-NRCS	**Checked:**	EBB **Date:** 5/7/19

Sampler advanced from 6.5 feet below ground surface to 8.5 feet bgs

Sampler Information

Tube Material: steel	Type of coating on Tube:
Tube Diameter and Length (inches): 3"	Condition of Tube Before Use: New

Drilling Information

Method of Drilling: 4-1/4" HSA	Type of Casing: Augers
Diameter of Borehole (inches): 8"	Drilling Fluid: none

Sampling Checklist (Not applicable for Pitcher Sampler)

1) Was sampler advanced in one uniform, continuous push without rotation? Comments:	(Yes) / No
2) Was downward force provided through the drill rods using the hydraulic drive mechanism on the drill rig? Comments:	(Yes) / No
3) Was liquid level in the borehole at or above ground water level during the drilling and sampling operation? Comments: N/A no water encountered, no water in augers	Yes / No
4) Was sample driven? If yes, record weight and fall of the hammer in comments. Comments:	Yes / (No)
5) Was the withdrawl of the sampler delayed a minimum of 5 minutes after push? Comments (record rest time):	(Yes) / No
6) Was the tube slowly rotated to shear the material at the end of the tube prior to extraction? Comments (record number of rotations or amount of rotation):	(Yes) / No

Sample Measurement, Sealing and Labeling

Sampler Penentration (inches): 24	Sample Recovery (inches): 13

Sample Length Preserved in Tube (after bottom ~1" removed) (inches): ~12.5

Sample Tube Tip Condition (undamaged, bent, nicked, crimped, etc): slightly bent

Sample Description:

Sandy CL w/ gravel, brown, moist

7) Were both ends of exposed soil sample sealed? Comments and type of seal: wax	(Yes) / No
8) Was packing material placed between sealed sample and ends of tube? Comments: Sand	(Yes) / No
9) Were both ends of tube capped and taped? Comments and type of capping:	(Yes) / No
10) Were the tube and cap appropriately labeled (project name, boring number, sample number, sample depth interval, sample recovery, date sample was taken, and arrow on tube labeled "TOP" pointing toward top of sample)?	(Yes) / No

Supplemental Comments: sampled w/ ball valve head

Schnabel ENGINEERING

UNDISTURBED SAMPLING FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-653
Location:	Mercer Co. WV	**Sample ID:**	ST-2A
Schnabel Project No.:	18C35013.04	**By:** CDS	**Date:** 2/27/19
Client Name:	WV - NRCS	**Checked:** EBB	**Date:** 5/7/19

Sampler advanced from 26.5 feet below ground surface to 28.5 feet bgs

Sampler Information

Tube Material: Steel	Type of coating on Tube:
Tube Diameter and Length (inches): 3"	Condition of Tube Before Use: New

Drilling Information

Method of Drilling: 4-1/4" HSA	Type of Casing: Augers
Diameter of Borehole (inches): 8"	Drilling Fluid: none

Sampling Checklist (Not applicable for Pitcher Sampler)

1) Was sampler advanced in one uniform, continuous push without rotation? Comments:	Yes / No
2) Was downward force provided through the drill rods using the hydraulic drive mechanism on the drill rig? Comments:	Yes / No
3) Was liquid level in the borehole at or above ground water level during the drilling and sampling operation? Comments: N/A no water encountered, no water in augers	Yes / No
4) Was sample driven? If yes, record weight and fall of the hammer in comments. Comments:	Yes / No
5) Was the withdrawl of the sampler delayed a minimum of 5 minutes after push? Comments (record rest time):	Yes / No
6) Was the tube slowly rotated to shear the material at the end of the tube prior to extraction? Comments (record number of rotations or amount of rotation):	Yes / No

Sample Measurement, Sealing and Labeling

Sampler Penentration (inches): 24	Sample Recovery (inches): 20
Sample Length Preserved in Tube (after bottom ~1" removed) (inches): 20"	
Sample Tube Tip Condition (undamaged, bent, nicked, crimped, etc): undamaged	

Sample Description:

CL, brown, moist

7) Were both ends of exposed soil sample sealed? Comments and type of seal: wax	Yes / No
8) Was packing material placed between sealed sample and ends of tube? Comments: sand, both ends	Yes / No
9) Were both ends of tube capped and taped? Comments and type of capping:	Yes / No
10) Were the tube and cap appropriately labeled (project name, boring number, sample number, sample depth interval, sample recovery, date sample was taken, and arrow on tube labeled "TOP" pointing toward top of sample)?	Yes / No

Supplemental Comments: Lost ~4" of sample at bottom

Sampled w/ ball valve head

Schnabel ENGINEERING

UNDISTURBED SAMPLING FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-653
Location:	Mercer Co WV	**Sample ID:**	ST - 2B
Schnabel Project No.:	18C35013.04	**By:** CDS	**Date:** 2/27/19
Client Name:	WV - NRCS	**Checked:** EBB	**Date:** 5/7/19

Sampler advanced from 28.5 feet below ground surface to 30.5 feet bgs

Sampler Information

Tube Material: steel	Type of coating on Tube:
Tube Diameter and Length (inches): 3"	Condition of Tube Before Use: New

Drilling Information

Method of Drilling: 4-1/4" HSA	Type of Casing: Augers
Diameter of Borehole (inches): 8"	Drilling Fluid: none

Sampling Checklist (Not applicable for Pitcher Sampler)

1) Was sampler advanced in one uniform, continuous push without rotation? Comments:	(Yes) / No
2) Was downward force provided through the drill rods using the hydraulic drive mechanism on the drill rig? Comments:	(Yes) / No
3) Was liquid level in the borehole at or above ground water level during the drilling and sampling operation? Comments: N/A no water encountered, no water in augers	Yes / No
4) Was sample driven? If yes, record weight and fall of the hammer in comments. Comments:	Yes / (No)
5) Was the withdrawl of the sampler delayed a minimum of 5 minutes after push? Comments (record rest time):	(Yes) / No
6) Was the tube slowly rotated to shear the material at the end of the tube prior to extraction? Comments (record number of rotations or amount of rotation):	Yes / (No)

Sample Measurement, Sealing and Labeling

Sampler Penentration (inches): 24	Sample Recovery (inches): 16
Sample Length Preserved in Tube (after bottom ~1" removed) (inches): 16	
Sample Tube Tip Condition (undamaged, bent, nicked, crimped, etc): undamaged	
Sample Description: CL, brown, moist	
7) Were both ends of exposed soil sample sealed? Comments and type of seal: wax	(Yes) / No
8) Was packing material placed between sealed sample and ends of tube? Comments: sand, both ends	(Yes) / No
9) Were both ends of tube capped and taped? Comments and type of capping:	(Yes) / No
10) Were the tube and cap appropriately labeled (project name, boring number, sample number, sample depth interval, sample recovery, date sample was taken, and arrow on tube labeled "TOP" pointing toward top of sample)?	(Yes) / No

Supplemental Comments: Lost ~8" of sample at bottom sampled w/ ball valve head

Schnabel ENGINEERING

UNDISTURBED SAMPLING FIELD FORM

Project:	Brush Creek Site 15	**Boring ID:**	B-153
Location:	Mercer County WV	**Sample ID:**	ST-2C
Schnabel Project No.:	18C3501J.04	**By:** CDS **Date:**	2/27/19
Client Name:	WV-NRCS	**Checked:** EBB **Date:**	5/7/19

Sampler advanced from 30.5 feet below ground surface to 32.5 feet bgs

Sampler Information

Tube Material: steel	Type of coating on Tube:
Tube Diameter and Length (inches): 3"	Condition of Tube Before Use: New

Drilling Information

Method of Drilling: 4-1/4" HSA	Type of Casing: Augers
Diameter of Borehole (inches): 8"	Drilling Fluid: none

Sampling Checklist (Not applicable for Pitcher Sampler)

1) Was sampler advanced in one uniform, continuous push without rotation? Comments:	(Yes) / No
2) Was downward force provided through the drill rods using the hydraulic drive mechanism on the drill rig? Comments:	(Yes) / No
3) Was liquid level in the borehole at or above ground water level during the drilling and sampling operation? Comments: N/A no water encountered, no water in augers	Yes / No
4) Was sample driven? If yes, record weight and fall of the hammer in comments. Comments:	Yes / (No)
5) Was the withdrawl of the sampler delayed a minimum of 5 minutes after push? Comments (record rest time):	(Yes) / No
6) Was the tube slowly rotated to shear the material at the end of the tube prior to extraction? Comments (record number of rotations or amount of rotation):	(Yes) / No

Sample Measurement, Sealing and Labeling

Sampler Penentration (inches): 24	Sample Recovery (inches): 24
Sample Length Preserved in Tube (after bottom ~1" removed) (inches): ~23.5"	
Sample Tube Tip Condition (undamaged, bent, nicked, crimped, etc): undamaged	

Sample Description:

CL, brown, moist

7) Were both ends of exposed soil sample sealed? Comments and type of seal: wax	(Yes) / No
8) Was packing material placed between sealed sample and ends of tube? Comments: sand	(Yes) / No
9) Were both ends of tube capped and taped? Comments and type of capping:	(Yes) / No
10) Were the tube and cap appropriately labeled (project name, boring number, sample number, sample depth interval, sample recovery, date sample was taken, and arrow on tube labeled "TOP" pointing toward top of sample)?	(Yes) / No

Supplemental Comments: sampled w/ ball valve head

ROCK CORE BOX PHOTOGRAPHS

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PHOTOGRAPH 1
Date of Drilling: 3/14/2019
Boring: B-51
Box No.: 1 of 6
Depth (ft): 85.0 to 98.0

PHOTOGRAPH 2
Date of Drilling: 3/14/2019
Boring: B-51
Box No.: 2 of 6
Depth (ft): 98.0 to 108.0

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PHOTOGRAPH 3
Date of Drilling: 3/14/2019
Boring: B-51
Box No.: 3 of 6
Depth (ft): 108.0 to 118.0

PHOTOGRAPH 4
Date of Drilling: 3/14/2019
Boring: B-51
Box No.: 4 of 6
Depth (ft): 118.0 to 126.8

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PHOTOGRAPH 5
Date of Drilling: 3/14/2019
Boring: B-51
Box No.: 5 of 6
Depth (ft): 126.8 to 136.8

PHOTOGRAPH 6
Date of Drilling: 3/15/2019
Boring: B-51
Box No.: 6 of 6
Depth (ft): 136.8 to 141.8

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PHOTOGRAPH 7
Date of Drilling: 3/5/2019
Boring: B-52
Box No.: 1 of 2
Depth (ft): 71.0 to 81.0

PHOTOGRAPH 8
Date of Drilling: 3/5/2019
Boring: B-52
Box No.: 2 of 2
Depth (ft): 81.0 to 85.2

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PHOTOGRAPH 9
Date of Drilling: 3/12/2019
Boring: B-251
Box No.: 1 of 2
Depth (ft): 19.1 to 29.1

PHOTOGRAPH 10
Date of Drilling: 3/12/2019
Boring: B-251
Box No.: 2 of 2
Depth (ft): 29.1 to 39.1

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PHOTOGRAPH 11
Date of Drilling: 3/12/2019
Boring: B-252
Box No.: 1 of 1
Depth (ft): 10.9 to 20.9

PHOTOGRAPH 12
Date of Drilling: 3/6/2019
Boring: B-253
Box No.: 1 of 1
Depth (ft): 34.4 to 39.4

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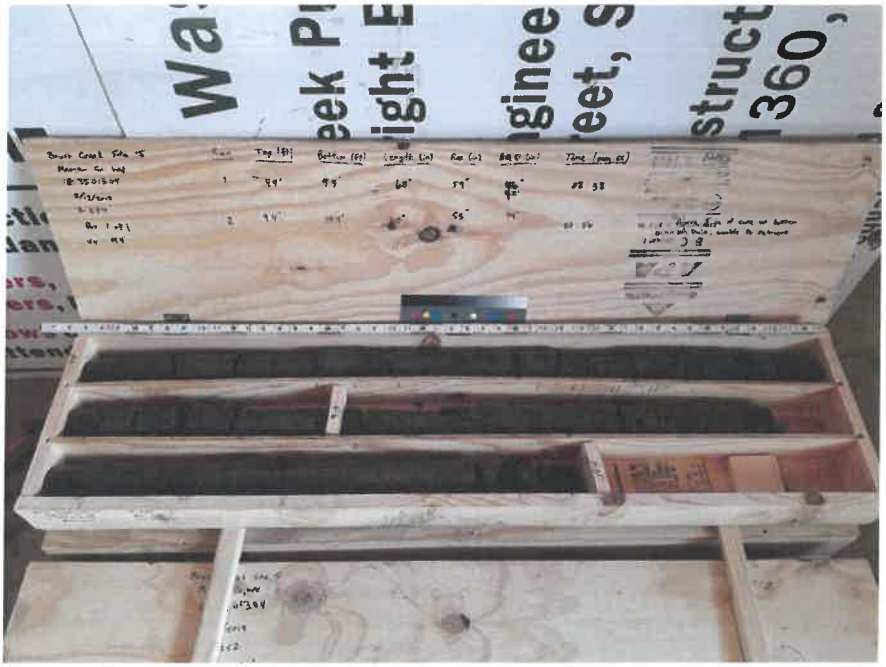

PHOTOGRAPH 13
Date of Drilling: 3/12/2019
Boring: B-254
Box No.: 1 of 1
Depth (ft): 4.4 to 14.4

PHOTOGRAPH 14
Date of Drilling: 3/11/2019
Boring: B-255
Box No.: 1 of 1
Depth (ft): 15.8 to 25.8

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PHOTOGRAPH 15
Date of Drilling: 2/26/2019
Boring: B-256
Box No.: 1 of 1
Depth (ft): 19.7 to 24.7

PHOTOGRAPH 16
Date of Drilling: 2/26/2019
Boring: B-257
Box No.: 1 of 4
Depth (ft): 5.3 to 17.5

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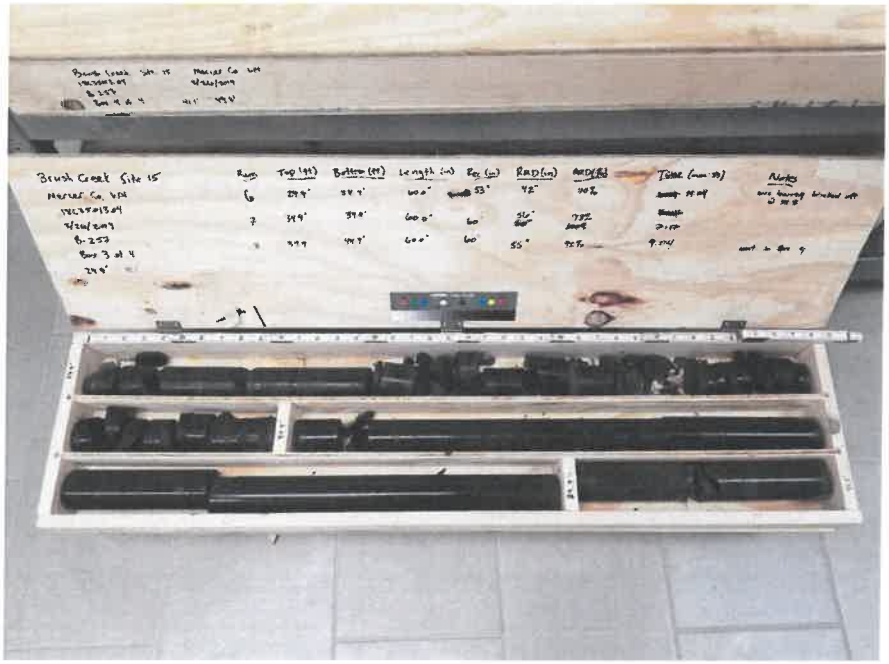
PHOTOGRAPH 17
Date of Drilling: 2/26/2019
Boring: B-257
Box No.: 2 of 4
Depth (ft): 17.5 to 29.9



PHOTOGRAPH 18
Date of Drilling: 2/26/2019
Boring: B-257
Box No.: 3 of 4
Depth (ft): 29.9 to 41.1

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PHOTOGRAPH 19
Date of Drilling: 2/26/2019
Boring: B-257
Box No.: 4 of 4
Depth (ft): 41.1 to 49.9

PHOTOGRAPH 20
Date of Drilling: 3/18/2019
Boring: B-651
Box No.: 1 of 1
Depth (ft): 16.5 to 26.0

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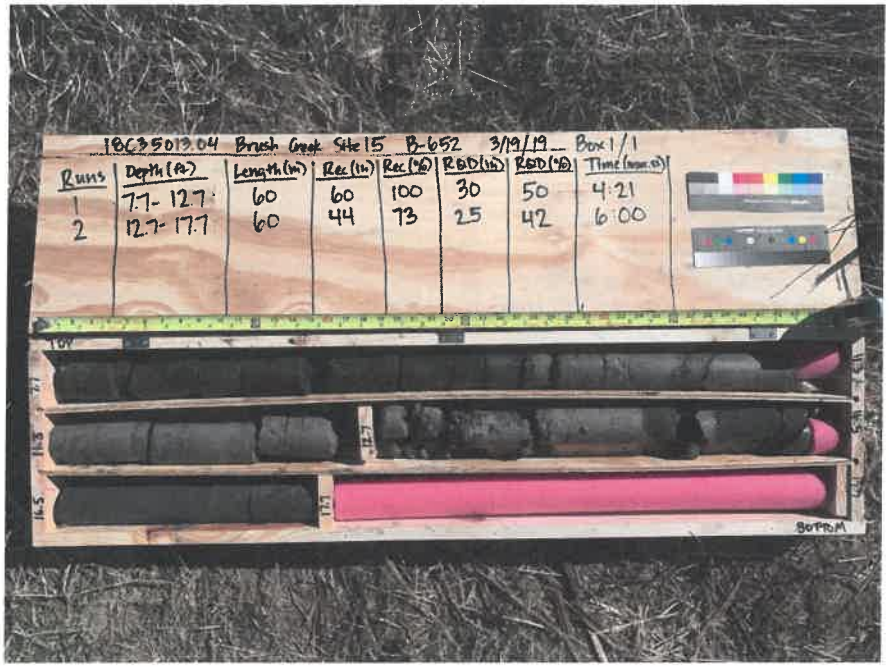
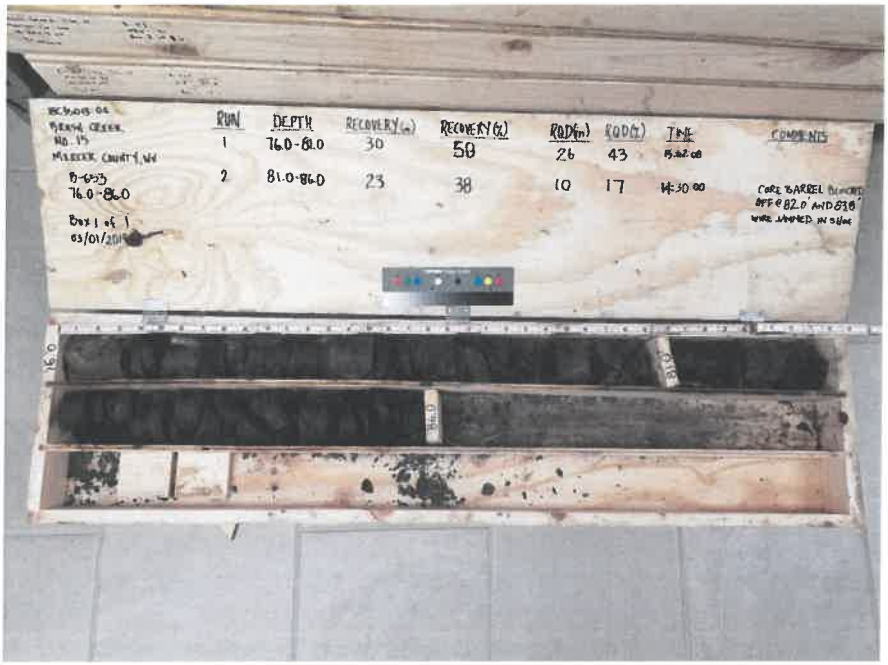


PHOTOGRAPH 21
Date of Drilling: 3/19/2019
Boring: B-652
Box No.: 1 of 1
Depth (ft): 7.7 to 17.7



PHOTOGRAPH 22
Date of Drilling: 3/1/2019
Boring: B-653
Box No.: 1 of 1
Depth (ft): 76.0 to 86.0

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APPENDIX B

PIEZOMETER INSTALLATION SKETCHES AND DEVELOPMENT RECORDS

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PIEZOMETER INSTALLATION SKETCH

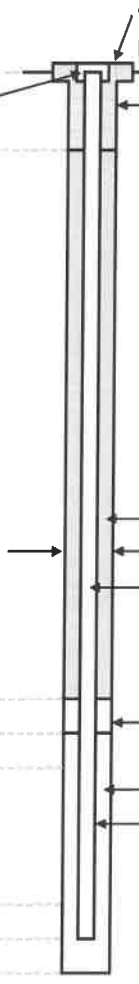
Project:	Brush Creek Site 15	**Piezometer ID:**	B-51A		
Location:	Bluefield, WV	**Date of Installation:**			3/18/2019
Schnabel Project No.:	18C35013.04	**By:**	SMB	**Date:**	3/18/2019
Client Name:	WV - NRCS	**Checked:**		**Date:**	
Subcontractor:	Horn & Associates, Inc.	**Station:**	N/A	**Offset:**	N/A

Elev of Top of Open Riser Pipe (Reference El. for water level measurements,ft): **2508.10**

Depth to Bottom of Well from Top of Open Riser Pipe (ft): **-75.90**

Horizontal Location (ft): **Northing:** **118,270.70** **Easting:** **1,914,787.30**

Elevation (ft, M.S.L.)	Depth or Height (ft) from: Top of Open Riser	Ground Surface
2508.5	0.4	0.0
2508.1	0.0	-0.4
2507.2	-0.9	-1.3
2442.1	-65.6	-66.0
2440.1	-67.6	-68.0
2438.1	-69.6	-70.0
2433.5	-74.6	-75.0
2433.0	-75.1	-75.5
2432.5	-75.6	-76.0



Type of Flush Mount Box	8" steel flush mount
Type of Surface Seal	Quickcrete (cement)
Type of Backfill	Cement/bentonite grout
Diameter of Borehole	8 inches
I.D. of Riser Pipe	2 inches
Riser Pipe Material	Sch 40 PVC
Type of Seal	Coated bentonite pellets
Size of Filter Sand	#5 Quartz Sand Pack
I.D. of Screen	2 inches
Screen Opening	0.01 inches
Screen Material	Sch 40 PVC
Slot Type	Machine slotted

Diagram Not to Scale

Comments:

3 batches of grout used. 1 batch = 1-94 lb bag Portland Cement Type I-II, 25 lb bentonite powder, and 30 gal water.

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PIEZOMETER DEVELOPMENT FIELD FORM

Project:	Brush Creek Site 15	**Well ID:**	B-51A
Location:	Bluefield, WV	**Date(s):**	4/3/19
Schnabel Project No.:	180350 13.03	**Time Started:**	**Time Ended:**
Client Name:	WV-NRCS	**Weather Conditions:**	Sunny, 50°F
Field Personnel:	Sue Buchanan	**Checked By:**	**Date:**

Water Level measured from TOC (d_{swl}, feet): 70.9	Riser Pipe Diameter (r_c, inches): 2
Well Depth measured from TOC (d_w, feet): 75.5	Well Volume (gal) $V=0.041\ (r_c)^2\ (d_w-d_{swl})$: 0.75
Screened Interval from TOC (feet): 75-70	Note: TOC = Top of Open Riser Pipe

Comments on Well Condition (riser pipe type, outer casing, lock, etc):

6.75 or 9
9 or 12

Purge Information

Purging Method: (put an X by one)	___ Stainless Steel Bailer ___ Peristalic Pump ___ Grundfos Pump X Bailer ___ Polyethylene Bailer ___ Bladder Pump ___ DC Pump ___ Other:
Purge Equipment/Serial No:	
Monitoring Instrument(s)/Serial No:	
Purge Flow Rate (gpm):	Well Purged Dry (circle one): (Yes) or No

Test Information	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
Date	4/3/19		4/17/19	4/18/19	4/22/19	
Time (of day, hr:min)	11:25		3:55p	9:49a	1:00p	
Volume Purged (Gal): Cumulative or Per Test (circle one)	5.0		4.5	1.0	1.0	
Water Level (ft from TOC) After Purging	73.2		74.5	75.1	74.8	
Temperature (°C)	X	X	X	X	X	
pH (s.u.)						
Conductivity (µS/cm)						
Turbidity (NTU)						
Sheen/Color	clear → Brown/Sandy		→		→	
Odor	—	—	—	—	—	

Note: Fill in columns as appropriate based on project requirements. NR = Not Recorded; NA = Not Applicable.

Comments:

WL on 4/17/19 = 61.6' before developing well
clear for 1 gallon on 4/17/19

WL on 4/18/19 = 73.6' before developing well
↳ well purged dry on 4/18/19

WL on 4/22/19 = 72.8' (1:00pm) before developing well

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PIEZOMETER DEVELOPMENT FIELD FORM - Continuation Sheet

Project: Brush Creek Site 15 **Well ID:** B-51A

Purge Information

Test Information	Test	Test	Test	Test	Test	Test
Date	5/1/19	5/6/19				
Time (of day, hr:min)	11:30a	12:20p				
Volume Purged (Gal): Cumulative or Per Test (circle one)	2.0	1.5				
Water Level (ft from TOC) After Purging	74.3	74.35				
Temperature (°C)	X	X				
pH (s.u.)	X	X				
Conductivity (µS/cm)	X	X				
Turbidity (NTU)	X	X				
Sheen/Color	Lt. Brown/Sandy	Clear / Lt. Brown				
Odor	—	—				

Note: Fill in columns as appropriate based on project requirements. NR = Not Recorded; NA = Not Applicable.

Comments: WL on 5/1/19 prior to development = 70.9'
WL on 5/6/19 prior to development = 71.6'
↳ 2 bailers w/ clear water when purged.

Purge Information

Test Information	Test	Test	Test	Test	Test	Test
Date						
Time (of day, hr:min)						
Volume Purged (Gal): Cumulative or Per Test (circle one)						
Water Level (ft from TOC) After Purging						
Temperature (°C)						
pH (s.u.)						
Conductivity (µS/cm)						
Turbidity (NTU)						
Sheen/Color						
Odor						

Note: Fill in columns as appropriate based on project requirements. NR = Not Recorded; NA = Not Applicable.

Comments:

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PIEZOMETER INSTALLATION SKETCH

Project:	Brush Creek Site 15	**Piezometer ID:**	B-651		
Location:	Bluefield, WV	**Date of Installation:**			3/19/2019
Schnabel Project No.:	18C35013.04	**By:**	SMB	**Date:**	3/19/2019
Client Name:	WV - NRCS	**Checked:**		**Date:**	
Subcontractor:	Horn & Associates, Inc.	**Station:**	N/A	**Offset:**	N/A

Elev of Top of Open Riser Pipe (Reference El. for water level measurements,ft): **2436.80**

Depth to Bottom of Well from Top of Open Riser Pipe (ft): **-26.60**

Horizontal Location (ft): **Northing:** **118,448.30** **Easting:** **1,914,720.30**

Elevation (ft, M.S.L.)	Depth or Height (ft) from: Top of Open Riser	Ground Surface		
2437.6	0.8	0.0	Type of Flush Mount Box	12" steel flush mount
2436.8	0.0	-0.8	Type of Surface Seal	
2436.8	2.0	-2.0		Quickcrete (cement)
			Diameter of Borehole	8 inches
			Type of Backfill	Cement/bentonite grout
			I.D. of Riser Pipe	2 inches
			Riser Pipe Material	Sch 40 PVC
2423.6	-13.2	-14.0		
2421.1	-15.7	-16.5	Diameter of Borehole	3.4 inches
2420.6	-16.2	-17.0	Type of Seal	Coated bentonite pellets
2418.4	-18.4	-19.2		
			Size of Filter Sand	#5 Quartz Sand Pack
			I.D. of Screen	2 inches
			Screen Opening	0.01 inches
2413.4	-23.4	-24.2	Screen Material	Sch 40 PVC
2411.8	-25.0	-25.8	Slot Type	Machine slotted
2411.6	-25.2	-26.0		

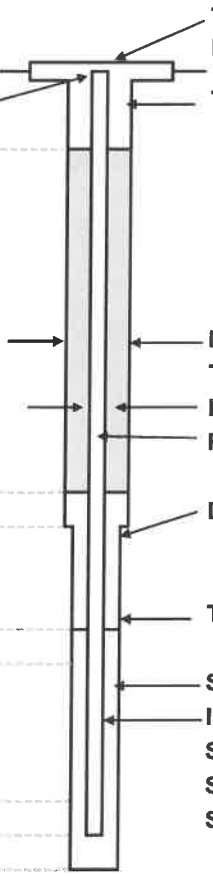

Diagram Not to Scale

Comments:

Well installed with 2" glued-on PVC cap and 0-15psi glycerin-filled pressure gauge located 0.8 feet bgs.

1 grout batch used: 1-94 lb bag Portland Type I-II, 25 lb bentonite powder, and 30 gal water.

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PIEZOMETER DEVELOPMENT FIELD FORM

Project:	Brush Creek Site #4 15	**Well ID:**	B-651
Location:	Bluefield, WV	**Date(s):**	4/3/19
Schnabel Project No.:	180350130.03	**Time Started:**	**Time Ended:**
Client Name:	WV-NRCS	**Weather Conditions:**	Sunny, 55°F
Field Personnel:	Sue Buchanan	**Checked By:** EBB	**Date:** 5/7/19

Water Level measured from TOC (d_{swl}, feet): 0	Riser Pipe Diameter (r_c, inches): 2
Well Depth measured from TOC (d_w, feet): 25.8	Well Volume (gal) $V=0.041\ (r_c)^2\ (d_w-d_{swl})$: 4.2
Screened Interval from TOC (feet): 19.2-24.2	Note: TOC = Top of Open Riser Pipe

Comments on Well Condition (riser pipe type, outer casing, lock, etc):
Sch40 PVC, 10psi gauge w/ cap, 12" ID steel flush mount cover & concrete pad

Purge Information

Purging Method: (put an X by one)	___ Stainless Steel Bailer ___ Peristalic Pump ___ Grundfos Pump X Bailer ___ Polyethylene Bailer ___ Bladder Pump ___ DC Pump ___ Other:
Purge Equipment/Serial No:	
Monitoring Instrument(s)/Serial No:	
Purge Flow Rate (gpm):	Well Purged Dry (circle one): Yes or (No)

Test Information	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
Date	4/3/19					
Time (of day, hr:min)	12:35p					
Volume Purged (Gal): Cumulative or (Per Test) (circle one)	5.0					
Water Level (ft from TOC) After Purging	+1.0					
Temperature (°C)	X	X	X	X	X	X
pH (s.u.)						
Conductivity (µS/cm)						
Turbidity (NTU)	—	—	—	—	—	—
Sheen/Color	clear to silty					
Odor	—	—	—	—	—	—

Note: Fill in columns as appropriate based on project requirements. NR = Not Recorded; NA = Not Applicable.

Comments:
3.83-4.9
water level 4/3/19 @ 12:37p +1.07ft

APPENDIX C

RESULTS OF HYDRAULIC CONDUCTIVITY TESTING IN SOIL

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HYDRAULIC CONDUCTIVITY (SLUG) TESTING IN SOIL

Brief Description of the Test Methods

Aterra-Schnabel JV personnel performed hydraulic conductivity tests in piezometers using the slug test method. The test equipment included an In-Situ Level TROLL 700 Data Logger, 2-ft or 4-ft steel slug, and the tablet software V-Situ for data monitoring. Each piezometer installed during this investigation was developed prior to slug testing using a bailer and graduated 5-gallon bucket for measurement of purged well volumes. Prior to each test, the static water level and total depth of the piezometer were measured.

To begin the falling head test, the initial water level in the well was measured. A data logger was then lowered down to the well screen. Once the water level stabilized, a slug was submerged to displace the water level in the piezometer, and the data logger recorded the falling water level at various times. The falling head test was terminated after the water level returned to approximately the initial level. The slug was then removed, causing the water level in the piezometer to drop. The data logger recorded the rising water level at various times. The rising head test was terminated after the water level returned to approximately the initial level.

Test data was evaluated using the software program Aqtesolv Pro (Version 4.50). Two analytical methods were used: the Bouwer and Rice Method (Bouwer and Rice, 1976; Bouwer, 1989A, 1989B) and the KGS Model (Hyder et al., 1994). The Bouwer and Rice Method was considered when the data did not fit well with the KGS Model. This testing is only an approximation of the in situ hydraulic conductivity at selected locations and variations are to be expected.

At time of this report, the slug tests were ongoing. Slug test results will be submitted with the final report.

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Schnabel ENGINEERING

SLUG TEST FIELD FORM

Project: Brush Creek Site 15
Location: Bluefield, WV
Schnabel Project No.: 18C35013.04
Client Name: WV - NRCS
Attachments: Falling head test obs.

Well No.: B-51A
Date: 5/9/2019
Weather/Temp.: Sunny, 75 degrees, windy
By: SMB **Date:** 5/9/2019
Checked: **Date:**

Depth Reference (Depth = 0ft): Top of casing

Well Construction:

Inside Diameter (D_w): Casing **2 in**; Screen **2 in**

Total Depth of Well Length (d_w): **75.5 ft**

Screen Depth: Top (d_{ts}): **70 ft**; Bottom (d_{bs}): **75 ft**

Equipment (Make, Model, SN, and/or Description):

Transducer: **Level Troll In-Situ 700**

Vented (circle one): **Yes** or No

Data Logger: **Vu-Situ**

Water Level Indicator: **Heron Dipper-T (100 ft)**

Slug: Type (circle one): Mechanical or **Water**

Diameter (d_s): in; Length (l_s): in

Volume (v_s): in^3 (= l_s x $\pi(½\ d_s)^2$)

Pre-Test Setup Data:

Initial water level depth (manual) (d_{swl}): **72.7 ft**

Initial head (transducer) (H_i): **1.97 ft**

Approx. depth of pressure transducer (d_T): **73.53 ft**

Pre-test data file name: _____

Pre-test data logger start time: _____

Pre-test data logger end time: _____

Comments: Top of Casing (TOC) is 4.8" below flush mount. Due to slow recovery and low static water level, addition of slue was not performed. Used water slug instead and only a falling head test is performed. Water added, about 3.5 gallons.

Pre-Test Check:

Planned depth of slug after insertion: Top: _____ ft; Bottom: _____ ft (*NA for water slug*)

Will top of mechanical slug be submerged below the pre-test ref. water level? (circle one): Yes or No or **NA**

Estimated water level rise immediately after slug insertion: _____in (= v_s / $\pi(½\ D_w)^2$); _____ft

Estimated water level depth immediately after slug insertion: _____ft

Will water be discharged from the well upon slug insertion? (circle one): Yes or No

Test Data (Falling Head):

Falling head data file name: **B-51A_FH**

Falling head data logger start time: **1:07pm 5/9**

Head before slug insertion = **1.97 ft**

Time of slug insertion: **1:09pm**

Head immed. after slug insertion (h_1): **12.9 ft**

Falling head data logger end time: **12:06pm 5/13**

Falling Head Measurements: (Recovery = [(h_1-h_2)/h_1] x 100)

Test can be stopped at 90% or more recovery.

Time (min:sec)	Head (h_2)	Recovery
12:06pm	**15.3 ft**	_____%
_____	_____ft	_____%
_____	_____ft	_____%
_____	_____ft	_____%

Test Data (Rising Head):

Rising head data file name:

Rising head data logger start time:

Head before slug removal:

Time of slug removal:

Head immed. after slug removal (h_1):

Rising head data logger end time:

Rising Head Measurements: (Recovery = [(h_1-h_2)/h_1] x 100)

Test can be stopped at 90% or more recovery.

Time (hr:min)	Head (h_2)	Recovery
_____	_____ft	_____%
_____	_____ft	_____%
_____	_____ft	_____%
_____	_____ft	_____%

Schnabel ENGINEERING

FALLING HEAD TEST DATA SHEET

Project:	Brush Creek Site 15		Boring No.:	B-51A		
Location:	Bluefield, WV		Well Screen:	70.0	to 75.0	ft, from TOC
Schnabel Project No.:	18C35013.04		Test Interval:	2438.1	to 2433.1	EL, ft from TOC
Client Name:	WV NRCS		Test Date:	5/9/2019		
Ground Elevation (NAVD88)	2508.1		By:	SMB	Date:	5/9/2019
Northing:	118270.7		Checked:	CDS	Date:	6/14/2019
Easting:	1914787.3					

Measured Water Level at Start of Day: 72.7 ft bgs
Casing Type: 2" ID sch 40 PVC
Casing Stick-Up Height: -0.4 ft, below flush mount cover
Total Well Length: 75.5 ft, from TOC

Elapsed Time (sec)	Water Level measured by transducer (ft)	Displacement (ft)	Water level below top of casing (ft)
0.00	12.97	-2.36	62.53
0.15	12.96	-2.36	62.54
0.31	12.96	-2.36	62.54
0.47	12.95	-2.37	62.55
0.65	12.95	-2.37	62.55
0.84	12.95	-2.38	62.55
1.04	12.95	-2.38	62.55
1.25	12.91	-2.41	62.59
1.47	12.90	-2.42	62.60
1.71	12.85	-2.47	62.65
1.96	12.89	-2.43	62.61
2.22	12.89	-2.43	62.61
2.50	12.89	-2.44	62.61
2.80	12.88	-2.44	62.62
3.11	12.84	-2.48	62.66
3.45	12.87	-2.46	62.63
3.80	12.86	-2.46	62.64
4.17	12.86	-2.46	62.64
4.57	12.86	-2.47	62.64
4.99	12.85	-2.47	62.65
5.43	12.85	-2.48	62.65
5.90	12.85	-2.48	62.65
6.40	12.84	-2.48	62.66
6.93	12.84	-2.49	62.66
7.49	12.83	-2.49	62.67
8.09	12.82	-2.50	62.68
8.69	12.83	-2.50	62.67
9.39	12.82	-2.51	62.68
10.09	12.82	-2.51	62.68
10.79	12.82	-2.50	62.68
11.59	12.82	-2.51	62.68
12.49	12.82	-2.51	62.68
13.29	12.81	-2.51	62.69
14.29	12.81	-2.52	62.69

Schnabel ENGINEERING

FALLING HEAD TEST DATA SHEET

Project:	Brush Creek Site 15		Boring No.:	B-51A		
Location:	Bluefield, WV		Well Screen:	70.0	to 75.0	ft, from TOC
Schnabel Project No.:	18C35013.04		Test Interval:	2438.1	to 2433.1	EL, ft from TOC
Client Name:	WV NRCS		Test Date:	5/9/2019		
Ground Elevation (NAVD88)	2508.1		By:	SMB	Date:	5/9/2019
Northing:	118270.7		Checked:	CDS	Date:	6/14/2019
Easting:	1914787.3					

Measured Water Level at Start of Day: 72.7 ft bgs
Casing Type: 2" ID sch 40 PVC
Casing Stick-Up Height: -0.4 ft, below flush mount cover
Total Well Length: 75.5 ft, from TOC

Elapsed Time (sec)	Water Level measured by transducer (ft)	Displacement (ft)	Water level below top of casing (ft)
15.29	12.80	-2.52	62.70
16.29	12.80	-2.53	62.70
17.39	12.79	-2.53	62.71
18.59	12.79	-2.53	62.71
19.89	12.79	-2.54	62.71
21.19	12.78	-2.55	62.72
22.59	12.78	-2.55	62.72
24.09	12.77	-2.55	62.73
25.69	12.77	-2.56	62.73
27.29	12.76	-2.56	62.74
29.09	12.76	-2.56	62.74
30.99	12.75	-2.57	62.75
32.99	12.75	-2.58	62.75
35.09	12.75	-2.58	62.75
37.29	12.74	-2.58	62.76
39.69	12.74	-2.59	62.76
42.19	12.73	-2.59	62.77
44.79	12.73	-2.59	62.77
47.59	12.73	-2.60	62.77
50.59	12.72	-2.60	62.78
53.69	12.72	-2.61	62.78
57.09	12.71	-2.61	62.79
60.59	12.71	-2.62	62.79
64.29	12.70	-2.62	62.80
68.29	12.70	-2.63	62.80
72.49	12.70	-2.63	62.80
76.89	12.69	-2.63	62.81
81.59	12.68	-2.64	62.82
86.59	12.68	-2.64	62.82
91.89	12.68	-2.65	62.82
97.49	12.68	-2.65	62.82
103.49	12.68	-2.65	62.82
109.49	12.67	-2.65	62.83
116.49	12.67	-2.65	62.83
123.49	12.67	-2.66	62.83
130.49	12.67	-2.66	62.83
138.49	12.67	-2.66	62.83
147.49	12.67	-2.65	62.83
155.49	12.67	-2.66	62.83

Schnabel ENGINEERING

FALLING HEAD TEST DATA SHEET

Project:	Brush Creek Site 15					
Location:	Bluefield, WV		Boring No.:	B-51A		
Schnabel Project No.:	18C35013.04		Well Screen:	70.0	to 75.0	ft, from TOC
Client Name:	WV NRCS					
			Test Interval:	2438.1	to 2433.1	EL, ft from TOC
Ground Elevation (NAVD88)	2508.1		Test Date:	5/9/2019		
Northing:	118270.7		By:	SMB	Date:	5/9/2019
Easting:	1914787.3		Checked:	CDS	Date:	6/14/2019

Measured Water Level at Start of Day: 72.7 ft bgs
Casing Type: 2" ID sch 40 PVC
Casing Stick-Up Height: -0.4 ft, below flush mount cover
Total Well Length: 75.5 ft, from TOC

Elapsed Time (sec)	Water Level measured by transducer (ft)	Displacement (ft)	Water level below top of casing (ft)
165.49	12.67	-2.66	62.83
175.49	12.66	-2.66	62.84
185.49	12.67	-2.66	62.83
195.49	12.66	-2.66	62.84
205.49	12.66	-2.66	62.84
215.49	12.66	-2.66	62.84
225.49	12.67	-2.65	62.83
235.49	12.67	-2.66	62.83
245.49	12.67	-2.65	62.83
255.49	12.67	-2.65	62.83
265.49	12.67	-2.66	62.83
275.49	12.67	-2.65	62.83
285.49	12.67	-2.65	62.83
295.49	12.68	-2.65	62.82
305.49	12.67	-2.65	62.83
315.49	12.68	-2.64	62.82
325.49	12.68	-2.64	62.82
335.49	12.68	-2.64	62.82
345.49	12.69	-2.63	62.81
355.49	12.68	-2.64	62.82
365.49	12.69	-2.63	62.81
375.49	12.70	-2.63	62.80
385.49	12.69	-2.63	62.81
395.49	12.70	-2.63	62.80
405.49	12.70	-2.62	62.80
415.49	12.71	-2.62	62.79
425.49	12.71	-2.61	62.79
435.49	12.71	-2.61	62.79
445.49	12.72	-2.61	62.78
455.49	12.72	-2.61	62.78
465.49	12.72	-2.60	62.78
475.49	12.72	-2.60	62.78
485.49	12.73	-2.59	62.77
495.49	12.73	-2.60	62.77
505.49	12.73	-2.59	62.77
515.49	12.73	-2.59	62.77
525.49	12.74	-2.59	62.76
535.49	12.74	-2.58	62.76
545.49	12.75	-2.58	62.75

Schnabel ENGINEERING

FALLING HEAD TEST DATA SHEET

Project:	Brush Creek Site 15		Boring No.:	B-51A		
Location:	Bluefield, WV		Well Screen:	70.0	to 75.0	ft, from TOC
Schnabel Project No.:	18C35013.04		Test Interval:	2438.1	to 2433.1	EL, ft from TOC
Client Name:	WV NRCS		Test Date:	5/9/2019		
Ground Elevation (NAVD88)	2508.1		By:	SMB	Date:	5/9/2019
Northing:	118270.7		Checked:	CDS	Date:	6/14/2019
Easting:	1914787.3					

Measured Water Level at Start of Day: 72.7 ft bgs
Casing Type: 2" ID sch 40 PVC
Casing Stick-Up Height: -0.4 ft, below flush mount cover
Total Well Length: 75.5 ft, from TOC

Elapsed Time (sec)	Water Level measured by transducer (ft)	Displacement (ft)	Water level below top of casing (ft)
555.49	12.75	-2.58	62.75
565.49	12.75	-2.57	62.75
575.49	12.75	-2.57	62.75
585.49	12.75	-2.57	62.75
595.49	12.77	-2.56	62.73
605.49	12.76	-2.56	62.74
615.49	12.76	-2.56	62.74
625.49	12.77	-2.55	62.73
635.49	12.77	-2.55	62.73
645.49	12.78	-2.55	62.72
655.49	12.78	-2.55	62.72
665.49	12.78	-2.54	62.72
675.49	12.79	-2.53	62.71
685.49	12.79	-2.53	62.71
695.49	12.80	-2.53	62.70
705.49	12.80	-2.52	62.70
715.49	12.81	-2.51	62.69
725.49	12.81	-2.52	62.69
735.49	12.81	-2.51	62.69
745.49	12.81	-2.51	62.69
755.49	12.82	-2.50	62.68
765.49	12.83	-2.50	62.67
775.49	12.83	-2.50	62.67
785.49	12.83	-2.49	62.67
795.49	12.84	-2.48	62.66
805.49	12.85	-2.48	62.65
815.49	12.85	-2.47	62.65
825.49	12.85	-2.47	62.65
835.49	12.85	-2.47	62.65
845.49	12.86	-2.46	62.64
855.49	12.86	-2.46	62.64
865.49	12.87	-2.45	62.63
875.49	12.87	-2.45	62.63
885.49	12.87	-2.45	62.63
895.49	12.88	-2.44	62.62
905.49	12.88	-2.44	62.62
915.49	12.89	-2.44	62.61
925.49	12.89	-2.43	62.61
935.49	12.90	-2.43	62.60

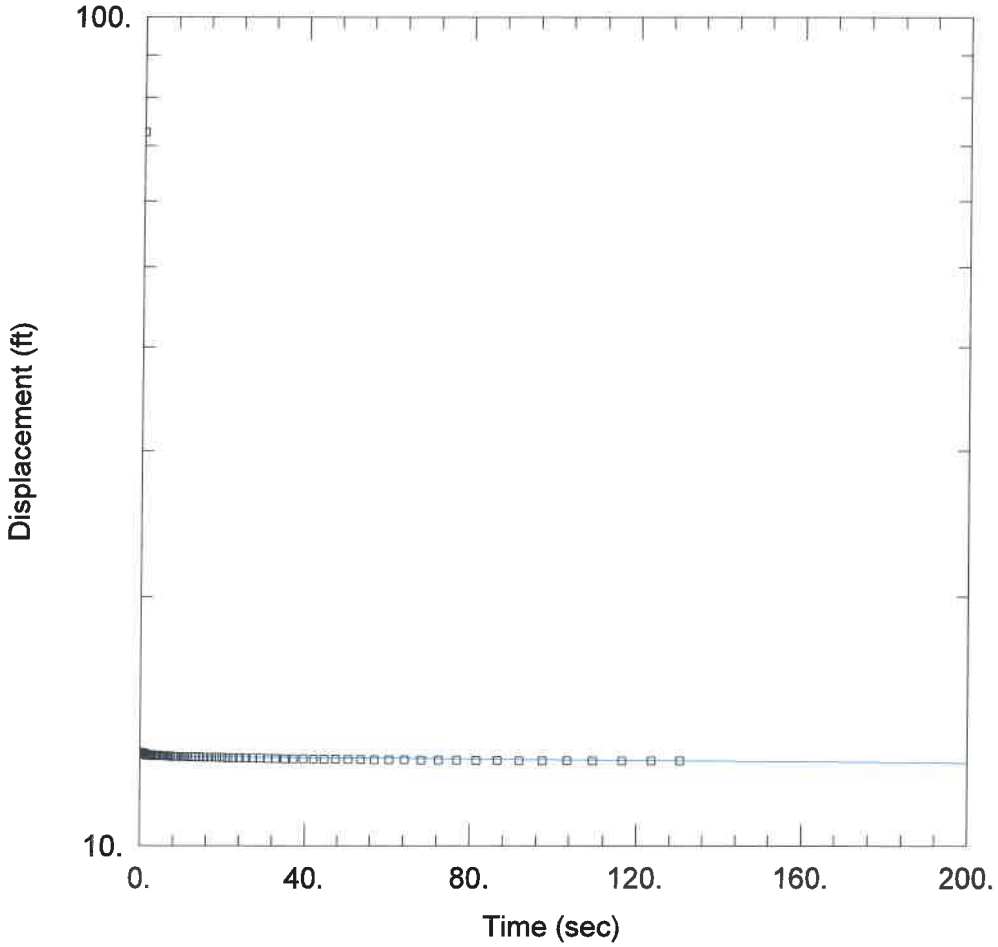
Schnabel ENGINEERING

FALLING HEAD TEST DATA SHEET

Project:	Brush Creek Site 15		Boring No.:	B-51A		
Location:	Bluefield, WV		Well Screen:	70.0	to 75.0	ft, from TOC
Schnabel Project No.:	18C35013.04		Test Interval:	2438.1	to 2433.1	EL, ft from TOC
Client Name:	WV NRCS		Test Date:	5/9/2019		
Ground Elevation (NAVD88)	2508.1		By:	SMB	Date:	5/9/2019
Northing:	118270.7		Checked:	CDS	Date:	6/14/2019
Easting:	1914787.3					

Measured Water Level at Start of Day: 72.7 ft bgs
Casing Type: 2" ID sch 40 PVC
Casing Stick-Up Height: -0.4 ft, below flush mount cover
Total Well Length: 75.5 ft, from TOC

Elapsed Time (sec)	Water Level measured by transducer (ft)	Displacement (ft)	Water level below top of casing (ft)
945.49	12.90	-2.42	62.60
955.49	12.91	-2.42	62.59
965.49	12.91	-2.41	62.59
975.49	12.92	-2.40	62.58
985.49	12.92	-2.40	62.58
995.49	12.92	-2.40	62.58
1005.49	12.93	-2.39	62.57
1015.49	12.93	-2.39	62.57
1025.49	12.94	-2.38	62.56
1035.49	12.94	-2.39	62.56
1045.49	12.94	-2.38	62.56
1055.49	12.95	-2.38	62.55
1065.49	12.95	-2.37	62.55
1075.49	12.96	-2.37	62.54
1085.49	12.96	-2.36	62.54
1095.49	12.96	-2.37	62.54
1105.49	12.96	-2.36	62.54
1115.49	12.96	-2.36	62.54
1125.49	12.97	-2.35	62.53
1135.49	12.98	-2.34	62.52
1145.49	12.98	-2.34	62.52
1155.49	12.99	-2.34	62.51
1165.49	12.99	-2.33	62.51
1175.49	12.99	-2.33	62.51
1185.49	13.00	-2.32	62.50
1195.49	13.01	-2.32	62.49
1205.49	13.01	-2.32	62.49
1215.49	13.01	-2.31	62.49
1225.49	13.02	-2.31	62.48
1235.49	13.02	-2.30	62.48
1245.49	13.03	-2.30	62.47
1255.49	13.03	-2.29	62.47
1265.49	13.04	-2.28	62.46
1275.49	13.04	-2.28	62.46
1285.49	13.04	-2.28	62.46



FALLING HEAD TEST

Data Set: G:\...\B-51A Falling Head Test.aqt
Date: 06/10/19 Time: 15:22:21

PROJECT INFORMATION

Company: Schnabel Engineering
Client: NRCS WV
Project: 18C35013.04
Location: Bluefield, WV
Test Well: B-51A
Test Date: 5/9/19

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (B-51A)

Initial Displacement: 72.7 ft
Total Well Penetration Depth: 75. ft
Casing Radius: 0.08 ft
Static Water Column Height: 2.8 ft
Screen Length: 5. ft
Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 4.09E-6 cm/sec
y0 = 12.83 ft

Data Set: G:\2018\West Chester\18C35013_0X_NRCS_NE_Brush_Creek\03-SE Products\01-Investigations\04-
Title: Falling Head Test
Date: 06/10/19
Time: 15:22:53

PROJECT INFORMATION

Company: Schnabel Engineering
Client: NRCS WV
Project: 18C35013.04
Location: Bluefield, WV
Test Date: 5/9/19
Test Well: B-51A

AQUIFER DATA

Saturated Thickness: 150. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: B-51A

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 72.7 ft
Static Water Column Height: 2.8 ft
Casing Radius: 0.08 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 5. ft
Total Well Penetration Depth: 75. ft

No. of Observations: 70

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.	12.97	16.29	12.8
0.15	12.96	17.39	12.79
0.31	12.96	18.59	12.79
0.47	12.95	19.89	12.79
0.65	12.95	21.19	12.78
0.84	12.95	22.59	12.78
1.04	12.95	24.09	12.77
1.25	12.91	25.69	12.77
1.47	12.9	27.29	12.76
1.71	12.85	29.09	12.76
1.96	12.89	30.99	12.75
2.22	12.89	32.99	12.75
2.5	12.89	35.09	12.75
2.8	12.88	37.29	12.74
3.11	12.84	39.69	12.74
3.45	12.87	42.19	12.73
3.8	12.86	44.79	12.73
4.17	12.86	47.59	12.73
4.57	12.86	50.59	12.72
4.99	12.85	53.69	12.72
5.43	12.85	57.09	12.71
5.9	12.85	60.59	12.71
6.4	12.84	64.29	12.7
6.93	12.84	68.29	12.7
7.49	12.83	72.49	12.7
8.09	12.82	76.89	12.69
8.69	12.83	81.59	12.68
9.39	12.82	86.59	12.68
10.09	12.82	91.89	12.68
10.79	12.82	97.49	12.68
11.59	12.82	103.5	12.68
12.49	12.82	109.5	12.67
13.29	12.81	116.5	12.67
14.29	12.81	123.5	12.67

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
15.29	12.8	130.5	12.67

SOLUTION

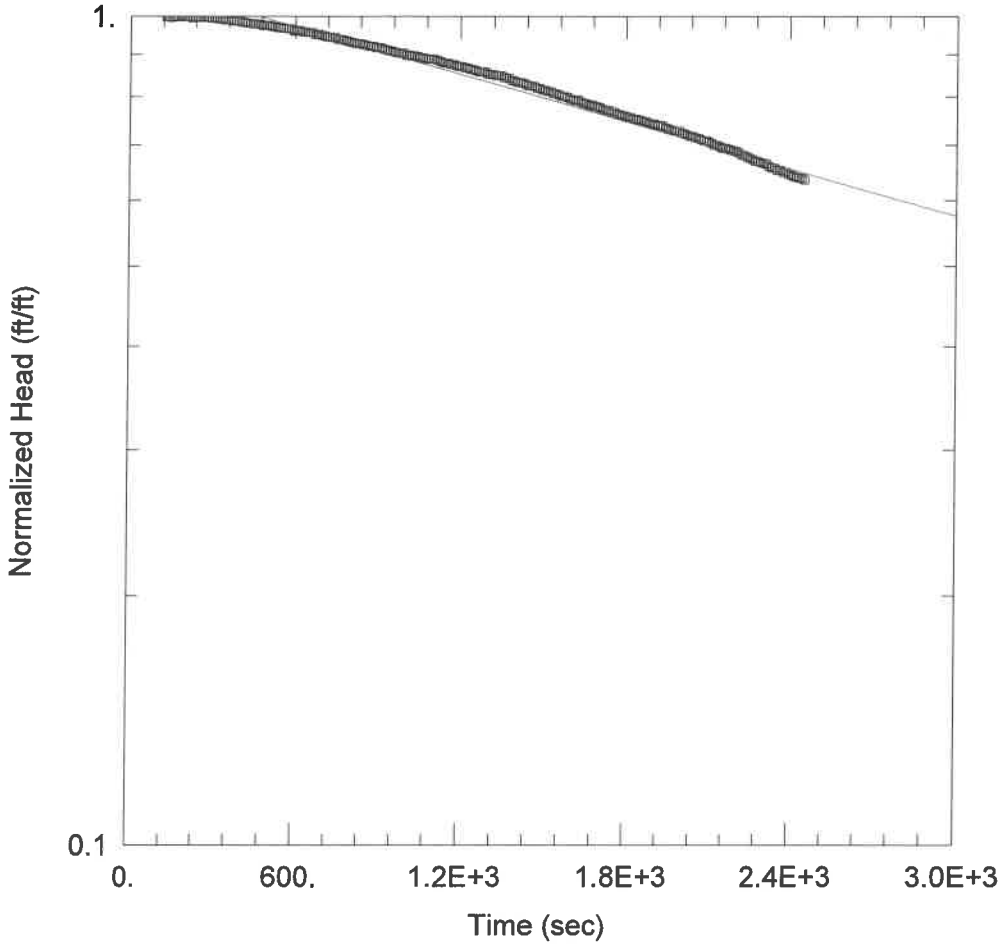
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.249

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	4.09E-6	cm/sec
y0	12.83	ft

T = K*b = 0.0187 cm²/sec



WELL RECOVERY

Data Set: G:\...\B-51A Well Recovery.aqt
Date: 06/14/19 Time: 13:46:21

PROJECT INFORMATION

Company: Schnabel Engineering
Client: NRCS WV
Project: 18C35013.04
Location: Bluefield, WV
Test Well: B-51A
Test Date: 5/9/19

AQUIFER DATA

Saturated Thickness: 2.8 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (B-51A)

Initial Displacement: -2.662 ft
Total Well Penetration Depth: 75. ft
Casing Radius: 0.08 ft
Static Water Column Height: 2.8 ft
Screen Length: 5. ft
Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 2.223E-5 cm/sec
y0 = -2.948 ft

Data Set: G:\2018\West Chester\18C35013_0X_NRCS_NE_Brush_Creek\03-SE Products\01-Investigations\04
Title: Well Recovery
Date: 06/14/19
Time: 13:46:37

PROJECT INFORMATION

Company: Schnabel Engineering
Client: NRCS WV
Project: 18C35013.04
Location: Bluefield, WV
Test Date: 5/9/19
Test Well: B-51A

AQUIFER DATA

Saturated Thickness: 2.8 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: B-51A

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: -2.662 ft
Static Water Column Height: 2.8 ft
Casing Radius: 0.08 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 5. ft
Total Well Penetration Depth: 75. ft

No. of Observations: 234

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
130.5	-2.658	1295.5	-2.27
138.5	-2.657	1305.5	-2.265
147.5	-2.652	1315.5	-2.266
155.5	-2.658	1325.5	-2.259
165.5	-2.658	1335.5	-2.258
175.5	-2.66	1345.5	-2.257
185.5	-2.657	1355.5	-2.247
195.5	-2.662	1365.5	-2.244
205.5	-2.66	1375.5	-2.241
215.5	-2.659	1385.5	-2.229
225.5	-2.651	1395.5	-2.225
235.5	-2.655	1405.5	-2.217
245.5	-2.655	1415.5	-2.216
255.5	-2.652	1425.5	-2.213
265.5	-2.656	1435.5	-2.205
275.5	-2.653	1445.5	-2.196
285.5	-2.653	1455.5	-2.196
295.5	-2.647	1465.5	-2.193
305.5	-2.65	1475.5	-2.182
315.5	-2.644	1485.5	-2.179
325.5	-2.641	1495.5	-2.17
335.5	-2.643	1505.5	-2.17
345.5	-2.635	1515.5	-2.163
355.5	-2.639	1525.5	-2.16
365.5	-2.635	1535.5	-2.15
375.5	-2.627	1545.5	-2.149
385.5	-2.629	1555.5	-2.141
395.5	-2.629	1565.5	-2.133
405.5	-2.62	1575.5	-2.131
415.5	-2.618	1585.5	-2.126
425.5	-2.614	1595.5	-2.118
435.5	-2.61	1605.5	-2.113
445.5	-2.609	1615.5	-2.108
455.5	-2.606	1625.5	-2.11

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
465.5	-2.605	1635.5	-2.1
475.5	-2.601	1645.5	-2.093
485.5	-2.593	1655.5	-2.091
495.5	-2.596	1665.5	-2.081
505.5	-2.593	1675.5	-2.083
515.5	-2.589	1685.5	-2.075
525.5	-2.585	1695.5	-2.071
535.5	-2.582	1705.5	-2.066
545.5	-2.577	1715.5	-2.058
555.5	-2.575	1725.5	-2.052
565.5	-2.573	1735.5	-2.052
575.5	-2.574	1745.5	-2.043
585.5	-2.57	1755.5	-2.042
595.5	-2.556	1765.5	-2.032
605.5	-2.562	1775.5	-2.026
615.5	-2.559	1785.5	-2.024
625.5	-2.552	1795.5	-2.02
635.5	-2.55	1805.5	-2.014
645.5	-2.546	1815.5	-2.013
655.5	-2.545	1825.5	-2.004
665.5	-2.544	1835.5	-2.002
675.5	-2.53	1845.5	-1.998
685.5	-2.532	1855.5	-1.995
695.5	-2.527	1865.5	-1.986
705.5	-2.523	1875.5	-1.988
715.5	-2.515	1885.5	-1.979
725.5	-2.515	1895.5	-1.972
735.5	-2.51	1905.5	-1.976
745.5	-2.51	1915.5	-1.966
755.5	-2.5	1925.5	-1.968
765.5	-2.497	1935.5	-1.963
775.5	-2.496	1945.5	-1.953
785.5	-2.489	1955.5	-1.949
795.5	-2.483	1965.5	-1.942
805.5	-2.477	1975.5	-1.938
815.5	-2.474	1985.5	-1.938
825.5	-2.469	1995.5	-1.936
835.5	-2.469	2005.5	-1.925
845.5	-2.463	2015.5	-1.921
855.5	-2.459	2025.5	-1.915
865.5	-2.454	2035.5	-1.91
875.5	-2.45	2045.5	-1.909
885.5	-2.452	2055.5	-1.9
895.5	-2.44	2065.5	-1.897
905.5	-2.441	2075.5	-1.892
915.5	-2.438	2085.5	-1.886
925.5	-2.429	2095.5	-1.886
935.5	-2.426	2105.5	-1.879
945.5	-2.419	2115.5	-1.874
955.5	-2.417	2125.5	-1.863
965.5	-2.411	2135.5	-1.862
975.5	-2.405	2145.5	-1.854
985.5	-2.401	2155.5	-1.847
995.5	-2.405	2165.5	-1.848
1005.5	-2.39	2175.5	-1.843
1015.5	-2.393	2185.5	-1.838
1025.5	-2.384	2195.5	-1.834
1035.5	-2.387	2205.5	-1.83
1045.5	-2.383	2215.5	-1.823
1055.5	-2.376	2225.5	-1.813
1065.5	-2.375	2235.5	-1.811
1075.5	-2.368	2245.5	-1.803
1085.5	-2.365	2255.5	-1.796
1095.5	-2.365	2265.5	-1.79
1105.5	-2.363	2275.5	-1.781
1115.5	-2.36	2285.5	-1.78
1125.5	-2.35	2295.5	-1.776
1135.5	-2.344	2305.5	-1.772
1145.5	-2.339	2315.5	-1.768
1155.5	-2.339	2325.5	-1.756
1165.5	-2.33	2335.5	-1.75

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
1175.5	-2.329	2345.5	-1.748
1185.5	-2.322	2355.5	-1.737
1195.5	-2.318	2365.5	-1.739
1205.5	-2.317	2375.5	-1.728
1215.5	-2.309	2385.5	-1.73
1225.5	-2.307	2395.5	-1.719
1235.5	-2.299	2405.5	-1.714
1245.5	-2.298	2415.5	-1.708
1255.5	-2.292	2425.5	-1.703
1265.5	-2.283	2435.5	-1.701
1275.5	-2.281	2445.5	-1.698
1285.5	-2.282	2455.5	-1.691

SOLUTION

Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.916

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	2.223E-5	cm/sec
y0	-2.948	ft

T = K*b = 0.001898 cm²/sec

APPENDIX D

RESULTS OF HYDRAULIC CONDUCTIVITY TESTING IN ROCK

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HYDRAULIC CONDUCTIVITY TESTING IN ROCK

Brief Description of Packer Testing

Hydraulic conductivity of the rock was measured at various depth intervals in borings using the method described in the US Bureau of Reclamation Ground Water Manual (1995). Hydraulic conductivity testing was performed using either a single- and double-packer assembly. The double-packer assembly provided a test interval of approximately 10 ft between two pneumatic packers. Test depth intervals, or stages, were selected in the field. Tests were typically run under five pressures with the first three steps increasing in pressure and Steps 4 and 5 decreasing in pressure. Steps 4 and 5 may not have been run if the test interval was not taking water at the maximum pressure (Step 3).

The minimum pressure applied during the test (typically Steps 1 and 5) was selected so that it exceeded the hydrostatic pressure that exists under non-pumping conditions at the test interval due to the water column in the boring. The maximum pressure applied during the test (typically Step 3) was selected so that it did not exceed the total vertical stress at the test interval to reduce the potential for hydrofracturing the formation.

Results of Packer Testing

Calculations were performed using the field test data to estimate the average hydraulic conductivity in the test section, in feet per second (ft/s) and centimeters per second (cm/s), using the method described in the US Bureau of Reclamation (1995) and for transmissivity, in Lugeons, using the method described in Houlsby (1990). Hydraulic conductivity and transmissivity values for the test interval were typically selected from the pressure step that returned the highest value. Flow rates into the test interval at different test pressures can be interpreted using published methods (USBR, 1995; Houlsby, 1990) and indicate several different conditions, including laminar flow through fracture, turbulent flow through fractures, dilation of fractures during the test, washing out of fracture fill material, filling and clogging of fractures, or combinations of these conditions. A detailed summary of the transmissivity (Lugeons) and the average hydraulic conductivity (ft/s, cm/s) is presented in Table 3. Details on each test are included on the test data and calculation sheets provided in this appendix. This testing is only an approximation of the in situ hydraulic conductivity at selected locations and variations are to be expected.

Brief Description of Falling Head Testing

Aterra-Schnabel JV personnel performed falling head tests near the soil-rock interface. A double packer assembly was used to isolate the test interval from the underlying bedrock and the overlying embankment fill and foundation materials. The top of the upper packer, which was 2 ft in length, was placed immediately below the bottom of the augers to prevent damage to the packer. The rods of the packer assembly were filled to the top with water. Water levels were recorded at various times using a Heron Dipper-T water level meter.

Results of Falling Head Testing

Test data was evaluated using the software program Aqtesolv Pro (Version 4.50). Hydraulic conductivity of the test interval was evaluated using the KGS analytical method (Hyder et al., 1994). Details on the test are included on the test data and calculation sheets provided in this appendix. This testing is only an approximation of the in situ hydraulic conductivity at selected locations and variations are to be expected.

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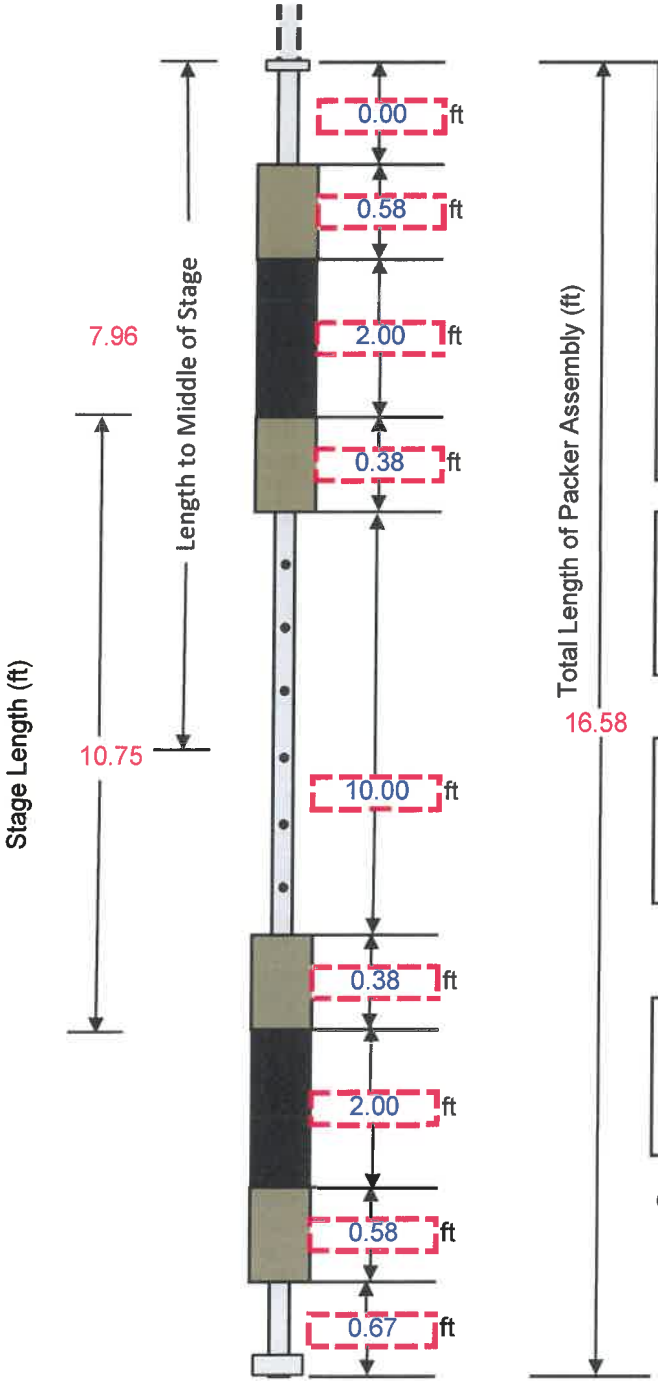
Schnabel ENGINEERING

DOUBLE PACKER SETUP DOCUMENTATION

Project:	Brush Creek Site 15	By:	CDS	Date:	3/16/2019
Location:	Mercer County, WV	Checke	EBB	Date:	5/7/2019
Schnabel Project No.:	18C35013.04				
Client Name:	WV NRCS				



CHECK CALCS FOR VALID CONDITIONS

Is $A_{holes} \geq 2(A_{inside\ CS\ of\ pipe})$?

Diameter of holes in pipe (in):		
Radius of hole (in):	0	
Area (A) of hole (in^2):		
No. of holes:		
Total Area of holes (in^2):		(a)
Nominal Stage Pipe Diameter (in):	1.00	
Measured O.D. (in):	1.050	
Measured I.D. (in):	0.824	
Wall Thickness (in):	0.226	
Inside cross sectional area of the stage pipe (in^2):	0.53	(b)
Is (a) ≥ 2*(b):	NO	Invalid

Is $d_{borehole}$ /stage length less than 5?

Stage Length (ft):	10.75	(c)
Diameter of borehole (in):	3.80	
Diameter of borehole (ft):	0.316667	(d)
Is (d)/(c) < 5?:	YES	Valid

Is Packer Length ≥ $10r_{borehole}$

Packer Length (ft):	16.58333	(e)
Radius of borehole (ft):	0.158333	(f)
Is (e) ≥ 10*(f)?:	YES	Valid

(applies to double packer assemblies only)

GENERAL PACKER INFORMATION

Packer Diameter (in):		(deflated)
Packer Manufacturer:		
Packer Model:		
Condition of Packers:		

OTHER INFORMATION

Schnabel ENGINEERING

WATER PRESSURE TEST (PACKER TEST)
SHEET 1, FIELD DATA

Project:	Brush Creek Site 15	Boring No.:	B-51			
Location:	Mercer County, WV	Hole Angle:	0	degrees from vertical		
Schnabel Project No.:	18C35013.04	Test Interval:	97.0	to	107.8	ft, in hole
Client Name:	WV NRCS	Test Interval:	97.0	to	107.8	ft, bgs
		Test Interval:	2411.1	to	2400.3	EL, ft
Ground Elevation (NGVD29)	2508.1	Test Date:	3/16/2019			
Northing:	118269.7167	By:	CDS	Date:	3/16/2019	
Easting:	1914781.9410	Checked:	EBB	Date:	5/7/2019	

TEST METHOD: Single or Double Packer Method using Multiple Pressure Tests — Calc Sheet Version: 2018-08-06a

METHOD REFERENCE: Ground Water Manual, US Bureau of Reclamation, 1995, Chapter 10

TEST DATA (Enter data in shaded, underlined cells. Other cells are calculated from data cells):

Rock Type:	SHALE		Rock Unit:	B		
Rock Weathering:	moderately weathered		RQD:	50	to	87
Rock Fracturing:	highly fractured		Recovery:	67	to	100

Source of test water and clarity:	Reservoir				
Method of cleaning hole prior to testing:	flush through tremie				
Method of checking flow meter accuracy prior to test:	Pumped metered volume into calibrated bucket				
Drilling Fluid (water or type of drilling mud):	Water				
Packer Brand:	QSP	Packer Model:			
Packer Inflation Pressure: Start of testing:	300	psi	End:	300	psi
Packer Length (length of black rubber bladder):	2.0	feet			
Method: Single (1) or double (2) packer (Enter 1 or 2):	2				
Interval below base of packer, Method 1 (single packer test), A_1:		feet			
Interval between packers, Method 2 (double packer test), A_2:	10.8	feet			
Depth of hole at time of test:	141.8	vertical ft below ground surface			
Depth to top of rock (thickness of soil interval), R_d:	85.0	vertical feet below ground surface			
Diameter of borehole, d:	3.8	inches	0.32	feet	
Radius of the borehole, r:	0.16	feet			
Depth to water table (thickness of unsaturated material above water table), U:	42.2	feet	18.3	psi	
Depth to top of impermeable zone:	200.0	feet			
Estimated porosity of test section:	2%				
Thickness of saturated material above a relatively impermeable bed, S:	157.8	feet			
Depth to top of test section (bottom of upper packer), h_t:	97.0	feet bgs	42.0	psi	
Depth to bottom of test section (top of lower packer if double packer used, bottom of hole for a single packer, D):	107.8	feet bgs			
Is test section above or below water table?	below				
For tests above water table determine h_1, the distance from gauge to bottom of test interval:	--	feet		psi	
For tests below the water table determine h_1, the distance between the gauge and the water table:	48.0	feet	20.8	psi	

Friction Loss Parameters

Length of pipe over which head loss occurs (distance from gauge to the bottom of the top packer):	102.8	feet
Height of pressure gauge above the ground surface at boring:	5.8	feet ags
Length of pipe/hose from pressure gauge to top of pipe in boring:	0.0	feet
Number of 90° Elbows downstream of pressure gauge:	1	
Number of 45° elbows downstream of pressure gauge:	0	
Pipe Material (iron, steel, pvc, rubber hose, black plastic):	steel	
Pipe Outside Diameter (measured with Caliper):	1.05	inches
Pipe Inside Diameter (measured with Caliper):	0.824	inches
Pipe Nominal Diameter (approx inside diameter):	1.00	inches
Pipe Schedule:	40	
Approximate Water Temperature	50	°F

Schnabel ENGINEERING

WATER PRESSURE TEST (PACKER TEST)
SHEET 1b, FIELD TEST PARAMETERS

TEST LIMITATIONS

Have the limitations of the test and calculation been met?

The value of S must be greater or equal to 5A	True
The value A/d must be less than 5.	True
Packer length must be >=10r for double packer setup	True

CALCULATE WATER INJECTION PRESSURES TO BE APPLIED DURING THE TEST

Estimated Confining Pressure, per foot of material

Maximum pressure per foot of rock, p_{Rmax}:	1 psi/ft	2.3 ft of water
Maximum allowable pressure per foot of soil, p_{Smax}:	0.5 psi/ft	1.2 ft of water
For reference, the pressure at the center of the test interval applied by the head of water standing in pipe:	46.9 psi	108.2 ft of water

Target maximum effective pressure for this test ($P_{t\,max}$):

$(R_d * P_{Smax}) + [(h_t - R_d)*P_{Rmax})]$	59.9 psi	59.875 psi

Maximum Allowable Water Injection Gauge Pressure (pressure at gauge during test)

Estimated maximum flow for this test:	0 gpm	
Estimated frictional pressure loss (P_L) for this test:	0.0 psi	ft of water
Maximum Allowable Gauge Pressure for this test:	39 psi	39.1 psi
Ptmax - gauge hgt-center of stage+(center of stage-U)		
Percent of Maximum Allowable Pressure to be Applied	100%	

Summary of Target Water Injection Pressures - Suggested Values for GAUGE Pressure

Step 1, Minimum Pressure, approx 33% of maximum	13 psi	
Step 2, approx 67% of maximum	26 psi	
Step 3, Maximum Pressure	39 psi	
Step 4, approx 67% of maximum	26 psi	
Step 5, approx 33% of maximum	13 psi	
Proposed **Packer Inflation Pressure** at tank gauge (for gas):	139 psi	
Maximum **Packer Inflation Pressure** at tank gauge (fo gas):	399 psi	DO NOT EXCEED

Summary of Target Water Injection Pressures - Suggested Values for EFFECTIVE Pressure

Step 1, approx 33% of maximum	20 psi	
Step 2, approx 67% of maximum	40 psi	
Step 3, Maximum Effective Pressure	60 psi	
Step 4, approx 67% of maximum	40 psi	
Step 5, approx 33% of maximum	20 psi	44.00

AARDVARK, QSP, & ~~GEOPRO BIMBAR~~ PACKERS - MAX. PACKER INFLATION PRESSURE TO BE APPLIED

USE GEOPRO CALCULATION (factors in water level)

Calculated Packer Inflation Pressure for test: G = [(Dp x psi/foot of water) + Sp + Pp] * 1.1	**139** psi
Unconfined packer pressure rating (**Sp**) for the borehole size (see chart, refs tab):	45 psi
Dp = Depth to top of test section or bottom of top packer (feet)	97 ft
Pp = Injection pump pressure (psi) or maximum proposed gauge pressure	39 psi
Confined pressure rating for borehole size (from chart, references tab):	375 psi
Max packer inflation pressure (Confined packer pressure + [(Dp - Dw) * 0.433])	399 psi
Dw = Depth to static water level in borehole (feet)	42.2 ft
Does calculated packer inflation pressure (G) exceed calculated max packer inflation pressure?	NO

If yes, then packer may fail during test.

Schnabel ENGINEER NG

WATER PRESSURE (PACKER) TEST
SHEET 2, FIELD DATA

Project:	Brush Creek Site 15		Boring No.:	B-51		
Location:	Mercer County, WV		Test Interval:	97.0	to 107.8	bgs
Schnabel Project No.:	18C35013.04		Test Interval:	2411.1	to 2400.3	EL
Client Name:	WV NRCS		Test Date:	3/16/2019		
By:	CDS	Date: 3/16/2019	Checked:	EBB	Date: 5/7/2019	

Time at start of setup:	8:00 AM	Time at end of tear down:	10:45 AM
Time at start of test:	8:32 AM	Time at end of test:	8:50 AM

Step 1 Start Time:

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
14	0		292.5	--
14	1		292.5	0.0
14	2		292.5	0.0
14	3		292.5	0.0
14	4		292.5	0.0
14	5		292.5	0.0
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			
			Average	0.0
			Selected stabilized flow rate	0.0
			Selected pressure for calculations	14

Step 2 Start Time:

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
26	0		293.1	--
27	1		293.1	0.0
26	2		293.1	0.0
26	3		293.1	0.0
26	4		293.1	0.0
26	5		293.1	0.0
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			
			Average	0.0
			Selected stabilized flow rate	0.0
			Selected pressure for calculations	26

Step 3 Start Time:

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
39	0		293.6	--
40	1		293.6	0.0
40	2		293.6	0.0
40	3		293.6	0.0
40	4		293.6	0.0
39	5		293.6	0.0
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			
			Average	
			Selected stabilized flow rate	0.0
			Selected pressure for calculations	40

Step 4 Start Time:

	0			--
	1			
	2			
	3			
	4			
	5			
			Average	
			Selected stabilized flow rate	
			Selected pressure for calculations	

Step 5 Start Time:

	0			--
	1			
	2			
	3			
	4			
	5			
			Average	
			Selected stabilized flow rate	
			Selected pressure for calculations	

Comments:

None

Schnabel ENGINEERING

WATER PRESSURE TEST (PACKER TEST)
SHEET 3, CALCULATIONS

Project:	Brush Creek Site 15	Boring No.:	B-51		
Location:	Mercer County, WV	Test Interval:	97.0	to	107.8 ft, bgs
Schnabel Project No.:	18C35013.04	Test Interval:	2411.1	to	2400.3 EL, ft
Client Name:	WV NRCS	Test Date:	3/16/2019		
		By:	CDS		
Ground Elevation (NGVD29)	2508.1	Checked:	EBB		
Northing:	118269.717				
Easting:	1914781.941				

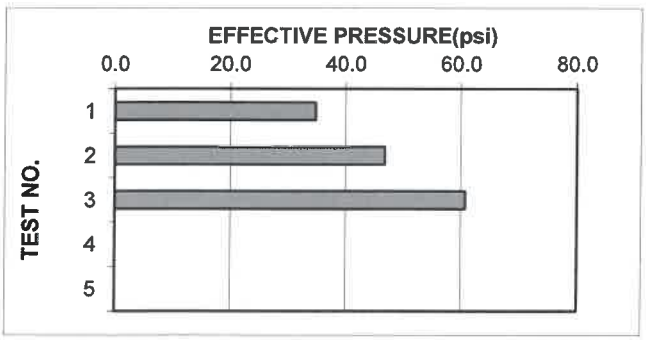
METHOD REFERENCE: Ground Water Manual, US Bureau of Reclamation, 1995, Chapter 10
TEST DATA (Enter data in shaded, underlined cells. Other cells are calculated from data cells):

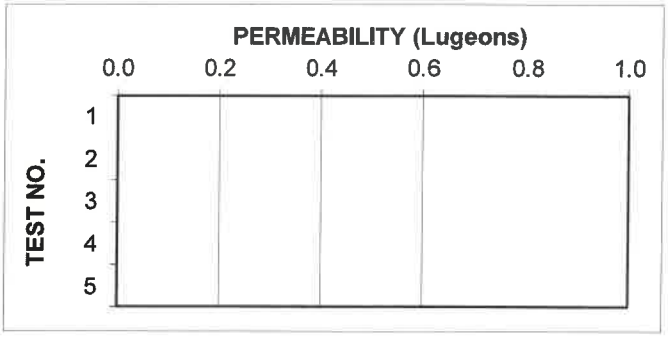
Results of Permeability Calculations
Multiple Step Test

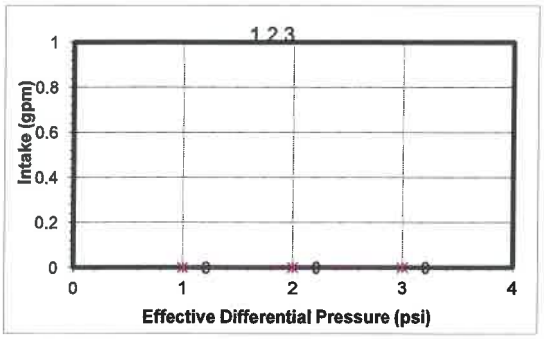
Step	Flow, Q (gpm)	Pressure (psi)		Lugeons	Hydraulic Conductivity (ft/sec)	Hydraulic Conductivity (cm/sec)
		Gauge	Effective			
1	0	14	35	0	0.0E+00	0.0E+00
2	0	26	47	0	0.0E+00	0.0E+00
3	0	40	61	0	0.0E+00	0.0E+00
			AVERAGE	0	0.0E+00	0.0E+00
			VALUE (Maximum, Unless Otherwise Selected)	0	0.0E+00	0.0E+00

Rock Description of Tested Interval:
B, SHALE, moderately weathered, highly fractured, RQD: 50 to 87, Recovery: 67 to 100

Test Interpretation No Take
The tested stage did not accept any water under the applied pressures.







Schnabel ENGINEERING

WATER PRESSURE TEST (PACKER TEST)
SHEET 1, FIELD DATA

Project:	Brush Creek Site 15	Boring No.:	B-51			
Location:	Mercer County, WV	Hole Angle:	0	degrees from vertical		
Schnabel Project No.:	18C35013.04	Test Interval:	107.0	to	117.8	ft, in hole
Client Name:	WV NRCS	Test Interval:	107.0	to	117.8	ft, bgs
		Test Interval:	2401.1	to	2390.3	EL, ft
Ground Elevation (NGVD29)	2508.1	Test Date:	3/16/2019			
Northing:	118269.7167	By:	CDS	Date:	3/16/2019	
Easting:	1914781.9410	Checked:	EBB	Date:	5/7/2019	

TEST METHOD: Single or Double Packer Method using Multiple Pressure Tests — Calc Sheet Version: 2018-08-06a

METHOD REFERENCE: Ground Water Manual, US Bureau of Reclamation, 1995, Chapter 10

TEST DATA (Enter data in shaded, underlined cells. Other cells are calculated from data cells B

Rock Type:	SHALE	Rock Unit:	B		
Rock Weathering:	moderately weathered	RQD:	78	to	93
Rock Fracturing:	highly fractured	Recovery:	92	to	98

Source of test water and clarity:	Reservoir		
Method of cleaning hole prior to testing:	flush through tremie		
Method of checking flow meter accuracy prior to test:	Pumped metered volume into calibrated bucket		
Drilling Fluid (water or type of drilling mud):	Water		
Packer Brand: QSP	Packer Model:		
Packer Inflation Pressure: Start of testing:	300 psi	End:	300 psi
Packer Length (length of black rubber bladder):	2.0 feet		
Method: Single (1) or double (2) packer (Enter 1 or 2):	2		
Interval below base of packer, Method 1 (single packer test), A_1:	feet		
Interval between packers, Method 2 (double packer test), A_2:	10.8 feet		
Depth of hole at time of test:	141.8 vertical ft below ground surface		
Depth to top of rock (thickness of soil interval), R_d:	85.0 vertical feet below ground surface		
Diameter of borehole, d:	3.8 inches	0.32 feet	
Radius of the borehole, r:	0.16 feet		
Depth to water table (thickness of unsaturated material above water table), U:	42.2 feet	18.3 psi	
Depth to top of impermeable zone:	200.0 feet		
Estimated porosity of test section:	2%		
Thickness of saturated material above a relatively impermeable bed, S:	157.8 feet		
Depth to top of test section (bottom of upper packer), h_t:	107.0 feet bgs	46.3 psi	
Depth to bottom of test section (top of lower packer if double packer used, bottom of hole for a single packer, D):	117.8 feet bgs		
Is test section above or below water table?	below		
For tests above water table determine h_1, the distance from gauge to bottom of test interval:	-- feet	psi	
For tests below the water table determine h_1, the distance between the gauge and the water table:	48.0 feet	20.8 psi	

Friction Loss Parameters

Length of pipe over which head loss occurs (distance from gauge to the bottom of the top packer):	112.8 feet	
Height of pressure gauge above the ground surface at boring:	5.8	feet ags
Length of pipe/hose from pressure gauge to top of pipe in boring:	0.0	feet
Number of 90° Elbows downstream of pressure gauge:	1	
Number of 45° elbows downstream of pressure gauge:	0	
Pipe Material (iron, steel, pvc, rubber hose, black plastic):	steel	
Pipe Outside Diameter (measured with Caliper):	1.05	inches
Pipe Inside Diameter (measured with Caliper):	0.824	inches
Pipe Nominal Diameter (approx inside diameter):	1.00	inches
Pipe Schedule:	40	
Approximate Water Temperature	50	°F

Schnabel ENGINEERING

WATER PRESSURE TEST (PACKER TEST)
SHEET 1b, FIELD TEST PARAMETERS

TEST LIMITATIONS

Have the limitations of the test and calculation been met?

The value of S must be greater or equal to 5A	True
The value A/d must be less than 5.	True
Packer length must be >=10r for double packer setup	True

CALCULATE WATER INJECTION PRESSURES TO BE APPLIED DURING THE TEST

Estimated Confining Pressure, per foot of material

Maximum pressure per foot of rock, p_{Rmax}:	1 psi/ft	2.3 ft of water
Maximum allowable pressure per foot of soil, p_{Smax}:	0.5 psi/ft	1.2 ft of water
For reference, the pressure at the center of the test interval applied by the head of water standing in pipe:	51.2 psi	118.2 ft of water

Target maximum effective pressure for this test ($P_{t\,max}$):

$(R_d * P_{Smax}) + [(h_t - R_d)*P_{Rmax})]$ 69.9 psi 69.875 psi

Maximum Allowable Water Injection Gauge Pressure (pressure at gauge during test)

Estimated maximum flow for this test:	0 gpm	
Estimated frictional pressure loss (P_L) for this test:	0.0 psi	ft of water
Maximum Allowable Gauge Pressure for this test:	49 psi	49.1 psi
Ptmax - gauge hgt-center of stage+(center of stage-U)		
Percent of Maximum Allowable Pressure to be Applied	100%	

Summary of Target Water Injection Pressures - Suggested Values for GAUGE Pressure

Step 1, Minimum Pressure, approx 33% of maximum	16 psi	
Step 2, approx 67% of maximum	33 psi	
Step 3, Maximum Pressure	49 psi	
Step 4, approx 67% of maximum	33 psi	
Step 5, approx 33% of maximum	16 psi	
Proposed **Packer Inflation Pressure** at tank gauge (for gas):	155 psi	
Maximum **Packer Inflation Pressure** at tank gauge (fo gas):	403 psi	DO NOT EXCEED

Summary of Target Water Injection Pressures - Suggested Values for EFFECTIVE Pressure

Step 1, approx 33% of maximum	23 psi	
Step 2, approx 67% of maximum	47 psi	
Step 3, Maximum Effective Pressure	70 psi	
Step 4, approx 67% of maximum	47 psi	
Step 5, approx 33% of maximum	23 psi	44.00

AARDVARK, QSP, & ~~GEOPRO BIMBAR~~ PACKERS - MAX. PACKER INFLATION PRESSURE TO BE APPLIED

USE GEOPRO CALCULATION (factors in water level)

Calculated Packer Inflation Pressure for test: G = [(Dp x psi/foot of water) + Sp + Pp] * 1.1	**155** psi
Unconfined packer pressure rating (**Sp**) for the borehole size (see chart, refs tab):	45 psi
Dp = Depth to top of test section or bottom of top packer (feet)	107 ft
Pp = Injection pump pressure (psi) or maximum proposed gauge pressure	49 psi
Confined pressure rating for borehole size (from chart, references tab):	375 psi
Max packer inflation pressure (Confined packer pressure + [(Dp - Dw) * 0.433])	403 psi
Dw = Depth to static water level in borehole (feet)	42.2 ft
Does calculated packer inflation pressure (G) exceed calculated max packer inflation pressure?	NO
If yes, then packer may fail during test.	

Schnabel ENGINEERING

WATER PRESSURE (PACKER) TEST
SHEET 2, FIELD DATA

Project:	Brush Creek Site 15		Boring No.:	B-51			
Location:	Mercer County, WV		Test Interval:	107.0	to	117.8	bgs
Schnabel Project No.:	18C35013.04		Test Interval:	2401.1	to	2390.3	EL
Client Name:	WV NRCS		Test Date:	3/16/2019			
By:	CDS	Date: 3/16/2019	Checked:	EBB	Date:	5/7/2019	

Time at start of setup:	8:00 AM	Time at end of tear down:	10:45 AM
Time at start of test:	9:08 AM	Time at end of test:	9:25 AM

Step 1 Start Time:

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
16	0		298.1	--
15	1		298.1	0.0
16	2		298.1	0.0
16	3		298.1	0.0
16	4		298.1	0.0
16	5		298.1	0.0
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			

Average 0.0
Selected stabilized flow rate 0.0
Selected pressure for calculations 16

Step 3 Start Time:

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
49	0		308.4	--
49	1		308.4	0.0
48	2		308.4	0.0
49	3		308.4	0.0
49	4		308.4	0.0
49	5		308.4	0.0
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			

Average
Selected stabilized flow rate 0.0
Selected pressure for calculations 49

Step 2 Start Time:

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
33	0		308.3	--
34	1		308.3	0.0
32	2		308.3	0.0
32	3		308.3	0.0
32	4		308.3	0.0
34	5		308.3	0.0
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			

Average 0.0
Selected stabilized flow rate 0.0
Selected pressure for calculations 33

Step 4 Start Time:

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
	0			--
	1			
	2			
	3			
	4			
	5			

Average
Selected stabilized flow rate
Selected pressure for calculations

Step 5 Start Time:

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
	0			--
	1			
	2			
	3			
	4			
	5			

Average
Selected stabilized flow rate
Selected pressure for calculations

Comments:

None

Schnabel ENGINEERING

WATER PRESSURE TEST (PACKER TEST)
SHEET 3, CALCULATIONS

Project:	Brush Creek Site 15	Boring No.:	B-51		
Location:	Mercer County, WV	Test Interval:	107.0	to	117.8 ft, bgs
Schnabel Project No.:	18C35013.04	Test Interval:	2401.1	to	2390.3 EL, ft
Client Name:	WV NRCS	Test Date:	3/16/2019		
		By:	CDS		
Ground Elevation (NGVD29)	2508.1	Checked:	EBB		
Northing:	118269.717				
Easting:	1914781.941				

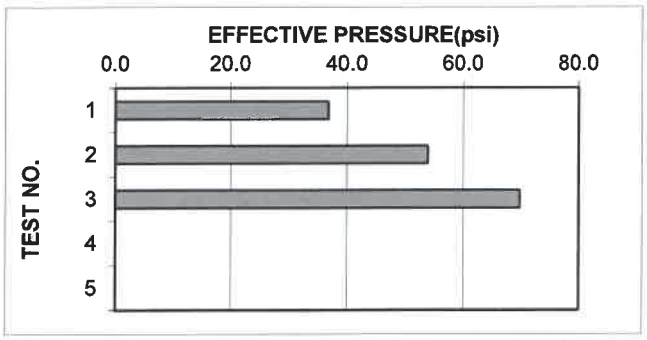
METHOD REFERENCE: Ground Water Manual, US Bureau of Reclamation, 1995, Chapter 10
TEST DATA (Enter data in shaded, underlined cells. Other cells are calculated from data cells):

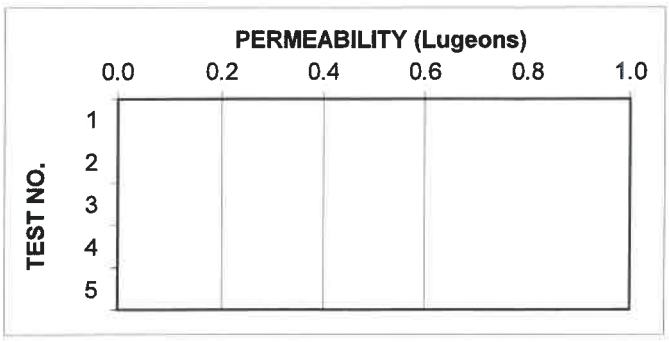
Results of Permeability Calculations
Multiple Step Test

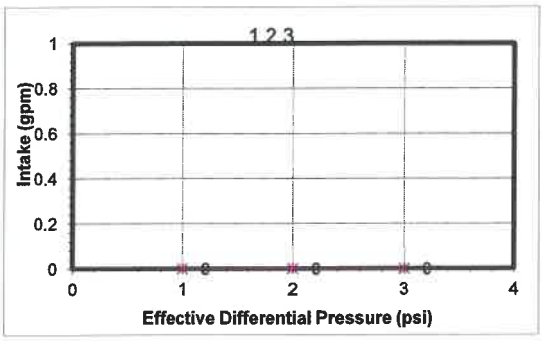
Step	Flow, Q (gpm)	Pressure (psi)		Lugeons	Hydraulic Conductivity (ft/sec)	Hydraulic Conductivity (cm/sec)
		Gauge	Effective			
1	0	16	37	0	0.0E+00	0.0E+00
2	0	33	54	0	0.0E+00	0.0E+00
3	0	49	70	0	0.0E+00	0.0E+00
			AVERAGE	0	0.0E+00	0.0E+00
			VALUE (Maximum, Unless Otherwise Selected)	0	0.0E+00	0.0E+00

Rock Description of Tested Interval:
B, SHALE, moderately weathered, highly fractured, RQD: 78 to 93, Recovery: 92 to 98

Test Interpretation No Take
The tested stage did not accept any water under the applied pressures.







