

Attachment E

Construction Specifications

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Pond 1 Ash Disposal Area Closure Clinch River Plant

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Clinch River Plant, Carbo, Virginia

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Section 1: Summary of Work

1.01 General

1.01.1 Summary

The requirements to close Pond 1 at the Clinch River facility include capping the ash with an impermeable geosynthetic liner system and placing a minimum of 2 feet of clean cover material that will be regraded to eliminate impoundment of water. Further details of the Pond 1 construction requirements can be found in Section 5.0 of the Engineering Report and Calculations (located in the Attachment C of the Closure Plan document dated April 2014 – Revised October 2015).

A. Section Includes

1. Project Information
2. Work Description
3. Work Covered by Others
4. Special Requirements

B. Related Requirements

1. Demolition and Pipe Abandonment
2. Excavation and Earthwork
3. Geosynthetics
4. Rip Rap
5. Concrete
6. Seeding and Mulching
7. Erosion and Sediment Control
8. Collection Channels and Underground Piping
9. Gabion Mattresses

1.01.2 Project Information

- A. Project Identification: The Project consists the closure and construction of surface drainage structures at the Clinch River Plant Pond 1 for American Electric Power (AEP), hereinafter referenced as the “Owner”, in Russell County, Virginia.
- B. Owner: American Electric Power, Headquarter Office at 1 Riverside Plaza, Columbus, Ohio 43215
- C. Engineer: Amec Foster Wheeler, Environment and Infrastructure, Inc.
 1. The Project has been designed by Amec Foster Wheeler Environment and Infrastructure, Inc., hereinafter referred to as the “Owner’s Engineer”. The Engineer will perform other duties and responsibilities as summarized in these Specifications and in accordance with the terms of the agreement between the Engineer and Owner.

1.01.3 Work Description

- A. The scope of work is defined by the Contract Documents and shall consist of, but is not necessarily limited to, the following:
1. Performance of the work in compliance with Owner's site specific health and safety rules and requirements, including all applicable local, state, and federal regulations.
 2. Completion by all personnel, including subcontractors, of Owner's general and site specific orientation program.
 3. The Contractor shall perform the work in accordance with the Project Drawings, Construction Specifications, Quality Assurance Plan, and Owner's Terms and Conditions.
 4. The Contractor shall furnish all equipment, tools, labor, and materials necessary to complete the work.
 5. Preparation, submission, and revision, as necessary, of all submittals as required by the Specifications and Owner, as applicable.
 6. Construction, maintenance, and repair, as necessary, of all erosion and sediment control measures required to complete the work in accordance with state and federal requirements for the duration of the work.
 7. Attendance of necessary personnel at all Owner required project meetings for the duration of the work.
 8. Demolition, abandonment, and proper disposal of structures, objects, and items identified on the Project Drawings.
 9. Completion of surveying requirements identified by the Specifications, Project Drawings, and Owner specified requirements. Surveying shall include layout and marking of construction boundaries or limits associated with the work, survey for material quantities, and As-built documentation.
 10. Temporary seeding required during the course of the work.
 11. Establish excavation grades within work boundary in the vicinity of the pond area in accordance with requirements of the approved Plan, Project drawings, and Specifications.
 12. Establish finished grades by placing and compacting relevant materials in accordance with requirements of the approved Project Drawings and the Specifications.
 13. Permanent seeding, including placement of erosion control matting and other stabilizers, upon completion of grading to finished grades.
 14. Decommission erosion and sediment control measures after closure of erosion and sediment control permit.
 15. Preparation, submittal, and revision of project record drawings in accordance with the Specifications.
 16. Demobilization from site and project close-out documentation.

1.01.4 Work By Others

- A. The Owner may retain the services of third party entities to perform activities at the site associated with Quality Assurance (QA) of the work or for tasks deemed necessary to the work that are not a part of the Contractor's scope of work. The Contractor shall make every effort to coordinate with the Owner, Owner's representatives, and third

parties, including allowing and facilitating access to the entirety of the site when requested.

1.01.5 Special Requirements

A. Environmental Boundaries

1. Wetland, jurisdictional waters, and any rare, threatened, or endangered (RTE) species boundaries, including applicable buffers, must be maintained and observed throughout the course of the work. Generally, no work should be performed within the identified boundary limits and all personnel should limit entering these areas unless Owner approved work clearly requires accessing these areas.
2. No land disturbing activities shall occur within the Environmental Boundaries without the approval of the Owner. Trees or other vegetation within the limits of the Environmental Boundaries shall not be cut, trimmed, or damaged.
3. The Contractor shall be responsible for training personnel, including any subcontractors or third parties performing work onsite at the request of the Contractor, on the importance of observing the Environmental Boundaries and enforcing restrictions at all times. Owner will consider third parties of the Contractor to include any delivery drivers or vendors entering the site.

B. Contact Water

1. Stormwater runoff that contacts the landfill shall be considered contact water for purposes of erosion and sediment control.
2. Contact water shall not be allowed to pass beyond the work boundary without appropriate treatment. Contact water shall be directed to Pond 1B located on the site, unless otherwise directed by the Owner.
3. The Owner may direct the Contractor to make alternate arrangements for disposing of contact water and coordinate arrangements for compensation based on the required form of disposal. The Owner will make every effort to provide this direction prior to mobilization to the site, but reserves the right to make such alterations during the course of the project as required to meet local, state, and federal regulations.

C. Erosion and Sediment Control

1. Erosion and sediment control for this Project is under the jurisdiction of Virginia Department of Environmental Quality (VDEQ). Representatives of VDEQ may perform periodic inspections, whether announced or unannounced, of the site during the course of the Project. The Contractor shall coordinate with the Owner to facilitate the inspections, including suspending the work in isolated areas of the site for personnel safety. After inspection, the VDEQ representative may issue recommendations and/or requirements, including a required timeline for implementation, of all required remedial measures necessary for compliance with VDEQ requirements.
2. In order to close out the VDEQ approved erosion and sediment control permit, a healthy stand of vegetation, as defined by VDEQ, must be established and the site must pass a VDEQ inspection. Once the VDEQ inspection is concluded and the

erosion and sediment control permit is closed, any remaining erosion and sediment control measures, such as sediment basins, sedimentation fence, diversion ditches, etc., are to be decommissioned and removed from service per the requirements of the Project Drawings and Technical Specifications.

D. Dewatering

1. Prior to commencement of design or implementation of dewatering systems, the Contractor shall coordinate with the Owner to ensure that proposed dewatering initiatives meet local, state, and federal requirements for discharge of dewatering effluent.

E. Limitation of Technical Specifications Pond 1 Ash Disposal Area Closure Plan

1. Technical Specifications for the Pond 1 Ash Disposal Area Closure Plan are applicable to the work performed on the site within the work boundary shown on the Project Drawings. Additional specifications or requirements, including Owner's Terms and Conditions and site specific health and safety requirements, will be applicable to the work performed on the site and adjacent boundaries of Owner's property. In addition, separate specifications, terms, and requirements may be applicable to work performed associated with mobilization, demobilization, or transportation of materials on to or off of the project site.
2. The Contractor shall be responsible for coordinating with the Owner to obtain and understand all specifications, terms and conditions, and requirements pertaining to the work necessary to successfully complete the Project.

Section 2: Demolition and Pipe Abandonment

2.01 General

2.01.1 Summary

- A. Section Includes demolition work necessary to complete the scope of work as shown on the Project Drawings. Work shall be performed in accordance with local, state and federal laws and regulations. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.
- B. Related Requirements:
 - 1. Summary of Work
 - 2. Section Excavation and Earthworks
 - 3. Section Erosion and Sediment Control
 - 4. Section Riprap

2.01.2 Definitions

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and collect for Owner reuse.
- C. Abandon: existing items that are not to be removed and are not indicated on the plans to be salvaged or reinstalled.
- D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

2.01.3 Pre-installation Meetings

- A. Pre-demolition Conference: Conduct conference at the Project Site: Clinch River Plant.
 - 1. Inspect and discuss condition of construction to be selectively demolished or abandoned.
 - 2. Review structural load limitations of existing structures or abandonment procedures.
 - 3. Review and finalize demolition and abandonment schedule to verify the availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review areas where existing construction is to remain and requires protection.

2.01.4 Description of Work

- A. As shown on the Project Drawings, tasks associated with demolition shall consist of:

1. Rip Rap: Remove Riprap currently used for drainage, slope protection, and ground cover within the construction limits and stockpile for reuse as Reclaimed Riprap.
2. Trees and Other Woody Vegetation: All trees and other woody vegetation shall be cleared and grubbed within excavation areas while complying with all local, state, and federal time-of-year restrictions. All material resulting from clearing and grubbing shall be removed from the site by methods approved by the Owner.
3. Existing Pipes: Existing pipes shall be removed, abandoned, or disposed of as indicated in the project drawings.