Schnabel ENGINEERING

WATER PRESSURE TEST (PACKER TEST)
SHEET 1, FIELD DATA

Project:	Brush Creek Site 15	Boring No.:	B-51			
Location:	Mercer County, WV	Hole Angle:	0	degrees from vertical		
Schnabel Project No.:	18C35013.04	Test Interval:	117.0	to	127.8	ft, in hole
Client Name:	WV NRCS	Test Interval:	117.0	to	127.8	ft, bgs
		Test Interval:	2391.1	to	2380.3	EL, ft
Ground Elevation (NGVD29)	2508.1	Test Date:	3/16/2019			
Northing:	118269.7167	By:	CDS	Date:	3/16/2019	
Easting:	1914781.9410	Checked:	EBB	Date:	5/7/2019	

TEST METHOD: Single or Double Packer Method using Multiple Pressure Tests — Calc Sheet Version: 2018-08-06a

METHOD REFERENCE: Ground Water Manual, US Bureau of Reclamation, 1995, Chapter 10

TEST DATA (Enter data in shaded, underlined cells. Other cells are calculated from data cells):

Rock Type:	SHALE	Rock Unit:	B		
Rock Weathering:	moderately weathered	RQD:	45	to	83
Rock Fracturing:	highly fractured	Recovery:	92	to	100

Source of test water and clarity:	Reservoir			
Method of cleaning hole prior to testing:	flush through tremie			
Method of checking flow meter accuracy prior to test:	Pumped metered volume into calibrated bucket			
Drilling Fluid (water or type of drilling mud):	Water			
Packer Brand: QSP	Packer Model:			
Packer Inflation Pressure: Start of testing:	300 psi	End:	300 psi	
Packer Length (length of black rubber bladder):	2.0 feet			
Method: Single (1) or double (2) packer (Enter 1 or 2):	2			
Interval below base of packer, Method 1 (single packer test), A_1:	feet			
Interval between packers, Method 2 (double packer test), A_2:	10.8 feet			
Depth of hole at time of test:	141.8 vertical ft below ground surface			
Depth to top of rock (thickness of soil interval), R_d:	85.0 vertical feet below ground surface			
Diameter of borehole, d:	3.8 inches	0.32 feet		
Radius of the borehole, r:	0.16 feet			
Depth to water table (thickness of unsaturated material above water table), U:	42.2 feet	18.3 psi		
Depth to top of impermeable zone:	200.0 feet			
Estimated porosity of test section:	2%			
Thickness of saturated material above a relatively impermeable bed, S:	157.8 feet			
Depth to top of test section (bottom of upper packer), h_t:	117.0 feet bgs	50.7 psi		
Depth to bottom of test section (top of lower packer if double packer used, bottom of hole for a single packer, D):	127.8 feet bgs			
Is test section above or below water table?	below			
For tests above water table determine h_1, the distance from gauge to bottom of test interval:	-- feet	psi		
For tests below the water table determine h_1, the distance between the gauge and the water table:	48.0 feet	20.8 psi		

Friction Loss Parameters

Length of pipe over which head loss occurs (distance from gauge to the bottom of the top packer):	122.8 feet	
Height of pressure gauge above the ground surface at boring:	5.8	feet ags
Length of pipe/hose from pressure gauge to top of pipe in boring:	0.0	feet
Number of 90° Elbows downstream of pressure gauge:	1	
Number of 45° elbows downstream of pressure gauge:	0	
Pipe Material (iron, steel, pvc, rubber hose, black plastic):	steel	
Pipe Outside Diameter (measured with Caliper):	1.05	inches
Pipe Inside Diameter (measured with Caliper):	0.824	inches
Pipe Nominal Diameter (approx inside diameter):	1.00	inches
Pipe Schedule:	40	
Approximate Water Temperature	50	°F

Schnabel ENGINEERING

WATER PRESSURE TEST (PACKER TEST)
SHEET 1b, FIELD TEST PARAMETERS

TEST LIMITATIONS

Have the limitations of the test and calculation been met?

The value of S must be greater or equal to 5A	True
The value A/d must be less than 5.	True
Packer length must be >=10r for double packer setup	True

CALCULATE WATER INJECTION PRESSURES TO BE APPLIED DURING THE TEST

Estimated Confining Pressure, per foot of material

Maximum pressure per foot of rock, p_{Rmax}:	1	psi/ft	2.3 ft of water
Maximum allowable pressure per foot of soil, p_{Smax}:	0.5	psi/ft	1.2 ft of water
For reference, the pressure at the center of the test interval applied by the head of water standing in pipe:	55.5	psi	128.2 ft of water

Target maximum effective pressure for this test ($P_{t\,max}$):

$(R_d * P_{Smax}) + [(h_t - R_d)*P_{Rmax})]$	79.9 psi	79.875 psi

Maximum Allowable Water Injection Gauge Pressure (pressure at gauge during test)

Estimated maximum flow for this test:	0 gpm	
Estimated frictional pressure loss (P_L) for this test:	0.0 psi	ft of water
Maximum Allowable Gauge Pressure for this test:	59 psi	59.1 psi
Ptmax - gauge hgt-center of stage+(center of stage-U)		
Percent of Maximum Allowable Pressure to be Applied	100%	

Summary of Target Water Injection Pressures - Suggested Values for GAUGE Pressure

Step 1, Minimum Pressure, approx 33% of maximum	19 psi	
Step 2, approx 67% of maximum	40 psi	
Step 3, Maximum Pressure	59 psi	
Step 4, approx 67% of maximum	40 psi	
Step 5, approx 33% of maximum	19 psi	
Proposed **Packer Inflation Pressure** at tank gauge (for gas):	171 psi	
Maximum **Packer Inflation Pressure** at tank gauge (fo gas):	407 psi	DO NOT EXCEED

Summary of Target Water Injection Pressures - Suggested Values for EFFECTIVE Pressure

Step 1, approx 33% of maximum	26 psi	
Step 2, approx 67% of maximum	54 psi	
Step 3, Maximum Effective Pressure	80 psi	
Step 4, approx 67% of maximum	54 psi	
Step 5, approx 33% of maximum	26 psi	44.00

AARDVARK, QSP, & ~~GEOPRO BIMBAR~~ PACKERS - MAX. PACKER INFLATION PRESSURE TO BE APPLIED

USE GEOPRO CALCULATION (factors in water level)

Calculated Packer Inflation Pressure for test: G = [(Dp x psi/foot of water) + Sp + Pp] * 1.1	**171** psi
Unconfined packer pressure rating (**Sp**) for the borehole size (see chart, refs tab):	45 psi
Dp = Depth to top of test section or bottom of top packer (feet)	117 ft
Pp = Injection pump pressure (psi) or maximum proposed gauge pressure	59 psi
Confined pressure rating for borehole size (from chart, references tab):	375 psi
Max packer inflation pressure (Confined packer pressure + [(Dp - Dw) * 0.433])	407 psi
Dw = Depth to static water level in borehole (feet)	42.2 ft
Does calculated packer inflation pressure (G) exceed calculated max packer inflation pressure?	NO

If yes, then packer may fail during test.

Schnabel ENGINEERING

WATER PRESSURE (PACKER) TEST
SHEET 2, FIELD DATA

Project:	Brush Creek Site 15		Boring No.:	B-51			
Location:	Mercer County, WV		Test Interval:	117.0	to	127.8	bgs
Schnabel Project No.:	18C35013.04		Test Interval:	2391.1	to	2380.3	EL
Client Name:	WV NRCS		Test Date:	3/16/2019			
By:	CDS	Date: 3/16/2019	Checked:	EBB	Date:	5/7/2019	

Time at start of setup:	8:00 AM	Time at end of tear down:	10:45 AM
Time at start of test:	9:42 AM	Time at end of test:	10:01 AM

Step 1 Start Time:

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
19	0		299	--
19	1		299	0.0
20	2		299	0.0
19	3		299	0.0
19	4		299	0.0
19	5		299	0.0
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			

Average 0.0
Selected stabilized flow rate 0.0
Selected pressure for calculations 19

Step 2 Start Time:

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
40	0		299.2	--
40	1		299.2	0.0
40	2		299.2	0.0
40	3		299.2	0.0
40	4		299.2	0.0
40	5		299.3	0.1
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			

Average 0.0
Selected stabilized flow rate 0.0
Selected pressure for calculations 40

Step 3 Start Time:

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
59	0		299.6	--
59	1		299.6	0.0
60	2		299.6	0.0
58	3		299.6	0.0
58	4		299.6	0.0
58	5		299.6	0.0
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			

Average
Selected stabilized flow rate 0.0
Selected pressure for calculations 58

Step 4 Start Time:

	0			--
	1			
	2			
	3			
	4			
	5			

Average
Selected stabilized flow rate
Selected pressure for calculations

Step 5 Start Time:

	0			--
	1			
	2			
	3			
	4			
	5			

Average
Selected stabilized flow rate
Selected pressure for calculations

Comments:

None

Schnabel ENGINEERING

WATER PRESSURE TEST (PACKER TEST)
SHEET 3, CALCULATIONS

Project:	Brush Creek Site 15	Boring No.:	B-51		
Location:	Mercer County, WV	Test Interval:	117.0	to	127.8 ft, bgs
Schnabel Project No.:	18C35013.04	Test Interval:	2391.1	to	2380.3 EL, ft
Client Name:	WV NRCS	Test Date:	3/16/2019		
		By:	CDS		
Ground Elevation (NGVD29)	2508.1	Checked:	EBB		
Northing:	118269.717				
Easting:	1914781.941				

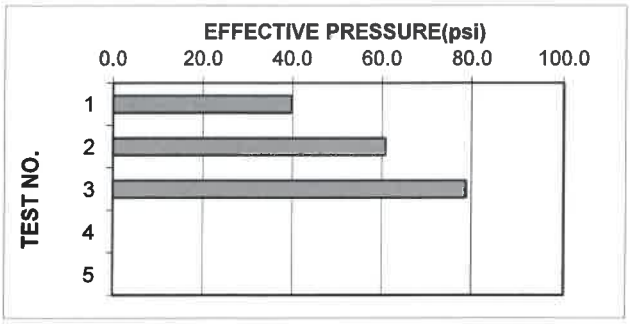
METHOD REFERENCE: Ground Water Manual, US Bureau of Reclamation, 1995, Chapter 10
TEST DATA (Enter data in shaded, underlined cells. Other cells are calculated from data cells):

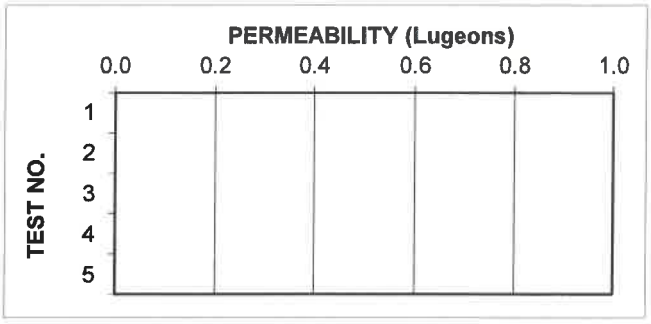
Results of Permeability Calculations
Multiple Step Test

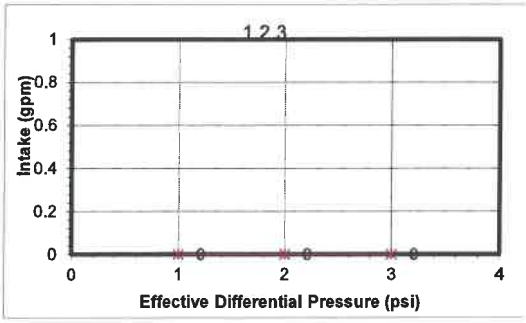
Step	Flow, Q (gpm)	Pressure (psi)		Lugeons	Hydraulic Conductivity (ft/sec)	Hydraulic Conductivity (cm/sec)
		Gauge	Effective			
1	0	19	40	0	0.0E+00	0.0E+00
2	0	40	61	0	0.0E+00	0.0E+00
3	0	58	79	0	0.0E+00	0.0E+00
			AVERAGE	0	0.0E+00	0.0E+00
			VALUE (Maximum, Unless Otherwise Selected)	0	0.0E+00	0.0E+00

Rock Description of Tested Interval:
B, SHALE, moderately weathered, highly fractured, RQD: 45 to 83, Recovery: 92 to 100

Test Interpretation No Take
The tested stage did not accept any water under the applied pressures.







Schnabel ENGINEERING

WATER PRESSURE TEST (PACKER TEST)
SHEET 1, FIELD DATA

Project:	Brush Creek Site 15	Boring No.:	B-51			
Location:	Mercer County, WV	Hole Angle:	0	degrees from vertical		
Schnabel Project No.:	18C35013.04	Test Interval:	127.0	to	141.8	ft, in hole
Client Name:	WV NRCS	Test Interval:	127.0	to	141.8	ft, bgs
		Test Interval:	-127.0	to	-141.8	EL, ft
Ground Elevation (NGVD29)	2508.1	Test Date:	3/15/2019			
Northing:	118269.7167	By:	CDS	Date:	3/15/2019	
Easting:	1914781.9410	Checked:	EBB	Date:	5/7/2019	

TEST METHOD: Single or Double Packer Method using Multiple Pressure Tests — Calc Sheet Version: 2018-08-06a

METHOD REFERENCE: Ground Water Manual, US Bureau of Reclamation, 1995, Chapter 10

TEST DATA (Enter data in shaded, underlined cells. Other cells are calculated from data cells):

Rock Type:	SHALE		Rock Unit:	B		
Rock Weathering:	moderately weathered		RQD:	45	to	62
Rock Fracturing:	highly fractured		Recovery:	93	to	100

Source of test water and clarity:	Reservoir			
Method of cleaning hole prior to testing:	flush through tremie			
Method of checking flow meter accuracy prior to test:	Pumped metered volume into calibrated bucket			
Drilling Fluid (water or type of drilling mud):	Water			
Packer Brand:	QSP	Packer Model:		
Packer Inflation Pressure: Start of testing:	300 psi	End:	300 psi	
Packer Length (length of black rubber bladder):	2.0 feet			
Method: Single (1) or double (2) packer (Enter 1 or 2):	1			
Interval below base of packer, Method 1 (single packer test), A_1:	14.8 feet			
Interval between packers, Method 2 (double packer test), A_2:	feet			
Depth of hole at time of test:	141.8 vertical ft below ground surface			
Depth to top of rock (thickness of soil interval), R_d:	85.0 vertical feet below ground surface			
Diameter of borehole, *d*:	3.8 inches	0.32 feet		
Radius of the borehole, *r*:	0.16 feet			
Depth to water table (thickness of unsaturated material above water table), *U*:	70.0 feet	30.3 psi		
Depth to top of impermeable zone:	200.0 feet			
Estimated porosity of test section:	2%			
Thickness of saturated material above a relatively impermeable bed, *S*:	130.0 feet			
Depth to top of test section (bottom of upper packer), h_t:	127.0 feet bgs	55.0 psi		
Depth to bottom of test section (top of lower packer if double packer used, bottom of hole for a single packer, *D*):	141.8 feet bgs			
Is test section above or below water table?	below			
For tests above water table determine h_1, the distance from gauge to bottom of test interval:	– feet	psi		
For tests below the water table determine h_1, the distance between the gauge and the water table:	75.8 feet	32.8 psi		

Friction Loss Parameters

Length of pipe over which head loss occurs (distance from gauge to the bottom of the top packer):	132.8	feet
Height of pressure gauge above the ground surface at boring:	5.8	feet ags
Length of pipe/hose from pressure gauge to top of pipe in boring:	0.0	feet
Number of 90° Elbows downstream of pressure gauge:	1	
Number of 45° elbows downstream of pressure gauge:	0	
Pipe Material (iron, steel, pvc, rubber hose, black plastic):	steel	
Pipe Outside Diameter (measured with Caliper):	1.05	inches
Pipe Inside Diameter (measured with Caliper):	0.824	inches
Pipe Nominal Diameter (approx inside diameter):	1.00	inches
Pipe Schedule:	40	
Approximate Water Temperature	50	°F

Schnabel ENGINEERING

WATER PRESSURE TEST (PACKER TEST)
SHEET 1b, FIELD TEST PARAMETERS

TEST LIMITATIONS

Have the limitations of the test and calculation been met?

The value of S must be greater or equal to 5A	True	
The value A/d must be less than 5.	True	
Packer length must be >=10r for double packer setup	-	

CALCULATE WATER INJECTION PRESSURES TO BE APPLIED DURING THE TEST

Estimated Confining Pressure, per foot of material

Maximum pressure per foot of rock, p_{Rmax}:	1 psi/ft	2.3 ft of water
Maximum allowable pressure per foot of soil, p_{Smax}:	0.5 psi/ft	1.2 ft of water
For reference, the pressure at the center of the test interval applied by the head of water standing in pipe:	60.7 psi	140.2 ft of water

Target maximum effective pressure for this test ($P_{t\,max}$):

$(R_d * P_{Smax}) + [(h_t - R_d)*P_{Rmax})]$	91.9 psi	91.9 psi

Maximum Allowable Water Injection Gauge Pressure (pressure at gauge during test)

Estimated maximum flow for this test:	0 gpm	
Estimated frictional pressure loss (P_L) for this test:	0.0 psi	ft of water
Maximum Allowable Gauge Pressure for this test:	59 psi	59.1 psi
Ptmax - gauge hgt-center of stage+(center of stage-U)		
Percent of Maximum Allowable Pressure to be Applied	100%	

Summary of Target Water Injection Pressures - Suggested Values for GAUGE Pressure

Step 1, Minimum Pressure, approx 33% of maximum	19 psi	
Step 2, approx 67% of maximum	40 psi	
Step 3, Maximum Pressure	59 psi	
Step 4, approx 67% of maximum	40 psi	
Step 5, approx 33% of maximum	19 psi	
Proposed **Packer Inflation Pressure** at tank gauge (for gas):	175 psi	
Maximum **Packer Inflation Pressure** at tank gauge (fo gas):	400 psi	DO NOT EXCEED

Summary of Target Water Injection Pressures - Suggested Values for EFFECTIVE Pressure

Step 1, approx 33% of maximum	30 psi	
Step 2, approx 67% of maximum	62 psi	
Step 3, Maximum Effective Pressure	92 psi	
Step 4, approx 67% of maximum	62 psi	
Step 5, approx 33% of maximum	30 psi	44.00

AARDVARK, QSP, & ~~GEOPRO BIMBAR~~ PACKERS - MAX. PACKER INFLATION PRESSURE TO BE APPLIED

USE GEOPRO CALCULATION (factors in water level)

Calculated Packer Inflation Pressure for test: G = [(Dp x psi/foot of water) + Sp + Pp] * 1.1	**175** psi
Unconfined packer pressure rating (**Sp**) for the borehole size (see chart, refs tab):	45 psi
Dp = Depth to top of test section or bottom of top packer (feet)	127 ft
Pp = Injection pump pressure (psi) or maximum proposed gauge pressure	59 psi
Confined pressure rating for borehole size (from chart, references tab):	375 psi
Max packer inflation pressure (Confined packer pressure + [(Dp - Dw) * 0.433])	400 psi
Dw = Depth to static water level in borehole (feet)	70 ft
Does calculated packer inflation pressure (G) exceed calculated max packer inflation pressure?	NO
If yes, then packer may fail during test.	

Schnabel ENGINEERING

WATER PRESSURE (PACKER) TEST
SHEET 2, FIELD DATA

Project:	Brush Creek Site 15		Boring No.:	B-51			
Location:	Mercer County, WV		Test Interval:	127.0	to	141.8	bgs
Schnabel Project No.:	18C35013.04		Test Interval:	-127.0	to	-141.8	EL
Client Name:	WV NRCS		Test Date:	3/15/2019			
By:	CDS	Date: 3/15/2019	Checked:	EBB		Date: 5/7/2019	

Time at start of setup:	10:30 AM	Time at end of tear down:	1:52 PM
Time at start of test:	12:22 PM	Time at end of test:	1:10 PM

Step 1 Start Time:

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
20	0		80	--
20	1		82	2.0
20	2		84.2	2.2
20	3		85.8	1.6
20	4		87.3	1.5
20	5		88.8	1.5
20	6		90.1	1.3
20	7		91.8	1.7
20	8		93.5	1.7
20	9		94.9	1.4
	10			
	11			
	12			
	13			
	14			
	15			

Average	1.7
Selected stabilized flow rate	1.5
Selected pressure for calculations	20

Step 2 Start Time:

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
40	0		122.0	--
40	1		127.0	5.0
40	2		131.4	4.4
40	3		136.3	4.9
40	4		140.6	4.3
40	5		145.5	4.9
40	6		149.8	4.3
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			

Average	4.6
Selected stabilized flow rate	4.6
Selected pressure for calculations	40

Step 3 Start Time:

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
60	0		165.0	--
60	1		170.8	5.8
61	2		176.7	5.9
61	3		182.0	5.3
60	4		187.5	5.5
60	5		192.8	5.3
62	6		198.0	5.2
60	7		203.3	5.3
60	8		208.1	4.8
60	9		213.8	5.7
60	10		218.5	4.7
	11			
	12			
	13			
	14			
	15			

Average	5.4
Selected stabilized flow rate	5.4
Selected pressure for calculations	60

Step 4 Start Time:

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
40	0		224.0	--
40	1		228.1	4.1
41	2		232.4	4.3
40	3		236.9	4.5
40	4		240.7	3.8
41	5		245.2	4.5

Average	4.2
Selected stabilized flow rate	4.2
Selected pressure for calculations	40

Step 5 Start Time:

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
20	0		248.0	--
20	1		251.2	3.2
20	2		254.9	3.7
20	3		257.8	2.9
20	4		260.8	3.0
20	5		264.3	3.5

Average	3.3
Selected stabilized flow rate	3.3
Selected pressure for calculations	20

Comments:

None

Schnabel ENGINEERING

WATER PRESSURE TEST (PACKER TEST)
SHEET 3, CALCULATIONS

Project:	Brush Creek Site 15	Boring No.:	B-51		
Location:	Mercer County, WV	Test Interval:	127.0	to	141.8 ft, bgs
Schnabel Project No.:	18C35013.04	Test Interval:	-127.0	to	-141.8 EL, ft
Client Name:	WV NRCS	Test Date:	3/15/2019		
		By:	CDS		
Ground Elevation (NGVD29)	2508.1	Checked:	EBB		
Northing:	118269.717				
Easting:	1914781.941				

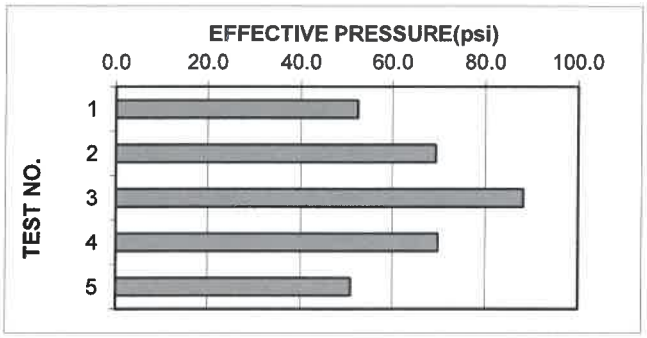
METHOD REFERENCE: Ground Water Manual, US Bureau of Reclamation, 1995, Chapter 10
TEST DATA (Enter data in shaded, underlined cells. Other cells are calculated from data cells):

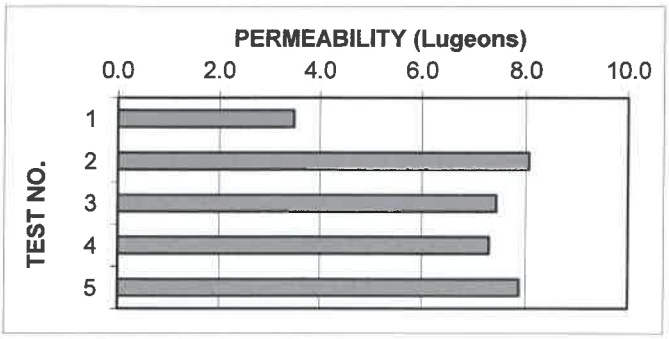
Results of Permeability Calculations
Multiple Step Test

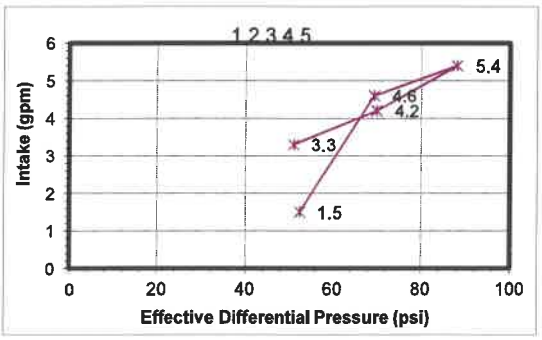
Step	Flow, Q (gpm)	Pressure (psi)		Lugeons	Hydraulic Conductivity (ft/sec)	Hydraulic Conductivity (cm/sec)
		Gauge	Effective			
1	1.5	20	52	3	1.4E-06	4.3E-05
2	4.6	40	69	8	3.3E-06	9.9E-05
3	5.4	60	88	7	3.0E-06	9.2E-05
4	4.2	40	70	7	3.0E-06	9.0E-05
5	3.3	20	51	8	3.2E-06	9.7E-05
			AVERAGE	7	2.8E-06	8.4E-05
			VALUE (Maximum, Unless Otherwise Selected)	8	3.3E-06	9.9E-05

Rock Description of Tested Interval:
B, SHALE, moderately weathered, highly fractured, RQD: 45 to 62, Recovery: 93 to 100

Test Interpretation Wash Out
Fracture filling washed out or fractures dilated and were propped open during test. Selected permeability is from the step with maximum permeability.







Schnabel ENGINEERING

WATER PRESSURE TEST (PACKER TEST)
SHEET 1, FIELD DATA

Project:	Brush Creek Site 15	Boring No.:	B-651			
Location:	Bluefield, WV	Hole Angle:	0	degrees from vertical		
Schnabel Project No.:	18C35013.04	Test Interval:	18.5	to	26.0	ft, in hole
Client Name:	WV-NRCS	Test Interval:	18.5	to	26.0	ft, bgs
		Test Interval:	2418.3	to	2410.8	EL, ft
Ground Elevation (ft msl):	2436.8	Test Date:	3/19/2019			
Northing:	118448.2669	By:	SMB	Date:	3/19/2019	
Easting:	1914720.3170	Checked:	EBB	Date:	5/7/2019	

TEST METHOD: Single or Double Packer Method using Multiple Pressure Tests — Calc Sheet Version: 2018-08-06a

METHOD REFERENCE: Ground Water Manual, US Bureau of Reclamation, 1995, Chapter 10

TEST DATA (Enter data in shaded, underlined cells. Other cells are calculated from data cells):

Rock Type:	SHALE		Rock Unit:	B		
Rock Weathering:	slightly weathered		RQD:	54	to	78
Rock Fracturing:	moderately fractured		Recovery:	98	to	100
Source of test water and clarity:		primary spillway outlet channel, clear				
Method of cleaning hole prior to testing:		wash out with water				
Method of checking flow meter accuracy prior to test:		graduated 5 gallon bucket				
Drilling Fluid (water or type of drilling mud):		water				
Packer Brand:	QSP Packers	Packer Model:				
Packer Inflation Pressure:	Start of testing:	300 psi	End:	300 psi		
Packer Length (length of black rubber bladder):		2.0 feet				
Method: Single (1) or double (2) packer (Enter 1 or 2):		1				
Interval below base of packer, Method 1 (single packer test), A_1:		7.5 feet				
Interval between packers, Method 2 (double packer test), A_2:		feet				
Depth of hole at time of test:		26.0 vertical ft below ground surface				
Depth to top of rock (thickness of soil interval), R_d:		16.5 vertical feet below ground surface				
Diameter of borehole, d:		3.5 inches	0.29 feet			
Radius of the borehole, r:		0.15 feet				
Depth to water table (thickness of unsaturated material above water table), U:		0.2 feet	0.1 psi			
Depth to top of impermeable zone:		200.0 feet				
Estimated porosity of test section:		6%				
Thickness of saturated material above a relatively impermeable bed, S:		199.8 feet				
Depth to top of test section (bottom of upper packer), h_t:		18.5 feet bgs	8.0 psi			
Depth to bottom of test section (top of lower packer if double packer used, bottom of hole for a single packer, D):		26.0 feet bgs				
Is test section above or below water table?		below				
For tests above water table determine h_1, the distance from gauge to bottom of test interval:		-- feet	psi			
For tests below the water table determine h_1, the distance between the gauge and the water table:		4.7 feet	2.0 psi			

Friction Loss Parameters

Length of pipe over which head loss occurs (distance from gauge to the bottom of the top packer):	23.5 feet	
Height of pressure gauge above the ground surface at boring:	4.5	feet ags
Length of pipe/hose from pressure gauge to top of pipe in boring:	0.5	feet
Number of 90° Elbows downstream of pressure gauge:	1	
Number of 45° elbows downstream of pressure gauge:	0	
Pipe Material (iron, steel, pvc, rubber hose, black plastic):	steel	
Pipe Outside Diameter (measured with Caliper):	1.315	inches
Pipe Inside Diameter (measured with Caliper):	1.049	inches
Pipe Nominal Diameter (approx inside diameter):	1.00	inches
Pipe Schedule:	40	
Approximate Water Temperature	50	°F

Schnabel ENGINEERING

WATER PRESSURE TEST (PACKER TEST)
SHEET 1b, FIELD TEST PARAMETERS

TEST LIMITATIONS

Have the limitations of the test and calculation been met?

The value of S must be greater or equal to 5A	True	
The value A/d must be less than 5.	True	
Packer length must be >=10r for double packer setup	-	

CALCULATE WATER INJECTION PRESSURES TO BE APPLIED DURING THE TEST

Estimated Confining Pressure, per foot of material

Maximum pressure per foot of rock, p_{Rmax}:	1 psi/ft	2.3 ft of water
Maximum allowable pressure per foot of soil, p_{Smax}:	0.5 psi/ft	1.2 ft of water
For reference, the pressure at the center of the test interval applied by the head of water standing in pipe:	11.6 psi	26.8 ft of water

Target maximum effective pressure for this test ($P_{t\,max}$):

$(R_d * P_{Smax}) + [(h_t - R_d)*P_{Rmax})]$	14.0 psi	14 psi

Maximum Allowable Water Injection Gauge Pressure (pressure at gauge during test)

Estimated maximum flow for this test:	1 gpm	
Estimated frictional pressure loss (P_L) for this test:	0.0 psi	0.0 ft of water
Maximum Allowable Gauge Pressure for this test:	12 psi	12.0 psi
Ptmax - gauge hgt-center of stage+(center of stage-U)		
Percent of Maximum Allowable Pressure to be Applied	100%	

Summary of Target Water Injection Pressures - Suggested Values for GAUGE Pressure

Step 1, Minimum Pressure, approx 33% of maximum	4 psi	
Step 2, approx 67% of maximum	8 psi	
Step 3, Maximum Pressure	12 psi	
Step 4, approx 67% of maximum	8 psi	
Step 5, approx 33% of maximum	4 psi	
Proposed **Packer Inflation Pressure** at tank gauge (for gas):	72 psi	
Maximum **Packer Inflation Pressure** at tank gauge (fo gas):	308 psi	DO NOT EXCEED

Summary of Target Water Injection Pressures - Suggested Values for EFFECTIVE Pressure

Step 1, approx 33% of maximum	5 psi	
Step 2, approx 67% of maximum	9 psi	
Step 3, Maximum Effective Pressure	14 psi	
Step 4, approx 67% of maximum	9 psi	
Step 5, approx 33% of maximum	5 psi	44.00

AARDVARK, QSP, & ~~GEOPRO BIMBAR~~ PACKERS - MAX. PACKER INFLATION PRESSURE TO BE APPLIED

USE GEOPRO CALCULATION (factors in water level)

Calculated Packer Inflation Pressure for test: G = [(Dp x psi/foot of water) + Sp + Pp] * 1.1	**72** psi
Unconfined packer pressure rating (**Sp**) for the borehole size (see chart, refs tab):	45 psi
Dp = Depth to top of test section or bottom of top packer (feet)	18.5 ft
Pp = Injection pump pressure (psi) or maximum proposed gauge pressure	12 psi
Confined pressure rating for borehole size (from chart, references tab):	300 psi
Max packer inflation pressure (Confined packer pressure + [(Dp - Dw) * 0.433])	308 psi
Dw = Depth to static water level in borehole (feet)	0.2 ft
Does calculated packer inflation pressure (G) exceed calculated max packer inflation pressure?	NO

If yes, then packer may fail during test.

Schnabel ENGINEERING

WATER PRESSURE (PACKER) TEST
SHEET 2, FIELD DATA

Project:	Brush Creek Site 15		Boring No.:	B-651			
Location:	Bluefield, WV		Test Interval:	18.5	to	26.0	bgs
Schnabel Project No.:	18C35013.04		Test Interval:	2418.3	to	2410.8	EL
Client Name:	WV-NRCS		Test Date:	3/19/2019			
By:	SMB	Date: 3/19/2019	Checked:	EBB		Date: 5/7/2019	

Time at start of setup:	9:45	Time at end of tear down:	10:51
Time at start of test:	10:36	Time at end of test:	

Step 1 Start Time: 10:36

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
5	0		24302.5	--
5	1		24307.1	4.6
5	2		24311.1	4.0
5	3		24315.5	4.4
5	4		24319.5	4.0
5	5		24323.9	4.4
5	6		24327.8	3.9
5	7		24331.7	3.9
5	8		24336.0	4.3
5	9		24339.8	3.8
5	10		24344.2	4.4
	11			
	12			
	13			
	14			
	15			
			Average	4.2
			Selected stabilized flow rate	4.2
			Selected pressure for calculations	5

Step 3 Start Time:

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
	0			--
	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			
			Average	
			Selected stabilized flow rate	
			Selected pressure for calculations	

Step 2 Start Time:

	0			--
	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			
			Average	
			Selected stabilized flow rate	
			Selected pressure for calculations	

Step 4 Start Time:

	0			--
	1			
	2			
	3			
	4			
	5			
			Average	
			Selected stabilized flow rate	
			Selected pressure for calculations	

Step 5 Start Time:

	0			--
	1			
	2			
	3			
	4			
	5			
			Average	
			Selected stabilized flow rate	
			Selected pressure for calculations	

Comments:

Due to previous artesian conditions, only one step was tested. No flowing water or bubbling was observed during the test.

Schnabel ENGINEERING

WATER PRESSURE TEST (PACKER TEST)
SHEET 3, CALCULATIONS

Project:	Brush Creek Site 15	Boring No.:	B-651		
Location:	Bluefield, WV	Test Interval:	18.5	to	26.0 ft, bgs
Schnabel Project No.:	18C35013.04	Test Interval:	2418.3	to	2410.8 EL, ft
Client Name:	WV-NRCS	Test Date:	3/19/2019		
		By:	SMB		
Ground Elevation (ft msl):	2436.8	Checked:	EBB		
Northing:	118448.267				
Easting:	1914720.317				

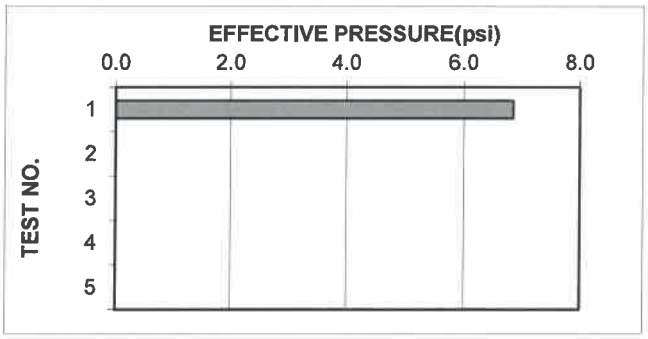
METHOD REFERENCE: Ground Water Manual, US Bureau of Reclamation, 1995, Chapter 10
TEST DATA (Enter data in shaded, underlined cells. Other cells are calculated from data cells):

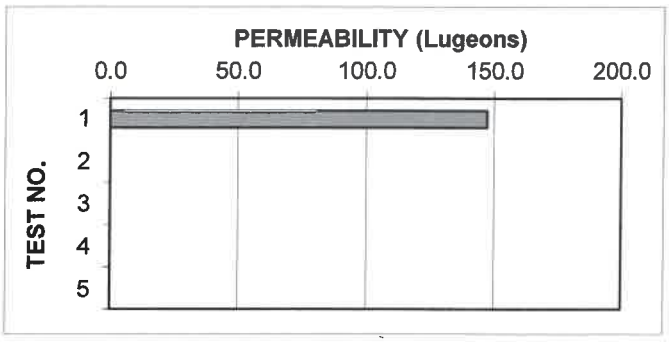
Results of Permeability Calculations
Multiple Step Test

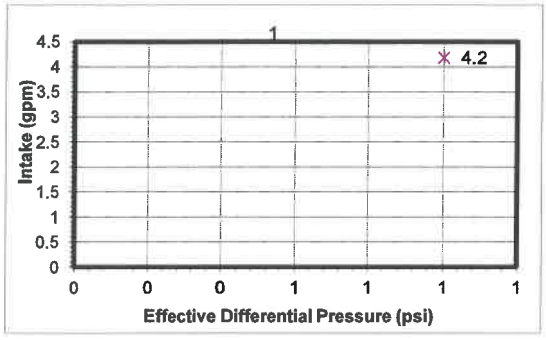
Step	Flow, Q (gpm)	Pressure (psi)		Lugeons	Hydraulic Conductivity (ft/sec)	Hydraulic Conductivity (cm/sec)
		Gauge	Effective			
1	4.2	5	7	147	5.3E-05	1.6E-03
			AVERAGE	147	5.3E-05	1.6E-03
			VALUE (Maximum, Unless Otherwise Selected)	147	5.3E-05	1.6E-03

Rock Description of Tested Interval:
B, SHALE, slightly weathered, moderately fractured, RQD: 54 to 78, Recovery: 98 to 100

Test Interpretation Inconclusive
Test data indicate more than one possible interpretation.







Schnabel ENGINEERING

WATER PRESSURE TEST (PACKER TEST)
SHEET 1, FIELD DATA

Project:	Brush Creek Site 15	Boring No.:	B-652			
Location:	Bluefield, WV	Hole Angle:	0	degrees from vertical		
Schnabel Project No.:	18C35013.04	Test Interval:	9.7	to	17.7	ft, in hole
Client Name:	WV-NRCS	Test Interval:	9.7	to	17.7	ft, bgs
		Test Interval:	2427.3	to	2419.3	EL, ft
Ground Elevation (ft msl):	2437.0	Test Date:	3/19/2019			
Northing:	118474.0799	By:	SMB	Date:	3/19/2019	
Easting:	1914821.4013	Checked:	EBB	Date:	5/7/2019	

TEST METHOD: Single or Double Packer Method using Multiple Pressure Tests — Calc Sheet Version: 2018-08-06a

METHOD REFERENCE: Ground Water Manual, US Bureau of Reclamation, 1995, Chapter 10

TEST DATA (Enter data in shaded, underlined cells. Other cells are calculated from data cells):

Rock Type:	SHALE AND CLAYSTONE		Rock Unit:	B		
Rock Weathering:	slightly weathered		RQD:	42	to	50
Rock Fracturing:	highly fractured		Recovery:	73	to	100

Source of test water and clarity:	primary spillway outlet channel, clear			
Method of cleaning hole prior to testing:	wash out with water			
Method of checking flow meter accuracy prior to test:	graduated 5 gallon bucket			
Drilling Fluid (water or type of drilling mud):	water			
Packer Brand:	QSP Packers	Packer Model:		
Packer Inflation Pressure: Start of testing:	300	psi	End: 300	psi
Packer Length (length of black rubber bladder):	2.0	feet		
Method: Single (1) or double (2) packer (Enter 1 or 2):	1			
Interval below base of packer, Method 1 (single packer test), A_1:	8.0	feet		
Interval between packers, Method 2 (double packer test), A_2:		feet		
Depth of hole at time of test:	17.7	vertical ft below ground surface		
Depth to top of rock (thickness of soil interval), R_d:	7.7	vertical feet below ground surface		
Diameter of borehole, d:	3.5	inches	0.29	feet
Radius of the borehole, r:	0.15	feet		
Depth to water table (thickness of unsaturated material above water table), U:	6.1	feet	2.6	psi
Depth to top of impermeable zone:	200.0	feet		
Estimated porosity of test section:	8%			
Thickness of saturated material above a relatively impermeable bed, S:	193.9	feet		
Depth to top of test section (bottom of upper packer), h_t:	9.7	feet bgs	4.2	psi
Depth to bottom of test section (top of lower packer if double packer used, bottom of hole for a single packer, D):	17.7	feet bgs		
Is test section above or below water table?	below			
For tests above water table determine h_1, the distance from gauge to bottom of test interval:	--	feet		psi
For tests below the water table determine h_1, the distance between the gauge and the water table:	11.4	feet	4.9	psi

Friction Loss Parameters

Length of pipe over which head loss occurs (distance from gauge to the bottom of the top packer):	15.5	feet
Height of pressure gauge above the ground surface at boring:	5.3	feet ags
Length of pipe/hose from pressure gauge to top of pipe in boring:	0.5	feet
Number of 90° Elbows downstream of pressure gauge:	1	
Number of 45° elbows downstream of pressure gauge:	0	
Pipe Material (iron, steel, pvc, rubber hose, black plastic):	steel	
Pipe Outside Diameter (measured with Caliper):	1.315	inches
Pipe Inside Diameter (measured with Caliper):	1.049	inches
Pipe Nominal Diameter (approx inside diameter):	1.00	inches
Pipe Schedule:	40	
Approximate Water Temperature	50	°F

Schnabel ENGINEERING

WATER PRESSURE TEST (PACKER TEST)
SHEET 1b, FIELD TEST PARAMETERS

TEST LIMITATIONS

Have the limitations of the test and calculation been met?

The value of S must be greater or equal to 5A	True	
The value A/d must be less than 5.	True	
Packer length must be >=10r for double packer setup	-	

CALCULATE WATER INJECTION PRESSURES TO BE APPLIED DURING THE TEST

Estimated Confining Pressure, per foot of material

Maximum pressure per foot of rock, p_{Rmax}:	1 psi/ft	2.3 ft of water
Maximum allowable pressure per foot of soil, p_{Smax}:	0.5 psi/ft	1.2 ft of water
For reference, the pressure at the center of the test interval applied by the head of water standing in pipe:	8.2 psi	19.0 ft of water

Target maximum effective pressure for this test ($P_{t\,max}$): $(R_d * P_{Smax}) + [(h_t - R_d)*P_{Rmax})]$	9.9 psi	9.85 psi

Maximum Allowable Water Injection Gauge Pressure (pressure at gauge during test)

Estimated maximum flow for this test:	1 gpm	
Estimated frictional pressure loss (P_L) for this test:	0.0 psi	0.0 ft of water
Maximum Allowable Gauge Pressure for this test:	5 psi	4.9 psi
Ptmax - gauge hgt-center of stage+(center of stage-U)		
Percent of Maximum Allowable Pressure to be Applied	100%	

Summary of Target Water Injection Pressures - Suggested Values for GAUGE Pressure

Step 1, Minimum Pressure, approx 33% of maximum	2 psi	
Step 2, approx 67% of maximum	3 psi	
Step 3, Maximum Pressure	5 psi	
Step 4, approx 67% of maximum	3 psi	
Step 5, approx 33% of maximum	2 psi	
Proposed **Packer Inflation Pressure** at tank gauge (for gas):	60 psi	
Maximum **Packer Inflation Pressure** at tank gauge (fo gas):	302 psi	DO NOT EXCEED

Summary of Target Water Injection Pressures - Suggested Values for EFFECTIVE Pressure

Step 1, approx 33% of maximum	3 psi	
Step 2, approx 67% of maximum	7 psi	
Step 3, Maximum Effective Pressure	10 psi	
Step 4, approx 67% of maximum	7 psi	
Step 5, approx 33% of maximum	3 psi	44.00

AARDVARK, QSP, & ~~GEOPRO BIMBAR~~ PACKERS - MAX. PACKER INFLATION PRESSURE TO BE APPLIED

USE GEOPRO CALCULATION (factors in water level)

Calculated Packer Inflation Pressure for test: G = [(Dp x psi/foot of water) + Sp + Pp] * 1.1	**60** psi
Unconfined packer pressure rating (**Sp**) for the borehole size (see chart, refs tab):	45 psi
Dp = Depth to top of test section or bottom of top packer (feet)	9.7 ft
Pp = Injection pump pressure (psi) or maximum proposed gauge pressure	5 psi
Confined pressure rating for borehole size (from chart, references tab):	300 psi
Max packer inflation pressure (Confined packer pressure + [(Dp - Dw) * 0.433])	302 psi
Dw = Depth to static water level in borehole (feet)	6.1 ft
Does calculated packer inflation pressure (G) exceed calculated max packer inflation pressure? If yes, then packer may fail during test.	NO

Schnabel ENGINEERING

WATER PRESSURE (PACKER) TEST
SHEET 2, FIELD DATA

Project:	Brush Creek Site 15		Boring No.:	B-652			
Location:	Bluefield, WV		Test Interval:	9.7	to	17.7	bgs
Schnabel Project No.:	18C35013.04		Test Interval:	2427.3	to	2419.3	EL
Client Name:	WV-NRCS		Test Date:	3/19/2019			
By:	SMB	Date: 3/19/2019	Checked:	EBB		Date: 5/7/2019	

Time at start of setup:	16:00	Time at end of tear down:	17:00
Time at start of test:	16:40	Time at end of test:	16:56

Step 1 Start Time: 16:40

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
4	0		24435.5	--
4	1		24448.5	13.0
4	2		24462	13.5
5	3		24475	13.0
5	4		24487.5	12.5
5	5		24500.1	12.6
5	6		24513.0	12.9
5	7		24525.0	12.0
5	8		24538.0	13.0
5	9		24550.5	12.5
5	10		24563.0	12.5
	11			
	12			
	13			
	14			
	15			
			Average	12.8
			Selected stabilized flow rate	12.8
			Selected pressure for calculations	5

Step 3 Start Time:

Gauge Pressure (h_2, psi)	Elapsed Time (min)	Flow Rate at Gauge (gpm)	Flow Vol at Gauge (gal)	Flow Rate (gpm)
	0			--
	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			
			Average	
			Selected stabilized flow rate	
			Selected pressure for calculations	

Step 2 Start Time:

	0			--
	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			
			Average	
			Selected stabilized flow rate	
			Selected pressure for calculations	

Step 4 Start Time:

	0			--
	1			
	2			
	3			
	4			
	5			
			Average	
			Selected stabilized flow rate	
			Selected pressure for calculations	

Step 5 Start Time:

	0			--
	1			
	2			
	3			
	4			
	5			
			Average	
			Selected stabilized flow rate	
			Selected pressure for calculations	

Comments:

Due to previous artesian conditions, only one step was tested. No flowing water or bubbling was observed during the test. No flow in B-651 during test. When pump was turned off at end of test in B-652, bubbles were observed in B-651.

Schnabel ENGINEERING

WATER PRESSURE TEST (PACKER TEST)
SHEET 3, CALCULATIONS

Project:	Brush Creek Site 15	Boring No.:	B-652		
Location:	Bluefield, WV	Test Interval:	9.7	to	17.7 ft, bgs
Schnabel Project No.:	18C35013.04	Test Interval:	2427.3	to	2419.3 EL, ft
Client Name:	WV-NRCS	Test Date:	3/19/2019		
		By:	SMB		
Ground Elevation (ft msl):	2437.0	Checked:	EBB		
Northing:	118474.080				
Easting:	1914821.401				

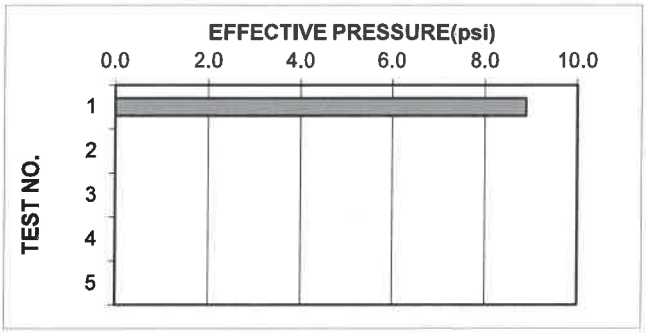
METHOD REFERENCE: Ground Water Manual, US Bureau of Reclamation, 1995, Chapter 10
TEST DATA (Enter data in shaded, underlined cells. Other cells are calculated from data cells):

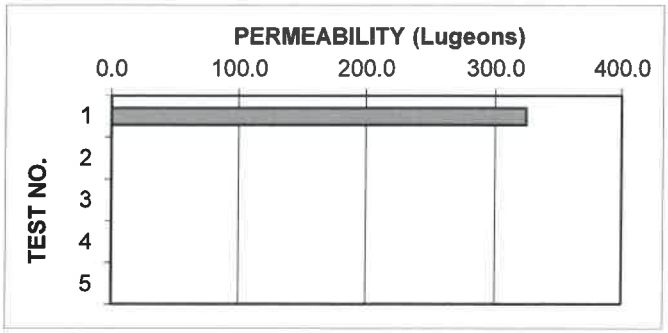
Results of Permeability Calculations
Multiple Step Test

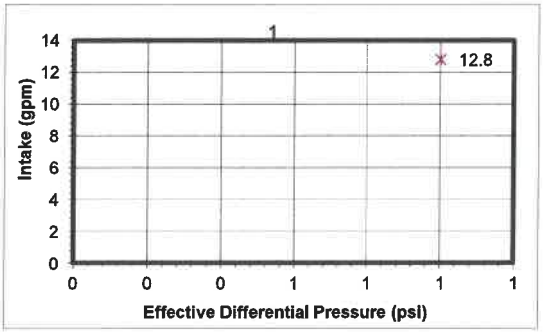
Step	Flow, Q (gpm)	Pressure (psi) Gauge	Pressure (psi) Effective	Lugeons	Hydraulic Conductivity (ft/sec)	Hydraulic Conductivity (cm/sec)
1	12.8	5	9	324	1.2E-04	3.8E-03
			AVERAGE	324	1.2E-04	3.8E-03
			VALUE (Maximum, Unless Otherwise Selected)	324	1.2E-04	3.8E-03

Rock Description of Tested Interval:
B, SHALE AND CLAYSTONE, slightly weathered, highly fractured, RQD: 42 to 50, Recovery: 73 to 100

Test Interpretation Inconclusive
Test data indicate more than one possible interpretation.







Schnabel ENGINEERING

FALLING HEAD TEST FIELD FORM

Project: Brush Creek Site 15
Location: Mercer Co, WV
Schnabel Project No.: 18C35013.04
Client Name: NRCS-WV
Attachments: Falling head test observations

Boring No.: B-51
Date: 3/15/2019
Weather/Temp.:_____
By: CDS **Date:** 3/15/2019
Checked: LWC **Date:** 5/3/2019

Depth Reference (Depth = 0ft): Ground surface

Well Construction:
Inside Diameter (D_w): Casing **1 in**; Screen **1 in**
Total Depth of Well Length (d_w): **87.0 ft**
Screen Depth: Top (d_{ts}): **87.0 ft**; Bottom (d_{bs}): **97.8 ft**

Equipment (Make, Model, SN, and/or Description):
Transducer: _____
Vented (circle one): Yes or No
Data Logger: _____
Water Level Indicator: **Heron Dipper-T**
Slug: Type (circle one): Mechanical or **Water**
Diameter (d_s): _____in; Length (l_s): _____in
Volume (v_s): _____in^3 (= l_s x π(½ d_s)^2)

Pre-Test Setup Data:
Initial water level depth (manual) (d_{swl}): **70.0** ft
Initial head (transducer) (H_i): _____ft
Approx. depth of pressure transducer (d_T): _____ft
Pre-test data file name: _____
Pre-test data logger start time: _____
Pre-test data logger end time: _____

Comments: Falling head test performed in open borehole from 87.0 ft to 97.8 ft. Test section isolated with double-packer assembly. Head applied through 1" ID steel rods. Water levels recorded manually.

Pre-Test Check:
Planned depth of slug after insertion: Top: **-5.5 ft**; Bottom: **NA** ft (*NA for water slug*)
Will top of mechanical slug be submerged below the pre-test ref. water level? (circle one): Yes or No or **NA**
Estimated water level rise immediately after slug insertion: _____in (= v_s / π(½ D_w)^2); _____ft
Estimated water level depth immediately after slug insertion: _____ft
Will water be discharged from the well upon slug insertion? (circle one): Yes or No

Test Data (Falling Head):
Falling head data file name: _____
Falling head data logger start time: _____
Head before slug insertion = **17.0 ft**
Time of slug insertion: **14:55**
Head immed. after slug insertion (h_1): **92.5 ft**
Falling head data logger end time: _____

Falling Head Measurements: (Recovery = [(h_1-h_2)/h_1] x 100)
Test can be stopped at 90% or more recovery.

Time (min:sec)	Head (h_2)	Recovery
_____	_____ft	_____%
_____	_____ft	_____%
_____	_____ft	_____%
_____	_____ft	_____%

Test Data (Rising Head):
Rising head data file name: _____
Rising head data logger start time: _____
Head before slug removal: _____ ft
Time of slug removal: _____
Head immed. after slug removal (h_1): _____ft
Rising head data logger end time: _____

Rising Head Measurements: (Recovery = [(h_1-h_2)/h_1] x 100)
Test can be stopped at 90% or more recovery.

Time (hr:min)	Head (h_2)	Recovery
_____	_____ft	_____%
_____	_____ft	_____%
_____	_____ft	_____%
_____	_____ft	_____%

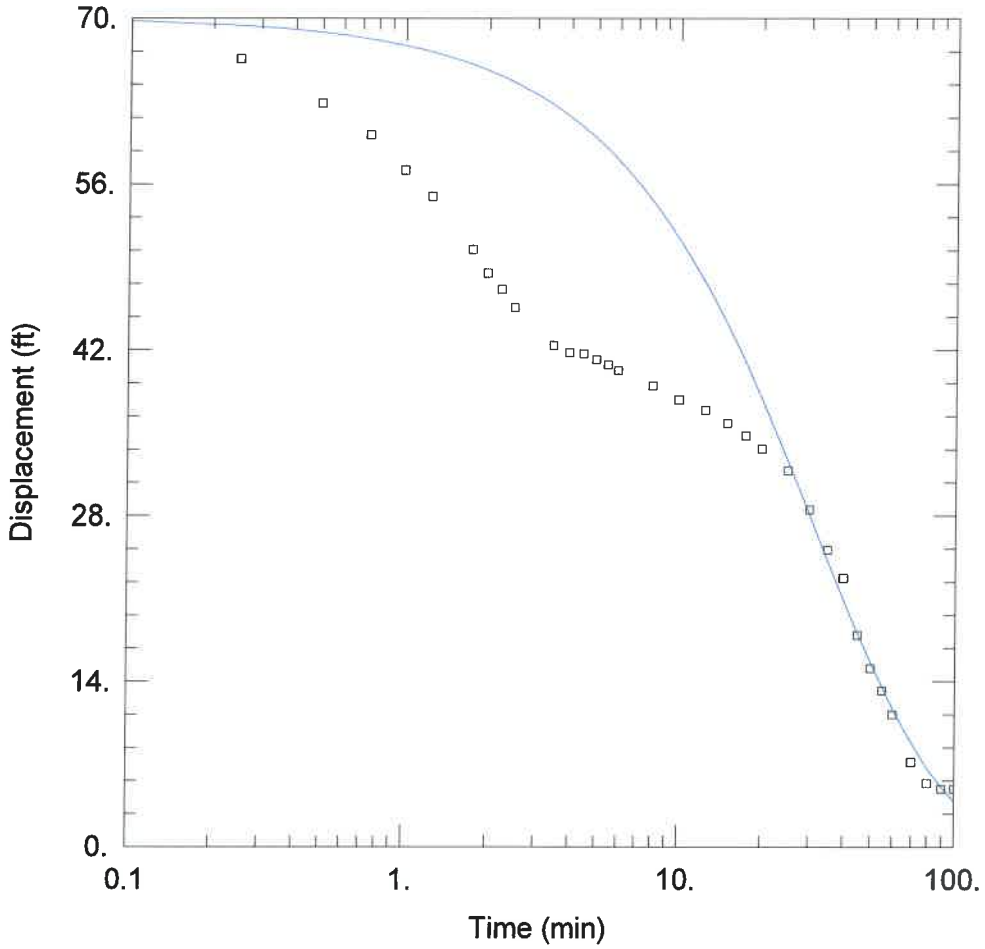
Schnabel ENGINEERING

FALLING HEAD TEST DATA SHEET

Project:	Brush Creek Site 15		Boring No.:	B-51		
Location:	Mercer County, WV		Hole Angle:	0	degrees from vertical	
Schnabel Project No.:	18C35013.04		Test Interval:	87.0	to 97.8	ft, in hole
Client Name:	WV NRCS		Test Interval:	87.0	to 97.8	ft, bgs
			Test Interval:	2421.1	to 2410.4	EL, ft
Ground Elevation (NAVD88)	2508.10		Test Date:	3/15/2019		
Northing:	118269.70		By:	CDS	Date:	3/15/2019
Easting:	1914781.90		Checked:		Date:	

Measured Water Level at Start of Day: 70 ft bgs
Casing Type: 1" ID sch 40 steel rods
Casing Stick-Up Height: 5.5 ft

Elapsed Time (min)	Water level below top of casing (ft)	Water level below ground surface (ft)
0	0	-5.5
0.25	3.4	-2.1
0.5	7.2	1.7
0.75	9.8	4.3
1	12.8	7.3
1.25	15	9.5
1.5	depth not recorded	
1.75	19.5	14
2	21.5	16
2.25	22.9	17.4
2.5	24.4	18.9
2.75	depth not recorded	
3	depth not recorded	
	depth not recorded	
3.5	27.6	22.1
4	28.2	22.7
4.5	28.3	22.8
5	28.8	23.3
5.5	29.2	23.7
6	29.7	24.2
8	31	25.5
10	32.2	26.7
12.5	33.1	27.6
15	34.2	28.7
17.5	35.2	29.7
20	36.3	30.8
25	38.2	32.7
30	41.5	36
35	44.9	39.4
40	47.2	41.7
45	52.1	46.6
50	54.9	49.4
55	56.8	51.3
60	58.8	53.3
70	62.8	57.3
80	64.6	59.1
90	65.1	59.6
100	65.1	59.6



FALLING HEAD TEST, B-51, 87.0 FT TO 97.8 FT

Data Set: G:\...\Falling Head Test_B-51_87ft to 98ft_all obs.aqt
Date: 05/03/19 Time: 09:19:39

PROJECT INFORMATION

Company: Schnabel Engineering
Client: NRCS - WV
Project: 18C35013.04
Location: Brush Creek Site 15
Test Well: B-51
Test Date: 3/15/2019

AQUIFER DATA

Saturated Thickness: 150. ft

WELL DATA (B-51)

Initial Displacement: 70. ft
Total Well Penetration Depth: 13.8 ft
Casing Radius: 0.04 ft
Static Water Column Height: 27.8 ft
Screen Length: 10.8 ft
Well Radius: 0.17 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 1.559E-7 ft/sec
Kz/Kr = 1.
Ss = 2.158E-8 ft^{-1}

Data Set: G:\2018\West Chester\18C35013_0X_NRCS_NE_Brush_Creek\03-SE Products\01-Investigations\04-
Title: Falling Head Test, B-51, 87.0 ft to 97.8 ft
Date: 05/03/19
Time: 09:20:00

PROJECT INFORMATION

Company: Schnabel Engineering
Client: NRCS - WV
Project: 18C35013.04
Location: Brush Creek Site 15
Test Date: 3/15/2019
Test Well: B-51

AQUIFER DATA

Saturated Thickness: 150. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: B-51

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 70. ft
Static Water Column Height: 27.8 ft
Casing Radius: 0.04 ft
Well Radius: 0.17 ft
Well Skin Radius: 0.17 ft
Screen Length: 10.8 ft
Total Well Penetration Depth: 13.8 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.04 ft
Gravel Pack Porosity: 0.

No. of Observations: 34

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.	70.	10.	37.8
0.25	66.6	12.5	36.9
0.5	62.8	15.	35.8
0.75	60.2	17.5	34.8
1.	57.2	20.	33.7
1.25	55.	25.	31.8
1.75	50.5	30.	28.5
2.	48.5	35.	25.1
2.25	47.1	40.	22.8
2.5	45.6	45.	17.9
3.5	42.4	50.	15.1
4.	41.8	55.	13.2
4.5	41.7	60.	11.2
5.	41.2	70.	7.2
5.5	40.8	80.	5.4
6.	40.3	90.	4.9
8.	39.	100.	4.9

SOLUTION

Slug Test
Aquifer Model: Confined
Solution Method: KGS Model

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
Kr	1.559E-7	ft/sec
Ss	2.158E-8	ft^{-1}
Kz/Kr	1.	

K = 4.751E-6 cm/sec
T = K*b = 2.338E-5 ft^2/sec (0.02172 sq. cm/sec)

APPENDIX E

AS-BUILT DRAWINGS

Aterra-Schnabel JV
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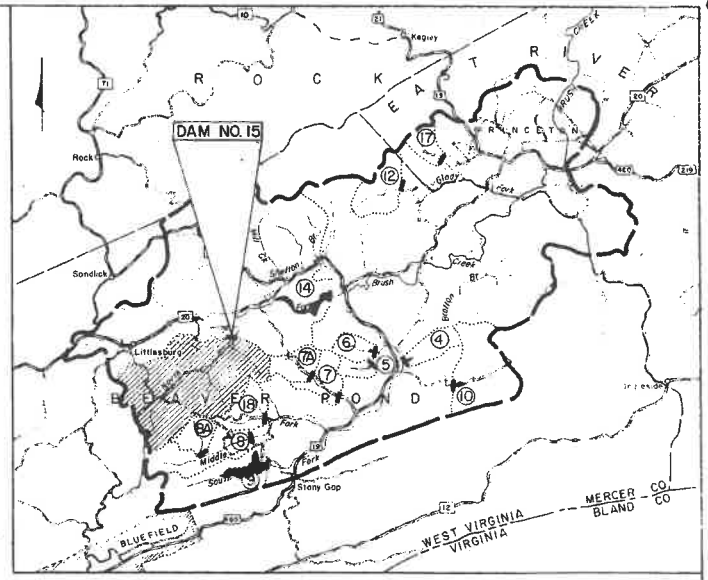
BRUSH CREEK WATERSHED PROJECT

MULTIPLE PURPOSE DAM NO. 15
NORTH FORK OF BRUSH CREEK
WATER SUPPLY FOR THE CITY OF PRINCETON AND FLOOD PREVENTION

DRAINAGE AREA	1768	Acres
FLOOD STORAGE TO EMERGENCY SPILLWAY CREST	558	Acre Ft.
WATER SURFACE AREA AT PERMANENT POOL	72	Acres
HEIGHT OF DAM	74	Feet
VOLUME OF FILL	236,100	Cubic Yards

BUILT UNDER THE WATERSHED PROTECTION AND
FLOOD PREVENTION ACT
by
BRUSH CREEK WATERSHED IMPROVEMENT DISTRICT
MERCER COUNTY COURT AND CITY OF PRINCETON
with the assistance of the
SOIL CONSERVATION SERVICE
of the
U. S. DEPARTMENT OF AGRICULTURE
1964

"AS BUILT"



LOCATION MAP
SCALE - 1 62500

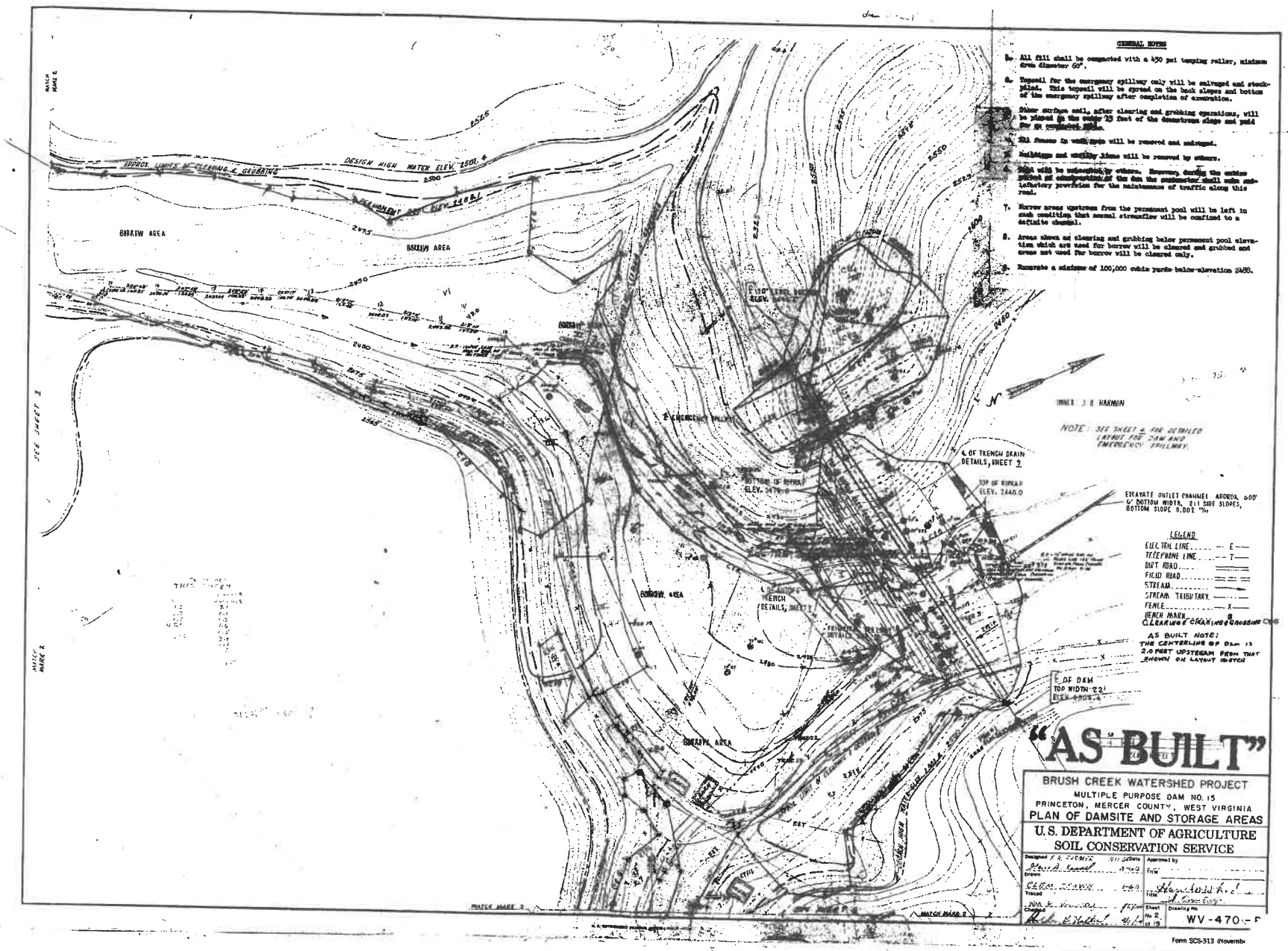
INDEX

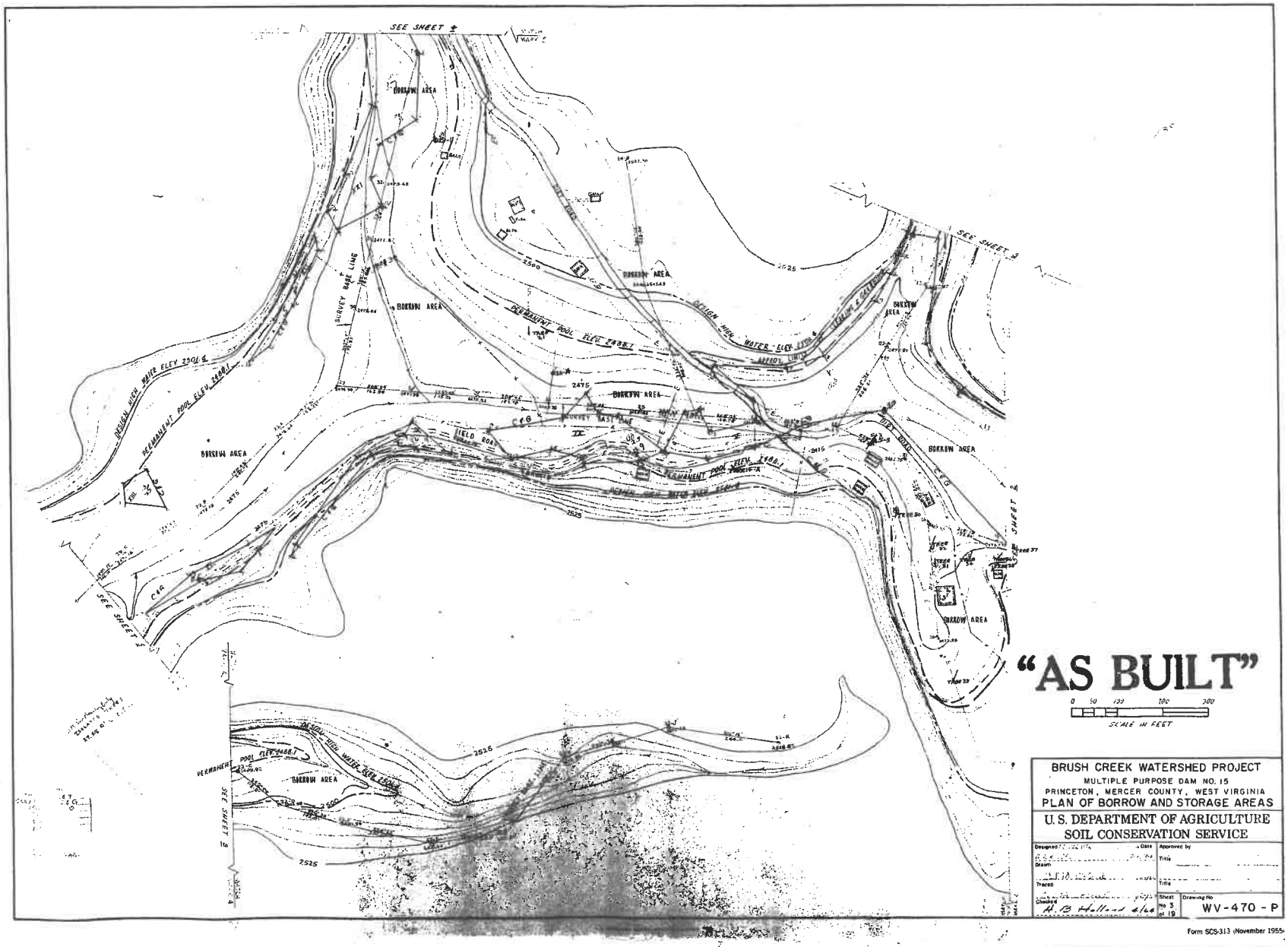
SHEET 1 - COVER SHEET
SHEET 2 - PLAN OF DAMSITE AND STORAGE AREAS
SHEET 3 - PLAN OF BORROW AND STORAGE AREAS
SHEET 4 - PLAN OF BORROW AND STORAGE AREAS
SHEET 5 - PLAN OF BORROW AND STORAGE AREAS
SHEET 6 - PLAN OF BORROW AND STORAGE AREAS
SHEET 7 - PROFILES
SHEET 8 - EMERGENCY SPILLWAY DETAILS
SHEET 9 - SEEPAGE DRAIN DETAILS
SHEET 10 - PLAN-PROFILE OF PRINCIPAL SPILLWAY
SHEET 11 - LOGS OF TEST PITS
SHEET 12 - LOGS OF DRILL HOLES
SHEET 13 - LOGS OF DRILL HOLES
SHEET 14 - RISER - STRUCTURAL DETAILS
SHEET 15 - RISER - REINF. STEEL DETAILS
SHEET 16 - RISER - REINF. STEEL DETAILS
SHEET 17 - TRASH RACKS, LADDER AND MISC. DETAILS
SHEET 18 - CRADLE, COLLAR, AND STEEL SCHEDULE
SHEET 19 - IMPACT BASIN DETAILS

"AS BUILT"
1967

BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
COVER SHEET
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

F.N. FARMER	JULY 64	HEAD, E & WR INV.
M. NIKOLICH		SOIL CONSERVATION ENGR.
F.M. WYSONG	AUG. 64	SHEET 1 OF 19 — WV-470-P


GENERAL NOTES
a. All fill shall be compacted with a 450 psi tamping roller, minimum drum diameter 60".
b. Topsoil for the emergency spillway only will be salvaged and stockpiled. This topsoil will be spread on the back slopes and bottom of the emergency spillway after completion of excavation.
c. Minor surface soil, after clearing and grubbing operations, will be placed in the outer 25 feet of the downstream slope and yard for an emergency spillway.
d. All fences in work area will be removed and salvaged.
e. Buildings and existing dams will be removed by others.
f. Roads will be relocated by others. However, during the entire period of construction of the dam the contractor shall make satisfactory provision for the maintenance of traffic along this road.
g. Borrow areas upstream from the permanent pool will be left in such condition that normal streamflow will be confined to a definite channel.
h. Areas shown as clearing and grubbing below permanent pool elevation which are used for borrow will be cleared and grubbed and areas not used for borrow will be cleared only.
i. Excavate a minimum of 100,000 cubic yards below elevation 2430.
DESIGN HIGH WATER ELEV. 2501.4
APPROX. LIMITS OF CLEARING & GRUBBING
BORROW AREA
EMERGENCY SPILLWAY
SEE SHEET 3
MATCH MARK C
MATCH MARK D
MATCH MARK E
MATCH MARK F
SEE DETAILS, SHEET 7
TOP OF RIPRAP ELEV. 2440.0
BOTTOM OF RIPRAP ELEV. 2419.0
EXCAVATE OUTLET CHANNEL ACCORDG. 600' 0' BOTTOM WIDTH, 2:1 SIDE SLOPES, BOTTOM SLOPE 0.002' /'
NOTE: SEE SHEET 6 FOR DETAILED LAYOUT FOR DAM AND EMERGENCY SPILLWAY.
LEGEND
ELECTRIC LINE
TELEPHONE LINE
DIRT ROAD
FIELD ROAD
STREAM
STREAM TRIBUTARY
FENCE
BENCH MARK
CLEARING & GRUBBING LINE
AS BUILT NOTE: THE CENTERLINE OF DAM IS 2.0 FEET UPSTREAM FROM THAT SHOWN ON LAYOUT SKETCH
℄ OF DAM
TOP WIDTH 22'
ELEV. 2506.4
"AS BUILT"
BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
PLAN OF DAMSITE AND STORAGE AREAS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed F. R. FLEMER
Drawn
Traced
Checked
Approved by
Title
Sheet No. 2 of 19
Drawing No. WV-470-P
Form SCS-313 (Novemb



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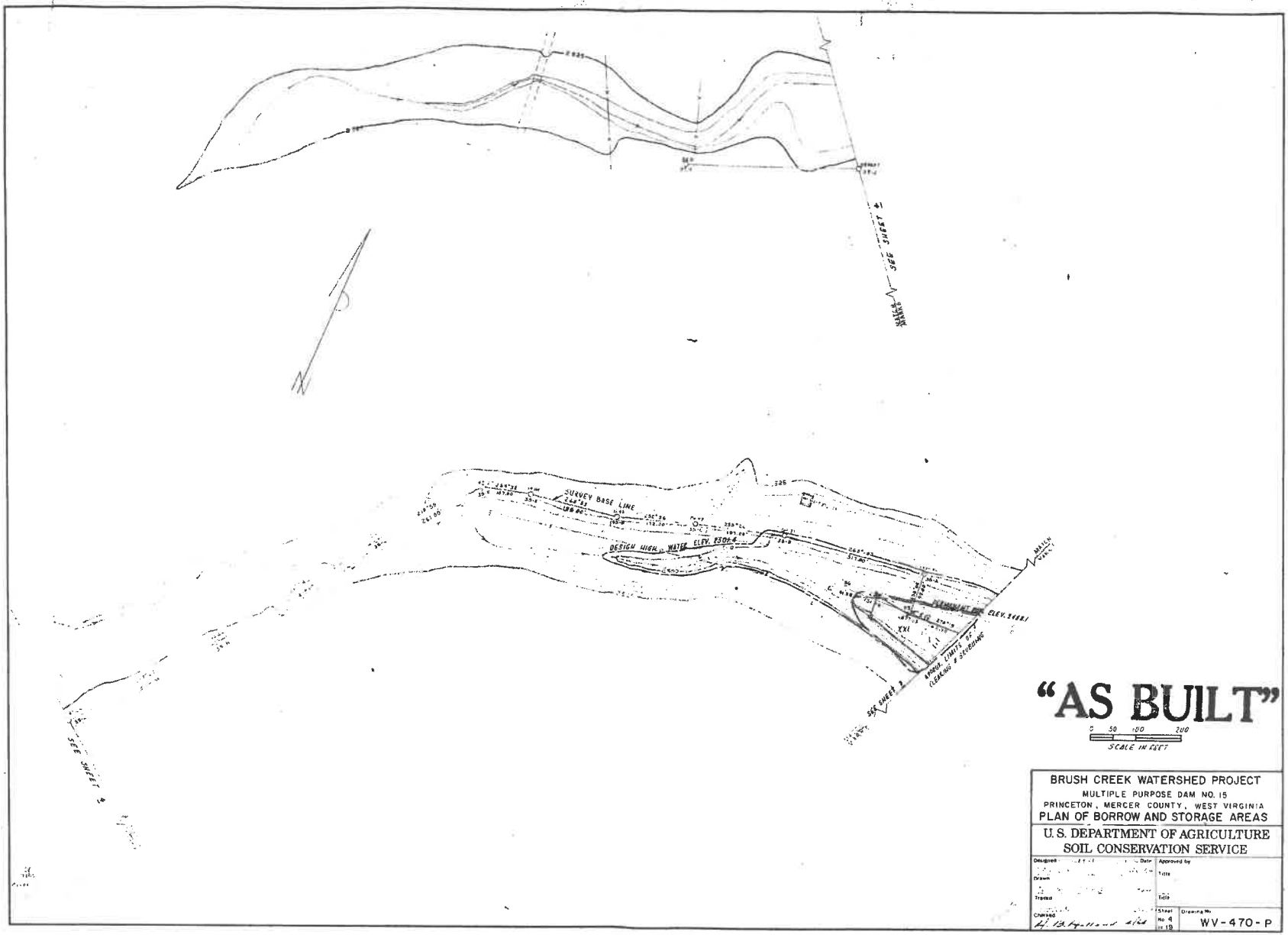

"AS BUILT"

0 50 100 200
SCALE IN FEET

BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
PLAN OF BORROW AND STORAGE AREAS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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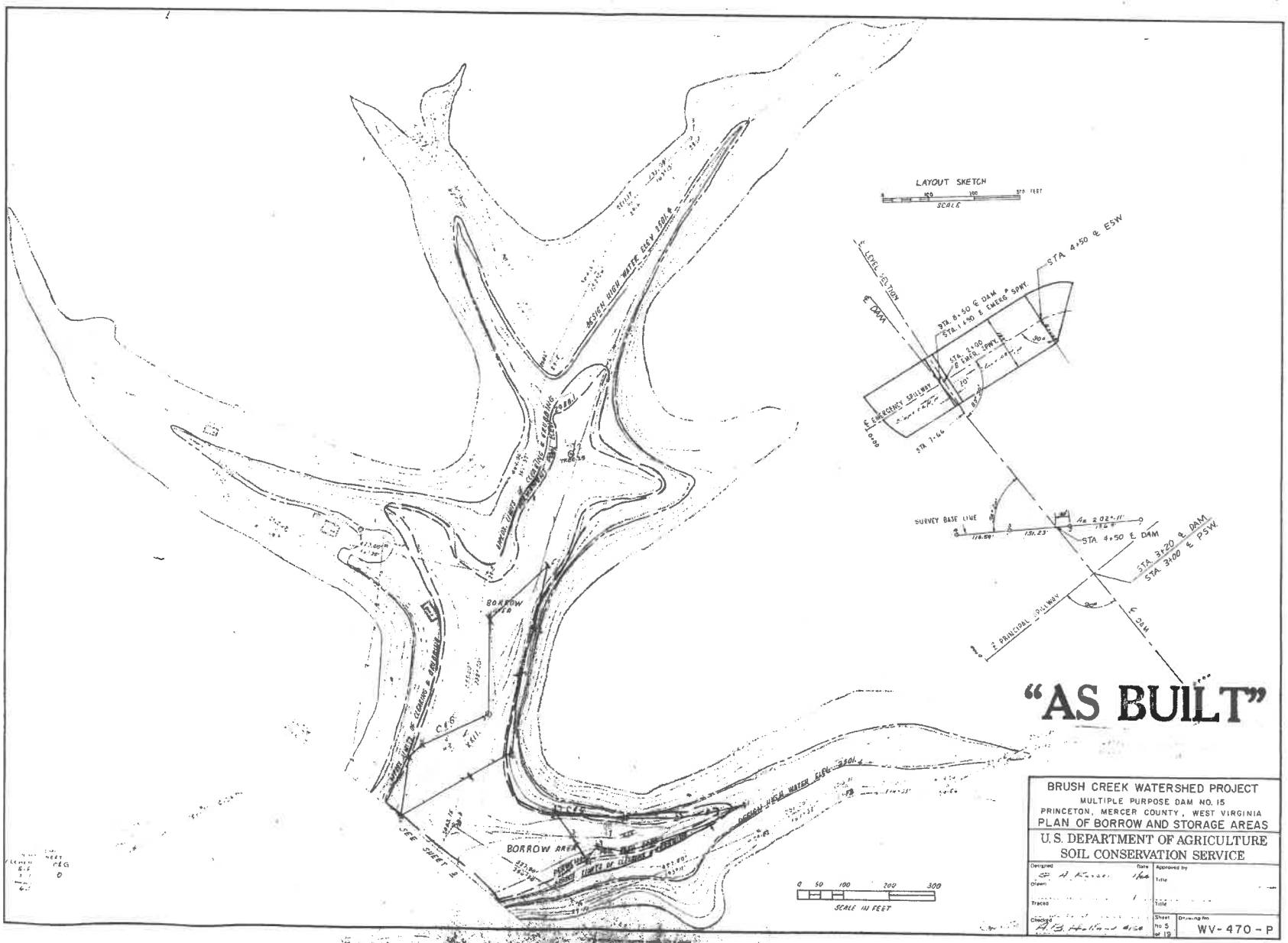
Traced		Title	
Checked		Sheet No. 9 of 19	Drawing No. WV-470-P



BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
PLAN OF BORROW AND STORAGE AREAS
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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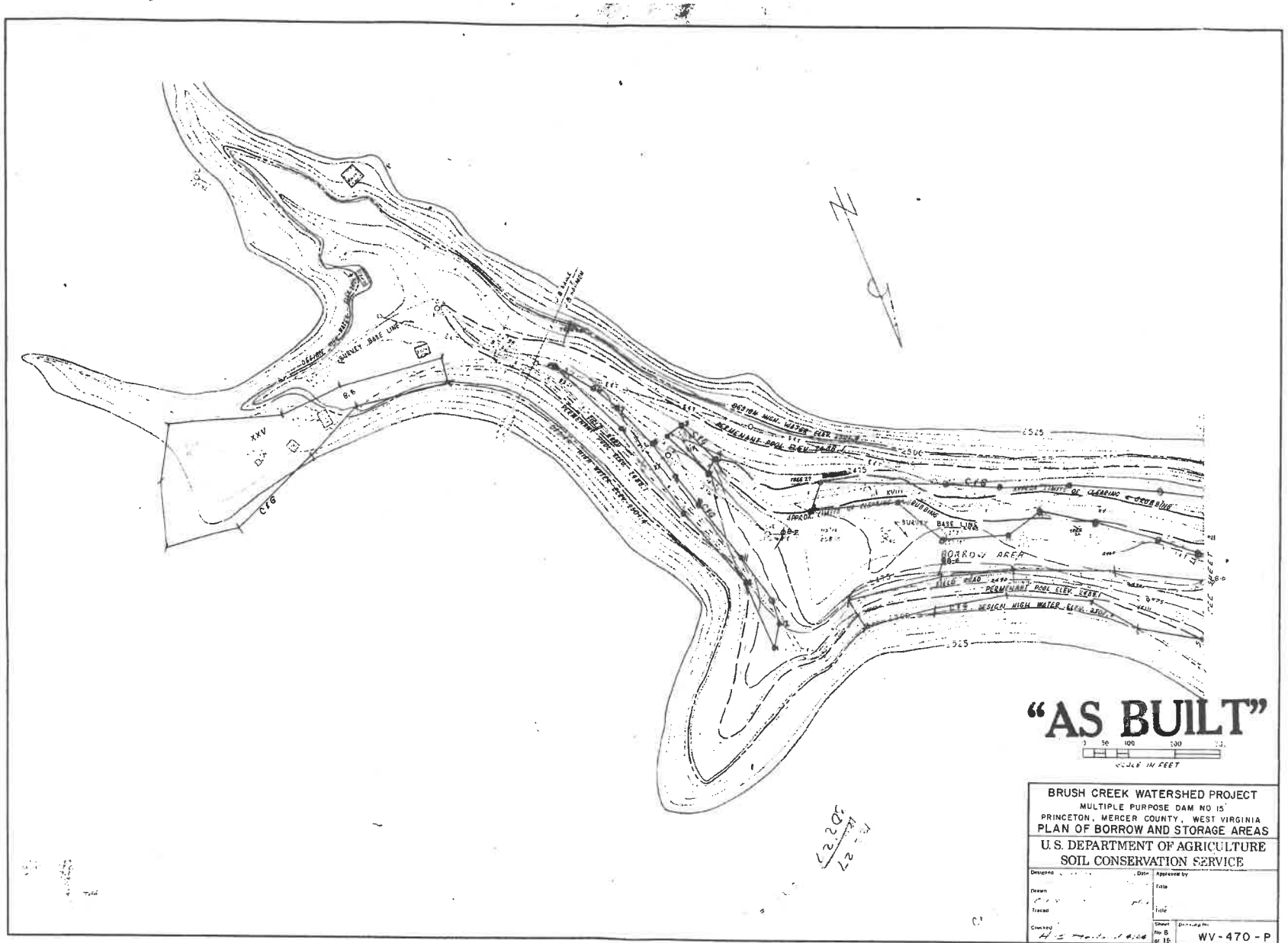
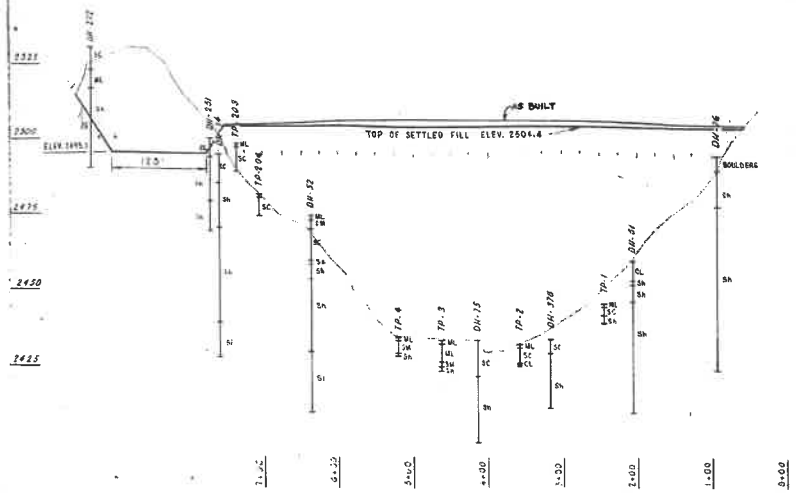
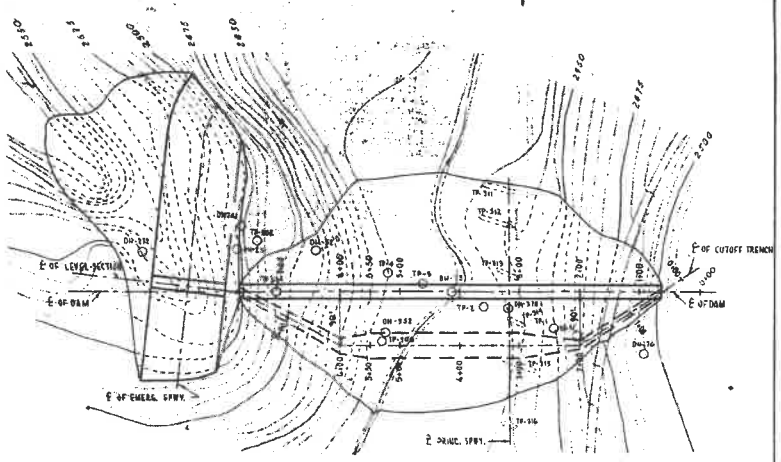
Form SCS-313 (November 1955)

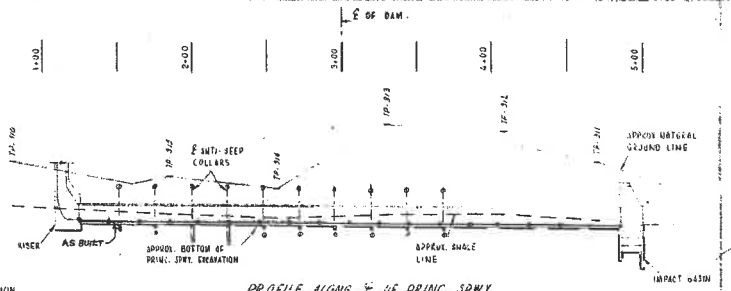

N
SURVEY BASE LINE
DESIGN HIGH WATER ELEV. 2550
PERMANENT POOL ELEV. 2525
BORROW AREA
SURVEY BASE LINE
DESIGN HIGH WATER ELEV. 2550
PERMANENT POOL ELEV. 2525
2525
2550
2475
CFG
CFG
CFG



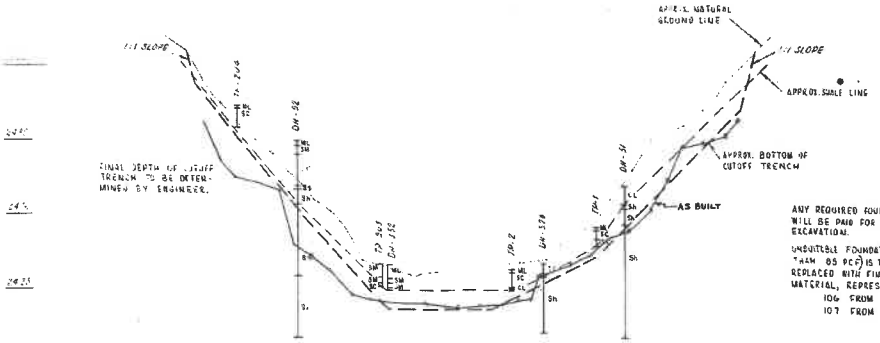
PROFILE ALONG ℄ OF DAM & LEVEL SECTION OF EMERGENCY SPILLWAY
(LOOKING DOWNSTREAM)



PLAN OF DAM
SHOWING LOCATION OF CUTOFF TRENCH



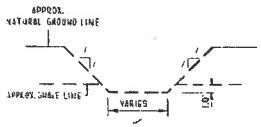
PROFILE ALONG ℄ OF PRINC. SPWY.



PROFILE ALONG ℄ OF CUTOFF TRENCH (LOOKING DOWNSTREAM)

ANY REQUIRED FOUNDATION EXCAVATION WILL BE PAID FOR AS CUTOFF TRENCH EXCAVATION.

UNSUITABLE FOUNDATION SOIL (DRY DENSITY LESS THAN 85 PCF) IS TO BE EXCAVATED AND REPLACED WITH FINE GRAINED, CLAYEY (CL) MATERIAL, REPRESENTED BY TEST HOLES
10G FROM 1' TO 7'
10T FROM 0' TO 8'



TYPICAL SECTION OF CUTOFF TRENCH EXCAVATION

"AS BUILT"

NOTE: TEST PITS 311 TO 316 ARE EXPLORATORY ONLY & ARE NOT LOGGED.
SEE SHEETS 11, 12 & 13 FOR LOGS OF TEST PITS AND DRILL HOLES.

TYPICAL SECTION OF PRINC. SPWY EXCAVATION

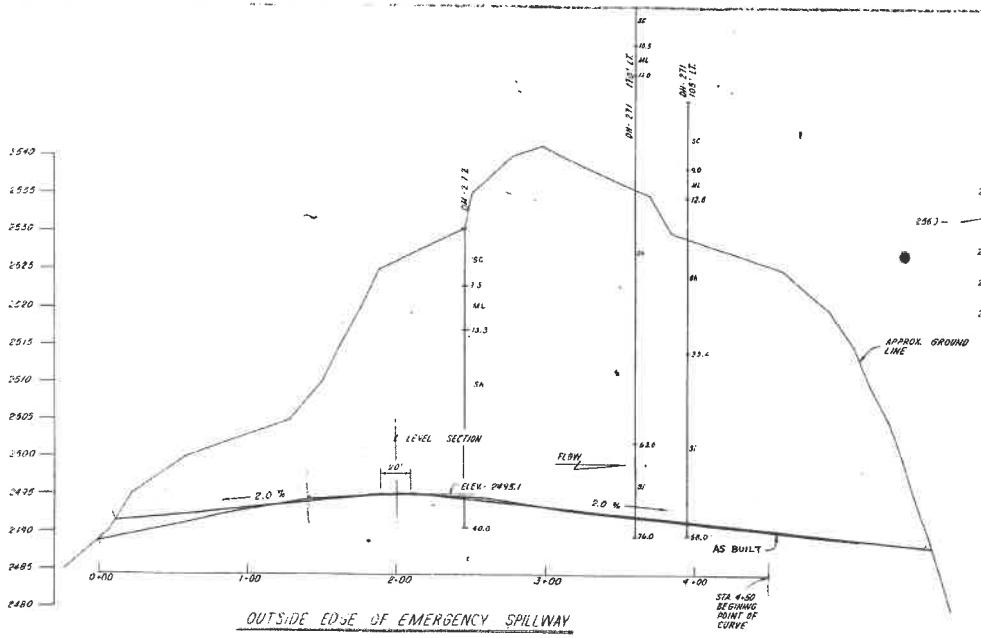
BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
PROFILES

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

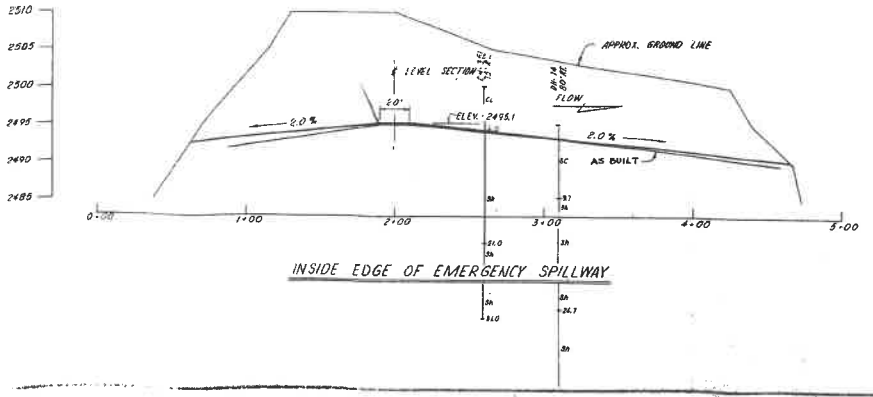
F.R.FARMER JULY '64
H.T. BROWNING JR. JULY '64
E.M. WYSONG AUG. '64

7
19

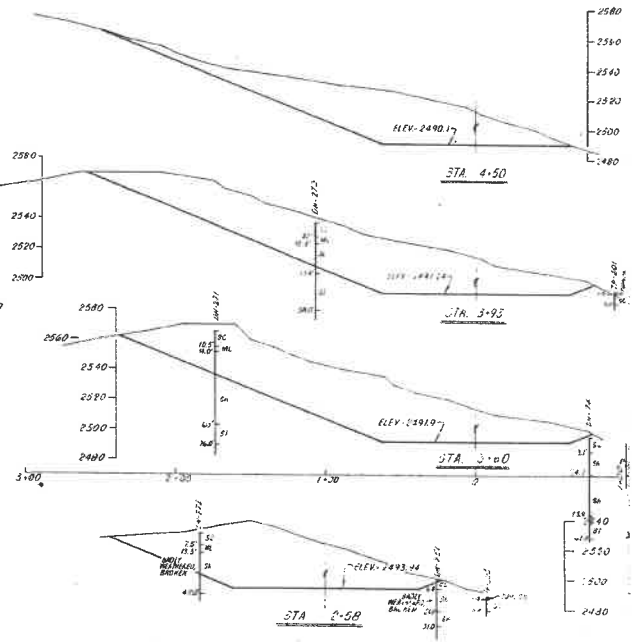
WV-470-P

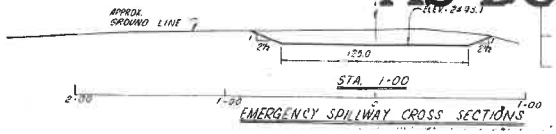


OUTSIDE EDGE OF EMERGENCY SPILLWAY



INSIDE EDGE OF EMERGENCY SPILLWAY





EMERGENCY SPILLWAY CROSS SECTIONS

"AS BUILT"

NOTE:
SEE SHEETS 4, 12 & 13 FOR LOGS OF TEST PITS AND DRILL HOLES.

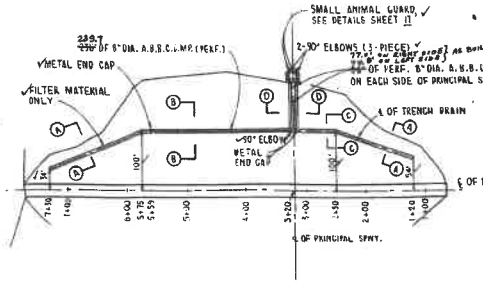
BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
EMERGENCY SPILLWAY DETAILS

C. B. FARMER APR '64
C.B. FORD AUG '64
F.M. WYSONG AUG '64

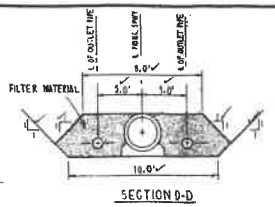
8
15

WV-470-P

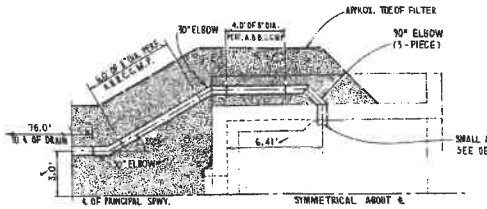
NOTE:
THE SEEPAGE DRAIN PIPES SHALL BE 8" DIA. PERFORATED ANNULAR OR SPIRAL 16 GAUGE ASBESTOS BONDED BITUMINOUS COATED CORRUGATED METAL PIPE.



PLAN OF SEEPAGE DRAIN

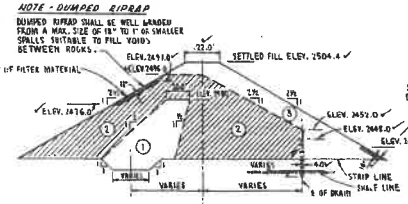


SECTION D-D

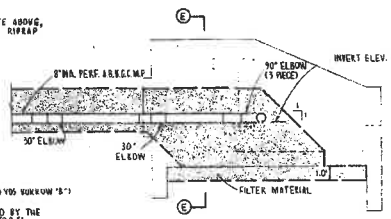


PLAN OF OUTLET DRAIN PIPE
AS BUILT IN PLACE MEASUREMENTS RIGHT SIDE = 18.2' LEFT SIDE = 18.6'

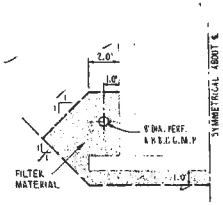
NOTE - DUMPED RIPRAP
DUMPED RIPRAP SHALL BE WELL GRADED FROM A MAX. SIZE OF 18" TO 1" OR SMALLER SPALLS SUITABLE TO FILL VOIDS BETWEEN ROCKS.



TYPICAL SECTION OF DAM



TYPICAL SECTION ALONG OUTLET DRAIN PIPE



SECTION E-E

PLACEMENT OF FILL
SECTION 1 - COMPACTED FILL, CLASS S-1, FINE GRAINED CLAYEY (CL) MATERIAL REPRESENTED BY TEST HOLES 106 FROM 1'-7' AND 107 FROM 1'-8' (90,000 YDS BOROW "B")

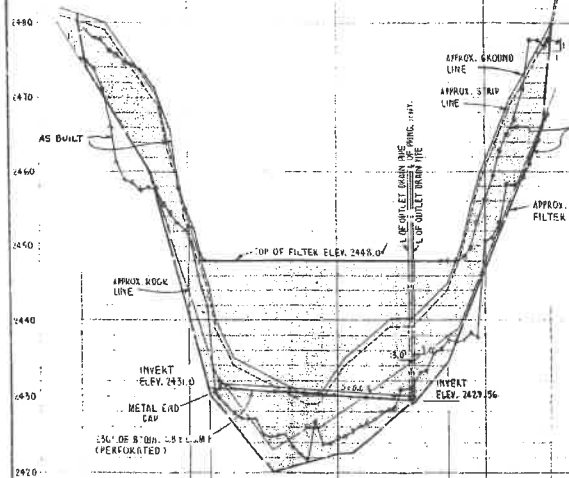
SECTION 2 - COMPACTED FILL, CLASS S-1, CLAYEY AND SILTY SAND (SC, ML-CL) REPRESENTED BY THE FOLLOWING TEST HOLES 104, 3.0 TO 7.0', 104, 1.0' TO 8.0', 102, 1.0' TO 9.0', 105, 1.0' TO 9.5', 106, 2.0' TO 7.0', 102, 1.0' TO 9.5', 103, 4.0' TO 7.0', 101, 1.0' TO 5.0', AND 105, 1.0' TO 4.0' 100,000 YDS. EMERGENCY SPILLWAY AND BOROW "A")

SECTION 3 - CLASS "C" FILL - SHALE AND SILTSTONE REPRESENTED BY DRILL HOLE 273, 42.0' TO 71.0' AND 45.0' TO 50.0' (COMPACT TO OBTAIN A MINIMUM DRY DENSITY OF 120 LBS./FT³ FOR MATERIAL FINER THAN 1½"). 56,100 CU. YDS. - EMERGENCY SPILLWAY.

SECTION A-A
STA. 1+45 TO 2+50 & 5+60 TO 7+45.5

SECTION B-B
STA. 5+25 TO 5+60

SECTION C-C
STA. 2+50 TO 3+17

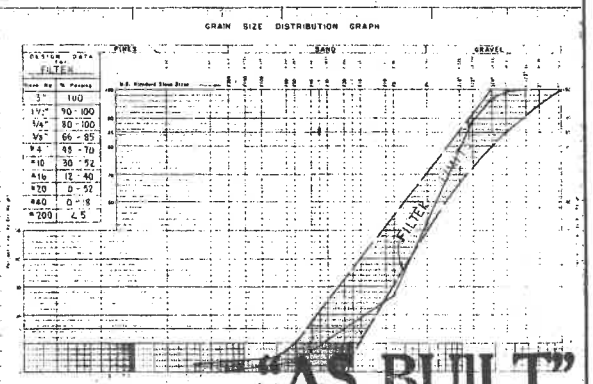


PROFILE ALONG ℄ OF SEEPAGE DRAIN (LOOKING DOWNSTREAM)

BILL OF MATERIALS

(14)	90° ELBOWS
(2)	90° ELBOWS (3 PIECE)
(1)	90° ELBOW (2 PIECE)
(2)	METAL END CAPS
5400'	OF 8" DIA. PERF. A.B.B.C.C.M.P.
(1)	SMALL ANIMAL GUARDS
2,750	CU. YDS. FILTER MATERIAL

NOTE:
IF FILTER GRADATION REQUIREMENTS ARE SUCH THAT SAND MUST BE MIXED WITH GRAVEL TO MEET THE LIMITS SHOWN ON THESE PLANS, THE FILTER MATERIAL WILL BE THOROUGHLY MIXED & THEN DAMPENED WITH WATER PRIOR TO PLACEMENT.



"AS BUILT"

BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
SEEPAGE DRAIN DETAILS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	Date	Approved by
J. ZURLO	AUG. 64	Title
Drawn		
W.H. MORGAN	AUG. 64	Title
Traced		
Checked		Sheet No 9 of 19
E.M. WYCONG	AUG. '64	Drawing No WV-470-P

Form SCS-317 (November 1955)

JOINT	DISTANCE FROM RISER WALL	INVERT ELEV. OF 24" DIA. PIPE	SLOPE
J-1	0.33	2430.20	SLOPE = 0.002.33 FT/FT. ALTERNATE "A"
J-2	20.33	2430.15	
J-3	40.33	2430.11	
J-4	60.33	2430.06	
J-5	80.33	2430.01	
J-6	100.33	2429.97	
J-7	120.33	2429.92	
J-8	140.33	2429.87	
J-9	160.33	2429.83	
J-10	180.33	2429.78	
J-11	200.33	2429.73	
J-12	220.33	2429.69	
J-13	240.33	2429.64	
J-14	260.33	2429.59	
J-15	280.33	2429.55	
J-16	300.33	2429.50	
J-17	320.33	2429.49	
J-18	340.33	2429.41	
OUTLET	360.33	2429.36	

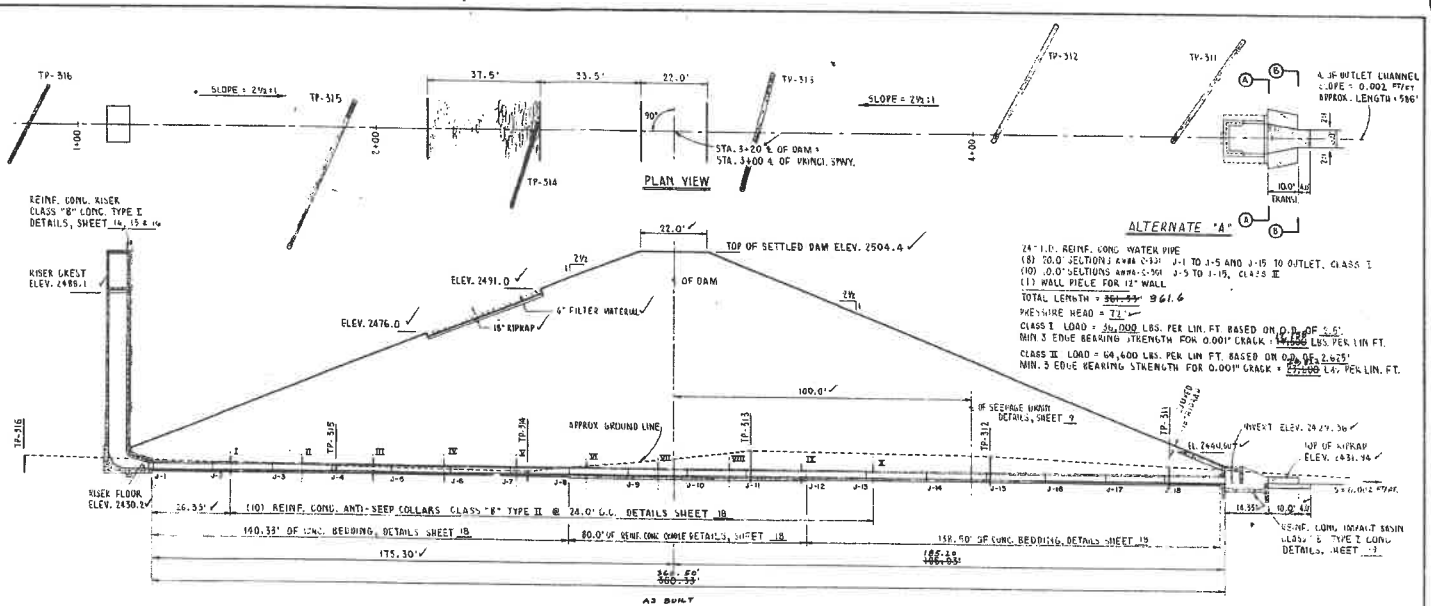
NOTE: ABOVE DIMENSIONS FOR LENGTHS OF PIPE ARE BASED ON NOMINAL LENGTHS AND DO NOT INCLUDE CREEP.

JOINT	DISTANCE FROM RISER WALL	INVERT ELEV. OF 24" DIA. PIPE	SLOPE
J-1	0.33	2430.20	SLOPE = 0.00239 FT/FT. ALTERNATE "B"
J-2	16.33	2430.16	
J-3	36.33	2430.14	
J-4	60.33	2430.11	
J-5	86.33	2430.08	
J-6	112.33	2430.03	
J-7	138.33	2429.99	
J-8	164.33	2429.96	
J-9	190.33	2429.92	
J-10	216.33	2429.89	
J-11	242.33	2429.85	
J-12	268.33	2429.81	
J-13	294.33	2429.77	
J-14	320.33	2429.73	
J-15	346.33	2429.70	
J-16	372.33	2429.66	
J-17	398.33	2429.62	
J-18	424.33	2429.58	
J-19	450.33	2429.55	
J-20	476.33	2429.51	
J-21	502.33	2429.47	
J-22	528.33	2429.43	
J-23	554.33	2429.40	
OUTLET	580.33	2429.36	

NOTE: ABOVE DIMENSIONS FOR LENGTHS OF PIPE ARE BASED ON NOMINAL LENGTHS AND DO NOT INCLUDE CREEP.

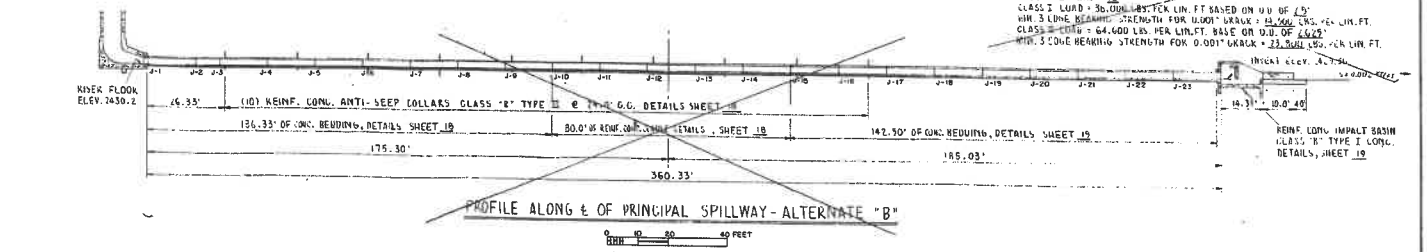
COLLAR	DISTANCE FROM RISER WALL	INVERT ELEV. OF 24" DIA. PIPE	"A" AND "B"
I	26.33	2430.14	ALTERNATE "A" AND "B"
II	50.33	2430.08	
III	74.33	2430.03	
III	98.33	2429.97	
V	122.33	2429.91	
VI	146.33	2429.86	
VII	170.33	2429.80	
VIII	194.33	2429.75	
IX	218.33	2429.69	
X	242.33	2429.64	

JOINT	INVERT ELEV. OF 24" DIA. PIPE	GAP TOP	GAP BOTTOM
J8	2430.20	-	-
J1	2430.20	1.0	1.0
J2	2430.15	1.5	1
J3	24 30.11	1	1
J4	24 30.06	1.5	2
J5	24 30.01	2	2
J6	24 29.97	0	1
J7	24 29.93	0	1
J8	24 29.87	1	0
J9	24 29.83	1	0
J10	24 29.78	1.5	0
J11	24 29.73	2	1
J12	24 29.69	0	0
J13	24 29.64	1	0
J14	24 29.59	0	1
J15	24 29.55	1	1
J16	24 29.50	1	0
J17	24 29.49	1	1.5
J18	24 29.41	0	1
OUTLET	24 29.36	-	



PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY - ALTERNATE "A"

0 10 20 40 FEET



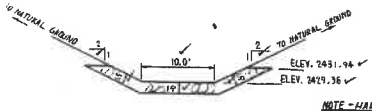
PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY - ALTERNATE "B"

0 10 20 40 FEET

Not Applicable

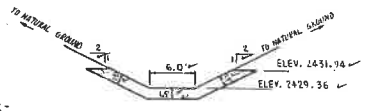
PIPE SUPPLIERS NOTE:
CAST OUTSIDE OF SPIGOT JOINT RING WITH CONCRETE ON ONE 16' SECTION OR ONE 20' SECTION.

NOTE:
THE NEAT LINES OF THE BOTTOM OF THE CRADLE AND RISER WILL BE ESTABLISHED AFTER THE PRINCIPAL SPILLWAY EXCAVATION IS COMPLETED.



SECTION A-A

NOTE - HAND PLACED RIPRAP -
RIPRAP SHALL BE WELL GRADED FROM A MAX. SIZE OF 18" TO A MIN. SIZE OF 6" AND SHALL BE PLACED WITH ITS LONGEST DIMENSION PERPENDICULAR TO THE LINE OF FLOW.



SECTION B-B

"AS BUILT"

BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
PLAN-PROFILE OF PRINCIPAL SPILLWAY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed F.R. FARMER	Date JULY '64	Approved By	
Drawn W.M. MORGAN	AUG. 64	Title	
Traced			
Checked F.M. WYSONG	AUG. 64	Sheet No. 10 of 19 sheets	Drawing No. WV-470-P

Form SCS 313 (November 1955)

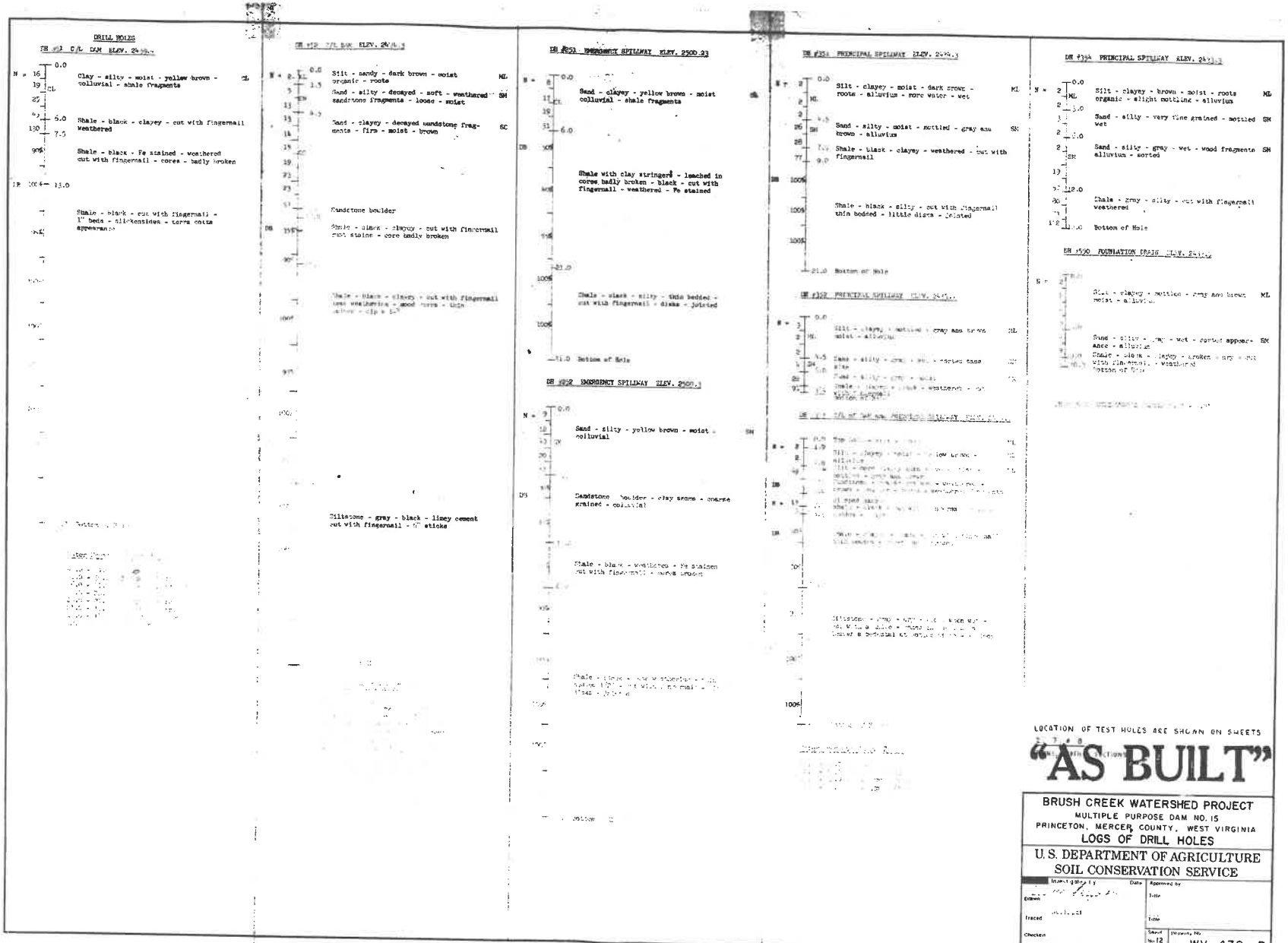
"AS BUILT"

BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
LOGS OF TEST PITS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Investigated by | Date
Drawn
Traced
Checked
Approved by | Title
Title
Sheet No. 11 of 19
Drawing No. WV-470-P

Form SCS-213 (November 1955)


DRILL HOLES
DH #51 C/L DAM ELEV. 24[illegible]
0.0
Clay - silty - moist - yellow brown - colluvial - shale fragments
CL
6.0
Shale - black - clayey - cut with fingernail weathered
7.5
Shale - black - Fe stained - weathered cut with fingernail - cores - badly broken
DH 100%
13.0
Shale - black - cut with fingernail - 1" beds - slickensides - terra cotta appearance
DH #52 EMERGENCY SPILLWAY ELEV. 2500.93
0.0
Sand - clayey - yellow brown - moist colluvial - shale fragments
6.0
Shale with clay stringers - leached in cores badly broken - black - cut with fingernail - weathered - Fe stained
21.0
Bottom of Hole
DH #52 EMERGENCY SPILLWAY ELEV. 2500.1
0.0
Sand - silty - yellow brown - moist - colluvial
SM
Sandstone boulder - clay seams - coarse grained - colluvial
Shale - black - weathered - Fe stained cut with fingernail - cores broken
DH #53 PRINCIPAL SPILLWAY ELEV. 2499.1
0.0
Silt - clayey - moist - dark brown - roots - alluvium - some water - wet
ML
Sand - silty - moist - mottled - gray and brown - alluvium
SM
Shale - black - clayey - weathered - cut with fingernail
9.0
Shale - black - silty - cut with fingernail thin bedded - little discs - jointed
100%
21.0
Bottom of Hole
DH #54 PRINCIPAL SPILLWAY ELEV. 2497.1
0.0
Silt - clayey - brown - moist - roots organic - slight mottling - alluvium
ML
3.0
Sand - silty - very fine grained - mottled wet
SM
5.0
Sand - silty - gray - wet - wood fragments alluvium - sorted
SM
18.0
Shale - gray - silty - cut with fingernail weathered
Bottom of Hole
DH #50 FOUNDATION DRAIN ELEV. 2491.1
Silt - clayey - mottled - gray and brown moist - alluvium
ML
Sand - silty - gray - wet - coarse appearance - alluvium
SM
Shale - black - clayey - broken - gray - cut with fingernail - weathered
Bottom of Hole
LOCATION OF TEST HOLES ARE SHOWN ON SHEETS
2 3 4 8
"AS BUILT"
BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCIPAL MERCER, COUNTY, WEST VIRGINIA
LOGS OF DRILL HOLES
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Drawn
Traced
Checked
Approved by
Title
Sheet No. 12 of 19
Drawing No. WV-470-P
Form SCS 313 (November 1956)

DRILL HOLES

DH #72 EMERGENCY SPILLWAY ELEV. 2565.54

0.0
N = 21
14
Sandy clay - brown - moist
19 SC
24
15
10
16
17 10.5
50 ML Silty clay - gray brown - moist
14.0
DB = 50%
60%
90%
30%
Shale - clay seams - gray - soft to medium hard
50%
25%
25%
30%
50%
50%
63.0
95% Siltstone - blue- cut with fingernail
100%
100%
76.0 Bottom of Hole

DH #73 EMERGENCY SPILLWAY ELEV. 2530.83

0.0
N = 2
4
4 SC Sandy clay - brown - moist
12
13
16
7.5
33
46 ML Silty clay - gray brown - moist
13.3
DB = 60%
30% Shale - badly weathered - broken cores - clay in joints and bedding planes - dark gray
90%
65%
40%
40% 40.0 Bottom of Hole

DH #75 C/L DAM ELEV. 2533.66

0.0
N = 2 WL 4-10-64 2432.5
2
2
1
17 SC Sandy clay - gray - wet
25
31
28
12.0
DB = 80%
95% Shale - black - clayey - moderately hard - thin bedded good cores
95%
100%
100%
34.0 Bottom of Hole

Water Pressure Tests DH #75

25.0 - 34.0 = 0 gpm @ 30 psi
20.0 - 25.0 = 4.3 gpm @ 30 psi
15.0 - 20.0 = water leaking through casing
10.0 - 34.0 = 0 gpm @ 30 psi

DH #73 EMERGENCY SPILLWAY ELEV. 2547.54

0.0
N = 6
7 SC Sandy clay - brown - moist
8
9
8
12
30
68 ML Silty clay - gray brown - moist
9.0
12.0
DB = 65% Shale - badly weathered - broken cores - clay in joints and bedding planes - dark gray
95%
60%
55%
33.4
90% Siltstone - gray black - hard - cut with fingernail - 6" sticks
100%
100%
100%
58.0 Bottom of Hole

DH #74 C/L DAM ELEV. 2495.0

0.0
N = 6
10
11 SC Sandy clay - brown - moist
19
23
22
62 9.7
60%
DB = 35% Shale - black - clayey - soft weathered - cores badly broken
75%
80%
24.7
100%
100% Shale - black - clayey - moderately hard - thin bedded - good cores
95%
Lost drill water at 37.5'
100%
100%
100%
55.9
100% Siltstone - gray black - moderately hard
95%
67.0 Bottom of Hole

Water Pressure Tests DH #74

65.0 - 67.0 = 11.25 gpm @ 16 psi
60.0 - 65.0 = 13.25 gpm @ 4 psi
55.0 - 60.0 = 0 gpm @ 24 psi
50.0 - 55.0 = 0 gpm @ 14 psi
45.0 - 50.0 = 0 gpm @ 15 psi
40.0 - 45.0 = 13.75 gpm @ 10 psi
35.0 - 40.0 = 13.75 gpm @ 10 psi
30.0 - 35.0 = 0 gpm @ 15 psi
25.0 - 30.0 = water leaking through casing
20.0 - 25.0 = 3.6 gpm @ 14 psi
15.0 - 20.0 = 8.0 gpm @ 11 psi
10.0 - 15.0 = 13.75 gpm @ 12 psi (water leaking)

DH #76 C/L DAM ELEV. 2495.0

0.0
Boulders - no sample
5.0
DB = 65%
Shale - black - soft - weathered cores badly broken
85%
60%
17.0
45%
▼ WL 4-9-64 2471.7
100%
100%
100%
100%
100%
100% Shale - black - moderately soft - thin bedded - good cores
100%
100%
100%
100%
90%
100%
100%
71.0 Bottom of Hole

Water Pressure Tests DH #76

45.0 - 70.0 = 0 gpm @ 12 psi
40.0 - 45.0 = 0 gpm @ 12 psi
35.0 - 40.0 = 0.5 gpm @ 17 psi
30.0 - 35.0 = 0 gpm @ 18 psi
25.0 - 30.0 = 0 gpm @ 12 psi
20.0 - 25.0 = 0.1 gpm @ 20 psi
15.0 - 20.0 = water leaking through casing
5.0 - 70.0 = 6.5 gpm @ 18 psi

NOTE:
HOLES LOGGED BY DRILLER

LOCATION OF TEST HOLES ARE SHOWN ON SHEETS 6, 7, & 8.
(PLANS, PROFILES SECTIONS)

DH #377 PRINCIPAL SPILLWAY ELEV. 2436.80

0.0
N = 6
15 SC Sandy clay - brown - wet
14
39
6.0
73 SC Sandy clay with shale fragments
8.5
DB = 60%
90%
Shale - black - cut with fingernail clay in beds and joints - 1/8" disks - more massive with depth
100%
100%
100%
23.5 Bottom of Hole

DH #378 PRINCIPAL SPILLWAY ELEV. 2441.75

0.0
N = 8
20 SC Sandy clay - brown - wet
83
4.5
DB= 60%
80% Shale - black - cut with fingernail clay in beds and joints - 1/8" disks more massive with depth
90%
90%
100%
22.5 Bottom of Hole

DH #379 PRINCIPAL SPILLWAY ELEV. 2437.06

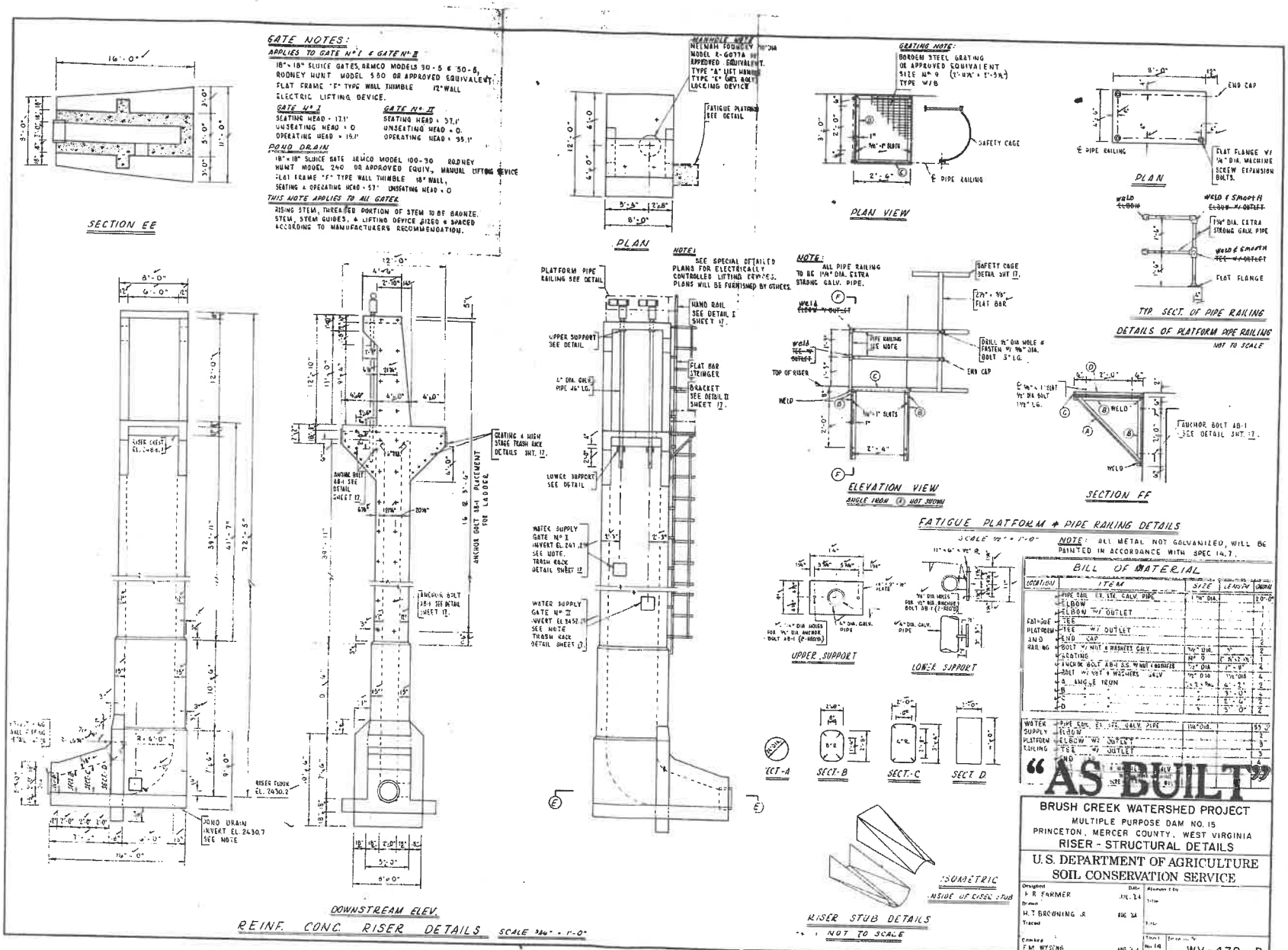
0.0
N = 5
8 SC Sandy clay - brown - wet
17
27
6.0
48 SC Sandy clay with shale fragments
7.5
DB= 85%
Shale - black - cut with fingernail clay in beds and joints - 1/4" disks more massive with depth
100%
100%
22.5 Bottom of Hole

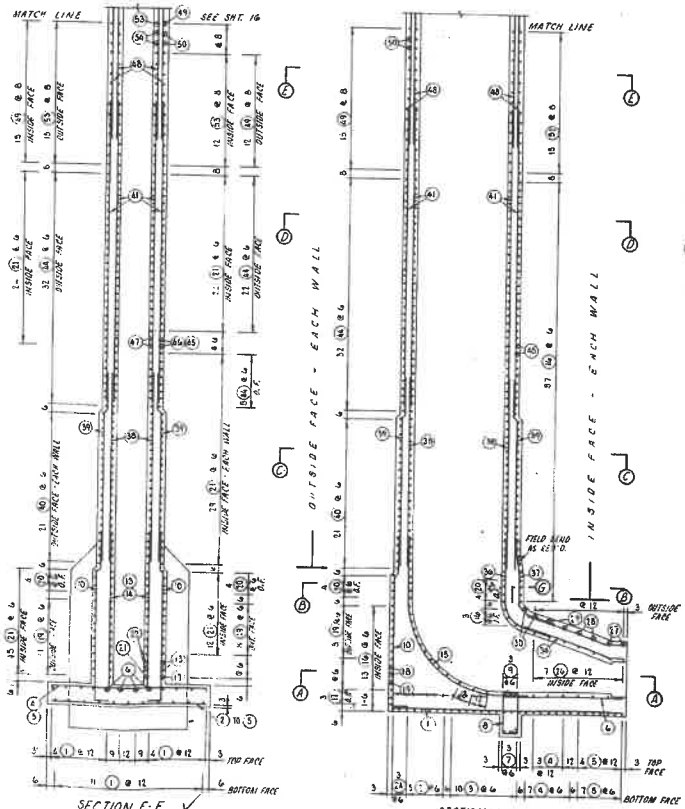
"AS BUILT"

BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
LOGS OF DRILL HOLES
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Investigated by JAMES FERGUSON	Date MAR,'64	Approved By	
Drawn L. MULLINS	APR,'64	Title	
Typed by L. McCLAIN	APR. '64	Sheet No. 13 of 18	Drawing No. WV-470-P
Checked G. A. KESSEL	APR. '64		

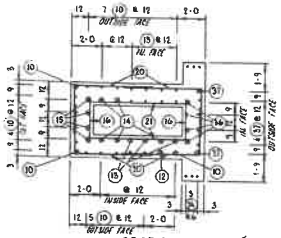
Form SCS-313 November 1959


GATE NOTES:
APPLIES TO GATE N° I & GATE N° II
18" x 18" SLUICE GATES, ARMCO MODELS 90-5 & 90-6, ROONEY HUNT MODEL 550 OR APPROVED EQUIVALENT. FLAT FRAME "F" TYPE WALL THIMBLE 12" WALL ELECTRIC LIFTING DEVICE.
GATE N° I
SEATING HEAD = 17.1'
UNSEATING HEAD = 0
OPERATING HEAD = 19.1'
GATE N° II
SEATING HEAD = 37.1'
UNSEATING HEAD = 0.
OPERATING HEAD = 39.1'
POND DRAIN
18" x 18" SLUICE GATE ARMCO MODEL 100-30 ROONEY HUNT MODEL 240 OR APPROVED EQUIV., MANUAL LIFTING DEVICE FLAT FRAME "F" TYPE WALL THIMBLE 18" WALL, SEATING & OPERATING HEAD = 57' UNSEATING HEAD = 0
THIS NOTE APPLIES TO ALL GATES
RISING STEM, THREADED PORTION OF STEM TO BE BRONZE. STEM, STEM GUIDES, & LIFTING DEVICE SIZED & SPACED ACCORDING TO MANUFACTURERS RECOMMENDATION.
SECTION EE
MANHOLE NOTE
NEENAH FOUNDRY MODEL R-6077A OR APPROVED EQUIVALENT. TYPE "A" LIFT HANDLE TYPE "C" GRD. BOLT LOCKING DEVICE
FATIGUE PLATFORM SEE DETAIL
PLAN
GRATING NOTE:
BORDEN STEEL GRATING OR APPROVED EQUIVALENT SIZE N° 9 (3'-0" x 1'-0") TYPE W/B
SAFETY CAGE
¢ PIPE RAILING
PLAN VIEW
END CAP
¢ PIPE RAILING
FLAT FLANGE ½" x ¼" DIA. MACHINE SCREW EXPANSION BOLTS.
PLAN
WELD ELBOW
WELD & SMOOTH ELBOW W/ OUTLET
1½" DIA. EXTRA STRONG GALV. PIPE
WELD & SMOOTH SEE W/ OUTLET
FLAT FLANGE
TYP SECT. OF PIPE RAILING
DETAILS OF PLATFORM PIPE RAILING
NOT TO SCALE
NOTE:
SEE SPECIAL DETAILED PLANS FOR ELECTRICALLY CONTROLLED LIFTING DEVICES. PLANS WILL BE FURNISHED BY OTHERS
NOTE:
ALL PIPE RAILING TO BE 1½" DIA. EXTRA STRONG GALV. PIPE.
SAFETY CAGE DETAIL SHT. 17.
2½" x ⅜" FLAT BAR
WELD ELBOW W/ OUTLET
PIPE RAILING SEE NOTE
DRILL ⅞" DIA HOLE & FASTEN ⅞" DIA. BOLT 3" LG.
END CAP
TOP OF RISER
WELD
¾" x 1" SLOTS
ELEVATION VIEW
ANGLE IRON (A) NOT SHOWN
¢ ⅝" x 1" SLOT ⅝" DIA BOLT 1¾" LG.
WELD
ANCHOR BOLT AB-1 SEE DETAIL SHT. 17.
SECTION FF
FATIGUE PLATFORM & PIPE RAILING DETAILS
SCALE ½" = 1'-0"
NOTE: ALL METAL NOT GALVANIZED, WILL BE PAINTED IN ACCORDANCE WITH SPEC 14.7.
BILL OF MATERIAL
LOCATION | ITEM | SIZE | LENGTH | UNITS
FATIGUE PLATFORM AND RAILING
PIPE RAIL EX. STR. GALV. PIPE 1½" DIA. 20'-0"
ELBOW
ELBOW W/ OUTLET
TEE
TEE W/ OUTLET
END CAP
BOLT W/ NUT & WASHERS GALV. ⅝" DIA.
GRATING
ANCHOR BOLT AB-1 S.S. W/ NUT & WASHER ¾" DIA 2'-6"
BOLT W/ NUT & WASHERS GALV. ⅝" DIA 1'-0"
ANGLE IRON ½" x 3½" 2'-6"
B ½" x 3½" 5'-0"
D ½" x 3½" 5'-0"
WATER SUPPLY PLATFORM RAILING
PIPE RAIL EX. STR. GALV. PIPE 1½" DIA. 55'-0"
ELBOW
ELBOW W/ OUTLET
TEE W/ OUTLET
END CAP
UPPER SUPPORT
LOWER SUPPORT
SECT-A
SECT-B
SECT-C
SECT D
ISOMETRIC
INSIDE OF RISER STUB
RISER STUB DETAILS
NOT TO SCALE
"AS BUILT"
BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
RISER - STRUCTURAL DETAILS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed F. R. FARMER DATE 10/64
Drawn H. T. BROWNING JR 8/65
Traced
Checked F. M. WYSONG 4/65
Approved
Sheet No. 14 of 19 Sheets
WV-470-P
DOWNSTREAM ELEV.
REINF. CONC. RISER DETAILS SCALE 3/16" = 1'-0"
Form SCS-313 (November 1964)

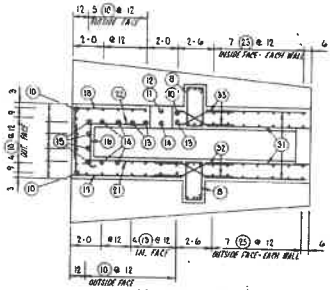


SECTION F-F

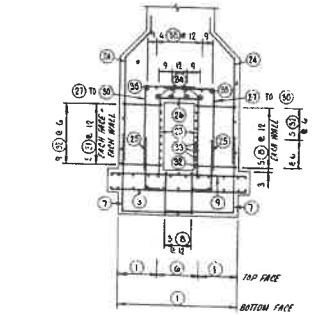
SECTION ALONG E



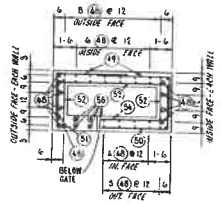
SECTION B-B



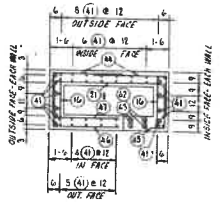
SECTION A-A



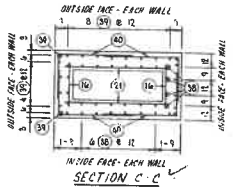
SECTION G-G



SECTION E-E



SECTION D-D



SECTION C-C

NOTE:
BAR TYPES, REINF. STEEL SCHEDULE, SEE SHEET 18

"AS BUILT"

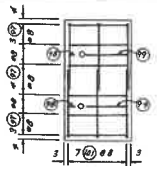
SCALE

BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
RISER-REINF. STEEL DETAILS

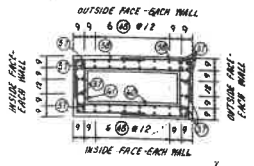
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed F.R. FARMER	Date JULY '64	Approved by	
Drawn M. NIKOLICH	AUG. 64	Title	
Traced		Title	
Checked F.R. FARMER	SEPT '64	Sheet No. 15 of 19	Drawing No. WV-470-P

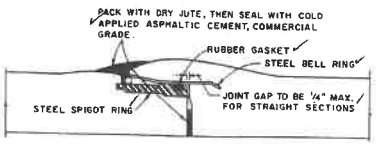
Form SCS-313 (November 1955)



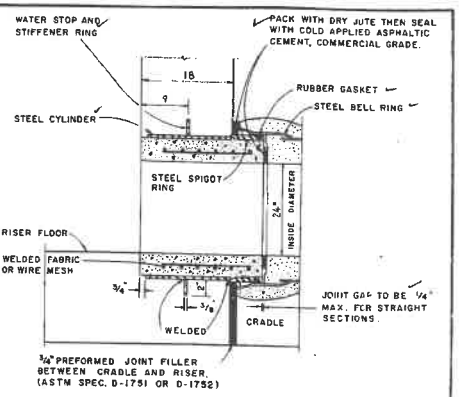
TOP FACE OF PLATFORM



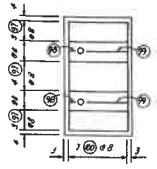
SECTION L-L



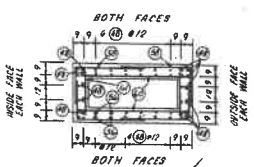
DETAIL OF REINFORCED CONCRETE WATER PIPE JOINT



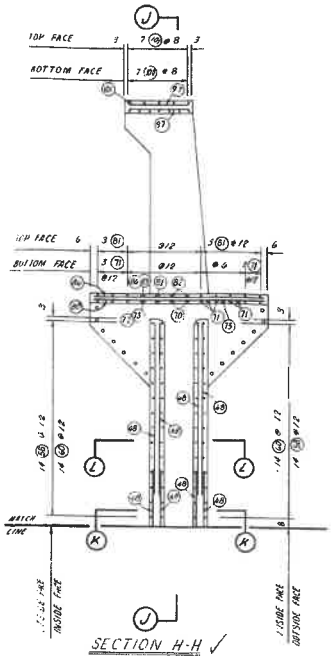
SPIGOT RING WALL FITTING



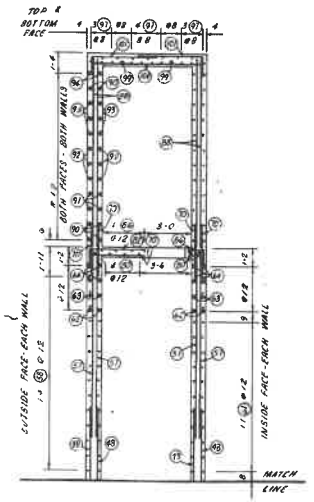
BOTTOM FACE OF PLATFORM



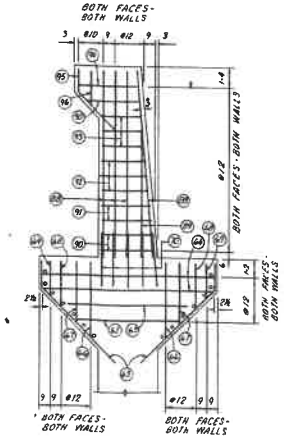
SECTION K-K



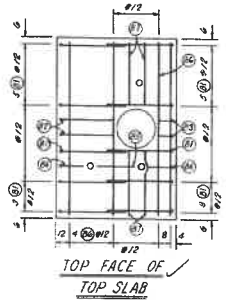
SECTION H-H



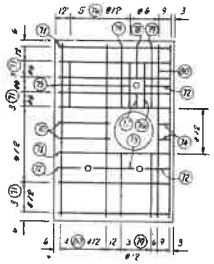
SECTION J-J



PLATFORM AND TOP SLAB SUPPORTS



TOP FACE OF TOP SLAB



BOTTOM FACE OF TOP SLAB

GENERAL NOTES:

1. ALL CONCRETE SHALL BE CLASS "B" @ OF THE TYPE NOTED
2. PORTLAND CEMENT TYPE IA ~~OR TYPE I WITH AN AIR-ENTRAINING ADMIXTURE~~ SHALL BE USED
3. ALL REINF. STEEL TO BE LAPPED A MIN. OF 30 BAR DIA.
4. ALL REINF STEEL PLACED IN CONCRETE POURED AGAINST THE GROUND SHALL HAVE A MIN. OF 3" CLEAR. WHERE FORMS ARE USED BARS SHALL HAVE A MIN. OF 2" CLEAR COVER.
5. ALL EXPOSED EDGES OF CONCRETE TO HAVE A 3/4" CHAMFER UNLESS OTHERWISE NOTED.

NOTES:
BAR TYPES, STEEL SCHEDULE
REFER TO SHEET 12.

"AS BUILT"

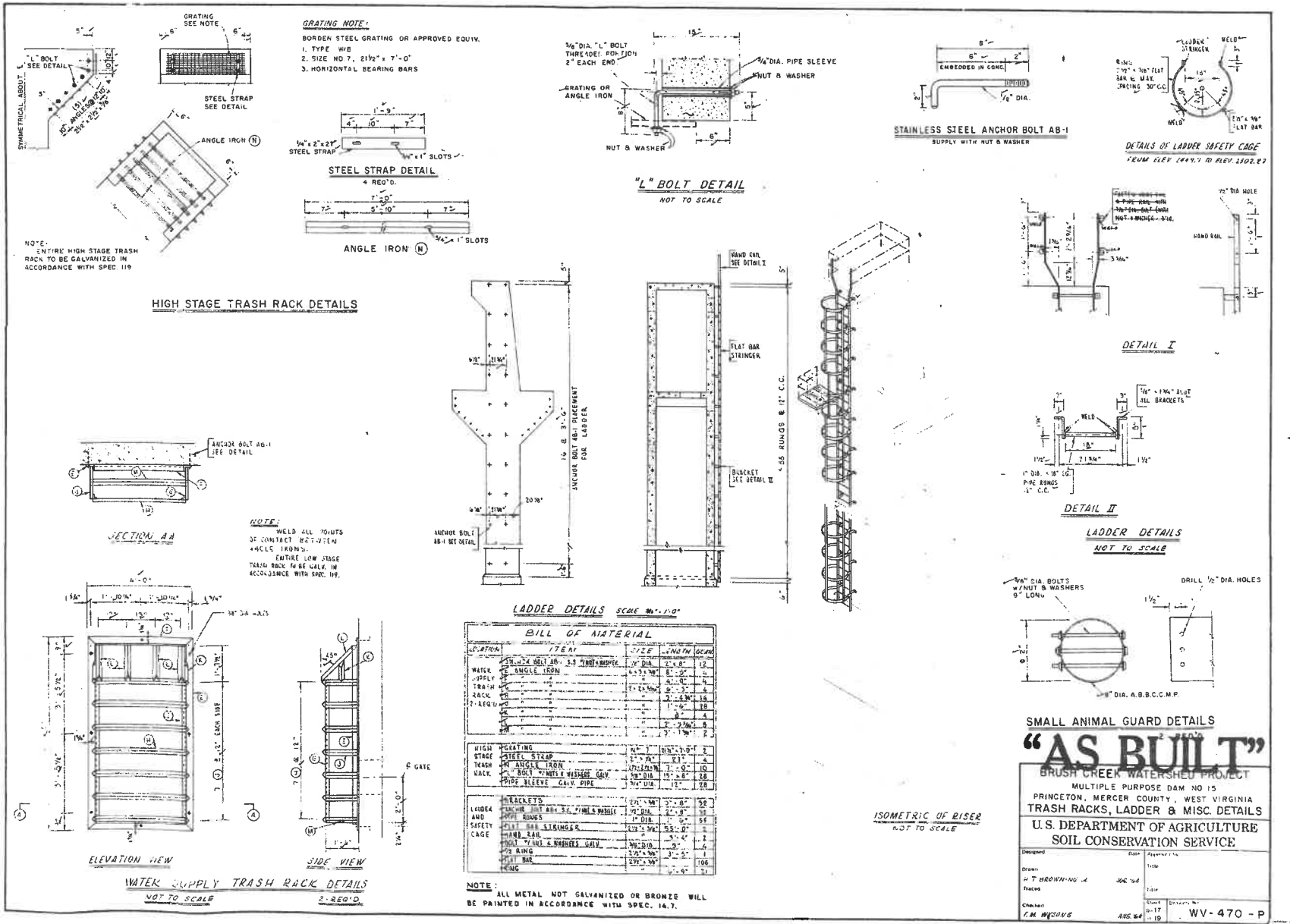
SCALE

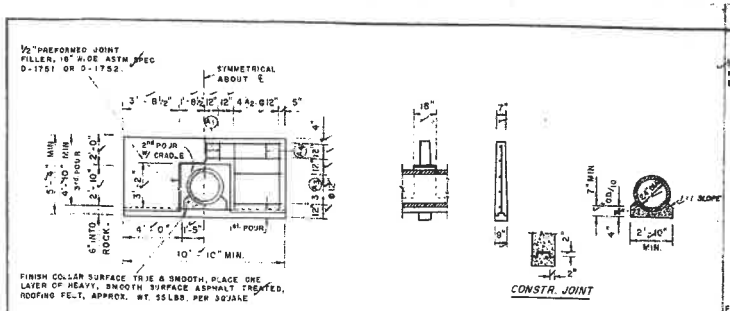
BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
RISER - REINF. STEEL DETAILS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed F.R. FARMER	Date JUL. '64	Approved by	
Drawn C.B FOND	SCALE 1"=1'-0"	Title	
Traced		Date	
Checked F.R. FARMER	SFA 64	Sheet No. 14 of 19 sheets	Drawing No. WV-470-P

Form SCS 313 (November 1955)


GRATING NOTE:
BORDEN STEEL GRATING OR APPROVED EQUIV.
1. TYPE WB
2. SIZE NO 7, 21⅛" x 7'-0"
3. HORIZONTAL BEARING BARS
GRATING SEE NOTE
STEEL STRAP SEE DETAIL
"L" BOLT SEE DETAIL
SYMMETRICAL ABOUT ℄
ANGLE IRON (N)
NOTE:
ENTIRE HIGH STAGE TRASH RACK TO BE GALVANIZED IN ACCORDANCE WITH SPEC 119
STEEL STRAP DETAIL
4 REQ'D.
ANGLE IRON (N)
HIGH STAGE TRASH RACK DETAILS
⅝"DIA. "L" BOLT THREADED FOR 2" EACH END
⅝"DIA. PIPE SLEEVE
NUT & WASHER
GRATING OR ANGLE IRON
"L" BOLT DETAIL
NOT TO SCALE
STAINLESS STEEL ANCHOR BOLT AB-1
SUPPLY WITH NUT & WASHER
LADDER STRINGER
WELD
DETAILS OF LADDER SAFETY CAGE
FROM ELEV 1449.1 TO ELEV 1502.83
HAND RAIL
DETAIL I
WELD
DETAIL II
LADDER DETAILS
NOT TO SCALE
ANCHOR BOLT AB-1 SEE DETAIL
SECTION AA
NOTE:
WELD ALL POINTS OF CONTACT BETWEEN ANGLE IRONS.
ENTIRE LOW STAGE TRASH RACK TO BE GALV. IN ACCORDANCE WITH SPEC. 119.
ANCHOR BOLT AB-1 PLACEMENT FOR LADDER
ANCHOR BOLT AB-1 SET DETAIL
FLAT BAR STRINGER
BUCKET SEE DETAIL II
HAND GRIL SEE DETAIL I
LADDER DETAILS SCALE ⅜"=1'-0"
ELEVATION VIEW
SIDE VIEW
℄ GATE
WATER SUPPLY TRASH RACK DETAILS
NOT TO SCALE
2 REQ'D.
BILL OF MATERIAL
LOCATION
ITEM
SIZE
LENGTH
QUAN.
WATER SUPPLY TRASH RACK 2 REQ'D
¾"-H.H.X BOLT AB-1 S.S. W/NUT & WASHER
ANGLE IRON
HIGH STAGE TRASH RACK
GRATING
STEEL STRAP
ANGLE IRON
SOCT. W/NUTS & WASHERS GALV.
PIPE SLEEVE GALV. PIPE
LADDER AND SAFETY CAGE
BRACKETS
ANCHOR BOLT AB-1 S.S. W/NUT & WASHER
PIPE RUNGS
END RAIL
BOLT W/NUT & WASHERS GALV.
"S" RING
FLAT BAR
RING
NOTE:
ALL METAL NOT GALVANIZED OR BRONZE WILL BE PAINTED IN ACCORDANCE WITH SPEC. 14.7.
ISOMETRIC OF RISER
NOT TO SCALE
⅜" DIA. BOLTS W/NUT & WASHERS 9" LONG
DRILL ½" DIA. HOLES
⅜" DIA. A,B,B,C,C,M,P.
SMALL ANIMAL GUARD DETAILS
2 REQ'D.
"AS BUILT"
BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
TRASH RACKS, LADDER & MISC. DETAILS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed
Date
Approved by
Drawn
H T BROWNING JR
JUL '64
Title
Traced
Date
Checked
C.M. WEAVER
AUG. '64
Sheet No. 17 of 19
WV-470-P
Form SCS-313 (November 1



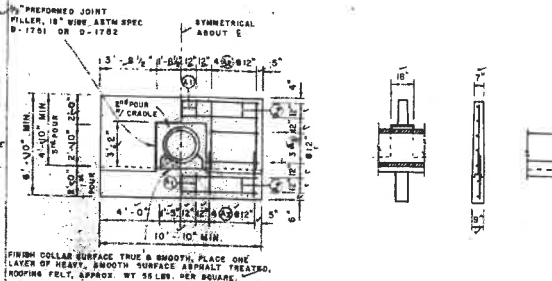
REINFORCED CONCRETE ANTI-SEEP COLLAR DETAILS - ALTERNATE "A"

SCALE 0 1 2 3 4 5 6 FEET

4 COLLARS WITH BEDDING

ALTERNATE "B"

4 COLLARS WITH BEDDING

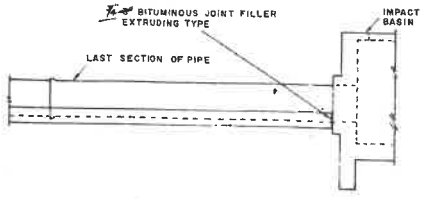


REINFORCED CONCRETE ANTI-SEEP COLLAR DETAILS

SCALE 0 1 2 3 4 5 6 FEET

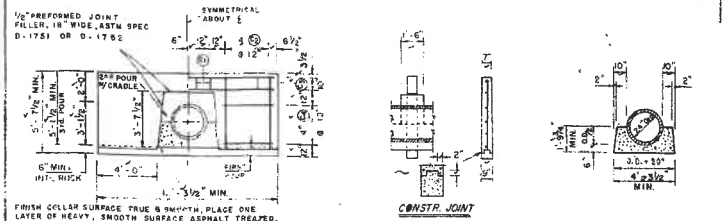
ALTERNATE "A" or "B"

2 - REQUIRED



CONCRETE BEDDING DETAILS

SCALE 0 1 2 3 4 5 6 FEET



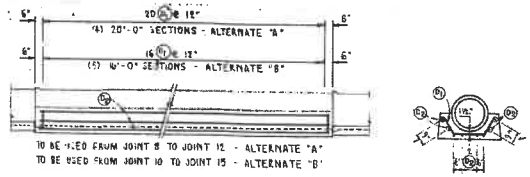
REINFORCED CONCRETE ANTI-SEEP COLLAR DETAILS - ALTERNATE "A"

SCALE 0 1 2 3 4 5 6 FEET

4 COLLARS WITH CRADLE

ALTERNATE "B"

3 COLLARS WITH CRADLE



REINF. CONCRETE CRADLE DETAILS

SCALE 0 1 2 3 4 5 6 FEET

PROJECT QUAN. - ALTERNATE "A"

STEEL QUAN.			CONC. QUAN.	
№ 4 BAR	1496.4 LIN FT 1996.4	LBS.	CLASS "B" TYPE I	74.5 C.Y.
№ 5 BAR	2351.52 LIN FT 2935.5	LBS.	CLASS "B" TYPE II	29.7 C.Y.
№ 6 BAR	2.242.80 LIN FT 2805.5	LBS.	CLASS "B" TYPE III	18.6 C.Y.
№ 7 BAR	1499.87 LIN FT 3182.5	LBS.		
№ 8 BAR	79.50 LIN FT 111.5	LBS.		
TOTAL	20,549	LBS.		

PROJECT QUAN. - ALTERNATE "B"

STEEL QUAN.			CONC. QUAN.	
№ 4 BAR	1536.83 LIN. FT. 1996.4	LBS	CLASS "B" TYPE I	74.5 C.Y.
№ 5 BAR	8503.71 LIN FT 8657.7	LBS	CLASS "B" TYPE II	29.7 C.Y.
№ 6 BAR	2.242.80 LIN. FT. 3281.5	LBS	CLASS "B" TYPE III	18.6 C.Y.
№ 7 BAR	1499.87 LIN FT 3182.5	LBS		
№ 8 BAR	79.50 LIN FT 111.5	LBS		
TOTAL	20,491			

STEEL SCHEDULE

MARK	LOCATION	QUAN	SIZE	LENGTH	TYPE	A	B	C	D	TOTAL FT.
	ALTERNATE "A"									
			4	1-0						18.00
			4	4						22.00
			4	1-3						149.00
		10	4	12-0						120.00
		4	4	1-4						24.00
		3	4	4-10						174.00
			4							
			4							
0-1	CRADLE	10	4	4-6	1	4-3	1-0	1-3		360.00
	ALTERNATE "B"									
		23	4	1-4	1					47.12
		4	4	4-7	1					19.00
		38	4	3-3	1					126.67
		18	4	10-4	1					189.00
		11	5	1-4	1					14.00
		4	4	4-10	1					19.00
		4	4	11-7	1					51.00
		4	4	3-6	1					14.00
0-1	CRADLE	10	4	4-6	1	4-3	1-0	1-3		360.00
		49	5	15-6	1					949.00
	RISER									
			5	3-2						9.50
			5	3-9						48.75
			5	2-2	1					30.75
			5	8-0	1					88.33
			5	8-5	1					82.50
			5	3-6	1					56.50
			5	3-9						32.50
			5	3-3	1	0-11	2-6			56.63
			5	5-1	1					105.33
			5	8-6	1					23.50
			5	8-5	1					42.50
			5	15-9	1	1-11	2-11			63.33
			5	8-5	1					170.00
			5	8-5	1					11.50

STEEL SCHEDULE

MARK	LOCATION	QUAN.	SIZE	LENGTH	TYPE	A	B	C	D	TOTAL FT.
18		2	7	8-6	2	4-9	5-8			14.83
19		20	3	11-0	2	1-4	3-5			220.00
20		83	3	1-6	1	1-4	2-3			145.00
21		132	7	7-0	1					924.00
22		2	7	4-0	1					8.00
23		16	6	4-1	1					65.33
24		6	7	10-6	6	7-0	7-6	1-0	1-2	63.00
25				2-3			2-6			82.50
26										
27										
28				2-6	2	2-3	3-0			220.00
29										23.10
30		6	6	8-0	2	4-9	3-5			98.00
31		2	6	3-9	1	0-6	2-3			55.00
32		10	5	6-9	1					115.00
33		6	7	5-7	2	1-11	1-9	1-11	1-9	136.50
34		4	6	4-1	2	1-11	1-9	0-6	1-6	75.00
35		4	6	7-0	2	1-0	6-0			58.00
36		6	6	7-0	2	1-3	5-9			42.00
37		4	6	8-0	3	1-11	2-11	4-0		53.50
38		6	6	7-0	2	1-11	2-10	4-9		42.00
39		3	6	10-6	1					23.00
40		38	4	1-9	4	10-3	5-4	2-5	1-8	357.00
41		54	6	8-0	2	3-0	5-9			432.00
42		44	6	2-6	1					110.00
43		6	5	3-0	1					18.00
44		4	5	15-0	1					60.00
45		24	4	1-3	2	2-3	2-0			33.00
46		2	6	3-3	2	1-7	2-0			7.50
47		2	6	2-3	2	1-7	2-0			14.00
48		69	5	1-6	1					103.50
49		56	5	7-2	2	4-7	2-7			401.33
50		2	6	3-0	2	4-6	2-7			14.00
51		2	5	3-1	2	1-7	2-7			7.17
52		36	5	2-6	1					90.00
53		26	5	7-3	1					196.00
54		2	5	4-2	1					8.50
55		4	5	5-4	1					22.00
56		4	5	4-1	1					16.00
57		24	5	12-2	1					300.00
58		56	5	7-6	2	7-7	4-7			401.33

STEEL SCHEDULE

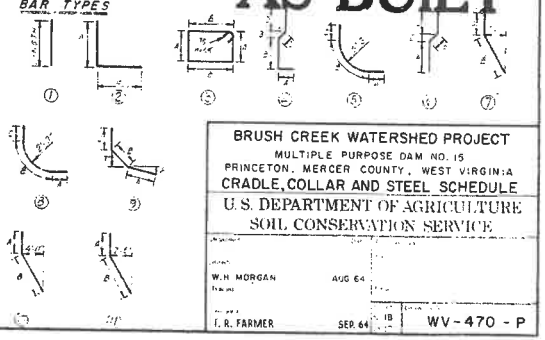
MARK	LOCATION	QUAN	SIZE	LENGTH	TYPE	A	B	C	D	TOTAL FT.
59		5	5	5-1	1	2-7	1-0			5.17
60		28	5	1-6	1					3.50
61		22	5	3-0	1					17.00
62		3	5	1-6	1					24.00
63		5	5	8-0	1					30.00
64		5	5	11-6	1					57.50
65		5	5	6-9	10	1-9	7-0			93.33
66				6-2	1					23.00
67				4-0	1					24.00
68				2-2	12					24.00
69				1-2	1					1.50
70				3-6	1					21.00
71				3-6	1					82.50
72				1-9	1					1.83
73				2-9	1					1.92
74				0-9	1					1.25
75				4-8	1					1.33
76				3-0	1					8.00
77				1-0	1					1.33
78				2-3	1					1.92
79				2-8	1					1.83
80				11-6	1					46.00
81				5-10	2	4-5	1-4			105.33
82				4-11	2	3-6	1-5			9.83
83				2-3		0-10	1-5			4.83
84				2-11	2	1-6	1-5			5.83
85				1-6	1					1.50
86				11-6	1					11.50
87				4-8	1					1.00
88				12-6	1					100.00
89				8-6	1					34.00
90				3-6	1					42.00
91				3-1	1					16.00
92				3-0	1					12.00
93				2-3	1					9.00
94				4-0	1					16.00
95				2-1	11	6	5	6		88.00
96				1-0	1					4.00
97				2-3	1					9.00
98				1-9	1					7.00
99				2-9	1					11.50

STEEL SCHEDULE

MARK	LOCATION	QUAN	SIZE	LENGTH	TYPE	A	B	C	D	TOTAL FT.
			5	7-4	1					37.00
			5	6-8	2	4-7	1-7			85.83
			8	3-0	1					48.00

"AS BUILT"

BAR TYPES



BRUSH CREEK WATERSHED PROJECT

MULTIPLE PURPOSE DAM NO. 15

PRINCETON, MERCER COUNTY, WEST VIRGINIA

CRADLE, COLLAR AND STEEL SCHEDULE

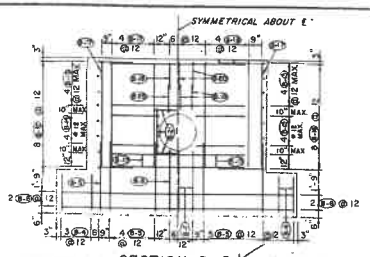
U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

DESIGNED	W.H. MORGAN	AUG 64
DRAWN	I.R. FARMER	SEP. 64
TRACED		
CHECKED		
APPROVED		

WV-470 - P

CONSTR. JOINT DETAILS



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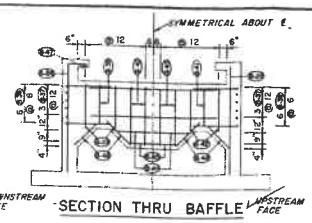

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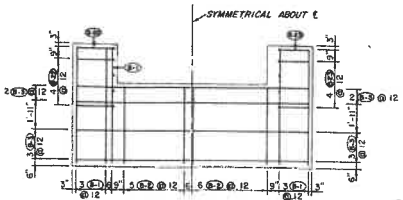

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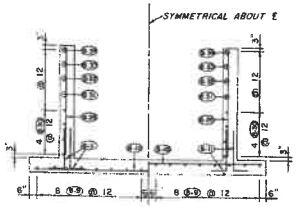

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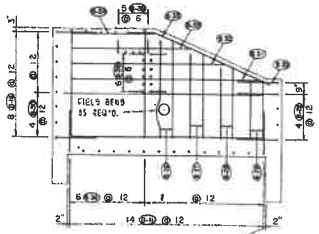

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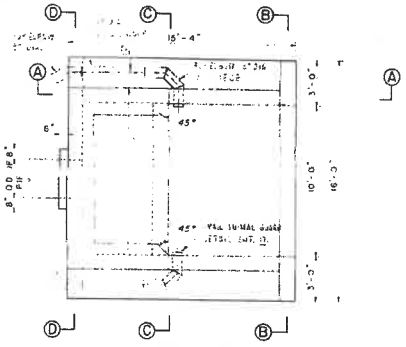

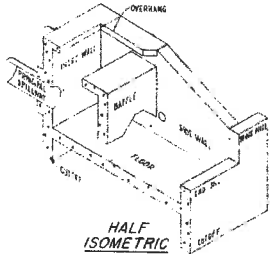

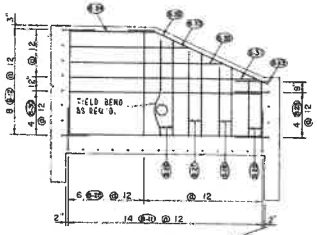

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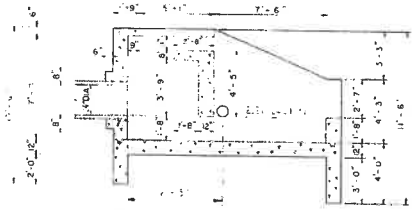
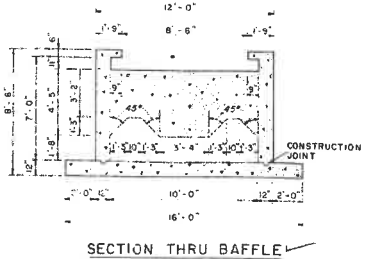


SECTION ON ℄



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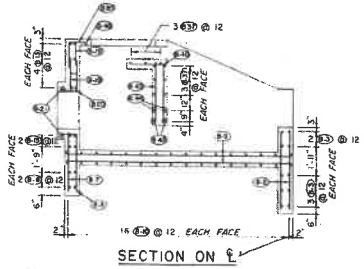


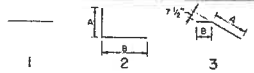
SECTION ON ℄

MAX ALLOWABLE DISCHARGE	INSIDE DIA OF PIPE
100 C.F.S.	2'-0"

GENERAL NOTES SEE SHEET 5

STEEL SCHEDULE

MARK	LOCATION	QUAN	SIZE	LENGTH	TYPE	A	B	TOTAL FT.
B-1	CUTOFF	14	5	7-9	1			108.50
2		21	5	5-3	1			110.25
3		10	5	15-6	1			155.00
4		10	5	2-7	1			25.83
B-5		20	5	4-6	1			90.00
6		2	5	5-0	2	4-0	1-0	10.00
7		3	5	4-0	1			12.00
8		4	5	15-6	1			62.00
9	FLOOR	32	5	15-0	1			480.00
B-10		32	5	15-6	1			496.00
11		56	5	3-9	2	2-9	1-0	210.00
12	INLET WALL	16	5	4-3	2	2-3	2-0	68.00
13		12	5	9-0	1			108.00
14		8	5	4-3	2	3-3	1-0	34.00
B-15		8	5	3-3	1			26.00
16		16	5	5-8	2	3-0	2-9	92.00
17		12	5	7-0	1			84.00
18		8	5	8-3	2	7-0	1-3	66.00
19		8	5	5-1	1			8.75
B-20		5	5	3-0	2	1-9	1-3	15.00
21		4	5	3-0	1			12.00
22	WING WALLS	10	5	5-3	2	2-6	2-9	52.50
23		10	5	4-3	2	2-0	2-3	42.50
24	SIDE WALLS	12	5	8-3	2	7-0	1-3	99.00
B-25		12	5	7-0	1			84.00
26		8	5	6-6	1			52.00
27		8	5	5-9	1			46.00
28		8	5	4-9	1			38.00
29		8	5	3-9	1			30.00
B-30		16	5	13-0	1			208.00
31		4	5	12-6	1			50.00
32		4	5	10-3	1			41.00
33		4	5	8-0	1			32.00
34		4	5	5-9	1			23.00
35		4	5	10-1	3	8-8	1-7	40.33
36	BAFFLE	34	5	4-0	2	3-0	1-0	136.00
37		8	5	8-8	1			76.50
38		2	5	3-9	2	2-6	2-3	9.50
39		4	5	5-1	2	2-10	2-5	20.33
B-40		4	5	6-1	2	3-10	2-3	24.33
41		2	5	2-6	1			5.00
42		4	5	2-9	1			11.00
43		4	5	3-9	1			15.00
44		2	5	5-0	1			10.00
B-45		2	5	3-3	1			6.50
46		8	5	2-3	1			18.00
47	OVERHANG	2	5	4-6	1			9.00
48		1	5	9-0	1			9.00



BAR TYPES

QUANTITIES THIS SHEET ONLY

REINFORCING STEEL
NO. 5 BARS 3461.8 LIN FT 3810.7 LBS

CONCRETE
CLASS "B" TYPE I 25.9 / 59.58 CU YDS

"AS BUILT"

SCALE 0 1 2 3 4 5 FEET

BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO. 15
PRINCETON, MERCER COUNTY, WEST VIRGIN A
IMPACT BASIN DETAILS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Engr. & Planner
W. NIKOLICH
W. H. MORGAN

J. B. FARMER SEPT 64 15 19 WV-470-P

APPENDIX F

HISTORICAL SUBSURFACE DRILLING AND SAMPLING DATA

2013–2014 Boring Logs by NRCS
2016 Boring Logs and Piezometer Construction Logs by Gannett Fleming

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Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-65

Sheet 1 of 3

Surface Elevation: 2,508.0	Quadrangle: Bluefield , W. VA. - VA.	Map Projection: UTM Zone 17N	Datum: NAD 83
Ref. Alignment:	Sta.:	Offset:	Coordinates(UTM): North- East-
Contractor:	Driller: R. Luzier	Exploration Equipment: Hetager Rig 225	Exploration Method: Drill Hole
Azimuth: ---	Angle from Horizontal: 90	Hammer Type: Automatic	Hammer Wgt: 300 Hammer Fall: 18
Logged By: J. McClure	Start Date: 1/21/2014	Time: 8:00:00 AM	Finish Date: 1/21/2014 Time:
Core Boxes:	Samples:	Overburden:	Rock: Total Depth: 34

GROUNDWATER DATA

Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol:
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol:
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol:
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol:

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
		0	2	S-1	4-5-6-5		1.7	85		CL	0.4' of topsoil. Gravelly orangish-brown CL.	
	Advanced with augers.											2505
5		5	7	S-2	4-5-8-8		1.8	90		GC	Gray to brown GC. Angular rock fragments.	
	Advanced with augers.											2500
10		10	12	S-3	5-8-10-1-		2	100		GC	Gray to brown GC.	

USDA Natural Resources Conservation Service

Purpose: Slope stability, zone compatibility, piesometric surface determination

Hole Termination (ft.): 34

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks:

*Soil Classifications in accordance with ASTM D2488

Report: WEST VIRGINIA DRILL 2014 | Project: BRUSH_CREEK_15.GPJ | Data Template: USDA-NM V82-2008.GDT | Last Mod: 19 Feb 2014 10:49 am | Printed: 25 Feb 2014 01:39 pm

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-65 (Continued)

Sheet 2 of 3

Surface Elevation: 2,508.0 Quadrangle: Bluefield , W. VA. - VA. Map Projection: UTM Zone 17N Datum: NAD 83

Ref. Alignment: Sta.: Offset: Coordinates(UTM): North- East-

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
	Advanced with augers.											2495
15		15	17	S-4	5-6-9-12		1.5	75		GC	Orange-brown CL, bottom 0.1' is shale fragement 2 " in diameter.	
	Advanced with augers.											2490
20		20	22	S-5	5-7-12-17		2	100		CL	Brown CL with gravels. Weathered sandstone rock fragments give sample a sandy texture.	
	Advanced with augers.											2485
25		25	27	S-6	7-15-12-19		1.9	95		GC	Brown GC. Gravels are weathered sandstone fragments	
	Advanced with augers.											2480

USDA Natural Resources Conservation Service

Purpose: Slope stability, zone compatibility, piesometric surface determination

Hole Termination (ft.): 34

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks:

*Soil Classifications in accordance with ASTM D2488

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-65 (Continued)

Sheet 2 of 3

Surface Elevation: 2,508.0 Quadrangle: Bluefield , W. VA. - VA. Map Projection: UTM Zone 17N Datum: NAD 83

Ref. Alignment: Sta.: Offset: Coordinates(UTM): North- East-

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
	Advanced with augers.											2495
15		15	17	S-4	5-6-9-12		1.5	75		GC	Orange-brown CL, bottom 0.1' is shale fragement 2 " in diameter.	
	Advanced with augers.											2490
20		20	22	S-5	5-7-12-17		2	100		CL	Brown CL with gravels. Weathered sandstone rock fragments give sample a sandy texture.	
	Advanced with augers.											2485
25		25	27	S-6	7-15-12-19		1.9	95		GC	Brown GC. Gravels are weathered sandstone fragments	
	Advanced with augers.											2480

USDA Natural Resources Conservation Service

Purpose: Slope stability, zone compatibility, piesometric surface determination

Hole Termination (ft.): 34

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks:

*Soil Classifications in accordance with ASTM D2488

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-65 (Continued)

Sheet 3 of 3

Surface Elevation: 2,508.0 Quadrangle: Bluefield , W. VA. - VA. Map Projection: UTM Zone 17N Datum: NAD 83

Ref. Alignment: Sta.: Offset: Coordinates(UTM): North- East-

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
		30	32	S-7	5-7-10-11		1.7	85		GC	Brown GC.	
	Advanced with augers. Unsampled.											2475
35											completed at 34.0 ft on	
												2470
40												
												2465
45												

USDA Natural Resources Conservation Service

Purpose: Slope stability, zone compatibility, piesometric surface determination

Hole Termination (ft.): 34

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks:

*Soil Classifications in accordance with ASTM D2488

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-221

Sheet 1 of 4

Surface Elevation: 2,489.4	Quadrangle: Bluefield , W. VA. - VA.	Map Projection: UTM Zone 17N	Datum: NAD 83
Ref. Alignment:	Sta.:	Offset:	Coordinates(UTM): North- East-
Contractor:	Driller: R. Luzier	Exploration Equipment: Hetager Rig 225	Exploration Method: Drill Hole
Azimuth: —	Angle from Horizontal: 90	Hammer Type: Automatic	Hammer Wgt: 300 Hammer Fall: 18
Logged By: J. McClure	Start Date: 1/16/2013	Time: 2:47:00 PM	Finish Date: 12/16/2013 Time: 10:15:00 AM
Core Boxes: 4	Samples: 14	Overburden:	Rock: Total Depth: 61

GROUNDWATER DATA

Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▽
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▼
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▼
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▼

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
		0	2	S-1	2-3-5-13		2	100		CL-ML	Brown CL-ML, very little gravel, 1/2" sub-angular.	
		2	4	S-2	23-35-39-63		1.9	95			Weathered very friable gray shale.	
5	Advanced with augers/no sample.	4	5	S-3								2485
		5	10	R-1		36	4.2	84			Dark gray shale. Near vertical fracture @ 17.7'	2480
10		10	14	R-2		79	4	100				

USDA Natural Resources Conservation Service

Purpose: SITES parameters.

Hole Termination (ft.): 61

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks: Water level checked 12:55 PM, 12/18/2013. 9.9'

*Soil Classifications in accordance with ASTM D2488

Report: WEST VIRGINIA DRILL 2014 | Project: BRUSH_CREEK_15.GPJ | Data Template: USDA-NM V82-2008.GDT | Last Mod: 19 Feb 2014 10:49 am | Printed: 28 Jul 2014 02:03 pm

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-221 (Continued)

Sheet 2 of 4

Surface Elevation: 2,489.4 Quadrangle: Bluefield , W. VA. - VA. Map Projection: UTM Zone 17N Datum: NAD 83

Ref. Alignment: Sta.: Offset: Coordinates(UTM): North- East-

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
		10	14	R-2		79	4	100				
15		14	19	R-3		90	5	100				2475
20		19	24	R-4		55	5	100			Dark gray shale. Near vertical fracture @ 17.7'. *(continued)*	2470
25		24	29	R-5		63	5	100				2465
		29	34	R-6		11	4.75	95				2460

USDA Natural Resources Conservation Service

Purpose: SITES parameters.

Hole Termination (ft.): 61

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks: Water level checked 12:55 PM, 12/18/2013. 9.9'

*Soil Classifications in accordance with ASTM D2488

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-221 (Continued)

Sheet 3 of 4

Surface Elevation: 2,489.4 | Quadrangle: Bluefield , W. VA. - VA. | Map Projection: UTM Zone 17N | Datum: NAD 83

Ref. Alignment: | Sta.: | Offset: | Coordinates(UTM): North- East-

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
		29	34	R-6		11	4.75	95				
35		34	39	R-7		11	4.75	95			Dark gray shale. Near vertical fracture @ 17.7'. *(continued)*	2455
40		39	44	R-8		51	3.8	76				2450
45		44	49	R-9		100	5	100			Dark gray shale, but increasing calcium carbonate cement.	2445
											Grades into lt. gray shaley limestone after 45.6.	

USDA Natural Resources Conservation Service

Purpose: SITES parameters.

Hole Termination (ft.): 61

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks: Water level checked 12:55 PM, 12/18/2013. 9.9'

*Soil Classifications in accordance with ASTM D2488

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-221 (Continued)

Sheet 4 of 4

Surface Elevation: 2,489.4 Quadrangle: Bluefield , W. VA. - VA. Map Projection: UTM Zone 17N Datum: NAD 83

Ref. Alignment: Sta.: Offset: Coordinates(UTM): North- East-

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
		44	49	R-9		100	5	100				2440
50		49	54	R-10		95	4.75	95				
55		54	59	R-11		77	3.85	77			Grades into lt. gray shaley limestone after 45.6. *(continued)*	2435
60		59	61	R-12		100	2	100				2430
											completed at 61.0 ft on	2425

USDA Natural Resources Conservation Service

Purpose: SITES parameters.

Hole Termination (ft.): 61

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks: Water level checked 12:55 PM, 12/18/2013. 9.9'

*Soil Classifications in accordance with ASTM D2488

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-222

Sheet 1 of 2

Surface Elevation: 2,492.6	Quadrangle: Bluefield , W. VA. - VA.		Map Projection: UTM Zone 17N	Datum: NAD 83
Ref. Alignment:	Sta.:	Offset:	Coordinates(UTM): North- East-	
Contractor:	Driller: R. Luzier		Exploration Equipment: Hetager Rig 225	Exploration Method: Drill Hole
Azimuth: ---	Angle from Horizontal: 90	Hammer Type: Automatic	Hammer Wgt: 300	Hammer Fall: 18
Logged By: J.McClure	Start Date: 12/17/2013	Time: 11:00:00 AM	Finish Date: 12/17/2013	Time: 3:06:00 PM
Core Boxes: 1	Samples: 7	Overburden:	Rock:	Total Depth: 24

GROUNDWATER DATA

Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▽
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▼
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▼
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▼

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
		0	2	S-1	1-3-5-11		1.8	90		CL-ML	Brown CL-ML, up to 1.5", bottom of spoon is a large shale gravel.	
		2	4	S-2	6-8-9-11		1.8	90		CL	Orangish brown CL, very little gravel.	2490
5	Advanced with augers/no sample.	4	5									
		5	7	S-3	3-5-6-10		2	100			Orange-brown weathered rock, saprolite. Bottom of spoon appeared to be weathered rock.	
		7	9	S-4	3-4-5-80		2	100			Weathered rock	2485
10	Advanced with augers/no sample.	9	10									
		10	14	R-1		46	4	100			Dark gray shale. Interval from 13.0 to 13.6' had rough, iron-stained gracture faces 30 degrees from vertical.	

USDA Natural Resources Conservation Service

Purpose: SITES parameters

Hole Termination (ft.): 24

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks: Water level checked at 12:57 PM, 12/18/2013. 6.6'

*Soil Classifications in accordance with ASTM D2488

Report: WEST VIRGINIA DRILL 2014 | Project: BRUSH_CREEK_15.GPJ | Data Template: USDA-NM V82-2008.GDT | Last Mod: 19 Feb 2014 10:49 am | Printed: 28 Jul 2014 03:17 pm

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-222 (Continued)

Sheet 2 of 2

Surface Elevation: 2,492.6 Quadrangle: Bluefield , W. VA. - VA. Map Projection: UTM Zone 17N Datum: NAD 83

Ref. Alignment: Sta.: Offset: Coordinates(UTM): North- East-

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
		10	14	R-1		46	4	100				2480
15		14	19	R-2		82	4.8	96			Dark gray shale. Interval from 13.0 to 13.6' had rough, iron-stained gracture faces 30 degrees from vertical. *(continued)*	2475
20		19	24	R-3		89	4.7	94				2470
25											completed at 24.0 ft on	2465

USDA Natural Resources Conservation Service

Purpose: SITES parameters

Hole Termination (ft.): 24

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks: Water level checked at 12:57 PM, 12/18/2013. 6.6'

*Soil Classifications in accordance with ASTM D2488

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-223

Sheet 1 of 3

Surface Elevation: 2,495.1	Quadrangle: Bluefield , W. VA. - VA.	Map Projection: UTM Zone 17N	Datum: NAD 83
Ref. Alignment:	Sta.:	Offset:	Coordinates(UTM): North- East-
Contractor:	Driller: R. Luzier	Exploration Equipment: Hetager Rig	Exploration Method: Drill Hole
Azimuth: —	Angle from Horizontal: 90	Hammer Type: Automatic	Hammer Wgt: 300 Hammer Fall: 18
Logged By: J. McClure	Start Date: 12/18/2013 Time: 8:45:00 AM	Finish Date: 12/18/2013 Time: 1:48:00 PM	
Core Boxes: 2	Samples: 11 Overburden:	Rock:	Total Depth: 39

GROUNDWATER DATA

Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▽
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▼
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▽
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▼

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
		0	2	S-1	1-5-6-10		1.9	95		CL-ML	Orange brown gravelly CL-ML. At 4.0' (bottom of that spoon) appears to be shale cobble vertical bedding.	2495
		2	4	S-2	8-8-9-21		2	100				
5		4	6		11-18-19-21		2	100			Weathered shale. Still appears to be vertically bedded.	2490
		6	8		10-18-21-22		2	100			Top 0.55 feet is a gravelly CL-ML. Rest of spoon was vertically bedded weathered shale.	
		8	10		11-12-22-25		1.95	98			Weathered shale	
10		10	14	R-1		0	2.8	70			Weathered shale with some layers of gravelly CL=-ML.	2485

USDA Natural Resources Conservation Service

Purpose: Sites parameters

Hole Termination (ft.): 39

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks:

*Soil Classifications in accordance with ASTM D2488

Report: WEST VIRGINIA DRILL 2014 | Project: BRUSH_CREEK_15.GPJ | Data Template: USDA-NM V82-2008.GDT | Last Mod: 19 Feb 2014 10:49 am | Printed: 17 Sep 2014 01:40 pm

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-223 (Continued)

Sheet 2 of 3

Surface Elevation: 2,495.1 Quadrangle: Bluefield , W. VA. - VA. Map Projection: UTM Zone 17N Datum: NAD 83

Ref. Alignment: Sta.: Offset: Coordinates(UTM): North- East-

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
		10	14	R-1		0	2.8	70			Weathered shale with some layers of gravelly CL=-ML. *(continued)*	
15		14	19	R-2		19	5	100			Dark gray shale	2480
20		19	24	R-3		20	2.6	52			Weathered shale	2475
25		24	29	R-4		93	5	100			Dark gray shale, large fracture @ 33' - 33.5 15 degrees from vertical, below 34 feet there was one rough fracture 0.5' long.	2470
		29	34	R-5		84	4.5	90				

USDA Natural Resources Conservation Service

Purpose: Sites parameters

Hole Termination (ft.): 39

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks:

*Soil Classifications in accordance with ASTM D2488

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-223 (Continued)

Sheet 3 of 3

Surface Elevation: 2,495.1 Quadrangle: Bluefield , W. VA. - VA. Map Projection: UTM Zone 17N Datum: NAD 83

Ref. Alignment: Sta.: Offset: Coordinates(UTM): North- East-

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
		29	34	R-5		84	4.5	90				2465
35		34	39	R-6		76	5	100			Dark gray shale, large fracture @ 33' - 33.5 15 degrees from vertical, below 34 feet there was one rough fracture 0.5' long. *(continued)*	2460
40											completed at 39.0 ft on	2455
45												2450

USDA Natural Resources Conservation Service

Purpose: Sites parameters

Hole Termination (ft.): 39

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks:

*Soil Classifications in accordance with ASTM D2488

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-705

Sheet 1 of 4

Surface Elevation: 2,490.2 | Quadrangle: Bluefield , W. VA. - VA. | Map Projection: UTM Zone 17N | Datum: NAD 83

Ref. Alignment: | Sta.: | Offset: | Coordinates(UTM): North- East-

Contractor: | Driller: R. Luzier | Exploration Equipment: Hetager Rig 225 | Exploration Method: Drill Hole

Azimuth: --- | Angle from Horizontal: 90 | Hammer Type: Automatic | Hammer Wgt: 300 | Hammer Fall: 18

Logged By: J. McClure | Start Date: 1/14/2014 | Time: 10:57:00 AM | Finish Date: 1/15/2014 | Time:

Core Boxes: | Samples: | Overburden: | Rock: | Total Depth: 52

GROUNDWATER DATA

Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▽
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▼
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▼
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▼

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
		0	2	S-1	1-3-3-6		1.65	82		GC	Orange-brown GC, shale rock fragments, angular, up to 0.21' in diameter (diameter of spoon).	2490
	Advanced with augers.											
5		5	7	S-2	2-5-7-7		1.6	80		GC	Brown GC with shale rock fragments.	2485
	Advanced with augers.											
10		10	12	S-3	4-7-6-11		1.7	85		GC	Brown GC with shale rock fragments.	2480
		12	14	S-4	7-9-12-13		1.25	62		GC	Brown GC with shale rock fragments	

USDA Natural Resources Conservation Service

Purpose: Slope stability, zone compatibility, piesometric surface determination

Hole Termination (ft.): 52

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks:

*Soil Classifications in accordance with ASTM D2488

Report: WEST VIRGINIA DRILL 2014 | Project: BRUSH_CREEK_15.GPJ | Data Template: USDA-NM V82-2008.GDT | Last Mod: 19 Feb 2014 10:49 am | Printed: 21 Feb 2014 03:25 pm

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-705 (Continued)

Sheet 2 of 4

Surface Elevation: 2,490.2 Quadrangle: Bluefield , W. VA. - VA. Map Projection: UTM Zone 17N Datum: NAD 83

Ref. Alignment: Sta.: Offset: Coordinates(UTM): North- East-

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
	Spoon came out very wet.	12	14	S-4	7-9-12-13		1.25	62		GC	Brown GC with shale rock fragments *(continued)*	
15	Spoon was not wet.	14	16	S-5	3-6-11-13		1.9	95		CL	Gravelly CL or GC, gravels are smaller than pervious spt sample.	2475
		16	18	S-6	0-13-11-13		1.9	95		GC	Gray to orange-brown GC. Some gravels 2" in diameter. All gravels are angular.	
		18	20	S-7	4-4-7-7		1.7	85		GC	Gray brown GC, angular rock fragments, some of which are spoon diameter.	
20		20	22	S-8	3-9-12-18		1.85	92		GC	Olive brown GC, bottom of spoon at 0.15' of rock spoon diameter.	2470
	Advanced with augers.											
25		25	27	S-9	8-11-10-14		1.85	92		CL-ML	Orange brown sandy CL with some rock fragments, but less than earlier samples.	2465
	Advanced with augers.											

USDA Natural Resources Conservation Service

Purpose: Slope stability, zone compatibility, piesometric surface determination

Hole Termination (ft.): 52

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks:

*Soil Classifications in accordance with ASTM D2488

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-705 (Continued)

Sheet 3 of 4

Surface Elevation: 2,490.2 Quadrangle: Bluefield , W. VA. - VA. Map Projection: UTM Zone 17N Datum: NAD 83

Ref. Alignment: Sta.: Offset: Coordinates(UTM): North- East-

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
		30	32	S-10	6-8-9-11		1.85	92		GC	Brown GC or gravelly CL.	2460
	Advanced with augers. Shelby tube refusal at 34.7	33	34.7	S-11								
35	Advanced with augers.	35	37	S-12	7-9-13-15					GC	Brown GC, angular rock fragments.	2455
	Advanced with augers.											
40		40	42	S-13	9-13-13-14		1.7	85		GC	Brown GC, angular rock fragments.	2450
	Advanced with augers.											
45		45	47	S-14	7-11-12-15		1.95	98		GC	Brown GC with angular rock fragments.	2445

USDA Natural Resources Conservation Service

Purpose: Slope stability, zone compatibility, piesometric surface determination

Hole Termination (ft.): 52

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks:

*Soil Classifications in accordance with ASTM D2488

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-705 (Continued)

Sheet 4 of 4

Surface Elevation: 2,490.2 Quadrangle: Bluefield , W. VA. - VA. Map Projection: UTM Zone 17N Datum: NAD 83

Ref. Alignment: Sta.: Offset: Coordinates(UTM): North- East-

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
50	Advanced with augers.											
		50	52	S-15	8-13-30-24		1.8	90		GC	Brown GC with angular rock fragments.	2440
											completed at 52.0 ft on	
55												2435
60												2430

USDA Natural Resources Conservation Service

Purpose: Slope stability, zone compatibility, piesometric surface determination

Hole Termination (ft.): 52

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks:

*Soil Classifications in accordance with ASTM D2488

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-706

Sheet 1 of 3

Surface Elevation: 2,470.8	Quadrangle: Bluefield , W. VA. - VA.	Map Projection: UTM Zone 17N	Datum: NAD 83
Ref. Alignment:	Sta.:	Offset:	Coordinates(UTM): North- East-
Contractor:	Driller: R. Luzier	Exploration Equipment: Hetager Rig 225	Exploration Method: Drill Hole
Azimuth: ---	Angle from Horizontal: 90	Hammer Type: Automatic	Hammer Wgt: 300 Hammer Fall: 18
Logged By: J. McClure	Start Date: 1/13/2014	Time: 9:35:00 AM	Finish Date: 1/13/2014 Time: 3:25:00 AM
Core Boxes:	Samples:	Overburden:	Rock: Total Depth: 40.4

GROUNDWATER DATA

Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▽
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▼
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▼
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▼

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
		0	2	S-1	1-4-5-6		1.95	98		GC	Orange-brown GC, angular rock fragments. Some up to 2" shale fragments.	2470
	Advanced with augers.											
5		5	7	S-2	2-4-6-7		1.75	88		GC	Orange brown to brown GC, angular rock fragments composed of shale.	2465
	Advanced with augers.											
10		10	12	S-3	3-7-8-10		1.65	82		GC	Orange-brown GC, angular shale rock fragments, up to the spoon diameter - 0.21'.	2460

USDA Natural Resources Conservation Service

Purpose: Slope stability, zone compatibility, piezometric surface determination

Hole Termination (ft.): 40.4

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks:

*Soil Classifications in accordance with ASTM D2488

Report: WEST VIRGINIA DRILL 2014 | Project: BRUSH_CREEK_15.GPJ | Data Template: USDA-NM V82-2008.GDT | Last Mod: 19 Feb 2014 10:49 am | Printed: 20 Mar 2014 10:50 am

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-706 (Continued)

Sheet 2 of 3

Surface Elevation: 2,470.8 Quadrangle: Bluefield , W. VA. - VA. Map Projection: UTM Zone 17N Datum: NAD 83

Ref. Alignment: Sta.: Offset: Coordinates(UTM): North- East-

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
	Advanced with augers.											
15		15	17	S-4	5-5-6-9		1.7	86		GC	Gravelly, sandy orange-brown GC, angular shale fragments	2455
	Advanced with augers.											
20		20	22	S-5	5-9-9-9		1.6	80		GC	Orange-brown sandy GC, angular shale rock fragments.	2450
	Advanced with augers.											
25	Damp at 26.3'.	25	27	S-6	5-7-8-9		1.95	98		GC	Orange-brown GC, mainly shale rock fragments. Some rock fragments are weathered sandstone which has given matrix a sandy texture.	2445
	Advanced with augers.											