2.01.5 Submittals

- A. The contractor shall provide an Existing Pipe Abandonment Plan. The existing pipe abandonment plan shall consist of the following information:
 1. Methods for the purging and cleaning pipes.
 2. Methods for verifying the pipes have been purged and cleaned.
 3. Bulkhead design and installation procedures.
 4. Non-Shrink Grout Mix Design.
 5. Non-Shrink Grouting Methods and Procedures.

2.02 Demolition

2.02.1 Demolition Work

- A. Existing structures shall be demolished or removed in accordance to the Project Drawings.
- B. During the course of the Work, the Contractor may encounter underground structures, pipes, culverts, utilities, or other abandoned structures or materials not identified in the Project Drawings. When encountered, the Contractor shall inform the Owner immediately and obtain direction from the Owner.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

2.02.2 Removal and Disassembly

- A. Demolished materials shall be transported off-site and disposed at a permitted landfill as approved by the Owner. Materials may be disposed on-site in a designated location with Owner's approval.
- B. Disposal of removed materials shall comply with all applicable local, state, and federal regulations.
- C. The contractor shall remove the pipes indicated on the Project Drawings.

D. Asbestos Pipe:

1. Asbestos Pipes require careful disassembly to avoid cracking and breaking of the material.
2. Asbestos Pipes shall be disposed of in accordance to the regulating authority's standard asbestos disposal procedures.

2.03 Pipe Abandonment

2.03.1 Pipe Abandonment Procedures

- A. The contractor shall abandoned the pipes indicated on the Project Drawings.
- B. Pipes shall be purged and cleaned prior to pumping Non-Shrink Grout by methods approved by the Owner's Engineer. Pipes must be cleaned to bond the inner surface of the pipe and the grout. The contractor shall be responsible for verifying the pipe has been purged and clean throughout in the presence of Quality Assurance personnel by methods approved by the Owner's Engineer.
- C. The contractor will be responsible to design and install a bulkhead for Non-Shrink Grouting. The bulkhead shall be designed to support the load of the non-shrink grout and prevent contamination to the surrounding environment. The bulkhead shall be approved by the owner's engineer prior to installation.
- D. The contractor shall fill pipes with non-Shrink grout by tremie grouting from the bulkhead or alternate methods approved by the Owner's Engineer.

Section 3: Excavation and Earthwork

3.01 General

3.01.1 Summary

- A. This section includes a description of the excavation and earthwork involved for the Pond 1A -1B closure. The Work shall also include all miscellaneous activities associated with general grading and tasks necessary to perform excavation and earthwork required to complete the project. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

- B. Related Requirements
 - 1. Summary of Work
 - 2. Erosion and Sediment Control
 - 3. Riprap
 - 4. Seeding and Mulching

3.01.2 References

- A. ASTM International
 - 1. ASTM D 698 “Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.”
 - 2. ASTM D 2216, “Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.”
 - 3. ASTM D 2487, “Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).”
 - 4. ASTM D 4318, “Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index for Soils.”
 - 5. ASTM D 4959, “Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating.”
 - 6. ASTM D 4643, “Standard Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Heating.”
 - 7. ASTM D 6938, “Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).”

3.01.3 Definitions

- A. Contouring Fill: soil and/or ash used to establish the subgrade within the extents of 30 mil PVC.

- B. Unsuitable Materials: soil materials not suitable for compacted fill. Including, but not limited to, materials containing Coal Combustion Residuals (outside of the PVC geomembrane extents), trash, organic materials, and any deleterious materials.

- C. Compacted Fill: material excavated from on-site and materials borrowed from off-site sources, not classified as Unsuitable Materials, used to establish finished grade and compacted to meet the requirements of the Technical Specifications.
- D. Excavation Grade: material defined as the grade or subgrade after removal of all Unsuitable Materials from the site per the requirements of the Technical Specifications and the Project Drawings.
- E. Finished Grade: Grade established to meet the final contours per the requirements of the Technical Specifications and Project Drawings.
- F. Aggregate: shall consist of imported natural crushed rock originating from a commercial quarry meeting the requirements of these Construction Specifications and Project Drawings.
 - 1. Aggregate specified in the Project Plans must meet VDOT's gradation and quality requirements of VDOT's Standard Specifications for Roads and Bridge Construction.

3.01.4 Description of Work

A. Excavation

- 1. Contractor shall furnish all equipment, materials, and labor to complete the work associated with excavation, establishing excavation grades and finished grades as applicable, and transporting all unsuitable materials offsite or onsite as approved by the Owner.

B. Earthwork

- 1. Contractor shall furnish all equipment, materials, and labor to complete the work associated with establishing excavation and final grades.
- 2. Furnishing and placing offsite aggregate materials required to complete the work.
- 3. The contractor shall be responsible for providing grade control in compliance with the Project Drawings.
- 4. Grading and maintaining all access roads and haul roads required to complete the work.
- 5. Transporting and compacting relevant materials required to establish Finished Grades.
- 6. Grading and compacting fill required to construct and maintain erosion and sediment control measures.
- 7. Construction and maintenance of all stockpiles within the work boundary.
- 8. Controlling and maintaining site drainage during the course of the project to facilitate completion of the work including meeting the requirements of local, state, and federal erosion and sediment control requirements.

3.01.5 Pre-installation Meetings

- A. Pre-installation Conference: Conduct a pre-excavation conference at the Clinch River Plant. Review methods and procedures related to earthmoving including, but not limited to, the following:
 - 1. Safety.
 - 2. Personnel and equipment needed to make progress and avoid delays.
 - 3. Coordination of work.
 - 4. Field quality control.
 - 5. Other items as necessary.

3.01.6 Submittals

- A. Excavation Plan: A detailed excavation plan that provides means and methods for completing the earthwork associated with the project. The excavation plan shall consist of means and methods pertaining to excavation, transportation of excavated materials, placement, compaction, and the disposal of any unsuitable materials. The excavation plan shall include, but not be limited to, the following:
 - 1. Construction entrances including locations, dimensions, and design.
 - 2. Dust mitigation plan.
 - 3. Location, alignment, dimensions, and traffic patterns of proposed haul roads.
 - 4. Detailed description of how the excavation of the Pond 1 Closure will be performed, including anticipated progression and timing of how areas will be excavated.
- B. Dewatering Plan: a detailed dewatering plan that provides the means and methods for any dewatering of the construction area during excavation and any decanting methods necessary for earthwork or excavation. The Dewatering Plan shall include, but not be limited to, the following:
 - 1. Description of methods to be used for dewatering, such as trenches, sumps, or active dewatering elements.
 - 2. Dewatering system design including electrical and pumping systems for active dewatering elements.
 - 3. Anticipated electrical requirements and rate of usage.
 - 4. Dewatering system layout and phasing, as applicable.
 - 5. Anticipated discharge rates.
 - 6. Anticipated drawdown rates.
 - 7. Discharge treatment methods.
 - 8. Description of methods used to adjust moisture content of excavated soil prior to transportation offsite.
 - 9. Proposed location of any pertinent areas to be used in dewatering or moisture control activities.

3.02 Excavation and Earthwork Execution

3.02.1 Excavation

- A. The contractor shall be responsible for excavating materials to the excavation grades and finished grade as specified in the Project Drawings.

3.02.2 PVC Subgrade

- A. The proposed facility PVC subgrade elevations and extents are shown in the plans and will be established by the excavation and grading of the insitu materials. If required or specified, clean fill materials from other borrow sources will be obtained to complete the subgrade construction.
- B. PVC Subgrade construction activities at the site will include stripping existing vegetation, placing and compacting in-situ materials, and proof rolling.
- C. Contouring Fill:
 - 1. In areas where subgrade will be established by excavation, soil and/or ash will be cut to the lines and grades shown on the plans. Excavated materials generated from this process will be used as structural fill. Excavated soil containing ash will not be used as cover material above the liner.
 - 2. Fill material shall be free of residual waste, debris, foreign or deleterious materials. Fill shall not be placed upon frozen surfaces nor shall snow, ice, or frozen earth be incorporated in the fills.
 - 3. Abrupt grade changes shall not be greater than 45 degrees or have creases deeper than one inch.
- D. Compaction of Areas to Receive PVC Liner:
 - 1. All areas to receive fill are to be stripped of topsoil and organic materials. Soil and/or ash fill utilized beneath or to achieve PVC subgrade is to be compacted to a minimum of 90 percent of maximum dry density as determined by the Standard Proctor Test (ASTM D698). The initial "bridging" lift shall be 24 inches thick. Subsequent ash fill is to be placed in lifts no greater than 12 inches (before compaction). The top of the ash subgrade shall be prepared for liner installation by use of a smooth-drum roller.
- E. The materials immediately beneath the liner shall be smooth drum rolled, free of all rocks, stones, sticks, and debris of any kind, with no particles larger than three-eighths of an inch in diameter. Protruding angular, sharp materials are not allowed in the subgrade, regardless of particle size. Where subgrade does not meet this requirement, a minimum of 6 oz. / sq. yd. cushion geotextile may be used beneath the liner with permission from the Owner's Engineer.