USDA Natural Resources Conservation Service

Purpose: Slope stability, zone compatibility, piezometric surface determination

Hole Termination (ft.): 40.4

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks:

*Soil Classifications in accordance with ASTM D2488

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-706 (Continued)

Sheet 3 of 3

Surface Elevation: 2,470.8 Quadrangle: Bluefield , W. VA. - VA. Map Projection: UTM Zone 17N Datum: NAD 83

Ref. Alignment: Sta.: Offset: Coordinates(UTM): North- East-

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
		30	32	S-7	5-8-10-15		1.75	88		GC	Orange-brown GC, gravel is angular and 1/4" to 1/2".	2440
		32	34	S-8	16-18-19-22		2	100		GC	Top 1' Orange brown GC, then changes to reddish brown GC. Angular rock fragments.	
35		34	36	S-9	5-6-8-9		1.75	88		GC	Top 1' orange brown GC (S-9a), remainder is ML, reddish brown (S-9b).	2435
		36	38	S-10	5-7-9-11		2	100		CL-ML	0.6' is reddish brown ML, then changes to olive brown ML.	
		38	38.9	S-11								
40		38.9	40.4	S-12	98 in 0.5'							
											completed at 40.4 ft on	2430
45												2425

USDA Natural Resources Conservation Service

Purpose: Slope stability, zone compatibility, piezometric surface determination

Hole Termination (ft.): 40.4

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks:

*Soil Classifications in accordance with ASTM D2488

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-707

Sheet 1 of 3

Surface Elevation: 2,494.2	Quadrangle: Bluefield , W. VA. - VA.	Map Projection: UTM Zone 17N	Datum: NAD 83
Ref. Alignment:	Sta.:	Offset:	Coordinates(UTM): North- East-
Contractor:	Driller: R. Luzier	Exploration Equipment: Hetager Rig 225	Exploration Method: Drill Hole
Azimuth: ---	Angle from Horizontal: 90	Hammer Type: Automatic	Hammer Wgt: 300 Hammer Fall: 18
Logged By: J. McClure	Start Date: 1/15/2014	Time: 2:30:00 PM	Finish Date: 1/16/2014 Time:
Core Boxes: 0	Samples: 14	Overburden:	Rock: Total Depth: 37

GROUNDWATER DATA

Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▽
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▼
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▼
Date:	Time:	Water Depth (Ft):	Casing Depth (Ft):	Hole Depth (Ft):	Symbol: ▼

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
		0	2	S-1	1-4-4-4		1.5	75		CL	Yellowish-brown CL with gravel (or GC), angular 1" to 2" gravels.	
	Advanced with augers.											2490
5		5	7	S-2	4-7-9-12		1.7	85		GC	Yellow-orange-brown GC, angular rock fragments - shale, up to 0.21' in diameter.	
	Advanced with augers.											2485
10		10	12	S-3	4-4-7-7		1.6	80		GC	Orange-brown GC, angular rock fragments, shale, up to 0.21' in diamteter,	

USDA Natural Resources Conservation Service

Purpose: Slope stability, zone compatibility, piesometric surface determination

Hole Termination (ft.): 37

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks: Water level checked afternoon of 1/20, no water.

*Soil Classifications in accordance with ASTM D2488

Report: WEST VIRGINIA DRILL 2014 | Project: BRUSH_CREEK_15.GPJ | Data Template: USDA-NM V82-2008.GDT | Last Mod: 19 Feb 2014 10:49 am | Printed: 26 Feb 2014 01:21 pm

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-707 (Continued)

Sheet 2 of 3

Surface Elevation: 2,494.2 Quadrangle: Bluefield , W. VA. - VA. Map Projection: UTM Zone 17N Datum: NAD 83

Ref. Alignment: Sta.: Offset: Coordinates(UTM): North- East-

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
	Advanced with augers.											2480
15		15	17	S-4	6-8-8-12		1.45	72		GC	Orange - brown GC.	
		17	19	S-5	13-17-19-19		1.8	90		GC	Orange - brown GC.	2475
20		19	21	S-6	8-12-13-16		0.8	40		GC	Orange - brown GC.	
		21	23	S-7	13-14-18-20		1.4	70		CL	Orange - brown CL, with gravel, appears to have less gravel in bottom 0.5'.	
		23	25	S-8	5-8-12-14		1.85	92		CL	Orange - brown CL, one (1) gravel on top of sample.	2470
25	Shelby tube sample.	25	27	S-9			2	100				
		27	29	S-10	6-10-15-14		2	100		CL	Top 0.5' is reddish brown CL. Bottom 1.5' is an olive brown CL.	
		29	31	S-11	18-18-21-23		2	100		CL	Olive to reddish brown CL.	2465

USDA Natural Resources Conservation Service

Purpose: Slope stability, zone compatibility, piesometric surface determination

Hole Termination (ft.): 37

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks: Water level checked afternoon of 1/20, no water.

*Soil Classifications in accordance with ASTM D2488

Project: Brush Creek 15

Location: Mercer County, WV

HOLE No. BH-707 (Continued)

Sheet 3 of 3

Surface Elevation: 2,494.2 Quadrangle: Bluefield , W. VA. - VA. Map Projection: UTM Zone 17N Datum: NAD 83

Ref. Alignment: Sta.: Offset: Coordinates(UTM): North- East-

Depth (ft)	Remarks	Depth (Ft.) From	Depth (Ft.) To	Sample/Run No.	SPT Blows	RQD (%)	Rec. (ft.)	Rec. (%)	Graphic Log	USCS	Material Description	Elevation (ft)
		29	31	S-11	8-18-21-23		2	100		CL	Olive to reddish brown CL. *(continued)*	
		31	33	S-12	4-8-12-16		2	100		CL	Olive brown to reddish brown CL.	
		33	35	S-13	5-18-19-22		1.9	95		CL	Olive brown to reddish brown CL.	2460
35	Shelby tube sample.	35	37	S-14			2	100				
											completed at 37.0 ft on	
												2455
40												
												2450
45												

USDA Natural Resources Conservation Service

Purpose: Slope stability, zone compatibility, piesometric surface determination

Hole Termination (ft.): 37

Hole Abandonment: Grouted to surface with neat cement with 6% bentonite mixed in.

Drilling Method:

Additional Remarks: Water level checked afternoon of 1/20, no water.

*Soil Classifications in accordance with ASTM D2488

Date Started: 3/10/16	**DRILLING LOG**		Hole Number: GF-1
Date Finished: 3/15/16	Gannett Fleming		Sheet: 1 of 4
Soil Drilling: 74.5 ft			Line & Station: 5+67.8
Rock Sampling: 20.0 ft	Project: Brush Creek Site 15 Dam		Offset: 11 ft L
Total Depth of Hole: 94.5 ft	Drilling Agency: L.G. Hetager Drilling, Inc.		N Coordinate: 118217 ft
No. of Undist. Samples: 2	Driller: Floyd Himes		E Coordinate: 1914620 ft
Total Number of Core Boxes: 2	Bit Size and Type: NX	CME Sampler N/A	Elev. Top of Hole: +2507.4 ft
GROUNDWATER OBSERVATIONS At 0.0 ft After 0 Hrs Elev. 2507.4 ft After 0 Hrs	Casing Size: N/A	Spoon Size: 3.0 " O.D.	Direction of Hole Vertical ☒ Inclined ☐ Degrees from Vertical —
	Hollow Stem: 4.25 " I.D.	Hammer wt.: 300 lb	
	Drilling Fluid: Water NX coring	Hammer Drop: 18.0 "	
	Drill Rig: Hetager 223 Track Rig		Inspector: L. Daher

Remarks	Depth (Ft.)	Sample No.	Blows or RQD (%)	Rec. (ft.)	Rec. (%)	USCS	Description Of Materials
Started on 3-10-2016 at 1:15 PM	0.0 - 2.0	S-1	2-4-4-7	1.7	85		0.0'-2.0': Sandy SILT (ml) 10% gravel, 40% sand, 50% fines. subangular, flat and elongated, hard, Gravel is fine, subangular; Fines: low plasticity, medium dry strength. slow dilatancy, Dark yellowish brown, (10yr 4/6), moist, homogeneous, roots, top soil. 2505.4
GF-1: located on upstream edge of crest. Ground cover is grass.	2.0 - 4.0	S-2	8-9-9-9	1.7	85		2.0'-6.0': Clayey SAND (sc) 10% gravel, 50% sand, 40% fines. subangular, flat and elongated, Sand is medium grained, Fines: low to medium plasticity, high dry strength. slow dilatancy, Yellowish brown, (10yr 6/8), moist, homogeneous, gravel fracture with hammer hit. 2501.4
	4.0 - 6.0	S-3	5-9-11-12	2.0	100		
	6.0 - 8.0	S-4	12-12-13-13	1.6	80		6.0'-31.0': Sandy SILT (ML) 3.7% gravel, 28.2% sand, 68.1% fines. subangular, flat and elongated, Gravel is fine, Sand is fine to coarse grained, Fines: medium plasticity, medium dry strength. slow dilatancy, Yellowish brown, (10 yr 5/6), moist, homogeneous, some gravel will break with hammer hit. S-5: some black and gray soil.
P.P. = 3.5 tsf	8.0 - 10.0	S-5	4-5-9-8	1.8	90		
P.P. = 3.0 tsf	10.0 - 12.0	S-6	5-7-7-10	2.0	100		
P.P. = 2.5 tsf	12.0 - 14.0	S-7	5-7-13-13	1.6	80		12.0'-16.0': Some coarse gravel, subangular to angular, flat and elongated.
P.P. = 4.0 tsf	14.0 - 16.0	S-8	10-12-13-13	2.0	100		
P.P. = 3.5 tsf	16.0 - 18.0	S-9	10-12-10-11	2.0	100		16..0'-18.0', S-9: Clayey gravel, black soil organic, increase in sand content.
	18.0 - 20.0	S-10	5-7-10-13	2.0	100		Bottom of sample 10: some gray soil (mottling).
P.P. = 3.5 tsf	20.0 - 22.0	S-11	8-10-10-10	2.0	100		
	22.0 - 24.0	S-12	9-12-13-13	2.0	100		

Purpose: Evaluate Embankment; collect soil and rock samples for laboratory analysis; install nested piezometers.
Hole Termination: 20 feet of rock
Hole Abandonment: Two nested piezometer installed after drilling to termination depth.
Drilling Method: NX
Additional Remarks: Boring located on the crest of the dam at the upstream edge. Drilled on stake

Agency: L.G. Hetager Drilling, Inc.	DRILLING LOG	Hole Number: GF-1
Driller: Floyd Himes	Gannett Fleming	Sheet: 2 of 4
Inspector: L. Daher		Elev. Top of Hole: 2507.4

Brush Creek Site 15 Dam

Remarks	Depth (Ft.)	Sample No.	Blows or RQD (%)	Rec. (ft.)	Rec. (%)	USCS	Description Of Materials
	24.0 - 26.0	S-13	6-12-15-18	2.0	100		
P.P. = 3.5 tsf	26.0 - 28.0	S-14	14-22-24-24	2.0	100		26.0'-31.0': Decrease in gravel content, sandy clay, 10yr 6/6 reddish yellow, fine to medium sand.
End of Day at 4:30 PM 3-10-16. Stopped at 28.0'. P.P. = 2.5 tsf	28.0 - 30.0	S-15	7-8-9-12	2.0	100		
Resumed on 3-11-16 at 7:30 AM. W.T. = Dry.	30.0 - 32.0	ST-1	-	1.4	70		2476.4
ST-1 pushed at 400 psi	32.0 - 34.0	S-16	11-11-12-9	2.0	100		31.0'-39.0': Silty Clayey SAND With Gravel (SC-SM) 31.6% gravel, 39.1% sand, 29.3% fines. angular to subangular, Gravel is fine to coarse, Sand is fine to coarse grained, Fines: low plasticity, Yellowish brown, (10yr 5/6), moist, homogeneous, Gravel fractures under hammer hit.
	34.0 - 36.0	S-17	9-12-15-14	2.0	100		
	36.0 - 38.0	S-18	9-10-8-7	1.4	70		
P.P. = 3.0 tsf	38.0 - 40.0	S-19	4-9-13-22	2.0	100		2468.4
End of Day at 11:30 AM on 3-11-16.	40.0 - 42.0	ST-2	-	1.7	85		39.0'-48.0': Sandy LEAN CLAY (CL) 12.4% gravel, 20.6% sand, 67% fines. Gravel is fine, Sand is fine to coarse grained, subangular; Fines: low to medium plasticity, Light yellowish brown, (10yr 6/4), moist, homogeneous
ST-2 pushed at 12,000 psi	42.0 - 44.0	S-20	16-19-17-21	2.0	100		
P.P. = 3.5->4.5 tsf Resumed on 3-14-16 at 1:00PM. WT: 37.3'	44.0 - 46.0	S-21	9-11-16-21	1.8	90		
P.P. = 3.5-4 tsf S-22 and S-24: Spoons wet from outside.	46.0 - 48.0	S-22	16-26-27-38	1.1	55		2459.4
S-22: more clayey soil. P.P. = 1.5-3.0 tsf	48.0 - 50.0	S-23	11-15-17-21	1.6	80		48.0'-62.0': Silty Clayey SAND (SC-SM) 8.6% gravel, 57% sand, 34.4% fines. subangular, Sand is fine to coarse grained, Fines: low plasticity, Strong brown, (7.5yr 5/6), moist, homogeneous, gravel will fracture with hammer hit.
P.P. = 4-4.5 tsf	50.0 - 52.0	S-24	7-9-12-13	1.6	80		
P.P. = >4.5 tsf	52.0 - 54.0	S-25	19-19-21-13	1.7	85		
P.P. = 1.5-3.5 tsf	54.0 - 56.0	S-26	9-13-15-16	2.0	100		50.0'-52.0': Increase in fines possible clay with sand (cl), 7.5yr 5/8 strong brown.
P.P. = >4.5 tsf	56.0 - 58.0	S-27	8-14-27-29	1.0	50		
P.P. = 1.5-2.5> tsf							

Agency: L.G. Hetager Drilling, Inc.	DRILLING LOG	Hole Number: GF-1
Driller: Floyd Himes	Gannett Fleming	Sheet: 3 of 4
Inspector: L. Daher		Elev. Top of Hole: 2507.4

Brush Creek Site 15 Dam

Remarks	Depth (Ft.)	Sample No.	Blows or RQD (%)	Rec. (ft.)	Rec. (%)	USCS	Description Of Materials
	~~58.0 - 60.0~~	~~S-28~~	~~11-12-17-18~~	~~2.0~~	~~100~~		
P.P. = 2.5 tsf	60.0 - 62.0	S-29	10-8-8-7	1.5	75		2445.4
P.P. = 2.5-3.5 tsf	62.0 - 64.0	S-30	8-15-23-28	1.8	90		62.0'-64.0': Lean CLAY (cl) 15% sand, 85% fines. Sand is fine grained, rounded; Fines: medium plasticity, Brownish yellow, (10yr 6/8), mottling (10yr 7/2) light gray, fine sand, (10yr 7/8) yellow. 2443.4
P.P. = 1.5-3.5 tsf Stopped at 64.0' on 3-14-16 at 3:30PM.	64.0 - 66.0	S-31	6-10-19-21	2.0	100		64.0'-66.0': Clayey SAND (sc) Sand is fine grained, subrounded; Fines: medium plasticity, Brownish yellow, (10yr 6/8), no HCl reaction 2441.4
Resumed on 3-15-16 at 7:30AM W.T.= Dry	66.0 - 68.0	S-32	10-13-23-47	2.0	100		66.0'-74.5': Clayey GRAVEL (gc) 50% gravel, 20% sand, 30% fines. flat and elongated, Gravel is fine and coarse, subangular to subrounded; Fines: medium plasticity, Very dark brown, (7.5yr 2.5/1), no HCl reaction
S-32 to 35 spoons were wet from outside.	68.0 - 69.4	S-33	52-77-100/.4	1.4	100		
	69.4 - 70.0	Auger					
	70.0 - 71.8	S-34	19-37-58-100/0.3	1.4	78		
	71.8 - 72.0	Auger					
	72.0 - 73.7	S-35	23-33-62-100/0.2				
	73.7 - 74.0	Auger					
	74.0 - 74.5	S-36	100/0.5				Top of Rock @ 74.5 ft 2432.9
End of spooning at 11:00AM Started coring at 2:00PM, Top of rock at 73.5. W.T.=Dry	74.5 - 76.5	R-1	0.4' - 20%	2.0	100		74.5'-94.5': SHALE, Gray moderately to slightly weathered, moderately hard, moderately to slightly fractured, very closely to very widely spaced fractures, RD = 05° - 30° 74.5': irregular, smooth. 74.9': Low angle fracture, smooth, RD=15°.
	76.5 - 79.5	R-2	1.5' - 50%	3.0	100		Low angle fracture, smooth, RD=15* 75.5': Low angle fracture, smooth, RD=10°.
	79.5 - 84.5	R-3	2.85' - 57%	5.0	100		75.7': Low angle fracture, smooth, RD=17°. 76.0': Low angle fracture, smooth, RD=10°. 76.3': Low angle fracture, smooth, RD=10°. 76.4': Low angle fracture, smooth, RD=10°. 76.5': Low angle fracture, smooth, RD=10°.
	84.5 - 89.5	R-4	2.6' - 52%	5.0	100		76.7': Low angle fracture,smooth, RD=5°. 77.0': healed fracture. 77.1': Low angle fracture, smooth, RD=5°. 77.3': Low angle fracture, smooth, RD=5°. 77.31': Low angle fracture, smooth, RD=5°. 77.4': Low angle fracture, smooth, RD=5°.
	89.5 - 94.5	R-5	4.2' - 84%	5.0	100		77.7': Low angle fracture, irregular. 77.9': Low angle fracture, smooth, RD=20°. 77.9'-78.0': moderately weathering. 78.5': Low angle fracture, smooth, RD=10°. 78.7': Low angle fracture, smooth, RD=10°. 79.2': Low angle fracture, smooth,

Agency: L.G. Hetager Drilling, Inc.	DRILLING LOG	Hole Number: GF-1
Driller: Floyd Himes	Gannett Fleming	Sheet: 4 of 4
Inspector: L. Daher		Elev. Top of Hole: 2507.4

Brush Creek Site 15 Dam

Remarks	Depth (Ft.)	Sample No.	Blows or RQD (%)	Rec. (ft.)	Rec. (%)	USCS	Description Of Materials
							RD=10°. 2412.9 79.5': Low angle fracture, slightly rough, RD=30°. 79.7': Low anlge fracture, smooth, RD=5°. 79.8': Low angle fracture, smooth, RD=5°. 79.9': Low angle fracture, smooth, RD=5°. 80.0': Low angle fracture, smooth, RD=5°. 80.3': Low angle fracture, conjuncte fractures, smooth, RD=25°. 80.6': Low angle fracture, smooth, RD=5°. 82.0': Low angle fracture, smooth, RD=5°. 82.1': Low angle fracture, smooth, RD=5°. 82.4': Low angle fracture, Low angle fracture,smooth, RD=15°. 82.9': Low angle fracture, smooth, RD=5°. 83.5'-83.7': Fracture. 83.9': Low angle fracture, smooth, wavy, RD=5°. 84.1': Low angle fracture, smooth, RD=5°. 84.2': Low angle fracture, smooth, RD=5°. 84.3': Low angle fracture,smooth, RD=5°. 84.5': Low angle fracture, smooth, RD=5°. 84.5'-84.6': slightly wating. 86.3': Low angle fracture, smooth, RD=5°. 87.0': Low angle fracture, smooth, RD=5°. 87.7': Low angle fracture, smooth, RD=5°. 87.7'-88.5': intensely to moderately fractured. 88.7': Low angle fracture, smooth, RD=5°. 88.1'-88.9': moderately fractured. 89.2': Low angle fracture, smooth, RD=30°. 89.3'-94.5' 89.5': Low angle fracture, smooth, RD=5°. 89.5'-90.2': intensely to moderately fractured. 93.0': Low angle fracture, smooth, RD=5°. 94.5': Low anlge fracture, smooth, RD=5°. Bottom of borehole at 94.5 feet.

94 96 98 100 102 104 106 108 110 112 114 116 118 120 122 124 126 128

Date Started: 3/8/16	**DRILLING LOG**		Hole Number: GF-2
Date Finished: 3/9/16	Gannett Fleming		Sheet: 1 of 3
Soil Drilling: 41.5 ft			Line & Station: 5+64.8
Rock Sampling: 15.0 ft	Project: Brush Creek Site 15 Dam		Offset: 82.5 ft R
Total Depth of Hole: 56.5 ft	Drilling Agency: L.G. Hetager Drilling, Inc.		N Coordinate: 118308 ft
No. of Undist. Samples: 2	Driller: Floyd Himes		E Coordinate: 1914600 ft
Total Number of Core Boxes: 1	Bit Size and Type: NX	CME Sampler N/A	Elev. Top of Hole: +2476.5 ft
GROUNDWATER OBSERVATIONS At 6.0 ft After 0 Hrs Elev. 2470.5 ft After 0 Hrs	Casing Size: N/A	Spoon Size: 3.0 " O.D.	Direction of Hole Vertical ☒ Inclined ☐ Degrees from Vertical —
	Hollow Stem: 4.25 " I.D.	Hammer wt.: 300 lb	
	Drilling Fluid: Water NX coring	Hammer Drop: 18.0 "	
	Drill Rig: Hetager 225 Track Rig		Inspector: L. Daher

Remarks	Depth (Ft.)	Sample No.	Blows or RQD (%)	Rec. (ft.)	Rec. (%)	USCS	Description Of Materials
Started at 8:23am 3-8-16	0.0 - 2.0	S-1	2-3-3-7	2.0	100		0.0'-2.0': Clayey SAND (sc) 10% gravel, 50% sand, 40% fines. angular to subangular, elongated, Gravel is fine, Sand is fine to medium grained, Fines: medium plasticity, high dry strength. no dilatancy, low toughness. Brownish yellow, (10yr 6/8), moist, homogeneous, loose 2474.5
	2.0 - 4.0	S-2	4-5-6-7	1.6	80		2.0'-32.0': Clayey SAND With Gravel (SC) 16.3% gravel, 44.8% sand, 38.9% fines. angular to subangular, flat and elongated, Gravel is fine to coarse, Sand is fine to coarse grained, Dark olive brown, (25yr 3/3), moist, homogeneous, Gravel fractures with hammer hit. 4.5'-6.0': Sample is wet. 7.5'-8.0': sandy gravel, medium to coarse gravel, medium sand.
	4.0 - 6.0	S-3	3-4-8-9	2.0	100		
	6.0 - 8.0	S-4	10-12-9-12	1.8	90		
	8.0 - 10.0	S-5	5-7-9-11	2.0	100		
	10.0 - 12.0	S-6	5-6-10-12	2.0	100		
	12.0 - 14.0	S-7	5-11-16-18	1.3	65		
	14.0 - 16.0	S-8	4-8-9-12	1.9	95		
	16.0 - 18.0	S-9	11-14-15-17	1.6	80		
	18.0 - 20.0	S-10	6-10-9-9	1.7	85		
ST-1 pushed @ 700 psi	20.0 - 22.0	ST-1	-	1.7	85		20.0'-22.0': Increase in sand content possible sandy gravel layer.
	22.0 - 24.0	S-11	10-10-11-21	2.0	100		

Purpose: Evaluate Embankment; collect soil and rock samples for laboratory analysis; install nested piezometers.
Hole Termination: 15 feet of rock
Hole Abandonment: Two nested piezometer installed after drilling to termination depth.
Drilling Method: NX
Additional Remarks: Boring is located at the downstream slope. Drilled on stake

Agency: L.G. Hetager Drilling, Inc.	DRILLING LOG	Hole Number: GF-2
Driller: Floyd Himes	Gannett Fleming	Sheet: 2 of 3
Inspector: L. Daher		Elev. Top of Hole: 2476.5

Brush Creek Site 15 Dam

Remarks	Depth (Ft.)	Sample No.	Blows or RQD (%)	Rec. (ft.)	Rec. (%)	USCS	Description Of Materials
bottom of S-12 is wet	24.0 - 26.0	S-12	19-11-6-6	1.5	75		24.5'-26.0': Shale Gravel is friable and fractures with hammer to flat and elongated.
26.0'-27.0: sample is wet	26.0 - 28.0	S-13	4-4-8-10	1.5	75		
	28.0 - 30.0	S-14	4-5-9-12	1.6	80		
	30.0 - 32.0	S-15	4-5-6-7	1.8	90		2444.5
	32.0 - 34.0	S-16	7-8-8-8	2.0	100		32.0'-36.0': Silty SAND (SM) 6.4% gravel, 60.4% sand, 33.2% fines. Sand is fine to medium grained, Fines: low plasticity, low dry strength. no dilatancy, low toughness. Strong brown, (7.5yr 5/6), moist, homogeneous
ST-2 pushed at 900 psi	34.0 - 36.0	ST-2	-	2.0	100		2440.5
Top of S-17 is wet, water in spoon.	36.0 - 38.0	S-17	8-13-15-20	1.6	80		36.0'-41.5': Sandy SILT (ML) 6.6% gravel, 28.5% sand, 64.9% fines. angular to subangular, flat and elongated, Gravel is coarse, Sand is fine to coarse grained, Fines: low plasticity, medium dry strength. slow dilatancy, Brown, (7.5yr 4/3), moist, homogeneous, Gravel does not fracture under hammer hit.
	38.0 - 40.0	S-18	10-15-29-56	1.4	70		
	40.0 - 41.5	S-19	25-56-100/0.5	1.5	100		40.0'-41.5: rock fragments, severely weathered rock, iron staining. Top of Rock @ 41.5 ft 2435.0
41.5': Start coring at 15:15; WT at 36.0'.	41.5 - 43.0	R-1	0' - 0%	1.4	93		41.5'-56.5': SHALE, Dark gray moderately to slightly weathered, soft to hard, very closely to very widely spaced fractures. laminated, RD=5°-15°.
41.5'-56.5': Drill water return is gray	43.0 - 46.0	R-2	0' - 0%	2.2	73		41.6': Low angle fracture, slightly rough, wavy, iron staining, thin soil layer, RD=10°.
46.0': End of 3-8-16 @ 17:15. Start 3-9-16 @ 07:00; WT at 42.8'.							41.8': Low angle fracture, smooth, RD=10°.
	46.0 - 49.0	R-3	1.7' - 57%	3.0	100		41.9': Low angle fracture, irregular, RD=10°.
							42.0': Healed fracture.
							42.0'-42.4': soft
							42.4'-43.0': broken, iron staining, intensely weathered and altered to clay, soft.
Pressure tests at 49.0' 8:30-9:30.	49.0 - 53.0	R-4	3.4' - 85%	4.0	100		43.0': Low angle fracture, irregular, RD=40°.
							43.2': Low angle fracture, conjecate fracture, smooth, thin soil layer, RD=10°.
							43.4': Low angle fracture, smooth, clay, irregular.
							43.4'-45.0': broken, moderately hard, moderately weathered, clay.
	53.0 - 56.5	R-5	3.5' - 100%	3.5	100		45.2': Low angle fracture, smooth, clay, RD=15°, moderately hard.
							45.3': Low angle fracture, thin soil layer, smooth.
EOD of coring on 3-9-16 at 10:00AM.							45.3'-45.7': soft, moerately weathered, broken.
							45.8': Low angle fracture, smooth, RD=15°. 2420.0
							46.0': Low angle fracture, slightly rough, RD=15°.
							46.1': Low angle fracture, smooth, RD=5°.

Agency:	L.G. Hetager Drilling, Inc.	DRILLING LOG	Hole Number:	GF-2
Driller:	Floyd Himes	Gannett Fleming	Sheet:	3 of 3
Inspector:	L. Daher		Elev. Top of Hole:	2476.5

Brush Creek Site 15 Dam

Remarks	Depth (Ft.)	Sample No.	Blows or RQD (%)	Rec. (ft.)	Rec. (%)	USCS	Description Of Materials
							46.2': Low angle fracture, smooth, RD=5°. 46.4': Low angle fracture, smooth, wavy, RD=10°. 46.5': Low angle fracture, smooth, RD=5°. 46.6': healed fracture. 46.7': Low angle fracture, smooth, RD=15°. 46.7'-46.8': broken, very close joint spacing. 48.5': Low anlge fracture, slightly rough, RD=15°. 48.7': Low angle fracture, rough, RD=10°. 48.8': Low angle fracture, rough, RD=10°. 49.0': Low angle fracture, wavy, slightly rough, RD=5°. 49.7': Low angle fracture, slightly rough, RD=5°. 50.7': Low anlge fracture, slightly rough, RD=5°. 51.2': Low angle fracture, slightly rough, RD=5°. 52.2': Low angle fracture, smooth, RD=5°. 52.7': Low angle fracture, slightly rough, RD=10°. 53.0': Low angle fracture, smooth, RD=15°. 56.5': Low angle fracture, smooth, RD=10°.

Bottom of borehole at 56.5 feet.

Date Started: 3/8/16	**DRILLING LOG**		Hole Number: GF-3
Date Finished: 3/8/16	Gannett Fleming		Sheet: 1 of 2
Soil Drilling: 13.3 ft			Line & Station: 5+62.2
Rock Sampling: 15.0 ft	Project: Brush Creek Site 15 Dam		Offset: 224.5 ft R
Total Depth of Hole: 28.3 ft	Drilling Agency: L.G. Hetager Drilling, Inc.		N Coordinate: 118447 ft
No. of Undist. Samples: 0	Driller: Donald Bergreen, Jr.		E Coordinate: 1914569 ft
Total Number of Core Boxes: 1	Bit Size and Type: NX	CME Sampler N/A	Elev. Top of Hole: +2437.8 ft
GROUNDWATER OBSERVATIONS At 0.0 ft After 0 Hrs Elev. 2437.8 ft After 0 Hrs	Casing Size: N/A	Spoon Size: 3.0 " O.D.	Direction of Hole Vertical ☒ Inclined ☐ Degrees from Vertical ---
	Hollow Stem: 4.25 " I.D.	Hammer wt.: 300 lb	
	Drilling Fluid: Water NX coring	Hammer Drop: 18.0 "	
	Drill Rig: Hetager 223 Track Rig		Inspector: D. Snyder

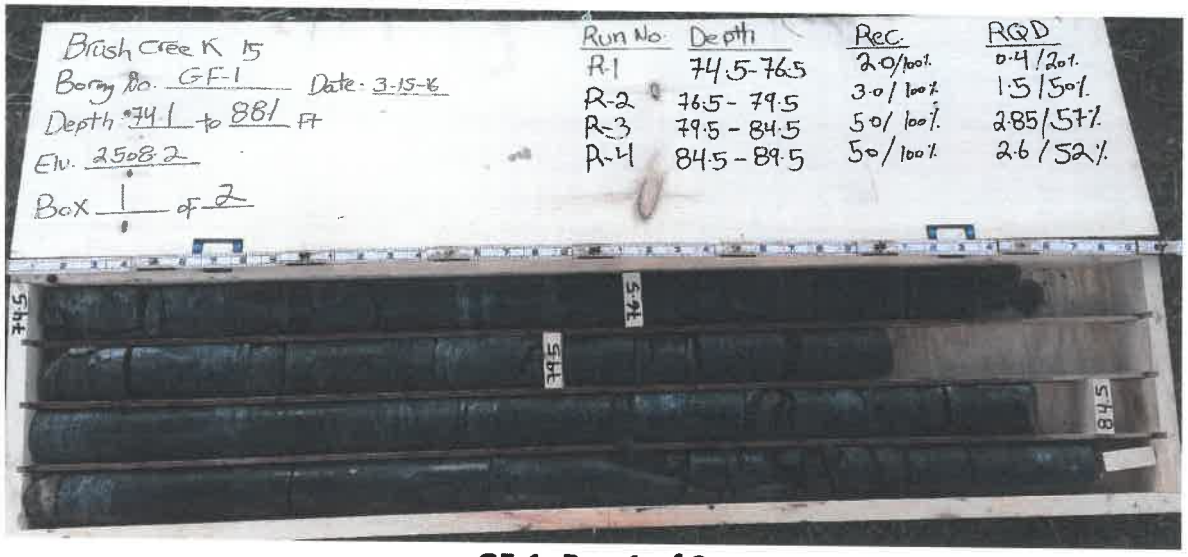
Remarks	Depth (Ft.)	Sample No.	Blows or RQD (%)	Rec. (ft.)	Rec. (%)	USCS	Description Of Materials
P.P. = 2.0 tsf Start 08:45 typically drove two split spoons then auger 4.0'.	0.0 - 2.0	S-1	3-3-4-4	1.9	95		0.0'-0.8': Silty SAND (sm) Brown, moist, Topsoil. 2437.0 0.8'-7.0': Clayey FINE TO MEDIUM SAND (sc) 15% gravel, 40% sand, 45% fines. subrounded, max. particle size: 1-1/2"; Fines: medium plasticity, Orangish brown and dark gray, moist to wet, heterogeneous, (Fill)
P.P. = 1.0 tsf	2.0 - 4.0	S-2	5-5-7-7	1.9	95		
P.P. = 1.5 tsf	4.0 - 6.0	S-3	3-3-3-3	2.0	100		
P.P. = 2.0 tsf	6.0 - 8.0	S-4	3-5-6-11	2.0	100		2430.8 7.0'-10.3': Silty FINE TO MEDIUM SAND (SM) 51.7% sand, 48.3% fines. angular to subangular, max. particle size: medium sand; Fines: low plasticity, slow to rapid dilatancy, moist, stratified, with lenses of wet.
P.P. = >4.5 tsf	8.0 - 10.0	S-5	5-2-1-2	2.0	100		
S-6: Spoon wet on outside. Driller reports sand flowing up from bottom of hole after S-5.	10.0 - 12.0	S-6	11-11-19-27	1.9	95		8.5'-9.0': Lense of gray medium sand poorly graded (sp), 10% fines, alluvium 2427.5 10.3'-13.3': Silty CLAY With Sand (cl) 15% sand, 85% fines. max. particle size: fine sand; Fines: medium plasticity, slow dilatancy, Dark gray, dry to moist, blocky, very dense and friable (Completely Weathered Rock) 2424.5 Top of Rock @ 13.3 ft
P.P. = >4.5 tsf	12.0 - 13.3	S-7	25-64-100/0.3	1.3	100		
S-7: Spoon very difficult to recover. 13.3': Auger refusal. Began coring at 10:00am	13.3 - 15.0	R-1	1.5' - 88%	1.7	100		13.3'-28.3': SHALE, Dark gray laminated to very thinly bedded, freshly weathered, soft, moderately to widely spaced fractures, slightly rough, RD = 05°. fractures are typically tight and rough, most fractures are along bedding planes, bedding not discernible unless wet core dries out.
13.3'-27.7': Constant dark gray drill water return. 16.0'-21.0': Pressure test stage 1	15.0 - 18.0	R-2	2.8' - 93%	2.8	93		
	18.0 - 21.0	R-3	2.9' - 97%	2.9	97		14.1': Bedding fracture, smooth, tight, freshly weathered, RD=5°. 16.7': Bedding fracture, smooth, tight, fresh, RD=5°. 21.0': Joint slightly rough, tight, fresh, RD=40°.
12:30-13:00 GWT at ground surface, No visible flow at ground.	21.0 - 26.0	R-4	4.3' - 86%	5.0	100		21.8'-22.0': Brecciated with white granules and nodules. Pyrite present. 21.85'-28.3': Fossiliferous 21.85': Fracture, rough, tight, fresh,

Purpose: Evaluate Embankment foundation; collect soil and rock samples for laboratory analysis; install nested piezometer.
Hole Termination: 15 feet of rock
Hole Abandonment: One nested piezometer installed after drilling to termination depth.
Drilling Method: NX
Additional Remarks: Drilled at downstream toe near left groin. Drilled on stake.

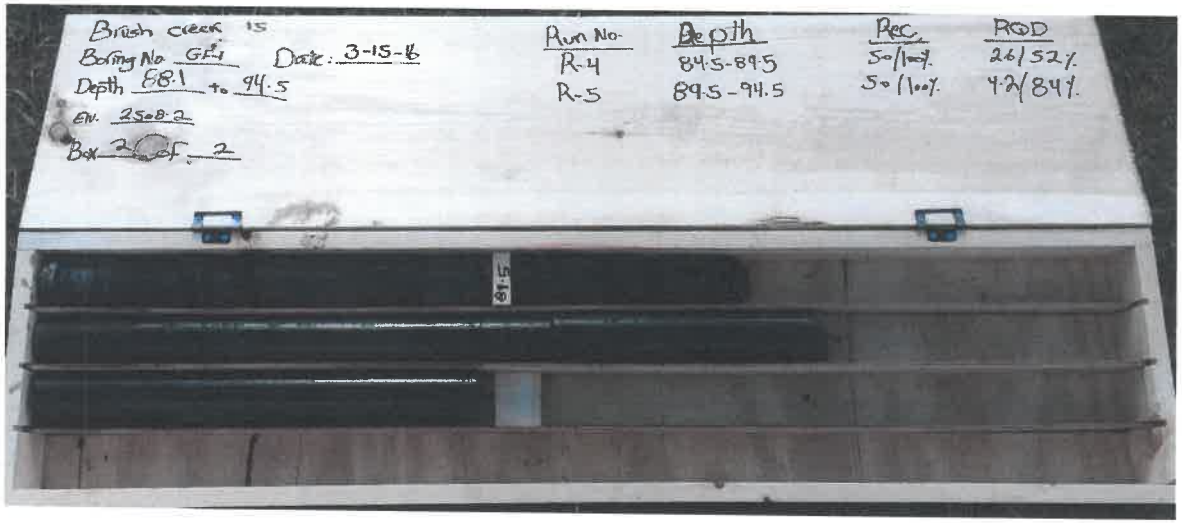
Agency:	L.G. Hetager Drilling, Inc.	DRILLING LOG	Hole Number:	GF-3
Driller:	Donald Bergreen, Jr.	Gannett Fleming	Sheet:	2 of 2
Inspector:	D. Snyder		Elev. Top of Hole:	2437.8

Brush Creek Site 15 Dam

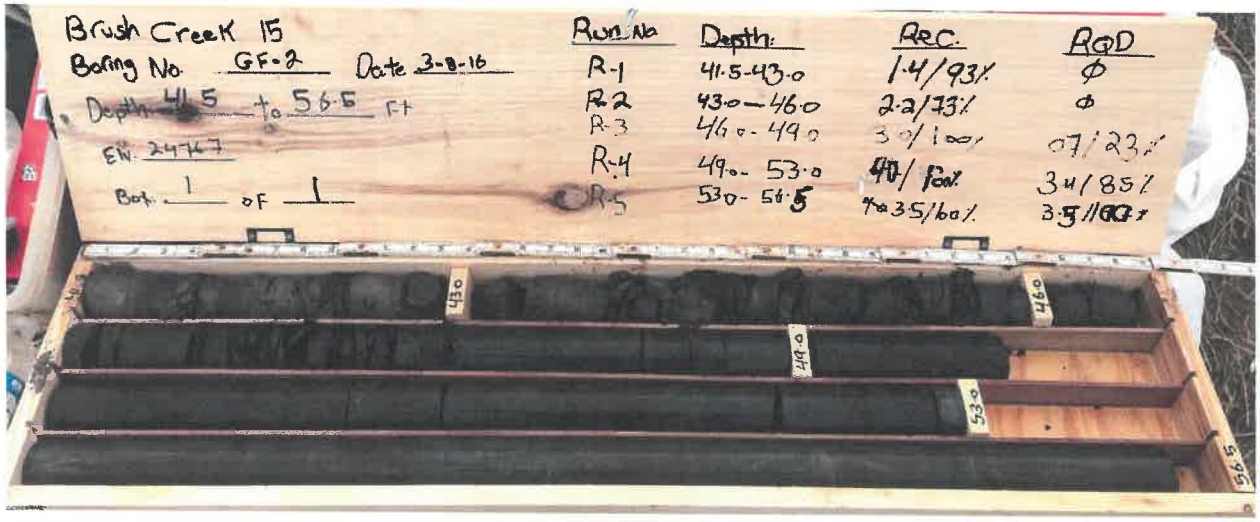
Remarks	Depth (Ft.)	Sample No.	Blows or RQD (%)	Rec. (ft.)	Rec. (%)	USCS	Description Of Materials
27.7'-28.3': Driller reports rapid drilling rate and temporary loss of drill water. Artesian flow from borehole begins; NX bit moved up to 15.0' below ground surface to perform pressure testing. Artesian head is 3.6' above ground surface. Inflated packer to measure artesian pressure, but too small to measure. 21.0'-28.3': pressure test Stage 2. After test, artesian flow from top of augers is <2gpm (top of auger flight 8" above ground). Added auger flight to measure head @ 2.6' above ground. Installed bentonite pellets from bottom of hole to 11.0' below ground surface. Installed nested piezometer at 10.0' depth.							RD=15°. 23.7': Fracture, rough, tight, fresh, RD=20°. 24.2': Bedding Fracture, rough, open, fresh, RD=5°. 24.7': Bedding Fracture, slightly rough, moderately open freshly weathered, RD=5°. 25.8': Bedding fracture, slightly rough, slightly open, fresh, RD=5°. 2409.5 27.0': Bedding fracture, slightly rough, slightly open, fresh, RD=5° 27.7'-28.3': Broken zone, rough, fresh.
	26.0 - 28.3	R-5	1.7' - 74%	2.1	91		Bottom of borehole at 28.3 feet.



GF-1, Box 1 of 2



GF-1, Box 2 of 2



GF-2, Box 1 of 1

GF-3, Box 1 of 1

Gannett Fleming

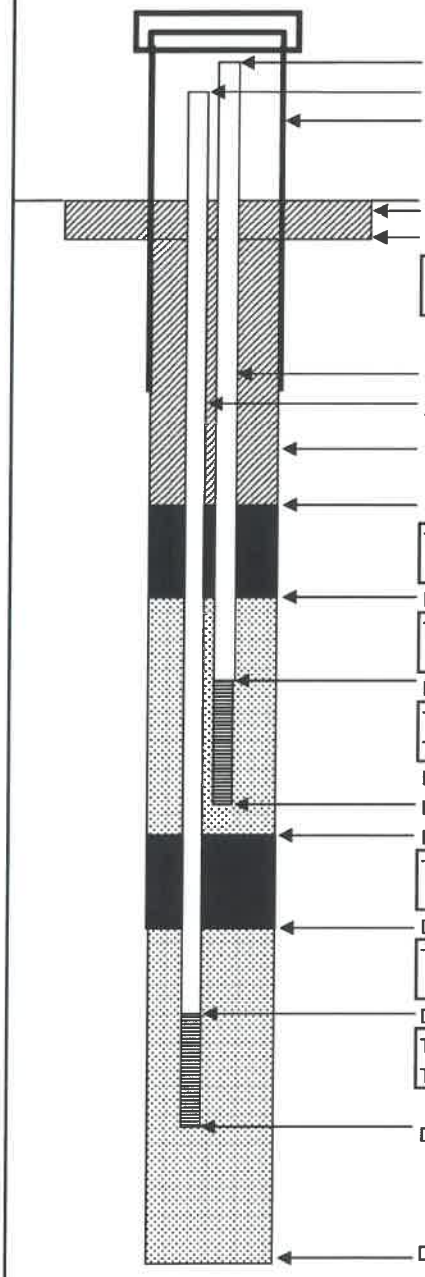
BORING NO.: GF-1 PIEZOMETER(S): GF-1(S) and 1(D)

PIEZOMETER CONSTRUCTION FIELD LOG

PROJECT: BRUSH CREEK SITE 15 DAM - WVCA	PROJECT NO.: 61371.203
LOCATION: Valley Section near Left Abutment	DRILLER: Floyd Himes
BASELINE: Dam (D) STATION: OFFSET:	COMPANY: L.G. Hetager, Inc.
FIELD INSPECTOR: L. Daher	DATE STARTED: 3/9/2016
PROJECT ENGINEER: D. Snyder PHONE #: x2000	DATE COMPLETED: 3/9/2016

NOTE: ALL DEPTHS MEASURED FROM GROUND SURFACE UNLESS OTHERWISE INDICATED.

KEY #, MANUFACTURER (if any): Master #3461



SHALLOW PIEZO RISER PIPE STICK-UP: 2.6 ft. El: 2510.02

DEEP PIEZO RISER PIPE STICK-UP: 2.6 ft. El: 2510.05

SURFACE CASING ID: 8.0"

TYPE, DEPTH OF SURFACE CASING: Steel, 6' length

GROUND SURFACE ELEV: 2507.4

TYPE OF SURFACE SEAL: Neat cement grout with 5% bentonite

DEPTH TOP OF BACKFILL: N/A

TYPE OF BACKFILL: Neat cement grout with 5% bentonite

RISER PIPE MATERIAL: PVC

RISER PIPE I.D. & SCHEDULE: 1" Nominal -Schedule 40

TYPE OF PIPE COUPLING: Flush threaded

BOREHOLE DIAMETER: 8" from 0'-74.5'; 4" from 74.5'-94.5'

DEPTH TOP OF SEAL: 44.0 ft. El: 2463.4

TYPE OF SEAL: 1/4" bentonite pel-plug

DEPTH TOP OF SAND PACK: 49.0 ft. El: 2458.4

TYPE OF SAND PACK: Best Sand: 2040 Silica Sand

DEPTH TOP OF SCREEN: 51.0 ft. El: 2456.4

TYPE OF SCREEN: Geokon ID# 4580-11-24

TYPE, I.D. OF SCREEN/RISER CONNECTION: 13/16" I.D.

DEPTH BOTTOM OF PIEZOMETER:

DEPTH BOTTOM OF SCREEN: 53.0 ft. El: 2454.4

DEPTH TOP OF SEAL: 54.0 ft. El: 2453.4

TYPE OF SEAL: 1/4" bentonite pel-plug

DEPTH TOP OF SAND PACK: 89.5 ft. El: 2417.9

TYPE OF SAND PACK: Best Sand: 2040 Silica Sand

DEPTH TOP OF SCREEN: 91.5 ft. El: 2415.9

TYPE OF SCREEN: Geokon ID# 4580-11-24

TYPE, I.D. OF SCREEN/RISER CONNECTION: 13/16" I.D.

DEPTH BOTTOM OF SCREEN: 93.5 ft. El: 2413.9

DEPTH BOTTOM OF HOLE: 94.5 ft. El: 2412.9

Gannett Fleming

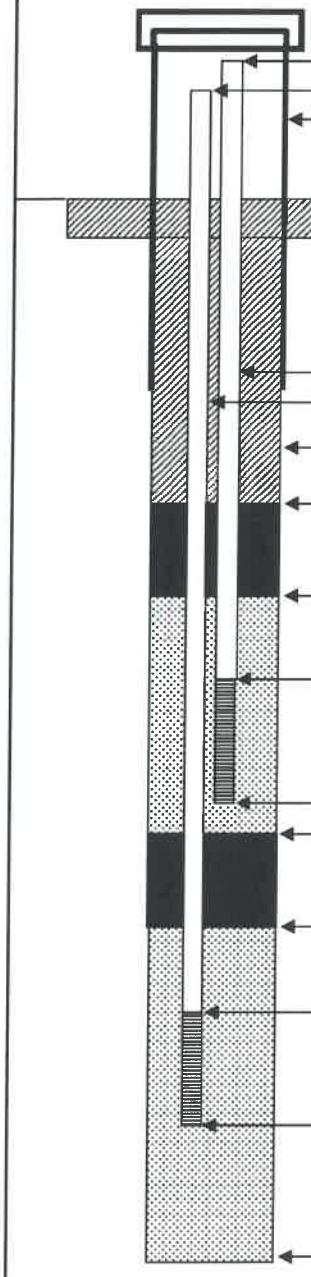
BORING NO.: GF-2 PIEZOMETER(S): GF-2(S) and 2(D)

PIEZOMETER CONSTRUCTION FIELD LOG

PROJECT: BRUSH CREEK SITE 15 DAM - WVCA	PROJECT NO.: 61371.203
LOCATION: Valley Section near Left Abutment	DRILLER: Floyd Himes
BASELINE: Dam (D) STATION: OFFSET:	COMPANY: L.G. Hetager, Inc.
FIELD INSPECTOR: L. Daher	DATE STARTED: 3/9/2016
PROJECT ENGINEER: D. Snyder PHONE #: x2000	DATE COMPLETED: 3/9/2016

NOTE: ALL DEPTHS MEASURED FROM GROUND SURFACE UNLESS OTHERWISE INDICATED.

KEY #, MANUFACTURER (if any): Master #3461



SHALLOW PIEZO RISER PIPE STICK-UP: 2.87 ft. El: 2479.37

DEEP PIEZO RISER PIPE STICK-UP: 2.78 ft. El: 2479.28

SURFACE CASING ID: 8.0"

TYPE, DEPTH OF SURFACE CASING: Steel, 6' length

GROUND SURFACE ELEV: 2476.5

TYPE OF SURFACE SEAL: Neat cement grout with 5% bentonite

DEPTH TOP OF BACKFILL: N/A

TYPE OF BACKFILL: Neat cement grout with 5% bentonite

RISER PIPE MATERIAL: PVC

RISER PIPE I.D. & SCHEDULE: 1" Nominal -Schedule 40

TYPE OF PIPE COUPLING: Flush threaded

BOREHOLE DIAMETER: 8" from 0'-41.5'; 4" from 41.5'-56.5'

DEPTH TOP OF SEAL: 25.0 ft. El: 2451.5

TYPE OF SEAL: 1/4" bentonite pel-plug

DEPTH TOP OF SAND PACK: 30.0 ft. El: 2446.5

TYPE OF SAND PACK: Best Sand: 2040 Silica Sand

DEPTH TOP OF SCREEN: 32.0 ft. El: 2444.5

TYPE OF SCREEN: Geokon ID# 4580-11-24

TYPE, I.D. OF SCREEN/RISER CONNECTION: 13/16" I.D.

DEPTH BOTTOM OF SCREEN: 34.0 ft. El: 2442.5

DEPTH TOP OF SEAL: 35.0 ft. El: 2441.5

TYPE OF SEAL: 1/4" bentonite pel-plug

DEPTH TOP OF SAND PACK: 49.0 ft. El: 2427.5

TYPE OF SAND PACK: Best Sand: 2040 Silica Sand

DEPTH TOP OF SCREEN: 53.5 ft. El: 2423.0

TYPE OF SCREEN: Geokon ID# 4580-11-24

TYPE, I.D. OF SCREEN/RISER CONNECTION: 13/16" I.D.

DEPTH BOTTOM OF SCREEN: 55.5 ft. El: 2421.0

DEPTH BOTTOM OF HOLE: 56.5 ft. El: 2420.0

Gannett Fleming

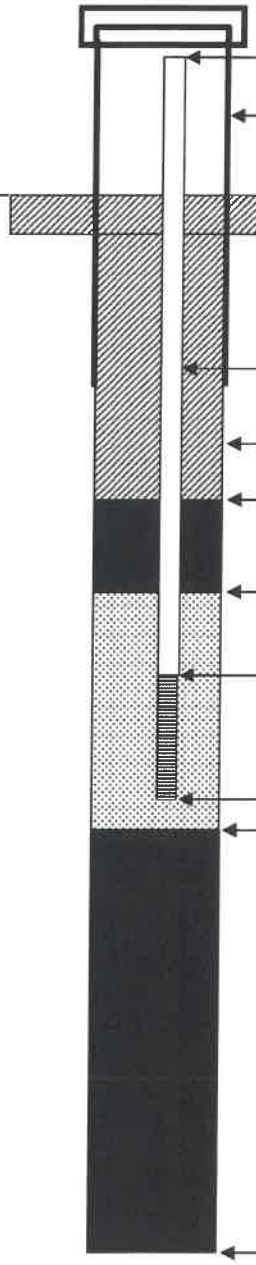
BORING NO.: GF-3 PIEZOMETER(S): GF-3

PIEZOMETER CONSTRUCTION FIELD LOG

PROJECT: BRUSH CREEK SITE 15 DAM - WVCA	PROJECT NO.: 61371.203
LOCATION: Valley Section near Left Abutment	DRILLER: Donald Bergreen Jr.
BASELINE: Dam (D) STATION: OFFSET:	COMPANY: L.G. Hetager, Inc.
FIELD INSPECTOR: D. Snyder	DATE STARTED: 3/8/2016
PROJECT ENGINEER: D. Snyder PHONE #: x2000	DATE COMPLETED: 3/8/2016

NOTE: ALL DEPTHS MEASURED FROM GROUND SURFACE UNLESS OTHERWISE INDICATED.

KEY #, MANUFACTURER (if any): Master #3461



PIEZO RISER PIPE STICK-UP: 2.5 ft. El: 2440.32

SURFACE CASING ID: 8.0"

TYPE, DEPTH OF SURFACE CASING: Steel, 6' length

GROUND SURFACE ELEV: 2437.8

TYPE OF SURFACE SEAL: Neat cement grout with 5% bentonite

DEPTH TOP OF BACKFILL: N/A

TYPE OF BACKFILL: Neat cement grout with 5% bentonite

RISER PIPE MATERIAL: PVC

RISER PIPE I.D. & SCHEDULE: 1" Nominal -Schedule 40

TYPE OF PIPE COUPLING: Flush threaded

BOREHOLE DIAMETER: 8" from 0'-13.3'; 4" from 13.3'-28.3'

DEPTH TOP OF SEAL: 3.0 ft. El: 2434.8

TYPE OF SEAL: 1/4" bentonite pel-plug

DEPTH TOP OF SAND PACK: 6.0 ft. El: 2431.8

TYPE OF SAND PACK: Best Sand: 2040 Silica Sand

DEPTH TOP OF SCREEN: 8.0 ft. El: 2429.8

TYPE OF SCREEN: Geokon ID# 4580-11-24

TYPE, I.D. OF SCREEN/RISER CONNECTION: 13/16" I.D.

DEPTH BOTTOM OF SCREEN: 10.0 ft. El: 2427.8

DEPTH TOP OF SEAL: 11.0 ft. El: 2426.8

TYPE OF SEAL: 1/4" bentonite pel-plug

DEPTH BOTTOM OF HOLE: 28.3 ft. El: 2409.5

GEOPHYSICAL INVESTIGATION REPORT

Brush Creek – Sites 9, 14, and 15
NRCS – West Virginia
Mercer County, West Virginia

NRCS Task Order 12-SPEC-18-F0053
Contract 12SPEC18D0023
Task Order No: 12FPC320F0253

Aterra-Schnabel JV Reference 18proj007
Schnabel Reference 18C35013.010, 18C35013.020, and 18C35013.030
September 12, 2022

ATERRA SOLUTIONS | Schnabel ENGINEERING | NRCS

September 12, 2022

Ms. Lauri M. Eipp
Contracting Officer
U.S. Department of Agriculture
Natural Resources Conservation Services

laureen.eipp@wdc.usda.gov

Subject: **Geophysical Investigation Report for Brush Creek Sites 9, 14, and 15**
NRCS Task Order 12-SPEC-18-F0053, Contract 12SPEC18D0023
Mercer County, West Virginia (Aterra-Schnabel Reference 18pro007;
Schnabel Reference 18C35013.010, 18C35013.020, and 18C35013.030)

Dear Ms. Eipp:

Aterra-Schnabel JV is pleased to submit our Geophysical Investigation Report for this project. This report was prepared in accordance with our proposal dated February 10, 2022, (original November 16, 2021; first revision December 17, 2021); and our Task Order signed on March 9, 2022.

We appreciate the opportunity to be of service for this project. Please call us if you have any questions regarding this report.

Sincerely,

Aterra-Schnabel JV

Mia A. Painter, PG
Associate

Evan B. Binder, PE
Associate

CS:JS:MAP:EBB:vm

Distribution:
NRCS – West Virginia (email only)
Attn: Mr. Derrick Crane
Attn: Mr. Andy Deichert

GEOPHYSICAL INVESTIGATION REPORT
NRCS – WEST VIRGINIA
BRUSH CREEK – SITES 9, 14, AND 15
MERCER COUNTY, WEST VIRGINIA

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1.0 INTRODUCTION

1.1 Background

This Geophysical Investigation Report presents the findings of the seismic refraction (SR) and electrical resistivity imaging (ERI) surveys performed by **Aterra-Schnabel JV** at Brush Creek – Sites 9, 14, and 15 for the Natural Resources Conservation Service (NRCS). The sites are in Mercer County, West Virginia. A Site Vicinity Map is provided in Figure 1.

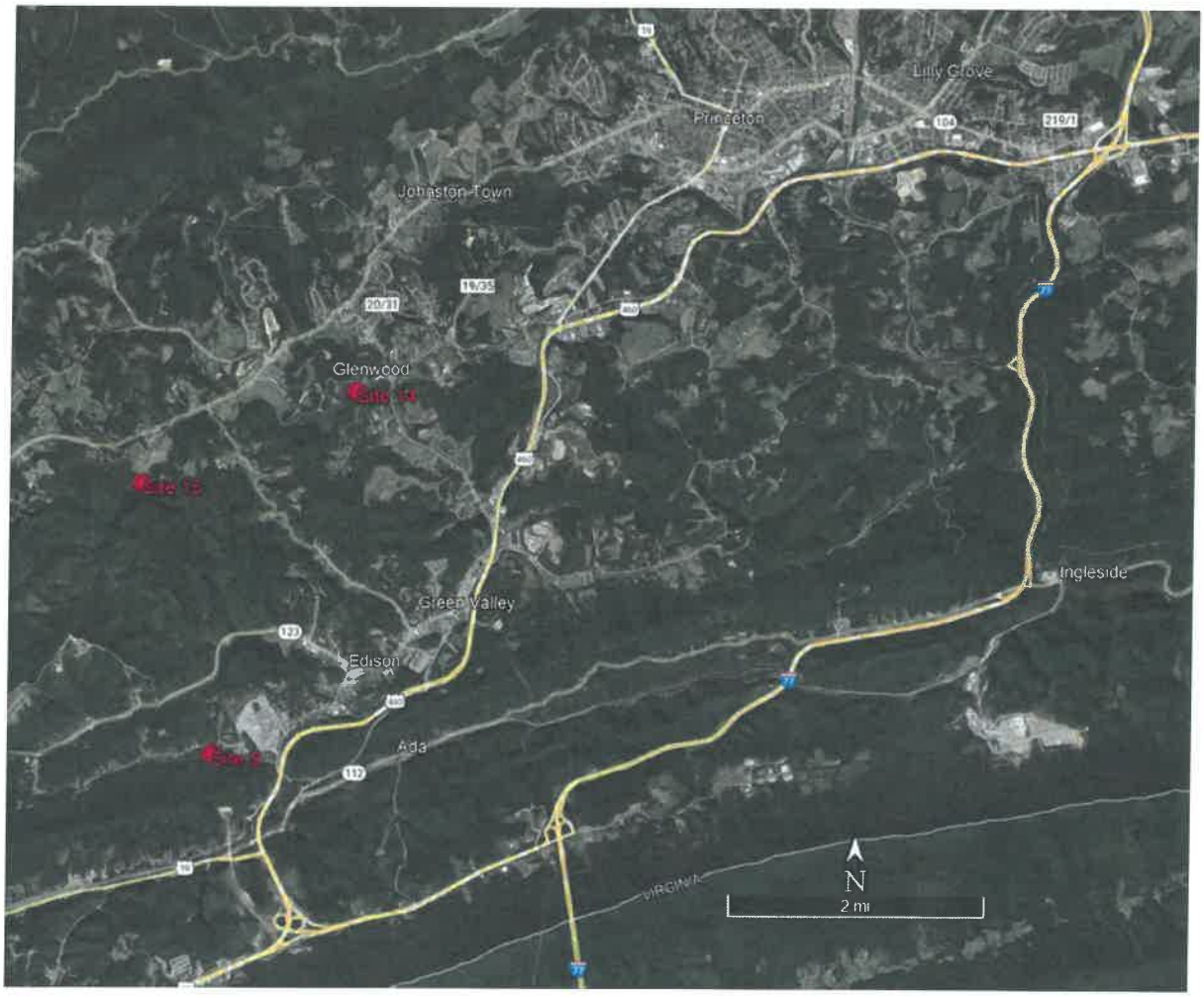

Figure 1: Site Vicinity Map Showing Locations of the Three Sites in Mercer County, West Virginia

1.2 Objective and Scope of Services

This study was completed to support the design of the proposed auxiliary spillway cutoff walls and the toe drains, and additionally, at Site 9 to identify where seepage and/or groundwater flow was occurring. The objective of this study was to: (1) evaluate the depth to rock and rippability of rock at the proposed auxiliary spillway cutoff walls and toe drains at Sites 9, 14, and 15; and (2) evaluate saturated zones and potential seepage pathways to support design of drainage features for the right abutment at Site 9.

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The work presented herein is defined under our proposal dated February 10, 2022, (original November 16, 2021; first revision December 17, 2021); and our Task Order signed on March 9, 2022.

The study includes an SR survey at Sites 9, 14, and 15 to estimate depth to rock and rippability of rock, as well as an ERI survey at Site 9 to estimate saturated zones and potential seepage pathways. This report includes a description of the methods used; conditions encountered; a discussion of the resulting data and interpretations with regard to depth to rock, rippability, and ripping index; annotated presentation of the data; and site location plans.

1.3 Terminology

Descriptive nomenclature for dams is based upon one looking downstream in the direction of flow. "Right" and "left" are referenced in this manner. The reservoir side is known as the upstream side, with the opposite slope referred to as the downstream slope. The abbreviation "EL" in this report represents elevation in feet.

Many of the borehole logs show a layer of disintegrated rock overlying the top of competent rock. This layer will have seismic properties more consistent with a soil layer than a rock layer. Therefore, we will generally be referring to the top of competent rock as opposed to disintegrated rock when referring to top of rock, unless specifically noted otherwise.

2.0 RIPPABILITY DISCUSSION

Seismic compression wave (i.e., P-wave) velocity is empirically correlated to the rippability of rock. The *Caterpillar Performance Handbook Edition 43* (2013) lists earth materials and correlates seismic velocities to rippability. Table 4-23, "Excavation characteristics of rock," and Table 4-27, "Correlation of indicators of rock excavatability" (Chapter 4, NRCS Part 631 Geology, National Engineering Handbook) indicate the 7,000 ft/s P-wave velocity contour is critical in determining the headcut erodibility index (kh) value.

The *Caterpillar Handbook* indicates that a CAT D8R bulldozer equipped with a multi- or single-shank No. 8 stripper can rip rocks such as shale and sandstone with associated seismic velocities of up to about 6,000 to 6,300 ft per second (ft/s). Velocities above these to about 8,200 to 8,400 ft/s are considered marginally rippable, and above these velocities are considered non-rippable. Productivity of rock removal will decrease significantly as the rippability limit is approached.

For this project, we correlated the estimated depth to top of rock based primarily on the test boring results available at each site, as previously reported in the final Geotechnical Investigation Reports submitted for Sites 9, 14, and 15 on May 10, 2019, June 19, 2019 and October 28, 2021, respectively. In addition, we provided the velocity contours of interest based on the information in the NRCS Geology Handbook.

Note that regardless of the method used to estimate rippability, variation depends on conditions such as size and openness of the excavation and maneuverability of the equipment, lithology changes, banding or bedding thickness and orientation, and fracture orientation and frequency.

3.0 SITE 9 GEOPHYSICAL INVESTIGATION

The Brush Creek Watershed Site 9 Dam is located in Mercer County, West Virginia, approximately 4.5 miles northeast of the City of Bluefield on the South Fork of Brush Creek (see Figure 1). The site is primarily a grassy, open area along the embankment, although the southern portion of the site is wooded. Figure 2 shows the site conditions at the time of data collection.

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Figure 2: Site Conditions at Site 9 at Time of Data Collection

A total of 2,285 linear feet (lf) of SR data were collected from April 27 through 29, 2022, along Lines 9-A1, 9-A2-1, 9-A2-2, 9-B1, 9-B2, 9-B3, and 9-C as shown on Figure 3 and Figures A-1, A-2, and A-3. Historical weather data from Weather Underground (https://www.wunderground.com) shows that there was about 0.4 inches of rainfall on April 19, which was 8 days before seismic data collection.

A total of 1,350 lf of ERI data were collected on April 11 and 12, 2022, along Lines 9-D, 9-E, 9-F, and 9-G, as shown on Figures 3 and A-4. The GPS data for each SR and ERI line are given in Appendix A, Table A-1. Historic weather data from Weather Underground shows that there was about 1 inch of rainfall between April 6 and April 7, which was 4 days before collecting the ERI data.

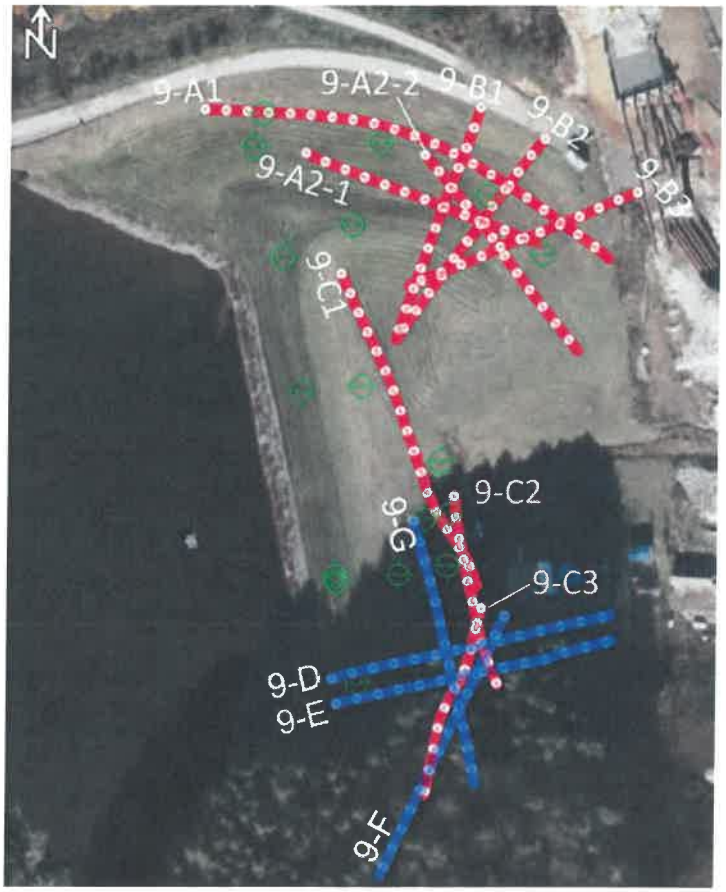

Figure 3: Site 9 Layout Map (Red Lines Show SR Line Locations; Blue Lines Show ERI Line Locations)

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3.1 Seismic Refraction Data Collection and Analysis

SR data were collected using two Geometrics Geode seismographs and 48 10-Hz geophones with a geophone spacing of 5 ft. SR traverses extended beyond the length of the proposed survey lines, where accessible, to provide the required depth coverage along the traverses.

Seismic data processing was conducted using Rayfract Version 4 from Intelligent Resources. The processing involved Schnabel personnel manually picking first-arrival times of seismic energy, incorporating elevations into the data, and generating a model that matches the first arrivals. Gradational velocity changes are common in geologic environments with thicker zones of weathered and fractured bedrock, such as at this site; therefore, we performed a tomographic inversion to estimate these gradational changes in the P-wave velocities. Due to the nature of tomographic inversions, even a sharp geologic boundary will be imaged as a gradient. Therefore, while a specific velocity contour can serve as a tool for interpreting the top of rock, for example, the actual velocity of the rock may be higher than the contour representing the top of the rock.

3.2 Seismic Refraction Results

The results from the SR survey for Site 9 are shown in Figures A-1, A-2, and A-3 in Appendix A. Figure A-1 shows the results for Lines 9-A1, 9-A2-1, and 9-A2-2; Figure A-2 shows the results for Lines 9-B1, 9-B2, and 9-B3; and Figure A-3 shows the results for Lines 9-C1, 9-C2, and 9-C3. The SR results are displayed using color-coded cross-sections with key velocity contours overlaid.

The geologic units, as noted in logs of boreholes located near the lines are overlaid on the geophysical results. Generally, the 5,000 ft/s velocity contour line corresponds closest to the top of competent rock as noted in the borehole logs. It is important to understand that this value represents the top of interpreted rock, not the actual velocity of the rock itself, which may be higher due to the nature of tomographic inversions and because the bulk of the rock is generally more competent, and therefore likely has a higher velocity, than the disintegrated rock/competent rock interface.

On each figure there is a plan-view image that shows the locations of the boreholes and geophysical lines. The symbols along each line are labeled to correspond to the horizontal axis of each line, which is referred to as the downline distance in the discussion of results below.

The results for Line 9-A1 (Figure A-1) show that depth to top of rock, as represented by the 5,000 ft/s contour, varies over the line length. At a downline distance of about 40 ft, the top of rock is interpreted to be within 3 to 5 ft of the ground surface, while only 20 ft farther to the west, at a downline distance of 20 ft, the depth to rock is interpreted to be nearly 20 ft below the ground. Rock is again shallow about 120 ft down the line.

The results for Line 9-A2-1 (Figure A-1) show that rock varies between about 11 to 17 ft below the ground surface. The results for 9-A2-2 show that rock is closer to the surface at a downline distance of about 160 ft.

The results for Lines 9-B1, 9-B2, and 9-B-3 (Figure A-2) show that the interpreted top of rock is about 12 to 18 ft below the ground surface over the line length. However, on Line 9-B3 between downline distances of 0 to 20 ft, rock is up to 30 ft deep; between downline distances of 20 to 60 ft, rock is about 8 ft below the ground surface.

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The results for Lines 9-C1, 9-C2, and 9-C3 are shown on Figure A-3. For most of Line 9-C1, top of rock is interpreted to be about 8 ft from the ground surface; the deepest depth is at a downline distance of 240 ft, where the depth is about 14 ft. Along Line 9-C2, rock is as deep as about 15 ft at a downline distance of 85 ft to within about 4 to 5 ft deep near the surface at about 140 ft down the line; however, this could be caused by increased near surface soil saturation. Along Line 9-C3, rock is as shallow as 6 ft below the surface at the start of the line, but about 25 ft deep at the end of the line.

The seismic data for Site 9 were also imaged as a 3D perspective view that can be helpful for visualization and quality control of the results where the lines intersect. Additionally, this 3D model can be helpful for observing site-wide trends in the results. The view looking from the east to the west is shown in Figure 4.

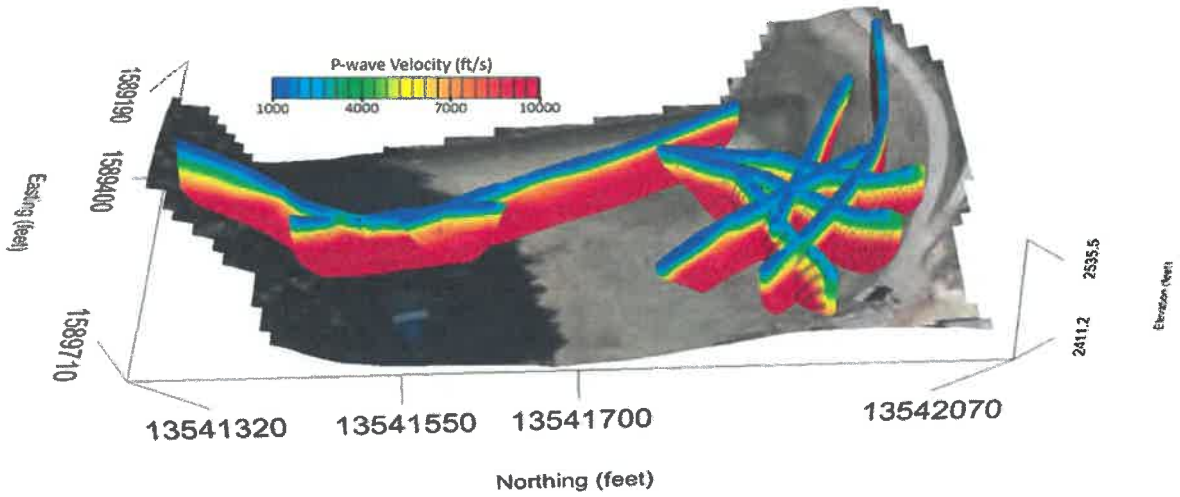

Figure 4: 3D Perspective View of Site 9 Seismic Refraction Results

3.3 Electrical Resistivity Imaging Data Collection and Analysis

Schnabel Personnel conducted an ERI survey on the right abutment at Site 9. A total of 1,350 lf of ERI data were collected using 56 electrodes with a 1.5-m spacing. Data was collected using an AGI Supersting resistivity meter.

The ERI data processing was conducted using EarthImager Version 2.4.4 from AGI. The processing involved Schnabel personnel loading all ERI measurements, filtering out noisy data points, incorporating elevations into the data, and generating a model that matches the observed data via tomographic inversion.

3.4 Electrical Resistivity Imaging Results

The ERI results are shown in Figure A-4 in Appendix A. The ERI results are displayed using color-coded cross-sections with key contours overlaid. The location of boreholes located near the lines are noted; the depth to rock is noted from the corresponding borehole logs. On each map there is a plan-view that shows the locations of the boreholes and resistivity lines. The symbols along each line are labeled to correspond to the horizontal axis of each line.

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Generally, increased soil moisture levels will lead to a decrease in electrical resistivity; however, grain size and material type can also affect resistivity values. Generally, sands and gravels will have a higher resistivity value than silt and clay. Therefore, lower resistivity values are typically indicative of finer materials or wetter materials, where higher resistivity values are typically indicative of coarser or drier materials. When evaluating seepage pathways, both high and low values could be of interest. The low resistivity zones could indicate zones of increased saturation caused by seepage. High resistivity could indicate zones of sand and gravel with higher hydraulic permeability that could be allowing seepage.

The four ERI lines show a wide range of resistivity values. Line 9-D shows a conductive zone underlying the full line. Based on the borehole information from B-34, the top of this conductive zone corresponds to the top of the water table and may not necessarily be related to seepage. The low resistivity zone beneath the full line may be related to the former location of the stream channel, which is reportedly in this approximate location. The low resistivity zone at depth beneath Line 9-G between a downline distance of 60 to 120 ft is also in the approximate same location as the former stream channel. This area may be more highly fractured and permeable than the surrounding bedrock areas.

On Line 9-D there is a smaller low resistivity feature of interest in the embankment that is located at EL 2500 at the start of the line that daylights at the historic wet area observed on the downstream slope at a downline distance of about 100 ft. During the ERI survey, we observed wet soils downstream of this, at a downline distance of about 110 ft. We interpret this low resistivity zone to be a potential source of seepage, though the source appears to be either the reservoir or groundwater. Where the wet area was observed is on top of a high resistivity zone of material; we infer from this that the seeping water daylights at a downline distance of about 100 ft, and then flows on the ground surface above the high resistivity material causing noticeable wet and soft soils just downstream. It should also be noted that the locations where this feature would intersect with SR Lines 9-C2 (140 ft) and 9-C3 (40 ft), both seismic profiles show an increase in near surface velocity, as would be expected if the near surface materials at those points have higher water saturation or an isolated zone of shallow bedrock.

Although not as clear in Line 9-D, on Line 9-E there is an interruption in the highly resistive surface that occurs between about 70 and 90 ft down that indicates a somewhat similar, if more subdued, anomaly as seen on Line 9-D. This feature could also be related to the same seepage observed on Line 9-D in the embankment. The historic zone of wetness on the embankment ends between Lines 9-D and 9-E, and the subtle, low resistivity zone in Line 9-E could be a 3D effect from wet embankment material, or it could be a zone that has a lesser amount of seepage.

Line 9-E shows a low resistivity zone at depth that we interpret to indicate groundwater, which is also observed at the intersection with Line 9-G. This low resistivity zone does not appear to daylight on the embankment at this location, but it could indicate a seepage pathway from the abutment to the historic wetland area.

The results from Line 9-G show a somewhat similar feature at about EL 2480 between the start of the line and 120 ft down the line. This line runs parallel to the embankment, so it is not possible to tell if this extends upward into the embankment.

Line 9-F shows generally higher resistivity value than the rest of the lines and shows no features that clearly indicate potential seepage. Most of the line is located on the native abutment materials, which may account for the higher resistivity values.

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As with the SR results, we can display the ERI results in a 3D perspective view (Figure 5). Due to software limitations, the color scale for 3D is not a direct match to the 2D images shown in Figure A-4; however, the trends discussed are visible, including the potential seepage pathway seen in Lines 9-D and 9-E.

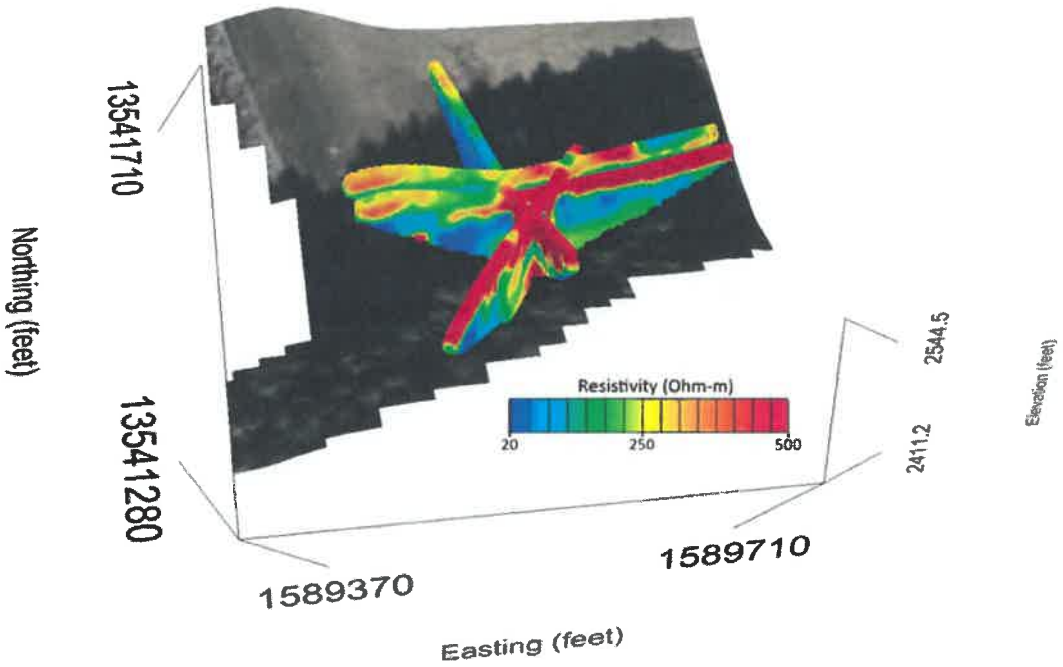

Figure 5: 3D Perspective View of ERI Results, Looking from the South to the North

4.0 SITE 14 GEOPHYSICAL INVESTIGATION

The Brush Creek Watershed Site 14 Dam is in Mercer County, West Virginia, almost 9 miles northeast of the City of Bluefield and about 4 miles southwest of the City of Princeton on the North Fork of Brush Creek (see Figure 1). The site is primarily grassy, open area along the embankment, although the southwest portion of the site is wooded (Figure 6).

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Figure 6: Site Conditions at Site 14 at Time of Data Collection

A total of 1,135 lf of SR was collected on April 7, 2022, along Lines 14-A, 14-B, 14-C, and 14-D, as shown on Figures 7 and B-1. Additionally, the GPS data for each line are given in Appendix B, Table B1. Data collection took place within a day of a rainfall that, according to Weather Underground, was about an inch combined between April 6 and April 7, 2022.

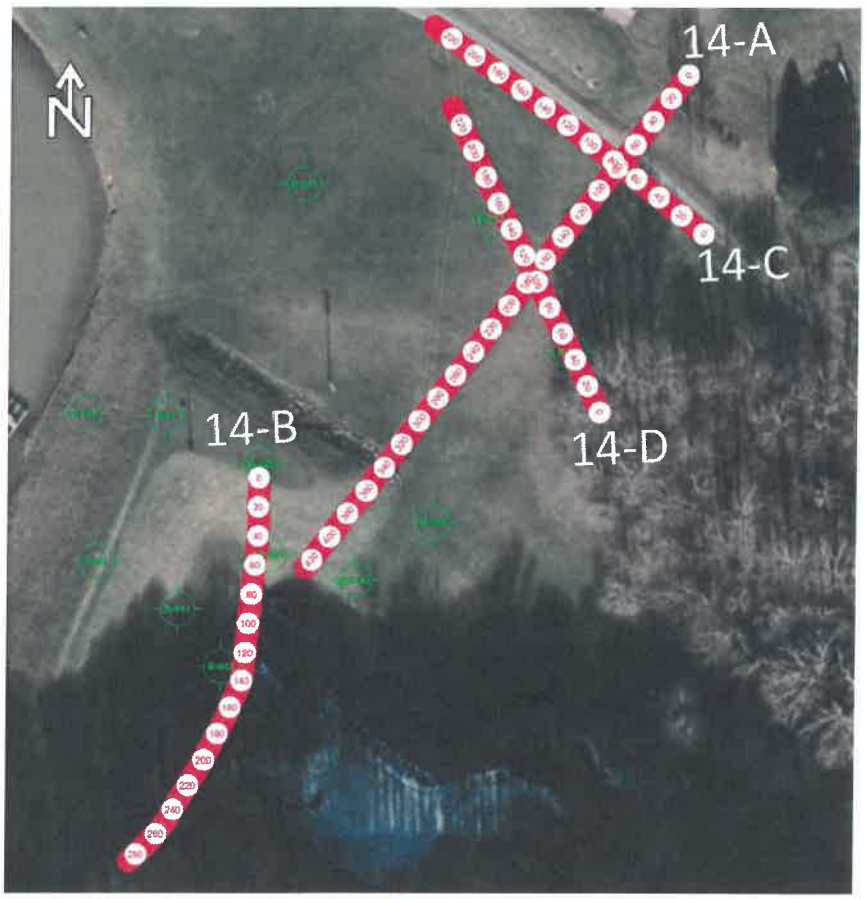

Figure 7: Site 14 Line Layout.

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4.1 Seismic Refraction Data Collection and Analysis

Schnabel personnel conducted an SR survey to evaluate the depth to rock and rippability of rock at the proposed auxiliary spillway cutoff walls and toe drains. Two Geometrics Geode seismographs were used with up to 48 10-Hz geophones with a geophone spacing of 5 ft. SR traverses extended beyond the length of the proposed survey lines, where accessible, to provide the necessary depth coverage along the traverses.

Seismic data processing was conducted using Rayfract Version 4 from Intelligent Resources. The processing involved Schnabel personnel manually picking first-arrival times of seismic energy, incorporating elevations into the data, and generating a model that matches the first arrivals. Gradational velocity changes are common in geologic environments with thicker zones of weathered and fractured bedrock, such as at this site; therefore, we performed a tomographic inversion to estimate these gradational changes in the P-wave velocities.

4.2 Seismic Refraction Results

The results from the SR survey for Site 14 are shown in Figure B-1 in Appendix B. The geologic units, as noted in logs of boreholes located near the lines are overlaid on the geophysical results. Generally, the 5,000 ft/s velocity contour line corresponds closest to the top of competent rock as noted in the borehole logs. It is important to understand that this value represents the top of interpreted rock, not the actual velocity of the rock itself, which may be higher due to the nature of tomographic inversions and because the bulk of the rock is generally more competent, and therefore likely has a higher velocity, than the disintegrated rock/rock interface.

On each figure there is a plan-view image that shows the locations of the boreholes and seismic lines. The symbols along each line are labeled to correspond to the horizontal axis of each line, which is referred to as the downline distance in the discussion of results below.

The results for Line 14-A (Figure B-1) show that top of rock, as represented by the 5,000 ft/s contour, is generally flat over the line length at a depth of about 18 to 20 ft. At a downline distance of about 30 to 80 ft there is a zone where the near surface soil velocity values increase from less than 2,500 ft/s to greater than 3,000 ft/s. Generally, this could be an indication of increased soil saturation, but, in this case, it also corresponds to the road that this line crosses and is possibly related to increased soil compaction related to the road construction.

The results for Line 14-B show more variation in the depth to rock. At the start of the line, the depth to rock is about 20 ft, which stays mostly stable until about 100 ft down the line, where there the depth to rock appears to be about 10 ft below the surface. From there, the depth to rock increases again to about 20 ft, before being as shallow as about 6 ft at the end of the line. There is a zone of lower velocity rock between about 130 and 170 ft downline. This could indicate a zone of increased fracturing or weathering within the rock.

The results for Line 14-C show that the top of rock is generally about 14 to 20 ft below the ground surface over the full line, and is shallowest at about 90 ft down the line.

The results from Line 14-D show that the depth to rock starts at about 25 ft deep on the southeast portion of the line, with the rock becoming shallower to the northwest, where it is only about 15 ft deep at the line end. However, the agreement between the depth to rock as estimated with the 5,000 ft/s contour does not

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agree well with the borehole logs from B-244 and B-242. This can be explained by the fact that B-242 notes bedrock as medium strong to very weak, moderately weathered to severely weathered sandstone, while B-244 shows strong to medium, fresh to slightly weathered shale. This change in lithology down the line makes estimating a single velocity value more challenging.

The seismic data for Site 14 were also imaged as a 3D perspective view that can be helpful for visualization and quality control of the results where the lines intersect. Additionally, this 3D model can be helpful for observing site-wide trends in the results. The view looking from the east to the west is shown in Figure 8.

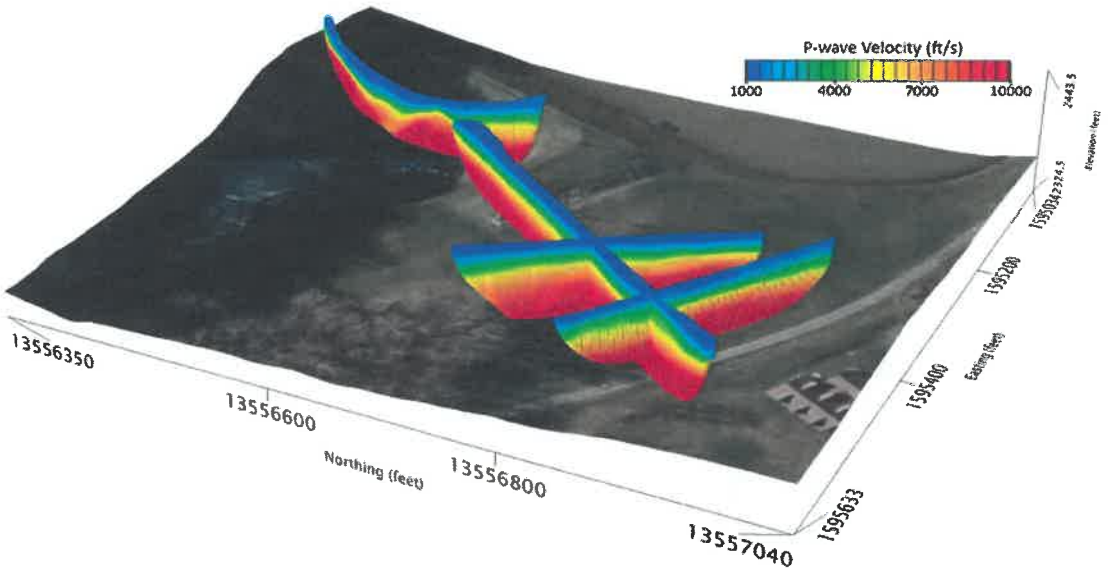

Figure 8: 3D Perspective View of Site 14 Seismic Refraction Results

5.0 SITE 15 GEOPHYSICAL INVESTIGATION

The Brush Creek Watershed Site 15 Dam is located in Mercer County, West Virginia, about 9.5 miles northeast of the City of Bluefield and about 6 miles southwest of the City of Princeton on the North Fork of Brush Creek (see Figure 1). The site is partially grassy, open area along the embankment and spillway, but part of Line 15-Alt and 15-A were located within heavy brush, including heavy multi-floral rose that required extensive clearing before data collection could be conducted (See Figure 9).

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Figure 9: Site Conditions at Site 15 at Time of Data Collection

A total of 1,020 lf of SR data were collected from April 4 through 6, 2022, along Lines 15-A, 15-B1, 15-B2, 15-Alt, and 15-E as shown on Figures 10 and C-1. Additionally, the GPS data for each line is given in Table C1 in Appendix C. Historical weather data from Weather Underground shows that there was about 1 inch of rainfall on ~~May~~ 27.

Figure 10: Site 15 Line Layout Map

5.1 Seismic Refraction Data Collection and Analysis

Schnabel personnel conducted an SR survey to evaluate the depth to rock and rippability of rock at the proposed auxiliary spillway cutoff walls and toe drains. Two Geometrics Geode seismographs were used with up to 48 10-Hz geophones with a geophone spacing of 5 ft for the embankment lines (Lines 15-B1

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and 15-B2) and 2.5 ft for the spillway lines (Lines 15-Alt, 15-E, and 15-A). SR traverses extended beyond the length of the proposed survey lines, where accessible, to provide the necessary depth coverage along the traverses.

Seismic data processing was conducted using Rayfract Version 4 from Intelligent Resources. The processing involved Schnabel personnel manually picking first-arrival times of seismic energy, incorporating elevations into the data, and generating a model that matches the first arrivals. Gradational velocity changes are common in geologic environments with thicker zones of weathered and fractured bedrock, such as at this site; therefore, we performed a tomographic inversion to estimate these gradational changes in the P-wave velocities.

5.2 Seismic Refraction Results

The results from the SR survey for Site 15 are shown in Appendix C, Figure C-1. The SR results are displayed using color-coded cross-sections with key velocity contours overlaid. The geologic units, as noted in logs of boreholes located near the lines are overlaid on the geophysical results.

On each figure there is a plan-view image that shows the locations of the boreholes and seismic lines. The symbols along each line are labeled to correspond to the horizontal axis of each line, which is referred to as the downline distance in the discussion of results below.

Comparing the SR results to the borehole logs indicates there is variation in the rock type, weathering, and strength that affects estimating a velocity contour to represent top of rock. For BH-257, located near the intersection of Lines 15-Alt and 15-E in the auxiliary spillway, the top of rock corresponds to a velocity value of 3,000 ft/s; however, for B-561 and AP-351 located in the embankment, the top of rock corresponds to a velocity value of 5,000 ft/s. The rock encountered at BH-257 is described as very weak, while the rock encountered in B-651, for example, is described as moderately strong. Therefore, within the auxiliary spillway, we interpret the 3,000 ft/s contour line as an estimate for the top of rock, while in the embankment the 5,000 ft/s contour is our estimate for top of rock. It is important to understand that these values represent the top of interpreted rock, not the actual velocity of the rock itself, which may be higher due to the nature of tomographic inversions and because the bulk of the rock is generally more competent, and therefore likely has a higher velocity, than the disintegrated rock/rock interface.

The results for Line 15-A show a generally flat laying velocity structure, with a depth to the 3,000 ft/s contour being about 8 to 15 ft and to the 5,000 ft/s contour being about 20 ft. There are no boreholes close to this line, so it is unknown if the 5,000 ft/s or 3,000 ft/s contour is best used as an estimate for top of rock; however, based on intersecting SR lines from close borings, we recommend considering the 3,000 ft/s contour to represent top of rock in the auxiliary spillway.

The results for Line 15-Alt indicate that rock is very shallow along the top of the auxiliary spillway (southwest portion of the line), and then gets deeper as the line extends down the hill. Assuming the correlation with B-257 holds for the line length, the 3,000 ft/s contour represents the top of rock along Line 15-Alt. There is thicker, low velocity material on the slope of the hillside compared to that at the top (start of the line) or very bottom (end of the line), ranging from about 5 to 14 ft based on the 3,000 ft/s contour. It should be noted that Line 15-Alt extends down a steep slope and could encounter different rock conditions at the bottom of the slope than at the top, as observed elsewhere on this site.

The results for Line 15-E show that the top of rock, as defined by the 3,000 ft/s contour, varies between 6 ft deep on the northeast side and up to 12 ft deep on the southeast side.

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The results from Lines 15-B1 and 15-B2, the lines located along the toe of the embankment, show that rock is generally about 10 to 16 ft and 15 to 18 ft below the ground surface for Lines 15-B1 and 15-B2 respectively, based on the 5,000 ft/s contour line. At about 160 ft down the line on Line 15-B1, the velocity at the surface increases to over 2,000 ft/s, indicating possible increased surface moisture at that location.

The seismic data for Site 15 were also imaged as a 3D perspective view that can be helpful for visualization and quality control of the results where the lines intersect. Additionally, this 3D model can be helpful for observing site-wide trends in the results. The view looking from the southeast to the northwest is shown in Figure 11.

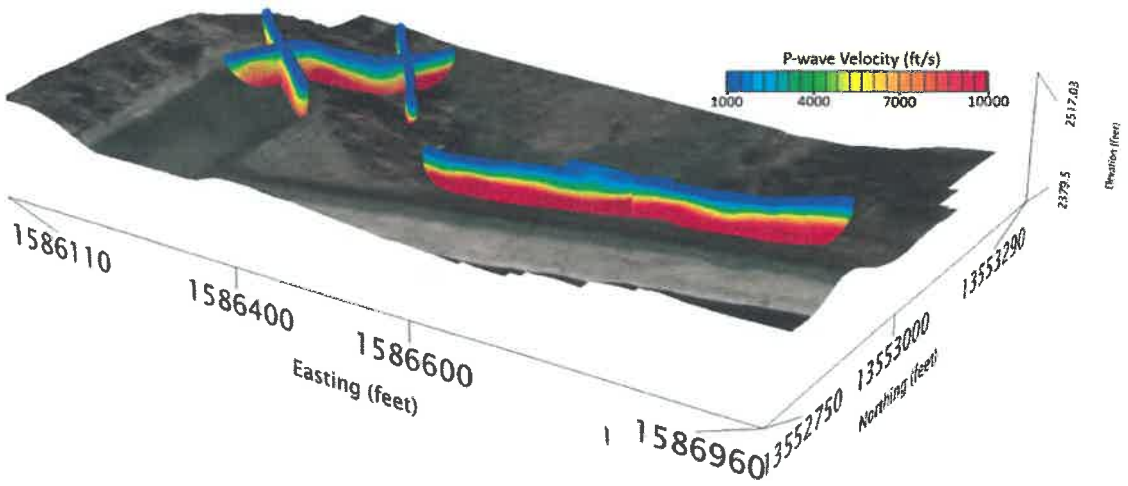

Figure 11: 3D Perspective View of Site 15 Seismic Refraction Results

6.0 LIMITATIONS

The data provided in this report are based on the information obtained from geophysical surveys performed by Aterra-Schnabel JV. The report also includes other physical data and information as indicated in investigations and work by others. Conditions at the sites may vary between the discrete locations observed at the time of our field investigations, the investigations by others, and from the methods and equipment used to conduct the respective subsurface investigations. The nature and extent of variations and physical properties may not become evident until future construction and/or additional investigation activities.

We have endeavored to complete the services identified herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions as this project. No other representation, express or implied, is included or intended, and no warranty or guarantee is included or intended in this report or other instrument of service.

Results produced by the SR method are limited to the inherent physics of seismic waves traveling through earth materials. These limitations include: (1) the fact that material boundaries require a contrast in seismic velocity to be defined by the method; (2) low velocity materials cannot be identified below high velocity materials; (3) modeling thin dipping beds may look like a smooth gradational blurring of these boundaries or may be undulating; (4) assumptions that the seismic ray-paths are traveling below the

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seismic line at the ground surface, and not along a faster out-of-plane pathway; and (5) non-uniqueness, meaning that earth materials are not defined by a particular seismic velocity, differing materials may have the same velocity, and multiple conditions can produce the same results. Additional factors that affect the correlation of seismic refraction results with subsurface conditions include the resolution, which is based on the line spacing; geophone and shot spacing; and the amount of noise (traffic noise, wind, rain, or other vibrational energy sources) in the seismic data, which introduces subjectivity in selecting the data for input into the model.

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APPENDIX A

SITE 9 GEOPHYSICAL INVESTIGATION RESULTS AND DATA

Figure A-1: Site 9 – A Lines Seismic Refraction Results
Figure A-2: Site 9 – B Lines Seismic Refraction Results
Figure A-3: Site 9 – C Lines Seismic Refraction Results
Figure A-4: Site 9 – ERI Results
Table A-1: GPS Information for Site 9

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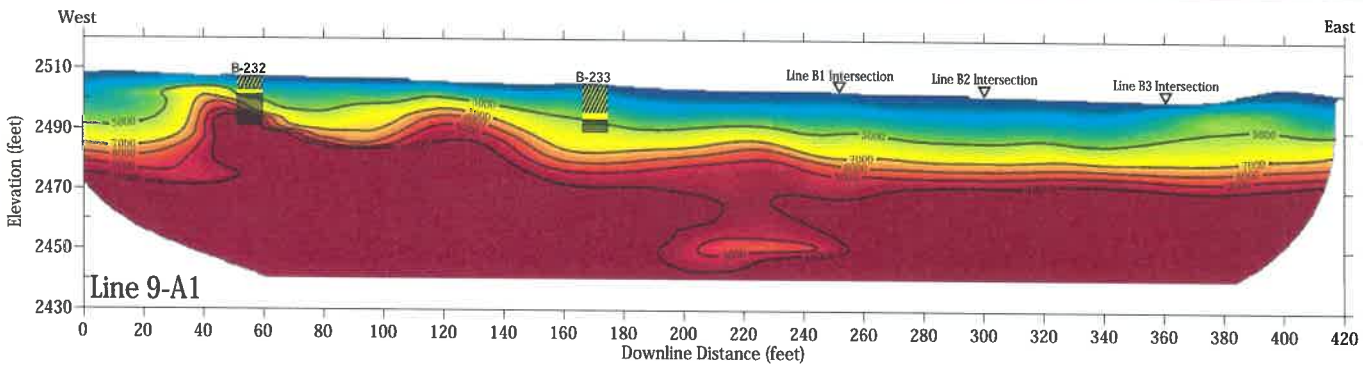
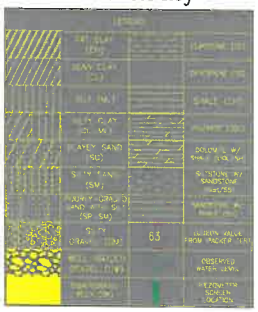
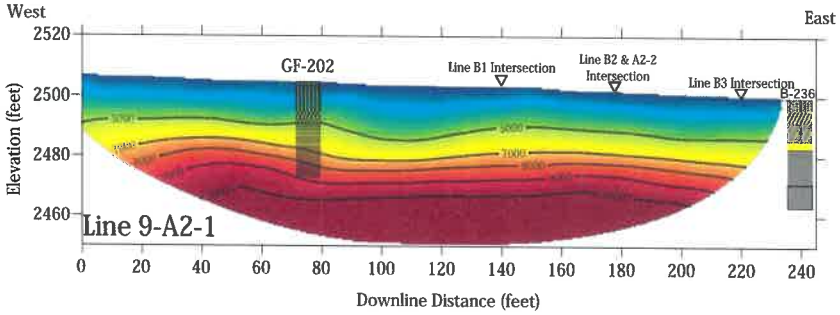
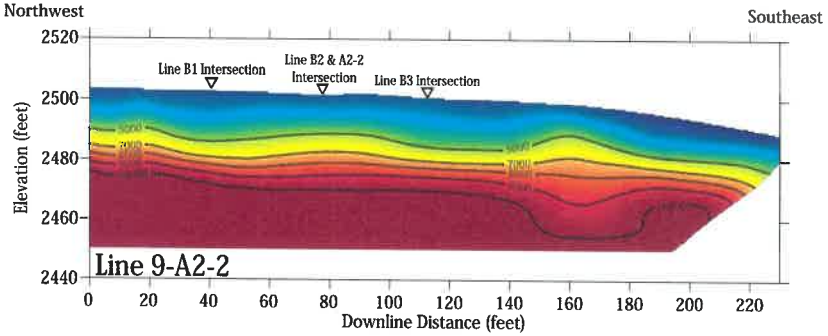




Schnabel Boreholes

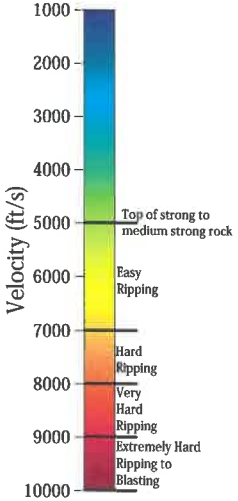
Gennett Fleming Boreholes

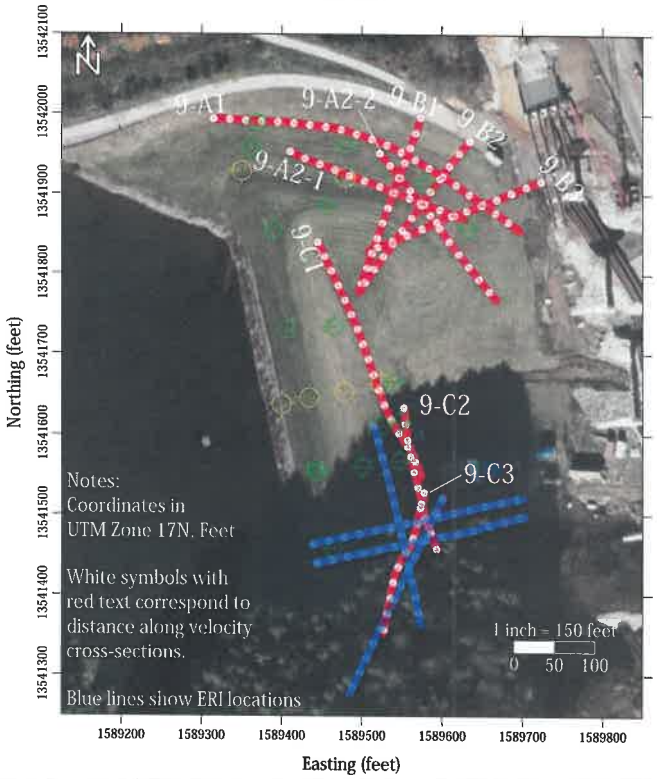




Seismic Velocity Values and Interpretations

Rippability Estimates from Table 4-27 of NRCS National Engineering Handbook





Seismic Profile Scale

1 inch = 40 feet

0 10 20 30 40

Key

Line intersections ▽

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Site 9 - A Lines
Seismic Refraction

FIGURE A-1

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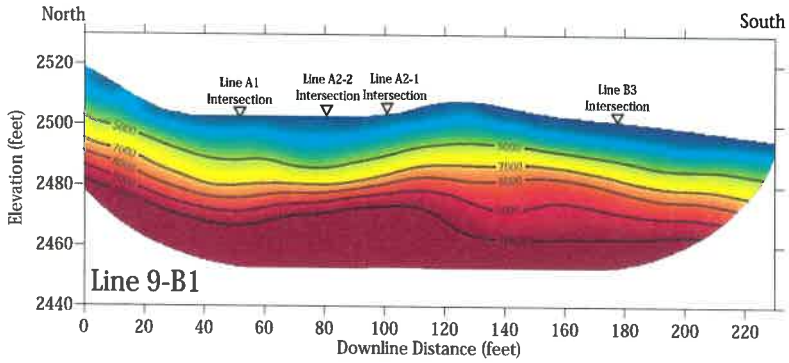
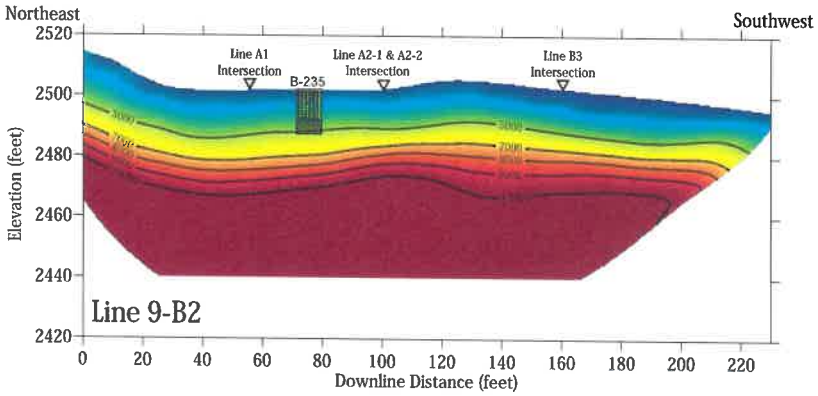
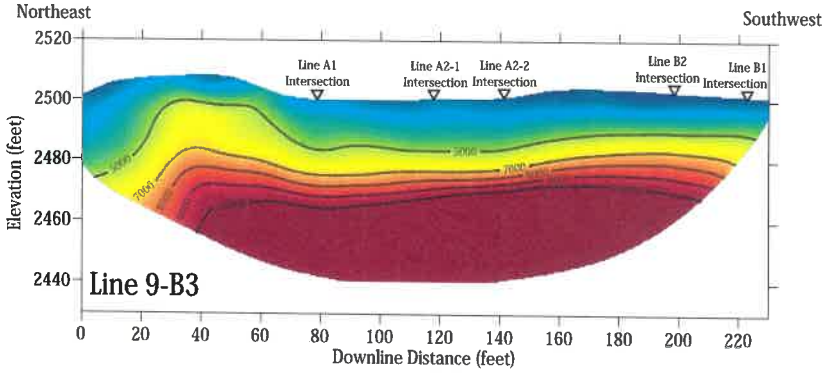
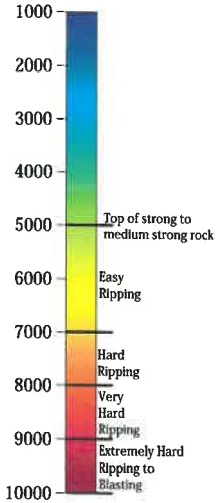






Seismic Velocity Values and Interpretations

Rippability Estimates from Table 4-27 of NRCS National Engineering Handbook



Key

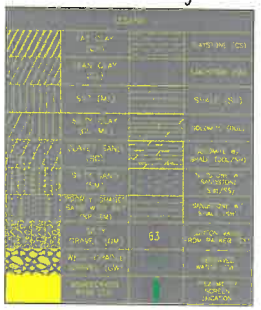
Line intersections ▽

Seismic Profile Scale

1 inch = 40 feet

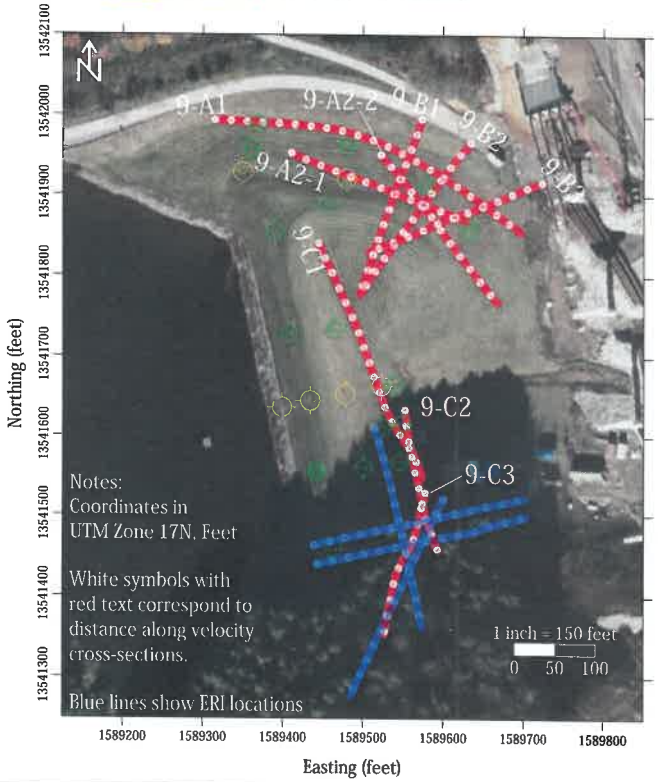
0 10 20 30 40

Borehole Key



Schnabel Boreholes

Gennett Fleming Boreholes



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Site 9 - B Lines
Seismic Refraction
FIGURE A-2

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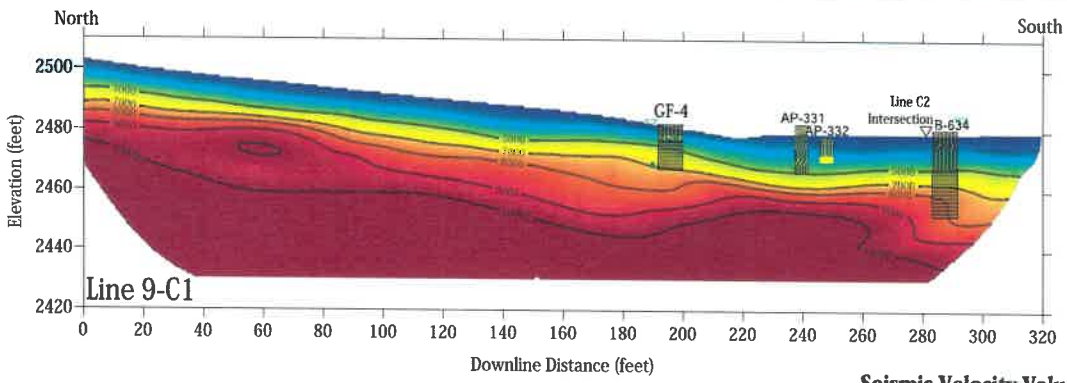
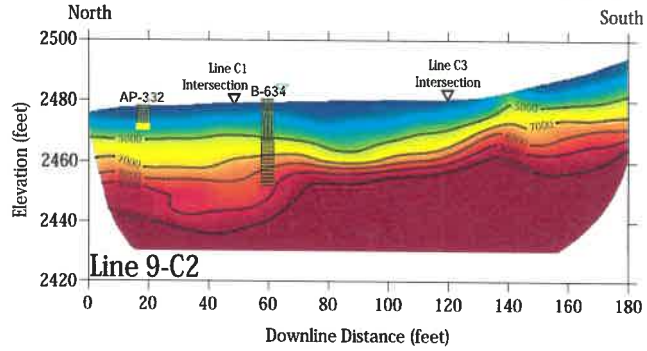
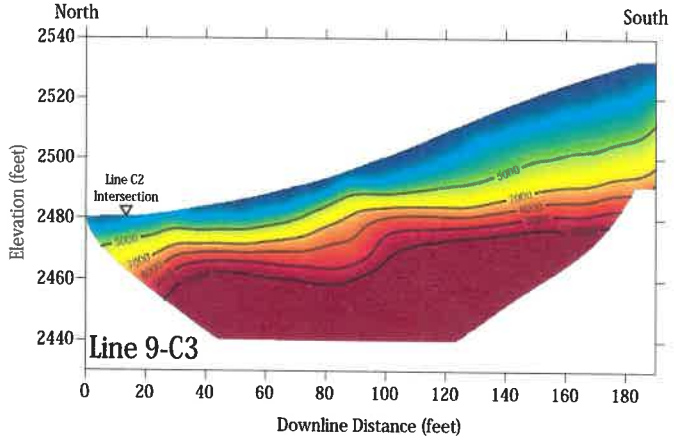
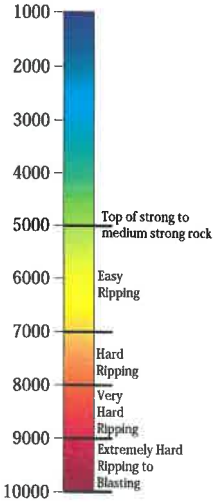






Seismic Velocity Values and Interpretations

Rippability Estimates from Table 4-27 of NRCS National Engineering Handbook



Seismic Profile Scale

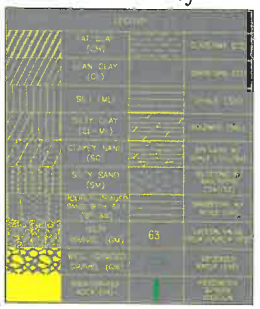
1 inch = 40 feet

0 10 20 30 40

Key

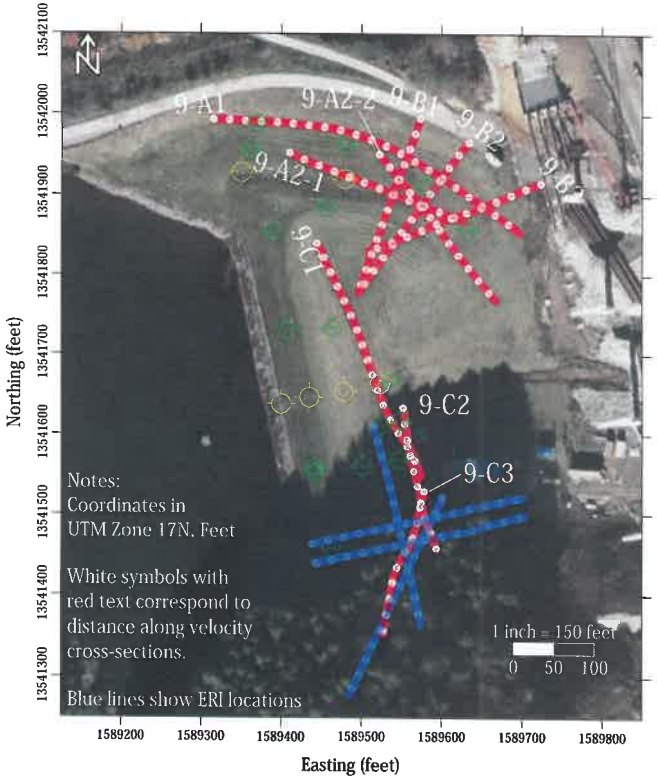
Line intersections ▽

Borehole Key



Schnabel Boreholes

Gennett Fleming Boreholes



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Site 9 - C Lines
Seismic Refraction
FIGURE A-3

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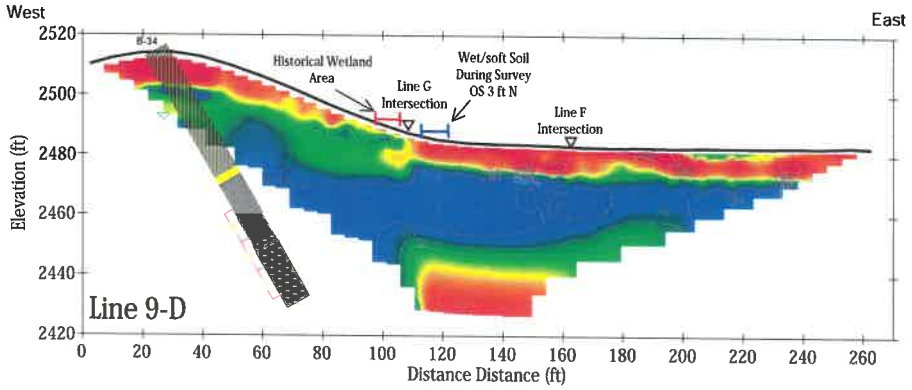
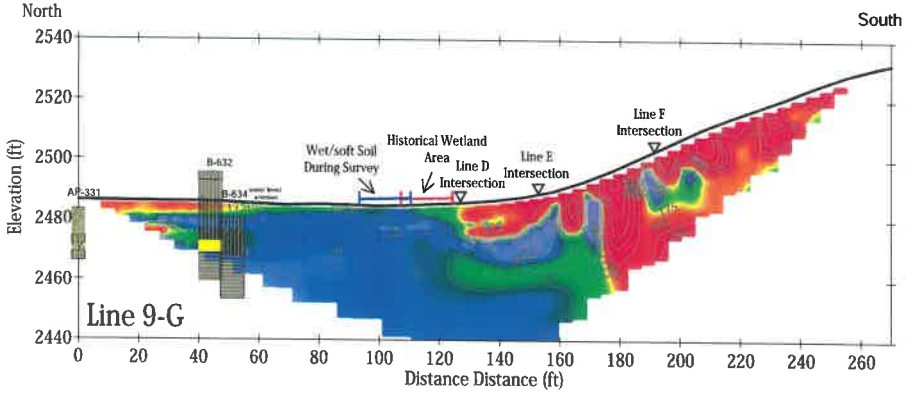
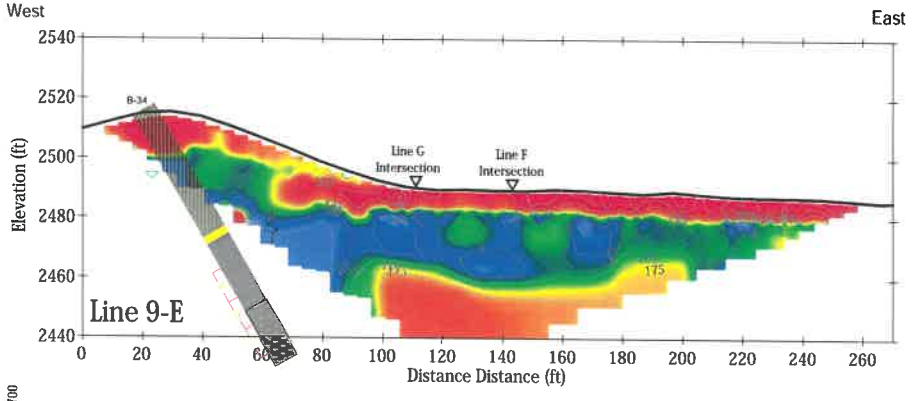
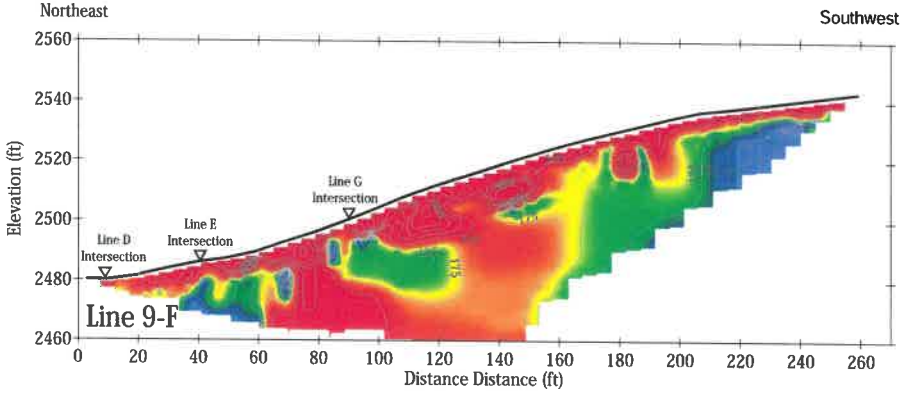
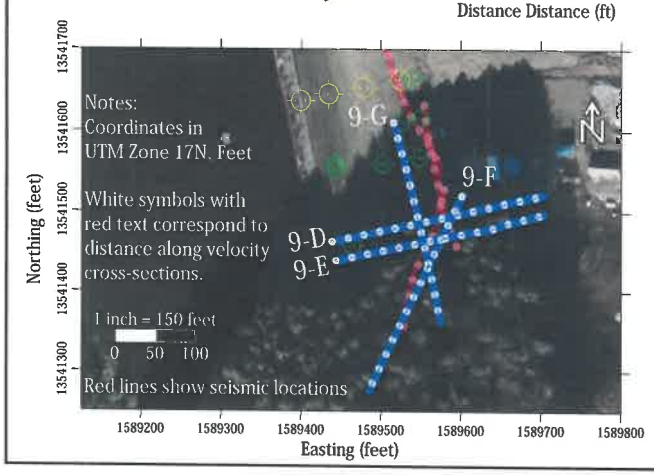
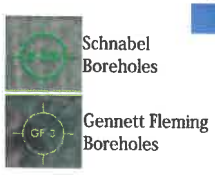












ERI Profile Scale

1 inch = 40 feet

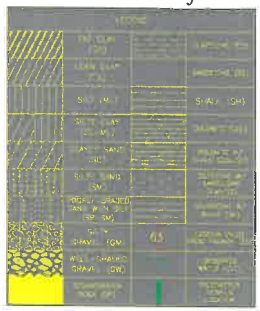
0 10 20 30 40

Resistivity Generalized Interpretation

Finer soil and/or wetter soil or rock — Coarser soil and/or drier soil or rock

30 100 300

Borehole Key



Key

- Line intersections
- Historical Wetland Area
- Wet/Soft Soil During Survey

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Mercer County, WV
SCHNABEL PROJECT NO. 18C35013.020

Site 9 - ERI Results

FIGURE A-4

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APPENDIX B

SITE 14 GEOPHYSICAL INVESTIGATION RESULTS AND DATA

Figure B-1: Site 14 – Seismic Refraction Results
Table B-1: GPS Information for Site 14

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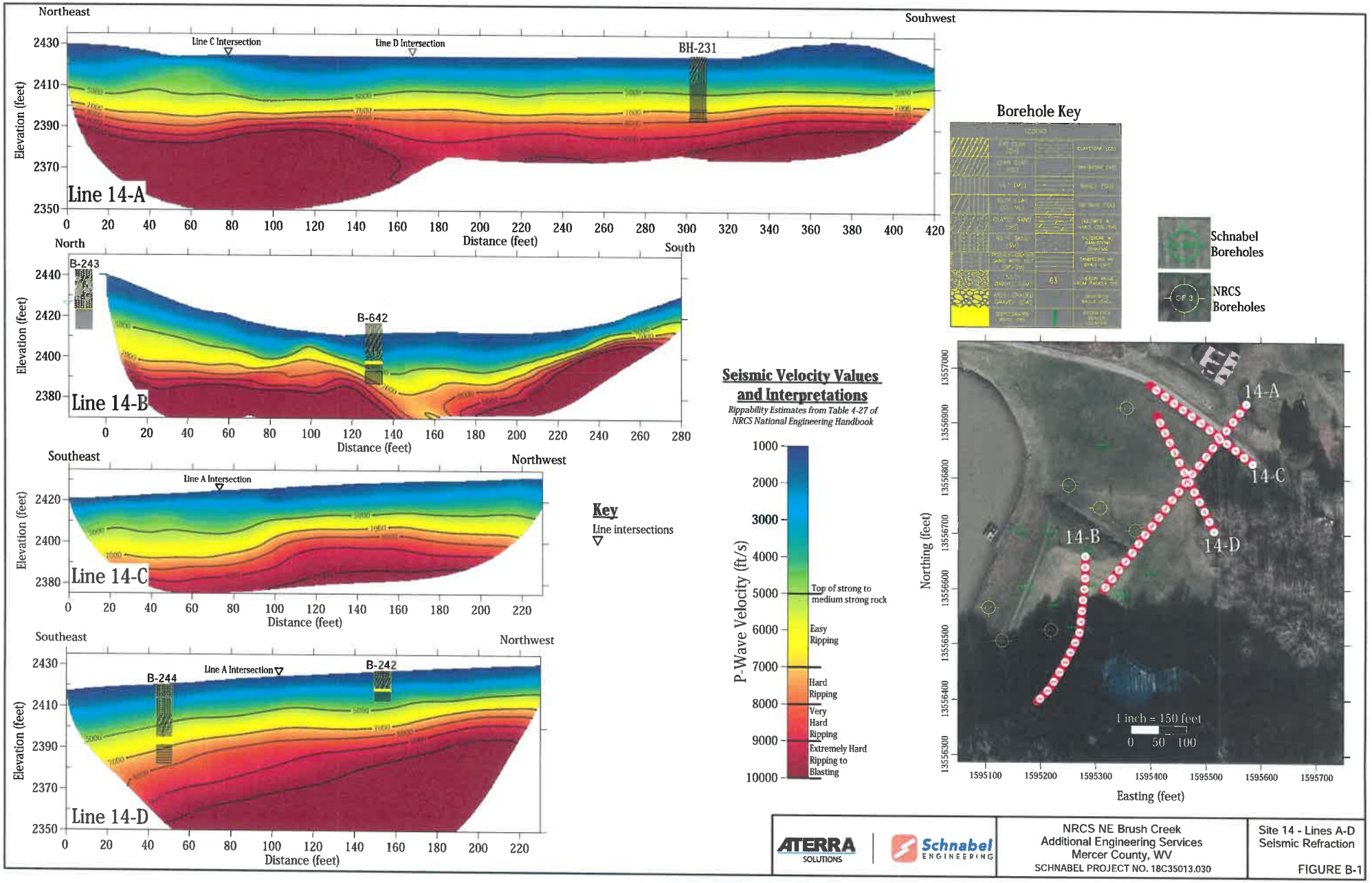

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Mercer County, WV
SCHNABEL PROJECT NO. 18C35013.030

Site 14 - Lines A-D
Seismic Refraction

FIGURE B-1

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APPENDIX C

SITE 15 GEOPHYSICAL INVESTIGATION RESULTS AND DATA

Figure C-1: Site 15 – Seismic Refraction Results
Table C-1: GPS Information for Site 15

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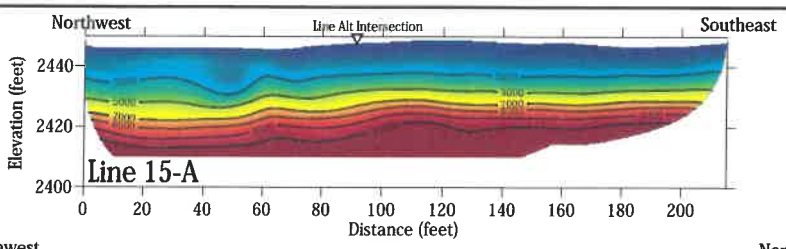
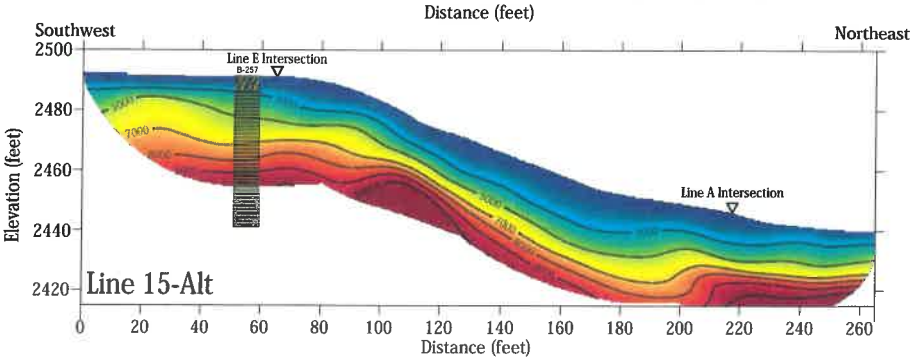
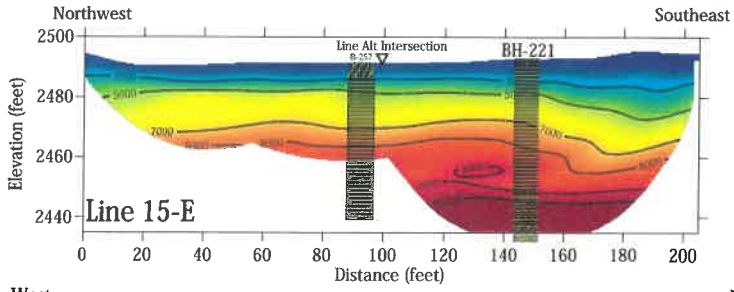
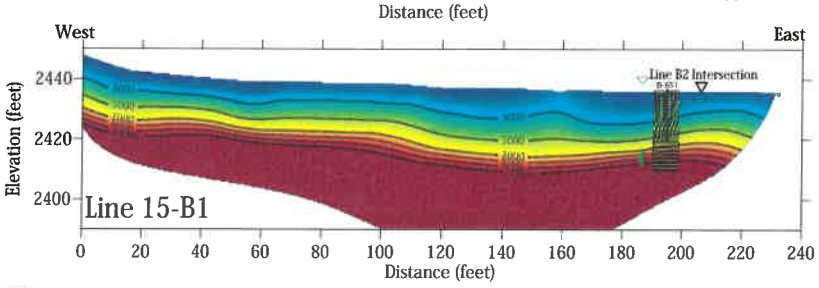
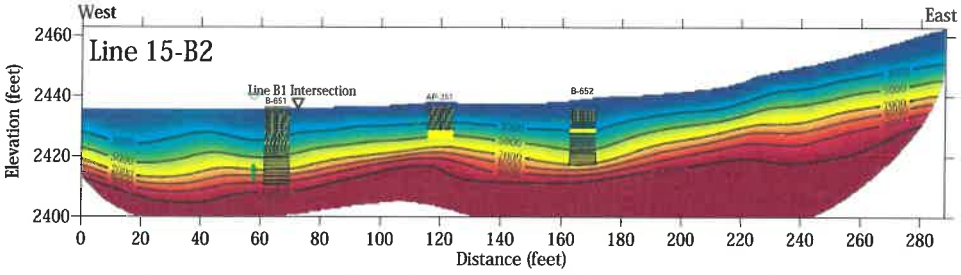
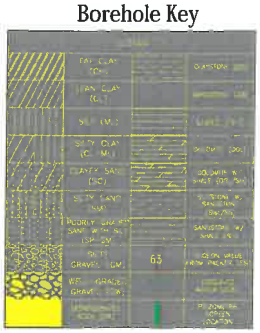












Key

Line intersections ▽

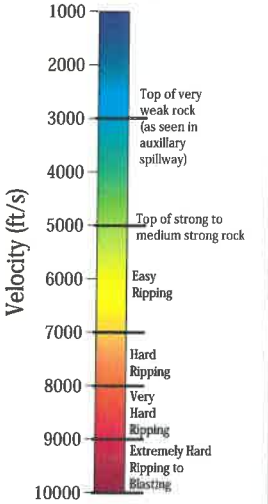
Seismic Profile Scale

1 inch = 40 feet

0 10 20 30 40

Seismic Velocity Values and Interpretations

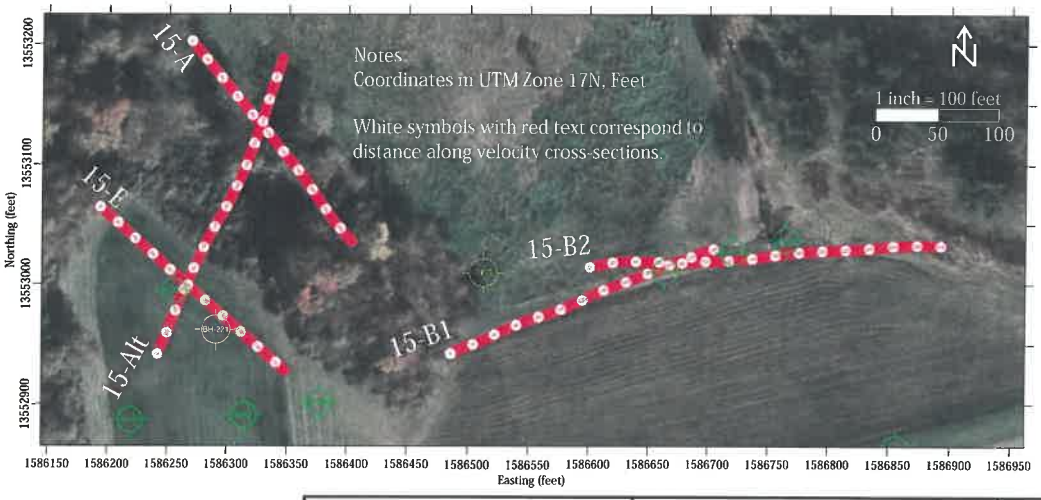
Rippability Estimates from Table 4-27 of NRCS National Engineering Handbook



Schnabel Boreholes

Gennett Fleming Boreholes

NRCS Boreholes



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NRCS NE Brush Creek
Additional Engineering Services
Mercer County, WV
SCHNABEL PROJECT NO. 18C35013.040

Site 15
Seismic Refraction
FIGURE C-1

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Summary of Water Levels in Observations at Brush Creek Site 15 Normal Pool EL (ft) 2489.5

Boring ID	Ground Surface Elevation (ft)	Depth to Water (ft)	Elevation of Water (ft)	Date of Water Level Reading	Notes	Event	Reservoir Level
B-51A	2508.1	68.7	2439.5	3/20/2019 11:24		Observation Well	
B-51A	2508.1	56.7	2451.4	4/3/2019 11:20		Observation Well	
B-51A	2508.1	62.0	2446.1	4/17/2019 15:57		Observation Well	
B-51A	2508.1	70.9	2437.2	5/1/2019 11:25		Observation Well	
B-51A	2508.1	71.6	2436.5	5/6/2019 12:20		Observation Well	
B-51A	2508.1	72.8	2435.3	5/9/2019 12:15		Observation Well	
B-51A	2508.1	72.4	2435.7	5/13/2019 12:14		Observation Well	
B-51A	2508.1	46.1	2462.0	9/29/2021 18:15		Observation Well	Low Pool (~8ft.)
B-51A	2508.1	48.1	2460.0	2/1/2022 11:30		Observation Well	~10' low
B-51A	2508.1	47.2	2460.9	5/12/2022 0:00		Observation Well	~0.5' high
B-51A	2508.1	46.2	2461.9	2/7/2023 0:00		Observation Well	
B-51A	2508.1	46.5	2461.7	10/1/2023 0:00		Observation Well	
B-51A	2508.1	46.3	2461.8	1/30/2024 0:00		Observation Well	Normal
B-51A	2508.1	46.3	2461.8	4/29/2024 0:00		Observation Well	Normal
B-51A	2508.1	46.2	2461.9	7/24/2024 0:00		Observation Well	Pool Level Low
B-651	2436.8	11.4	2425.4	3/18/2019 14:37		Encountered	
B-651	2436.8	0.0	2436.8	3/18/2019 17:02		Completion	
B-651	2436.8	0.2	2436.6	3/19/2019 7:30		After Drilling	
B-651	2436.8	-0.7	2437.5	3/19/2019 11:39	Artesian	Casing Pulled	
B-651	2436.8	-1.1	2437.9	4/3/2019 12:00	Artesian	After Drilling	
B-651	2436.8	-1.5	2438.3	4/17/2019 15:44	Artesian	Observation Well	
B-651	2436.8	-2.4	2439.2	5/6/2019 13:14	Artesian	Observation Well	
B-651	2436.8	-2.1	2438.9	5/6/2019 17:15	Artesian	Observation Well	
B-651	2436.8	-2.1	2438.9	5/9/2019 14:00	Artesian	Observation Well	
B-651	2436.8	-2.7	2439.5	5/13/2019 11:57	Artesian	Observation Well	
B-651	2436.8	0.0psi @guage	-	9/29/2021 18:00		Observation Well	Low Pool (~8ft.)
B-651	2436.8	0.0psi @guage	-	2/1/2022 11:30		Observation Well	
B-651	2436.8	0.0psi @guage	-	5/12/2022 0:00		Observation Well	~0.5' high
B-651	2436.8	0.0psi @guage	-	2/7/2023 0:00		Observation Well	Normal
GF-1D	2507.4	33.5	2473.9	3/11/2019 17:40		Observation Well	
GF-1D	2507.4	33.4	2474.0	3/16/2019 13:50		Observation Well	
GF-1D	2507.4	33.7	2473.7	3/19/2019 8:22		Observation Well	

Summary of Water Levels in Observations at Brush Creek Site 15 Normal Pool EL (ft) 2489.5

Boring ID	Ground Surface Elevation (ft)	Depth to Water (ft)	Elevation of Water (ft)	Date of Water Level Reading	Notes	Event	Reservoir Level
GF-1D	2507.4	34.6	2472.8	4/3/2019 13:18		Observation Well	
GF-1D	2507.4	33.9	2473.5	4/17/2019 15:30		Observation Well	
GF-1D	2507.4	32.8	2474.6	5/6/2019 12:54		Observation Well	
GF-1D	2507.4	38.3	2469.1	8/31/2021 10:35		Observation Well	Low Pool
GF-1D	2507.4	39.6	2467.8	9/29/2021 17:30		Observation Well	Low Pool (~8ft.)
GF-1D	2507.4	41.9	2465.5	2/1/2022 11:40		Observation Well	~10' low
GF-1D	2507.4	35.9	2471.5	6/9/2022 12:00		Observation Well	Normal
GF-1D	2507.4	36.1	2471.3	2/7/2023 0:00		Observation Well	Normal
GF-1D	2507.4	37.4	2470.0	10/1/2023 0:00			
GF-1D	2507.4	37.2	2470.2	1/30/2024 0:00		Observation Well	Normal
GF-1D	2507.4	37.4	2470.0	4/29/2024 0:00		Observation Well	Normal
GF-1D	2507.4	37.4	2470.0	7/24/2024 0:00		Observation Well	Pool Level Low
GF-1S	2507.4	47.2	2460.2	3/11/2019 17:40		Observation Well	
GF-1S	2507.4	47.6	2459.8	3/16/2019 13:51		Observation Well	
GF-1S	2507.4	48.5	2458.9	3/19/2019 8:28		Observation Well	
GF-1S	2507.4	47.8	2459.6	4/3/2019 13:14		Observation Well	
GF-1S	2507.4	21.4	2486.0	4/17/2019 15:30		Observation Well	
GF-1S	2507.4	30.5	2476.9	5/6/2019 12:57		Observation Well	
GF-1S	2507.4	24.2	2483.2	8/31/2021 10:35		Observation Well	Low Pool
GF-1S	2507.4	44.1	2463.3	9/29/2021 17:30		Observation Well	Low Pool (~8ft.)
GF-1S	2507.4	46.0	2461.4	2/1/2022 11:40		Observation Well	~10' low
GF-1S	2507.4	42.6	2464.8	6/9/2022 12:00		Observation Well	Normal
GF-1S	2507.4	29.9	2477.5	2/7/2023 0:00		Observation Well	Normal
GF-1S	2507.4	30.3	2477.2	10/1/2023 0:00			
GF-1S	2507.4	30.1	2477.3	1/30/2024 0:00		Observation Well	Normal
GF-1S	2507.4	30.3	2477.2	4/29/2024 0:00		Observation Well	Normal
GF-1S	2507.4	30.2	2477.2	7/24/2024 0:00		Observation Well	Pool Level Low
GF-2D	2476.5	33.1	2443.4	3/11/2019 17:50		Observation Well	
GF-2D	2476.5	33.3	2443.2	3/16/2019 13:53		Observation Well	
GF-2D	2476.5	33.2	2443.3	3/19/2019 9:10		Observation Well	
GF-2D	2476.5	33.0	2443.5	4/3/2019 12:20		Observation Well	
GF-2D	2476.5	33.3	2443.2	4/17/2019 15:35		Observation Well	

Summary of Water Levels in Observations at Brush Creek Site 15 Normal Pool EL (ft) 2489.5

Boring ID	Ground Surface Elevation (ft)	Depth to Water (ft)	Elevation of Water (ft)	Date of Water Level Reading	Notes	Event	Reservoir Level
GF-2D	2476.5	33.1	2443.4	5/6/2019 13:04		Observation Well	
GF-2D	2476.5	34.1	2442.4	8/31/2021 11:00		Observation Well	Low Pool
GF-2D	2476.5	33.9	2442.6	9/29/2021 17:40		Observation Well	Low Pool (~8ft.)
GF-2D	2476.5	36.3	2440.2	2/1/2022 11:40		Observation Well	~10' low
GF-2D	2476.5	35.3	2441.2	6/9/2022 12:10		Observation Well	Normal
GF-2D	2476.5	20.0	2456.5	2/7/2023 0:00		Observation Well	Normal
GF-2D	2476.5	20.6	2455.9	10/1/2023 0:00			
GF-2D	2476.5	20.4	2456.1	1/30/2024 0:00		Observation Well	Normal
GF-2D	2476.5	20.6	2455.9	4/29/2024 0:00		Observation Well	Normal
GF-2D	2476.5	20.6	2455.9	7/24/2024 0:00		Observation Well	Pool Level Low
GF-2S	2476.5	31.0	2445.5	3/11/2019 17:50		Observation Well	
GF-2S	2476.5	-	-	3/16/2019 13:54	Dry	Observation Well	
GF-2S	2476.5	-	-	3/19/2019 9:15	Dry	Observation Well	
GF-2S	2476.5	-	-	4/3/2019 12:25	Dry	Observation Well	
GF-2S	2476.5	-	-	4/17/2019 15:35	Dry	Observation Well	
GF-2S	2476.5	31.3	2445.2	5/6/2019 13:01		Observation Well	
GF-2S	2476.5	-	-	8/31/2021 11:00	Dry	Observation Well	Low Pool
GF-2S	2476.5	-	-	9/29/2021 17:40	Dry	Observation Well	Low Pool (~8ft.)
GF-2S	2476.5	-	-	2/1/2022 11:50	Dry	Observation Well	~10' low
GF-2S	2476.5	-	-	6/9/2022 12:10	Dry	Observation Well	Normal
GF-2S	2476.5	33.0	2443.5	2/7/2023 0:00		Observation Well	Normal
GF-2S	2476.5	33.7	2442.9	10/1/2023 0:00			
GF-2S	2476.5	33.6	2442.9	1/30/2024 0:00		Observation Well	Normal
GF-2S	2476.5	33.7	2442.9	4/29/2024 0:00		Observation Well	Normal
GF-2S	2476.5	33.6	2442.9	7/24/2024 0:00		Observation Well	Pool Level Low
GF-3	2437.8	0.3	2437.5	3/11/2019 18:00		Observation Well	
GF-3	2437.8	-0.5	2438.3	3/16/2019 13:56	Artesian	Observation Well	
GF-3	2437.8	-0.2	2438.0	4/3/2019 12:16	Artesian	Observation Well	
GF-3	2437.8	-0.8	2438.6	4/17/2019 15:40	Artesian	Observation Well	
GF-3	2437.8	-1.3	2439.1	5/6/2019 13:08	Artesian	Observation Well	
GF-3	2437.8	1.5	2436.3	8/31/2021 11:05		Observation Well	Low Pool
GF-3	2437.8	1.5	2436.3	9/29/2021 17:45		Observation Well	Low Pool (~8ft.)

Summary of Water Levels in Observations at Brush Creek Site 15 Normal Pool EL (ft) 2489.5

Boring ID	Ground Surface Elevation (ft)	Depth to Water (ft)	Elevation of Water (ft)	Date of Water Level Reading	Notes	Event	Reservoir Level
GF-3	2437.8	2.6	2435.2	2/1/2022 11:50		Observation Well	~10' low
GF-3	2437.8	2.3	2435.5	6/9/2022 12:20		Observation Well	Normal
GF-3	2437.8	1.8	2436.0	2/7/2023 0:00		Observation Well	Normal
GF-3	2437.8	1.9	2435.9	10/1/2023 0:00			
GF-3	2437.8	1.8	2436.0	1/30/2024 0:00		Observation Well	Normal
GF-3	2437.8	1.9	2435.9	4/29/2024 0:00		Observation Well	Normal
GF-3	2437.8	1.9	2435.9	7/24/2024 0:00		Observation Well	Pool Level Low

Title 210 – National Engineering Handbook

Part 645 – Construction Inspection

Appendix F – NRCS Supplement to OSHA Parts 1910 and 1926

Amended April 2025

645APPF.0 Introduction

A. NRCS construction contracts include the NRCS Supplement to Occupational Safety and Health Administration (OSHA) Parts 1910 and 1926. The supplement is also beneficial for other contracts where NRCS is involved, such as contracting local organization (CLO) contracts. It contains requirements not included in the OSHA requirements and emphasizes specific safety requirements covered in OSHA Parts 1910 and 1926.

B. The Contractor must comply with OSHA Parts 1910 and 1926, Construction Industry Standards and Interpretations, and with this supplement.

C. Requests for variances or waiver from this supplement must be made in writing to the Contracting Officer (CO) and include supporting evidence that every reasonable effort has been made to comply with the contractual requirements. A written request for a waiver or a variance must include:

1. A specific reference to the provision or standard in question.
2. An explanation justifying the waiver request.
3. The contractor's proposed alternative, including technical drawings, materials, or equipment specifications.

D. The CO will not approve any waiver or variance if it endangers any person. The contractor may not proceed under any requested revision of provision until the CO has given written approval. The contractor must hold and save harmless the NRCS from any claims or causes of action whatsoever resulting from the contractor or subcontractor proceeding under a waiver or approved variance. The CO cannot approve a waiver or variance for any OSHA requirements.

E. Obtain copies of OSHA Parts 1910 and 1926, Construction Industry Standards and Interpretations from:

1. https://www.osha.gov/laws-regs/regulations/standardnumber/1910
2. https://www.osha.gov/laws-regs/regulations/standardnumber/1926

645APPF.1 General Contractor Requirements

A. Safety Program. The contractor or subcontractor must demonstrate they have the facilities to conduct a safety program commensurate with the work under contract. The contractor must propose a comprehensive safety program in writing to the CO for approval before construction operations begin. The program must specifically state what provisions the contractor proposes to take for the health and safety of all employees, including subcontractors and rental equipment operators. The program must be site specific and provide details relevant to the work to be done, the hazards associated with the work, and the actions that will be necessary to minimize the identified hazards. The plan must include a job hazard analysis which describes the significant hazards to life, limb, and property inherent in this contract and a plan for controlling these hazards. The contractor may use the NRCS version or their own, comparable form. The need for a Job Hazard Analysis for Non- Federal Acquisition Regulations (FAR) contracts is at the discretion of the State Safety Officer or State Conservation Engineer. Refer to FAR 52.236-13 and Title 210 National Engineering Manual, Part 512 "Construction," Subpart G "Safety" for more information on the job hazard analysis.

B. Preconstruction Safety Meeting. The contractor's representatives must meet with the CO or the CO's representatives before the start of construction to discuss the safety program and the implementation of all health and safety standards pertinent to the work under this contract.

C. Joint Safety Policy Committee. The contractor, or their designated on-site representative, must participate in a monthly Joint Safety Policy Committee meeting. The committee must consist of the NRCS (CLO for locally awarded contracts) and contractor's supervisory personnel. During these meetings, the contractor's project manager and the CO must review the effectiveness of the contractor's safety effort, resolve current health and safety problems, and coordinate safety activities for upcoming work.

D. Safety Personnel. Each contractor must designate a competent supervisory employee to administer the safety program. The CO must approve the selection.

E. Safety Meetings. All field supervisors, or foremen, must conduct at least one "on-the-job" or "toolbox" safety meeting every week for all construction personnel and mechanics on the jobsite. The contractor must conduct at least one regularly scheduled supervisory safety meeting each month for all levels of job supervision.

F. Safety Inspection. The contractor must perform frequent and regular safety inspections of the jobsite, materials, and equipment, and correct deficiencies.

G. First Aid Training. Every work crew must include an employee who has a current first aid certificate from the Mine Safety and Health Administration, American Red Cross, or other state-approved organization.

H. Reports. The contractor must maintain an accurate record of all job-related deaths, diseases, or disabling injuries in a manner the CO approves. They must immediately report all fatal or serious injuries and all other occurrences with serious accident potential, such as equipment failures, slides, and cave-ins to the CO. The contractor must provide the CO with a copy of all reports (including narratives, data, and information), and assist the CO fully with all investigations.

I. Certification of Insurance. Contractors must provide the CO or their authorized representative with certificates of insurance before the start of operations indicating full compliance with state worker's compensation statutes, as well as other certificates of insurance required under the contract.

645APPF.2 First Aid and Medical Facilities

A. First Aid Kits. Each accessible, well-identified first aid location must have a 16-unit first aid kit approved by the American Red Cross. There must be at least one kit per 25 employees. The kits must be moisture proof, dust tight, and have their contents replenished as used or as they become ineffective or outdated.

B. Emergency First Aid. At least one employee certified to administer emergency first aid must be available on each shift and duly designated by the contractor to care for injured employees. The contractor must post the names of the certified employees at the jobsite.

C. Communication and Transportation. Prior to the start of work, the contractor must make necessary arrangements for prompt and dependable communications, transportation, and medical care for injured employees. If mobile telephone reception is not consistent, the contractor must locate the nearest location with reliable service.

D. First Aid and Medical Reports. The contractor must maintain a record system for first aid and medical treatment on the jobsite. These records must be readily available to the CO and include:

   1. A daily treatment log in chronological order listing all persons treated for occupational injuries and illnesses.
   2. A cumulative record of injury for everyone.
   3. All monthly statistical records of occupational injuries, classified by type and nature of injury.
   4. All required records for worker's compensation.

E. Signs and Directional Markings. Each first aid station must have adequate identification and directional markers to make them easily identifiable.

F. Emergency Listing. Each first aid location must have a list of telephone numbers and addresses of doctors, rescue squads, hospitals, police, and fire departments.

645APPF.3 Physical Qualifications of Employees

A. General Requirements. Anyone employed throughout the contract must be physically qualified to perform their assigned duties. Employees must not knowingly be permitted or required to work while their ability or alertness is impaired by fatigue, illness, or any other reason that jeopardizes anyone.

B. Hoist Operators. Operators of cranes, cableways, and other hoisting equipment must annually obtain a licensed physician's examination and a certification from that physician stating they are physically qualified to safely operate hoisting equipment. The contractor must submit a copy of each certification to the CO.

C. Heavy Equipment Operators. Truck and heavy construction equipment operators must be physically qualified to perform their assigned work without endangering themselves or others.

D. Motor Vehicle Operators. Motor vehicle operators engaged primarily in the transportation of personnel must be 18 years of age or older and have a valid state operator's permit or license for the equipment operated. The operators must be physically qualified to operate vehicles safely.

645APPF.4 Personal Protective Equipment

A. Hardhat Areas. The entire jobsite, except for offices, are a hardhat area. Anyone entering the area must, without exception, wear a hardhat. The contractor must provide hardhats for visitors entering hardhat areas.

1. **Labels**. Hardhats must bear a manufacturer's label indicating design compliance with the appropriate American National Standards Institute (ANSI) standard.

B. Posting. Signs at least 3 by 4 feet worded as follows with red letters at least 6-inches tall on a white background must be erected at access points to designated hardhat areas:

1. CONSTRUCTION AREA - HARDHATS REQUIRED BEYOND THIS POINT

2. The contractor must furnish and install these signs at entries to shops, construction yards, and job access points.

C. Safety Goggles (Drillers).

1. **Drillers and Helpers**. Drillers and helpers operating pneumatic rock drills must wear protective safety goggles.

645APPF.5 Machinery and Mechanized Equipment

A. Safe Condition. Before any machinery or mechanized equipment is initially used on the job, it must be tested by a qualified operator and inspected by the

contractor's designated safety personnel and determined to be in safe operating condition and appropriate for the intended use. Operators must inspect their equipment prior to the beginning of each shift. Any deficiencies or defects must be corrected before using the equipment. Equipment operators must use all safety equipment installed in the machinery, such as seatbelts.

B. Tagging and Locking. All power-driven equipment under repair must have their control locked. An effective lockout and tagging procedure must be established, prescribing specific responsibilities and safety procedures to be followed by the person or persons performing repair work. Mixer barrels must be locked out before employees may enter them for cleaning or repair.

C. Haul Roads for Equipment.

1. **Road Maintenance**. The contractor must maintain all roadways, including haul roads and access roads, in a safe condition to eliminate or control dust and ice hazards. Wherever dust is a hazard, adequate dust-laying equipment must be available at the jobsite and utilized to control the dust. The intersections of haul roads and public roads must be inspected daily and cleared of any debris, clods, or dropped haul materials.
2. **Single-Lane Haul Roads**. Single-lane haul roads with two-way traffic must have adequate turnouts. Where turnouts are not practical, the contractor must provide a traffic control system to prevent accidents.
3. **Two-Way Haul Roads**. On two-way haul roads, arrangements are to be such that vehicles travel on the right side wherever possible. The contractor must employ signs and traffic control devices to clearly indicate any variations from a right-hand traffic pattern. The road must be wide enough to permit safe passage of opposing traffic, considering the type of hauling equipment used.
4. **Design and Construction of Haul Roads**. If the CO requests haul road design criteria and drawings, the contractor must submit them for approval prior to road construction. Sustained grades must not exceed 12 percent, and all curves must have open-sight line with as great a radius as practical. All roads must have curve signs and maximum speed limits posted that permit the equipment to be stopped within one-half the minimum sight distance.
5. **Operators**. Only qualified persons may operate machinery and mechanized equipment.
6. **Riding on Equipment**. Unauthorized personnel may not ride on equipment. Operators and passengers must have seats and safety belts.
7. **Getting on or off Equipment**. No one may get on or off any equipment while it is in motion.
8. **Hours of Operation**. Except in emergencies, no equipment operator may operate any mobile or hoisting equipment for more than 12 hours without an 8-hour rest interval away from the job.

D. Power Cranes and Hoists (Truck Cranes, Crawler Cranes, Tower Cranes, Gantry Cranes, Hammerhead Cranes, Derricks, Cableways, and Hoists).

1. **Performance Test**. Before initial onsite operation, at 12-month intervals, and after major repairs or modification, power cranes, derricks, cableways, and hoists must satisfactorily complete a performance test to demonstrate the equipment's ability to safely handle and maneuver the rated loads. The CO, or their representative, must witness the tests. The test data must be recorded and a copy submitted to the CO.
2. **Performance Test – Power Cranes** (Crawler mounted, truck mounted and wheel mounted). The performance test must be conducted per ANSI requirements. The test must consist of raising, lowering, and braking the load and rotating the test load through 360° degrees at the specified boom angle or radius. Cranes equipped with jibs or boom-tip extensions must be tested using both the main boom and the jib, with an appropriate test load in each case.
3. **Performance Test – Derricks, Gantry Cranes, Tower Cranes, Cableways, and Hoists, Including Overhead Cranes**. This equipment's performance must be tested per ANSI requirements.
4. **Boom Angle Indicator**. Power cranes (includes draglines) with booms capable of moving in the vertical plane must have a boom angle indicator in good working order.
5. **Crane Test Certification**. The contractor providing the CO a copy of a certificate of inspection made by a qualified person (or by a government or private agency satisfactory to the CO) within the last 12 months, satisfies the performance test required in sections 2 and 3 above.
6. **Posting for High Voltage Lines**. A notice of the 10-foot (or greater) clearance required by OSHA 1926.1408, Subpart CC, (Table A), must be posted in the operator's cab of cranes, shovels, boom-type concrete pumps, backhoes, and related equipment.
7. **Boom Stops**. Cranes or derricks with cable-supported booms, except draglines, must have a device attached between the gantry of the A-frame and the boom chords to limit the elevation of the boom. The device must control the vertical motions of the boom with increasing resistance from 83° or less, until completely stopping the boom at not over 87° above horizontal.
8. **Safety Hooks**. Hooks used in hoisting personnel or hoisting loads over construction personnel or in the immediate vicinity of construction personnel must be forged steel equipped with safety keepers. When using shackles under these conditions, they must be of the locking type or have the pin secured to prohibit turning.

E. Rollover Protective Structures (ROPS).

1. **ROPS**. OSHA 1926, Subpart W "Overhead Protection," Sections 1001 and 1002 are applicable regardless of the year in which the equipment was manufactured and regardless of the struck capacity of the equipment.
2. **Equipment Requiring ROPS**. The requirement for ROPS applies to crawler and rubber-tired tractors such as dozers, push-and-pull tractors, winch tractors, tractors with backhoes, and mowers; off-highway, self-propelled, pneumatic-tired earthmovers, including scrapers, motor graders and loaders; and rollers, compactors, water tankers (excluding trucks with cabs). These requirements also apply to agricultural and industrial tractors and similar equipment.
3. **Equipment Requiring Seatbelts**. The requirements for seatbelts as specified in OSHA Subpart O "Motor Vehicles, Mechanized Equipment, and Marine Operations," Section 1926.602 also apply to self- propelled compactors and rollers, and rubber-tired skid-steer equipment.

F. Ladders and Scaffolding.

1. **Ladders**. OSHA Subpart L - Section 1926.450. Ladders may only be used as work platforms when using small hand tools or handling light material. Lifting heavy materials or substantial exertion may not be done from ladders.
2. **Scaffolding**. OSHA Subpart L - Section 1926.451. Scaffolds, platforms, or temporary floors must be provided for all work except that which can be done safely from the ground or similar footing.
3. **Safety Belts, Lifeline, and Lanyards**. OSHA, Subpart E, Section 1926.104. Lifelines, safety belts, and lanyards independently attached or attended, must be used when the following work is performed and the requirements for ladders and scaffolding cannot be met:
   a. Work on stored material in hoppers, bins, silos, tanks, or other confined spaces.
   b. Work on hazardous slopes, structural steel, or poles; erection or dismantling of safety nets, tying reinforcing bars; and work from Boatswain's chairs, swinging scaffolds, or other unguarded locations at elevations greater than six feet.
   c. Work on skips and platforms used in shafts by crews when the skip or cage does not block the opening to within 1 foot of the sides of the shaft unless cages are provided.

Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Centralized Request for Quote
Construction

Proc Folder:	1793301	**Reason for Modification:**
Doc Description:	Brush Creek 15 Dam Rehabilitation-Construction	To post Addendum no. 01
Proc Type:	Central Purchase Order	

Date Issued	Solicitation Closes	Solicitation No	Version
2025-10-20	2026-01-07 13:30	CRFQ 1400 AGR2600000016	2

BID RECEIVING LOCATION

BID CLERK
DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
2019 WASHINGTON ST E
CHARLESTON WV 25305
US

VENDOR

Vendor Customer Code:

Vendor Name :

Address :

Street :

City :

State : **Country :** **Zip :**

Principal Contact :

Vendor Contact Phone: **Extension:**

FOR INFORMATION CONTACT THE BUYER
Larry D McDonnell
304-558-2063
larry.d.mcdonnell@wv.gov

Vendor Signature X **FEIN#** **DATE**

All offers subject to all terms and conditions contained in this solicitation

ADDITIONAL INFORMATION

Addendum no. 01

To attach revised terms and conditions - see version 2
To attach revised specifications - see version 2
To attach revised Exhibit A - Pricing Page - see version 2
To attach revised Federal Funds Addendum - version 2

NOTE VERSION 2 SUPERSEDES ANY PREVIOUS VERSION OF THE TERMS AND CONDITIONS, SPECIFICATIONS, EXHIBIT A - PRICING PAGE, AND FEDERAL FUNDS ADDENDUM ONLY.

To remove the following files:
2024-09-27 BC15 Operation and Maintenance Plan
2024-09-27 BC15 Quality Assurance and Inspection Staffing Plan

Mandatory pre-bid meeting date and time still remains 11/12/2025 at 10:30AM EST/EDT located at the Mercer County 4-H Camp located at 1823 Glenwood Park Road Princeton, WV 24740.

Vendor question deadline date and time still remains 11/20/2025 by 2:00PM EST/EDT

Bid opening date and time still remains 01/07/2026 at 1:30PM EST/EDT

No other changes

PLEASE NOTE: READ ALL INFORMATION IN ITS ENTIRETY. THERE ARE SEVERAL LARGE DOCUMENTS WITH DRAWINGS. MOST FILES HAVE BEEN ATTACHED IN VSS. IF YOU HAVE ANY ISSUES WITH DOWNLOADING THE ATTACHMENTS, CONTACT LARRY MCDONNELL, SENIOR BUYER WITH THE PURCHASING DIVISION.

INVOICE TO		SHIP TO	
AGRICULTURE DEPARTMENT OF		WEST VIRGINIA CONSERVATION AGENCY	
ADMINISTRATIVE SERVICES		WEST VIRGINIA CONSERVATION AGENCY	
1900 KANAWHA BLVD E		255 GUS R DOUGLASS LN	
CHARLESTON	WV	CHARLESTON	WV
US		US	

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
1	Brush Creek Site 15 Dam Rehab Construction Services				

Comm Code	Manufacturer	Specification	Model #
72141203			

Extended Description:
Dam Rehabilitation services for Brush Creek 15.

See all attached documentation for further details.

PLEASE READ INSTRUCTIONS IN THEIR ENTIRETY. THE AMOUNT ENTERED ON THIS COMMODITY LINE SHOULD BE THE TOTAL COST FOR SITE 15 - SEE EXHIBIT A PRICING PAGE.

SCHEDULE OF EVENTS

Line	Event	Event Date
1	Pre-Bid Meeting 10:30AM EST/EDT	2025-11-12
2	Vendor questions due by 2:00PM EST/EDT	2025-11-20

SOLICITATION NUMBER: CRFQ AGR26*16
Addendum Number: 1

The purpose of this addendum is to modify the solicitation identified as ("Solicitation") to reflect the change(s) identified and described below.

Applicable Addendum Category:

[ ] Modify bid opening date and time

[ ] Modify specifications of product or service being sought

[ ] Attachment of vendor questions and responses

[ ] Attachment of pre-bid sign-in sheet

[ ] Correction of error

[X] Other

Description of Modification to Solicitation:

To attach revised terms and conditions – version 2

To attach revised specifications – version 2

To attach revised Exhibit A – Pricing Page – version 2

To attach revised Federal Funds Addendum – version 2

****NOTE VERSION 2 SUPERSEDES ANY PREVIOUS VERSION OF THE TERMS AND CONDITIONS, SPECIFICATIONS, EXHIBIT A – PRICING PAGE, AND FEDERAL FUNDS ADDENDUM ONLY.****

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Vendor question deadline date and time still remains 11/20/2025 by 2:00PM EST/EDT
Bid opening date and time still remains 01/07/2026 at 1:30PM EST/EDT

No other changes

Additional Documentation: Documentation related to this Addendum (if any) has been included herewith as Attachment A and is specifically incorporated herein by reference.

Terms and Conditions:

1. All provisions of the Solicitation and other addenda not modified herein shall remain in full force and effect.

2. Vendor should acknowledge receipt of all addenda issued for this Solicitation by completing an Addendum Acknowledgment, a copy of which is included herewith. Failure to acknowledge addenda may result in bid disqualification. The addendum acknowledgement should be submitted with the bid to expedite document processing.

REVISED AS OF 10/20/2025
VERSION 2 - SUPERSEDES ANY PREVIOUS VERSIONS

INSTRUCTIONS TO VENDORS SUBMITTING BIDS

1. **REVIEW DOCUMENTS THOROUGHLY:** The attached documents contain a solicitation for bids. Please read these instructions and all documents attached in their entirety. These instructions provide critical information about requirements that if overlooked could lead to disqualification of a Vendor's bid. All bids must be submitted in accordance with the provisions contained in these instructions and the Solicitation. Failure to do so may result in disqualification of Vendor's bid.

2. **MANDATORY TERMS:** The Solicitation may contain **mandatory** provisions identified by the use of the words "**must**," "**will**," and "**shall**." Failure to comply with a mandatory term in the Solicitation will result in bid disqualification.

3. **PRE-BID MEETING:** The item identified below shall apply to this Solicitation.

☐ A pre-bid meeting will not be held prior to bid opening

☑ A **MANDATORY PRE-BID** meeting will be held at the following place and time:

Location: Mercer County 4-H Camp
Date: November 12, 2025
Time: 10:30 am EST .
Address: 1823 Glenwood Park Road, Princeton, WV 24740

All Vendors submitting a bid must attend the **mandatory** pre-bid meeting. Failure to attend the **mandatory** pre-bid meeting shall result in disqualification of the Vendor's bid. No one individual is permitted to represent more than one vendor at the pre-bid meeting. Any individual that does attempt to represent two or more vendors will be required to select one vendor to which the individual's attendance will be attributed. The vendors not selected will be deemed to have not attended the pre-bid meeting unless another individual attended on their behalf.

An attendance sheet provided at the pre-bid meeting shall serve as the official document verifying attendance. Any person attending the pre-bid meeting on behalf of a Vendor must list on the attendance sheet his or her name and the name of the Vendor he or she is representing. It is the Vendor's responsibility to locate the attendance sheet and provide the required information. Failure to complete the attendance sheet as required may result in disqualification of Vendor's bid.

Vendors who arrive after the starting time but prior to the end of the pre-bid will be permitted to sign in but are charged with knowing all matters discussed at the pre-bid.

Any discussions or answers to questions at the pre-bid meeting are preliminary in nature and are non-binding. Official and binding answers to questions will be published in a written addendum to the Solicitation prior to bid opening.

4. **VENDOR QUESTION DEADLINE:** Vendors may submit questions relating to this Solicitation to the Purchasing Division. Questions must be submitted in writing. All questions **must be submitted on or before the date listed below and to the address listed below to be considered**. A written response will be published in a Solicitation addendum if a response is possible and appropriate. Non-written discussions, conversations, or questions and answers regarding this Solicitation are preliminary in nature and are non-binding.

Submitted emails should have the solicitation number in the subject line. Question

Submission Deadline: November 20, 2025 by 2:00PM EST/EDT

Submit Questions to: Larry D. McDonnell
2019 Washington Street, East Charleston, WV 25305
Fax: (304) 558-3970
Email: larry.d.mcdonnell@wv.gov

5. **VERBAL COMMUNICATION:** Any verbal communication between the Vendor and any State personnel is not binding, including verbal communication at the mandatory pre-bid conference. Only information issued in writing and added to the Solicitation by an official written addendum by the Purchasing Division is binding.

6. **BID SUBMISSION:** All bids must be submitted on or before the date and time of the bid opening listed in section 7 below. Vendors can submit bids electronically through *wv*OASIS, in paper form delivered to the Purchasing Division at the address listed below either in person or by courier, or in facsimile form by faxing to the Purchasing Division at the number listed below. Notwithstanding the foregoing, the Purchasing Division may prohibit the submission of bids electronically through *wv*OASIS at its sole discretion. Such a prohibition will be contained and communicated in the *wv*OASIS system resulting in the Vendor's inability to submit bids through *wv*OASIS. The Purchasing Division will not accept bids or modification of bids via email.

Bids submitted in paper, facsimile, or via *wv*OASIS must contain a signature. Failure to submit a bid in any form without a signature will result in rejection of your bid.

A bid submitted in paper or facsimile form should contain the information listed below on the face of the submission envelope or fax cover sheet. Otherwise, the bid may be rejected by the Purchasing Division.

VENDOR NAME:
BUYER:
SOLICITATION NO.:
BID OPENING DATE:
BID OPENING TIME:
FAX NUMBER:

Any bid received by the Purchasing Division staff is considered to be in the possession of the Purchasing Division and will not be returned for any reason.

Bid Delivery Address and Fax Number:
Department of Administration, Purchasing Division 2019 Washington Street East
Charleston, WV 25305-0130
Fax: 304-558-3970

7. **BID OPENING:** Bids submitted in response to this Solicitation will be opened at the location identified below on the date and time listed below. Delivery of a bid after the bid opening date and time will result in bid disqualification. For purposes of this Solicitation, a bid is considered delivered when confirmation of delivery is provided by *wv*OASIS (in the case of electronic submission) or when the bid is time stamped by the official Purchasing Division time clock (in the case of hand delivery or via delivery by mail).

Bid Opening Date and Time: January 7th, 2026 at 1:30PM EST/EDT

Bid Opening Location:
Department of Administration, Purchasing Division
2019 Washington Street East
Charleston, WV 25305-0130

8. **ADDENDUM ACKNOWLEDGEMENT:** Changes or revisions to this Solicitation will be made by an official written addendum issued by the Purchasing Division. Vendor should acknowledge receipt of all addenda issued with this Solicitation by completing an Addendum Acknowledgement Form. Failure to acknowledge addenda may result in bid disqualification. The addendum acknowledgement should be submitted with the bid to expedite document processing.

9. **BID FORMATTING:** Vendor should type or electronically enter the information onto its bid to prevent errors in the evaluation. Failure to type or electronically enter the information may result in bid disqualification.

10. **ALTERNATE MODEL OR BRAND:** Unless the box below is checked, any model, brand, or specification listed in this Solicitation establishes the acceptable level of quality only and is not intended to reflect a preference for, or in any way favor, a particular brand or vendor. Vendors may bid alternates to a listed model or brand provided that the alternate is at least equal to the model or brand and complies with the required specifications. The equality of any alternate being bid shall be determined by the State at its sole discretion. Any Vendor bidding an alternate model or brand **shall** clearly identify the alternate items in its bid and should include manufacturer's specifications, industry literature, and/or any other relevant documentation demonstrating the equality of the alternate items. Failure to provide information for alternate items **may** be grounds for rejection of a Vendor's bid.

☐ This Solicitation is based upon a standardized commodity established under W. Va. Code § 5A-3-61. Vendors are expected to bid the standardized commodity identified. Failure to bid the standardized commodity will result in your firm's bid being rejected.

11. **COMMUNICATION LIMITATIONS:** In accordance with West Virginia Code of State Rules §148-1-6.6.2, communication with the State of West Virginia or any of its employees regarding this Solicitation during the solicitation, bid, evaluation or award periods, except through the Purchasing Division, is strictly prohibited without prior Purchasing Division approval. Purchasing Division approval for such communication is implied for all agency delegated and exempt purchases.

12. **REGISTRATION:** Prior to Contract award, the apparent successful Vendor **must** be properly registered with the West Virginia Purchasing Division and must have paid the $125 fee, if applicable.

13. **UNIT PRICE:** Unit prices **shall** prevail in cases of a discrepancy in the Vendor's bid.

14. **PREFERENCE:** Vendor Preference may be requested in purchases of motor vehicles or construction and maintenance equipment and machinery used in highway and other infrastructure projects. Any request for preference must be submitted in writing with the bid, must specifically identify the preference requested with reference to the applicable subsection of West Virginia Code § 5A-3-37, and must include with the bid any information necessary to evaluate and confirm the applicability of the requested preference. A request form to help facilitate the request can be found at: www.state.wv.us/admin/purchase/vrc/Venpref.pdf.

15A. **RECIPROCAL PREFERENCE:** The State of West Virginia applies a reciprocal preference to all solicitations for commodities and printing in accordance with W. Va. Code § 5A-3-37(b). In effect, non-resident vendors receiving a preference in their home states, will see that same preference granted to West Virginia resident vendors bidding against them in West Virginia. Any request for reciprocal preference must include with the bid any information necessary to evaluate and confirm the applicability of the preference. A request form to help facilitate the request can be found at: www.state.wv.us/admin/purchase/vrc/Venpref.pdf.

15. **SMALL, WOMEN-OWNED, OR MINORITY-OWNED BUSINESSES:** For any solicitations publicly advertised for bid, in accordance with West Virginia Code §5A-3-37 and W. Va. CSR § 148-22-9, any non-resident vendor certified as a small, women-owned, or minority-owned business under W. Va. CSR § 148-22-9 shall be provided the same preference made available to any resident vendor. Any non-resident small, women-owned, or minority- owned business must identify itself as such in writing, must submit that writing to the Purchasing Division with its bid, and must be properly certified under W. Va. CSR § 148-22-9 prior to contract award to receive the preferences made available to resident vendors.

16. **WAIVER OF MINOR IRREGULARITIES:** The Director reserves the right to waive minor irregularities in bids or specifications in accordance with West Virginia Code of State Rules § 148-1-4.7.

17. **ELECTRONIC FILE ACCESS RESTRICTIONS:** Vendor must ensure that its submission in *wv*OASIS can be accessed and viewed by the Purchasing Division staff immediately upon bid opening. The Purchasing Division will consider any file that cannot be immediately accessed and viewed at the time of the bid opening (such as, encrypted files, password protected files, or incompatible files) to be blank or incomplete as context requires and are therefore unacceptable. A vendor will not be permitted to unencrypt files, remove password protections, or resubmit documents after bid opening to make a file viewable if those documents are required with the bid. A Vendor may be required to provide document passwords or remove access restrictions to allow the Purchasing Division to print or electronically save documents provided that those documents are viewable by the Purchasing Division prior to obtaining the password or removing the access restriction.

18. **NON-RESPONSIBLE:** The Purchasing Division Director reserves the right to reject the bid of any vendor as Non-Responsible in accordance with W. Va. Code of State Rules § 148-1- 5.3, when the Director determines that the vendor submitting the bid does not have the capability to fully perform or lacks the integrity and reliability to assure good-faith performance."

19. **ACCEPTANCE/REJECTION:** The State may accept or reject any bid in whole, or in part in accordance with W. Va. Code of State Rules § 148-1-4.6. and § 148-1-6.3."

20. **WITH THE BID REQUIREMENTS:** In instances where these specifications require documentation or other information with the bid, and a vendor fails to provide it with the bid, the Director of the Purchasing Division reserves the right to request those items after bid opening and prior to contract award pursuant to the authority to waive minor irregularities in bids or specifications under W. Va. CSR § 148-1-4.7. This authority does not apply to instances where state law mandates receipt with the bid.

21. **EMAIL NOTIFICATION OF AWARD:** The Purchasing Division will attempt to provide bidders with e-mail notification of contract award when a solicitation that the bidder participated in has been awarded. For notification purposes, bidders must provide the Purchasing Division with a valid email address in the bid response. Bidders may also monitor *wv*OASIS or the Purchasing Division's website to determine when a contract has been awarded.

22. **EXCEPTIONS AND CLARIFICATIONS:** The Solicitation contains the specifications that **shall** form the basis of a contractual agreement. **Vendor shall clearly mark any exceptions, clarifications, or other proposed modifications in its bid.** Exceptions to, clarifications of, or modifications of a requirement or term and condition of the Solicitation may result in bid disqualification.

REVISED AS OF 10/20/2025
VERSION 2 - SUPERSEDES ANY PREVIOUS VERSIONS

GENERAL TERMS AND CONDITIONS:

1. CONTRACTUAL AGREEMENT: Issuance of an Award Document signed by the Purchasing Division Director, or his designee, and approved as to form by the Attorney General's office constitutes acceptance by the State of this Contract made by and between the State of West Virginia and the Vendor. Vendor's signature on its bid, or on the Contract if the Contract is not the result of a bid solicitation, signifies Vendor's agreement to be bound by and accept the terms and conditions contained in this Contract.

2. DEFINITIONS: As used in this Solicitation/Contract, the following terms shall have the meanings attributed to them below. Additional definitions may be found in the specifications included with this Solicitation/Contract.

2.1. "Agency" or **"Agencies"** means the agency, board, commission, or other entity of the State of West Virginia that is identified on the first page of the Solicitation or any other public entity seeking to procure goods or services under this Contract.

2.2. "Bid" or **"Proposal"** means the vendors submitted response to this solicitation.

2.3. "Contract" means the binding agreement that is entered into between the State and the Vendor to provide the goods or services requested in the Solicitation.

2.4. "Director" means the Director of the West Virginia Department of Administration, Purchasing Division.

2.5. "Purchasing Division" means the West Virginia Department of Administration, Purchasing Division.

2.6. "Award Document" means the document signed by the Agency and the Purchasing Division, and approved as to form by the Attorney General, that identifies the Vendor as the contract holder.

2.7. "Solicitation" means the official notice of an opportunity to supply the State with goods or services that is published by the Purchasing Division.

2.8. "State" means the State of West Virginia and/or any of its agencies, commissions, boards, etc. as context requires.

2.9. "Vendor" or **"Vendors"** means any entity submitting a bid in response to the Solicitation, the entity that has been selected as the lowest responsible bidder, or the entity that has been awarded the Contract as context requires.

3. CONTRACT TERM; RENEWAL; EXTENSION: The term of this Contract shall be determined in accordance with the category that has been identified as applicable to this Contract below:

☐ **Term Contract**

Initial Contract Term: The Initial Contract Term will be for a period of _____ _____. The Initial Contract Term becomes effective on the effective start date listed on the first page of this Contract, identified as the State of West Virginia contract cover page containing the signatures of the Purchasing Division, Attorney General, and Encumbrance clerk (or another page identified as _____), and the Initial Contract Term ends on the effective end date also shown on the first page of this Contract.

Renewal Term: This Contract may be renewed upon the mutual written consent of the Agency, and the Vendor, with approval of the Purchasing Division and the Attorney General's office (Attorney General approval is as to form only). Any request for renewal should be delivered to the Agency and then submitted to the Purchasing Division thirty (30) days prior to the expiration date of the initial contract term or appropriate renewal term. A Contract renewal shall be in accordance with the terms and conditions of the original contract. Unless otherwise specified below, renewal of this Contract is limited to _____ successive one (1) year periods or multiple renewal periods of less than one year, provided that the multiple renewal periods do not exceed the total number of months available in all renewal years combined. Automatic renewal of this Contract is prohibited. Renewals must be approved by the Vendor, Agency, Purchasing Division and Attorney General's office (Attorney General approval is as to form only)

☐ **Alternate Renewal Term** – This contract may be renewed for _____ successive _____ year periods or shorter periods provided that they do not exceed the total number of months contained in all available renewals. Automatic renewal of this Contract is prohibited. Renewals must be approved by the Vendor, Agency, Purchasing Division and Attorney General's office (Attorney General approval is as to form only)

Delivery Order Limitations: In the event that this contract permits delivery orders, a delivery order may only be issued during the time this Contract is in effect. Any delivery order issued within one year of the expiration of this Contract shall be effective for one year from the date the delivery order is issued. No delivery order may be extended beyond one year after this Contract has expired.

☐ **Fixed Period Contract:** This Contract becomes effective upon Vendor's receipt of the notice to proceed and must be completed within _____days.

☐ **Fixed Period Contract with Renewals:** This Contract becomes effective upon Vendor's receipt of the notice to proceed and part of the Contract more fully described in the attached specifications must be completed within _____ days. Upon completion of the work covered by the preceding sentence, the vendor agrees that:

☐ the contract will continue for _____ years;

☐ the contract may be renewed for _____ successive _____ year periods or shorter periods provided that they do not exceed the total number of months contained in all available renewals. Automatic renewal of this Contract is prohibited. Renewals must be approved by the Vendor, Agency, Purchasing Division and Attorney General's Office (Attorney General approval is as to form only).

☐ **One-Time Purchase:** The term of this Contract shall run from the issuance of the Award Document until all of the goods contracted for have been delivered, but in no event will this Contract extend for more than one fiscal year.

☑ **Construction/Project Oversight:** This Contract becomes effective on the effective start date listed on the first page of this Contract, identified as the State of West Virginia contract cover page containing the signatures of the Purchasing Division, Attorney General, and Encumbrance clerk (or another page identified as _____), and continues until the project for which the vendor is providing oversight is complete.

☐ **Other:** Contract Term specified in _____

4. AUTHORITY TO PROCEED: Vendor is authorized to begin performance of this contract on the date of encumbrance listed on the front page of the Award Document unless either the box for "Fixed Period Contract" or "Fixed Period Contract with Renewals" has been checked in Section 3 above. If either "Fixed Period Contract" or "Fixed Period Contract with Renewals" has been checked, Vendor must not begin work until it receives a separate notice to proceed from the State. The notice to proceed will then be incorporated into the Contract via change order to memorialize the official date that work commenced.

5. QUANTITIES: The quantities required under this Contract shall be determined in accordance with the category that has been identified as applicable to this Contract below.

☐ **Open End Contract:** Quantities listed in this Solicitation/Award Document are approximations only, based on estimates supplied by the Agency. It is understood and agreed that the Contract shall cover the quantities actually ordered for delivery during the term of the Contract, whether more or less than the quantities shown.

☐ **Service:** The scope of the service to be provided will be more clearly defined in the specifications included herewith.

☐ **Combined Service and Goods:** The scope of the service and deliverable goods to be provided will be more clearly defined in the specifications included herewith.

☐ **One-Time Purchase:** This Contract is for the purchase of a set quantity of goods that are identified in the specifications included herewith. Once those items have been delivered, no additional goods may be procured under this Contract without an appropriate change order approved by the Vendor, Agency, Purchasing Division, and Attorney General's office.

☑ **Construction:** This Contract is for construction activity more fully defined in the specifications.

6. EMERGENCY PURCHASES: The Purchasing Division Director may authorize the Agency to purchase goods or services in the open market that Vendor would otherwise provide under this Contract if those goods or services are for immediate or expedited delivery in an emergency. Emergencies shall include, but are not limited to, delays in transportation or an unanticipated increase in the volume of work. An emergency purchase in the open market, approved by the Purchasing Division Director, shall not constitute of breach of this Contract and shall not entitle the Vendor to any form of compensation or damages. This provision does not excuse the State from fulfilling its obligations under a One-Time Purchase contract.

7. REQUIRED DOCUMENTS: All of the items checked in this section must be provided to the Purchasing Division by the Vendor as specified:

☑ **LICENSE(S) / CERTIFICATIONS / PERMITS:** In addition to anything required under the Section of the General Terms and Conditions entitled Licensing, the apparent successful Vendor shall furnish proof of the following licenses, certifications, and/or permits upon request and in a form acceptable to the State. The request may be prior to or after contract award at the State's sole discretion.

☑ West Virginia Contractors License Classification: C - General Engineering

☑ See Construction Specifications RFQ Brush Creek 15, Section 11.

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The apparent successful Vendor shall also furnish proof of any additional licenses or certifications contained in the specifications regardless of whether or not that requirement is listed above.

8. INSURANCE: The apparent successful Vendor shall furnish proof of the insurance identified by a checkmark below prior to Contract award. The insurance coverages identified below must be maintained throughout the life of this contract. Thirty (30) days prior to the expiration of the insurance policies, Vendor shall provide the Agency with proof that the insurance mandated herein has been continued. Vendor must also provide Agency with immediate notice of any changes in its insurance policies, including but not limited to, policy cancelation, policy reduction, or change in insurers. The apparent successful Vendor shall also furnish proof of any additional insurance requirements contained in the specifications prior to Contract award regardless of whether that insurance requirement is listed in this section.

Vendor must maintain:

☑ **Commercial General Liability Insurance** in at least an amount of: $1,000,000.00 per occurrence.

☑ **Automobile Liability Insurance** in at least an amount of: $1,000,000.00 per occurrence.

☐ **Professional/Malpractice/Errors and Omission Insurance** in at least an amount of: _____ per occurrence. Notwithstanding the forgoing, Vendor's are not required to list the State as an additional insured for this type of policy.

☐ **Commercial Crime and Third Party Fidelity Insurance** in an amount of: _____ per occurrence.

☐ **Cyber Liability Insurance** in an amount of: _____ per occurrence.

☑ **Builders Risk Insurance** in an amount equal to 100% of the amount of the Contract.

☐ **Pollution Insurance** in an amount of: _____ per occurrence.

☐ **Aircraft Liability** in an amount of: _____ per occurrence.

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9. WORKERS' COMPENSATION INSURANCE: Vendor shall comply with laws relating to workers compensation, shall maintain workers' compensation insurance when required, and shall furnish proof of workers' compensation insurance upon request.

10. VENUE: All legal actions for damages brought by Vendor against the State shall be brought in the West Virginia Claims Commission. Other causes of action must be brought in the West Virginia court authorized by statute to exercise jurisdiction over it.

11. LIQUIDATED DAMAGES: This clause shall in no way be considered exclusive and shall not limit the State or Agency's right to pursue any other available remedy. Vendor shall pay liquidated damages in the amount specified below or as described in the specifications:

☐ _____ for _____.

☑ Liquidated Damages Contained in the Specifications.

☐ Liquidated Damages Are Not Included in this Contract.

12. ACCEPTANCE: Vendor's signature on its bid, or on the certification and signature page, constitutes an offer to the State that cannot be unilaterally withdrawn, signifies that the product or service proposed by vendor meets the mandatory requirements contained in the Solicitation for that product or service, unless otherwise indicated, and signifies acceptance of the terms and conditions contained in the Solicitation unless otherwise indicated.

13. PRICING: The pricing set forth herein is firm for the life of the Contract, unless specified elsewhere within this Solicitation/Contract by the State. A Vendor's inclusion of price adjustment provisions in its bid, without an express authorization from the State in the Solicitation to do so, may result in bid disqualification. Notwithstanding the foregoing, Vendor must extend any publicly advertised sale price to the State and invoice at the lower of the contract price or the publicly advertised sale price.

14. PAYMENT IN ARREARS: Payments for goods/services will be made in arrears only upon receipt of a proper invoice, detailing the goods/services provided or receipt of the goods/services, whichever is later. Notwithstanding the foregoing, payments for software maintenance, licenses, or subscriptions may be paid annually in advance.

15. PAYMENT METHODS: Vendor must accept payment by electronic funds transfer and P-Card. (The State of West Virginia's Purchasing Card program, administered under contract by a banking institution, processes payment for goods and services through state designated credit cards.)

16. TAXES: The Vendor shall pay any applicable sales, use, personal property or any other taxes arising out of this Contract and the transactions contemplated thereby. The State of West Virginia is exempt from federal and state taxes and will not pay or reimburse such taxes.

17. ADDITIONAL FEES: Vendor is not permitted to charge additional fees or assess additional charges that were not either expressly provided for in the solicitation published by the State of West Virginia, included in the Contract, or included in the unit price or lump sum bid amount that Vendor is required by the solicitation to provide. Including such fees or charges as notes to the solicitation may result in rejection of vendor's bid. Requesting such fees or charges be paid after the contract has been awarded may result in cancellation of the contract.

18. FUNDING: This Contract shall continue for the term stated herein, contingent upon funds being appropriated by the Legislature or otherwise being made available. In the event funds are not appropriated or otherwise made available, this Contract becomes void and of no effect beginning on July 1 of the fiscal year for which funding has not been appropriated or otherwise made available. If that occurs, the State may notify the Vendor that an alternative source of funding has been obtained and thereby avoid the automatic termination. Non-appropriation or non-funding shall not be considered an event of default.

19. CANCELLATION: The Purchasing Division Director reserves the right to cancel this Contract immediately upon written notice to the vendor if the materials or workmanship supplied do not conform to the specifications contained in the Contract. The Purchasing Division Director may also cancel any purchase or Contract upon 30 days written notice to the Vendor in accordance with West Virginia Code of State Rules § 148-1-5.2.b.

20. TIME: Time is of the essence regarding all matters of time and performance in this Contract.

21. APPLICABLE LAW: This Contract is governed by and interpreted under West Virginia law without giving effect to its choice of law principles. Any information provided in specification manuals, or any other source, verbal or written, which contradicts or violates the West Virginia Constitution, West Virginia Code, or West Virginia Code of State Rules is void and of no effect.

22. COMPLIANCE WITH LAWS: Vendor shall comply with all applicable federal, state, and local laws, regulations and ordinances. By submitting a bid, Vendor acknowledges that it has reviewed, understands, and will comply with all applicable laws, regulations, and ordinances.

> **SUBCONTRACTOR COMPLIANCE:** Vendor shall notify all subcontractors providing commodities or services related to this Contract that as subcontractors, they too are required to comply with all applicable laws, regulations, and ordinances. Notification under this provision must occur prior to the performance of any work under the contract by the subcontractor.

23. ARBITRATION: Any references made to arbitration contained in this Contract, Vendor's bid, or in any American Institute of Architects documents pertaining to this Contract are hereby deleted, void, and of no effect.

24. MODIFICATIONS: This writing is the parties' final expression of intent. Notwithstanding anything contained in this Contract to the contrary no modification of this Contract shall be binding without mutual written consent of the Agency, and the Vendor, with approval of the Purchasing Division and the Attorney General's office (Attorney General approval is as to form only). Any change to existing contracts that adds work or changes contract cost, and were not included in the original contract, must be approved by the Purchasing Division and the Attorney General's Office (as to form) prior to the implementation of the change or commencement of work affected by the change.

25. WAIVER: The failure of either party to insist upon a strict performance of any of the terms or provision of this Contract, or to exercise any option, right, or remedy herein contained, shall not be construed as a waiver or a relinquishment for the future of such term, provision, option, right, or remedy, but the same shall continue in full force and effect. Any waiver must be expressly stated in writing and signed by the waiving party.

26. SUBSEQUENT FORMS: The terms and conditions contained in this Contract shall supersede any and all subsequent terms and conditions which may appear on any form documents submitted by Vendor to the Agency or Purchasing Division such as price lists, order forms, invoices, sales agreements, or maintenance agreements, and includes internet websites or other electronic documents. Acceptance or use of Vendor's forms does not constitute acceptance of the terms and conditions contained thereon.

27. ASSIGNMENT: Neither this Contract nor any monies due, or to become due hereunder, may be assigned by the Vendor without the express written consent of the Agency, the Purchasing Division, the Attorney General's office (as to form only), and any other government agency or office that may be required to approve such assignments.

28. WARRANTY: The Vendor expressly warrants that the goods and/or services covered by this Contract will: (a) conform to the specifications, drawings, samples, or other description furnished or specified by the Agency; (b) be merchantable and fit for the purpose intended; and (c) be free from defect in material and workmanship.

29. STATE EMPLOYEES: State employees are not permitted to utilize this Contract for personal use and the Vendor is prohibited from permitting or facilitating the same.

30. PRIVACY, SECURITY, AND CONFIDENTIALITY: The Vendor agrees that it will not disclose to anyone, directly or indirectly, any such personally identifiable information or other confidential information gained from the Agency, unless the individual who is the subject of the information consents to the disclosure in writing or the disclosure is made pursuant to the Agency's policies, procedures, and rules. Vendor further agrees to comply with the Confidentiality Policies and Information Security Accountability Requirements, set forth in www.state.wv.us/admin/purchase/privacy.

31. YOUR SUBMISSION IS A PUBLIC DOCUMENT: Vendor's entire response to the Solicitation and the resulting Contract are public documents. As public documents, they will be disclosed to the public following the bid/proposal opening or award of the contract, as required by the competitive bidding laws of West Virginia Code §§ 5A-3-1 et seq., 5-22-1 et seq., and 5G-1-1 et seq. and the Freedom of Information Act West Virginia Code §§ 29B-1-1 et seq.

DO NOT SUBMIT MATERIAL YOU CONSIDER TO BE CONFIDENTIAL, A TRADE SECRET, OR OTHERWISE NOT SUBJECT TO PUBLIC DISCLOSURE.

Submission of any bid, proposal, or other document to the Purchasing Division constitutes your explicit consent to the subsequent public disclosure of the bid, proposal, or document. The Purchasing Division will disclose any document labeled "confidential," "proprietary," "trade secret," "private," or labeled with any other claim against public disclosure of the documents, to include any "trade secrets" as defined by West Virginia Code § 47-22-1 et seq. All submissions are subject to public disclosure without notice.

32. LICENSING: In accordance with West Virginia Code of State Rules § 148-1-6.1.e, Vendor must be licensed and in good standing in accordance with any and all state and local laws and requirements by any state or local agency of West Virginia, including, but not limited to, the West Virginia Secretary of State's Office, the West Virginia Tax Department, West Virginia Insurance Commission, or any other state agency or political subdivision. Obligations related to political subdivisions may include, but are not limited to, business licensing, business and occupation taxes, inspection compliance, permitting, etc. Upon request, the Vendor must provide all necessary releases to obtain information to enable the Purchasing Division Director or the Agency to verify that the Vendor is licensed and in good standing with the above entities.