F. Proof Rolling:

1. Proof rolling shall be performed with appropriate equipment at the direction of the Owner's Engineer in the presence of the CQA inspector. When specified, the earth foundation, prior to the placement of fill, having been stripped of all vegetation and organic matter, will be scarified. Water will be added, if in the opinion of the Owner's Engineer it is necessary, and then the subgrade will be compacted.
2. The equipment used for proof rolling shall be equipment such as a dump truck loaded with a minimum of six cubic yards of soil or a minimum 15 ton pneumatic-tired roller having not less than four pneumatic wheels. Under working conditions, the roller shall deliver a compression of not less than 150 pounds per square inch (psi) for each tire. Compact the surface of the subgrade to be proof rolled. Proof roll the surface by making a minimum of two coverage's with the proof rolling equipment at a speed not greater than 3 mph. Each succeeding trip of the proof roll equipment shall be offset by not greater than one tire width. Make additional passes over areas of suspected instability. The subgrade shall be considered failed if, under the action of proof rolling, the subgrade yields, pumps, or is otherwise unstable as determined by the Owner's engineer. Remove all failed areas a minimum depth of two feet or as directed by Owner's Engineer and replace with satisfactory fill approved by the Owner's engineer. No fill shall be placed until the subgrade has been accepted by the Owner's Engineer.

3.02.3 Structural Fill

- A. Structural fill shall be required to establish final grades by the placement and compaction of compacted fill materials and aggregate to construct anchor trenches, diversion channels, and other water conveyances.
- B. Excavated material may require moisture conditioning prior to compaction. Moisture conditioning shall include wetting or drying such that the moisture content of the material is relatively uniform throughout the loose lift.
- C. Compacted structural fill shall be spread in uniform loose lifts no greater than 8 inches prior to compaction. Compacted structural fill shall be compacted to a minimum of 95% of the Standard Proctor (ASTM D698).
- D. Aggregates shall be placed in accordance with the Construction Specifications and Project Drawings.
- E. Prior to placement of compacted fill and aggregate, subgrade shall be free of standing or running water, ice, mud, or frozen soil.
- F. Where compacted fill is placed on or against existing slopes steeper than 5H:1V, scarify sloped surface to promote bonding between existing material and newly placed material.

- G. The Contractor shall be responsible for grading fill surfaces to promote positive drainage. Any damage or re-work of fill surfaces due to standing or ponded water shall be the responsibility of the Contractor.
- H. Material shall not be frozen or contain ice crystals when placed.
- I. Finished Grade shall be smooth and free of irregular or significant grade or elevation changes over the graded surface. Finished Grade shall not vary more than ± 3 inches from grades as shown on the Project Drawings.
 - 1. See Section 7 - Seeding and Mulching for preparation of finished grade prior to application of soil amendments and seed.

3.02.4 Cap Protection Layer (Vegetative Cover Soil)

- A. A vegetative layer, consisting of a minimum of 24 inches of soil or an approved alternate will be placed on all cap geocomposite drainage net areas that reach the final lines and grades shown on the plans.
 - 1. The cap erosion layer shall consist of a maximum particles size of 9 inches for the first 18 inches.
 - 2. The cap erosion layer shall consist of a maximum particle size of 3 inches for the top 6 inches.
- B. Cover soil and topsoil shall be compacted by the weight of the grading equipment. Compaction equipment used to compact soils placed directly on geosynthetics shall not have feet or pads that will penetrate the soil layer. The specified fill material shall be placed and spread utilizing vehicles with a low ground pressure (LGP). The compaction of the initial lift placed over PVC must be performed in a manner that does not damage Nonwoven Geotextile or Geocomposite Drainage Net. Unless otherwise specified by the engineer, all equipment for spreading fill material overlying the geotextile shall comply with the following:

Table 3.1 Maximum Ground Pressure and Minimum Thickness for Material Placement on underlying Geosynthetics

Maximum Equipment Ground Pressure (PSI)	Minimum Separation Thickness (FT.)
< 5	1.0
5-10	1.5
10-20	2.0
>20	3.0

- C. The top six inches shall be a vegetative soil layer consisting of a loamy soil (i.e. a sandy loam, sandy clay loam, silt loam, silty clay loam, or clay loam material as classified by the U.S. Department of Agriculture or other soil type that will support vegetation). The

pH of the topsoil shall be 5.0 to 7.5. Lime will be added as necessary to raise the pH of the topsoil to this level should it be less than pH 5.0 when delivered. The top layer of cover soil shall be evaluated and fertilizer application rates shall be recommended by the Owner's Engineer prior to seeding. If the top six inches of soil does not meet the above criteria, the contractor may amend the soil with compost at a rate recommended by the owner's engineer. The compost will be spread evenly, then disked or tracked in.

- D. Seed composition must be submitted to the owners engineer for approval prior to installation.
- E. Grass seed shall be of the previous year's crop and in no case shall the weed seed content exceed 1 percent by weight.
- F. All seed shall bear dealer's tags showing recent tests and an analysis of each type of seed. The clover seed shall be inoculated, if applicable.
- G. The seed shall be delivered premixed. All seed shall comply with State and Federal Seed Laws.
- H. A manufacturer's Certificate of Compliance to the Construction Requirements shall be submitted by the manufacturers with each shipment of each type of seed. These certificates shall include the guaranteed percentages of purity, weed content, and germination.
- I. No seeding shall be done during windy weather or when the ground is frozen or otherwise deemed unsuitable. As soon as the seed is placed, it shall be thoroughly covered with a thin layer of topsoil by harrowing or digging. Hydro-seeding is an acceptable method for placement of seed.
- J. Mulching shall be performed immediately after seeding in accordance with the plans. Sod may be used in lieu of seeding and mulching. The sod shall be grown in the same region as the project.

3.02.5 Dust Control

- A. The Contractor shall be responsible for obtaining a dust control permit if required and shall be responsible for controlling dust caused by the grading operations in compliance with that permit. Water shall be applied uniformly and lightly to prevent muddy, slippery, or other hazardous conditions. The application shall be frequent enough to adequately control the dust nuisance. However, excessive application that would affect compacting operations shall be avoided.

3.02.6 Access and Haul Roads

- A. The Contractor shall be responsible for construction and maintenance of all access and haul roads necessary to complete the work, including any grading, fill placement, excavation, and control of drainage.

- B. The Contractor shall coordinate with the Owner regarding the location and alignment of access and haul roads. The Owner will attempt to grant the Contractor's proposed locations and alignments for access and haul roads but may reject, as necessary, proposed locations and alignments and require the Contractor to adjust the locations and alignments as necessary.
- C. Access and haul roads shall be maintained in a condition that allows the Owner access to all parts of the site in passenger vehicles. For this purpose, the term "passenger vehicles" is defined as Sport Utility Vehicles (SUVs) or pickup trucks which can reasonably traverse mild off-road conditions.

3.02.7 Disposal of Surplus and Waste Materials

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property in accordance to approved removal procedures.

3.03 As-Builts

3.03.1 PVC Subgrade

- A. The contractor shall be responsible for surveying the PVC Subgrade to establish a 100 foot grid plus grade breaks and other permanent features. The owner, owner's engineer, or quality assurance personnel may review the survey submittal prior to progressing with work.

3.03.2 Vegetative Protective Cover

- A. The contractor shall be responsible for surveying the finish grade elevations on the 100 foot grid established in 3.03.1 part A.
- B. The contractor shall be responsible for surveying grade breaks for the finished grade of the protective cover.
- C. The contractor shall be responsible for surveying any other permanent features associated with the vegetative protective cover.

3.03.3 Finish Grade and Permanent Features

- A. The contractor shall be responsible to survey finish grades and permanent features.

Section 4: Geosynthetics

4.01 General

4.01.1 Summary

- A. This section includes a description of the installation of the Nonwoven Geotextile (NWGT), 30 mil PVC, and Geocomposite Drainage Net (GDN) at the Pond 1 site to the dimensions as indicated on the Project Drawings. The purpose of the Geocomposite Drainage Net is to provide the infiltration drainage layer for any precipitation that percolates through the cover soil. Drawings and general provisions of the contract apply to this Section.

4.01.2 Related Requirements

- A. Summary of Work
- B. Erosion and Sediment Control

4.01.3 Storage

- A. Storage of the 30 mil PVC, non-woven geotextile, and geocomposite drainage net rolls shall be the responsibility of the installer. A dedicated storage area shall be selected at the job site that is away from high traffic areas and is level, dry, and well drained.
- B. Rolls that are not equipped with pre-packaging or another protective cover from the manufacturer shall be covered to protect from damage and UV deterioration upon delivery to the site.
- C. Rolls should be stored in a manner that prevents sliding or rolling from the stacks and may be accomplished by the use of chock blocks. Rolls should be stacked at a height no higher than that at which the lifting apparatus can be safely handled (typically no higher than four rolls).
- D. The integrity and legibility of the labels shall be preserved during storage.

4.01.4 Shipping and Handling

- A. The manufacturer assumes responsibility for the initial loading of the 30 mil PVC, non-woven geotextile, and geocomposite drainage net. Shipping will be the responsibility of the party paying the freight. Unloading, on-site handling, and storage of the 30 mil PVC, non-woven geotextile, and geocomposite drainage net are the responsibility of the Contractor, Installer, or other designated party.
- B. A visual inspection of each roll should be made during unloading to identify if any packaging has been damaged. Rolls with damaged packaging should be marked and

set aside for further inspection. The packaging should be repaired prior to being placed in storage.

- C. The party responsible for unloading the 30 mil PVC, non-woven geotextile, and geocomposite drainage net should contact the manufacturer prior to shipment to ascertain the appropriateness of the proposed unloading methods and equipment.

4.01.5 Pre-installation Meetings

- A. Pre-installation Conference: Conduct a conference at the Clinch River Plant prior to the installation of geosynthetics.
- B. The Pre-Installation meeting shall review methods and procedures for geosynthetic installation including, but not limited to, the following:
 - 1. Safety
 - 2. Personnel and equipment needed to make progress and avoid delays.
 - 3. Coordination of Work
 - 4. Field Quality Control

4.02 Nonwoven Geotextile (NWGT)

4.02.1 Materials

- A. The contractor shall furnish 6 oz./sy non-woven geotextile and 12 oz. non-woven geotextile material as required by the Project Drawings. Geotextile manufacturer quality control certificates and mill certificates for the geotextile shall meet the requirements outline in Table 4.1

Table 4.1 - Nonwoven Geotextile Manufacturer Quality Control Data

Property	Test Method	Frequency	Units	Value	
Mass per Unit Area	ASTM D5261	Per Lot	oz/sy	6	12
AOS (MaxARV)	ASTM D4751	Per Lot	mm	0.22	N/A
Permittivity	ASTM D4491	Per Lot	sec ⁻¹	0.4	N/A
Grab Tensile Strength	ASTM D4632	Per Lot	lbs	160	300
Trapezoid Tear	ASTM D4533	Per Lot	lbs	60	115
Puncture (pin) Strength	ASTM D4833	Per Lot	lbs	60	140
CBR Puncture Strength	ASTM D6241	Per Lot	lbs	320	800
UV Resistance (MIN) @ 500 Hours	ASTM D4355	Per Formulation	1 / Formulation	70	70

4.02.2 References

- A. ASTM D4355 “Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water”
- B. ASTM D4491 “Standard Test Method for Water Permeability of Geotextiles by Permittivity Method”
- C. ASTM D4533 “Standard Test Method for Trapezoid Tearing Strength of Geotextiles”
- D. ASTM D4632 “Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method)”
- E. ASTM D4751 “Standard Test Method for Determining Apparent Opening Size (AOS) of a Geotextile”
- F. ASTM D4833 “Standard Practice for Determining Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products”
- G. ASTM D5261 “Standard Test Method for Measuring Mass per Unit Area of Geotextiles”
- H. ASTM D6241 “Standard Test Method for the Static Puncture of Geotextiles and Related Products”

4.02.3 Submittals

- A. The contractor shall submit mill certificates and manufacturer quality control data sheets prior to the delivery of geotextile for review by the Quality Assurance Officer. Mill certificates and manufacturer quality control data sheets shall conform to the values specified in Table 4.1.

4.02.4 Installation

- A. Equipment and tools used to deploy and install geotextile will not puncture, tear, or otherwise damage the material and shall not damage the adjacent 30 mil PVC geomembrane.
- B. Geotextile shall be unrolled and placed in such a manner as to minimize dragging of panels into position.
- C. Geotextile shall be placed as such that the “upstream” panel overlaps the “downstream” panel in order to minimize the possibility of lifting panel edges during placement of covering material.
- D. The geotextile shall be rolled down-slope in such a manner as to continuously keep the geotextile in tension by self-weight. To resist sliding, the geotextile shall be securely anchored in an anchor trench, where applicable, or by other approved methods by the

Owner's Engineer. Anchor trench compacting equipment shall not come in direct contact with the geotextile.

- E. If necessary, the geotextile shall be positioned by hand after being unrolled to minimize wrinkles.
- F. Each component of the geotextile shall be secured or seamed to the like component at overlaps per the manufactures recommendations or methods approved by the owner's engineer. Geotextile shall be overlapped a minimum of 6 inches.

4.03 30 mil PVC Geomembrane

4.03.1 Material

- A. The contractor shall furnish 30 mil PVC geomembrane that complies with the minimum requirements specified in ASTM D7176.

4.03.2 References

- A. ASTM D4437 "Standard Specification for Determining the Integrity of Seams Used in Joining Flexible Polymeric Sheet Geomembranes"
- B. ASTM D6392 "Standard Test Method for Determining the Integrity of Non-reinforced Geomembrane Seams Produced Using Thermo-Fusion Welds"
- C. ASTM D7176 "Standard Specification for Non-Reinforced PVC Geomembranes Used in Buried Applications"
- D. ASTM D7177 "Standard Specification for Air Channel Evaluation of PVC Dual Track Seamed Geomembranes"

4.03.3 Submittals

- A. The contractor shall submit mill certificates and manufacturer quality control data sheets prior to the delivery of 30 mil PVC for review by the Quality Assurance Officer. Mill certificates and manufacturer quality control data sheets shall conform to the values specified in ASTM D7176.
- B. The contractor shall submit a letter provided from the Manufacturer that all factory welds/seams have been non-destructively tested in accordance with ASTM D4437. Results of seam non-destructive testing shall be submitted with the manufacturer's quality control data sheets.
- C. A Conceptual description or design of the proposed plan for placement of 30 mil PVC.
- D. At the Engineer's or Owner's request the Contractor shall furnish a representative sample of 30 mil PVC.

4.03.4 Installation

- A. No PVC shall be installed until the QA Officer has reviewed all certifications and supporting test data and determined that the PVC furnished for the project is acceptable for use.
- B. Installation of the PVC liner involves the placement of the liner panels, field seaming of adjacent panels together, anchoring of the liner perimeter in trenches, and liner attachment to penetrations.
- C. Liner shall only be placed on subgrade that has been installed in accordance with the Construction Requirements and has been accepted by the Contractor and the QA Officer. Once the subgrade has been accepted by the QA Officer, any additional surface preparation that the Contractor feels necessary to meet the requirements of the construction requirements shall be the responsibility of the Contractor.
- D. Liner placement shall not proceed at an ambient temperature below 40°F or above 104°F unless otherwise approved by the Owner's Engineer. Liner placement shall not be done during any precipitation, in the presence of excessive moisture, in an area of ponded water, or in the presence of excessive wind.
- E. When seaming by thermal fusion (i.e., using a hot wedge or hot air welder), each seaming apparatus shall be tested by constructing and testing field test seams for peel and shear at the beginning of each seaming period and at least once every six-hours thereafter for each seaming crew used each day. When seaming by chemical fusion or adhesion, no seaming apparatus is used and; therefore, field test seams are not applicable and shall not be constructed.
- F. The contractor shall provide equipment to non-destructively test field seams and repairs in accordance with ASTM D4437 or ASTM D7177 over the full seam length. All areas where the seam is discontinuous shall be marked for repair, repaired by patching, and retested.
- G. Destructive seam testing and sampling for laboratory peel and shear testing shall be performed at the frequencies specified in the Quality Assurance plan. The cut-out sections shall be 12 inches wide by 40 inches long with the seam centered length-wise. All holes in the geomembrane resulting from sampling shall be immediately repaired by patching and non-destructively tested.
- H. The Contractor shall ensure that the entire surface of each panel is free of tears, punctures, etc. Any defects shall be repaired.
- I. Geomembrane panels and seams that have damage, defects, or are non-compliant with the Construction Requirements shall be repaired. Repair methods shall include:
 - 1. Patching: For repair of surface defects, small tears, punctures, destructive sampling locations, etc. Patches shall have a minimum size of 12 inches by 12 inches, extend at least 6 inches beyond the edge(s) of a defect, and have rounded corners.