SUBCONTRACTOR COMPLIANCE: Vendor shall notify all subcontractors providing commodities or services related to this Contract that as subcontractors, they too are required to be licensed, in good standing, and up-to-date on all state and local obligations as described in this section. Obligations related to political subdivisions may include, but are not limited to, business licensing, business and occupation taxes, inspection compliance, permitting, etc. Notification under this provision must occur prior to the performance of any work under the contract by the subcontractor.

33. ANTITRUST: In submitting a bid to, signing a contract with, or accepting a Award Document from any agency of the State of West Virginia, the Vendor agrees to convey, sell, assign, or transfer to the State of West Virginia all rights, title, and interest in and to all causes of action it may now or hereafter acquire under the antitrust laws of the United States and the State of West Virginia for price fixing and/or unreasonable restraints of trade relating to the particular commodities or services purchased or acquired by the State of West Virginia. Such assignment shall be made and become effective at the time the purchasing agency tenders the initial payment to Vendor.

34. VENDOR NON-CONFLICT: Neither Vendor nor its representatives are permitted to have any interest, nor shall they acquire any interest, direct or indirect, which would compromise the performance of its services hereunder. Any such interests shall be promptly presented in detail to the Agency.

35. VENDOR RELATIONSHIP: The relationship of the Vendor to the State shall be that of an independent contractor and no principal-agent relationship or employer-employee relationship is contemplated or created by this Contract. The Vendor as an independent contractor is solely liable for the acts and omissions of its employees and agents. Vendor shall be responsible for selecting, supervising, and compensating any and all individuals employed pursuant to the terms of this Solicitation and resulting contract. Neither the Vendor, nor any employees or subcontractors of the Vendor, shall be deemed to be employees of the State for any purpose whatsoever. Vendor shall be exclusively responsible for payment of employees and contractors for all wages and salaries, taxes, withholding payments, penalties, fees, fringe benefits, professional liability insurance premiums, contributions to insurance and pension, or other deferred compensation plans, including but not limited to, Workers' Compensation and Social Security obligations, licensing fees, etc. and the filing of all necessary documents, forms, and returns pertinent to all of the foregoing.

Vendor shall hold harmless the State, and shall provide the State and Agency with a defense against any and all claims including, but not limited to, the foregoing payments, withholdings, contributions, taxes, Social Security taxes, and employer income tax returns.

36. INDEMNIFICATION: The Vendor agrees to indemnify, defend, and hold harmless the State and the Agency, their officers, and employees from and against: (1) Any claims or losses for services rendered by any subcontractor, person, or firm performing or supplying services, materials, or supplies in connection with the performance of the Contract; (2) Any claims or losses resulting to any person or entity injured or damaged by the Vendor, its officers, employees, or subcontractors by the publication, translation, reproduction, delivery, performance, use, or disposition of any data used under the Contract in a manner not authorized by the Contract, or by Federal or State statutes or regulations; and (3) Any failure of the Vendor, its officers, employees, or subcontractors to observe State and Federal laws including, but not limited to, labor and wage and hour laws.

37. NO DEBT CERTIFICATION: In accordance with West Virginia Code §§ 5A-3-10a and 5-22-1(i), the State is prohibited from awarding a contract to any bidder that owes a debt to the State or a political subdivision of the State. By submitting a bid, or entering into a contract with the State, Vendor is affirming that (1) for construction contracts, the Vendor is not in default on any monetary obligation owed to the state or a political subdivision of the state, and (2) for all other contracts, neither the Vendor nor any related party owe a debt as defined above, and neither the Vendor nor any related party are in employer default as defined in the statute cited above unless the debt or employer default is permitted under the statute.

38. CONFLICT OF INTEREST: Vendor, its officers or members or employees, shall not presently have or acquire an interest, direct or indirect, which would conflict with or compromise the performance of its obligations hereunder. Vendor shall periodically inquire of its officers, members and employees to ensure that a conflict of interest does not arise. Any conflict of interest discovered shall be promptly presented in detail to the Agency.

39. REPORTS: Vendor shall provide the Agency and/or the Purchasing Division with the following reports identified by a checked box below:

☑ Such reports as the Agency and/or the Purchasing Division may request. Requested reports may include, but are not limited to, quantities purchased, agencies utilizing the contract, total contract expenditures by agency, etc.

☐ Quarterly reports detailing the total quantity of purchases in units and dollars, along with a listing of purchases by agency. Quarterly reports should be delivered to the Purchasing Division via email at purchasing.division@wv.gov.

40. BACKGROUND CHECK: In accordance with W. Va. Code § 15-2D-3, the State reserves the right to prohibit a service provider's employees from accessing sensitive or critical information or to be present at the Capitol complex based upon results addressed from a criminal background check. Service providers should contact the West Virginia Division of Protective Services by phone at (304) 558-9911 for more information.

41. PREFERENCE FOR USE OF DOMESTIC STEEL PRODUCTS: Except when authorized by the Director of the Purchasing Division pursuant to W. Va. Code § 5A-3-56, no contractor may use or supply steel products for a State Contract Project other than those steel products made in the United States. A contractor who uses steel products in violation of this section may be subject to civil penalties pursuant to W. Va. Code § 5A-3-56. As used in this section:

a. "State Contract Project" means any erection or construction of, or any addition to, alteration of or other improvement to any building or structure, including, but not limited to, roads or highways, or the installation of any heating or cooling or ventilating plants or other equipment, or the supply of and materials for such projects, pursuant to a contract with the State of West Virginia for which bids were solicited on or after June 6, 2001.

b. "Steel Products" means products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated or otherwise similarly processed, or processed by a combination of two or more or such operations, from steel made by the open heath, basic oxygen, electric furnace, Bessemer or other steel making process.

c. The Purchasing Division Director may, in writing, authorize the use of foreign steel products if:

    1. The cost for each contract item used does not exceed one tenth of one percent (.1%) of the total contract cost or two thousand five hundred dollars ($2,500.00), whichever is greater. For the purposes of this section, the cost is the value of the steel product as delivered to the project; or

    2. The Director of the Purchasing Division determines that specified steel materials are not produced in the United States in sufficient quantity or otherwise are not reasonably available to meet contract requirements.

42. PREFERENCE FOR USE OF DOMESTIC ALUMINUM, GLASS, AND STEEL: In Accordance with W. Va. Code § 5-19-1 et seq., and W. Va. CSR § 148-10-1 et seq., for every contract or subcontract, subject to the limitations contained herein, for the construction, reconstruction, alteration, repair, improvement or maintenance of public works or for the purchase of any item of machinery or equipment to be used at sites of public works, only domestic aluminum, glass or steel products shall be supplied unless the spending officer determines, in writing, after the receipt of offers or bids, (1) that the cost of domestic aluminum, glass or steel products is unreasonable or inconsistent with the public interest of the State of West Virginia, (2) that domestic aluminum, glass or steel products are not produced in sufficient quantities to meet the contract requirements, or (3) the available domestic aluminum, glass, or steel do not meet the contract specifications. This provision only applies to public works contracts awarded in an amount more than fifty thousand dollars ($50,000) or public works contracts that require more than ten thousand pounds of steel products.

The cost of domestic aluminum, glass, or steel products may be unreasonable if the cost is more than twenty percent (20%) of the bid or offered price for foreign made aluminum, glass, or steel products. If the domestic aluminum, glass or steel products to be supplied or produced in a "substantial labor surplus area", as defined by the United States Department of Labor, the cost of domestic aluminum, glass, or steel products may be unreasonable if the cost is more than thirty percent (30%) of the bid or offered price for foreign made aluminum, glass, or steel products. This preference shall be applied to an item of machinery or equipment, as indicated above, when the item is a single unit of equipment or machinery manufactured primarily of aluminum, glass or steel, is part of a public works contract and has the sole purpose or of being a permanent part of a single public works project. This provision does not apply to equipment or machinery purchased by a spending unit for use by that spending unit and not as part of a single public works project.

All bids and offers including domestic aluminum, glass or steel products that exceed bid or offer prices including foreign aluminum, glass or steel products after application of the preferences provided in this provision may be reduced to a price equal to or lower than the lowest bid or offer price for foreign aluminum, glass or steel products plus the applicable preference. If the reduced bid or offer prices are made in writing and supersede the prior bid or offer prices, all bids or offers, including the reduced bid or offer prices, will be reevaluated in accordance with this rule.

43. INTERESTED PARTY SUPPLEMENTAL DISCLOSURE: W. Va. Code § 6D-1-2 requires that for contracts with an actual or estimated value of at least $1 million, the Vendor must submit to the Agency a disclosure of interested parties prior to beginning work under this Contract. Additionally, the Vendor must submit a supplemental disclosure of interested parties reflecting any new or differing interested parties to the contract, which were not included in the original pre-work interested party disclosure, within 30 days following the completion or termination of the contract. A copy of that form is included with this solicitation or can be obtained from the WV Ethics Commission. This requirement does not apply to publicly traded companies listed on a national or international stock exchange. A more detailed definition of interested parties can be obtained from the form referenced above.

44. PROHIBITION AGAINST USED OR REFURBISHED: Unless expressly permitted in the solicitation published by the State, Vendor must provide new, unused commodities, and is prohibited from supplying used or refurbished commodities, in fulfilling its responsibilities under this Contract.

45. VOID CONTRACT CLAUSES: This Contract is subject to the provisions of West Virginia Code § 5A-3-62, which automatically voids certain contract clauses that violate State law.

46. ISRAEL BOYCOTT: Bidder understands and agrees that, pursuant to W. Va. Code § 5A-3-63, it is prohibited from engaging in a boycott of Israel during the term of this contract.

ADDITIONAL TERMS AND CONDITIONS (Construction Contracts Only)

1. CONTRACTOR'S LICENSE: Until June 15, 2021, West Virginia Code § 21-11-2, and after that date, § 30-42-2, requires that all persons desiring to perform contracting work in this state be licensed. The West Virginia Contractors Licensing Board is empowered to issue the contractor's license. Applications for a contractor's license may be made by contacting the West Virginia Contractor Licensing Board.

The apparent successful Vendor must furnish a copy of its contractor's license prior to the issuance of a contract award document.

2. BONDS: The following bonds must be submitted:

☑ **BID BOND:** Pursuant to the requirements contained in W. Va. Code § 5-22-1(c), All Vendors submitting a bid on a construction project shall furnish a valid bid bond in the amount of five percent (5%) of the total amount of the bid protecting the State of West Virginia. **THE BID BOND MUST BE SUBMITTED WITH THE BID OR VENDOR'S BID WILL BE DISQUALIFIED.**

☑ **PERFORMANCE BOND:** The apparent successful Vendor shall provide a performance bond in the amount of 100% of the contract. The performance bond must be received by the Purchasing Division prior to Contract award. (Attorney General requires use of the State approved bond forms found at: www.state.wv.us/admin/purchase/forms2.html)

☑ **LABOR/MATERIAL PAYMENT BOND**: The apparent successful Vendor shall provide a labor/material payment bond in the amount of 100% of the Contract value. The labor/material payment bond must be delivered to the Purchasing Division prior to Contract award. (Attorney General requires use of the State approved bond forms found at: www.state.wv.us/admin/purchase/forms2.html)

☐ **MAINTENANCE BOND:** The apparent successful Vendor shall provide a two (2) year maintenance bond covering the roofing system if the work impacts an existing roof. The amount of the bond must be equal to the price associated with the percentage of the project impacting the roof. The maintenance bond must be issued and delivered to the Purchasing Division prior to Contract award. (Attorney General requires use of the State approved bond forms found at: www.state.wv.us/admin/purchase/forms2.html)

At a minimum, all construction projects require a bid bond, performance bond, and labor/material payment bond. Failure on the part of the state of West Virginia to checkmark the required bonds above does not relieve the vendor from the legal requirement of providing these bonds.

In lieu of the Bid Bond, the Vendor may provide certified checks, cashier's checks, or irrevocable letters of credit. Any certified check, cashier's check, or irrevocable letter of credit provided in lieu of the bid bond must be of the same amount required of the Bid Bond and delivered with the bid.

3. DRUG-FREE WORKPLACE AFFIDAVIT: W. Va. Code § 21-1D-5 provides that any solicitation for a public improvement contract requires each Vendor that submits a bid for the work to submit an affidavit that the Vendor has a written plan for a drug-free workplace policy. If the affidavit is not submitted with the bid submission, the Purchasing Division shall promptly request by telephone and electronic mail that the low bidder and second low bidder provide the affidavit within one business day of the request. Failure to submit the affidavit within one business day of receiving the request shall result in disqualification of the bid. To comply with this law, Vendor should complete the enclosed drug-free workplace affidavit and submit the same with its bid. Failure to submit the signed and notarized drugfree workplace affidavit or a similar affidavit that fully complies with the requirements of the applicable code, within one business day of being requested to do so shall result in disqualification of Vendor's bid. Pursuant to W. Va. Code 21-1D-2(b) and (k), this provision does not apply to public improvement contracts the value of which is $100,000 or less or temporary or emergency repairs.

3.1. DRUG-FREE WORKPLACE POLICY: Pursuant to W. Va. Code § 21-1D-4, Vendor and its subcontractors must implement and maintain a written drug-free workplace policy that complies with said article. The awarding public authority shall cancel this contract if: (1) Vendor fails to implement and maintain a written drug-free workplace policy described in the preceding paragraph, (2) Vendor fails to provide information regarding implementation of its drug-free workplace policy at the request of the public authority; or (3) Vendor provides to the public authority false information regarding the contractor's drug-free workplace policy.

Pursuant to W. Va. Code 21-1D-2(b) and (k), this provision does not apply to public improvement contracts the value of which is $100,000 or less or temporary or emergency repairs.

4. DRUG FREE WORKPLACE REPORT: Pursuant to W. Va. Code § 21-1D-7b, no less than once per year, or upon completion of the project, every contractor shall provide a certified report to the public authority which let the contract. For contracts over $25,000, the public authority shall be the West Virginia Purchasing Division. For contracts of $25,000 or less, the public authority shall be the agency issuing the contract. The report shall include:

(1) Information to show that the education and training service to the requirements of West Virginia Code § 21-1D-5 was provided;

(2) The name of the laboratory certified by the United States Department of Health and Human Services or its successor that performs the drug tests;

(3) The average number of employees in connection with the construction on the public improvement;

(4) Drug test results for the following categories including the number of positive tests and the number of negative tests: (A) Pre-employment and new hires; (B) Reasonable suspicion; (C) Post-accident; and (D) Random.

Vendor should utilize the attached Certified Drug Free Workplace Report Coversheet when submitting the report required hereunder. Pursuant to W. Va. Code 21-1D-2(b) and (k), this provision does not apply to public improvement contracts the value of which is $100,000 or less or temporary or emergency repairs.

5. AIA DOCUMENTS: All construction contracts that will be completed in conjunction with architectural services procured under Chapter 5G of the West Virginia Code will be governed by the attached AIA documents, as amended by the Supplementary Conditions for the State of West Virginia, in addition to the terms and conditions contained herein.

6. PROHIBITION AGAINST GENERAL CONDITIONS: Notwithstanding anything contained in the AIA Documents or the Supplementary Conditions, the State of West Virginia will not pay for general conditions, or winter conditions, or any other condition representing a delay in the contracts. The Vendor is expected to mitigate delay costs to the greatest extent possible and any costs associated with Delays must be specifically and concretely identified. The state will not consider an average daily rate multiplied by the number of days extended to be an acceptable charge.

7. GREEN BUILDINGS MINIMUM ENERGY STANDARDS: In accordance with § 22-29-4, all new building construction projects of public agencies that have not entered the schematic design phase prior to July 1, 2012, or any building construction project receiving state grant funds and appropriations, including public schools, that have not entered the schematic design phase prior to July 1, 2012, shall be designed and constructed complying with the ICC International Energy Conservation Code, adopted by the State Fire Commission, and the ANSI/ASHRAE/IESNA Standard 90.1-2007: Provided, That if any construction project has a commitment of federal funds to pay for a portion of such project, this provision shall only apply to the extent such standards are consistent with the federal standards.

8. LOCAL LABOR MARKET HIRING REQUIREMENT: Pursuant to West Virginia Code §21-1C-1 et seq., Employers shall hire at least seventy-five percent of employees for public improvement construction projects from the local labor market, to be rounded off, with at least two employees from outside the local labor market permissible for each employer per project.

Any employer unable to employ the minimum number of employees from the local labor market shall inform the nearest office of Workforce West Virginia of the number of qualified employees needed and provide a job description of the positions to be filled.

If, within three business days following the placing of a job order, Workforce West Virginia is unable to refer any qualified job applicants to the employer or refers less qualified job applicants than the number requested, then Workforce West Virginia shall issue a waiver to the employer stating the unavailability of applicant and shall permit the employer to fill any positions covered by the waiver from outside the local labor market. The waiver shall be in writing and shall be issued within the prescribed three days. A waiver certificate shall be sent to both the employer for its permanent project records and to the public authority.

Any employer who violates this requirement is subject to a civil penalty of $250 per each employee less than the required threshold of seventy-five percent per day of violation after receipt of a notice of violation.

Any employer that continues to violate any provision of this article more than fourteen calendar days after receipt of a notice of violation is subject to a civil penalty of $500 per each employee less than the required threshold of seventy-five percent per day of violation.

The following terms used in this section have the meaning shown below.

(1) The term "construction project" means any construction, reconstruction, improvement, enlargement, painting, decorating or repair of any public improvement let to contract in an amount equal to or greater than $500,000. The term "construction project" does not include temporary or emergency repairs;

(2) The term "employee" means any person hired or permitted to perform hourly work for wages by a person, firm or corporation in the construction industry; The term "employee" does not include:(i) Bona fide employees of a public authority or individuals engaged in making temporary or emergency repairs;(ii) Bona fide independent contractors; or(iii) Salaried supervisory personnel necessary to assure efficient execution of the employee's work;

(3) The term "employer" means any person, firm or corporation employing one or more employees on any public improvement and includes all contractors and subcontractors;

(4) The term "local labor market" means every county in West Virginia and any county outside of West Virginia if any portion of that county is within fifty miles of the border of West Virginia;

(5) The term "public improvement" includes the construction of all buildings, roads, highways, bridges, streets, alleys, sewers, ditches, sewage disposal plants, waterworks, airports and all other structures that may be let to contract by a public authority, excluding improvements funded, in whole or in part, by federal funds.

9. DAVIS-BACON AND RELATED ACT WAGE RATES:

☐ The work performed under this contract is federally funded in whole, or in part. Pursuant to _____, Vendors are required to pay applicable Davis-Bacon wage rates.

☑ The work performed under this contract is not subject to Davis-Bacon wage rates.

10. SUBCONTRACTOR LIST SUBMISSION: In accordance with W. Va. Code § 5-22-1, the apparent low bidder on a contract valued at more than $250,000.00 for the construction, alteration, decoration, painting or improvement of a new or existing building or structure shall submit a list of all subcontractors who will perform more than $25,000.00 of work on the project including labor and materials. (This section does not apply to any other construction projects, such as highway, mine reclamation, water or sewer projects.) The subcontractor list shall be provided to the Purchasing Division within one business day of the opening of bids for review.
If the apparent low bidder fails to submit the subcontractor list, the Purchasing Division shall promptly request by telephone and electronic mail that the low bidder and second low bidder provide the subcontractor list within one business day of the request. Failure to submit the subcontractor list within one business day of receiving the request shall result in disqualification of the bid.

If no subcontractors who will perform more than $25,000.00 of work are to be used to complete the project, the apparent low bidder must make this clear on the subcontractor list, in the bid itself, or in response to the Purchasing Division's request for the subcontractor list.

a. Required Information. The subcontractor list must contain the following information:

i. Bidder's name

ii. Name of each subcontractor performing more than $25,000 of work on the project.

iii. The license number of each subcontractor, as required by W. Va. Code § 21-11-1 et. seq.

iv. If applicable, a notation that no subcontractor will be used to perform more than $25,000.00 of work. (This item iv. is not required if the vendor makes this clear in the bid itself or in documentation following the request for the subcontractor list.)

b. Subcontractor List Submission Form: The subcontractor list may be submitted in any form, including the attached form, as long as the required information noted above is included. If any information is missing from the bidder's subcontractor list submission, it may be obtained from other documents such as bids, emails, letters, etc. that accompany the subcontractor list submission.

c. Substitution of Subcontractor. Written approval must be obtained from the State Spending Unit before any subcontractor substitution is permitted. Substitutions are not permitted unless:

i. The subcontractor listed in the original bid has filed for bankruptcy;

ii. The subcontractor in the original bid has been debarred or suspended; or

iii. The contractor certifies in writing that the subcontractor listed in the original bid fails, is unable, or refuses to perform his subcontract.

Subcontractor List Submission (Construction Contracts Only)

Bidder's Name: _____

☑ Check this box if no subcontractors will perform more than $25,000.00 of work to complete the project.

Subcontractor Name	License Number if Required by W. Va. Code § 21-11-1 et. seq.
* SEE ATTACHED	

Attach additional pages if necessary

To: ***Larry D. McDonnell***
Senior Buyer
Purchasing Division

Re: **Proposed Subcontractor List**
Brush Creek #15

Dear Mr. McDonnell,

Below is Sequoia's proposed list of subcontractors for the Brush Creek #15 Project. Please note that we will be conducting final scope reviews with each proposed subcontractor and verifying all prequalification information received at bid time. In the unlikely event that any proposed subcontractor needs to be replaced, Sequoia will provide an alternative qualified subcontractor to serve in their place.

Brush Creek 15 - List of Subcontractors (Sequoia Services)	
Subcontractor	**Work Scope**
Central Carolina Seeding	E&SC installation, seeding
Premier CPS	PSW concrete repair and water-proofing
Griffin Dewatering	Construction dewatering
In-Water Services	Commercial diving
GZA	Instrumentation
Terracon / ESC	Engineering Services & Quality Control

Sincerely,

Liam Collins
Sr. Vice President

DESIGNATED CONTACT: Vendor appoints the individual identified in this Section as the Contract Administrator and the initial point of contact for matters relating to this Contract.

(Printed Name and Title) Liam Collins, Sr. Vice President

(Address) 3300 Battleground Ave., Suite 102, Greensboro, NC 27410

(Phone Number) / (Fax Number) 336-708-2505/336-232-1517 (fax)

(email address) liam@seqserv.com

CERTIFICATION AND SIGNATURE: By signing below, or submitting documentation through *wv*OASIS, I certify that: I have reviewed this Solicitation/Contract in its entirety; that I understand the requirements, terms and conditions, and other information contained herein; that this bid, offer or proposal constitutes an offer to the State that cannot be unilaterally withdrawn; that the product or service proposed meets the mandatory requirements contained in the Solicitation/Contract for that product or service, unless otherwise stated herein; that the Vendor accepts the terms and conditions contained in the Solicitation, unless otherwise stated herein; that I am submitting this bid, offer or proposal for review and consideration; that this bid or offer was made without prior understanding, agreement, or connection with any entity submitting a bid or offer for the same material, supplies, equipment or services; that this bid or offer is in all respects fair and without collusion or fraud; that this Contract is accepted or entered into without any prior understanding, agreement, or connection to any other entity that could be considered a violation of law; that I am authorized by the Vendor to execute and submit this bid, offer, or proposal, or any documents related thereto on Vendor's behalf; that I am authorized to bind the vendor in a contractual relationship; and that to the best of my knowledge, the vendor has properly registered with any State agency that may require registration.

By signing below, I further certify that I understand this Contract is subject to the provisions of West Virginia Code § 5A-3-62, which automatically voids certain contract clauses that violate State law; and that pursuant to W. Va. Code 5A-3-63, the entity entering into this contract is prohibited from engaging in a boycott against Israel.

Sequoia Services, LLC
(Company)

(Signature of Authorized Representative)
Liam Collins, Sr. Vice President
(Printed Name and Title of Authorized Representative) (Date)
336-708-2505/336-232-1517 (fax)
(Phone Number) (Fax Number)
liam@seqserv.com
(Email Address)

REQUEST FOR QUOTATION
Construction: Brush Creek 15 Dam Rehabilitation
CRFQ AGR26*16
REVISED AS OF 10/20/2025
VERSION 2 - SUPERSEDES ANY PREVIOUS VERSIONS

GENERAL CONSTRUCTION SPECIFICATIONS (No AIA Documents)

1. **PURPOSE AND SCOPE:** The West Virginia Purchasing Division is soliciting bids on behalf of WV Conservation Agency to establish a contract for the following:

   To complete the rehabilitation of dam structure that is classified as high hazard potential. The dam structure is Brush Creek Site 15. This dam provides a combination of flood protection, water supply, and recreation benefits to the surrounding communities. Brush Creek Site 15 is located on the North Fork of Brush Creek in Mercer County, West Virginia

   The Vendor shall furnish all materials, labor, and equipment necessary to complete all Construction Services. The Vendor shall furnish any incidental work, materials, labor, and equipment that are necessary to complete the Construction Services, even if such incidental work is not explicitly included in the Project Plans.

   Site 15 description: The dam is an approximately 690-feet-long zoned earthen embankment with a crest width of 22 feet, and a maximum height of 76 feet measured from the invert of the principal spillway conduit to the low point on the crest of the dam. The upstream slope of the embankment ranges from about 2H: 1 V to 2.5H: 1 V and the downstream slope is approximately 2.5H: 1 V.

   Site 15 rehabilitation measures: These measures include the installation of an upstream riprap stability berm, riser structure improvements, installation of a new downstream filter drainage system, flattening of the downstream embankment slope, extension of the 24-inch diameter principal spillway pipe, and installation of a new impact basin. The existing grass-lined auxiliary spillway will be improved with a roller compacted concrete (RCC) stepped chute spillway.

   These items are to be accomplished by following the construction and material specifications, design drawings, Oversight Engineer, and as identified during the Job Showing.

   The contractor will perform post-construction site reclamation on all disturbed areas of the construction site.

   Final approval will be given by the Contracting Officer Representative.

2. **DEFINITIONS:** The terms listed below shall have the meanings assigned to them below. Additional definitions can be found in section 2 of the General Terms and Conditions and in the Project Plans as defined below.

   2.1 **"Construction Services"** means the work will consist of supplying all equipment, labor, and materials required for the rehabilitation efforts of Brush Creek Site 15 dam structure as more fully described in the Project Plans.

2.2 **"Pricing Page"** means the pages contained in wvOASIS, attached hereto as Exhibit A. Exhibit A is included in this documentation upon which Vendor should list its proposed price for the Construction Services.

2.3 **"Solicitation"** means the official notice of an opportunity to supply the State with Construction Services that is published by the Purchasing Division.

2.4 **"Project Plans"** means documents developed by an architect, an engineer, the Agency, or another design professional, which are attached hereto exhibits, that provide detailed instructions on how the Construction Services are to be performed. Project Plans are documents developed by an architect, an engineer, the Agency, or another design professional, which are attached hereto as exhibits (See exhibit "B"), that provide detailed instructions on how the Construction Services are to be performed. If Project Plans contain drawings or other documents too large to attach in the exhibits. Vendors can obtain copies in accordance with West Virginia Purchasing Division guidelines.

2.5 **"United States Department of Agriculture – Natural Resources Conservation Services (NRCS)"** means a federal agency of the United States government. NRCS works hand-in-hand with landowners, local conservation districts, and state and federal government agencies to provide federal assistance through programs, initiatives, and resources. One of those programs is the Watershed Rehabilitation Program (REHAB). The REHAB program is authorized by Public Law 83-566 which helps project sponsors rehabilitate aging dams that are reaching the end of their design life and/or no longer meet federal or state safety criteria or performance standards. This contract is derived from an agreement between NRCS and the WVCA for Rehab of Brush Creek site 15.

2.6 **"West Virginia State Conservation Committee (SCC)"** means a key body overseeing conservation efforts across the state. The SCC comprises various members, including representatives from federal and state agriculture and environmental agencies, agricultural producers, and nonprofit organizations. The SCC may employ an administrative officer (Executive Director), technical experts, and other agents and employees, permanent and temporary, as required. The administrative officer (Executive Director) and support staff shall be known as the West Virginia Conservation Agency (WVCA). The SCC approves policy and provides guidance to the WVCA. The SCC can direct the WVCA to partner and coordinate with conservation districts to implement programs through one or several conservations districts on several different programs. The SCC can also direct the WVCA to implement its programs at the state government level through a state contract utilizing the West Virginia State Purchasing Division.

2.7 **"West Virginia Conservation Agency (WVCA)"** means a state agency that provides conservation activities to the State of West Virginia and provides administrative support and technical support to the fourteen (14) conservation districts in the State of West Virginia. The WVCA is tasked with providing conservation activities that include

implementation of agricultural enhancement, conservation services water quality projects, and watershed projects to include Emergency Watershed Protection; The Operations, Maintenance, and Repair (OMR) of Flood Control Structures (Dams); and Rehabilitation of Flood Control Structures (Dams). The West Virginia Conservation Agency shall be called by its full name or the "WVCA" in this document.

2.8 "**WVCA Contracting Officer (CO)**" means an appointed staff member of the WVCA whose signature will be on all official contract decisions on behalf of the government. The WVCA will direct the CO as to the proper agency response before the CO places a signature. The CO's signed documents shall be the official response of the government, and no other responses are binding. Federal, State, and County entities will take their issues to the WVCA Contracting Officer. The CO will take all issues to the WVCA for guidance and approval. Upon approval, the CO will issue a statement as to how the issue is to be addressed or sign off on documents related to determinations, findings, and any administrative or technical aspects of the contract as the official responses. The WVCA Contracting Officer has the signatory authority to request through West Virginia Purchasing Division to establish, administer, modify and/or terminate this contract. The CO will utilize the WVCA Procurement Officer to take any action on the construction contract. The WVCA Procurement Officer will forward the contract request to the WV Purchasing Division. Following WV Purchasing Division approval, the CO will share the decisions with the COR who will then share decisions with the contractor. All changes to the contract documents require a Change Order. When required, the COR sends a request to the CO. The CO, with approval of the WVCA, will have the WVCA Procurement Officer send the change order request to the WV Purchasing Division as stated above. If approved, a construction change order will be issued.

2.9 "**WVCA Contracting Officer Representative (COR)**" means an appointed staff member of the WVCA whose responsibility is to assist the Contracting Officer (CO) in managing and overseeing a specific contract, acting as the CO's representative at the project site.

2.10 "**Quality Assurance Firm / Oversight Engineer (Oversight Engineer)**" means a firm (and engineers working for that firm) that is responsible for construction oversight by providing technical guidance and quality assurance to the contractor on implementation of the construction project. Ensuring the work on the ground adherence to standards of all construction documents and to the highest standards of quality, safety, and efficiency.

2.11 "**Sponsoring Local Organizations (SLO)**" means organizations below the state level which include, but not limited to, county commissions, municipalities, public service districts, and grassroots organizations providing financial and administrative support to a project.

2.12 "**Subcontractor**" means a person/business/company who performs a portion of a project undertaken by a principal or general contractor or another subcontractor. During bid

submission, the bidder shall submit a list of all subcontractors who will perform more than $25,000 worth of work on the project including labor and materials.

2.13 "Substantially Complete" means the work shall be deemed "substantially complete" if and only if the Contractor has completed the work and related contract obligations in accordance with the contract documents, such that the Government may enjoy the intended access, occupancy, possession, and use of the entire work without impairment due to incomplete or deficient work, and without interference from the Contractor's completion of remaining work or correction of deficiencies in completed work.

2.14 "Gantt Chart" means a visual project management tool, usually bar chart, used to illustrate a project schedule, showing tasks along a timeline.

3. **ORDER OF PRECEDENCE:** This General Construction Specifications document will have priority over, and supersede, anything contained in the Project Plans.

4. **QUALIFICATIONS:** Vendor, or Vendor's staff if requirements are inherently limited to individuals rather than corporate entities, shall have qualifications in experience through number of projects; experience with Dam-Rehabilitation, Construction, and/or Repair; and experience with Roller Compacted Concrete (RCC) for Dam Rehabilitation, Construction, and/or Repair projects. Compliance with this experience requirement will be evaluated by the State prior to the contract award. The vendor must provide in their bid packet documentation of experience through past projects, documents demonstrating evidence that the vendor has successfully completed the requested type of work listed in the specifications and drawings, and references. The vendor must provide any documentation requested by the State to assist in confirmation of compliance with this provision. References, documentation, or other information to confirm compliance with this experience requirement may be requested after bid opening and prior to contract award.

Contractors must have the following minimum qualifications:

a. The vendor, or vendor's supervisory staff assigned to this project, must have successfully completed at least two (2) projects within the last ten (10) years that involved work similar in nature to that described in these specifications or the Project Plans.

b. Vendor must have experience with Dam Construction, Repair, or Rehabilitation projects.

c. Vendor must have experience with Roller Compacted Concrete (RCC) for Dam Rehabilitation projects.

Submission of Qualifications:

d. A list of projects similar in scope and size during the past ten (10) years. The bidder shall submit a list of projects that are similar in scope and size to the proposed Brush Creek site 15 Rehabilitation Construction Project. These projects must have been

completed during the past ten (10) years. The list shall contain the contractee/owner of the project and shall contain a POC for that contractee/owner of the project.

e. Documentation that details a minimum of two (2) projects similar in scope and size during the past ten (10) years. The bidder shall submit a minimum of two (2) projects that are similar in scope and size to the proposed Brush Creek site 15 Rehabilitation Construction Project (each project shall be submitted on a separate document). These projects must have been completed during the past ten (10) years.

f. Each document shall include but not limited to project description, scope, major items of work, contractee/owner, inspection company, and references.
Projects examples shall be provided exhibiting dam construction, rehabilitation, or repair, particularly those requiring similar construction practices to those required for this contract.

Project Examples and project information should be included to allow the WVCA to contact the contractees who were served in previous contracts (owners/agencies served).
This will give the WVCA the ability to assess the quality of the services provided. Examples of contractor's past performance on NRCS construction projects (or projects of similar nature may be substituted) should exhibit construction practices aligning with the work to be performed for the Brush Creek site 15 Rehabilitation Construction Project.
Examples should highlight measures implemented to meet construction milestones on schedule, as well as management techniques to meet or exceed the deliverables and requirements of the contract specifications.

g. Resume-style format of Qualifications. In addition to the contractor's licensing and qualifications set forth is this document, the contractor/subcontractor qualifications provided should identify key personnel in a resume-style format that have demonstrated expertise in past projects related to earthwork, concrete, project management, and other components necessary to meet the construction requirements.

When the contractor utilizes subcontractors by choice or as the construction specifications require, the contractor is responsible for ensuring all subcontractors meet the professional licensing requirements as detailed in the construction specifications.

A qualified contractor or subcontractor must meet the required experience to submit an eligible bid.

h. Documented experience of previous project requiring placement of roller compacted concrete (RCC). The contractor must be experienced in high hazard potential classified dam construction and/or rehabilitation. The contractor must provide documented experience provide documented experience of a previous project requiring mixing and placing of roller compacted concrete (RCC).

If the contractor is choosing to subcontract the roller compacted concrete work, the documents submission must include separate qualifications, experience, and past performance of the subcontractor identified to complete the RCC work.
The requirements of the construction personnel according to the construction specifications are as follows:

The Roller Compacted Concrete (RCC) Plant Operator shall be experienced in production of RCC with at least 1 project of similar quantity and scope within the past 3 years, or 2 jobs of similar quantity and scope within the past 5 years.

The contractor shall engage an independent third party to serve as RCC Quality Control Supervisor. The RCC Quality Control Supervisor shall be experienced in production and placement of RCC with at least 1 project of similar quantity and scope within the past 3 years, or 2 jobs of similar quantity and scope within the past 5 years.

The RCC Placement Foreman/Superintendent shall have at least one RCC project of similar quantity and scope in the last 5 years with at least 10 years of experience in earthwork.

The contractor is responsible for ensuring all subcontractors meet the minimum requirements of experience as detailed in the construction specifications.

The contractor may be disqualified from bidding if contractor fails to provide a project example of a previous dam construction, rehabilitation, or repair project with a large component of roller compacted concrete installation.

Where experience in NRCS assisted dam construction, rehabilitation, or repair projects is not available, projects of similar nature may be substituted.

5. **CONTRACT AWARD:** The Contract is intended to provide Agency with a purchase price for the Construction Services. The Contract will be awarded to the lowest qualified responsible bidder meeting the required specifications. If the Pricing Pages contain alternates/add-ons, the Contract will be awarded based on the grand total of the base bid and any alternates/add-ons selected.

6. **SELECTION OF ALTERNATES:** Pursuant to W. Va. Code § 5-22-1(f), any solicitation of bids shall include no more than five alternates. Alternates, if accepted, shall be accepted in the

order in which they are listed on the bid form. Any unaccepted alternate contained within a bid shall expire 90 days after the date of the opening of bids for review. Determination of the lowest qualified responsible bidder shall be based on the sum of the base bid and any alternates accepted.

7. **PERFORMANCE:** Vendor shall perform the Construction Services in accordance with this document and the Project Plans, Exhibit B.

8. **SUBSTITUTIONS:** Any substitution requests must be submitted in accordance with the official question and answer period described in the INSTRUCTIONS TO VENDORS SUBMITTING BIDS, Paragraph 4. Vendor Question Deadline. Vendors submitting substitution requests should submit product brochures and product specifications during the official question and answer period.

9. **PROJECT PLANS:** The checked box will apply to Project Plans for this solicitation.

   No Additional Project Plan Documents: There are no additional Project Plans other than those attached hereto as Exhibit B or any subsequent addenda modifying Exhibit B.

   The documents listed on Exhibit B are attached to the solicitation via wvOASIS Vendor Self Service portal. If you have any issues downloading the attachments, contact Larry McDonnell at Larry.D.McDonnell@wv.gov

10. **FEDERAL ACQUISITION REGULATIONS – 52.211-18 VARIATION IN ESTIMATED QUANTITY:** As prescribed in Federal Acquisition Regulations (FAR) 11.703, Contract clauses, Variation in Estimated Quantity (Apr 1984), when a fixed-price construction contract is contemplated that authorizes a variation in the estimated quantity of unit priced items:

    If the quantity of a unit-priced item in this contract is an estimated quantity and the actual quantity of the unit-priced item varies more than 15 percent above or below the estimated quantity, an equitable adjustment in the contract price shall be made upon demand of either party. The equitable adjustment shall be based upon any increase or decrease in costs due solely to the variation above 115 percent or below 85 percent of the estimated quantity.

    If the quantity variation is such as to cause an increase in the time necessary for completion, the Contractor may request, in writing, an extension of time, to be received by the WVCA Contracting Officer within 10 days from the beginning of the delay (or within such further period as may be granted by the WVCA before the date of final settlement of the contract).

    Upon receipt of a written request for an extension, the WVCA Contracting Officer shall submit to WVCA to ascertain the facts and to decide if adjustment to extend the completion date is valid. The judgement of the WVCA shall be given to the WVCA Contracting Officer to place an official response.

11. CONDITIONS OF THE WORK

a. **Permits:** The Vendor shall procure all necessary permits and licenses to comply with all applicable Federal, State, or Local laws, regulations and ordinances of any regulating body.

The contractor is responsible for any additional necessary permits and associated fees. The contractor shall, without additional expense to the West Virginia Purchasing Division, be responsible for codes, any necessary licenses/permits, and for complying with any applicable federal, state, and municipal laws, and regulations applicable to the performance of the work.

The WVCA shall be responsible for obtaining all work rights of entry for the project. The contractor is permitted only to do the work outlined by the Oversight Engineer while completing work on-site under this contract. Any additional work requested by the landowner will occur only after the final inspection is completed by the WVCA and all necessary permits and rights of entry for additional work must be obtained by the contractor or landowner.

The following permits have been obtained for Brush Creek Site 15:

I. WV DEP Dam Safety Certificate of Approval
II. USACOE Section 404 General Permit - Clean Water Act
III. WV DEP Section 401 Water Quality Certification
IV. WV DEP NPDES Construction Stormwater
V. WV DNR Public Lands Corp Stream Activity Application

b. **Land Rights:** Adequate land rights needed to perform the work under this contract have been acquired by, or on behalf of, the WVCA. The right to enter, remove, or otherwise make use of adjacent property, roads, utility lines, fences, and other improvements not included within the land rights provided shall be the sole responsibility of the contractor.

c. **Ingress and Egress:** The WVCA shall be responsible for obtaining all work rights-of-entry for the project. Where ingress and egress are not defined by the drawings, the vendor shall review the drawings and determine their recommendation for Ingress and Egress into a particular area of the project site and determine whether the ingress/egress should be used together or separately for entrance and exit purposes. The Oversight Engineer will review the vendor's proposal and provide a recommendation to the COR. The COR will designate the right-of-way to be used. The COR shall inform the CO who will provide an official response in writing as to the location and traffic pattern.

12. PROJECT SITE: The contractor is permitted only to do the work outlined in the drawings and in the specifications while completing work on-site under this contract. Any variations by the contractor in implementing the specifications or drawings without a modification will cause the work to be suspended. Upon identifying any variations, the Oversight Engineer will contact

the Contracting Officer Representative (COR) to request that all work be halted at the project site. The Oversight Engineer will identify the variations made by the contractor to the drawings or specifications and inform the COR of the changes. The COR will meet with the contractor and inform them of the corrections needed before work continues.

Any additional work requested by the partnership of this project (to include but not limited to State and Federal entities, the Mercer County Commission, and the Green Valley-Glenwood PSD) will only occur through an approved modification to the contract. Without modification, no work will be conducted outside the perimeters of the drawings and specifications.

The State of West Virginia, the Purchasing Division, the State Conservation Committee, the WVCA, the Oversight Engineer, the Mercer County Commission, the Green Valley-Glenwood PSD, and the NRCS will not be held responsible or liable for any work or any resulting damage from work performed outside of the contract or work limits.

13. **Utility Identification:** It is the responsibility of the contractor before any ground-disturbing activities to place a telephone call to Miss Utility of West Virginia to ensure that utilities are identified at the project site. You can also get additional information at their website at www.WV811.com. **To make contact, dial 811 or 1-800-245-4848.**

14. **Existing Conditions**: If discrepancies are discovered between the existing conditions and those noted in the specifications, Vendor must immediately notify the Agency's representative. Vendor must also immediately notify the Agency if suspected hazardous materials are encountered.

15. **Construction Schedule:** The construction contractor shall submit a construction schedule within 21 days following the contract award. Schedule should identify milestones that show a projected start date, substantial completion date, final completion date, and duration of critical activities that demonstrate an understanding of the timeline specified within this document and is consistent with the Brush Creek site 15 construction contract sequencing criteria. Major work areas such as the upstream embankment, downstream embankment, & auxiliary spillway at each site must be identified.

    The schedule shall be presented in a chart and graphical form. and a digital copy of the schedule shall be provided with each submission or update.

    The Gantt chart schedule shall be prepared in construction scheduling software that includes work activities linked together with logic between tasks. The start, finish, duration, and interdependent tasks shall be shown for each construction task.

    All liquidated damage milestones shall be shown in the schedule.

    The schedule shall also include the status of reservoir the pools (pool operating normally, being drained, drained, refilling, pool lowered, etc.) throughout the timeline of the construction period.

The forty-six (46) bid line-items for Brush Creek Site 15 shall be included as scheduled tasks at a minimum (contractor can choose to include more items) to sufficiently detail the work to be performed. The schedule should assume a notice to proceed with field work of March 2, 2026.

Preconstruction work activities such as preparation of submittals, work plans, continuous video monitoring set-up, and shop drawings are anticipated to occur between the contract award and notice to proceed dates.

Following approval of the contractor initial schedule submission, the contractor shall expand the schedule to include the contractor and subcontractor resources and requirements for each task, identify and track bid schedule costs within tasks, and track the progress of all tasks. The schedule shall be updated and resubmitted with each monthly request for payment and as requested by the WVCA.

16. **Project Closeout**: Project Closeout shall include the following:

a. The construction contractor shall participate in a "Substantial Completion Inspection" and a "Final Completion Inspection" prior to release from the contract. In each of these inspections, the COR, Oversight Engineer, and/or any additional subject matter expert(s) designated by West Virginia Conservation Agency will participate as inspectors to identify any deficiencies.

b. Substantial Completion Inspection: The purpose of this inspection will be to identify deficiencies that need to be remedy prior to the Agency's final completion inspection. During this period the contractor is still obligated to perform in accordance with the contract and must take all actions necessary to ensure that work complies with the requirements of the contract prior to final acceptance.

c. Prior to the final completion inspection, the contractor shall complete a final clean-up of the project site. The contractor is responsible for removing and disposing of all unused and/or unnecessary materials and/or debris, off site and at the contractor's expense.

d. Final Completion Inspection: the purpose of this inspection will be to inspect those deficiencies found in the substantial completion inspection and verify that all deficiencies have been addressed. If all deficiencies have been corrected, final acceptance of the work will be given. The vendor shall submit any warranty documents to the Agency project manager at final inspection.

17. **Mobilization and Demobilization:**

The work shall consist of the mobilization and demobilization of the equipment and personnel necessary for performing the work required for the contract.

During mobilization, the construction of all temporary access roads will be completed as necessary to begin work on a substantial phase of the contract, when applicable. The cost for this will be included in the bid for mobilization and demobilization.

Mobilization may include additional buildings and other facilities (upon written approval of the WVCA Contracting Officer).

Also, during the mobilization process, the contractor shall include the establishment of the contractor's field office (field office is bid as a separate line item from the mobilization and demobilization line item. For Brush Creek site 15 is line item #45).

Demobilization shall include all activities involving removal from the sites of equipment, supplies, and personnel after completion of the work including cleanup of all rubbish and waste materials generated during the construction of this project; and restoration of any damage to existing site improvements resulting from the contractor's activities at the site.

Measurement and Basis of Payment for Mobilization and Demobilization: The line item shall be bid as a Lump Sum amount. Line-item number seven (7) on the Bid Schedule Sheet contains Mobilization and Demobilization.

Payment of Mobilization and Demobilization:

Payment will be made as the work proceeds, after presentation of paid invoices or documentation of direct costs by the Contractor showing specific mobilization and demobilization costs and supporting evidence of the charges of suppliers, subcontractors, and others. When the total of such payments is less than the lump sum contract price, the balance remaining will be included in the final contract payment.

Up to seventy-five percent (75%) of the lump sum amount for this bid item may be submitted for payment upon completion of mobilization as defined in this specification. The remaining twenty-five percent (25%) of the lump sum amount for this bid item may not be submitted for payment until the completion of the project to ensure proper clean-up and removal of equipment, parts, supplies, and all other such items.

18. **FACILITIES ACCESS:** Performance of Contract Services may require access cards and/or keys to gain entrance to Agency's facilities. In the event that access cards and/or keys are required:

    a. Vendor must identify principal service personnel which will be issued access cards and/or keys to perform service.

    b. Vendor will be responsible for controlling cards and keys and will pay replacement fee, if the cards or keys become lost or stolen.

    c. Vendor shall notify Agency immediately of any lost, stolen, or missing card or key.

    d. Anyone performing under this Contract will be subject to Agency's security protocol and procedures.

e. Vendor shall inform all staff of Agency's security protocol and procedures.

19. GENERAL CONSTRUCTION SITE OPERATIONS:

a. START OF CONSTRUCTION:

The WVCA will issue a "Notice to Proceed" to the awarded contractor which provides for the start of work. Upon the contractor's receipt of the "Notice to Proceed", the awarded contractor will follow the Sequencing Document/construction schedule and begin work.

b. WORK TIMEFRAME:

The Pre-construction activities can begin following the receipt of the "Notice to Proceed". The on-site construction will start **March 02, 2026**, and conclude on the established "substantial completion date" of **December 30, 2027**.

An additional 30 days will be given to complete the rest of the work for final completion.

To assist the vendor, we have calculated the number of Total Available Workdays and the Total Available Non-Restricted Workdays between the two dates given above.

The total available workdays in 2026 are 206 workdays.
The total available workdays in 2027 are 246 workdays.

The non-restricted workdays in 2026 are 188 workdays.
The non-restricted workdays in 2027 are 174 workdays.

To derive at those numbers, the WVCA identified the **Total Number of Days** and then subtracted the total number of days in (a) **Non-Available Days** (Saturday, Sunday, Holidays) and then broke down further by calculating the number of days in (b) **Limited Construction Work Period**.
Total Number of Days: There are 669 days between the two dates with 305 days in 2026 and 364 days in 2027.

Non-Available Days: Days the WVCA has determined that the contractor will be off from work as a standard routine is Saturdays, Sundays, and Holidays. If during the construction season, the contractor wishes to work on these days, the contractor will need to seek approval from the WVCA and if approved a contract modification will be written.

Saturdays, Sundays Off: There are a total of forty-three (43) Saturdays off from work and forty-three (43) Sundays off from work in the calendar year 2026. There are a total of fifty-two (52) Saturdays off from work and fifty-two (52) Sundays off from work in the calendar year 2027.

Holidays Off: The holidays that will be observed in 2026 and 2027 are provided below for each of the two construction seasons. There is a total of thirteen (13) observed holidays in calendar year 2026. There is a total of fourteen (14) observed holidays in calendar year 2027. Additional mandated State and Federal holidays may be observed in addition to those listed below.

2026		2027
Primary Election Day* – May 12, 2026.		**New Years Day** – January 01, 2027.
Memorial Day – May 25, 2026		**Martin Luther King Jr. Day** – January 18, 2027
Juneteenth Day – June 19, 2026.		**Presidents' Day** – February 15, 2027.
Independence Day – July 3, 2026.		**Memorial Day** – May 31, 2027.
Labor Day – September 07, 2026.		**Juneteenth Day** – June 18, 2027.
Columbus Day – October 12, 2026.		**West Virginia Day*** – June 21, 2027.
General Election Day – November 3, 2026.		**Independence Day** – July 5, 2027.
Veterans' Day – November 11, 2026.		**Labor Day** – September 6, 2027.
Thanksgiving Day – November 26, 2026.		**Columbus Day** – October 11, 2027.
Day After Thanksgiving* – November 27, 2026.		**Veterans' Day** – November 11, 2027.
Christmas Eve* – December 24, 2026.		**Thanksgiving Day** – November 25, 2027.
Christmas Day – December 25, 2026.		**Day After Thanksgiving*** – November 26, 2027.
New Years Eve* – December 31, 2026.		**Christmas Eve*** (observed) – December 23, 2027.
		Christmas Day-(observed) December 14, 2027

* West Virginia State Holidays.

Limited Construction Work Period: A winter shutdown is not required for the project; however, contractors should anticipate that winter weather conditions will impact the ability to perform work activities. In this contract, the limited construction work period is from December 14, 2026, through March 12, 2027.

During this timeframe the contractor must notify the Contracting Officer Representative (COR) to seek approval for any work activities they plan to complete during the limited construction work period. The COR, in consultation with the Oversight Engineer, will determine if that work can be completed based on the restrictions in the specifications and quality control requirements. The specifications and the quality control requirements will be strictly adhered to and may limit the work that can be performed during this period.

From December 14, 2026, through March 12, 2027, the WVCA has an estimated sixty-one (61) limited workdays (minus weekends and Holidays) in the "Limited Construction Work Period" for this contract.

Adverse Weather Days: Are not calculated into the total number of days available (As shown above in number 2). The design has an estimated sixty-five (65) days per construction season and should be assumed lost due to adverse weather conditions. This estimate is based on adverse weather conditions when rainfall **exceeded 0.1 - inches** of rain per day.

Contractors should plan for this amount of lost work time. Time extension for adverse weather conditions would only be considered by the WVCA if the contractor experiences delay that exceed the 65 days and is adequately supported by construction diaries, entries and site weather conditions.

c. **TIMEFRAME SUCCESS THROUGH STRICT ADHERENCE TO THE CONSTRUCTION SCHEDULE:** The WVCA has concluded that this contract can be completed during this timeframe that has been presented. Contractors should schedule the work in accordance with the Construction Sequencing Criteria and provide a workforce to complete the work within the identified timeframe.

Workweek: The WVCA expects that the standard for a workweek shall be at a minimum Monday through Friday.

Variations may be made to the Workweek schedule: Any variation to the work week (requesting to work weekends or holidays) shall be requested by the contractor. The contractor will make a request to the COR. The COR, in consultation with the Oversight Engineer, will decide on the proposal. If approved, the WVCA Contracting Officer (CO) will issue a change order.

Workday: The WVCA expects that the standard workday shall be at a minimum from 7:00 a.m. to 5:30 p.m. A mandatory lunch break of a minimum of 30 minutes will be taken by the contractor and crew each day.

Variations may be made to the Workday schedule: Any variation to the workday shall be requested by the contractor. One such variation would be the adjustment of the workday start time and end time based upon the time of year concerning Eastern Standard Time

or Daylight Savings Time. Another such variation would be the use of Multiple Shifts. The contractor may contemplate this option for multiple tasks to include, but not limited to, the Site 15 upstream berm work and the Roller Compacted Concrete (RCC) work.

The contractor will make a request to the COR. The COR, in consultation with the Oversight Engineer, will decide on the proposal. If approved, the WVCA Contracting Officer (CO) will issue a change order.

Multiple Shifts: To implement multiple shifts, the contractor will make a request to the Contracting Officer Representative (COR). The COR, in consultation with the Oversight Engineer, will decide on the proposal. If approved, the WVCA Contracting Officer (CO) will issue a change order.

When multiple shifts are approved by the WVCA, the number of shifts and the number of hours per shift will be determined and placed into a change order.

The contractor will have an experienced and acceptable workforce on-site that will consist of the appropriate number of employees to complete all the required tasks during a shift.

Also, the contractor will have equipment in serviceable and operating condition on-site that will consist of the appropriate size and pieces of equipment and required equipment to meet OSHA standards to complete all the required tasks during a shift to include night operations.

d. **AUTHORITY OF THE CONTRACTING OFFICER REPRESENTATIVE (COR):** Is responsible for assisting the Contracting Officer (CO) in managing and overseeing a specific contract, acting as the CO's representative at the project site. The COR serves as the primary point of contact on the project site. The COR will direct discussions between the government and the contractor at the project site. The COR will facilitate communications from the project site which includes communications from the contractor to the CO and from the Oversight Engineer to the CO.

The COR will monitor the performance of all personnel at the project site, ensure quality standards are met. The COR ensures the contractor fulfills the contract's technical and performance requirements by comparing the contractor's work to the construction specification, drawings, permits, and construction timeline. To ensure this the COR will implement the following:

(a) Communicate daily with the Oversight Engineer on implementation of the construction specification, drawings by the contractor.
(b) Discuss the implementation of the Quality Assurance Plan with the Oversight Engineer.
(c) Ensure all operations continue to move forward each day.
(d) Elevate issues and concerns to the Contracting Officer.

(e) Monitor work on the ground versus the Construction Timeline and any variance needs to be elevated.
(f) Call for the removal of any individual interfering with project operations.
(h) Document daily construction activities, including daily job diary entries, photos, and videos.
(i) Is the lead representative for the WVCA during the update meetings with the contractor, oversight engineer, and project stakeholders.

e. **AUTHORITY OF THE OVERSIGHT ENGINEER:** Is responsible for construction oversight by providing technical guidance and quality assurance to the WVCA on implementation of all construction related activities. Ensuring work on the ground adherence to standards of all construction documents and to the highest standards of quality, safety, and efficiency as follows:

(a) Implement the Quality Assurance Plan, including, but not limited to surveying, material testing, construction observation, inspections, and record keeping.
(b) Ensure all tasks follow the drawings and specifications. Any variation is to be reported to the COR.
(c) Oversee quality control inspections and tests performed by the vendor.
(d) Prepare (as-built) drawings.
(e) Review vendor submittals and coordinate the submittal review responses with project stakeholders.
(f) Review and verifying vendor survey notes for compliance with contract documents.
(g) Document daily construction activities, including daily job diary entries, photos, and videos.
(h) Monitor pollution control measures for compliance with the NPDES permit, state and local regulations.
(i) Monitor safety plan and construction schedule.
(j) Processing the pay estimates, as required by WVCA, and assist with pay-roll-related contract requirements.
(k) Provide independent cost estimates for contract modifications and changes.
(l) Coordinates and leads updating meetings with the contractor and project stakeholders.

Dispute Management: Any disagreements between the Contractor and the Oversight Engineer on interpretation of the drawings and specifications made by the Oversight Engineer will be elevated to the COR. The decision of the COR with a written response from the WVCA Contracting Officer will be final.

Obligating the State: The Oversight Engineer is not authorized to increase the obligation of the State of West Virginia, the State Conservation Committee, the WVCA, the Oversight Engineer, the Mercer County Commission, and the Green Valley-Glenwood PSD in this contract unless a Change Order is issued changing the obligations.

20. PROJECT OVERSIGHT: The contractor shall contact the WVCA and coordinate prior to mobilization to the site. The contractor shall meet with the COR and the Oversight Engineer at the site prior to the start of work.

Performance: Work shall be performed by the contractor as shown in the work drawings and as stated in the work specifications. The COR will provide oversight with consultation from the Oversight Engineer, to ensure drawings and specifications are followed.

Safety: Safety is a top priority, and any unsafe condition or act shall immediately shut down operations at the project site. This action can be announced by the WVCA, COR, or the Oversight Engineer. Work will resume when the COR determines the condition, or act has been corrected and gives the order for work to restart.

Suspension of Work: The COR, with consultation from the Oversight Engineer, may suspend the work, in whole or in part, for such time as the COR deems it necessary to prevent unsafe conditions for the employees or the public, or for any other condition or reason deemed to be of public interest.

All such suspension orders will be verbally stated to the contractor by the COR and work will cease immediately. A written suspension order from the CO to the contractor will follow the verbal order.

The COR may suspend the work, in whole or in part, for such time as the COR deems it necessary because of contractor shortfalls (inefficient operation, equipment not in good operating condition, or any condition or circumstance that is considered unsatisfactory for the performance of the work), unsatisfactory work performance, or failure of the contractor to comply with any of the requirements of this contract. Work suspension due to contractor shortfalls will not extend the end date established in this contract.

The COR may suspend the work, in whole or in part, for such time as the COR deems it necessary because of adverse weather conditions (the weather that places the contractor's staff and agency staff in harm's way or conditions that will cause equipment to do damage to the structure during operations). Adverse weather conditions exceeding the stated 65 days will cause the creation of a change order to adjust schedule and Liquidated damages.

Extension of Contract beyond Established End Date: If in order to complete the project it requires the contract end date is extended, a determination will be made as to if it was a result of Contractor Shortfall or Adverse Weather/ "Act of God".

If it is determined to be Contractor Shortfall based on COR/Oversight Engineer documentation (daily work log showing no work when work could have been completed), the contractor will not be additionally monetarily compensated for expenses incurred by the contractor for work beyond the established end date.

If it is determined to be Adverse Weather/"Act of God" based on COR/Oversight Engineer documentation (daily work log showing that work could not proceed for more than the allotted adverse weather/"Act of God" days [65 days]) or the contractor can provide evidence that the

delay was due to conditions outside the control of the contractor, the contractor shall be entitled to seek additional monetarily compensated for expenses incurred by the contractor for work beyond the established end date. This action will cause the creation of a change order to adjust compensation.

Increase Cost over the life of the Project: If, during the course of the project, the contractor can show valid justification for increased costs due to unforeseen events in the World, the contractor shall be entitled to seek additional monetarily compensated for expenses incurred by the contractor for increased costs of more than 15% above the original bid on materials. Also, if the Oversight Engineer determines during the course of work that additional work must be added to complete the project, the contractor shall be entitled to seek additional monetarily compensated for expenses incurred by the contractor for increased costs Thess actions will cause the creation of a change order to adjust compensation.

21. **THE WEST VIRGINIA CONSERVATION AGENCY INSPECTIONS AND TESTING:** All work (which term includes but is not restricted to materials, workmanship, and manufacture and fabrication of components) shall be subject to inspection and testing by the WVCA at all reasonable times and at places before acceptance. Any such inspection and testing are for the sole benefit of the WVCA and shall not relieve the contractor of the responsibility of providing quality control measures to ensure that the work strictly complies with the contract requirements.

    No inspections or tests by the WVCA shall be construed as constituting or implying acceptance. Inspections or tests shall not relieve the contractor of responsibility for damage to or loss of the material before acceptance, nor in any way affect the continuing rights of the WVCA after acceptance of the completed work.

22. **INSPECTIONS OF CONSTRUCTION:** The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. The Contractor shall maintain complete inspection records and make them available to the Oversight Engineer and the WVCA. All work shall be conducted under the general observation of the Oversight Engineer and is subject to inspections and tests by the Oversight Engineer and the WVCA at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract.

    Such inspections and tests are for the sole benefit of the WVCA and do not:
    (a) Relieve the contractor's responsibility for providing adequate quality control measures.
    (b) Relieve the contractor's responsibility for damage to or loss of the material before acceptance.
    (c) Constitute or imply acceptance.
    (d) Affect the continuing rights of the State and Federal Government after acceptance of the completed work under the last paragraph of this section.

The presence or absence of an inspector does not relieve the contractor from any contract requirement. No inspector is authorized to change any term or condition of the contract, specification, or drawings without written authorization (modification/change order).

The WVCA may charge the contractor any additional cost of inspection or test when work is not ready at the time specified by the contractor for inspection or test, or when prior rejection makes re-inspection or retest necessary.

The Oversight Engineer and the COR shall perform all inspections and tests in a manner that will not unnecessarily delay the work. All special, full-size, and performance tests shall be performed as described in the contract.

The contractor shall, without charge, replace or correct work found by the COR and/or Oversight Engineer which does not conform to contract requirements, unless, in the public interest, the WVCA consents to accept the work with an appropriate adjustment in the contract price. The contractor shall promptly segregate and remove rejected material from the premises.

If the contractor does not promptly replace or correct rejected work, the WVCA may:

(a) By contract or otherwise, replace or correct the work and charge the cost to the contractor.
(b) Terminate for default the contractor's right to proceed.

If, before acceptance of the entire work, the COR and the Oversight Engineer decide to examine already completed work by removing it or tearing it out, the contractor, on request, shall promptly furnish all necessary facilities, labor, and material.

If the work is found to be defective or nonconforming in any material respect due to the fault of the contractor or its subcontractors, the contractor shall defray the expenses of the examination and of satisfactory reconstruction.

However, if the work is found to meet contract requirements, the WVCA shall make an equitable adjustment for the additional services involved in the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

Unless otherwise specified in the contract, the Oversight Engineer and the WVCA shall accept, as promptly as practicable after completion and inspection, all work required by the contract or that portion of the work the WVCA determines to be accepted separately.

Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the State of West Virginia, the State Conservation Committee, the WVCA, the Oversight Engineer, the Mercer County Commission, and the Green Valley-Glenwood PSD' rights under any warranty or guarantee.

23. **CONTRACTOR'S RESPONSIBILITIES:** The contractor is responsible for ensuring the safe and efficient execution of the project and its supervisors overseeing the entire construction process. The contractor will accomplish this through adhering to the contract documents, project management, maintaining high standards of quality and safety throughout the construction process, planning, executing, overseeing, and inspecting the project from start to finish, coordinating subcontractors, and providing materials and labor, and managing budgets

and timelines. This encompasses various tasks, from initial planning and coordination to final completion and closeout.

Key Responsibilities of a Contractor: Some of the items of responsibility the contractor has in this project and include, but not limited to, the following:

Project Management: This includes planning, scheduling, and overseeing all aspects of the construction project, ensuring it stays on track and within budget.

Safety: Implementing and maintaining a safe working environment for all personnel, adhering to safety regulations, conducting regular safety inspections, and that all workers are properly trained and equipped.

Planning and Coordination: Integrating erosion and sediment control practices into the project plan, coordinating with relevant authorities (state, local, and federal), and ensuring all work aligns with the contract documents.

Quality Control: Upholding the highest quality standards throughout the project, from material selection to construction methods. This involves close observation of construction activities, adherence to specifications, and timely reporting of any deviations.

Communication: Contractors need to effectively communicate with all stakeholders, including clients, subcontractors, and suppliers, to keep everyone informed and address any issues that arise.

Schedule Management: Developing and maintaining a construction schedule and monitoring progress to ensure the project stays on track.

Materials and Equipment: Providing the necessary materials and equipment for the project and managing their delivery and storage on the job site.

Legal and Regulatory Compliance: Ensuring all work complies with relevant laws, regulations, and building codes.

Budget Management: Contractors are responsible for managing project costs, tracking expenses, and ensuring the project stays within the allocated budget.

Hiring and Procurement: Contractors may be responsible for hiring employees, as well as procuring necessary materials and equipment from vendors.

Subcontractor Management: Contractors hire and manage subcontractors, ensuring their work is completed to the required specifications and the quality of work performed by subcontractors achieves the required standards. All within the agreed-upon timeframe.

Change Orders: Managing any changes to the original project scope, including documenting requests, negotiating costs, and ensuring the changes are properly incorporated into the project plan.

Project Construction Site: The contractor will take all reasonable actions to observe and understand the project site. This includes site conditions throughout the life of the project.

Site Investigation and Conditions Affecting the Work: The contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions that can affect the work or its cost, including but not limited to (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, electric power, and roads; (3) uncertainties of weather, groundwater levels, stream stages, river stages, or similar physical conditions at the site; (4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance.

The contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the government, as well as from the drawings and specifications made a part of this contract. Any failure of the contractor to take the actions described and acknowledged in this paragraph will not relieve the contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the State of West Virginia, the State Conservation Committee, the WVCA, the Oversight Engineer, the Mercer County Commission, and the Green Valley-Glenwood PSD.

The State of West Virginia, the Purchasing Division, the State Conservation Committee, the WVCA, the Oversight Engineer, the Mercer County Commission, and the Green Valley-Glenwood PSD assume no responsibility for any conclusions or interpretations made by the contractor based on the information made available by this group. Nor does this group assume responsibility for any understanding reached or representation made concerning conditions, which can affect the work by any of its officers or employees before the execution of this contract, unless that understanding, or representation is expressly stated in this contract.

Differing Site Conditions Pre-Construction: The contractor shall promptly, and before the conditions are disturbed (start of work), give written notice to the Oversight Engineer and the COR that site conditions have so dramatically changed since the job showing that the site now differs from those indicated in this contract.

The Oversight Engineer shall investigate the site conditions promptly after receiving the notice and provide a written report to the COR.

If, in the opinion of the Oversight Engineer, site conditions have so dramatically changed since the job showing that the site now differs from those indicated in this contract and causes an increase or decrease in the contractor's cost of, or the time required for, performing any part of the work under this contract, the Oversight Engineer will indicate any additional cost or additional time required to complete the project.

If, in the opinion of the Oversight Engineer, site conditions have not changed since the job showing, the Oversight Engineer will report what was found during the site investigation.

Based upon the Oversight Engineer's report, the WVCA will decide on whether differing site conditions exist or not. If differing site conditions exist, the WVCA will determine if the equitable adjustment is justified under this clause and will decide if a contract modification/change order is needed. Also, the WVCA will decide if a financial change to the contract is needed and incorporate it into the modification/change order.

The Change Order will be signed by the WVCA Contracting Officer and sent out for implementation.

If it is determined that the site changes identified do not pose a threat or change to the outcome if work continues, the WVCA Contracting Officer will provide a statement in writing that the conditions are safe to continue. The contractor will continue to work with no modification/change order.

If differing site conditions do not exist in the opinion of the WVCA, the WVCA Contracting Officer will provide a written statement that no differing site conditions could be found, and no modification will be written.

No request by the contractor for an equitable adjustment to the contract for the differing site conditions shall be allowed if done after the work is completed in the area of suspected differing site conditions and after the final inspection is completed.

Differing Site Conditions During Construction: If the contractor comes across conditions that are so different from those presented in the construction design reports, specifications and drawings, the contractor shall stop work and promptly give written notice to the Oversight Engineer and the COR that these differing site conditions exist, and the design can no longer be followed.

The Oversight Engineer shall investigate the site conditions promptly after receiving the notice and provide a written report to the COR.

If, in the opinion of the Oversight Engineer, site conditions have so dramatically changed from the design reports, specifications, or drawings, that the site now differs from those indicated in the design documents and will cause an increase or decrease in the contractor's cost of, or the time required for, performing any part of the work under this contract, the Oversight Engineer will indicate any additional cost or additional time required to complete the project.

If, in the opinion of the Oversight Engineer, site conditions have not changed in comparison to the design documents, the Oversight Engineer will report what was found during the site investigation.

Based upon the Oversight Engineer's report, the WVCA will decide on whether differing site conditions exist or not. If differing site conditions exist, the WVCA will determine if the equitable adjustment is justified under this clause and will decide if a contract modification/change order is needed. Also, the WVCA will decide if a financial change to the contract is needed and incorporate it into the modification/change order.

The Change Order will be signed by the WVCA Contracting Officer and sent out for implementation.

If it is determined that the site changes identified do not pose a threat or change to the outcome if work continues, the WVCA Contracting Officer will provide a statement in writing that the conditions are safe to continue. The contractor will continue to work with no modification/change order.

If differing site conditions do not exist in the opinion of the WVCA, the WVCA Contracting Officer will provide a written statement that no differing site conditions could be found, and no modification will be written.

No request by the contractor for an equitable adjustment to the contract for the differing site conditions shall be allowed if done after the work is completed in the area of suspected differing site conditions and after the final inspection is completed.

24. **CONTRACTOR'S PERFORMANCE OF WORK:** The contractor is responsible for the means, methods, techniques, sequences, or procedures of work. It is contemplated that the contractor will furnish the necessary personnel/skilled labor, material, equipment, services, and facilities (except as otherwise specified) to perform the Statement of Work/Specifications, and all other items necessary for the successful completion of work. The contractor shall give the work the constant attention necessary to facilitate progress.

Contractor Management: The contractor shall always have on the work site a competent superintendent capable of reading and thoroughly understanding the plans and specifications. One who is thoroughly experienced in the type of work being performed and who will effectively communicate and consult with the Contracting Officer Representative (COR) and the Oversight Engineer.

On contractual matters, the contractor shall go through the COR who shall elevate it to the CO. The CO, in consultation with the WVCA Procurement Officer and the West Virginia Purchasing Division, provide a response to all contract questions.

The contractor shall provide a list of addresses and telephone numbers of their personnel who may be reached in case of emergency during hours when no work is to be performed to the COR.

On weekends, holidays, suspensions of work, and the occurrence of storms, the contractor shall alert certain members of their personnel to stand by and inform the COR of arrangements made.

Workforce: The contractor shall perform work on the site (the contractor and his or her employees) equivalent to at least 15 percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement to this contract if, during the performance of the work, the contractor requests a reduction, and the WVCA determines that the reduction would be to the advantage of the government.

An employee of the contractor is an individual for whom the contractor withholds, and pays, employment taxes (FICA). All others will be considered Subcontractors. The West Virginia

Purchasing Division or the WVCA reserves the right to require successful contractors to produce evidence showing the payment of employment taxes for all onsite workers.

Equipment Operators: The contractor shall at all times employ sufficient equipment operators to prosecute the several classes of work to full completion in the manner and time required by these specifications.

Qualified Operator: The contractor shall provide qualified operators. Unqualified or inefficient operators shall immediately be replaced at the discretion of the COR in consultation with the Oversight Engineer. Should a contractor fail to remove such a person, or people as required above or fail to furnish suitable and sufficient personnel for the proper prosecution of the work, the WVCA may suspend the work by written notice until such order is complied with.

Laborers: The contractor shall always employ sufficient labor for prosecuting the several classes of work to full completion in the manner and time required by these Specifications. All employees will have sufficient skill and experience to perform the work assigned to them properly. Employees engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform all work properly and satisfactorily.

Disorderly or Threating Laborer: Any person who, in the opinion of the COR and in consultation with the Oversight Engineer, is disorderly or deemed a threat to another employee of the contractor, an employee of NRCS, an employee of the State of West Virginia, a member of the State Conservation Committee, an employee of the WVCA, an employee of the Oversight Engineer, a member of the Mercer County Commission, an employee of Green Valley-Glenwood PSD, or to the general public shall, at the request of the COR, be removed forthwith.

Any contractor employing such a person shall not reemploy such person on the project without the written approval of the WVCA Contracting Officer. Should a contractor fail to remove such a person, or people as required above or fail to furnish suitable and sufficient personnel for the proper prosecution of the work, the WVCA may suspend the work by written notice until such order is complied with.

Equipment: The contractor shall always provide enough equipment for prosecuting the several classes of work to full completion in the manner and time required by these specifications. Equipment will be of sufficient size and in such a mechanical condition as to meet the requirements of the work and to produce a satisfactory quality of work.

Mounted or attached equipment shall be customarily manufactured for the respective size of the tractor being offered. Backhoe(s) and excavator(s) shall have mounted or attached equipment that is customarily manufactured for the respective size of the backhoe or excavator being offered.

Horsepower shall be flywheel horsepower rating. Horsepower and bucket capacities shall be listed in the current edition of Rental Rate Blue Book for Construction Equipment (Published by Dataquest) or similar reliable reference approved by the WVCA. The equipment should

not deviate from the minimum and/or maximum horsepower specified in the Bid Schedule of this invitation to be considered as being acceptable to the terms of the contract. Equipment used on any portion of the project shall be such that no injury to the adjacent property will result from its use.

All equipment shall be maintained in a proper working condition and shall be free of any fluid leaks. Equipment in need of repair that prohibits work to its full potential shall be immediately replaced. The contractor shall provide all the oil and lubricants and perform the required maintenance promptly.

Personal Protective Equipment (PPE): At a minimum, all workers and contractor management on the project site shall have Hard Hats, Safety shirts/vests, Steel-toe boots, and safety goggles/glasses.

Hard Hat Areas: The entire job site, except for offices, shall be considered a Hard Hat Area. All people entering this area, without exception, are required to wear hard hats. This is a safety issue and all personnel on site shall ensure all visitors entering hard hat areas are wearing hard hats. This will be supervised by the contractor and the COR. If someone enters the hard hat area without wearing a hard hat, work will cease, and the individual will be escorted outside the hard hat area before work can continue.

Labels for hard hats shall bear a manufacturer's label indicating design compliance with the appropriate ANSI (American National Standards Institute) standard.

Safety Shirt/Vest: Safety shirts or vests shall be worn, at all times, on the entire job site. Any person entering the designed work area is, without exception, required to wear a safety shirt or vest. The contractor and the Oversight Engineer shall ensure all visitors entering the work area comply. If someone enters the identified work area without wearing a safety shirt or vest, work will cease, and the individual will be escorted outside the work area before work can continue.

Steel-toe boots: Steel-toe boots should be worn, at all times, on the entire job site. All people entering the area are, without exception, required to wear Steel-toe boots.

Safety Goggles/Glasses: Safety glasses should be worn at all times unless operating equipment with an enclosed cab. A face shield should be used, in addition to safety glasses, when operating a string/brush trimmer and other times when your face could be hit by debris. All personnel involved in or within 100 feet (33 yards) diameter around the working area of brush removal and tree removal must wear protective safety goggles/glasses.

Chainsaw Chaps: Chainsaw chaps refer to a type of personal protective equipment (PPE) that is to be worn by anyone using a chainsaw on the project site.

25. **CONTINUOUS VIDEO MONITORING:** The contractor will be required to supply and provide maintenance services on two (2) trailer mounted cameras to be placed at locations at the discretion of the Oversight Engineer. Each camera must meet the requirements set forth in the CONSTRUCTION SPECIFICATION 96-FIELD OFFICE.

In this specification - The Contractor shall provide cameras for real-time remote monitoring of construction activities.

Brush Creek Site 15 Cameras: The specification requirement will be connected to Bid Schedule Sheet Site 15, bid line-item number 45 (Field Office) to provide two (2) trailer mounted cameras at this site.

26. MISCELLANEOUS:

26.1 Contract Manager: During its performance of this Contract, Vendor must designate and maintain a primary contract manager responsible for overseeing Vendor's responsibilities under this Contract. The Contract manager must be available during normal business hours to address any customer service or other issues related to this Contract. Vendor should list its Contract manager and his or her contact information below.

Contract Manager:	Chad Groover
Telephone Number:	336-671-7727
Fax Number:	336-232-1517
Email Address:	chad.groover@seqserv.com

REQUEST FOR QUOTATION
Construction: Brush Creek 15 Dam Rehabilitation
CRFQ AGR26*16
REVISED AS OF 10/20/2025
VERSION 2 - SUPERSEDES ANY PREVIOUS VERSIONS

EXHIBIT B – PROJECT PLANS

Exhibit B – Project Plans – PDF files attached to solicitation include:

1. BC15 Drawings
2. BC15 Specifications
3. BC15 Construction Sequencing Criteria
4. BC15 As-Built Drawings
5. BC15 Geotechnical Investigation Report
6. BC 9-14-15 Geophysical Report
7. BC15 Piezometer Data Summary
8. NRCS Supplement to OSHA Parts 1910 and 1926

EXHIBIT C – LIQUIDATED DAMAGES

LIQUIDATED DAMAGES:

Liquidated damages are not punitive and are not negative performance incentives. Liquidated damages are used to compensate the WVCA for calculable damages. Therefore, the liquidated damages rate will be based upon those identified costs that the State of West Virginia, the State Conservation Committee, the WVCA, the Oversight Engineer, Mercer County Commission, and Green Valley-Glenwood PSD acquire because the contractor failed to work within the time specified in the contract to meet milestones and to complete all aspects of the contract by the established date. **Liquidated Damages have been calculated at the following rates for milestones and completion of project:**

Project Completion

- **Site 15** – If all work is not completed by December 30, 2027, the rate of LD will be **$ 4,183.33 per day**.

Milestones

- **Site 15** – If the Site 15 reservoir draining, upstream riprap berm installation, and riser work is not completed by December 30, 2026, of the current construction season, the rate of LD will be **$ 2,500.00 per day**.

REVISED AS OF 10/20/2025
VERSION 2 - SUPERSEDES ANY PREVIOUS VERSIONS

FEDERAL FUNDS ADDENDUM

REQUIRED CONTRACT PROVISIONS FOR NON-FEDERAL ENTITY CONTRACTS UNDER FEDERAL AWARDS (2 C.F.R. § 200.317):

The State of West Virginia Department of Administration, Purchasing Division, and the Vendor awarded this Contract intend that this Contract be compliant with the requirements of the Procurement Standards contained in the Uniform Administrative Requirements, Cost Principles, and Audit Requirements found in 2 C.F.R. § 200.317, et seq. for procurements conducted by a Non-Federal Entity. Accordingly, the Parties agree that the following provisions are included in the Contract.

1. MINORITY BUSINESSES, WOMEN'S BUSINESS ENTERPRISES, AND LABOR SURPLUS AREA FIRMS:

(2 C.F.R. § 200.321)

a. The State confirms that it has taken all necessary affirmative steps to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible. Those affirmative steps include:

(1) Placing qualified small and minority businesses and women's business enterprises on solicitation lists.

(2) Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources.

(3) Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses, and women's business enterprises.

(4) Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority businesses, and women's business enterprises.

(5) Using the services and assistance, as appropriate, of such organizations as the Small Business Administration and the Minority Business Development Agency of the Department of Commerce.

(6) Requiring the prime contractor, if subcontracts are to be let, to take the affirmative steps listed in paragraphs (1) through (5) above.

b. Vendor confirms that if it utilizes subcontractors, it will take the same affirmative steps to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible.

2. DOMESTIC PREFERENCES:

(2 C.F.R. § 200.322)

a. The State confirms that as appropriate and to the extent consistent with law, it has, to the greatest extent practicable under a federal award, provided a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products).

b. Vendor confirms that it will include the requirements of this Section 2. Domestic Preference in all subawards including all contracts and purchase orders for work or products under this award.

c. Definitions: For purposes of this section:

(1) "Produced in the United States" means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.

(2) "Manufactured products" means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.

3. BREACH OF CONTRACT REMEDIES AND PENALTIES:
(2 C.F.R. § 200.327 and Appendix II)

(a) The provisions of West Virginia Code of State Rules§ 148-1-5 provide for breach of contract remedies, and penalties. A copy of that rule is attached hereto as part of Exhibit A #1 and expressly incorporated herein by reference.

4. TERMINATION FOR CAUSE AND CONVENIENCE:
(2 C.F.R. § 200.327 and Appendix II)

(a) The provisions of West Virginia Code of State Rules§ 148-1-5 govern Contract termination. A copy of that rule is attached hereto as part of Exhibit A #1 and expressly incorporated herein by reference.

5. EQUAL EMPLOYMENT OPPORTUNITY:
(2 C.F.R. § 200.327 and Appendix II)

Except as otherwise provided under 41 CFR Part 60, and if this contract meets the definition of "federally assisted construction contract" in 41 CFR Part 60-1.3, this contract includes the equal opportunity clause provided under 41 CFR 60-1.4(b), in accordance with Executive Order 11246, "Equal Employment Opportunity" (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

6. ANTI-KICKBACK ACT:
(2 C.F.R. § 200.327 and Appendix II)

Vendor agrees that it will comply with the Copeland Anti-Kickback Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). Accordingly, Vendor, Subcontractors, and anyone performing under this contract are prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The State must report all suspected or reported violations to the Federal awarding agency.

7. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT:
(2 C.F.R. § 200.327 and Appendix II)

Where applicable, and only for contracts awarded by the State in excess of $100,000 that involve the employment of mechanics or laborers, Vendor agrees to comply with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, Vendor is required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week.

The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

8. RIGHTS TO INVENTIONS MADE UNDER A CONTRACT OR AGREEMENT:
(2 C.F.R. § 200.327 and Appendix II)

If the Federal award meets the definition of "funding agreement" under 37 CFR § 401.2 (a) and the recipient or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that "funding agreement," the recipient or subrecipient must comply with the requirements of 3 7 CFR Part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the awarding agency.

9. CLEAN AIR ACT:
(2 C.F.R. § 200.327 and Appendix II)

Vendor agrees that if this contract exceeds $150,000, Vendor is to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

10. DEBARMENT AND SUSPENSION:
(2 C.F.R. § 200.327 and Appendix II)

The State will not award any vendor that is listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the 0MB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), "Debarment and Suspension." SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.

11. BYRD ANTI-LOBBYING AMENDMENT:
(2 C.F.R. § 200.327 and Appendix 11)

Vendors that apply or bid for an award exceeding $100,000 must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award.

12. PROCUREMENT OF RECOVERED MATERIALS:
(2 C.F.R. § 200.327 and Appendix II; 2 C.F.R. § 200.323)

Vendor agrees that it and the State must comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act. The requirements of Section 6002 include procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds $10,000 or the value of the quantity acquired during the preceding fiscal year exceeded $10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.

13. PROHIBITION ON CERTAIN TELECOMMUNICATIONS AND VIDEO SURVEILLANCE SERVICES OR EQUIPMENT: (2 C.F.R. § 200.327 and Appendix II; 2 CFR § 200.216)

Vendor and State agree that both are prohibited from obligating or expending funds under this Contract to:

(1) Procure or obtain.

(2) Extend or renew a contract to procure or obtain.

(3) Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Public Law 115-232, section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

(i) For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).

(ii) Telecommunications or video surveillance services provided by such entities or using such equipment.

(iii) Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to the government of a covered foreign country.

In implementing the prohibition under Public Law 115-232, section 889, subsection (f), paragraph (1), heads of executive agencies administering loan, grant, or subsidy programs shall prioritize available funding and technical support to assist affected businesses, institutions and organizations as is reasonably necessary for those affected entities to transition from covered communications equipment and services, to procure replacement equipment and services, and to ensure that communications service to users and customers is sustained.

State of West Virginia Purchasing Division:

By: Haleigh Moses
Printed Name: Haleigh Moses

Title: Fiscal Services Manager, WVCA
Date: Feb 24, 2026

Vendor Name: Sequoia Services, LLC

By:
Printed Name: Liam Collins

Title: Sr. Vice President
Date: 2/13/2026

Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Centralized Request for Quote
Construction

Proc Folder:	1793301	**Reason for Modification:**
Doc Description:	Brush Creek 15 Dam Rehabilitation-Construction	Addendum No. 02
Proc Type:	Central Purchase Order	

Date Issued	Solicitation Closes	Solicitation No	Version
2025-11-18	2026-01-07 13:30	CRFQ 1400 AGR2600000016	3

BID RECEIVING LOCATION

BID CLERK
DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
2019 WASHINGTON ST E
CHARLESTON WV 25305
US

VENDOR

Vendor Customer Code:

Vendor Name :

Address :

Street :

City :

State : **Country :** **Zip :**

Principal Contact :

Vendor Contact Phone: **Extension:**

FOR INFORMATION CONTACT THE BUYER
Larry D McDonnell
304-558-2063
larry.d.mcdonnell@wv.gov

Vendor Signature X **FEIN#** **DATE**

All offers subject to all terms and conditions contained in this solicitation

ADDITIONAL INFORMATION

Addendum No. 02

To post pre-bid sign-in sheet from the mandatory pre-bid meeting held on 11/12/2025 at 10:30AM EST/EDT.

Vendor question deadline date and time still remains 11/20/2025 by 2:00PM EST/EDT

Bid opening date and time still remains 01/07/2026 at 1:30PM EST/EDT

No other changes

INVOICE TO		SHIP TO	
AGRICULTURE DEPARTMENT OF		WEST VIRGINIA CONSERVATION AGENCY	
ADMINISTRATIVE SERVICES		WEST VIRGINIA CONSERVATION AGENCY	
1900 KANAWHA BLVD E		255 GUS R DOUGLASS LN	
CHARLESTON	WV	CHARLESTON	WV
US		US	

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
1	Brush Creek Site 15 Dam Rehab Construction Services				

Comm Code	Manufacturer	Specification	Model #
72141203			

Extended Description:
Dam Rehabilitation services for Brush Creek 15.

See all attached documentation for further details.

PLEASE READ INSTRUCTIONS IN THEIR ENTIRETY. THE AMOUNT ENTERED ON THIS COMMODITY LINE SHOULD BE THE TOTAL COST FOR SITE 15 - SEE EXHIBIT A PRICING PAGE.

SCHEDULE OF EVENTS

Line	Event	Event Date
1	Pre-Bid Meeting 10:30AM EST/EDT	2025-11-12
2	Vendor questions due by 2:00PM EST/EDT	2025-11-20

SOLICITATION NUMBER: CRFQ AGR26*16
Addendum Number: 2

The purpose of this addendum is to modify the solicitation identified as ("Solicitation") to reflect the change(s) identified and described below.

Applicable Addendum Category:

[ ] Modify bid opening date and time

[ ] Modify specifications of product or service being sought

[ ] Attachment of vendor questions and responses

[X] Attachment of pre-bid sign-in sheet

[ ] Correction of error

[ ] Other

Description of Modification to Solicitation:

To post pre-bid sign-in sheet from the mandatory pre-bid meeting held on 11/12/2025 at 10:30AM EST/EDT.

Vendor question deadline date and time still remains 11/20/2025 by 2:00PM EST/EDT

Bid opening date and time still remains 01/07/2026 at 1:30PM EST/EDT

No other changes

Additional Documentation: Documentation related to this Addendum (if any) has been included herewith as Attachment A and is specifically incorporated herein by reference.

Terms and Conditions:

1. All provisions of the Solicitation and other addenda not modified herein shall remain in full force and effect.

2. Vendor should acknowledge receipt of all addenda issued for this Solicitation by completing an Addendum Acknowledgment, a copy of which is included herewith. Failure to acknowledge addenda may result in bid disqualification. The addendum acknowledgement should be submitted with the bid to expedite document processing.

Brush Creek 15 Dam Rehabilitation

Pre-Bid Sign-In Sheet

Solicitation Number: CRFQ AGR2600000016
Date of Pre-Bid Meeting: November 12, 2026
Location of Prebid Meeting: Mercer County, WV/4-H Camp

Please Note:
Vendors must sign-in on this sheet to verify attendance at the Pre-Bid meeting.
Failure to legibly sign in may be grounds for declaring a vendor ineligible to bid.
For further verification, please also provide a business card if possible.

Firm Represented:*	Rep Name (Printed):	Firm Address:	Telephone #:	Fax #:	Email:
WVCA	Chris Martin	255 Gus R Douglass Ln Charleston, WV 25312	304-558-2204	304-558-2035	cmartin@wvca.us
WVCA	Shana-Kay Maitland	255 Gus R Douglass Ln. Charleston, WV. 25312	681-781-8383	—	Smaitland@wvca.us
WVCA	Edward Cox	255 Gus R Douglass Ln Charleston WV 25312	304-558-2204	304-558-2035	ecox@wvca.us
WVCA	Chris Ellison	255 Gus R Douglass Ln Charleston. WV 25312	304-558-2204	304-558 2055	cellison@wvca.us
WVCA	Dan May	255 Gus R Douglas Ln Charleston, WV	304-539-0865	—	Dmay@wvca.us
WVCA	Jake Lavender	114 Northridge Drive Lewisburg WV	304-541-3045	—	jlavender@wvca.us

***One Vendor Per Representative** - No one individual is permitted to represent more than one vendor at the pre-bid meeting. Any individual that does attempt to represent two or more vendors will be required to select one vendor to which the individual's attendance will be attributed. The vendors not selected will be deemed to have not attended the pre-bid meeting unless another individual attended on their behalf.*

Brush Creek 15 Dam Rehabilitation

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Firm Represented:*	Rep Name (Printed):	Firm Address:	Telephone #:	Fax #:	Email:
WVCA	Hunter Vance	201 Scott Ave. Morgantown, WV 26508	(304) 539-3970	—	hvance@wvca.us
WVCA	Ben Wade	201 Scott Ave Morgantown, WV 26508	304 380 7362	—	bwade@wvca.us
WVCA	Shane Kittrey	195 Davis Street Princeton WV 24701	304 807-3052	—	Skittrey@wvca.us
NRCS	Patti Mitchell	418 Goff Mtn Rd Cross Lanes	304-776-5256	—	Patricia.Mitchell@usda.gov
NRCS	Rodney Sites	2118 Ripley Road Ripley, WV 25271	304-578-4766	—	rodney.SITES@USDA.GOV [redacted]
NRCS	David Sweeney	91 Bayles Lane Parkersburg, WV 26101	304.420.3214		david.sweeney@usda.gov

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Brush Creek 15 Dam Rehabilitation

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Firm Represented:*	Rep Name (Printed):	Firm Address:	Telephone #:	Fax #:	Email:
WVCA	Darican Carson	160346 Barbour CO HWY Philippi WV 26416	304-590-1969		dbender@wvca.us
NRCS	Andy Deichert	1550 Earl Core Rd Morgantown, WV 26505	304-284-7563		andy.deichert@usda.gov
Sequoia Services	Michael Kircher	3300 Battleground Ave Ste 102 Greensboro, NC	336-553-9059		Michael.Kircher@seqserv.com
SEQUOIA SERVICES	MYRON LEE	3300 BATTLEGROUND AVE #102 GREENSBORO NC 27410	336-601-0351		MYRON@SEQSERV.COM
TOM HARRILL	MORGAW CORP	11700 REAMES RD CHARLOTTE NC 28269	704-622-9671		THARRILL@MORGAW-CORP.COM
So Cons Dist	C.K. Mongold	B Rivesville Rock, W.V	304 467-7645		

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Brush Creek 15 Dam Rehabilitation

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Firm Represented:*	Rep Name (Printed):	Firm Address:	Telephone #:	Fax #:	Email:
NRCS	Titus Smith	1550 Earl L. Core Road Morgantown, WV 26505	304-322-5401	—	titus.smith@usda.gov
WVCA	Sigrid Teets	201 Scott Ave Morgantown, WV	304-993-6224	—	Steets@wvca.us
Rain For Rent Rental Pumps	Luke Williams	1015 Barlow Dr. Charleston, WV	304-207-3100	—	[redacted]lwilliams@rainforrent.com
NRCS	DERRICK CRANE	1550 EARL L COLE RD. MORGANTOWN, WV 26505	304 284 7556	-	derrick.crane@usda.gov
Morgan Corp	Will Drinnon	11700 reames road, Charlotte, NC	540-716-3026	—	wdrinnon@morgan-corp.com
[illegible] Fisher Contract	Mark Edlebeck	9800 Nashville Road Franklin, Ky 42134	270-253-3331	—	medlebeck@thefisher.co

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Brush Creek 15 Dam Rehabilitation

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Firm Represented:*	Rep Name (Printed):	Firm Address:	Telephone #:	Fax #:	Email:
Phillips	Clay Jackson	10142 Parkside Dr Knoxville, TN 37932	618-922-4777		cjackson@phillipsinc.com
KC Construction Co.	Joel Baker	1737 Stout Dr. Ivyland, PA 18974	267-961-0949		joelb@kcconstruct.com
Swope Construction	Bryson Murphy	1325 Bluefield Ave. Bluefield WV 24701	304-325-8146		bmurphy@swopeco.com bid@swopeco.com
[signature]		WVCA			

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Firm Represented:*	Rep Name (Printed):	Firm Address:	Telephone #:	Fax #:	Email:
KC Construction	John Lima	1737 Stout Drive Ivyland Pa 18974	267-784-6999		JohnL@kcconstruct.com
Main Street Builders	Rusty Sarver	311 South Walker St. Princeton WV 24740	304-920-2669		rustysarver@gmail.com
Crowder Construction	Erik Sundquist	6409 Brookshire Blvd Charlotte, NC 28216	704-348-1321		esundquist@crowderusa.com
Dan Hill Construction	Luke Begovich	24 Front Street Glen Fork WV 25090	304-951 3916		Luke.Begovich@DanHillConstruction.com

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Firm Represented:*	Rep Name (Printed):	Firm Address:	Telephone #:	Fax #:	Email:
Green Valley Glenwood PSD	Scott Clark	mscgvg@yahoo.com	304 716-5757		

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Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Centralized Request for Quote
Construction

Proc Folder:	1793301	**Reason for Modification:**
Doc Description:	Brush Creek 15 Dam Rehabilitation-Construction	Addendum No. 03
Proc Type:	Central Purchase Order	

Date Issued	Solicitation Closes	Solicitation No	Version
2025-11-19	2026-01-07 13:30	CRFQ 1400 AGR2600000016	4

BID RECEIVING LOCATION

BID CLERK
DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
2019 WASHINGTON ST E
CHARLESTON WV 25305
US

VENDOR

Vendor Customer Code:

Vendor Name :

Address :

Street :

City :

State : **Country :** **Zip :**

Principal Contact :

Vendor Contact Phone: **Extension:**

FOR INFORMATION CONTACT THE BUYER
Larry D McDonnell
304-558-2063
larry.d.mcdonnell@wv.gov

Vendor Signature X **FEIN#** **DATE**

All offers subject to all terms and conditions contained in this solicitation

ADDITIONAL INFORMATION

Addendum No. 03

To extend vendor question deadline date from 11/20/2025 to 12/01/2025

Deadline time remains: all questions are still due by 2:00PM EST/EDT

Bid opening date and time still remains 01/07/2026 at 1:30PM EST/EDT

No other changes

INVOICE TO		SHIP TO	
AGRICULTURE DEPARTMENT OF		WEST VIRGINIA CONSERVATION AGENCY	
ADMINISTRATIVE SERVICES		WEST VIRGINIA CONSERVATION AGENCY	
1900 KANAWHA BLVD E		255 GUS R DOUGLASS LN	
CHARLESTON	WV	CHARLESTON	WV
US		US	

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
1	Brush Creek Site 15 Dam Rehab Construction Services				

Comm Code	Manufacturer	Specification	Model #
72141203			

Extended Description:
Dam Rehabilitation services for Brush Creek 15.

See all attached documentation for further details.

PLEASE READ INSTRUCTIONS IN THEIR ENTIRETY. THE AMOUNT ENTERED ON THIS COMMODITY LINE SHOULD BE THE TOTAL COST FOR SITE 15 - SEE EXHIBIT A PRICING PAGE.