2. Reconstruction: For repair of lengths of unacceptable seams. Performed by cutting and removing the unacceptable seam segment and replacing it with new geomembrane that is seamed into place.
 3. Cap Stripping: For repair of lengths (segments) of unacceptable seams in lieu of reconstruction. Cap strips shall extend at least 12 inches beyond the edge(s) of an unsuitable seam and have rounded corners.
- J. The Contractor shall properly anchor the liner to ensure that the liner does not shift during seaming.
- K. Rubber-tired ATV's are acceptable directly above the liner system if wheel contact is less than 6 psi. Small rubber tired equipment i.e., air compressors, generators, etc. that would be required during installation and testing are acceptable.
- L. The Contractor shall properly seam each panel and ensure that each panel is free from dirt, dust, and moisture and that damage does not occur during the seaming process.

4.04 Geocomposite Drainage Net

4.04.1 Material

- A. The Geocomposite Drainage Net (GDN) will consist of a highly density polyethylene (HDPE) geonet with nonwoven geotextiles (NWGT) heat-bonded to its upper and lower surfaces. Geocomposite drainage net manufacturer quality control data for the geocomposite drainage net shall meet the requirements outline in Table 4.2.

Table 4.2 Geocomposite Drainage Net Manufacturer Quality Control Data

Property	Test Method	Frequency	Units	Value
Nonwoven Geotextile (Top and Bottom)				
Mass per Unit Area	ASTM D5261	Per Lot	oz./sy	8.0 (MARV)
HDPE Geonet				
Thickness	ASTM D5199	Per Lot	mil	250
Finished Geocomposite Drainage Net				
Transmissivity	ASTM D4716	Per Lot	m ² /sec	5x10 ⁻⁴
Ply Adhesion	ASTM D7005	Per Lot	lb./in	1

4.04.2 References

- A. ASTM D4716 "Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head"

- B. ASTM D5199 "Standard Test Method for Measuring Nominal thickness of Geotextiles, Geomembranes, and Related Products"
- C. ASTM D5261 "Standard Test Method for Measuring Mass per Unit Area of Geotextiles"

4.04.3 Submittals

- A. The contractor shall submit mill certificates and manufacturer quality control data sheets prior to the delivery of geocomposite drainage net for review by the Quality Assurance Officer. Mill certificates and manufacturer quality control data sheets shall conform to the values specified in Table 4.2.

4.04.4 Geocomposite Drainage Net (GDN)

- A. No geocomposite drainage net shall be installed until the QA Officer has reviewed all certifications and supporting test data and determined that the geocomposite drainage net furnished for the project is acceptable for use.
- B. Equipment and tools used to deploy and place geocomposite drainage net will not puncture, tear, or otherwise damage the geocomposite drainage net and shall protect the underlying geomembrane from damage.
- C. Geocomposite drainage net shall be unrolled and placed in such a manner as to minimize dragging of panels into position.
- D. Geocomposite drainage net shall be placed as such that the "downstream" panel overlaps the "upstream" panel in order to minimize the possibility of lifting panel edges during placement of covering material and offsetting all panel seams parallel to the toe of a slope ("longitudinal seams") a minimum of 10 feet from the toe of the slope.
- E. The geocomposite drainage net shall be rolled down the slope in such a manner as to continuously keep the geocomposite in tension by self-weight. To resist sliding, the geocomposite drainage net shall be securely anchored in an anchor trench where applicable or by other approved methods by the Owner's Engineer. Anchor trench compacting equipment shall not come in direct contact with the geocomposite drainage net.
- F. In the presence of wind, geocomposite drainage net shall be weighted by sandbags or approved equivalent. Such anchors shall be installed during placement and shall remain in place until replaced with cover material.
- G. If necessary, the geocomposite drainage net shall be positioned by hand after being unrolled to minimize wrinkles.
- H. Rubber-tired ATV's are acceptable if wheel contact is less than 6 psi on the liner system. Small rubber tired equipment i.e., air compressors, generators, etc. that would be required during installation and testing are acceptable.

- I. Each component of the geocomposite drainage net shall be secured or seamed to the like component at overlaps per the manufactures recommendations. "Butt" seams shall have a 24-inch overlap with ties spaced every 6 inches. Panel overlaps shall be three to six inches with ties spaced every 5 feet. Cover geotextile shall be mechanically seamed.
- J. No geocomposite drainage net shall be covered with protective cover until it has been accepted by the QA Officer. Once accepted by the QA Officer, geocomposite drainage net shall be covered as soon as possible in accordance with the construction specifications.

4.05 Geosynthetic As-Builts

4.05.1 30 mil PVC As-Built

- A. The contractor shall be responsible for surveying the extents of the installed 30 mil PVC.
- B. The contractor shall be responsible for producing a panel layout drawing that will include the following:
 - 1. Panel Layout
 - 2. Panel Seams
 - 3. Repairs
 - 4. Destructive Test Locations
 - 5. Other permanent features such as pipe penetrations, anchor trenches, etc.
- C. All as-built survey drawings shall be stamped and signed by a professional surveyor, licensed in the Commonwealth of Virginia.

5.05.2 Geocomposite Drainage Net As-Built

- A. The contractor shall be responsible for surveying the extents of the installed Geocomposite Drainage Net (GDN).
- B. The contractor shall be responsible for surveying a 100 ft. grid at the top elevation of the geocomposite drainage net.
- C. All as-built survey drawings shall be stamped and signed by a professional surveyor, licensed in the Commonwealth of Virginia.

Section 5: Riprap

5.01 General

5.01.1 Summary

- A. The contractor shall furnish and place riprap materials in accordance with these Construction Specifications and the Project Drawings. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.
- B. Related Sections
 - 1. Excavation and Earthwork
 - 2. Geosynthetics
 - 3. Erosion and Sediment Controls

5.01.2 References

- A. Virginia Department of Transportation (VDOT) Road and Bridge Specification
- B. Virginia Department of Transportation (VDOT) Drainage Manual
- C. Virginia Department of Environmental Quality (VDEQ) Virginia Erosion and Sediment Control Handbook
- D. ASTM D6825 "Standard Guide for Placement of Riprap Revetment"

5.01.3 Submittals

- A. Submit the following to the Owner's Engineer for review and approval prior to shipment of products to the site:
 - 1. Written documentation and certification (including gradation test results) signed by the material producer, indicating that the riprap meets or exceeds the specified requirements.
 - 2. Submit the name and location of the proposed riprap source and documentation that the product meets the requirements of the Construction Requirements. The proposed riprap source must be reviewed and approved by the Owner prior delivery of product to the site.
 - 3. Submit a mix design for the proposed 2500 psi grout used for the grouted riprap.

5.02 Materials

5.02.1 Riprap

- A. Class A1 Riprap shall be defined as sound stone or rock fragments imported to the site from a commercial quarry meeting requirements of the VDEQ Erosion and Sediment Control Handbook. Demolished concrete shall not be accepted as imported Class A1 Riprap.
- B. Class I Riprap shall be defined as sound stone or rock fragments imported to the site from a commercial quarry meeting the requirements of the VDEQ Erosion and Sediment Control Handbook. Demolished concrete shall not be accepted as imported Class I Riprap.
- C. Class II Riprap shall be defined as sound stone or rock fragments imported to the site from a commercial quarry meeting the requirements of the VDEQ Erosion and Sediment Control Handbook. Demolished concrete shall not be accepted as Class II Riprap.

5.02.2 Grout (Grouted Riprap)

- A. Grout shall have the following properties:
 - 1. Minimum compressive strength of 2500 PSI at 28 days.
 - 2. Entrained air should be 5.5% to 7.5%.
 - 3. A maximum of 25% Type F Fly Ash may be substituted for Portland cement.
 - 4. 1.5 lbs. of fiber mesh shall be included per cubic yard of grout.
- B. Class II riprap as defined in 5.02.1, part C, shall be used in grouted riprap applications.

5.02.3 VDOT 357 Aggregate

- A. VDOT 357 aggregate placed for riprap applications shall meet the requirements of the 2007 VDOT Road and Bridge Specifications.

5.02.4 Contractor's Responsibility

- A. The Contractor shall be solely responsible for providing materials that meet the Construction Requirements. Materials delivered to the site not meeting the specified requirements shall be removed from the site at the Contractor's expense and replaced with materials meeting the requirements of the Construction Requirements.

5.03 Riprap Placement and Execution

5.03.1 Preparation of Subgrade

- A. Prior to placing riprap, the subgrade shall be excavated, graded and compacted to the lines and grades required for placement of riprap to the depth indicated on the Drawings.

5.03.2 Placement of Filter Layer Materials

- A. VDOT 357 aggregate shall be placed prior to the placement of riprap and grouted riprap in channels.

5.03.3 Placement of Riprap

- A. Foundation or toe trenches and other necessary excavation shall be completed and approved by the engineer before the placement of riprap. Slopes to be protected with riprap shall be free of brush, trees, stumps, and other objectionable material and shall be dressed to a reasonably smooth surface. Placement of stone should follow the procedures outlined in ASTM D6825.
- B. The riprap shall be handled or placed as to secure a mass of the thickness, height, and length as shown on the construction drawings with minimum voids.
- C. The rock shall be manipulated sufficiently by means of a bulldozer, excavator, rock tongs, or other suitable equipment to secure a reasonably regular surface and mass stability. Riprap and rock should be placed in a manner which will produce an interlocked, well-graded mass of rock with minimum voids and well distributed large rocks.
- D. Riprap protection shall be placed to its full course thickness at one operation and in such a manner as to avoid damaging the filter cloth or displacing the underlying material. Placement of riprap protection in layers or by dumping into chutes or by similar methods likely to cause segregation will not be permitted. Placement should begin at the bottom of the area to be covered and continue up the slope.
- E. All aggregate shall be placed and distributed that there will be no large accumulation or area composed of either the larger or small sizes of rock.
- F. Unless otherwise authorized, the riprap protection shall be placed in conjunction with the construction of the embankment. Sufficient lag in construction of the riprap protection may be necessary to place filter cloth to prevent mixture of embankment and riprap material.
- G. Place riprap at locations shown on the project drawings in conformance with the dimensions and thicknesses specified.

- H. Riprap shall be placed within a tolerance of 4 inches of the lines and grades shown on Project Drawings.

5.03.4 Placement of Grouted Riprap

- A. Prior to placement of grout, any type of debris, fines, smaller rock, silt, or deleterious materials shall be removed from around or under the boulders.
- B. Dewatering shall be implemented to guarantee that the grout will not be placed directly in water or in contact with water for a period of twenty-four (24) hours after the grout has been placed.
- C. Immediately before pouring the grout, the riprap shall be wetted by sprinkling. The grout shall be carefully poured into the voids between the stones. This work shall begin at the lower portions of the riprap and progress upward. The entire bottom line of voids shall be filled with grout before the next line of voids above is poured.
- D. The grout should be placed by injection methods by pumping under low pressure through a two-inch (2") maximum diameter hose to ensure complete penetration of the grout into the void area as detailed on the Construction Drawings. If necessary, the grout mix shall be stiffened and other measures taken to retain the grout between the boulders.
- E. A "pencil" vibrator shall be used to make sure all voids are filled between the boulders from the subgrade and around the boulders to a depth as shown on the construction drawings. The "pencil" vibrator may be used to smooth the appearance of the surface, but the contractor should use a wood float to smooth and grade the grout around the boulders.
- F. Clean and wash any spillage before the grout sets so the visual surfaces of boulders will be free of grout to provide a clean, natural appearance.

5.04 Riprap As-Builts

5.04.1 Finish Grade and Permeant Features

- A. The contractor shall be responsible to survey finish grades and permanent features.
- B. All as-built survey drawings shall be stamped and signed by a professional surveyor, licensed in the Commonwealth of Virginia.

Section 6: Concrete

6.01 General

6.01.1 Summary

- A. The contractor shall furnish and place concrete in accordance with these Construction Specifications and the Project Drawings. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.
- B. Related Sections
 - 1. Excavation and Earthwork
 - 2. Section Erosion and Sediment Controls

6.01.2 References

- A. Virginia Department of Transportation (VDOT) Road and Bridge Specification
- B. ASTM C94 Standard Specification for Ready Mix Concrete

6.01.3 Submittals

- A. Submit the concrete mix design to the Owner's Engineer for review and approval prior to placement of concrete.

6.02 Materials

6.02.1 Concrete

- A. VDOT A4 concrete mix shall be required for concrete related work. Ready Mix concrete shall have a compressive strength of 4000 psi at 28 days. Concrete shall meet the requirements specified in Table 6.1 and the 2007 VDOT Road and Bridge Specifications.

6.03 Concrete Placement and Execution

6.03.1 Preparation of Subgrade

- A. Prior to placing concrete, the subgrade shall be excavated, graded, and compacted to the lines and grades required for placement of concrete to the depth indicated on the Project Drawings.

6.03.2 Batching, Mixing, and Transporting

- A. Concrete shall be batched at a National Ready Mix Association certified batch plant or a batch plant approved by the owner's engineer.
- B. Concrete shall be mixed in accordance to ASTM C94.
- C. Concrete shall be transported to the point of placement without significantly altering the concrete's desired properties associated with water-cement ratio, slump, air content, and homogeneity.

6.03.3 Preparation for Placing

- A. Concrete shall not be placed until all formwork, embedded items, steel reinforcement, foundation surfaces, and joints involved in the placing have been approved by quality assurance inspectors.
- B. Concrete shall not be placed in water or allow water from precipitation or other means to alter the desired properties of the concrete.
- C. Immediately prior to placing concrete, the surface shall be free from water, mud, debris, frost, ice, or any other undesirable materials that may alter the desired properties of the concrete.

6.03.4 Formwork

- A. The contractor must construct formwork to have sufficient strength to withstand pressure resulting from the placement and vibration of the concrete and shall be maintained rigidly in position so that formed surfaces conform to the dimensions specified in the Project Drawings.
- B. One inch chamfer strips shall be placed in the exposed exterior corners.
- C. Forms must be removed carefully so as not to damage the concrete. The removal of forms may be started as soon as the concrete has attained sufficient strength to support its own weight or any associated live loads.
- D. Falsework or shores use to support horizontal member shall not be removed until the concrete has attained 2/3 of its compressive strength, unless approved by the owner's engineer.

6.03.5 Joints

- A. Construction joints, expansion joints, and control joints shall be provided at the locations as specified in the Project Drawings.

6.03.6 Waterstops

- A. All waterstops must be placed so as to ensure a continuous watertight seal with all joints or connections.
- B. The waterstops shall be embedded so that one-half (1/2) of their width is on each side of the joint.

6.03.7 Placement

- A. Concrete shall be tested for consistency, air entrainment, and temperature prior to placement. Concrete shall meet requirements set forth in Table 6.1 and the 2007 VDOT Road and Bridge Specifications.
- B. Concrete shall be deposited as nearly as practicable directly in its final position and shall not be made to flow so as to cause separation of the coarse aggregate, paste, or water from the concrete mass.
- C. Formed concrete shall be spaced in near horizontal layers not to exceed 20 inches.
- D. Concrete cold joints will shall be avoided. In the event of a cold joint, concrete shall be consolidated to a reasonably uniform and stable joint surface while the concrete is still plastic. The concrete at the surface of the cold joint shall be cleaned and dampened as required for construction joints.
- E. All concrete shall be consolidated by internal vibration to the maximum practicable density so that it is free of pockets of coarse aggregate and trapped air and closes snugly against the subgrade and all surfaces of forms and embedded materials. Each layer shall be consolidated as it is placed.

6.03.8 Finishing and Curing

- A. Finishing of concrete shall be performed by skilled workmen.
- B. A floated finish shall be required for unformed surface not permanently concealed by fill materials.
- C. A screed finish shall be required for unformed surfaces that will be covered by fill material or concrete.
- D. For formed surface not permanently concealed by fill material or concrete, surface irregularities shall not exceed one-quarter inch for abrupt irregularities in the direction of the flow and one-eighth inch in other directions. Gradual irregularities shall not exceed one-quarter inch in any direction.
- E. The contractor will be responsible for protecting concrete from loss of moisture, excessively high or low temperatures, or any other event that may alter the desired concrete properties unless approved by the Owner's Engineer.

Table 6.1 Requirements for Hydraulic Cement Concrete

Requirement	Value / Type
Design Compressive Strength at 28 Days (f'c)(PSI)	4000
Aggregate Size No.	57
Nominal Maximum Aggregate Size (in)	1
Minimum Grade Aggregate	A
Minimum Cement Content (lb./cy)	635
Maximum Water (lb. water / lb. cement)	0.45
Consistency (in. of Slump)	2-4
Air Content (%)	6.5 +/- 1.5

6.04 Concrete As-Builts

6.04.1 Finish Grade and Permeant Features

- A. The contractor shall be responsible to survey finish grades and permanent features.
- B. All as-built survey drawings shall be stamped and signed by a professional surveyor, licensed in the Commonwealth of Virginia.