SCHEDULE OF EVENTS

Line	Event	Event Date
1	Pre-Bid Meeting 10:30AM EST/EDT	2025-11-12
2	Vendor questions due by 2:00PM EST/EDT	2025-12-01

SOLICITATION NUMBER: CRFQ AGR26*16
Addendum Number: 3

The purpose of this addendum is to modify the solicitation identified as ("Solicitation") to reflect the change(s) identified and described below.

Applicable Addendum Category:

[ ] Modify bid opening date and time

[ ] Modify specifications of product or service being sought

[ ] Attachment of vendor questions and responses

[ ] Attachment of pre-bid sign-in sheet

[ ] Correction of error

[X] Other

Description of Modification to Solicitation:

To extend vendor question deadline date from 11/20/2025 to 12/01/2025

Deadline time remains: all questions are still due by 2:00PM EST/EDT

Bid opening date and time still remains 01/07/2026 at 1:30PM EST/EDT

No other changes

Additional Documentation: Documentation related to this Addendum (if any) has been included herewith as Attachment A and is specifically incorporated herein by reference.

Terms and Conditions:

1. All provisions of the Solicitation and other addenda not modified herein shall remain in full force and effect.

2. Vendor should acknowledge receipt of all addenda issued for this Solicitation by completing an Addendum Acknowledgment, a copy of which is included herewith. Failure to acknowledge addenda may result in bid disqualification. The addendum acknowledgement should be submitted with the bid to expedite document processing.

Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Centralized Request for Quote
Construction

Proc Folder:	1793301	**Reason for Modification:**
Doc Description:	Brush Creek 15 Dam Rehabilitation-Construction	Addendum No. 04
Proc Type:	Central Purchase Order	

Date Issued	Solicitation Closes	Solicitation No	Version
2025-12-23	2026-01-14 13:30	CRFQ 1400 AGR2600000016	5

BID RECEIVING LOCATION

BID CLERK
DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
2019 WASHINGTON ST E
CHARLESTON WV 25305
US

VENDOR

Vendor Customer Code:

Vendor Name :

Address :

Street :

City :

State : **Country :** **Zip :**

Principal Contact :

Vendor Contact Phone: **Extension:**

FOR INFORMATION CONTACT THE BUYER
Larry D McDonnell
304-558-2063
larry.d.mcdonnell@wv.gov

Vendor Signature X **FEIN#** **DATE**

All offers subject to all terms and conditions contained in this solicitation

ADDITIONAL INFORMATION

Addendum No. 04

Answers to all vendor questions will be issued under a separate addendum.

To extend bid opening date from 1/07/2026 to 01/14/2026

Bid opening time still remains at 1:30PM EST/EDT

No other changes

INVOICE TO		SHIP TO	
AGRICULTURE DEPARTMENT OF ADMINISTRATIVE SERVICES 1900 KANAWHA BLVD E CHARLESTON US	WV	WEST VIRGINIA CONSERVATION AGENCY WEST VIRGINIA CONSERVATION AGENCY 255 GUS R DOUGLASS LN CHARLESTON US	WV

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
1	Brush Creek Site 15 Dam Rehab Construction Services				

Comm Code	Manufacturer	Specification	Model #
72141203			

Extended Description:
Dam Rehabilitation services for Brush Creek 15.

See all attached documentation for further details.

PLEASE READ INSTRUCTIONS IN THEIR ENTIRETY. THE AMOUNT ENTERED ON THIS COMMODITY LINE SHOULD BE THE TOTAL COST FOR SITE 15 - SEE EXHIBIT A PRICING PAGE.

SCHEDULE OF EVENTS

Line	Event	Event Date
1	Pre-Bid Meeting 10:30AM EST/EDT	2025-11-12
2	Vendor questions due by 2:00PM EST/EDT	2025-12-01

SOLICITATION NUMBER: CRFQ AGR26*16
Addendum Number: 4

The purpose of this addendum is to modify the solicitation identified as ("Solicitation") to reflect the change(s) identified and described below.

Applicable Addendum Category:

[X] Modify bid opening date and time

[ ] Modify specifications of product or service being sought

[ ] Attachment of vendor questions and responses

[ ] Attachment of pre-bid sign-in sheet

[ ] Correction of error

[ ] Other

Description of Modification to Solicitation:

Answers to all vendor questions will be issued under a separate addendum.

To extend bid opening date from 1/07/2026 to 01/14/2026

Bid opening time still remains at 1:30PM EST/EDT

No other changes

Additional Documentation: Documentation related to this Addendum (if any) has been included herewith as Attachment A and is specifically incorporated herein by reference.

Terms and Conditions:

1. All provisions of the Solicitation and other addenda not modified herein shall remain in full force and effect.

2. Vendor should acknowledge receipt of all addenda issued for this Solicitation by completing an Addendum Acknowledgment, a copy of which is included herewith. Failure to acknowledge addenda may result in bid disqualification. The addendum acknowledgement should be submitted with the bid to expedite document processing.

Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Centralized Request for Quote
Construction

Proc Folder: 1793301			**Reason for Modification:**
Doc Description: Brush Creek 15 Dam Rehabilitation-Construction			Addendum No. 05
Proc Type: Central Purchase Order			
Date Issued	**Solicitation Closes**	**Solicitation No**	**Version**
2025-12-31	2026-01-14 13:30	CRFQ 1400 AGR2600000016	6

BID RECEIVING LOCATION

BID CLERK
DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
2019 WASHINGTON ST E
CHARLESTON WV 25305
US

VENDOR

Vendor Customer Code:

Vendor Name :

Address :

Street :

City :

State : **Country :** **Zip :**

Principal Contact :

Vendor Contact Phone: **Extension:**

FOR INFORMATION CONTACT THE BUYER
Larry D McDonnell
304-558-2063
larry.d.mcdonnell@wv.gov

Vendor Signature X **FEIN#** **DATE**

All offers subject to all terms and conditions contained in this solicitation

ADDITIONAL INFORMATION

Addendum No. 05
To post answers to vendor questions.

To attach the following revised documents:
Site 15 - Exhibit A - Pricing Page
BC15 CS21 Excavation
BC15 CS61 Rock Riprap
BC15 CS95 Geotextile
15-C-16 - Toe Drain Details

To attach the following documents:
Firmette_BC15
BC15 Final Structural Conditions Report

Bid opening date and time still remains 01/14/2026 at 1:30PM EST/EDT

No other changes

INVOICE TO		SHIP TO	
AGRICULTURE DEPARTMENT OF ADMINISTRATIVE SERVICES 1900 KANAWHA BLVD E CHARLESTON US	WV	WEST VIRGINIA CONSERVATION AGENCY WEST VIRGINIA CONSERVATION AGENCY 255 GUS R DOUGLASS LN CHARLESTON US	WV

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
1	Brush Creek Site 15 Dam Rehab Construction Services				

Comm Code	Manufacturer	Specification	Model #
72141203			

Extended Description:
Dam Rehabilitation services for Brush Creek 15.

See all attached documentation for further details.

PLEASE READ INSTRUCTIONS IN THEIR ENTIRETY. THE AMOUNT ENTERED ON THIS COMMODITY LINE SHOULD BE THE TOTAL COST FOR SITE 15 - SEE EXHIBIT A PRICING PAGE.

SCHEDULE OF EVENTS

Line	Event	Event Date
1	Pre-Bid Meeting 10:30AM EST/EDT	2025-11-12
2	Vendor questions due by 2:00PM EST/EDT	2025-12-01

SOLICITATION NUMBER: CRFQ AGR26*16
Addendum Number: 5

The purpose of this addendum is to modify the solicitation identified as ("Solicitation") to reflect the change(s) identified and described below.

Applicable Addendum Category:

[ ] Modify bid opening date and time

[ ] Modify specifications of product or service being sought

[X] Attachment of vendor questions and responses

[ ] Attachment of pre-bid sign-in sheet

[ ] Correction of error

[X] Other

Description of Modification to Solicitation:

To post answers to vendor questions.

To attach the following revised documents:
Site 15 – Exhibit A – Pricing Page
BC15 CS21 Excavation
BC15 CS61 Rock Riprap
BC15 CS95 Geotextile
15-C-16 – Toe Drain Details

To attach the following documents:
Firmette_BC15
BC15 Final Structural Conditions Report

Bid opening date and time still remains 01/14/2026 at 1:30PM EST/EDT

No other changes

Additional Documentation: Documentation related to this Addendum (if any) has been included herewith as Attachment A and is specifically incorporated herein by reference.

Terms and Conditions:

1. All provisions of the Solicitation and other addenda not modified herein shall remain in full force and effect.

2. Vendor should acknowledge receipt of all addenda issued for this Solicitation by completing an Addendum Acknowledgment, a copy of which is included herewith. Failure to acknowledge addenda may result in bid disqualification. The addendum acknowledgement should be submitted with the bid to expedite document processing.

ADDENDUM ACKNOWLEDGEMENT FORM

Addendum 05
CRFQ AGR2600000016 - Vendor Q&A

1. Question: Are there any other projects related to this one in the near future? Is there a budget range for this project, $10-20M or more? Trying to get a sense of the size.
    a. Answer: Though there are no immediate solicitations pending, WV Conservation Agency has intentions to solicit for future dam rehabilitation-construction projects.
    b. Answer: It is not in the interest of the State of West Virginia to disclose budget ranges for solicitations.
2. Question: What is the magnitude of this job? moneywise?
    a. Answer: The magnitude of this job can be approximated using the solicitation documents.
    b. Answer: See answer to 1B.
3. Question: I am requesting to be added as a plan holder for this project. I have obtained the drawings and specs from construct connect but wanted to make sure these are accurate
    a. Answer: WV Conservation Agency is unaware of any process that adds vendors as "Plan Holders".
    b. Answer: WV Conservation Agency is unaware of "Construct Connect". All drawings and specifications can be found on the Vendor Self Service (VSS) portal under solicitation CRFQ AGR2600000016.

Questions 4-8 are in reference to the following statement.

The solicitation includes a section in the Federal Funds Addendum regarding MBE/WBE solicitation and appears to require "Good Faith Efforts".

4. Question: Is the contractor required to document and submit these efforts with the bid submittal?

    Answer: No

5. Question: Is the contractor required to document utilization throughout the duration of the contract?

    Answer: No

6. Question: Are there specific forms for documentation if required?

    Answer: No

Addendum 05
CRFQ AGR2600000016 - Vendor Q&A

7. Question: Are there specific MBE/WBE databases that are required to be used to identify such firms (i.e. WVDOT, WV SWAM rpt, etc.)?

   Answer: No

8. Question: Are there any minimum participation limits?

   Answer: No

9. Question: Could the question date to this project be extended?

   Answer: Question date had been extended to December 01, 2025. .

10. Question: Based on our review of the contract documents we have several concerns related to the upstream scope of work. See below:
    a. In an effort to get the domestic cast iron sluice gate ordered in time to be installed during specified drawdown schedule, we believe the preliminary investigation (field verification of existing conditions) will need to be performed by divers as early as possible. In order to complete this task, an unknown volume of sediment will need to be dredged but the specifications do not address dredging. Considering this operation would need to take place while the PSD would be actively drawing raw water, we expect there would be some restrictions/limitations to completing dredging work as ask that this be clarified.
       i. Note: Hydro-Gate sales rep has indicated a lead time of approximately 36 weeks (for domestic cast iron gate) from release to start shop dwgs which would most likely push this work into the second construction season.

    Answer:

    The intent is for the gate investigation to be performed at the beginning of the project due to the expected lead times for the gate procurement. CS-71 states to sidecast sediment away from the riser and that an estimated 6-9 feet of sediment is present within the vicinity of the riser. Sediment may not be removed from the reservoir, so the Contractor will not be required to obtain a permit for sediment removal for the initial investigation, or for the upstream stability berm work. Also stated in CS 71, the Contractor shall submit a Pond Drain Gate Removal Plan that includes a narrative of removal of sediment around the riser. Payment for work associated with initial sediment removal shall be paid for under Bid Item 35 - Removal of Pond Drain Gate

    b. The condition and volume of sediment to be removed to complete upstream improvements is essentially unknown and may require significant effort to relocate this material within the reservoir footprint inside the delineated LOD. The description for Bid Item 35 in specification 71, section 8.C.1.a - notes “side casting” of sediment. As noted, depending on the condition of this material additional

controls may be required to manage/relocate the sediment making it possible to construct the upstream riprap berm and replace the gate. We request the addition of a bid line item to capture and pay for this activity as well as establishing a volume for basis of bid. We also request further clarifications related to management of this material within the reservoir footprint as it could potentially have an impact on operations of the dam facility.

Answer

Payment for initial removal of sediment to verify the gate measurements will be paid for in line item 35 - Removal of Pond Drain Gate. Payment for sediment to be relocated for the installation of the upstream stability berm will be paid for in line item 31 – Embankment Upstream Stability Berm. The LOD shown should provide sufficient area for the relocation of sediment within the reservoir. Approximate sediment elevations and removal limits are shown on drawings 15-C-31 and 15-S-11.

c. Additionally, per paragraph 8.C.3.a - if the contractor has to remove sediment to perform the gate removal work, the contractor is required to obtain necessary permits from responsible authorities. This too could have a substantial impact on the timeline of getting the sluice gate ordered in time for installation window.

Answer:

See responses to previous items.

11. Question: Bid Item 8 section 4.A.9 requires the contractor to repair public roads in the vicinity of the project site. Can project vicinity be further clarified? Can a paving section of existing roads adjacent to the site be provided to help evaluate stability and repair costs.

Answer:

Per correspondences with WVDOH, Dale Hale Reservoir Road (20/12) and Gobbler Run Road ((20/13) are both "local service routes with a 65,000 lb legal weight limit. Both are open to legal 65,000 lb standard legal traffic". Additionally, WVDOH stated that in regard to the two bridges on these routes, "There are no restrictions on those two structures". If oversized/overweight loads are needed, a permit is required, see https://transportation.wv.gov/highways/maintenance/hauling_permits/Pages/default.aspx.

CS8, 4., A., 9) - Demobilization shall also include the repair of any damage to paved public roads within the project vicinity in accordance with West Virginia Department of Transportation standards and used for heavy equipment access and material deliveries that exceeds the weight limits for those roads. Damaged areas shall be repaired to pre-work condition or better to the satisfaction of the COR. No separate payment will be made for these restoration activities.

Addendum 05
CRFQ AGR2600000016 - Vendor Q&A

12. Question: Section 7 RCC Mix Plant of RCC specification 36 indicates the plant must be a pugmill. Please clarify if volumetric mixing trucks set up in a stationary, continuous mixing plant configuration would be considered acceptable.

    Answer:

    All mixing plants need to meet the requirements of Section 7 or as supplemented by Section 22, A. 6).

13. Question: The RFP documents appear to conflict with regard to the contractor license requirement. General Terms and Conditions item 7 notes the request for proof may be prior to or after contract award. Additional Terms and Conditions item 1 notes successful Vendor must furnish a copy of its contractor license prior to issuance of contract award. Exhibit A Pricing Page requests vendor to include a copy of contractor license with the bid response. Please confirm if the vendor is required have a contractor license in place at time of bid and a copy included with the bid submission.

    Answer: Vendors should submit a copy of contractor's license with bid response but are not required to do so. Vendors must provide Contractor's License upon request prior to contract award.

14. Question: Subcontractor List – Additional Terms and Conditions of the RFP itiem 10 notes: this section does not apply to any other construction projects, such as highway, mine reclamation, water or sewer projects. It also indicates that the apparent low bidder shall submit the Subcontractor list within one business day of bid opening. Please confirm if the Subcontractor list is required for this project and if it has to be submitted with the bid submission.

    Answer: Any vendor using subcontractors must submit list to the WV Purchasing Division within one business day of bid opening.

15. Question: Downstream Embankment work – the Construction Contract Sequencing document includes Dam Safety criteria requiring the downstream embankment scope be completed within the same calendar year. The construction sequence notes on the E&S drawings appear to indicate this scope starting in one construction season (Phase 1A), prepare for winter shutdown by protecting exposed soils (Phase 2), and resuming in the spring (Phase 2). Please clarify construction restrictions related to downstream embankment scope.

    Answer:

    The Construction sequencing criteria is required for development of the construction schedule. The E&S implementation sequence shall be modified to accommodate the sequencing criteria and approved construction schedule. All downstream embankment work shall be completed with the same calendar year.

Addendum 05
CRFQ AGR2600000016 - Vendor Q&A

16. Question: Site 14 fill stockpile – the Construction Contract Sequencing document considerations note that the Site 15 contractor shall stockpile 9,220 CY of Earthfill materials for future use by Site 14 contractor. Is the Site 15 contractor required to balance the earthfill for both Site 14 and Site 15, if other words – what happens if there is not sufficient suitable earthfill to provide a 9,220 CY stockpile for Site 14? Please clarify. Additionally, is the Site 15 contractor required to conduct QC testing confirming suitability of stockpiled materials for future use?

    Answer:

    The Site 15 Contractor will be required to construct the downstream berm on the embankment to the required minimum elevations, and stockpile/stabilize excess suitable material available for the Site 14 Contractor. If there is not sufficient on-site suitable material to provide 9,220 CY for the Site 14 Contractor, the Site 15 Contractor will not be responsible for providing additional materials from off-site sources. The Site 15 Contractor will be responsible for initially testing the material prior to stockpiling to confirm it is suitable for use and confirming the amount of material stockpiled prior to closeout of the project.

17. Question: Please confirm if the Contractor's Quality Control Supervisor (as defined in specification 94) can be assigned other duties and if they are required to be on-site fulltime.

    Answer:

    The Quality Control Supervisor could be assigned other duties, however the supervisor must be separate and apart from line supervision per CS94.

18. Question: Please confirm there are no stockpile location restrictions within the LOD.

    Answer:

    Stockpiles can be located within the identified limits of disturbance. The contractor should identify the proposed locations on their Staging and Stockpiling Plan per CS8.

19. Question: Specification 26, Section 7.A.2 references Method 1 shall apply. Method 1 states unsuitable materials encountered shall be disposed of onsite or hauled and disposed of offsite. Please confirm unsuitable soil and excess topsoil will remain onsite and not require disposal offsite.

    Answer:

    It is anticipated the unsuitable soil materials, and excess topsoil will be disposed of on-site.

Addendum 05
CRFQ AGR2600000016 - Vendor Q&A

20. Question: Please confirm if the 100yr floodplain encroaches the LOD? If so, please provide the locations.

    Answer:

    The FEMA Zone A flood hazard area is illustrated on the attached National Flood Hazard FIRMette (FIRMETTE_BC15). The Site 14 reservoir, 100-year, 24-hour flood pool, at elevation is 2432.6, is located north of Gobbler Run Road, which is outside the Site 15 LOD area.

21. Question: If encountered, please confirm how the contractor will be compensated for rock excavation?

    Answer:

    The specification defines common excavation as the excavation of materials that can be excavated, transported, and unloaded using heavy ripping equipment and pusher tractor (having a power rating of at least 150 flywheel horsepower). The intent is to remove material meeting that definition for excavations shown on the drawings. Any rock excavation, if encountered, would be measured and paid for under bid item 10 - Embankment, Common Excavation, and bid item 11 – Auxiliary Spillway, Common Excavation respectively. The most likely places where rock may be encountered include but is not limited to trenching in cutoffs for structures such as the impact basin and tailwater weir wall. A revised Construction Specification 21, Excavation is attached.

22. Question: Multiple concrete structures (Impact basin & RCC Structural Concrete) are proposed to be excavated to rock and foundation set on top of rock. However, these structures also call for concrete turndowns below bedrock. Where will the contractor be compensated for rock excavation in these areas?

    Answer:

    See previous response.

23. Question: Can the existing office building be utilized for the QA/QC laboratory? This will be a potential savings for the owner.

    Answer:

    The existing building does not have enough space to meet the specifications to be properly utilized as the QA/QC laboratory.

Addendum 05
CRFQ AGR2600000016 - Vendor Q&A

24. Question: Sediment relocation required for the construction of the Embankment Upstream Stability Berm is described in the requirements of Upstream Stability Berm Installation Plan, however sediment relocation is not listed as a separate bid item. Under which bid item will sediment relocation be paid?

    Answer:

    See response to question 10 above.

25. Question: If sediment relocation described above is not to be included in a new cost/CY bid item, what quantity of sediment should the bidders assume in their bid?

    Answer:

    See response to question 10 above.

26. Question: The quantity listed for the Principal Spillway Pipe Extension is listed as 24LF on the bid form and Drawing 15-S-10 lists Pipe extension length of over 27 LF. Please confirm which quantity should be used.

    Answer:

    The principal spillway pipe extension is 27 feet and 4 inches. The bid Item 26 quantity has been revised to 27.3'. Refer to the attached updated Exhibit A Pricing Pages, version 3.

27. Question: Detail 2 for the seepage collection box presented on Drawing 15-C-16 calls out a stainless-steel baffle in the plan view however the baffle is not shown in the section view. Please confirm the dimensions of the baffle or advise if the baffle is not required.

    Answer:

    The baffle is not required and has been removed from the drawing. Revised Drawing 15-C-16 is attached.

28. Question: Bid item 22 for the concrete repair and waterproofing has a bid quantity of 790 SF. Should the bidders assume the entire 790 SF requires repair and waterproofing?

    Answer:

    The intention is for the application of a uniform coating of concrete repair material and separate application of a water proofer along with the manufacturer's recommended primer.

Addendum 05
CRFQ AGR2600000016 - Vendor Q&A

29. Question: Is documentation (photos, video, inspection reports) available to review the condition of the interior of the PSW that the bidders may use to estimate the extent and severity of the repairs required under bid item 22?

    Answer:

    Per the Structural Conditions Report, "The interior concrete surface appeared to be in fair condition, with no observed cracking, spalling, bulging, leaking, or exposed rebar. Some concrete abrasion was observed on the interior walls." Also note the Structural Conditions Report states that the pond drain gate is inoperable (Reference CS11, 8., B., 5), ii.). The Brush Creek Site 15 Final Structural Conditions Report is attached.

30. Question: Bid Item 30 - Rock Riprap, PSW Outlet and ASW Entrance do not appear to include the ASW Outlet riprap, nor does it appear to be included as a subsidiary to any other bid items. Please advise where the contractor should include costs for the riprap associated with the ASW outlet.

    Answer:

    Bid Item 30 includes the ASW Outlet Riprap. A revised Construction Specification 61, Rock Riprap, and Construction Specification 95, Geotextile, is attached. The bid item description for Bid Item 30 has been revised to "Rock Riprap, PSW Outlet and ASW". Refer to the attached updated Exhibit A Pricing Pages, version 3.

REVISED DOCUMENTS AS OF 12/30/2025

Site 15 – Exhibit A – Pricing Page

BC15 CS21 Excavation

BC15 CS61 Rock Riprap

BC15 CS95 Geotextile

15-C-16 – Toe Drain Details

REVISED BC 15 CS Excavation - 12/30/25

CONSTRUCTION SPECIFICATION 21—EXCAVATION

1. Scope

The work shall consist of the excavation required by the drawings and specifications and disposal of the excavated materials.

2. Classification

Excavation is classified as common excavation, rock excavation, or unclassified excavation in accordance with the following definitions.

Common excavation is defined as the excavation of all materials that can be excavated, transported, and unloaded using heavy ripping equipment and wheel tractor-scrapers with pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by excavators having a rated capacity of one cubic yard or larger and equipped with attachments (shovel, bucket, backhoe, dragline, or clam shell) appropriate to the material type, character, and nature of the materials.

Rock excavation is defined as the excavation of all hard, compacted, or cemented materials that require blasting or the use of ripping and excavating equipment larger than defined for common excavation. The excavation and removal of isolated boulders or rock fragments larger than 1 cubic yard encountered in materials otherwise conforming to the definition of common excavation shall be classified as rock excavation. The presence of isolated boulders or rock fragments larger than 1 cubic yard is not in itself sufficient cause to change the classification of the surrounding material.

For the purpose of these classifications, the following definitions shall apply:

Heavy ripping equipment is a rear-mounted, heavy duty, single-tooth, ripping attachment mounted on a track type tractor having a power rating of at least 250 flywheel horsepower unless otherwise specified in Section 10.

Wheel tractor-scraper is a self-loading (not elevating) and unloading scraper having a struck bowl capacity of at least 12 cubic yards.

Pusher tractor is a track type tractor having a power rating of at least 250 flywheel horsepower equipped with appropriate attachments.

Unclassified excavation is defined as the excavation of all materials encountered, including rock materials, regardless of their nature or the manner in which they are removed.

3. Blasting

The transportation, handling, storage, and use of dynamite and other explosives shall be directed and supervised by a person(s) of proven experience and ability who is authorized and qualified to conduct blasting operations.

Blasting shall be done in a manner as to prevent damage to the work or unnecessary fracturing of the underlying rock materials and shall conform to any special requirements in Section 10 of this specification. When specified in Section 10, the Contractor shall furnish the Engineer, in writing, a blasting plan before blasting operations begin.

4. Use of excavated material

Method 1—To the extent they are needed, all suitable material from the specified excavations shall be used in the construction of required permanent earthfill or rockfill. The suitability of material for specific purposes is determined by the Engineer. The Contractor shall not waste or otherwise dispose of suitable excavated material.

Method 2—Suitable material from the specified excavations may be used in the construction of required earthfill or rockfill. The suitability of material for specific purposes is determined by the engineer.

5. Disposal of waste materials

Method 1—All surplus or unsuitable excavated materials are designated as waste and shall be disposed of at the locations shown on the drawings.

Method 2—All surplus or unsuitable excavated materials are designated as waste and shall be disposed of by the Contractor at sites of his own choosing away from the site of the work. The disposal shall be in an environmentally acceptable manner that does not violate local rules and regulations.

6. Excavation limits

Excavations shall comply with OSHA Construction Industry Standards (29CFR Part 1926) Subpart P, Excavations, Trenching, and Shoring. All excavations shall be completed and maintained in a safe and stable condition throughout the total construction phase. Structure and trench excavations shall be completed to the specified elevations and to the length and width required to safely install, adjust, and remove any forms, bracing, or supports necessary for the installation of the work. Excavations outside the lines and limits shown on the drawings or specified herein required to meet safety requirements shall be the responsibility of the Contractor in constructing and maintaining a safe and stable excavation.

7. Borrow excavation

When the quantities of suitable material obtained from specified excavations are insufficient to construct the specified earthfills and earth backfills, additional material shall be obtained from the designated borrow areas. The extent and depth of borrow pits within the limits of the designated borrow areas shall be as specified in Section 10 or as approved by the Engineer.

Borrow pits shall be excavated and finally dressed to blend with the existing topography and sloped to prevent ponding and to provide drainage.

8. Over excavation

Excavation in rock beyond the specified lines and grades shall be corrected by filling the resulting voids with portland cement concrete made of materials and mix proportions approved by the engineer. Concrete that will be exposed to the atmosphere when construction is completed shall meet the requirements of concrete selected for use under Construction Specification 31, Concrete for Major Structures, or 32, Structure Concrete, as appropriate.

Concrete that will be permanently covered shall contain not less than five bags of cement per cubic yard. The concrete shall be placed and cured as specified by the Engineer.

Excavation in earth beyond the specified lines and grades shall be corrected by filling the resulting voids with approved, compacted earthfill. The exception to this is that if the earth is to become the subgrade for riprap, rockfill, sand or gravel bedding, or drainfill, the voids may be filled with material conforming to the specifications for the riprap, rockfill, bedding, or drainfill. Before correcting an over excavation condition, the Contractor shall review the planned corrective action with the Engineer and obtain approval of the corrective measures.

9. Measurement and payment

For items of work for which specific unit prices are established in the contract, the volume of each type and class of excavation within the specified pay limits is measured and computed to the nearest cubic yard by the method of average cross-sectional end areas or by methods outlined in Section 10 of this specification. Regardless of quantities excavated, the measurement for payment is made to the specified pay limits except that excavation outside the specified lines and grades directed by the Engineer to remove unsuitable material is included. Excavation required because unsuitable conditions result from the Contractor's improper construction operations, as determined by the Engineer, is not included for measurement and payment.

Method 1—The pay limits shall be as designated on the drawings.

Method 2—The pay limits shall be defined as follows:

a. The upper limit shall be the original ground surface as it existed before the start of construction operations except that where excavation is performed within areas designated for previous excavation or earthfill, the upper limit shall be the modified ground surface resulting from the specified previous excavation or earthfill.

b. The lower and lateral limits shall be the neat lines and grades shown on the drawings.

Method 3—The pay limits shall be defined as follows:

a. The upper limit shall be the original ground surface as it existed before the start of construction operations except that where excavation is performed within areas designated for previous excavation or earthfill, the upper limit shall be the modified ground surface resulting from the specified previous excavation or earthfill.

b. The lower and lateral limits shall be the true surface of the completed excavation as directed by the engineer.

Method 4—The pay limits shall be defined as follows:

a. The upper limit shall be the original ground surface as it existed before the start of construction operations except that where excavation is performed within areas designated for previous excavation or earthfill, the upper limit shall be the modified ground surface resulting from the specified previous excavation or earthfill.

b. The lower limit shall be at the bottom surface of the proposed structure.

c. The lateral limits shall be 18 inches outside of the outside surface of the proposed structure or shall be vertical planes 18 inches outside of and parallel to the footings, whichever gives the larger pay quantity, except as provided in d below.

d. For trapezoidal channel linings or similar structures that are to be supported upon the sides of the excavation without intervening forms, the lateral limits shall be at the underside of the proposed lining or structure.

e. For the purposes of the definitions in b, c, and d, above, any specified bedding or drainfill directly beneath or beside the structure will be considered to be a part of the structure.

All methods—The following provisions apply to all methods of measurement and payment. Payment for each type and class of excavation is made at the contract unit price for that type and class of excavation. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to the performance of the work except that extra payment for backfilling over excavation will be made in accordance with the following provisions.

Payment for backfilling over excavation, as specified in Section 8 of this specification, is made only if the excavation outside specified lines and grades is directed by the Engineer to remove unsuitable material and if the unsuitable condition is not a result of the Contractor's improper construction operations as determined by the Engineer.

Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 10 of this specification.

10. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. General

1) The Contractor is required to submit an Excavation Plan to the COR at least 45 days prior to beginning work activity. The Excavation Plan shall contain the following, at a minimum:

   a. Description of the Contractor's proposed work sequence and schedule, as well as plans for creating stockpiles.

   b. Stockpile locations within the approved staging areas shown on the Drawings. All stockpile areas are to be located outside of the 100-yr floodplain.

   c. Plans and diagrams for handling excavation, earthfill, and spoil materials.

   d. Protection of stockpiles.

   e. Haul routes.

   f. Makes, models, and quantities of proposed excavating and hauling equipment; excavation proposed for the Contractor's convenience.

   g. Means and methods for protection of structures to remain, including but not limited to the principal spillway conduit.

   h. Means and methods for protection of existing embankment fill materials to remain.

   i. Means and methods for drying excavated wet soils prior to stockpiling and/or reuse as earthfill.

   j. Sequencing of embankment toe drain excavation. Provide detailed narrative describing proposed approach to completing the Phase 1 excavation, segmental excavations, and backfilling as required below.

2) An Excavation Dewatering Plan shall be provided with the Excavation Plan, as specified in Construction Specification 11, Removal of Water. A Fill Placement Plan shall also be provided with the Excavation Plan, as specified in Construction Specification 23, Earthfill. These three plans shall be coordinated. A Foundation Preparation Plan shall also be provided with the Excavation Plan, as specified in Construction Specification 63, Treatment of Rock Surfaces.

3) In addition, Excavation shall be performed within the following tolerances:

   a. Common excavation, plus or minus 0.1 feet from plan line and grade.

   b. For foundations of concrete structures, plus 0.1 feet to minus 0.5 feet.

4) In Section 2, Classification, Common Excavation is described in the bid items below. There will be small areas that are to be excavated below the common excavation limits where rock may be encountered. The most likely places where rock may be encountered include but is not limited to trenching in cutoffs for structures such as the impact basin and tailwater weir wall. Any rock excavation, if encountered, would be paid for under line item 10 – Embankment, Common Excavation, and line item 11 – Auxiliary Spillway, Common Excavation respectively.

B. Bid Item 10 – Embankment, Common Excavation

1) The item consists of excavation of material (after stripping) within the limits of embankment toe drain excavation, including excavations for the principal spillway conduit extension, impact basin, and precast seepage collection boxes, to the depths and grades shown on the Drawings or as directed by the COR.

2) The design intent is for the embankment toe drain excavation to extend to the bottom of the materials meeting the requirements for Common Excavation as defined in Section 10.B.9).

The bottom of the toe drain excavation shall terminate at the top of materials meeting the requirements for Rock Excavation as defined in Section 2. Additional requirements are provided as notes and details on the Drawings.

3) Any heavy, mechanized excavation equipment used to perform excavation around the existing principal spillway conduit and concrete cradle shall not be closer than 5 feet from the structure all times, unless otherwise shown on the Drawings. The Contractor shall repair any damages to the existing principal spillway conduit and concrete cradle resulting from the Contractor's improper construction operations as determined by the COR at no cost to the Government.

4) Suitable materials resulting from the required excavations shall be used to construct the specified fills and shall be stockpiled at the approved staging areas shown in the Contractor's approved Excavation Plan or designated by the COR. Unsuitable materials shall be placed in on-site waste areas designated by the COR.

5) The Contractor is required to sequence the excavation such that excavations below the Phase 1 excavation subgrade elevation shown on the Drawings are completed in segments not to exceed 50 linear feet in length. Backfill to the Phase 1 excavation subgrade prior to beginning the next segment.

6) If during excavation, groundwater is encountered, excavation operations shall cease, the excavation shall be stabilized, and excavation shall not continue until the area is dewatered to the required depth, as specified in Construction Specification 11, Removal of Water.

7) Meet the requirements of Construction Specification 63, Treatment of Rock Surfaces.

8) Contractor shall coordinate embankment backfilling activities with any planned winter shutdowns. The schedule provided in the Excavation Plan shall indicate the proposed target earthfill subgrade elevation prior to commencement of any winter shutdown.

9) In Section 2 – Classification, excavation is classified as Common Excavation. *Heavy ripping equipment* and *Pusher tractor* are re-defined as having a power rating of at least 150 flywheel horsepower.

10) In Section 3 – Blasting, blasting is prohibited.

11) In Section 4 – Use of Excavation Material, Method 1 will apply. Suitable materials resulting from these excavations shall be used as onsite Earthfill, as approved by the COR. Soil resulting from these excavations that is wet or saturated does not, in and of itself, constitute unsuitable material. Unsuitable material will be determined by the COR, The Contractor is responsible to manage wet soils, separate from dry soils, and moisture condition wet or dry soils for reuse as earthfill within the project activity time requirements. The Contractor will be permitted to stockpile excavated materials only within the approved staging areas shown in the Contractor's Excavation Plan. The excavated material shall be protected for re-use in a manner that will minimize contamination and moisture absorption, as approved by the COR. Stockpiled excavated materials shall meet the soil erosion and sediment control requirements stated on the drawings and in Construction Specification 5, Pollution Control.

12) In Section 5 – Disposal of Waste Materials, Method 1 will apply. Disposal of any excess soil materials from excavations shall be as specified in Construction Specification 23, Earthfill, Bid Item 12, Earthfill. On-site disposal will be allowed in the embankment downstream toe berm as shown on the Drawings or in the staging areas shown on the Drawings or as allowed by the COR in writing.

13) In Section 6 – Excavation Limits, Embankment Excavation shall be performed as shown on the Drawings. The Contractor shall furnish, put in place, and maintain any required trench boxes, supports, and bracing required to support the sides of the excavation and prevent loss of ground that could damage or delay the work or endanger adjacent structures. Driven sheet piles for excavation support will not be permitted. The excavation limits shown on the Drawings are neat lines for payment quantities. The Contractor is responsible for determining

excavation limits to comply with OSHA Construction Industry Standards (29CFR Part 1926) Subpart P, Excavations, Trenching, and Shoring, as well as the NRCS Supplement to OSHA.

14) In Section 8 – Over excavation

a. The estimated depth and extent of excavation is shown on the Drawings. During the progress of the work, the slopes, grades, or dimensions of the excavations may require adjustment from those shown on the plans or specified herein based on conditions encountered in the field.

b. All necessary precautions shall be taken to preserve the material below and beyond the indicated or specified lines of all excavations in the best possible condition. Any and all excess excavation for the convenience of the Contractor or over excavation performed by the Contractor for any purpose or reason except as may be ordered in writing by the COR shall be at the expense of the Contractor. Where required to complete the work, all such excess excavation and over excavation shall be refilled at the expense of and by the Contractor.

c. Backfill materials for use in areas of over excavation shall be as directed by the COR. Where earth backfill is used, over excavation shall be backfilled to the moisture and density specified for Earthfill in Construction Specification 23, Earthfill.

d. Following foundation preparation, the COR shall visually observe the foundation subgrades. The Contractor shall remove any unsuitable soils, as determined by the COR, and replace with suitable material as directed by the COR. Subgrades that have been properly dewatered in accordance with Construction Specification 11, Removal of Water and exhibit soft, loose, or weakened conditions shall be removed and replaced at the direction of the COR and will be paid for in accordance with Section 9. Subgrades and excavation slopes that have become loosened or weakened requiring removal and replacement due to lack of proper dewatering shall be removed and replaced as directed by the COR at no additional cost to the Government. The COR will be the sole judge of whether subgrades have been properly dewatered.

15) In Section 9 – Measurement and Payment, Method 3 shall apply. The neat lines and grades shown on the Drawings shall be considered the true surface of the completed excavation unless otherwise approved by the COR. After the limits of excavation shown on the Drawings are complete, the COR will examine the completed surface and mark areas that need additional excavation to remove unsuitable materials. The Contractor shall survey the completed limits of excavation for quantity calculations.

a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control

C. Bid Item 11 – Auxiliary Spillway, Common Excavation

1) The item shall consist of excavation of material (after stripping) within the limits of the auxiliary spillway to the depths and grades shown on the Drawings or as directed by the COR.

2) The design intent is for the auxiliary spillway excavation is to excavate materials meeting the requirements for Common Excavation as defined in Section 2 and to terminate at the lines and grades shown on the Drawings, unless the COR directs additional excavation be performed to remove unsuitable materials as defined herein.

3) Specified requirements for Bid Item 10 – Embankment, Common Excavation apply to this Bid Item, except as modified below:

a. In Section 2 – Classification, excavation is classified as Common Excavation. *Heavy ripping equipment* and *Pusher tractor* are defined as having a power rating of at least 150 flywheel horsepower.

b. In Section 6 – Excavation Limits, Auxiliary Spillway Excavation shall be performed as shown on the Drawings within the Auxiliary Spillway. The Contractor shall furnish, put in place, and maintain sheeting and bracing required to support the sides of the excavation and prevent loss of ground that could damage or delay the work or endanger adjacent structures.

4) In Section 9 – Measurement and Payment, Method 3 shall apply. The neat lines and grades shown on the drawings shall be considered the true surface of the completed excavation unless otherwise approved by the COR. After the limits of excavation shown on the drawings are complete, the COR will examine the completed surface and mark areas that need additional excavation to remove unsuitable materials. The Contractor shall survey the completed limits of excavation for quantity calculations.

   a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control

D. Subsidiary Item, Miscellaneous Excavation

1) This item consists of all excavation required for constructing the auxiliary spillway riprap wave protection, embankment toe drain outlet pipe, auxiliary spillway drain cleanouts, outlet channel rock riprap, surface completions for geotechnical instrumentation, and other miscellaneous structures shown on the Drawings.

2) In Section 3, Blasting, blasting will not be permitted.

3) In Section 4, Use of Excavated Materials, Method 1 shall apply.

4) In Section 5, Disposal of Waste Materials, Method 1 shall apply. Disposal of any excess soil materials from excavations shall be as specified in Construction Specification 23, Earthfill, Bid Item 12, Earthfill. On-site disposal will be allowed in the embankment downstream toe berm as shown on the Drawings or in the staging areas shown on the Drawings or as allowed by the COR in writing.

5) In Section 9 – Measurement and Payment, no separate payment will be made for this item of work. Compensation for this item will be included in the payment for:

   a. Construction Specification 45, Bid Item 27, Toe Drain Piping
   b. Construction Specification 45, Bid Item 29, ASW Drain Piping
   c. Construction Specification 61, Bid Item 30, Rock Riprap, PSW Outlet and ASW ~~Entrance~~
   d. Construction Specification 401, Bid Item 46, Geotechnical Instrumentation

****End of Construction Specification 21****

REVISED BC15 CS61 Rock Riprap - 12/30/25

CONSTRUCTION SPECIFICATION 61—ROCK RIPRAP

1. Scope

The work consists of the construction of rock riprap revetments and blankets, including filter or bedding where specified.

2. Material

Rock riprap must conform to the requirements of Material Specification 523, Rock for Riprap, or if so specified, must be obtained from designated sources. It must be free from dirt, clay, sand, rock fines, and other material not meeting the required gradation limits.

At least 30 days before rock is delivered from other than designated sources, the Contractor must designate in writing the source from which rock material will be obtained and provide information satisfactory to the Contracting Officer that the material meets contract requirements. The Contractor must provide the responsible Engineer free access to the source for the purpose of obtaining samples for testing. The size and grading of the rock must be as specified in Section 8.

Rock from approved sources must be excavated, selected, and processed to meet the specified quality and grading requirements at the time the rock is installed.

Based on a specific gravity of 2.65 (typical of limestone and dolomite) and assuming the individual rock is shaped midway between a sphere and a cube, typical size/weight relationships are:

Sieve size of rock	Approx. weight of rock	Weight of test pile
16 inches	300 pounds	6,000 pounds
11 inches	100 pounds	2,000 pounds
6 inches	15 pounds	300 pounds

When specified in Section 8 or when it is necessary to verify the gradation of the rock riprap, a particle size analysis must be performed in accordance with ASTM D5519, Test Method A or B. The analysis must be performed at the work site on a test pile of representative rock. The mass of the test pile must be at least 20 times the mass of the largest rock in the pile. The results of the test are compared to the gradation required for the project. Test pile results that do not meet the construction specifications must be cause for the rock to be rejected. The test pile that meets contract requirements must be left on the job site as a sample for visual comparison. The test pile must be used as part of the last rock riprap to be placed.

Filter or bedding aggregates when required must conform to Material Specification 521, Aggregates for Drainfill and Filters, unless otherwise specified. Geotextiles must conform to Material Specification 592, Geotextile.

3. Subgrade preparation

The subgrade surface on which the rock riprap, filter, bedding, or geotextile is to be placed must be cut or filled and graded to the lines and grades shown on the drawings. When fill to subgrade lines is required, it must consist of approved material and must conform to the requirements of the specified class of earthfill.

Rock riprap, filter, bedding, or geotextile must not be placed until the foundation preparation is completed and the subgrade surface has been inspected and approved.

4. Equipment-placed rock riprap

The rock riprap must be placed by equipment on the surface and to the depth specified. It must be installed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying material. The rock for riprap must be delivered and placed in a manner that ensures the riprap in place is reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks. Some hand placing may be required to provide a neat and uniform surface.

Rock riprap must be placed in a manner to prevent damage to structures. Hand placing is required as necessary to prevent damage to any new and existing structures.

5. Hand placed rock riprap

The rock riprap must be placed by hand on the surface and to the depth specified. It must be securely bedded with the larger rocks firmly in contact one to another without bridging. Spaces between the larger rocks must be filled with smaller rocks and spalls. Smaller rocks must not be grouped as a substitute for larger rock. Flat slab rock must be laid on its vertical edge except where it is laid like paving stone and the thickness of the rock equals the specified depth of the riprap course.

6. Filter or bedding

When the contract specifies filter, bedding, or geotextile beneath the rock riprap, the designated material must be placed on the prepared subgrade surface as specified. Compaction of filter or bedding aggregate is not required, but the surface of such material must be finished reasonably smooth and free of mounds, dips, or windrows.

7. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, the quantity of each type of rock riprap placed within the specified limits is computed to the nearest ton by actual weight. The volume of each type of filter or bedding aggregate is measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas. For each load of rock riprap placed as specified, the contractor must furnish to the responsible engineer a statement-of-delivery ticket showing the weight to the nearest 0.1 ton.

Payment is made at the contract unit price for each type of rock riprap, filter, or bedding. Such payment is considered full compensation for completion of the work.

Method 2—For items of work for which specific unit prices are established in the contract, the quantity of each type of rock riprap placed within the specified limits is computed to the nearest 0.1 ton by actual weight. The quantity of each type of filter or bedding aggregate delivered and placed within the specified limits is computed to the nearest 0.1 ton. For each load of rock riprap placed as specified, the contractor must furnish to the engineer a statement-of-delivery ticket showing the weight to the nearest 0.1 ton. For each load of filter or bedding aggregate, the contractor must furnish to the responsible engineer a statement-of-delivery ticket showing the weight to the nearest 0.1 ton.

Payment is made at the contract unit price for each type of rock riprap, filter, or bedding. Such payment is considered full compensation for completion of the work.

Method 3—For items of work for which specific unit prices are established by the contract, the

volume of each type of rock riprap and filter or bedding aggregate is measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas.

Payment is made at the contract unit price for each type of rock riprap, filter, or bedding. Such payment is considered full compensation for completion of the work.

Method 4—For items of work for which specific unit prices are established by the contract, the volume of each type of rock riprap, including filter and bedding aggregate, is measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas.

Payment is made at the contract unit price for each type of rock riprap, including filter and bedding. Such payment is considered full compensation for completion of the work.

Method 5—For items of work for which specific unit prices are established by the contract, the quantity of each type of rock riprap placed within the specified limits is computed to the nearest ton by actual weight. For each load of rock for riprap placed as specified, the contractor must furnish to the responsible engineer a statement-of-delivery ticket showing the weight to the nearest 0.1 ton.

Payment is made at the contract unit price for each type of rock riprap, and includes compensation for any aggregate or geotextile installed as specified for filter or bedding. Such payment is considered full compensation for completion of the work.

Method 6—For items of work for which specific unit prices are established by the contract, the volume of each type of rock riprap is measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas.

Payment is made at the contract unit price for each type of rock riprap and includes compensation for any aggregate or geotextile installed as specified for filter or bedding. Such payment is considered full compensation for completion of the work.

All methods—The following provision applies to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 8.

No separate payment is made for testing the gradation of the test pile. Compensation for testing is included in the appropriate bid item for riprap.

8. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Bid Item 30 - Rock Riprap, PSW Outlet and ASW ~~Entrance~~

1) This item of work consists of furnishing all labor, materials, and equipment to construct the permanent rock riprap armoring, including bedding and geotextile, in the outlet channel downstream of the impact basin, at the outlet of the precast seepage collection boxes, and for the ASW entrance wave protection and ASW outlet protection as shown on the Drawings. Temporary rock riprap for pollution control and stream diversion is included in Construction Specification 5, Pollution Control.

2) In Section 2 – Material – Submit for approval to the COR written certification from supplier that materials meet the specified requirements. Materials shall conform to the referenced Material Specifications and additional requirements specified below:

   a. Rock Type 2 shall apply.

   b. Riprap shall meet the requirements of West Virginia Department of Transportation Division of Highways Standard Specifications Roads and Bridges Section 704. Riprap gradation shall be as follows: 100% of the stones shall be less than 12 inches, 15 to 50% shall be 6 inches, and 0 to 15% shall be 3 inches. On-site gradation testing is not required. Submit for approval to the COR written certification from the supplier that riprap meets the specified requirements at least five working days before delivery.

   c. Riprap shall be underlain by Bedding and shall have non-woven geotextile placed over subgrade before placement, as shown on the Drawings. Geotextile materials and installation shall meet the requirements of Construction Specification 95, Geotextile.

   d. Bedding shall meet the gradation requirements of AASHTO No. 3 Coarse Aggregate and meet the requirements of the latest version of the West Virginia Department of Transportation Division of Highways Standard Specifications Roads and Bridges.

3) In Section 5 – Hand Placed Rock Riprap, riprap may be placed by equipment or by hand.

4) After placement, riprap surface shall be stabilized by pushing or moving the protruding rock into the riprap blanket with equipment or hand tools. Due care shall be exercised to prevent damage to the geotextile. Equipment shall not be allowed on the rock during or after placement.

5) Riprap shall not be dropped from a height greater than three (3) feet.

6) In Section 6 – Filter or bedding:

   a. Bedding materials shall be placed in a manner to avoid segregation of particle sizes, and to ensure the continuity and integrity of all zones. No foreign materials shall be allowed to become intermixed with, or otherwise contaminate, bedding materials.

   b. No compaction will be required beyond that resulting from the placing and spreading operations.

7) In Section 7 – Measurement and Payment, Method 6 shall apply.

8) Items subsidiary to this Bid Item include:

   a. Miscellaneous Excavation, Construction Specification 21 - Excavation

   b. Geotextile, Construction Specification 95 - Geotextile

B. Bid Item 31 - Embankment Upstream Stability Berm

1) This item of work consists of furnishing all labor, materials, and equipment to construct the upstream embankment riprap stability berm as shown on the Drawings and while the reservoir is completely drained.

2) At least 45 days prior to beginning work activity, Contractor shall submit an Upstream Stability Berm Installation Plan containing the following, at a minimum:

   a. Description of the Contractor's proposed work sequence and schedule for all work items required under this bid item, side casting sediment, and riprap placement.

   b. Material stockpile locations within the approved staging areas shown on the Drawings.

   c. Plans and diagrams for handling riprap.

   d. Makes, models, and quantities of proposed equipment to perform excavations and place riprap to the lines and grades shown on the Drawings, as well as means and methods to demonstrate that the Work conforms to the lines and grades shown on the Drawings.

   e. Means and methods for protection of structures to remain, including but not limited to the principal spillway riser.

   f. Means and methods for protection of existing embankment fill materials to remain.

   g. Means, methods, and equipment for side casting sediment away from the footprint of the riprap berm as required. It is estimated that 6 to 9 feet of sediment is present in the vicinity of the principal spillway riser, but the Contractor is responsible for verifying the volume of sediment to be moved in order to perform the work. Sediment may not be removed from the reservoir.

3) Survey submittals and records shall be as specified in Construction Specification 7, Construction Surveys. Perform topographic surveys of the following:

   a. Horizontal limits and top of sediment within footprint of riprap prior to side casting.

   b. Horizontal limits and top of riprap subgrade after completion of side casting of sediment and prior to riprap placement.

   c. Horizontal limits and top of riprap after placement.

   d. Sequential work shall not proceed until the survey submittals have been reviewed and approved by the COR.

   e. Additional surveys shall be completed as requested by the COR.

4) Specified requirements for Bid Item 30 – Rock Riprap, PSW Outlet and ASW ~~Entrance~~ apply to this Bid Item, except as modified below:

   a. In Section 2 – Material,

      a. Riprap shall meet the requirements of West Virginia Department of Transportation Division of Highways Standard Specifications Roads and Bridges Section 704. Riprap gradation shall be as follows: 100% of the stones shall be less than 6 inches, 15 to 50% shall be 3 inches, and 0 to 15% shall be 2 inches.

      b. Bedding materials are not required.

   b. In Section 6 – Filter or bedding, bedding materials are not required.

5) In Section 7 – Measurement and Payment, Method 6 shall apply.

   a. Measurement and Payment for quality control and testing in the section will be made under Bid Item 44 – Construction Quality Control in Construction Specification 94 – Construction Quality Control.

6) Items subsidiary to this Bid Item include:

   a. Geotextile, Construction Specification 95 – Geotextile
   b. Water for Construction, Construction Specification 10 – Water for Construction

**** End of Construction Specification 61 ****

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Revised BC15 CS95 Geotextile - 12/30/25

CONSTRUCTION SPECIFICATION 95—GEOTEXTILE

1. Scope

This work consists of furnishing all material, equipment, and labor necessary for the installation of geotextiles.

2. Quality

Geotextiles shall conform to the requirements of Material Specification 592 and this specification.

3. Storage

Before use, the geotextile shall be stored in a clean, dry location out of direct sunlight, not subject to extremes of either hot or cold temperatures, and with the manufacturer's protective cover undisturbed. Receiving, storage, and handling at the job site shall be in accordance with the requirements listed in ASTM D 4873.

4. Surface preparation

The surface on which the geotextile is to be placed shall be graded to the neat lines and grades as shown on the drawings. It shall be reasonably smooth and free of loose rock and clods, holes, depressions, projections, muddy conditions, and standing or flowing water (unless otherwise specified in Section 7 of this specification).

5. Placement

Before the geotextile is placed, the soil surface will be reviewed for quality assurance of the design and construction. The geotextile shall be placed on the approved prepared surface at the locations and in accordance with the details shown on the drawings and specified in Section 7 of this specification. It shall be unrolled along the placement area and loosely laid, without stretching, in such a manner that it conforms to the surface irregularities when material or gabions are placed on or against it. The geotextile may be folded and overlapped to permit proper placement in designated area(s).

Method 1—The geotextile shall be joined by machine sewing using thread material meeting the chemical requirements for the geotextile fibers or yarn. Thread shall be polypropylene, polyester, or Kevlar™ aramid thread, unless a specific thread type is specified. The thread shall consist of two parallel stitched rows at a spacing of about 1 inch and shall not cross (except for any required re-stitching). The stitching shall be a lock-type stitch. Each row of stitching shall be located a minimum of 2 inches from the geotextile edge. Unless otherwise specified, the seam tensile strength as measured according to ASTM D4884 shall be a minimum of 90 percent of the geotextile tensile strength in the weakest principal direction as measured according to ASTM D4632.

The geotextile shall be temporarily secured during placement of overlying material to prevent slippage, folding, wrinkling, or other displacement of the geotextile. Unless otherwise specified, methods of securing shall not cause punctures, tears, or other openings to be formed in the geotextile.

Method 2—The geotextile shall be joined by overlapping a minimum of 18 inches (unless otherwise specified) and secured against the underlying foundation material. Securing pins, approved and provided by the geotextile manufacturer, shall be placed along the edge of the panel or roll material to adequately hold it in place during installation. Pins shall be steel or fiberglass formed as a **U**, **L**, or **T** shape or contain "ears" to prevent total penetration through the geotextile. Steel washers shall be provided on all but the U-shaped pins. The upstream or upslope geotextile shall overlap the abutting downslope geotextile. At vertical laps, securing pins shall be inserted through the bottom layers along a line through approximately the mid-point of the overlap. At horizontal laps and across slope labs, securing shall be inserted through the bottom layer only. Securing pins shall be placed along a line about 2 inches in from the edge of the placed geotextile at intervals not to exceed 12 feet unless otherwise specified. Additional pins shall be installed as necessary and where appropriate to prevent any undue slippage or movement of the

geotextile. The use of securing pins will be held to the minimum necessary. Pins are to remain in place unless otherwise specified.

Should the geotextile be torn or punctured, or the overlaps or sewn joint disturbed, as evidenced by visible geotextile damage, subgrade pumping, intrusion, or grade distortion, the backfill around the damaged or displaced area shall be removed and restored to the original approved condition. The repair shall consist of a patch of the same type of geotextile being used and overlaying the existing geotextile. When the geotextile seams are required to be sewn, the overlay patch shall extend a minimum of 1 foot beyond the edge of any damaged area and joined by sewing as required for the original geotextile except that the sewing shall be a minimum of 6 inches from the edge of the damaged geotextile. Geotextile panels joined by overlap shall have the patch extend a minimum of 2 feet from the edge of any damaged area.

Geotextile shall be placed in accordance with the following applicable specification according to the use indicated in Section 7:

Slope protection—The geotextile shall not be placed until it can be anchored and protected with the specified covering within 48 hours or protected from exposure to ultraviolet light. In no case shall material be dropped on uncovered geotextile from a height of more than 3 feet.

Subsurface drains—The geotextile shall not be placed until drainfill or other material can be used to provide cover within the same working day. Drainfill material shall be placed in a manner that prevents damage to the geotextile. In no case shall material be dropped on uncovered geotextile from a height of more than 5 feet.

Road stabilization—The geotextile shall be unrolled in a direction parallel to the roadway centerline in a loose manner permitting conformation to the surface irregularities when the roadway fill material is placed on its surface. In no case shall material be dropped on uncovered geotextile from a height of more than 5 feet. Unless otherwise specified, the minimum overlap of geotextile panels joined without sewing shall be 24 inches. The geotextile may be temporarily secured with pins recommended or provided by the manufacturer, but they shall be removed before the permanent covering material is placed.

6. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, the quantity of geotextile for each type placed within the specified limits is determined to the nearest specified unit by measurements of the covered surfaces only, disregarding that required for anchorage, seams, and overlaps. Payment is made at the contract unit price. Such payment constitutes full compensation for the completion of the work.

Method 2—For items of work for which specific unit prices are established in the contract, the quantity of geotextile for each type placed with the specified limits is determined to the nearest specified unit by computing the area of the actual roll size or partial roll size installed. The computed area will include the amount required for overlap, seams, and anchorage as specified. Payment is made at the contract unit price. Such payment constitutes full compensation for the completion of the work.

Method 3—For items of work for which specific lump sum prices are established in the contract, the quantity of geotextile is not measured for payment. Payment for geotextiles is made at the contract lump sum price and constitutes full compensation for the completion of the work.

All methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

7. Items of work and construction details

Items of work to be performed in conformance with this specification and construction details are:

A. Subsidiary Item – Geotextile

1) This item consists of furnishing all material, equipment, and labor necessary for the installation of geotextiles as shown on the Drawings. Geotextiles shall be installed on top of aggregates for earthwork in the Auxiliary Spillway, except where mudmat is shown.

2) Submit manufacturer's product data to the COR for approval.

3) In Section 2 – Quality, materials shall conform to the referenced Material Specifications and additional requirement specified below:

   a. Geotextile: Nonwoven needle-punched Class IV geotextile shall be used. Heat-bonded and resin-bonded geotextiles are not acceptable. The Apparent Opening Size shall be a minimum of 0.150 mm (or #100 sieve).

4) In Section 5 – Placement, Method 2 will apply.

   a. No riprap, bedding, or RCC shall be dropped on geotextile from a height greater than three (3) feet. No other material shall be dropped on uncovered geotextile.

   b. The geotextile shall be placed immediately prior to the placement of the rock riprap, bedding, or RCC. The placement of the geotextile shall be approved by the COR before rock riprap, bedding, or RCC is installed.

5) In Section 6 – Measurement and Payment, no separate payment will be made for geotextile. Compensation for geotextile will be included in the payment under:

   a. Bid Item 7, Mobilization and Demobilization, Construction Specification 8 – Mobilization and Demobilization

   b. Bid Item 23, Roller Compacted Concrete, Construction Specification 36 – Roller Compacted Concrete

   c. Bid Item 30, Rock Riprap, PSW Outlet and ASW ~~Entrance~~, Construction Specification 61 – Rock Riprap

   d. Bid Item 31, Embankment Upstream Stability Berm, Construction Specification 61 – Rock Riprap

****End of Construction Specification 95****

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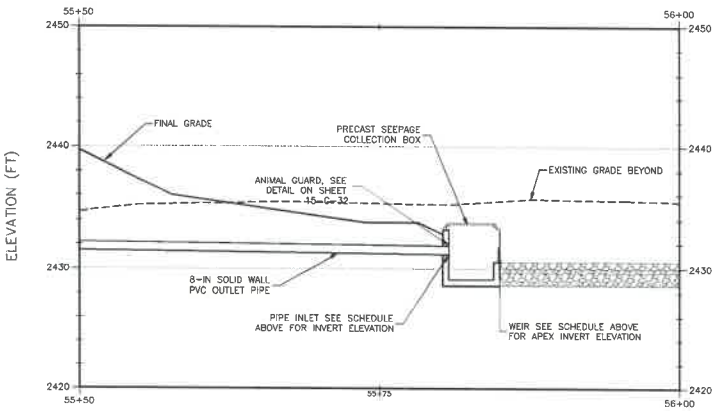
Revised 15-C-16 TOE DRAIN DETAILS - 12/30/2025

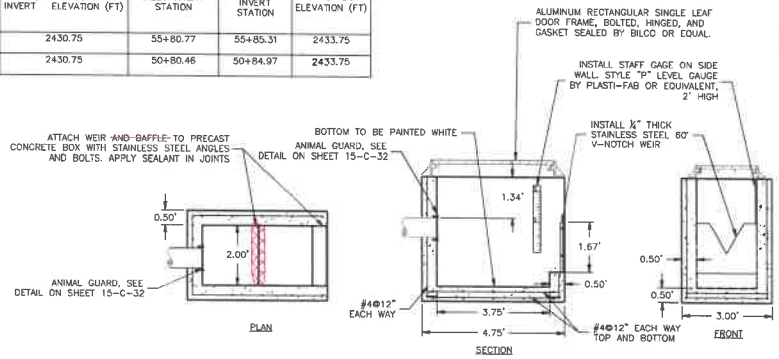
PRECAST SEEPAGE COLLECTION BOX SCHEDULE

SEEPAGE BOX	INLET PIPE INVERT ELEVATION (FT)	WEIR (V-NOTCH) APEX INVERT ELEVATION (FT)	INLET INVERT STATION	OUTLET INVERT STATION	TOP OF BOX ELEVATION (FT)
1	2431.20	2430.75	55+80.77	55+85.31	2433.75
2	2431.20	2430.75	50+80.46	50+84.97	2433.75

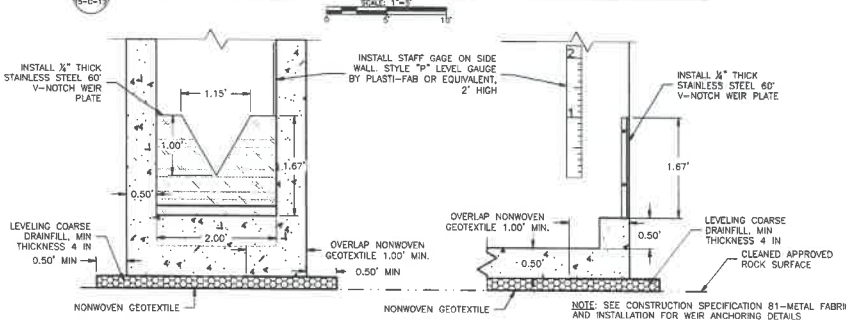


1 LEFT PRECAST SEEPAGE COLLECTION BOX PROFILE
15-C-13
SCALE: 1"=5'

NOTE: SEE SCHEDULE ABOVE FOR RIGHT PRECAST SEEPAGE COLLECTION BOX STATIONING AND ELEVATIONS

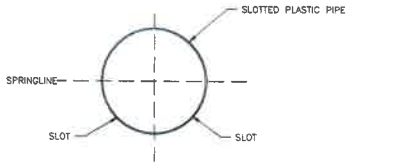


2 TYPICAL PRECAST SEEPAGE COLLECTION BOX DETAILS
NTS



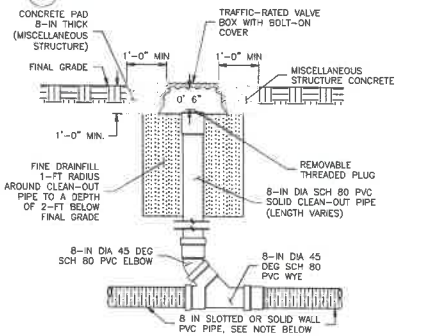
NOTE: SEE CONSTRUCTION SPECIFICATION 81-METAL FABRICATION AND INSTALLATION FOR WEIR ANCHORING DETAILS

3 PRECAST SEEPAGE COLLECTION BOX WEIR PLATE DETAIL
NTS



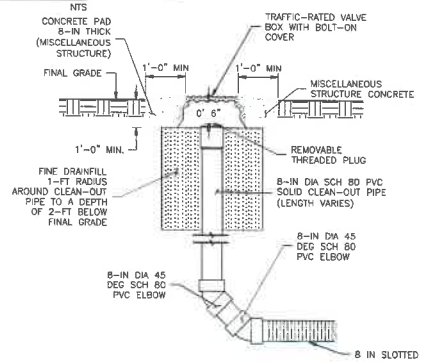
NOTE: SEE CS45 FOR SLOT SIZING AND PLACEMENT REQUIREMENTS

4 SLOTTED COLLECTION PIPE DETAIL
NTS



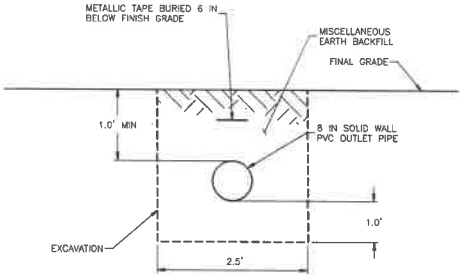
NOTE: PIPES CONNECTED BY CLEANOUTS LOCATED ALONG THE TOE DRAIN BASELINE ALIGNMENT TO BE SLOTTED. ALL OTHER CONNECTED TO CLEANOUT TO BE SLOTTED

5 TYPICAL IN-LINE CLEANOUT DETAIL
NTS



NOTE: DRAINFILL ENCAPSULATES COLLECTION PIPE NOT SHOWN FOR CLARITY

6 TYPICAL END-OF-LINE CLEANOUT DETAIL
NTS



7 TYPICAL SOLID WALL PIPE BEDDING DETAIL
15-C-13
NTS

REVISIONS				
#	DATE	APPROVED	TITLE	DESCRIPTION
1	12/26	12/23/25	BID ADDENDUM	BID QUESTION CLARIFICATION

	Date
Designed CDS	SEP 24
Drawn CRP	SEP 24
Checked EBB	SEP 24
Approved JMP	SEP 24

BRUSH CREEK SITE 15 DAM REHABILITATION
TOE DRAIN DETAILS - SHEET 2 OF 2
Brush Creek Watershed
Mercer County, WV

Aterra-Schnabel JV
300 Brookside Ave., Bldg. 18, Suite 160, Ambler, PA 19002
Phone: 336-221-6166
schnabel-eng.com

United States Department of Agriculture
Natural Resources Conservation Service

Contract No. 12SPEC18D0023
Drawing No. 15-C-16
SEPTEMBER 2024
SHEET 18 OF 61

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Last Saved by: CPATSCH3 SheetDate: 10/20/25 11:11 AM PltDate: 12/26/2025 11:08 AM
User Name: CPATSCH3 Drawing Name: C:\Users\CPATSCH3\Aterra-Schnabel JV\Aterra-Schnabel JV Team Site - Documents\CADD\Plans\Plans_Specs\15 15C-16-10-SPCS.dwg Layout: TOE DRAIN DETAILS - SHEET 2 OF 2

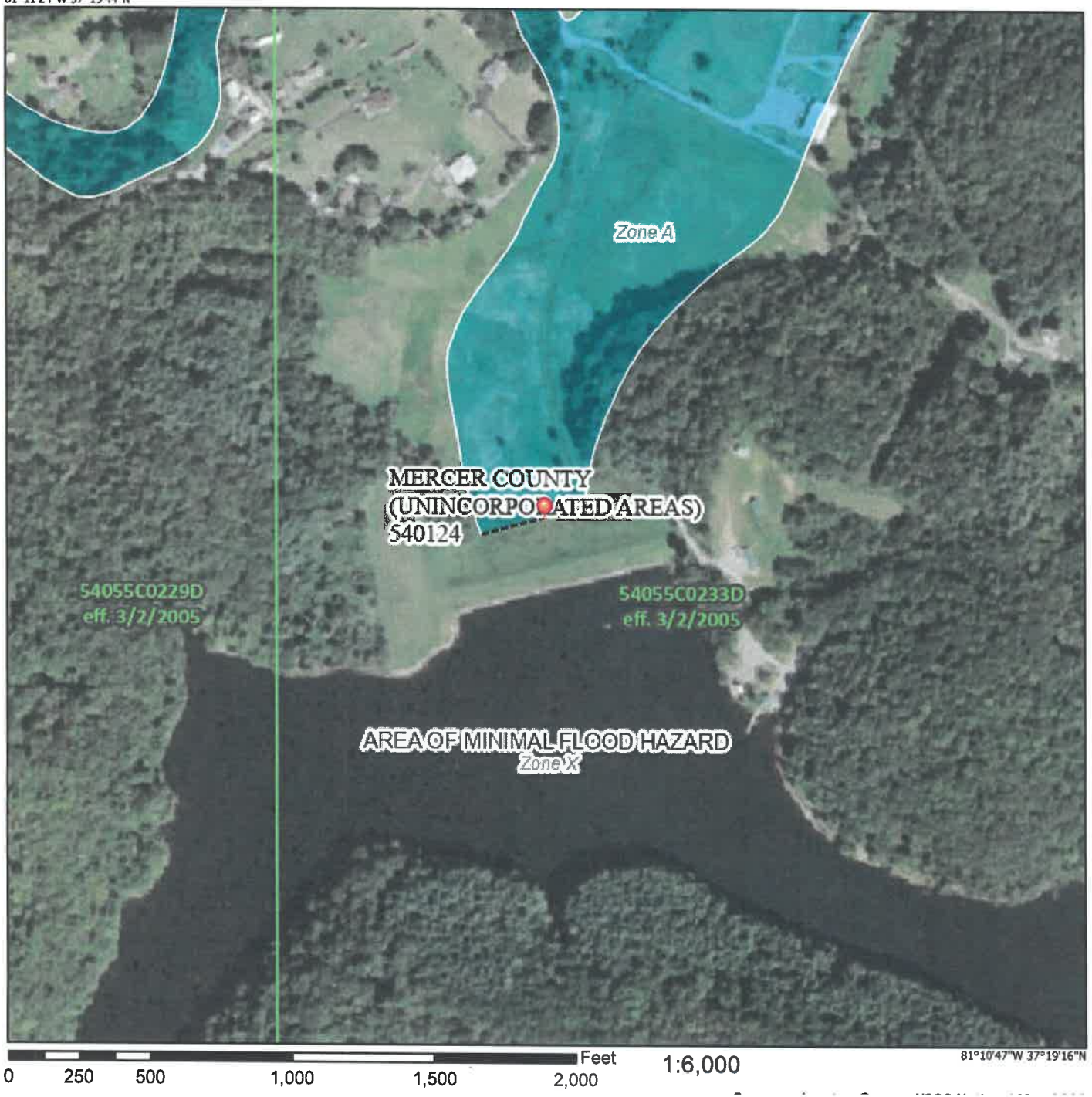
NEW DOCUMENTS

FIRMETTE_BC15

BC15 Final Structural Conditions Report

National Flood Hazard Layer FIRMette

FEMA



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/4/2025 at 5:21 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

FINAL STRUCTURAL CONDITIONS REPORT

Brush Creek Site 15 Dam Rehabilitation Design
Mercer County, West Virginia

Prepared For:
NRCS – West Virginia

Aterra-Schnabel Reference 18proj007
Schnabel Reference 18C35013.04
November 7, 2019

ATERRA SOLUTIONS | Schnabel ENGINEERING | NRCS

November 7, 2019

Mr. Timothy Ridley, PE
Contracting Officer's Representative
NRCS – West Virginia
1550 Earl L. Core Road, Suite 200
Morgantown, WV 26505

Subject: **Final Structural Conditions Report**
Brush Creek Site 15 Dam Rehabilitation Design, Mercer County, West Virginia
Aterra-Schnabel Reference 18proj007 / Schnabel Reference 18C35013.04

Dear Mr. Ridley:

Aterra-Schnabel Joint Venture (Aterra-Schnabel JV) is pleased to present this Final Report summarizing our evaluation of the existing structural conditions of the principal spillway riser for the Brush Creek Site 15 Dam Rehabilitation Design Project. This evaluation was performed by Aterra-Schnabel JV under contract with NRCS. It was performed in accordance with the approach described in our revised Plan of Work dated December 28, 2018.

SCOPE OF SERVICES

Our Plan of Work referenced above defines the following scope of services for this evaluation:

- **Goals**
  - To perform underwater inspection of the principal spillway riser.
  - To perform a seismic evaluation of the existing primary spillway riser. This also includes development of a design concept for seismic retrofits to the existing riser, if appropriate.

- **Approach**
  - Previous investigations of the principal spillway risers and conduits will be reviewed. Previous analyses of the structural integrity and stability of these structures, as well as recommendations for rehabilitation or replacement of these structures, will also be reviewed. Design concepts for addressing deficiencies in these structures beyond those already documented will be made.
  - Our subcontractor, In-Water Services Co. (In-Water), will perform the underwater inspections while a Schnabel representative is on site. Inspections of both the riser interior and exterior will be performed. Inspection of the riser interiors will require lowering the pool level below the weir. This will be coordinated with the Glenwood-Green Valley PSD.

- A seismic evaluation of the existing riser will be performed using the current version of *TR-60* and the *Seismic Analysis Manual*. If the riser does not meet current criteria, we will develop conceptual level sketches, figures, and an opinion of probable construction costs for the recommended design concepts.

SITE DESCRIPTION

The Brush Creek Site 15 Dam is located in Mercer County, West Virginia, about 9.5-miles northeast of the City of Bluefield and about 6-miles southwest of the City of Princeton, on the North Fork of Brush Creek. The site can be accessed via Dan Hale Reservoir Lake Road and Gobbler Run Road. The latitude and longitude of the approximate midpoint of the embankment centerline are 37.3246° N and 81.1848° W, respectively. All elevations contained in this report are referenced to the NAVD88. Note that the As-Built Drawings had used the National Geodetic Vertical Datum of 1929 (NGVD29). Based on the 2016 field survey, the datum shift is +1.4 ft from the NGVD29 to NAVD88. References to "left" and "right" within this report assume one is looking downstream.

According to the As-Built Drawings, the principal spillway consists of a covered-top reinforced concrete riser that is about 72-ft tall. The inside dimensions of the riser are about 2 ft x 6 ft. The invert of the riser crest is at the normal pool elevation of the reservoir, EL 2489.5 ft. The riser conveys flows from the reservoir through the embankment via an approximately 360-ft long, 24-inch diameter RCP that outlets into a reinforced concrete impact basin. The invert of the principal spillway outlet is EL 2430.8 ft. The principal spillway conduit was constructed with a concrete cradle founded on rock and includes reinforced concrete anti-seep collars spaced along the length of the conduit. Reservoir drain releases are controlled using an 18-inch seating head slide gate, designated the Pond Drain Gate, located at the base of the riser on the left face with invert EL 2432.1. Releases for drinking water processing are controlled using two 18-inch seating head slide gates, designated Water Supply Gate I and II, located on the right riser face with inverts of EL 2473.7 and 2453.7, respectively.

The Brush Creek Site 15 Dam is categorized as a High Hazard dam by both West Virginia Dam Safety and NRCS and is subject to both West Virginia Dam Safety and NRCS requirements. In 2017, the West Virginia Conservation Agency (WVCA), with support from Gannett Fleming, completed the *Planning Level Technical Memorandum* (Gannett Fleming, 2017a) and the *Draft Supplemental Watershed Plan – Environmental Assessment for the Rehabilitation of Brush Creek Site 15 Watershed Dam* (Plan-EA) (Gannett Fleming, 2017b). The Plan-EA process included an assessment of the condition of the dam and its compliance with current West Virginia Dam Safety and NRCS standards. The results of engineering analyses performed by NRCS (2013) and Gannett Fleming (2017a) demonstrated that the dam did not meet current West Virginia Dam Safety and/or NRCS criteria for auxiliary spillway integrity and stability, filter compatibility between the existing drain materials and adjacent embankment fill materials, embankment rapid drawdown and seismic slope stability, and principal spillway riser seismic stability.

The Plan-EA includes the following rehabilitation design concepts to bring the dam into compliance with NRCS requirements and West Virginia Dam Safety requirements:

- Installing a roller-compacted concrete cutoff wall in the auxiliary spillway
- Constructing stability berms on the upstream and downstream slopes of the embankment
- Constructing a new embankment toe drain system

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- Extending the principal spillway conduit and reconstructing the impact basin
- Seismic retrofitting of the principal spillway riser
- Repairing the existing sluice gates

PRINCIPAL SPILLWAY RISER EVALUATION

Seismic Evaluation of Existing Principal Spillway Riser

The existing principal spillway riser is a single-stage NRCS 2-ft x 6-ft (D×3D) riser with a covered top and a concrete platform extending 12.8 ft above the covered top. It was previously analyzed for seismic stability as described in the *Planning Level Technical Memorandum* (Gannett Fleming, 2017). The 2017 analysis combined the seismic coefficient method and a static finite element model. Seismic loads were developed by following U.S. Army Corps of Engineers (USACE) guidance documents. However, the analysis seems to apply an overly conservative seismic acceleration since it utilizes a spectral acceleration at a period of 0.1 seconds rather than the effective peak ground acceleration defined in USACE *EM 1110-2-2100*.

Schnabel analyzed the principal spillway riser for seismic stability in accordance with the NRCS *National Engineering Handbook (NEH), Part 636, Chapter 70, Design and Analysis of Risers*, and calculations are presented in Appendix A. This methodology uses the equivalent lateral force procedure and incorporates a spectral acceleration defined in a manner consistent with the International Building Code. It incorporates a Response Modification Factor and Occupancy Importance Factor which reduce the applied acceleration.

The analysis includes calculations for motion parallel to the endwalls, which is the controlling case. The existing principal spillway riser at Brush Creek Site 15 Dam meets the required factors of safety for overturning and sliding, and with bearing pressure within the allowable limit. The seismic stability analysis results for the existing riser are shown in Table 1.

Table 1: Seismic Evaluation of Existing Principal Spillway Riser – Factors of Safety

Loading Condition	Riser in Air	Riser in Water	Required Factor of Safety
Calculated Factor of Safety – Overturning	3.1	2.1	1.5*
Calculated Factor of Safety – Sliding	7.2	4.5	1.5

* *NEH Part 636 Chapter 70* allows a reduction in the required factor of safety for existing structures under seismic loading.

The 2017 analysis concluded that the existing riser did not meet NRCS criteria for extreme seismic events, but considered a seismic response coefficient representing the Maximum Credible Earthquake that was more than 4 times the seismic response coefficient used for the updated analysis presented herein. Also, the 2017 stability analysis did not follow acceptance criteria allowed by *NEH Part 636*, namely that the resultant may occur anywhere within the base of an existing structure as long as the overturning factor of safety exceeds 1.5. This updated analysis shows that the riser meets seismic stability requirements in accordance with *NEH Part 636*, and that rehabilitation of the existing riser is not required.

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Seismic Considerations

The updated analysis performed in accordance with *NEH Part 636 Chapter 7*0 demonstrates that the existing riser meets NRCS seismic stability criteria. This analysis employs the same risk-targeted method for calculating the seismic response coefficient as ASCE 7 and the International Building Code. By following this method, we conclude that the riser has less than a 1% probability of collapse due to a seismic event within a 50-year period (2×10^{-4} annual frequency of exceedance).

Our team discussed the impacts of a collapse of the riser during a seismic event. Based on the results of our analysis, the 'riser in water' condition is most vulnerable to an overturning failure during an extreme seismic event. If such an event would occur, we would anticipate the following sequence of events. A seismic event would occur when the pool level is at or above normal pool, and the riser would overturn. The overturned riser would pull away from the outlet conduit, initiating an uncontrolled release from the reservoir through the conduit. This is considered a loss of the reservoir and a dam failure in accordance with NRCS requirements. The volume of water released would be limited to the reservoir storage at normal pool, which is 1516 acre-ft through the 2-ft diameter conduit. Repairs would be necessary to reestablish pool level and full functionality of the dam, and to reduce the potential for long-term degradation around the conduit opening. Without the normal impoundment, the flood control benefits of the project would be reduced until repairs could be made. Following the seismic event, a complete inspection of the dam and appurtenant structures should be performed to evaluate damage to structures and the potential for a defect that could lead to a potential failure mode once the pool is reestablished.

2019 PRINCIPAL SPILLWAY INSPECTION

The principal riser structure was inspected on July 10, 2019, by David Bisio, EIT, of Schnabel Engineering with support from In-Water for underwater inspections. In-Water utilized an aluminum flat-bottom skiff and underwater inspection equipment, including a remote-controlled underwater rover with video capabilities, to perform the inspection. James Rogers, project manager and foreman for In-Water, led the 3-person diving crew. The reservoir level at the time of inspection was approximately at EL 2488.0, about 1.5 ft below the riser weir crest.

In-Water inspected the exterior of the riser structure with a remote-controlled underwater rover; the video feed was observed from the main landing of the riser structure, where Schnabel provided direction for In-Water to inspect areas and features in greater detail as needed. Depths below water were noted via a pressure gage on the rover relayed to the video monitor. A recording of the video feed was provided by In-Water and accompanies this report.

Overall, the exterior of the riser structure was observed to be in fair condition. The Pond Drain Gate was inoperable at the time of the inspection. A stem bracket located at about EL 2463.6 (about 23 ft below the water surface) was observed to be corroded and broken. The stem bowed slightly out from the structure, most noticeably around EL 2450.6 (about 36 ft below the water surface). The gate was not observed as it was buried a few feet below the sediment line. Water Supply Gates I and II appeared to be in very good condition, with some surficial rust and marine growth on the gates and associated trash racks. The stems of Gates I and II were also in good condition, not bent, and relatively rust-free. The stem brackets were rusted and covered in marine growth, but securely connected to the riser structure. The original operator and stem for Water Supply Gate II were corroded and disconnected just below the upper support landing above the water surface, and a new operator had been installed on the main riser landing. It is unknown

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when this repair was made. The exterior concrete appeared to be in good condition, with some heavier marine growth at lower depths; but no cracking, spalling, bulging, or exposed rebar was observed. Concrete edges, lips, chamfers and seams were observed to be in good condition as well. A significant layer of sediment and organics was observed around the base of the structure, ranging from depths of about 48 to 51 ft below the water surface, which is about 6 to 9 ft above the riser floor.

The high stage trash racks located on the left and right sides of the riser structure exhibited significant rusting and corrosion, but were securely connected to the structure. Most of the anchor bolts appeared to be in fair condition, but two were noted to have missing nuts and washers. The metal gratings above the trash racks were missing a few lower bars due to corrosion, but the frames were securely connected to the structure. The ladder attached to the downstream face exhibited significant corrosion at and below the water surface. Several rungs were missing, but the ladder frame was securely connected to the riser structure.

A diver was lowered inside the riser structure with a winch and harness system to perform an inspection of the interior. Observations were conveyed verbally to Schnabel personnel positioned on the main riser landing. The interior concrete surface appeared to be in fair condition, with no observed cracking, spalling, bulging, leaking, or exposed rebar. Some concrete abrasion was observed on the interior walls. The interior sides of Water Supply Gates I and II and the Pond Drain Gate were in good condition, with tight seals and no leaking. Some standing water and sandy sediment were observed on the bottom of the riser floor, but no debris was observed. The outlet pipe appeared to be in good condition and was free of blockage; the diver was able to see daylight at the downstream end of the pipe.

Gates were not operated during the inspection. The Pond Drain Gate was considered inoperable due to the depth of sediment immediately outside of the gate. The owner stated that Water Supply Gate I and II had been operated recently without problem prior to the inspection. It is unknown if the electrical control box is used to operate the water supply gate.

The impact basin at the downstream end of the principal spillway conduit appeared to be in good condition based on observations of the exposed concrete surface and metal grating made during 2019 site visits. Some exposed aggregate (abraded concrete) in the impact basin was also observed during the 2016 Formal Inspection Report.

Figures and photographs illustrating various features observed during the inspections are included in Appendices B and C, respectively. A copy of In-Water's inspection report is also included in Appendix D.

2015/2016 PRINCIPAL SPILLWAY CONDUIT INSPECTIONS

NRCS conducted inspections of the principal spillway outlet pipe in both 2015 and 2016; video footage was captured by a remote-controlled pipe crawler during the inspections and was provided to Schnabel for review. The pipe was flowing at approximately one-third capacity during the 2015 inspection and at low-flow condition (roughly 2 inches of flow) during the 2016 inspection.

Overall, the 24-inch concrete pipe was found to be in good condition during both inspections with no debris or blockages and no visible cracks, bulges, or holes in the pipe walls. The video footage includes recorded distances from the pipe outfall, which are approximate and may vary slightly from centerline stations along the length of the pipe included in the As-Built Drawings. The pipe alignment was observed

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to be generally straight with no noticeable low spots or bends. Most joints appeared in good condition. The inner portion of some of the rubber joint seals was partially deteriorated and there were some minor spalls observed on the joint edges, but no leaking or seepage was observed at these joints. At about 318-ft upstream of the pipe outfall, the rubber seal appeared to be bulging out of the joint and grouted in position along the upper portion of the pipe. Flow was not impeded by the bulging seal and no leakage was observed at this joint; however, the bulge may cause the concrete at the joint to be more susceptible to chipping or catching debris in the future. The conduit connection to the principal spillway riser structure and the transition zone to the vertical riser interior were observed to be in good condition with no blockage, debris, or visible cracking. Screenshots of the conduit inspection videos can be found in Appendix C.

EMBANKMENT TOE DRAIN

Toe drain inspections were not performed as part of the 2011 assessment or 2017 planning study. As described in our 2019 Geotechnical Engineering Report, the proposed rehabilitation includes removal and replacement of the existing toe drain; therefore, no additional toe drain inspections have been performed as part of this project.

CONCLUSIONS AND RECOMMENDATIONS

Seismic analyses show that the existing riser meets current NRCS stability criteria and seismic retrofits are not required.

Based on the conditions observed during the principal spillway riser inspection, we recommend:

- Removing the sediment around the base of the structure so that the Pond Drain Gate is unobstructed.
- Replacing the Pond Drain Gate stem and the broken stem bracket.
- Installing trash racks on all gates to prevent debris from blocking gates.
- Including provisions in the rehabilitation design to replace the Pond Drain Gate if it is found to be significantly damaged and inoperable after sediment is removed.
- Repairing or replacing the ladder, gratings, and corroded sections of the high stage trash rack.
- Confirming the functionality of the electric operator for Water Supply Gate II. If the operator is no longer functional, it should be removed.
- Cleaning the interior of the principal spillway and coating interior concrete surfaces with Xypex, or equivalent, to prevent further deterioration.

No repairs to the principal spillway conduit are recommended based on our review of the 2015 and 2016 outlet inspection. We recommend regularly inspecting the interior of the principal spillway conduit in intervals no longer than every 10 years. We also recommend regular operation of all gates.

The proposed rehabilitation measures are anticipated to extend the design life of the structures in accordance with NRCS criteria.

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We appreciate the opportunity to be of service for this project. Please call us if you have any questions regarding this report.

Sincerely,

Aterra-Schnabel JV

Jeremy R. Young, PE
Senior Associate

DBB:MLD:JRY:PIW:vm

Appendix A: Calculations
Appendix B: Figures
Appendix C: Photographs
Appendix D: In-Water Services Inspection Report
Appendix E: References

Distribution:
USDA – NRCS (email only)
Attn: Mr. Timothy Ridley, Morgantown, WV

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APPENDIX A

CALCULATIONS

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CALCULATION COVER SHEET

Project	Project Number
Brush Creek Site 15	18C35013.04

Title
Seismic Analysis of Existing Riser

Computer Programs Used	Version/Release No.
Microsoft Excel	

Purpose and Objective
Analyze seismic performance of existing riser using NEH Part 636, Chapter 70 and seismic design parameters from ASCE 7-16. Analyses were performed for ground motions parallel to the riser's endwalls since this will be the controlling condition.

Summary of Conclusions
Riser meets NRCS seismic stability criteria. The estimated allowable bearing pressure is greater than the computed maximum bearing pressure for the subject riser.

Originator			
Emily Gibson, PE	Emily M. Gibson		Apr 19, 2018
	Print	Sign	Date
Checked			
Melinda Dirdal, PE	Melinda Dirdal		Jul 15, 2019
	Print	Sign	Date

Project:	Brush Creek Site 15				
Project No.	18C35013.04	By	EMG	Date	4/2/2019
Client	NRCS	Checked	MLD	Date	7/15/2019
Subject	Layout and calculation of non-standard riser elements - motion parallel to endwalls				

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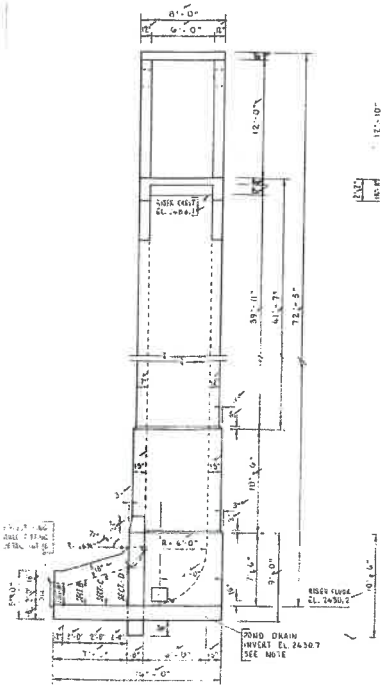
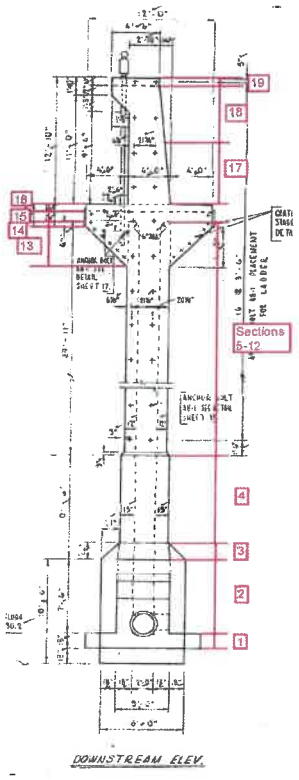
Sketch of existing riser. Red text shows segment numbers used in the calculations.





Project:	Brush Creek Site 15					
Project No.	18C35013.04	By	EMG	Date	4/2/2019	
Client	NRCS	Checked	MLD	Date	7/15/2019	
Subject	Layout and calculation of non-standard riser elements - motion parallel to endwalls					

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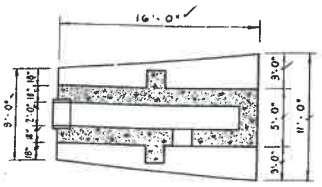
Note: B is parallel to the endwall; L is parallel to the sidewall. $\bar{x}$ is not calculated because of symmetry in this direction, $\bar{y}$ is taken from the bottom of each segment.