Section 7: Seeding and Mulching

7.01 General

7.01.1 Summary

- A. Includes preparation of subgrade or finished grades, seeding, application of fertilizer and other soil amendment associated with establishing temporary and permanent grass cover for areas of the site disturbed during construction operations. Related documents include the Project Drawings and the general provisions of the contract, including General and Supplementary Conditions.
- B. Related Requirements:
 - 1. Summary of Work
 - 2. Erosion and Sediment Controls

7.01.2 Definitions

- A. Finished Grade: Elevation of finished surface of planting soil.
- B. Weeds: Vegetative species other than specified species to be established in a given area.
- C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- D. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- E. Subgrade: The surface or elevation of sub-soil remaining after excavation is complete or the top surface of a fill or backfill before geosynthetics or planting soil is placed.

7.01.3 References

- A. VDEQ Erosion and Sediment Control Handbook, Section 3.32 "Permanent Seeding".

7.01.4 Submittals

- A. Prior to seeding, the Contractor shall submit a soil test(s) from an Owner approved laboratory that defines recommendations regarding soil amendments required to achieve optimal vegetative growth. The Contractor shall consult with the Owner regarding test sample locations prior to sampling the soil to be tested.

- B. Prior to or at the time of seeding, the Contractor shall submit the following to the Owner:
 - 1. Certification of grass seed from the seed vendor for each grass seed mixture stating the botanical and common name and percentage by weight of each species and variety of seed.
 - 2. Manufacturer's certification for agricultural lime and fertilizer showing compliance with the specifications.
 - 3. Tags, receipts, truck weight tickets, coverage area, and other information necessary to confirm application rates and types for all seed, agricultural lime, and fertilizer.

7.01.5 Closeout Submittals

- A. Operation and Maintenance Data: Include maintenance instructions, cutting methods, maximum grass height, and application frequency and recommended coverage of fertilizer. Recommended procedures are to be established by the Owner for maintenance of the vegetative cover system and grasses during a calendar year.

7.01.6 Delivery, Storage, and Handling

- A. Delivery, storage, and handling shall be per the manufacturer's instruction.
- B. The delivery, storage, and handling process shall not alter the properties of the seeding and mulching materials.
- C. The delivery, storage, and handling process shall not harm the surrounding environment.

7.02 Materials

7.02.1 Seed

- A. Seed Mixture: As specified on Drawings.
- B. Permanent Seed Mixture: As specified on Drawings.
- C. Seed Mixture shall be in accordance with the VDEQ Erosion and Sediment Control Manual Standard Specification 3.32 "Permanent Seeding".

7.02.2 Mulch

- A. Mulch shall be straw such as stalks of oats, wheat, rye, or other approved crops which are free from noxious weeds. Weight of straw shall be calculated on the basis of the material having not more than 15 percent moisture content.
- B. Hydro-Mulch Overspray Tackifier shall be the same as, or equal to, a recycled slick paper (containing wood cellulose and kaolinite clay), shall not contain any growth or germination-inhibiting factors, and shall be dyed an appropriate color to facilitate visual

metering during application. Slick paper composition on air-dry weight basis: 8 percent moisture maximum, pH 4.5 – 6.5. When added to water, it shall form a homogenous slurry specifically for use in hydraulic mulching equipment. This material, when sprayed on the straw mulch, becomes a tackifier/binder and provides a stable bed for seed germination. Hydraulic seeding shall not be performed within 100 feet of open bodies of water, wetlands, jurisdictional waters, or identified environmental boundaries.

7.02.3 Fertilizer

- A. Fertilizer shall be a standard commercial fertilizer furnished in unopened bags with the weight and contents clearly defined on the bag or attached tag. The fertilizer shall contain the percentage of nutrients specified by the soils report.
- B. The Contractor may propose alternative forms of fertilization but shall not utilize the alternatives until approved by the Owner Engineers.

7.03 Execution

7.03.1 Dates for Seeding

- A. Temporary seeding shall be performed at a timing and frequency as specified by VDEQ Erosion and Sediment Control Handbook.

7.03.2 Preparation, Placement, and Execution

- A. Finished grades or other soil surfaces to receive seed and soil amendments shall be prepared in general accordance with VDEQ Standard Specification 3.32 "Permanent Seeding".
- B. Prior to seeding operations, slopes steeper than 5H:1V shall be roughened with tracked equipment moving up and down the slope in a direction perpendicular to the slope.

7.03.3 Maintenance and Acceptance

- A. The Contractor shall be required to maintain seeded areas until such time as a healthy stand of vegetation is established and the erosion and sediment control permit is closed by VDEQ. If allowed by VDEQ and the Owner, the site may be closed in parts as vegetation is established.

Section 8: Erosion and Sediment Control

8.01 General

8.01.1 Summary

- A. The Contractor shall implement and maintain best management practices (BMP's) and perform other required activities as indicated on the Erosion, Sedimentation, and Pollution Control Plan, which is included as a part of the Drawings. This section shall be considered as supplementary to the requirements presented in the approved Erosion, Sedimentation, and Pollution Control Plan. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

- B. Related Requirements
 - 1. Summary of Work
 - 2. Excavation and Earthwork
 - 3. Geotextiles
 - 4. Riprap
 - 5. Seeding Mulching

8.01.2 References

- A. Virginia Department of Environment Quality (VDEQ) "Erosion and Sediment Control Handbook" (Handbook)

- B. Virginia Department of Transportation (VDOT) Drainage Manual Chapter 10 "Erosion and Sediment Control"

8.02 Materials

8.02.1 Erosion and Sediment Control (ESC) Materials and Products

- A. Furnish materials for erosion, sedimentation, and pollution controls in accordance to the applicable requirements of the VDEQ Erosion and Sediment Control Handbook.

8.03 Execution and Procedures

8.03.1 General Procedures

- A. ESC measures shall be installed prior to land disturbance at the site per the requirements of the approved VDEQ erosion and sediment control permit.

- B. Disturbance limits are provided on the Project Drawings. The Contractor shall not disturb any areas outside the limits shown without prior written authorization from the Owner.

8.03.2 Inspection and Maintenance

- A. Temporary erosion, sedimentation, and pollution controls shall be inspected and maintained as indicated in accordance with the erosion and sediment control permit.

8.03.3 Removal of Temporary Controls

- A. Remove temporary sediment fencing and skimmers at the completion of the project when approved by the Owner and Engineer. The areas upgradient from the sediment fencing shall be sufficiently stabilized with permanent controls as specified prior to the removal of temporary controls.

Section 9: Collection Channels and Underground Piping

9.01 General

9.01.1 Summary

- A. The contractor shall furnish and place materials associated with piping systems in accordance with these Construction Specifications and the Project Drawings. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.
- B. Related Sections
 - 1. Excavation and Earthwork
 - 2. Geosynthetics
 - 3. Erosion and Sediment Controls

9.01.2 Submittals

- A. Submit to the Engineer, for review and approval prior to shipment of products to the site, the manufacturer installation specifications and/or instructions.

9.02 Materials

9.02.1 6-Inch Schedule 80 PVC Perforated Pipe

- A. Perforate Pipe shall be schedule 80 PVC Pipe and have an inner diameter of 6 inches with three eighths inch perforations. Perforations shall be spaced as specified on the Project Drawings.
- B. All pipe fittings, elbows, couplings, cleanouts, adhesive, etc. shall be considered incidental to the pipe system as a whole unit.

9.02.2 8" High Density Polyethylene (HDPE) Pipe

All HDPE pipe shall have smooth inner walls. Pipe shall be pressure tested for leaks prior to backfill. All pipe fittings, elbows, couplings, cleanouts, adhesive, etc. shall be considered incidental to the pipe system as a whole unit.

9.02.3 48" High Density Polyethylene (HDPE) Pipe

All HDPE pipe shall have smooth inner walls. Pipe shall be pressure tested for leaks prior to backfill. All pipe fittings, elbows, couplings, cleanouts, adhesive, etc. shall be considered incidental to the pipe system as a whole unit.

9.03 Pond 1A Central Collection Channel Installation and Execution

9.03.1 Preparation of Subgrade

- A. The subgrade shall be excavated, graded, and compacted to the lines and grades required for placement of pipe as indicated on the Project Drawings.