Segment 1

Slab

h_i =	1.50	ft
B_i =	9.5	ft
L_i =	16	ft
V =	228	ft^3
$\bar{y}$ =	0.8	ft



SECTION EE

Fin Below Base (include with Segment 1)

h_i =	1.50	ft	
B_i =	8	ft	
L_i =	1.50	ft	
V =	18	ft^3	
$\bar{y}$ =	-0.75	ft	(from base)

Center of Gravity Segment 1 (entire segment)

W_1 =	37	kips
$\bar{y}$ =	0.64	ft

Segment 2 (no change in segment between existing and proposed)

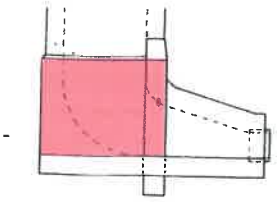
Fin at Side of Segment 2

h_i =	7.50	ft	Volume =	33.75 ft^3	(consider 2 sides)
B_i =	1.50	ft	$\bar{y}$ =	3.75 ft	(from bottom of segment)
L_i =	1.50	ft			

Segment 2A (Upstream wall and main tower sidewalls of Segment 2)

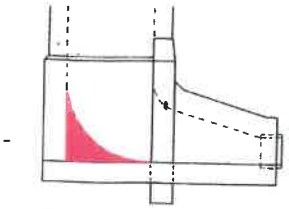
Note: Segment 2A excludes the interior concrete.

h_i =	7.50	ft	Volume =	225.00	ft^3
B_i =	5.0	ft	$\bar{y}$ =	3.75	ft
L_i =	9.0	ft			
B_i (inside) =	2	ft			
L_i (inside) =	6.0	ft			
$t_{U/S}$ =	1.50	ft	(wall thickness)		
t_{Side} =	1.50	ft	(wall thickness)		



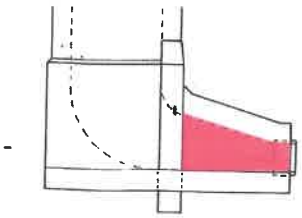
Segment 2B (Upstream rounded floor of Segment 2)

h_i =	6	ft	Area =	7.73	ft^2
B_i (inside) =	2	ft	Volume =	15.45	ft^3
L_i =	6	ft	$\bar{x}$ (square) =	4.50	ft
radius =	6	ft	$\bar{x}$ (1/4 circle) =	4.95	ft
			$\bar{x}$ (total) =	2.84	ft
			$\bar{y}$ =	1.34	ft



Segment 2C (Downstream tapered section walls)

$h_{i_U/S}$ =	4.00	ft	Volume =	60.00	ft^3
$h_{i_D/S}$ =	2.0	ft	$\bar{y}$ (rect)=	1	ft
B_i=	5	ft	$\bar{y}$ (triangle)=	3.33	ft
L_i =	7.00	ft	$\bar{y}$ =	1.70	ft
B_i (inside) =	2	ft			
L_i (triangle) =	6	ft			



Project:	Brush Creek Site 15				
Project No.	18C35013.04	By	EMG	Date	4/2/2019
Client	NRCS	Checked	MLD	Date	7/15/2019
Subject	Layout and calculation of non-standard riser elements - motion parallel to endwalls				

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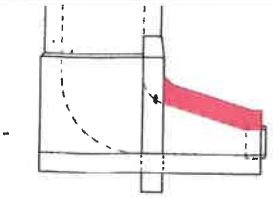
Segment 2D (Downstream tapered section lid)

h_i = 1.5 ft Volume = 56.25 ft^3

B_i = 5 ft $\bar{y}$ = 4.75 ft

L_i = 7.5 ft



Combined Segment 2 (including fin)

Volume = 390.45 ft^3

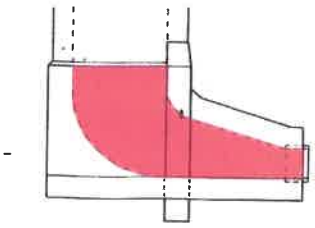
Weight = 58.57 kips

$\bar{y}$ = 3.48 ft

Interior Volume of Segment 2 (Use to calculate W_{wi})

Area = 69.27 ft^2

Volume = 138.55 ft^3



Segment 3

Fin at Side of Segment 3

h_i = 1.75 ft Volume = 4.59 ft^3 (consider 2 sides) Weight = 0.69 kips

B_i = 1.75 ft $\bar{y}$ = 1.17 ft (from bottom of segment)

L_i = 1.50 ft

Center of Gravity Segment 3 (entire segment)

W_1 = 9.35 kips (entire segment including fin - see table for riser in air)

$\bar{y}$ = 0.90 ft

Segment 17

h_i = 6 ft Area= 22.3 ft^2

L_i = 1.0 ft Volume = 44.5 ft^3 (consider 2 sides) Weight = 6.68 kips

B(rect)= 2.8 ft $\bar{y}$ = 2.92 ft

B(R triangle)= 1.2 ft

Segment 18

hi = 6 ft Area= 21.8 ft^2

L_i = 1.0 ft Volume = 43.6 ft^3 (consider 2 sides) Weight = 6.54 kips

B(rect)= 2.8 ft $\bar{y}$ = 3.20 ft

B(R triangle)= 1.2 ft

B(wing)= 1.7 ft

h(wing)= 2.7 ft

h(rect wing)= 1.0 ft

Project:	Brush Creek Site 15				
Project No.	18C35013.04	By	EMG	Date	4/2/2019
Client	NRCS	Checked	MLD	Date	7/15/2019
Subject	Seismic Design for Existing Riser (Riser in Air)				

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1. Equivalent Lateral Force Procedure

H_w= 59.42

H_s= 73.92 Y_o = 150.00

k= 1.00 (pg 70-43)

Vo= 14.1134 eq 70-30

Segment I	h_i	B_i	L_i	Inside Dimensions B_{inside}	Inside Dimensions L_{inside}	w_i	W_i	H_i	H_w-H_i	I_i (2-2)	$(H_w-H_i)^2*h_i/I_i$	$B_i h_i$	$W_i H_i^k$	H_x
	(ft)	(ft)	(ft)	(ft)	(ft)	(klf)	(kips)	(ft)	(ft)	(ft^4)	(ft^{-1})	(ft^2)	(kip-ft)	(ft)
Top Lat Force														
19	0.83	4.50	8.00	-	-	5.40	4.50	73.50					330.75	73.08
18	6.00	4.50	8.00	-	6.00	-	6.54	70.29					459.79	67.08
17	6.00	4.50	8.00	-	6.00	-	6.68	64.00					427.23	61.08
16	0.67	12.00	8.00	-	-	14.40	9.60	60.75					583.20	60.42
15	1.00	12.00	8.00	-	6.00	3.60	3.60	59.92					215.70	59.42
14	0.50	12.00	8.00	-	6.00	3.60	1.80	59.17					106.50	58.92
13	4.00	4.00	8.00	-	6.00	1.20	4.80	57.58					276.40	54.92
12	4.92	4.00	8.00	2.00	6.00	3.00	14.75	56.96	2.46	38.67	0.77	19.67	840.14	54.50
11	5.00	4.00	8.00	2.00	6.00	3.00	15.00	52.00	7.42	38.67	7.11	20.00	780.00	49.50
10	5.00	4.00	8.00	2.00	6.00	3.00	15.00	47.00	12.42	38.67	19.94	20.00	705.00	44.50
9	5.00	4.00	8.00	2.00	6.00	3.00	15.00	42.00	17.42	38.67	39.23	20.00	630.00	39.50
8	5.00	4.00	8.00	2.00	6.00	3.00	15.00	37.00	22.42	38.67	64.98	20.00	555.00	34.50
7	5.00	4.00	8.00	2.00	6.00	3.00	15.00	32.00	27.42	38.67	97.20	20.00	480.00	29.50
6	5.00	4.00	8.00	2.00	6.00	3.00	15.00	27.00	32.42	38.67	135.88	20.00	405.00	24.50
5	5.00	4.00	8.00	2.00	6.00	3.00	15.00	22.00	37.42	38.67	181.04	20.00	330.00	19.50
4	8.75	4.50	8.50	2.00	6.00	3.94	34.45	15.13	44.29	60.55	283.50	39.38	521.10	10.75
3	1.75	5.00	9.00	2.00	6.00	4.95	9.35	9.90	49.52	89.75	47.82	8.75	92.55	9.00
2	7.50	5.00	9.00	2.00	6.00	-	58.57	4.98	54.43	89.75	247.60	37.50	291.88	1.50
1	1.50	9.50	16.00	-	-	-	36.90	0.64	58.78	1143.17	4.53	14.25	23.63	0.00
	78.42						296.54				1129.59	259.54	8053.86	

I = soil-structure interaction factor

Segment I	C_{vx}	I=1.00 F_i	I=1.00 V_x	I=1.00 M_x	I= 1.000 $I*F_i$	$I*V_x$	$I*M_x$	M check
	(ft)	(kips)	(kips)	(ft-kips)	(kips)	(kips)	(ft-kips)	
19	0.0411	0.58	0.58	0.24	0.58	0.58	0.24	0.24
18	0.0571	0.81	1.39	6.30	0.81	1.39	6.30	6.30
17	0.0530	0.75	2.13	16.80	0.75	2.13	16.80	16.80
16	0.0724	1.02	3.16	18.56	1.02	3.16	18.56	18.56
15	0.0268	0.38	3.53	21.91	0.38	3.53	21.91	21.91
14	0.0132	0.19	3.72	23.72	0.19	3.72	23.72	23.72
13	0.0343	0.48	4.20	39.89	0.48	4.20	39.89	39.89
12	0.1043	1.47	5.68	45.27	1.47	5.68	45.27	45.27
11	0.0968	1.37	7.04	77.07	1.37	7.04	77.07	77.07
10	0.0875	1.24	8.28	115.38	1.24	8.28	115.38	115.38
9	0.0782	1.10	9.38	159.54	1.10	9.38	159.54	159.54
8	0.0689	0.97	10.36	208.88	0.97	10.36	208.88	208.88
7	0.0596	0.84	11.20	262.77	0.84	11.20	262.77	262.77
6	0.0503	0.71	11.91	320.53	0.71	11.91	320.53	320.53
5	0.0410	0.58	12.49	381.51	0.58	12.49	381.51	381.51
4	0.0647	0.91	13.40	494.75	0.91	13.40	494.75	494.75
3	0.0115	0.16	13.56	518.34	0.16	13.56	518.34	518.34
2	0.0362	0.51	14.07	621.83	0.51	14.07	621.83	621.83
1	0.0029	0.04	14.11	642.96	0.04	14.11	642.96	642.96
		14.11			14.11			

R = 3.00 (for reinforced concrete risers, pg 70-41)

Dam Class C I = 1.25 (occupancy importance factor)

Spectral Response Accelerations 0.2 sec duration, S_s = 0.248 F_a = 1.00

1.0 sec duration, S_1 = 0.074 F_v = 1.00

S_{MS} = 0.25 S_{DS} = 0.17 Seismic Design Category based on S_{DS} = 2.00 B

S_{M1} = 0.07 S_{D1} = 0.05 Seismic Design Category based on S_{D1} = 2.00 B Therefore, use seismic design category B

B_e 4.37 ft

T_{max} = 1.77 sec eq 70-111

T = 0.43 sec eq 70-110

$C_{s\,min}$ = 0.01

$C_{s\,max}$ = 0.05 C_s = 0.05 eq 70-29

V = 14.11 kips eq 70-138

Project:	Brush Creek Site 15				
Project No.	18C35013.04	By	EMG	Date	4/2/2019
Client	NRCS	Checked	MLD	Date	7/15/2019
Subject	Seismic Design for Existing Riser (Riser in Air)				

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2. Soil Structure Interaction

Moment at Base, M_{Ou} = 643 ft-kip $M_O = 0.7\,M_{Ou}$ = 450 ft-kip

Eccentricity, e = 1.52 ft
B/6 = 1.58
Check I, I = 1.00 eq 70-139 OK

3. Design For Flexure and Shear

f_y = 40.00 ksi f'_c = 4.00 ksi Note: Concrete strength was not identified. Strength based on typical capacity at time of construction.
ε_y = 0.00138 for E = 29,000 ksi Note: Steel strength was not identified. Grade 40 steel is typical of NRCS risers.
E= 5.19E+05 ksf for concrete

Flexure at Top of Footing:

Moment at Top of Ftg, M_{Ou} = 622 ft-kip
A_s = 0.88 in^2/ft (#6@12" OF, #6@12" IF) 10, 25, Section A-A, Sheet 15 of 19; 23, Section A-A, Sheet 15 of 19
$a = A_s f_y/(0.85 f'_c b)$ = 0.86 in eq 70-43
$c = a/0.85$ = 1.01 in eq 70-44 for f'_c = 4 ksi
d = 51.00 in
ε_c = 0.003
$\varepsilon_s = \varepsilon_c(d-c)/c)$ = 0.148 eq 70-45

$\Phi = 0.65+(\varepsilon_s-\varepsilon_y)*250/3$ = 0.90 ≤ 0.9 eq 70-46
$\Phi M_n = \Phi A_s f_y(d-a/2)$ = 1202 ft-kip eq 70-42

Check vertical bending: OK - ΦMn>Mou

Flexure at Top of Riser Walls:

Wall thickness, t = 1.00 ft (at section 12)

Stress Conditions Due to Horizontal Bending

Composite Section for Dx3D

Sidewall force, F_{is} = 0.52 kips eq 70-141
Unit pressure on sidewall, w_{is} = 0.015 ksf eq 70-142
M_u = 0.09 ft-kips/ft

A_s = 0.31 in^2/ft (#5@12") 58, 60, Section H-H, Sheet 16 of 19
bar dia = 0.625 in
$a = A_s f_y/(0.85 f'_c b)$ = 0.30 in eq 70-43
cover = 2.00 in
d = 9.69 in

$\Phi M_n = \Phi A_s f_y(d-a/2)$ = 8.87 ft-kip/ft eq 70-42

Check horizontal bending: OK - ΦMn>Mu

Shear Capacity at Top of Footing:

Φ = 0.75
Wall thickness, t = 18.00 in (at section 2)
b_w = 36.00 in
d = 51.00 in
$\Phi V_c = \Phi 2(f_c)^{0.5} b_w d$ = 174.18 kips eq 70-41

Check shear: OK - ΦVc>I*Vx

Seismic Shear Forces due to Closed Section Bending:

From Table 70-10: $V_u/w_{is}D$ = 1.5 (pg 70-50)
V_u = 0.04 kip/ft
$\Phi V_c = \Phi 2(f_c)^{0.5} b_w d$ = 11.03 kips/ft eq 70-41

Check shear: OK - ΦVc>Vu

4. Foundation Design

Moment at Base, $I*M_{Ou}$ = 643 ft-kip $M_O = 0.7\,M_{Ou}$ = 450 ft-kip
$P = W-0.7(0.2S_{DS}D)$ = 290 kips or $P = W+0.7(0.2S_{DS}D)$ = 303 kips
W = D = self-weight of riser and footing
e = 1.55 ft or e = 1.48 ft

B/6 = 1.58
B/2 = 4.75

Resultant is within the Middle Third

Max bearing pressure, q_{max} = 3.82 ksf or q_{max} = N/A ksf (Eq 70-89 and 70-140)
q_{min} = 0.08 ksf (Eq 70-90)
q_{allow} = 5.0 ksf
Check bearing pressure: OK - qallow>qmax

SF_O = 3.06 OK
SF_S = 7.18 OK (assume soil-rock interface coeff of friction = 0.35)

Project:	Brush Creek Site 15				
Project No.	18C35013.04	By	EMG	Date	4/2/2019
Client	NRCS	Checked	MLD	Date	7/15/2019
Subject	Seismic Design for Existing Riser (Riser in Water)				

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1. Equivalent Lateral Force Procedure

H_w= 61.08
H_s= 73.92
k= 1.00 (pg 70-43)
Vo= 14.1256 eq 70-30

Segment I	h_i	H_i	B_i	L_i	Inside Dimensions B_{inside}	Inside Dimensions L_{inside}	β_i	ζ_i	r	z_i	w_{ai}	W_{ai}	w_{wi}	W_{wi}	W_i (in air)	W_i	$W_iH_i^k$
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)					(klf)	(kips)	(klf)	(kips)	(kips)	(kips)	(kip-ft)
19	0.83	73.50	4.50	8.00											4.50	4.50	330.75
18	6.00	70.29	4.50	8.00											6.54	6.54	459.79
17	6.00	64.00	4.50	8.00											6.68	6.68	427.23
16	0.67	60.75	12.00	8.00	-	-									9.60	9.60	583.20
15S	1.67	60.25	4.00	8.00	2.00	6.00	0.05	0.04	0.99	0.01	0.21	0.36	0.75	1.25		1.61	96.72
15	1.00	59.92	12.00	8.00	-	6.00									3.60	3.60	215.70
14	0.50	59.17	12.00	8.00	-	6.00									1.80	1.80	106.50
13	4.00	57.58	4.00	8.00	-	6.00									4.80	4.80	276.40
12	4.92	56.96	4.00	8.00	2.00	6.00	0.05	0.04	0.93	0.02	0.47	2.31	0.75	3.68	14.75	20.74	1181.58
11	5.00	52.00	4.00	8.00	2.00	6.00	0.05	0.04	0.85	0.02	0.68	3.42	0.75	3.74	15.00	22.16	1152.34
10	5.00	47.00	4.00	8.00	2.00	6.00	0.05	0.04	0.77	0.03	0.83	4.16	0.75	3.74	15.00	22.90	1076.43
9	5.00	42.00	4.00	8.00	2.00	6.00	0.05	0.04	0.69	0.03	0.95	4.73	0.75	3.74	15.00	23.47	985.82
8	5.00	37.00	4.00	8.00	2.00	6.00	0.05	0.04	0.61	0.03	1.04	5.18	0.75	3.74	15.00	23.92	885.22
7	5.00	32.00	4.00	8.00	2.00	6.00	0.05	0.04	0.52	0.04	1.11	5.55	0.75	3.74	15.00	24.29	777.29
6	5.00	27.00	4.00	8.00	2.00	6.00	0.05	0.04	0.44	0.04	1.17	5.84	0.75	3.74	15.00	24.58	663.78
5	5.00	22.00	4.00	8.00	2.00	6.00	0.05	0.04	0.36	0.04	1.21	6.07	0.75	3.74	15.00	24.82	546.00
4	8.75	15.13	4.50	8.50	2.00	6.00	0.06	0.05	0.25	0.05	1.51	13.17	0.75	6.55	34.45	54.18	819.45
3	1.75	9.90	5.00	9.00	2.00	6.00	0.07	0.05	0.16	0.05	1.80	3.15	0.75	1.31	9.35	13.81	136.71
2	7.50	4.98	5.00	9.00	2.00	6.00	0.07	0.05	0.08	0.05	1.82	13.64	-	8.65	58.57	80.85	402.96
1	1.50	0.64	9.50	16.00	-	-	0.13	0.10	0.01	0.10	6.07	9.10	-		36.90	46.00	29.45
	80.08										18.87	76.68			296.54	420.87	11153.29

		I=1.00			I= 0.94			I = soil-structure interaction factor
Segment I	C_{vx}	F_i	V_x	M_x	$I*F_i$	$I*V_x$	$I*M_x$	
	(ft)	(kips)	(kips)	(ft-kips)	(kips)	(kips)	(ft-kips)	Hx
19	0.030	0.42	0.42	0.17	0.39	0.39	0.16	73.08
18	0.041	0.58	0.58	4.55	0.55	0.55	4.28	67.08
17	0.038	0.54	0.96	9.63	0.51	0.90	9.05	61.08
16	0.052	0.74	1.70	10.51	0.69	1.60	9.88	60.42
15S	0.009	0.12	1.82		0.12	1.71	0.00	
15	0.019	0.27	2.09	12.45	0.26	1.97	11.70	59.42
14	0.010	0.13	2.23	13.53	0.13	2.10	12.72	58.92
13	0.025	0.35	2.58	23.38	0.33	2.42	21.98	54.92
12	0.106	1.50	4.08	34.48	1.41	3.83	32.41	54.50
11	0.103	1.46	5.54	58.51	1.37	5.20	55.00	49.50
10	0.097	1.36	6.90	89.59	1.28	6.48	84.22	44.50
9	0.088	1.25	8.15	127.21	1.17	7.66	119.57	39.50
8	0.079	1.12	9.27	170.74	1.05	8.71	160.50	34.50
7	0.070	0.98	10.25	219.55	0.93	9.64	206.37	29.50
6	0.060	0.84	11.09	272.91	0.79	10.43	256.53	24.50
5	0.049	0.69	11.78	330.10	0.65	11.08	310.30	19.50
4	0.073	1.04	12.82	437.76	0.98	12.05	411.49	10.75
3	0.012	0.17	13.00	460.35	0.16	12.22	432.73	9.00
2	0.036	0.51	13.51	559.60	0.48	12.70	526.02	1.50
1	0.003	0.04	13.54	579.88	0.04	12.73	545.09	0.00
	1.00	14.13			13.28			

R = 3.00
Dam Class C I = 1.25 (occupancy importance factor)

Spectral Response Accelerations
0.2 sec duration, S_S = 0.25 F_a = 1.00
1.0 sec duration, S_1 = 0.07 F_v = 1.00

S_{MS} = 0.25 S_{DS} = 0.17 Seismic Design Category based on S_{DS} = B
S_{M1} = 0.07 S_{D1} = 0.05 Seismic Design Category based on S_{D1} = B Therefore, use seismic design category B

2. Equivalent Lateral Force Procedure

B_e 4.25 ft
β_e = B_e/H_s = 0.06

T_{max} = 1.79 sec eq 70-111
T = 0.43 sec eq 70-110
T_{wf} = 0.61 sec eq 70-131, 70-132

$C_{s\,min}$ = 0.01
$C_{s\,max}$ = 0.03 C_s = 0.03 eq 70-29

V = 13.28 kips eq 70-138

Project:	Brush Creek Site 15				
Project No.	18C35013.04	By	EMG	Date	4/2/2019
Client	NRCS	Checked	MLD	Date	7/15/2019
Subject	Seismic Design for Existing Riser (Riser in Water)				

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3. Soil Structure Interaction

Moment at Base, M_{ou} = 580 ft-kip M_O = 0.7 M_{ou} = 406 ft-kip

Buoyant Weight, W_B = 173

Eccentricity, e = 2.20 ft

B/6 = 1.58

Check I, I = 0.94 eq 70-139 OK

4. Design For Flexure and Shear

f_y = 40.00 ksi f'_c = 4.00 ksi

ε_y = 0.00138 for E = 29,000 ksi

E= 5.19E+05 for concrete

Note: Concrete strength was not identified. Strength based on typical capacity at time of construction.

Note: Steel strength was not identified. Grade 40 steel is typical of NRCS risers.

Flexure at Top of Footing:

Moment at Top of Ftg, M_{ou} = 526 ft-kip

A_s = 0.88 in^2/ft (#6@12" OF, #6@12" IF)

$a = A_s f_y/(0.85 f'_c b)$ = 0.86 in eq 70-43

$c = a/0.85$ = 1.01 in eq 70-44 for f'_c = 4 ksi

d = 51.00 in

ε_c = 0.003 eq 70-45

$\varepsilon_s = \varepsilon_c((d-c)/c)$ = 0.15

$\Phi = 0.65+(\varepsilon_s-\varepsilon_y)*250/3$ = 0.90 ≤ 0.9 eq 70-46

$\Phi M_n = \Phi A_s f_y(d-a/2)$ = 1201.51 ft-kip eq 70-42

Check vertical bending: OK - ΦMn>Mou

Flexure at Top of Riser Walls:

Wall thickness, t = 1.00 ft (at section 12)

Stress Conditions Due to Horizontal Bending

Sidewall force, F_{is} =	0.49	kips	eq 70-141
Unit pressure on sidewall, w_{is} =	0.014	ksf	eq 70-142
M_u =	0.09	ft-kips/ft	

Pressure Difference on Riser Walls Due to Pipe Flow

Max velocity, $v_{b(max)}$ =	30.00	fps	(typical)
$v_r = (a_b/a_r)v_b$ =	7.85	fps	eq 70-20
$h_w = v_r^2/2g$ =	0.96	ft	eq 70-21
pressure, $\Delta p = 6*h_w*62.4$ =	358.62	psf	endwalls
$\Delta p+w_{is}$ =	372.92	psf	sidewall
$\Delta p-w_{is}$ =	344.31	psf	sidewall
Constant Inward Load = 6*62.4 =	374.40	psf	
Conservative Max Moment, M_u =	2.29	ft-kips/ft	

A_s = 0.31 in^2/ft (#5@12")

$a = A_s f_y/(0.85 f'_c b)$ = 0.30 in eq 70-43

cover = 2.00 in

d = 10.00 in

$\Phi M_n = \Phi A_s f_y(d-a/2)$ = 9.16 ft-kip/ft eq 70-42

Check horizontal bending: OK - ΦMn>Mu

Shear Capacity at Top of Footing:

Φ = 0.75

Wall thickness, t = 18.00 in (at section 2)

b_w = 36.00 in

d = 51.00 in

$\Phi V_c = \Phi 2(f_c)^{0.5} b_w d$ = 174 kips eq 70-41

Check shear: OK - ΦVc>I*Vx

Seismic Shear Forces due to Closed Section Bending:

From Table 70-10: $V_u/w_{is}D$ = 1.5

V_u = 0.04 kip/ft

$\Phi V_c = \Phi 2(f_c)^{0.5} b_w d$ = 11.4 kips/ft eq 70-41

Check shear: OK - ΦVc>Vu

Project:	Brush Creek Site 15				
Project No.	18C35013.04	By	EMG	Date	4/2/2019
Client	NRCS	Checked	MLD	Date	7/15/2019
Subject	Seismic Design for Existing Riser (Riser in Water)				

Schnabel ENGINEERING

5. Foundation Design

Moment at Base, I^*M_{Ou} = 545 ft-kip

$M_O = 0.7\ M_{Ou}$ = 382 ft-kip

$P = W-0.7(0.2S_{DS}D)$ = 169 kips or $P = W+0.7(0.2S_{DS}D)$ = 177 kips

W = D = buoyant weight of riser and footing

e = 2.26 ft or e = 2.15 ft

B/6 = 1.58

B/2 = 4.75

Resultant is outside the middle third; Bearing Diagram is Triangular

Max bearing pressure, q_{max} = 2.83 ksf or q_{max} = 2.84 ksf (Eq 70-89 and 70-140)

q_{min} = 0.00 ksf (Eq 70-90)

q_{allow} = 5.0 ksf

Check bearing pressure: OK - qallow>qmax OK - qallow>qmax

SF_O = 2.1 OK - $SF_O \geq 1.5$

SF_S = 4.5 OK - $SF_S \geq 1.5$

OSHPD

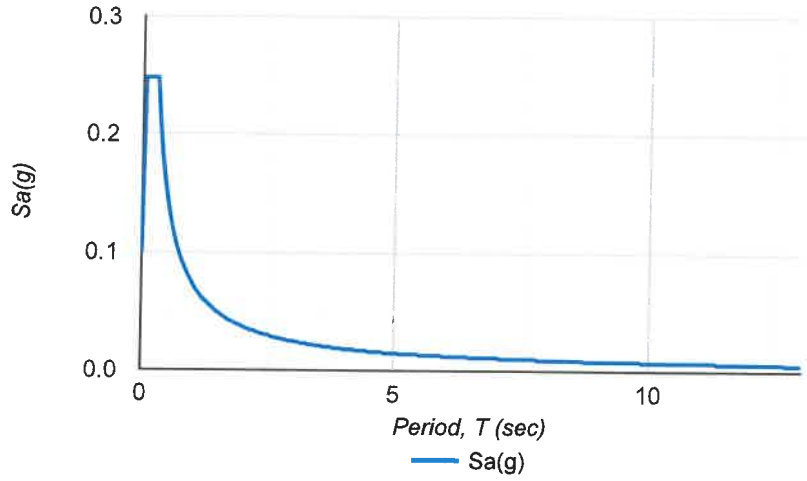
Latitude, Longitude: 37.324599, -81.184899

Date	3/26/2019, 4:29:57 PM
Design Code Reference Document	ASCE7-16
Risk Category	IV
Site Class	B - Estimated (see Section 11.4.3)

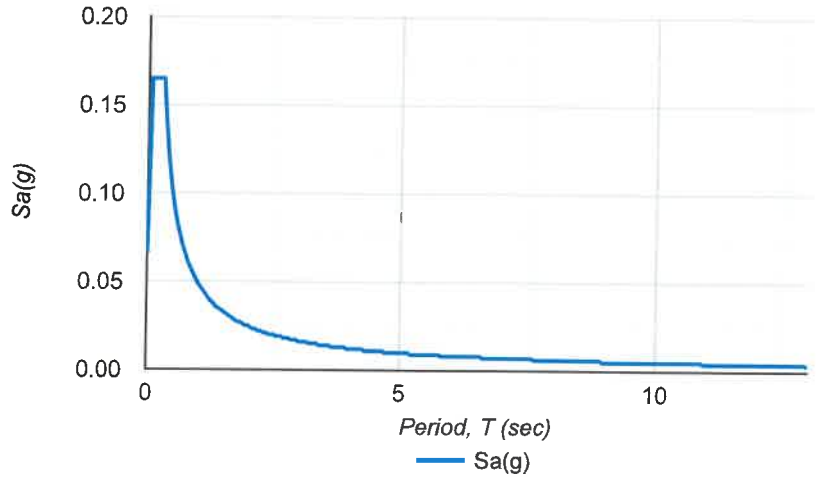
Type	Value	Description
S_S	0.248	MCE_R ground motion. (for 0.2 second period)
S_1	0.074	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.248	Site-modified spectral acceleration value
S_{M1}	0.074	Site-modified spectral acceleration value
S_{DS}	0.165	Numeric seismic design value at 0.2 second SA
S_{D1}	0.049	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	A	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	1	Site amplification factor at 1.0 second
PGA	0.145	MCE_G peak ground acceleration
F_{PGA}	1	Site amplification factor at PGA
PGA_M	0.145	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	0.248	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.263	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.074	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.079	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.943	Mapped value of the risk coefficient at short periods
C_{R1}	0.929	Mapped value of the risk coefficient at a period of 1 s

MCER Response Spectrum



Design Response Spectrum



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SUBJECT	*Brush Creek Site 15*		SHEET NO.
	Riser Seismic Stability		JOB NO. 18C3013.04
BY: EMG	DATE: 7/16/19	CHKD BY	EBB DATE 7/16/2019

Geomechanics Classification of Jointed Rock Masses - Carter and Kulwahy (1988)

Reference: AASHTO LRFD Bridge Design Specifications, 2012 (Table 10.4.6.4-1, Table 10.4.6.4-2, Table 10.4.6.4-3)

	PARAMETER		RANGE OF VALUES							SCORE
(a) Classification Parameters and their Ratings										Lab Test Data - Uniaxial Compressive Strength, C_o (psi):
1	Strength of Intact Rock Material	Point Load Strength Index	>1160 psi	580-1160 psi	290-580 psi	145-290 psi	For range <145 psi, uniaxial test is preferred			
		Uniaxial Compressive Strength	>29,000 psi	14,500-29,000 psi	7,250-14,500 psi	3,625-7,250 psi	1,450-3,625 psi	500-1,450 psi	145-500 psi	4,000
	Relative Rating		15	12	7	4	2	1	0	4
2	Drill Core Quality [RQD]		90-100%	75-90%	50-75%	25-50%	<25%			RQD: 43
	Relative Rating		20	17	13	8	3			8
3	Spacing of joints		>10 ft	3.0-10.0 ft	1.0-3.0 ft	2 in-1.0 ft	< 2 in			
	Relative Rating		30	25	20	10	5			10
4	Condition of joints		V. Rough Surfaces Not Continuous No Separation Hard joint wall rock	Slightly Rough Surfaces Separation < 0.05 in Hard joint wall rock	Slightly Rough Surfaces Separation < 0.05 in Soft joint wall rock	Slickensided or Gouge <0.2 in thick or Joints open 0.05-0.2 in Continuous Joints	Soft Gouge >0.2 in thick or Joints open >0.2 in Continuous Joints			
	Relative Rating		25	20	12	6	0			6
5	Groundwater	Inflow per 30 ft tunnel length	None	< 400 gal/hr	400-2,000 gal/hr	> 2,000 gal/hr				
			or	or	or	or				
		Ratio=joint water pressure/major principal stress	0	0.0-0.2	0.2-0.5	>0.5				
		General Conditions	Completely Dry	Moist only (interstitial water)	Water under moderate pressure	Severe water problem				
	Relative Rating		10	7	4	0				4
(b) Rating adjustment for Joint Orientation										
Strike and Dip Orientation of Joints			Very Favorable	Favorable	Fair	Unfavorable	Very Unfavorable			
RATING		Tunnels	0	-2	-5	-10	-12			
		Foundations	0	-2	-7	-15	-25			
		Slopes	0	-5	-25	-50	-60			-2
(c) Rock Mass Classes Determined from Total Ratings										
RATING			100 - 81	80 - 61	60 - 41	40 - 21	< 20			
CLASS NUMBER			I	II	III	IV	V			
DESCRIPTION			Very Good Rock	Good Rock	Fair Rock	Poor Rock	Very Poor Rock			30

ROCK CLASS: IV
DESCRIPTION: Poor Rock

TOTAL RATING: 30
"m" Parameter Value: 0.0675 Table 10.4.6.4-4
"s" Parameter Value: 0.000009 Table 10.4.6.4-4

ESTIMATED ULTIMATE BEARING RESISTANCE OF ROCK

q_n: 10.0 ksf $= [s^{1/2}+(m(s^{1/2})+s)^{1/2}]C_o$

(Carter and Kulwahy, 19

Minimum Estimated q_n: 10.0 ksf
Factor of Safety: 2.0
Allowable Bearing Pressure: 5.02 ksf

Figures 1 through 5 present ultimate bearing capacity diagrams for the following cases:

(1) See Figure 1 (Reference 1, Influence of Roughness of Base and Ground Water Condition-on the Ultimate Bearing Capacity of Foundations, by Meyerhof) for shallow footings with concentric vertical load. Formulas shown assume groundwater at a depth below base of footing equal to or greater than the narrow dimension of the footing.

(2) Use Figure 2 (Reference 1) to determine groundwater effect on ultimate bearing capacity and the depth of failure zone. For cohesive soils, changes in groundwater level do not affect theoretical ultimate bearing capacity.

(3) Use Figure 3a (Reference 2, The Bearing Capacity of Foundations Under Eccentric and Inclined Loads, by Meyerhof) for inclined load on continuous horizontal footing and for inclined load on continuous inclined footing.

(4) Use Figure 3b for eccentric load on horizontal footing.

(5) Use Figures 4a; 4b (Reference 3, The Ultimate Bearing Capacity of Foundations on Slopes, by Meyerhof) for shallow footing with concentric vertical load placed on a slope or near top of slope.

(6) Use Figure 5 (Reference 4, The Bearing Capacity of Footings on a Two-Layer Cohesive Subsoil, by Button) for shallow footing with concentric vertical load on two layered cohesive soil.

These diagrams assume general shear failure which normally occurs in dense and relatively incompressible soils. This type of failure is usually sudden and catastrophic; it is characterized by the existence of a well-defined failure pattern. In contrast, in loose or relatively compressible soils, punching or local shear failures may occur at lower bearing pressures. Punching or local shear failures are characterized by a poorly defined failure surface, significant vertical compression below the footing and very little disturbance around the footing perimeter.

To approximate the local or punching shear failures, the bearing capacity factors should be calculated with reduced strength characteristics c* and [phi]* defined as:

$$c^* - 0.67\ c$$
$$[\phi]^* = \tan.1- (0.67 \tan [\phi])$$

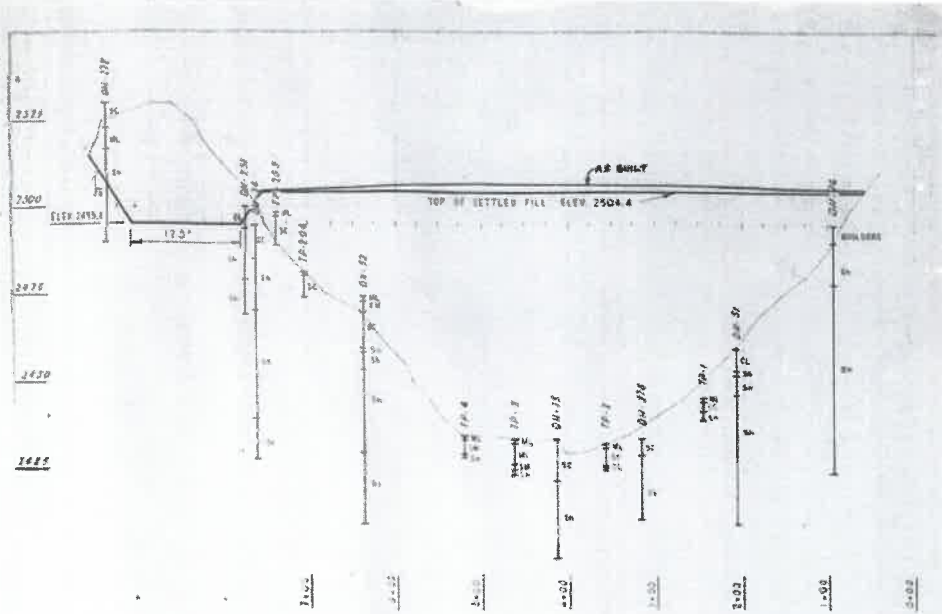
For more detailed and precise analysis, see Reference 5, Bearing Capacity of Shallow Foundations, by Vesic.

b. Allowable Bearing Capacity. To obtain allowable bearing capacity, use a safety factor of 3 for dead load plus maximum live load. When part of the live loads are temporary (earthquake, wind, snow, etc.) use a safety factor of 2. Include in design dead load the effective weight of footing and soil directly above footing. See Figures 6 and 7 for examples of allowable bearing capacity calculations.

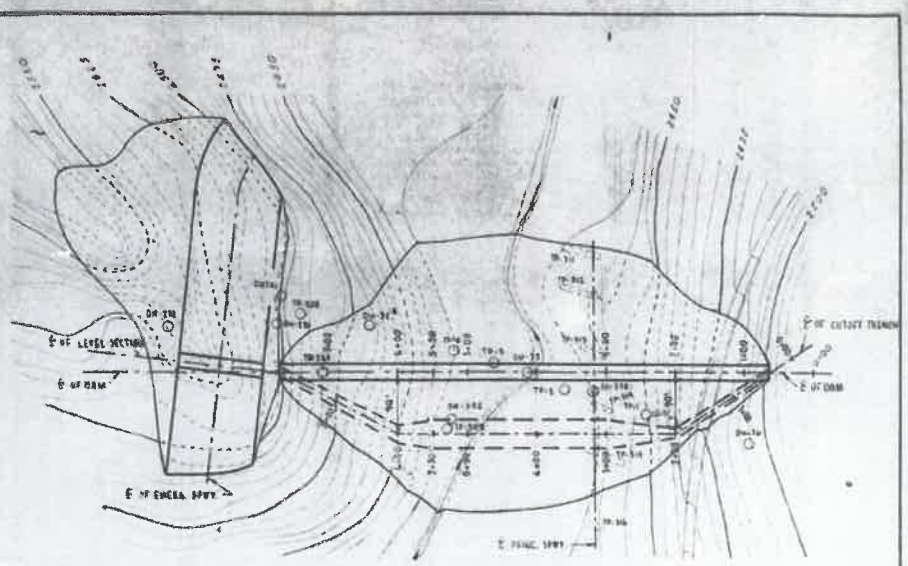
Average RQD at the Top of Shale

Boring	RQD	Core Run
B-51	28	5
B-52	0	5
B-251	48	5
B-252	80	5
B-253	52	5
B-254	70	5
B-255	45	5
B-256	25	5
B-257	60	5
B-651	54	5
B-652	50	5
B-653	43	5
BH-221	36	5
BH-222	46	4
BH-223	0	4
GF-1	38	5
GF-2	0	4.5
GF-3	91	4.5

Average	43

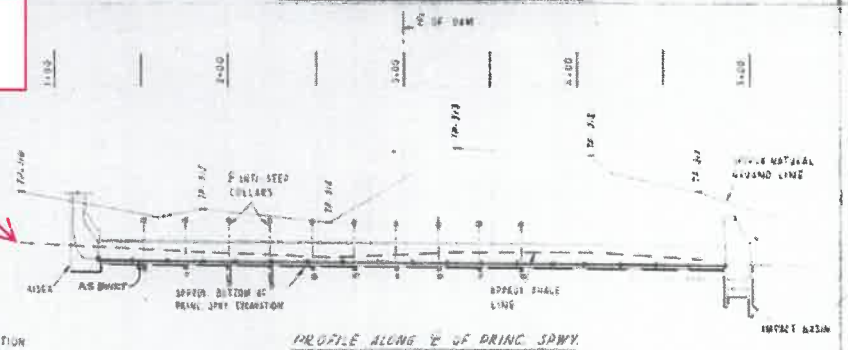


PROFILE ALONG ℄ OF DAM & LEVEL SECTION OF EMERGENCY SPILLWAY (LOOKING DOWNSTREAM)

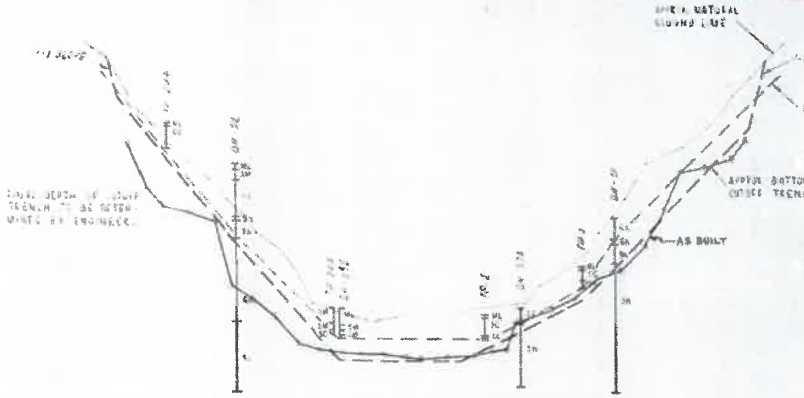


PLAN OF DAM SHOWING LOCATION OF CUTOFF TRENCH

Riser is founded on shale. RQD of 43 estimated from upper shale layer in all borings.



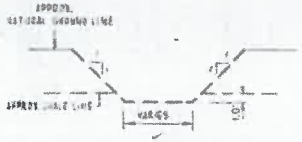
PROFILE ALONG ℄ OF PRINC. SPWY.



PROFILE ALONG ℄ OF CUTOFF TRENCH (LOOKING DOWNSTREAM)

ANY REQUIRED FOUNDATION EXCAVATION WILL BE PAID FOR AS CUTOFF TRENCH EXCAVATION.

UNSUITABLE FOUNDATION SOIL (DRY DENSITY LESS THAN 85 PCF) IS TO BE EXCAVATED AND REPLACED WITH FINE GRAINED, CLAYEY (CL) MATERIAL, REPRESENTED BY TEST HOLES
10W FROM 1' TO 7'
10T FROM 2' TO 8'



TYPICAL SECTION OF CUTOFF TRENCH EXCAVATION

"AS BUILT"

NOTE: TEST PITS AND DRILL HOLES ARE TEMPORARY SPILLWAY AND ARE NOT LOGGED. SEE SHEETS 9, 10 & 13 FOR LOGS OF TEST PITS AND DRILL HOLES.

TYPICAL SECTION OF PRINC. SPWY EXCAVATION

BRUSH CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO 15
PRINCETON, MERCER COUNTY, WEST VIRGINIA
PROFILES

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

F.R.KRAMER DES '66
H.T.BROWNING JR. DRAWN '66
T.M.WYSONG TRACED 7 19

WV-470-P

PROJECT NAME	Brush Creek Site 15
AEG PROJECT NUMBER	16001-13
DATE OF TEST	4/21/2016

Boring No.	Sample Run	Sample Depth (feet)	Rock Type	Sample Diameter (inches)	Sample Height (inches)	L/D	Sample Weight (lbs)	Unit Weight (pcf)	Break Load (lbs)	Unconfined Compressive Strength (psi)	Unconfined Compressive Strength (tsf)	Failure Type	Sample Notes / Remarks
GF-2	R-4	49.0-49.7		2.11	4.26	2.02	1.46	169.9	16,940	4,844.6	348.8	Columnar	
							Avg.	169.9	Avg.	4,844.6	348.8		

Moisture Condition of Samples	Air-dry
Temperature at Testing	69 deg.
Rate of Loading	85 lbf / sec
Direction of Load Application	Vertical to core

Note that specimen surface was not checked for straightness, flatness, parallelism, and perpendicularity as required by ASTM D4543. The results reported above may differ from results obtained from a test specimen that meets requirments of ASTM D4543.

AMRL and USACE certified laboratory

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE

ASTM D7012, Method C

By: KJE Ckd: SA

441 Friendship Road . Harrisburg, PA 17111 . Ph: 717/236-3006 . Fax: 717/233-0994 . www.gtstech.com

ADVANCED TERRA TESTING

Unconfined Compressive Strength
ASTM D7012 Method C

CLIENT	Schnabel Engineering	JOB NO.	2046-130
PROJECT	NRCS Brush Creek Sites 14, 15 Dams Rehab Desigr	LOCATION	--
PROJECT NO.	18C35013		

BORING NO.	B-241	B-241	B-642	B-643	B-254
DEPTH	21.9-22.5	27.7-28.5	21.1-21.7	37.6-38.0	12.8-13.3
SAMPLE NO.					
DATE SAMPLED					
DATE TESTED	05/21/19	05/21/19	05/21/19	05/21/19	05/21/19
TECHNICIAN	DH	DH	DH	DH	BF
ROCK TYPE	Shale	Shale	Sandstone	Shale	Shale
Diameter (in):	2.369	2.375	2.378	2.380	2.385
Height (in):	4.693	4.965	4.914	4.738	4.835
Mass of Wet Rock (g):	866.50	922.90	948.20	880.10	893.10
Wet Density (lbs/ft³):	159.6	159.8	165.5	159.1	157.5
Wet Density (g/cm³):	2.56	2.56	2.65	2.55	2.52
Peak Load (lbs):	25267	18459	87802	27281	29939
Compressive Strength (psi)	*5726	4167	19769	*6129	6701
Compressive Strength (kPa)	*39478	28728	136304	*42257	46205
Failure Type:	Fracture / Shear	Fracture / Shear	Fracture / Shear	Fracture / Shear	Fracture / Shear

BORING NO.	B-255	B-652	B-652
DEPTH	22.1-22.6	11.8-12.3	16.8-17.4
SAMPLE NO.			
DATE SAMPLED			
DATE TESTED	05/21/19	05/21/19	05/21/19
TECHNICIAN	BF	BF	BF
ROCK TYPE	Shale	Claystone	Shale
Diameter (in):	2.383	2.419	2.287
Height (in):	5.395	5.324	5.200
Mass of Wet Rock (g):	983.50	876.40	1010.40
Wet Density (lbs/ft³):	155.7	136.5	180.2
Wet Density (g/cm³):	2.49	2.19	2.89
Peak Load (lbs):	18179	1096	34241
Compressive Strength (psi)	4076	238	8335
Compressive Strength (kPa)	28103	1644	57470
Failure Type:	Fracture	Fracture	Fracture

Assume a minimum compressive strength of 4,000 psi based on B-255. There's no evidence that claystone is present under the riser.

NOTES

* Despite the ASTM recommendation, due to sample dimensions a correction is applied with the equation CF= 1/(0.88+0.24(D/H))

Data entry by: BFUTCH Date: 5/21/2019

Checked by: HN Date: 5/22/2019

File name: 2046130__Rock UCS-TCS ASTM D7012 Method A and C_0.xlsm

NAVFAC 7.02

TABLE 1

Presumptive Values of Allowable Bearing Pressures for Spread Foundations

Type of Bearing Material	Consistency In Place	Allowable Bearing Pressure Tons Per sq ft	
		Range	Recommended Value for Use
Massive crystalline igneous and metamorphic rock: granite, diorite, basalt, gneiss, thoroughly cemented conglomerate (sound condition allows minor cracks).	Hard, sound rock	60 to 100	80.0
Foliated metamorphic rock: slate, schist (sound condition allows minor cracks).	Medium hard sound rock	30 to 40	35.0
Sedimentary rock; hard cemented shales, siltstone, sandstone, limestone without cavities.	Medium hard sound rock	15 to 25	20.0
Weathered or broken bed rock of any kind except highly argillaceous rock (shale). RQD less than 25.	Soft rock	8 to 12	10.0
Compaction shale or other highly argillaceous rock in sound condition.	Soft rock	8 to 12	10.0
Well graded mixture of fine and coarse-grained soil: glacial till, hardpan, boulder clay (GW-GC, GC, SC)	Very compact	8 to 12	10.0
Gravel, gravel-sand mixtures, boulder gravel mixtures (SW, SP, SW, SP)	Very compact	6 to 10	7.0
	Medium to compact	4 to 7	5.0
	Loose	2 to 6	3.0
Coarse to medium sand, sand with little gravel (SW, SP)	Very compact	4 to 6	4.0
	Medium to compact	2 to 4	3.0
	Loose	1 to 3	1.5
Fine to medium sand, silty or clayey medium to coarse sand (SW, SM, SC)	Very compact	3 to 5	3.0
	Medium to compact	2 to 4	2.5
	Loose	1 to 2	1.5

Calculated allowable bearing capacity is less than a shale in sound condition and similar to that recommended for loose gravel or medium to compact sand.

APPENDIX B

FIGURES

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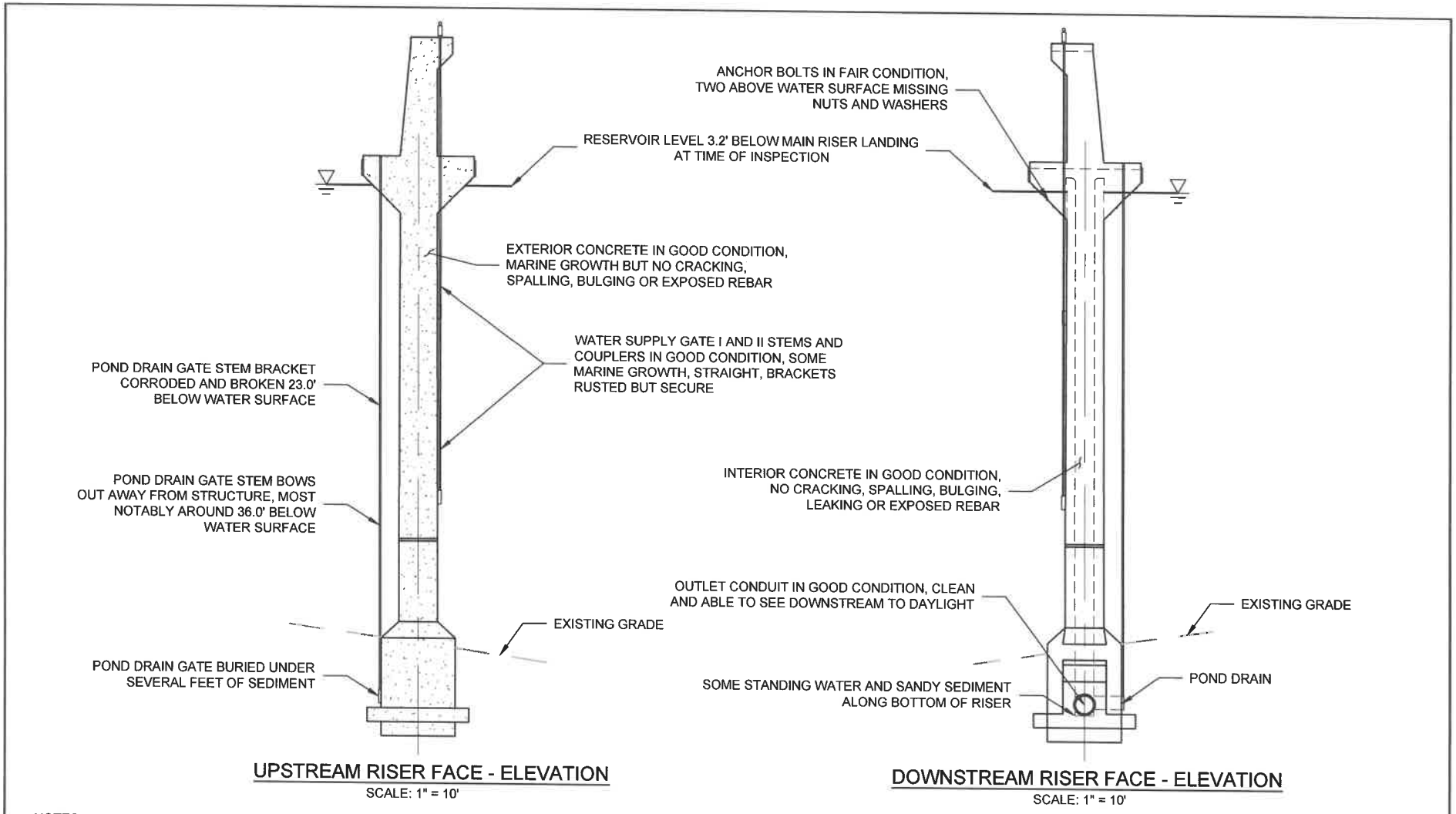
\\wchs-fs\projects\2018\West Chester\18C35013 DX NRCS NE Brush Creek\03-SE Products\08-CAD\DRAWINGS\04-REPORTS\18C15 PRELIM STRUCT COND\18C15 RISER INSPECTION COMMENTS.dwg 7/18/20



UPSTREAM RISER FACE - ELEVATION

SCALE: 1" = 10'

DOWNSTREAM RISER FACE - ELEVATION

SCALE: 1" = 10'

NOTES:

1. OBSERVATIONS BELOW POOL LEVEL NOTED BY SCHNABEL ENGINEERING DURING VIDEO SURVEILLANCE CONDUCTED BY DIVERS (IN-WATER CO.) VIA UNDERWATER ROVER.
2. OBSERVATIONS INSIDE OF RISER STRUCTURE RELAYED TO SCHNABEL ENGINEERING BY DIVER (IN-WATER CO.) LOWERED INTO STRUCTURE.
3. FIGURES BASED ON AS-BUILT DRAWINGS DATED AUGUST 1964.

Schnabel ENGINEERING	BRUSH CREEK SITE 15 NRCS - WEST VIRGINIA MERCER COUNTY, WEST VIRGINIA PROJECT NO. 18C35013.04	RISER INSPECTION (07/10/2019) OBSERVATIONS AND COMMENTS FIGURE 1

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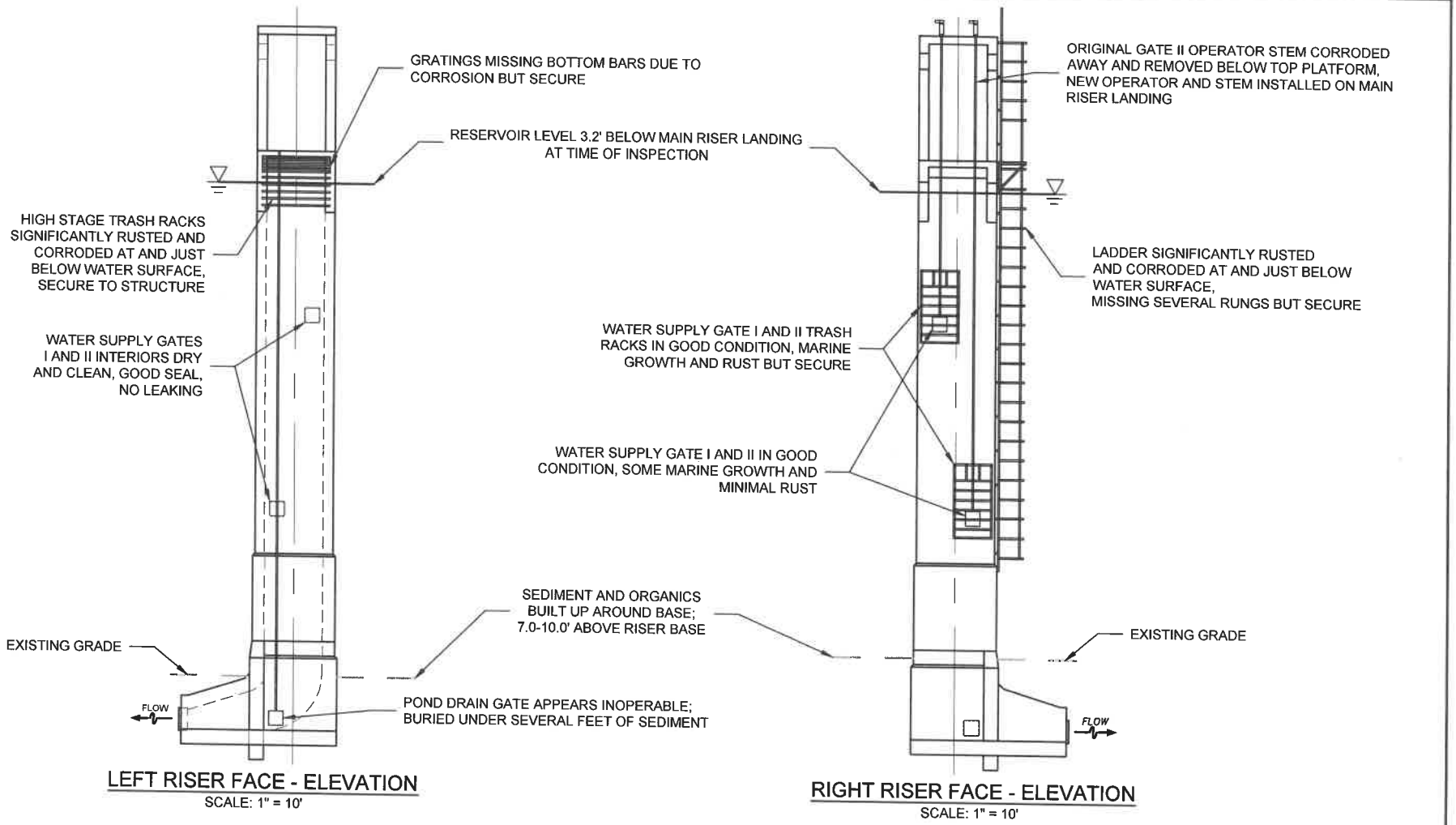

NOTES:

1. OBSERVATIONS BELOW POOL LEVEL NOTED BY SCHNABEL ENGINEERING DURING VIDEO SURVEILLANCE CONDUCTED BY DIVERS (IN-WATER CO.) VIA UNDERWATER ROVER.
2. OBSERVATIONS INSIDE OF RISER STRUCTURE RELAYED TO SCHNABEL ENGINEERING BY DIVER (IN-WATER CO.) LOWERED INTO STRUCTURE.
3. REFERENCE TO LEFT AND RIGHT SIDES AS VIEWED LOOKING DOWNSTREAM.
4. FIGURES BASED ON AS-BUILT DRAWINGS DATED AUGUST 1964.

Schnabel ENGINEERING

BRUSH CREEK SITE 15
NRCS - WEST VIRGINIA
MERCER COUNTY, WEST VIRGINIA
PROJECT NO. 18C35013.04

RISER INSPECTION
(07/10/2019)
OBSERVATIONS AND COMMENTS

FIGURE 2

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\\wchs-fs\projects\2018\West Chester\18C35013 DX NRCS Mt Brush Creek\03-Sit Products\08-CAD\DRAWINGS\04-REPORTS\18C15 PRELIM STRUCT COND\18C15 RISER INSPECTION COMMENTS.dwg //18/20

APPENDIX C

PHOTOGRAPHS

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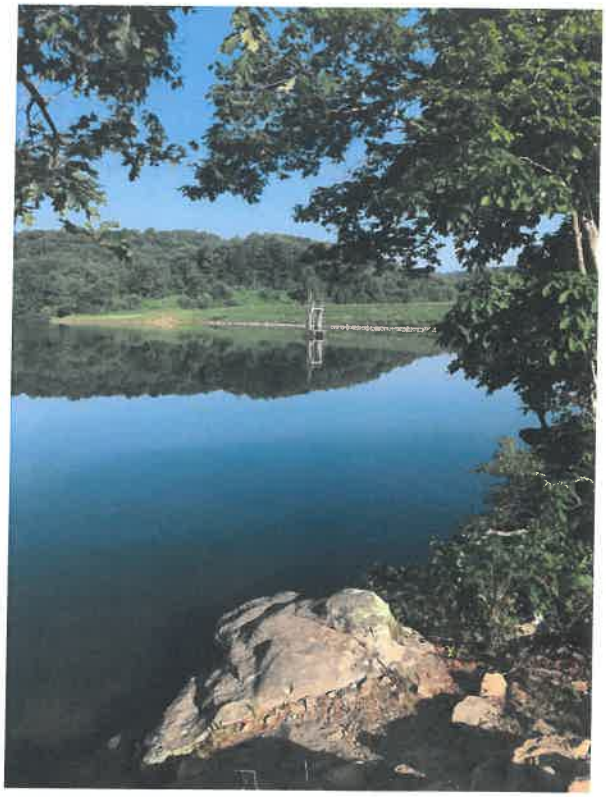

PHOTO 1

DATE TAKEN: 07/10/2019

LOCATION:

Principal spillway riser seen from right shoreline, downstream.

PHOTO 2

DATE TAKEN: 07/10/2019

LOCATION:

Downstream, right abutment. Boat access ramp.

COMMENTS:

In-Water Services Co. truck, trailer, boat, crew and diving equipment.

Schnabel ENGINEERING	BRUSH CREEK SITE 15 NRCS—WEST VIRGINIA MERCER COUNTY, WEST VIRGINIA PROJECT NO. 18C35013.04	RISER INSPECTION PHOTOS JULY 10, 2019

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PHOTO 3

DATE TAKEN: 07/10/2019

LOCATION:

Right side of principal spillway riser structure (as oriented looking downstream).

PHOTO 4

DATE TAKEN: 07/10/2019

LOCATION:

Upstream face of principal spillway riser structure.

COMMENTS:

Concrete is generally in good condition.

Schnabel ENGINEERING	BRUSH CREEK SITE 15 NRCS—WEST VIRGINIA MERCER COUNTY, WEST VIRGINIA PROJECT NO. 18C35013.04	RISER INSPECTION PHOTOS JULY 10, 2019

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PHOTO 5

DATE TAKEN: 07/10/2019

LOCATION:

Right side of principal spillway riser structure (as oriented looking downstream).

COMMENTS:

Grating missing bottom bars due to corrosion. High trash rack has significant rusting and corrosion.

PHOTO 6

DATE TAKEN: 07/10/2019

LOCATION:

Right side of principal spillway riser structure (as oriented looking downstream).

COMMENTS:

Grating missing bottom bars due to corrosion. High trash rack has significant rusting and corrosion.

Schnabel ENGINEERING	BRUSH CREEK SITE 15 NRCS—WEST VIRGINIA MERCER COUNTY, WEST VIRGINIA PROJECT NO. 18C35013.04	RISER INSPECTION PHOTOS JULY 10, 2019

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PHOTO 7

DATE TAKEN: 07/10/2019

LOCATION:

Principal spillway riser structure, main landing.

COMMENTS:

In-Water Services Co. underwater rover and associated equipment.

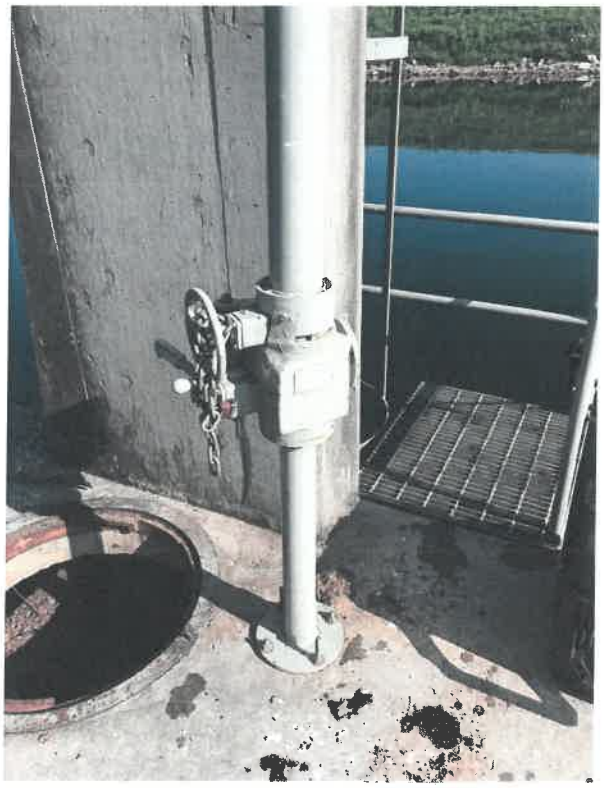

PHOTO 8

DATE TAKEN: 07/10/2019

LOCATION:

Principal spillway riser structure, main landing.

COMMENTS:

Water Supply Gate II operator (not original operator).

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PHOTO 9

DATE TAKEN: 07/10/2019

LOCATION:

Principal spillway riser structure, main landing.

COMMENTS:

Manhole on main landing, reservoir level below riser weir.

PHOTO 10

DATE TAKEN: 07/10/2019

LOCATION:

Principal spillway riser structure, main landing.

COMMENTS:

Diver lowered into interior riser structure for inspection with winch and harness system.

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PHOTO 11

DATE TAKEN: 07/10/2019

LOCATION:

Principal spillway riser structure, main landing.

COMMENTS:

Water Supply Gate II original operator stem, corroded away and disconnected. New operator and stem installed on main landing below (see Photo 8).

PHOTO 12

DATE TAKEN: 07/10/2019

LOCATION:

Principal spillway riser structure, main landing.

COMMENTS:

Pond Drain Gate operator without crank wheel.

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PHOTO 13

DATE TAKEN: 07/10/2019

LOCATION:

Principal spillway riser structure, main landing.

COMMENTS:

Riser ladder and steel grate platform, attached to downstream face of structure.

PHOTO 14

DATE TAKEN: 07/10/2019

LOCATION:

Principal spillway riser structure, main landing.

COMMENTS:

Riser ladder, heavily corroded at and below water surface.

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PHOTO 1

DATE TAKEN: 02/26/2019

LOCATION:

Impact basin, looking upstream.

COMMENTS:

Exterior concrete surface in good condition.

PHOTO 2

DATE TAKEN: 02/26/2019

LOCATION:

Impact basin, looking right.

Schnabel ENGINEERING	BRUSH CREEK SITE 15 NRCS—WEST VIRGINIA MERCER COUNTY, WEST VIRGINIA PROJECT NO. 18C35013.04	IMPACT BASIN INSPECTION PHOTOS FEBRUARY 26, 2019

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PHOTO 1

DATE TAKEN: 07/10/2019

LOCATION:

11 FT below water surface, right riser face.

COMMENTS:

Water Supply Gate I trash rack in good condition; marine growth and rust, but appears to be secure.

PHOTO 2

DATE TAKEN: 07/10/2019

LOCATION:

11 FT below water surface, right riser face.

COMMENTS:

Water Supply Gate I and guides in good condition; marine growth and possible rust.

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PHOTO 3

DATE TAKEN: 07/10/2019

LOCATION:

30 FT below water surface, right riser face.

COMMENTS:

Water Supply Gate II trash rack in good condition; marine growth and rust, but appears to be secure.

PHOTO 4

DATE TAKEN: 07/10/2019

LOCATION:

27 FT below water surface, right riser face.

COMMENTS:

Water Supply Gate II trash rack in good condition; marine growth and rust, but appears to be secure.

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PHOTO 5

DATE TAKEN: 07/10/2019

LOCATION:

2 FT below water surface, right riser face.

COMMENTS:

Water Supply Gate II stem and bracket appear to be in good condition; slight marine growth and minor discoloration, but appear to be straight and secure. Ladder on downstream face appears to be bent.

PHOTO 6

DATE TAKEN: 07/10/2019

LOCATION:

11 FT below water surface, right riser face.

COMMENTS:

Water Supply Gate II stem and bracket in good condition; slight marine growth and minor discoloration, but appears to be straight and secure.

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PHOTO 7

DATE TAKEN: 07/10/2019

LOCATION:

4 FT below water surface, left riser face.

COMMENTS:

Pond Drain Gate stem and bracket in fair condition; section loss of the stem due to rust.

PHOTO 8

DATE TAKEN: 07/10/2019

LOCATION:

24 FT below water surface, left riser face.

COMMENTS:

Pond Drain Gate stem bracket corroded away at front; section loss of the stem due to rust.

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PHOTO 9

DATE TAKEN: 07/10/2019

LOCATION:

36 FT below water surface, left riser face.

COMMENTS:

Pond Drain Gate stem in poor condition; significant rusting and bowing of the stem away from the structure.

PHOTO 10

DATE TAKEN: 07/10/2019

LOCATION:

48 FT below water surface, upstream riser face.

COMMENTS:

Sediment and organics built up around base of structure; approximately 7 to 10 FT above riser base.

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PHOTO 11

DATE TAKEN: 07/10/2019

LOCATION:

44 FT below water surface, external riser face.

COMMENTS:

Exterior concrete surface in good condition.

PHOTO 12

DATE TAKEN: 07/10/2019

LOCATION:

42 FT below water surface, external riser face.

COMMENTS:

Exterior concrete and corner chamfer in good condition, some marine growth.

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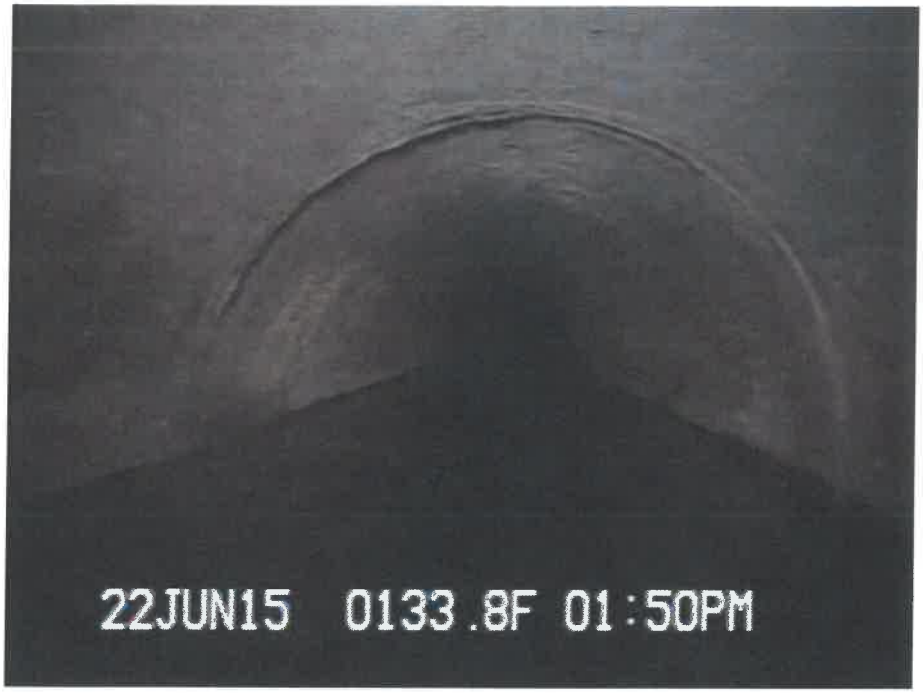

PHOTO 1

DATE TAKEN: 06/22/2015

LOCATION:

Primary spillway outlet conduit, 134 ft upstream of pipe outfall.

COMMENTS:

Conduit flowing at roughly 1/3 capacity, free of debris and blockage.

PHOTO 2

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 53 ft upstream of pipe outfall.

COMMENTS:

Conduit with low flow, free of debris and blockage.

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PHOTO 3

DATE TAKEN: 06/22/2015

LOCATION:

Primary spillway outlet conduit, 58 ft upstream of pipe outfall.

COMMENTS:

Rubber seal in good condition.

PHOTO 4

DATE TAKEN: 06/22/2015

LOCATION:

Primary spillway outlet conduit, 197 ft upstream of pipe outfall.

COMMENTS:

Joint showing slight chipping and deterioration.

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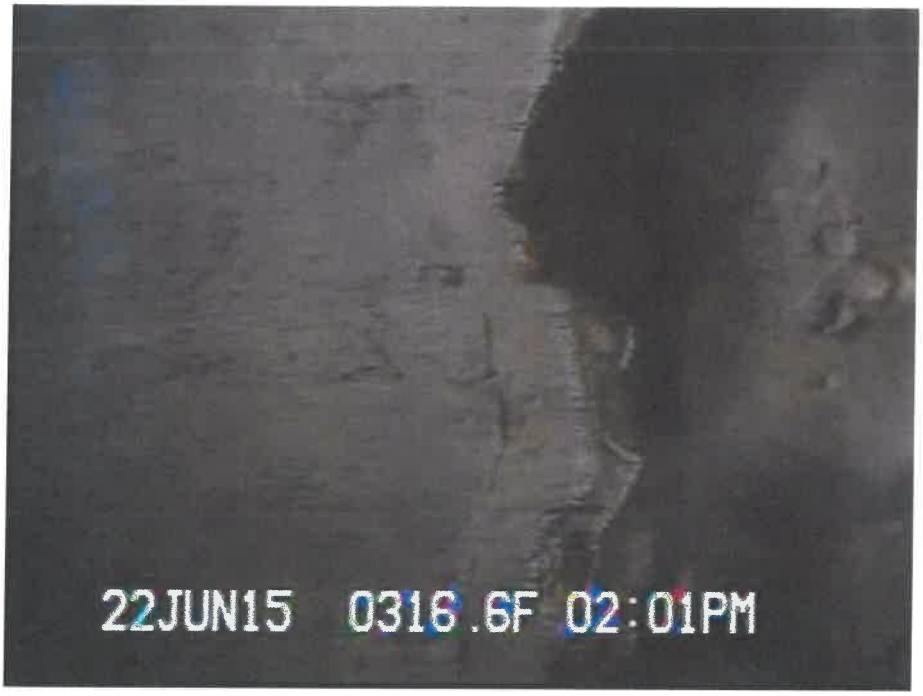

PHOTO 5

DATE TAKEN: 06/22/2015

LOCATION:

Primary spillway outlet conduit, 317 ft upstream of pipe outfall.

COMMENTS:

Rubber seal in joint appears to be grouted and bulging out of joint.

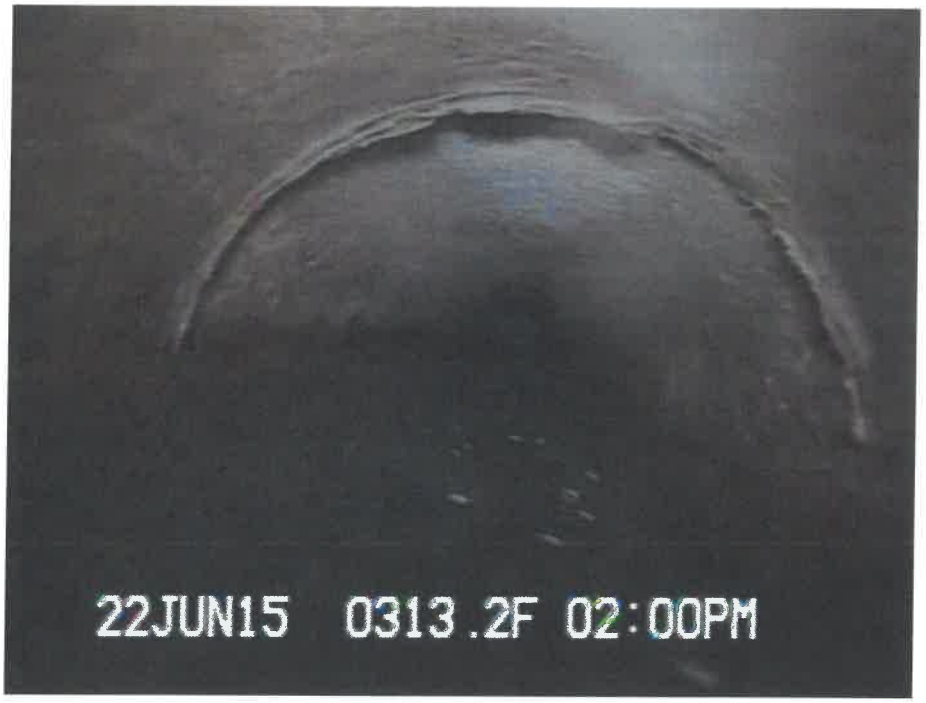

PHOTO 6

DATE TAKEN: 06/22/2015

LOCATION:

Primary spillway outlet conduit, 313 ft upstream of pipe outfall.

COMMENTS:

Rubber seal in joint appears to be grouted and bulging out of joint.

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PHOTO 7

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 356 ft upstream of pipe outfall, just downstream of riser structure.

COMMENTS:

Chipping in joint just downstream of riser structure.

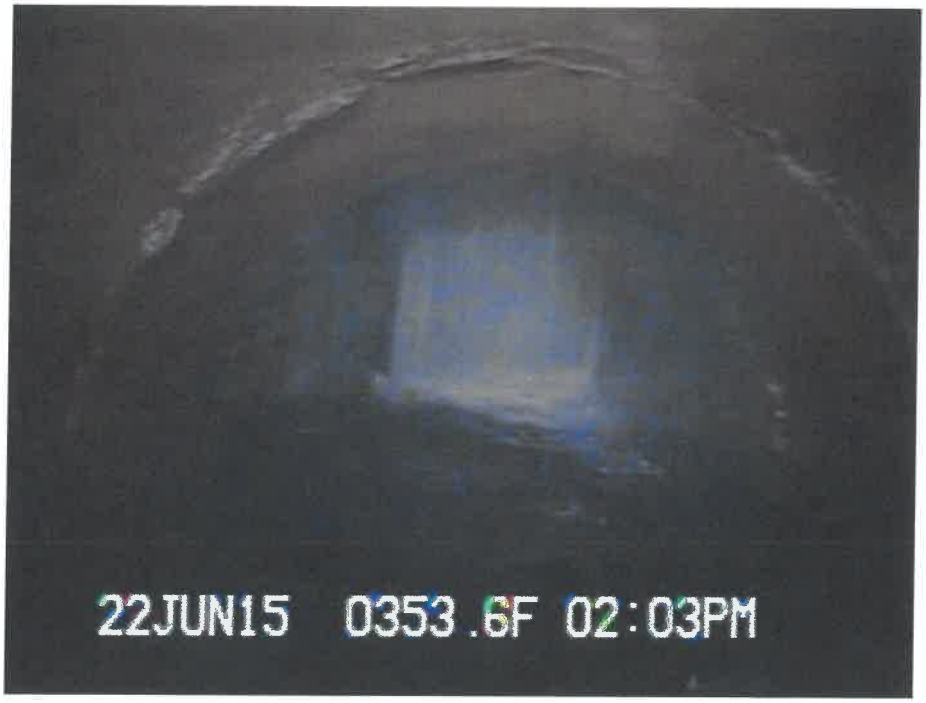

PHOTO 8

DATE TAKEN: 06/22/2015

LOCATION:

End of primary spillway outlet conduit, 354 ft upstream of conduit pipe outfall.

COMMENTS:

Bottom of riser structure and inflow in foreground.

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PHOTO 9

DATE TAKEN: 07/20/2016

LOCATION:

End of primary spillway outlet conduit, 353 ft upstream of conduit pipe outfall.

COMMENTS:

Bottom of riser structure and inflow in foreground.

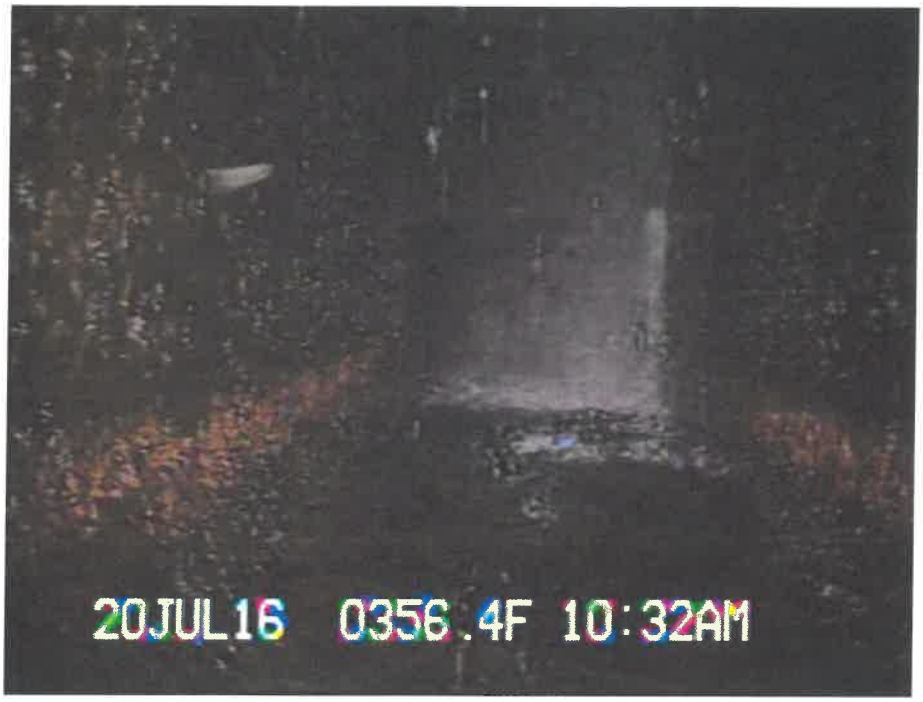

PHOTO 10

DATE TAKEN: 07/20/2016

LOCATION:

Bottom of riser structure, just upstream of conduit outlet pipe.

COMMENTS:

Pond Drain Gate interior in foreground.

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PHOTO 11

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 18 ft upstream of pipe outfall, joint J-18.

PHOTO 12

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 38 ft upstream of pipe outfall, joint J-17.

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PHOTO 13

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 58 ft upstream of pipe outfall, joint J-16.

PHOTO 14

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 78 ft upstream of pipe outfall, joint J-15.

Schnabel ENGINEERING	BRUSH CREEK SITE 15 NRCS—WEST VIRGINIA MERCER COUNTY, WEST VIRGINIA PROJECT NO. 18C35013.04	CONDUIT INSPECTION PHOTOS JUNE 22, 2015 AND JULY 20, 2016

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PHOTO 15

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 97 ft upstream of pipe outfall, joint J-14.

PHOTO 16

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 117 ft upstream of pipe outfall, joint J-13.

Schnabel ENGINEERING	BRUSH CREEK SITE 15 NRCS—WEST VIRGINIA MERCER COUNTY, WEST VIRGINIA PROJECT NO. 18C35013.04	CONDUIT INSPECTION PHOTOS JUNE 22, 2015 AND JULY 20, 2016

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PHOTO 17

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 137 ft upstream of pipe outfall, joint J-12.

PHOTO 18

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 157 ft upstream of pipe outfall, joint J-11.

Schnabel ENGINEERING	BRUSH CREEK SITE 15 NRCS—WEST VIRGINIA MERCER COUNTY, WEST VIRGINIA PROJECT NO. 18C35013.04	CONDUIT INSPECTION PHOTOS JUNE 22, 2015 AND JULY 20, 2016

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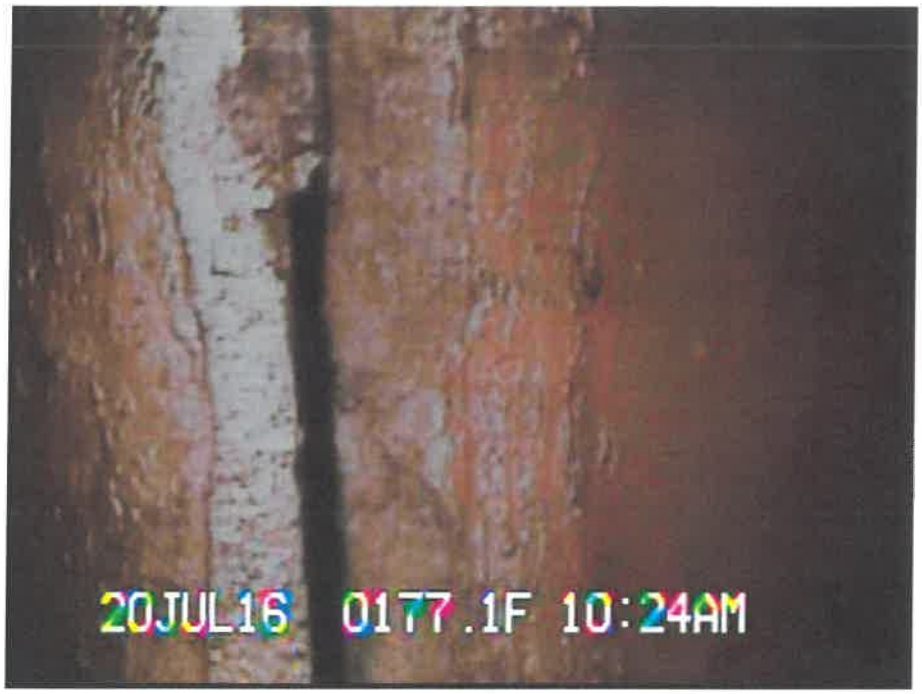

PHOTO 19

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 177 ft upstream of pipe outfall, joint J-10.

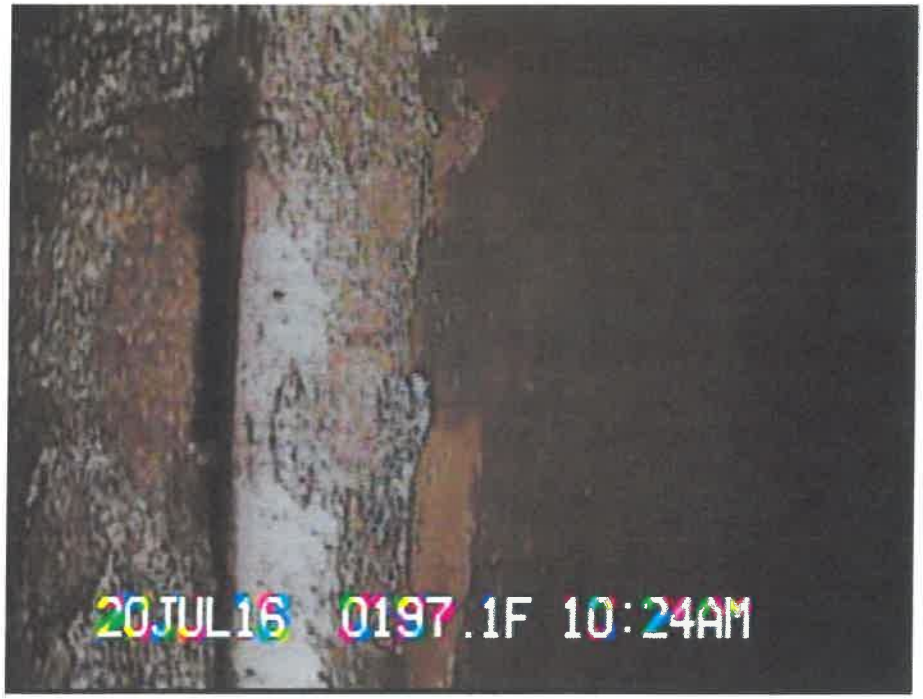

PHOTO 20

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 197 ft upstream of pipe outfall, joint J-9.

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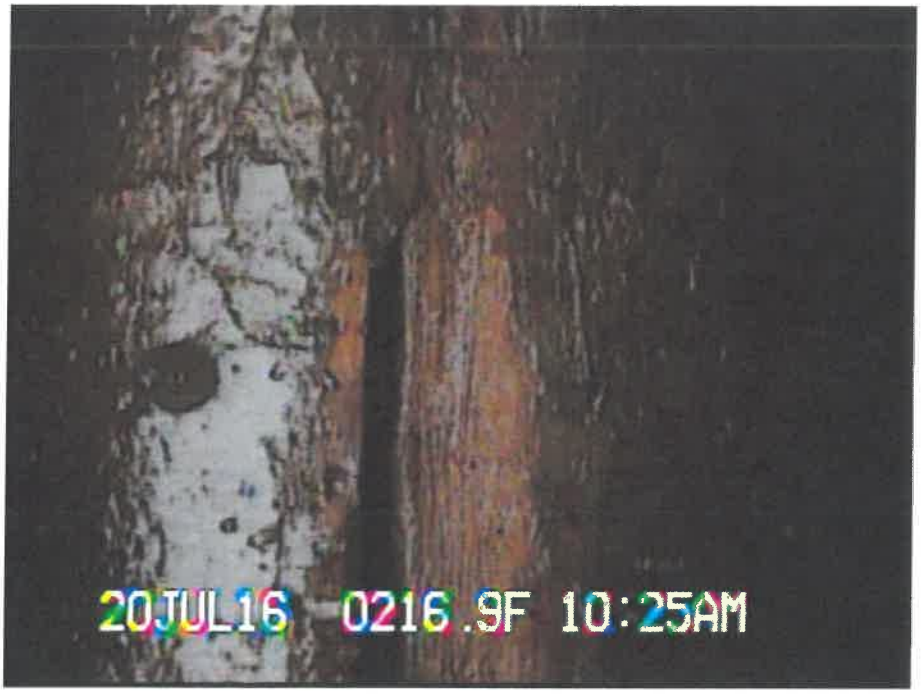

PHOTO 21

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 217 ft upstream of pipe outfall, joint J-8.

PHOTO 22

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 237 ft upstream of pipe outfall, joint J-7.

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PHOTO 23

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 257 ft upstream of pipe outfall, joint J-6.

PHOTO 24

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 277 ft upstream of pipe outfall, joint J-5.

Schnabel ENGINEERING	BRUSH CREEK SITE 15 NRCS—WEST VIRGINIA MERCER COUNTY, WEST VIRGINIA PROJECT NO. 18C35013.04	CONDUIT INSPECTION PHOTOS JUNE 22, 2015 AND JULY 20, 2016

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PHOTO 25

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 297 ft upstream of pipe outfall, joint J-4.

PHOTO 26

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 317 ft upstream of pipe outfall, joint J-3.

Schnabel ENGINEERING	BRUSH CREEK SITE 15 NRCS—WEST VIRGINIA MERCER COUNTY, WEST VIRGINIA PROJECT NO. 18C35013.04	CONDUIT INSPECTION PHOTOS JUNE 22, 2015 AND JULY 20, 2016

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PHOTO 27

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 336 ft upstream of pipe outfall, joint J-2.

PHOTO 28

DATE TAKEN: 07/20/2016

LOCATION:

Primary spillway outlet conduit, 356 ft upstream of pipe outfall, joint J-1.

Schnabel ENGINEERING	BRUSH CREEK SITE 15 NRCS—WEST VIRGINIA MERCER COUNTY, WEST VIRGINIA PROJECT NO. 18C35013.04	CONDUIT INSPECTION PHOTOS JUNE 22, 2015 AND JULY 20, 2016

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APPENDIX D

IN-WATER SERVICES INSPECTION REPORT

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In-Water Services Company Inc.

NRCS Brush Creek Structure #15 Inspection

Attention: Corey Schaal
From: James Rogers

On July 10th, 2019, In-Water Services Co. performed a diving inspection of NRCS Brush Creek Structure Number 15 in Princeton, WV.

Performed visual inspection of top and inside of structure. Topside exterior concrete above waterline was in good condition with no major cracks, spalls, or pop outs. The actuators for the upper and middle sluice gates appeared to be in good condition. We did not operate the sluice gates. The lake drain actuator appeared to be inoperable. Upon entering inside the structure, we noticed that there was a lot of exposed aggregate on all four walls and water races all the way to the bottom. Both the upper and middle sluice gates were not leaking and showed little to no corrosion on the inside. The lake drain sluice gate had minor corrosion, but the gate was not leaking. The outfall pipe had no debris in it and appeared to be in good condition. The overall condition of the inside of structure appeared to in good condition.

Performed inspection on the exterior of structure. The stem for the upper sluice gate was stainless steel. The stem guides and brackets appeared to be in good condition. The trash rack was anchored to the wall with stainless steel hardware. The upper sluice gate had minor marine growth and appeared to be in good working order. The middle sluice gate had a stainless steel stem, and all stem guide brackets appeared to be in good condition. The trash rack was secure and in-place. The middle sluice gate had minor marine growth on it. Overall, the middle sluice gate appeared to be in good condition. The lake drain sluice gate was buried in approximately 5 to 7 foot of sediment. The stem was bent in several places with missing stem guides and brackets. The lake drain sluice gate was inoperable. The overall condition of the exterior of structure appeared to in good condition.

Recommendations:

Pressure wash and clean out the bad concrete on the inside of structure and recoat with an epoxy paint to ensure longevity of the structure.

Remove sediment away from the lake drain sluice gate, take measurements, and replace with new stainless steel sluice gate, stem, and actuator. Install stainless steel trash rack around sluice gate. The lake level will need to be lowered to during installation due to the depth of the sluice gate.

APPENDIX E

REFERENCES

Gannett Fleming (2011). *Rehabilitation Assessment Report, Brush Creek Watershed Site 15, Mercer County, West Virginia.* Prepared for West Virginia NRCS, March 2011.

Gannett Fleming (2017a). *Planning Level Technical Memorandum, Brush Creek Site 15 Watershed Dam, Mercer County, West Virginia.* Prepared for the West Virginia Conservation Agency, September 2016, Revised February 2017.

Gannett Fleming (2017b). *Draft Supplemental Watershed Plan – Environmental Assessment for the Rehabilitation of Brush Creek Site 15 Watershed Dam.* Prepared for the West Virginia Conservation Agency, February 2017.

USDA-NRCS (2009). *National Engineering Handbook Part 636, Chapter 70, Design and Analysis of Risers.* United States Department of Agriculture, Natural Resources Conservation Service, October 2009.

USDA-NRCS (2018). *Specifications for Engineering Services, Brush Creek Sites 9, 14, and 15, Dam Rehabilitation Design, Mercer County, West Virginia.* United States Department of Agriculture, Natural Resources Conservation Service, September 2018.

USDA-SCS (1967). *Brush Creek Watershed Project – Multiple Purpose Dam No. 15, North Fork of Brush Creek – Princeton, Mercer County, West Virginia – AS BUILT.* Soil Conservation Service of the U.S. Department of Agriculture and Brush Creek Watershed Improvement District.

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ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.: CRFQ AGR26*16

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received:
(Check the box next to each addendum received)

[X]	Addendum No. 1	[ ]	Addendum No. 6
[X]	Addendum No. 2	[ ]	Addendum No. 7
[X]	Addendum No. 3	[ ]	Addendum No. 8
[X]	Addendum No. 4	[ ]	Addendum No. 9
[X]	Addendum No. 5	[ ]	Addendum No. 10

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

Sequoia Services, LLC
Company

Authorized Signature

1/14/2026
Date

NOTE: This addendum acknowledgement should be submitted with the bid to expedite document processing.

REQUEST FOR QUOTATION
Construction: Brush Creek 15 Dam Rehabilitation
CRFQ AGR26*16
REVISED AS OF 10/20/2025
VERSION 2 - SUPERSEDES ANY PREVIOUS VERSIONS

EXHIBIT A – Pricing Page

Dam Rehabilitation/Construction – Brush Creek 15

Name of Bidder: Sequoia Services, LLC

Bidders Address: 3300 Battleground Ave., Suite 102
Street

Greensboro, NC 27410
City State Zip

Telephone: 336-708-2505

Fax Number: 336-232-1517

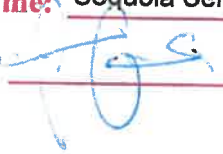
Email: liam@seqserv.com

Contractor's License No: WV059537
(include copy with bid response documents)

***NOTE: IF SUBMITTING AN ELECTRONIC BID THROUGH WVOASIS – VENDOR SELF-SERVICE PORTAL – THE TOTAL COST MUST BE ENTERED ON COMMODITY LINE 1.**

****Failure to use this bid form may result in bid disqualification**

Vendor Name: Sequoia Services, LLC

Signature:  **Date:** 1/14/2026

Revised BC Site 15 Bid Schedule - 12/30/25

Brush Creek Site 15 Dam Rehabilitation
Bid Schedule

Item	Bid Item Description	Spec. Section	Estimated Quantity	Unit	Unit Price	Total
1	Clearing and Grubbing	CS 2	2.3	AC	$ 22,800	$ 52,440
2	Structure Removal	CS 3	1	LS	$ 57,000	$ 57,000
3	Trench Drain Abandonment	CS 3	1	LS	$ 50,400	$ 50,400
4	Pollution Control	CS 5	1	LS	$ 590,000	$ 590,000
5	Permanent Seeding and Mulching	CS 6	4.6	AC	$ 18,500	$ 85,100
6	Construction Surveys	CS 7	1	LS	$ 169,500	$ 169,500
7	Mobilization and Demobilization	CS 8	1	LS	$ 865,600	$ 865,600
8	Excavation Dewatering	CS 11	1	LS	$ 1,835,000	$ 1,835,000
9	Stream Diversion	CS 11	1	LS	$ 785,000	$ 785,000
10	Embankment, Common Excavation	CS 21	26,200	CY	$ 28	$ 733,600
11	Auxiliary Spillway, Common Excavation	CS 21	13,800	CY	$ 28	$ 386,400
12	Earthfill	CS 23	34,190	CY	$ 29	$ 991,510
13	Fine Drainfill	CS 24	5,800	CY	$ 220	$ 1,276,000
14	Coarse Drainfill	CS 24	470	CY	$ 200	$ 94,000
15	Topsoil	CS 26	23,300	SY	$ 10	$ 233,000
16	Topsoil Import	CS 26	1,770	CY	$ 70	$ 123,900
17	Cast-in-Place Reinforced Concrete, Impact Basin	CS 31	40	CY	$ 2,900	$ 116,000
18	Cast-in-Place Reinforced Concrete, PSW Cradle	CS 31	7	CY	$ 2,100	$ 14,700
19	Cast-in-Place Reinforced Concrete, ASW Starter Wall	CS 31	81	CY	$ 2,300	$ 186,300
20	Cast-in-Place Reinforced Concrete, ASW Tailwater Weir and Baffle Blocks	CS 31	530	CY	$ 1,800	$ 954,000
21	Mudmat	CS 31	142	CY	$ 700	$ 99,400
22	Concrete Repair, Principal Spillway Riser	CS 35	790	SF	$ 310	$ 244,900
23	Roller Compacted Concrete	CS 36	4,430	CY	$ 550	$ 2,436,500
24	Furnishing and Handling Cementitious Material for RCC	CS 36	1,110	TN	$ 275	$ 305,250
25	Roller Compacted Concrete Test Section	CS 36	260	CY	$ 920	$ 239,200
26	Principal Spillway Pipe Extension	CS 41	27.3	LF	$ 4,200	$ 114,660
27	Toe Drain Piping	CS 45	530	LF	$ 200	$ 106,000
28	Precast Seepage Collection Boxes	CS 45	1	LS	$ 32,900	$ 32,900
29	ASW Drain Piping	CS 45	400	LF	$ 205	$ 82,000
30	Rock Riprap, PSW Outlet and ASW	CS 61	1,480	CY	$ 280	$ 414,400
31	Embankment Upstream Stability Berm	CS 61	13,730	CY	$ 105	$ 1,441,650
32	Rock Foundation Preparation, Embankment	CS 63	215	SY	$ 360	$ 77,400
33	Rock Foundation Preparation, ASW	CS 63	500	SY	$ 160	$ 80,000
34	Installation of New Pond Drain Gate, Gate Stem, and Stem Gu	CS 71	1	LS	$ 69,500	$ 69,500
35	Removal of Pond Drain Gate	CS 71	1	LS	$ 40,700	$ 40,700
36	Stainless Steel Metalwork	CS 81	1	LS	$ 60,500	$ 60,500
37	Principal Spillway Fatigue Platform	CS 81	1	LS	$ 14,600	$ 14,600
38	Principal Spillway Guardrail	CS 81	1	LS	$ 22,100	$ 22,100
39	Impact Basin Guardrail	CS 81	1	LS	$ 27,100	$ 27,100
40	Impact Basin Grating	CS 81	1	LS	$ 22,500	$ 22,500
41	Principal Spillway Ladder	CS 81	1	LS	$ 47,200	$ 47,200
42	Staff Gauge, Principal Spillway Riser	CS 93	1	LS	$ 16,500	$ 16,500
43	Project Monument	CS 93	1	LS	$ 17,800	$ 17,800
44	Construction Quality Control	CS 94	1	LS	$ 932,500	$ 932,500
45	Field Office	CS 96	1	LS	$ 655,300	$ 655,300
46	Geotechnical Instrumentation	CS 401	1	LS	$ 84,000	$ 84,000
					TOTAL =	$ 17,284,010

UNIT DEFINITIONS: LS=Lump Sum, LF=Linear Feet, CY=Cubic Yards, SY = Square Yards, SF = Square Feet, AC = Acre, TN =Ton