9.03.2 Placement of Underlying Geosynthetic Materials

- A. Geosynthetics shall be installed in accordance to Section 4 and the Project Drawings prior to the Central Collection Channel construction activity.

9.03.3 Perforated Pipe Placement and Installation

- A. Installation of pipe shall only proceed only after the trench has been dewatered.
- B. Perforated pipe shall be handled and placed using appropriate equipment to prevent damage to the pipe. To avoid damage, the pipe should not be dropped. When using equipment to unload or move the pipe, a fork extension can be used. Chains or wire ropes shall not be used to lift the pipe. The use of nylon slings or straps is acceptable. If slings are used, pipe shall be picked up from two or more places on the pipe. Any damage sections shall be removed and replaced.
- C. Perforated pipe shall be placed to the design lines and grades specified by the project specifications. All laid pipe shall be retained in position to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe.
- D. Perforated pipe shall be field jointed in accordance to the Manufacturer's specifications or instructions.

9.03.4 Bedding and Drainage Aggregate

- A. Drainage stone shall be placed to the required thickness specified in the Project Drawings.
- B. VDOT #8 aggregate shall be used as drainage aggregate and bedding for perforated pipe.
- C. Drainage Aggregate shall be placed uniformly without damaging the perforated pipe.

9.03.5 12 oz. Nonwoven Geotextile

- A. 12 oz. nonwoven geotextile shall conform to the requirements specified in Section 4.02.
- B. 12 oz. nonwoven geotextile deployed as required by the Project Drawings. Nonwoven geotextile shall be secured to adjacent nonwoven geotextile panels and double sided geocomposite drainage net by methods of heat bonding.

9.04 Pond 1B Subsurface Collection Drain Installation and Execution

9.04.1 Preparation of Subgrade

- A. The subgrade shall be excavated, graded and compacted to the lines and grades required for placement of geosynthetics as indicated in Section 3.02.2 and the Project Drawings. The contractor shall be responsible for all surveying to establish line and grade of the pipe system.

9.04.2 Placement of Underlying Geosynthetic Materials

- A. Geosynthetics shall be installed in accordance to Section 4 and Project Drawings prior to the Central Collection Channel construction activity.

9.04.3 Perforated Pipe Placement and Installation

- A. Perforated pipe shall be handled and placed using appropriate equipment to prevent damage to the pipe. To avoid damage, the pipe should not be dropped. When using equipment to unload or move the pipe, a fork extension can be used. Chains or wire ropes shall not be used to lift the pipe. The use of nylon slings or straps is acceptable. If slings are used, pipe shall be picked up from two or more places on the pipe. Any damaged sections shall be removed and replaced.
- B. Perforated pipe shall be placed to the design lines and grades specified by the Project Specifications. All laid pipe shall be retained in position to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe.
- C. Perforated pipe shall be connected and secured in accordance to the manufacturer's specifications.

9.04.4 Backfill and Drainage Aggregate

- A. Drainage stone shall be placed to the required thickness specified in the Project Drawings.
- B. VDOT #8 aggregate shall be used as drainage aggregate around all perforated pipe.
- C. Drainage Aggregate shall be placed uniformly without damaging the perforated pipe.

9.04.5 12 oz. Nonwoven Geotextile

- A. 12 oz. nonwoven geotextile shall conform to the requirements specified in Section 4.02.
- B. 12 oz. nonwoven geotextile shall be deployed as required by the Project Drawings. Nonwoven geotextile shall be secured to adjacent nonwoven geotextile panels and double sided geocomposite drainage net by methods of heat bonding.

9.05 HDPE Pipe Installation and Execution

9.05.1 Preparation of Subgrade

- A. The subgrade shall be excavated, graded, and compacted to the lines and grades as required in Section 3.02.2 and Project Drawings.

9.05.2 Installation

- A. The contractor shall only proceed with installation after the trench has been dewatered and properly shored to prevent collapse.
- B. The pipe shall be installed to the lines and grades shown on the Project Drawings. Pipes shall be laid with straight alignments and at a continuous slope. No breaks are allowed except at manholes and at turns in laterals where a clean out for the downstream lateral has been provided.
- C. All laid pipe shall be retained in position to maintain alignment until sufficient backfill has been completed to adequately hold the pipe in place.
- D. All HDPE pipe joints shall be welded by heat fusion methods to the manufacturer's welding requirements.
- E. HDPE pipe cleanouts shall be installed at the stations indicated on the Project Drawings. The HDPE cleanout stand pipes shall be secure by a saddle weld. Cleanout stand pipes shall be cut flush to the ground with installed water tight removable cap.
- F. Backfill shall consist of soil or crushed aggregate placed and compacted in accordance to Section 3.02.3 Structural Fill. Acceptable crushed aggregate pipe backfill will include the following Virginia Department of Transportation (VDOT) gradation classifications:
 - 1. VDOT Number 25
 - 2. VDOT Number 26
 - 3. VDOT Number 21A
 - 4. VDOT Number 21B
- G. Backfill and compaction shall be advanced simultaneously on both sides of the pipe.

9.05.3 Acceptance Testing

- A. The contractor shall be responsible for acceptance testing performed in accordance to the manufacturer's recommendations or methods approved by the Owner's Engineer.

9.06 Collection Channel and Underground Piping As-Builts

9.06.1 Finish Grade and Permeant Features

- A. The contractor shall be responsible for surveying finished grades and permanent features.
- B. All as-built survey drawings shall be stamped and signed by a professional surveyor, licensed in the Commonwealth of Virginia.

Section 10: Gabion Mattresses

10.01 General

10.01.1 Summary

- A. The contractor shall furnish and place materials associated with the Gabion Mattresses in accordance with these Construction Requirements and the Project Drawings. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this section.
- B. Related Sections
 - 1. Excavation and Earthwork
 - 2. Erosion and Sediment Controls

10.01.2 Submittals

- A. Submit to the Engineer, for review and approval prior to shipment of products to the site, the manufacturer installation specifications.
- B. Submit the name and location of the proposed basket fill aggregate source and documentation that the product meets the requirements of the Project Drawings and manufacturer's installation specifications. The proposed fill stone source must be reviewed and approved by the Owner's Engineer prior delivery of product to the site.

10.02 Materials

10.02.1 Galvanized Gabion Mattresses

- A. Maccaferri (or approved equal) galvanized gabion mattresses shall be manufactured in accordance with the Project Drawings.

10.02.2 Galvanized Gabion Counterforts

- A. Maccaferri (or approved equal) galvanized gabion counterforts shall be manufactured in accordance to the Project Drawings.

10.02.3 Gabion Anchor Stake

- A. Gabion anchor stakes shall be manufactured in accordance with the Project Drawings.

10.02.4 Basket Fill Aggregate

- A. Four to six-inch basket fill aggregate shall be defined as sound rock fragments that range from four to six inches in diameter and are imported to the site from a commercial quarry. Demolished concrete shall not be accepted as basket fill aggregate.

- B. Eight to Twelve-inch basket fill aggregate shall be defined as sound rock fragments that range from eight to twelve inches in diameter and are imported to the site from a commercial quarry. Demolished concrete shall not be accepted as basket fill aggregate.

10.03 Gabion Mattress Lower Diversion Installation and Execution

10.03.1 Preparation of Subgrade

- A. The subgrade shall be excavated, graded, and compacted to the lines and grades specified in Section 3.02.2 and on the Project Drawings.

10.03.2 Gabion Mattress Installation

- A. Installation of gabion mattresses shall be performed in accordance with the Project Drawings and the manufacturer installation specifications.
- B. Gabion anchor stakes shall be installed at the spacing intervals specified in the Project Drawings.

10.03.3 Basket Fill Stone

- A. Four to Six-inch basket fill aggregate shall be placed in the lower diversion gabion mattresses.
- B. Basket fill aggregate shall be placed by methods that do not damage or alter the properties of the gabion mattresses.

10.04 Gabion Mattress Upper Diversion Installation and Execution

10.04.1 Preparation of Subgrade

- A. The subgrade shall be excavated, graded, and compacted to the lines and grades specified in Section 3.02.2 and on the Project Drawings.

10.04.2 Gabion Mattress Installation

- A. Installation of gabion mattresses shall be performed in accordance with the Project Drawings and the manufacturer installation specifications.
- B. Gabion anchor stakes shall be installed at the spacing intervals specified in the Project Drawings.

10.04.3 Basket Fill Aggregate

- A. Eight to Twelve-inch basket fill aggregate shall be placed in the upper diversion gabion mattresses.

- B. Basket fill aggregate shall be placed by methods to not damage or alter the properties gabion mattresses.

10.05 Gabion Mattress As-Built

10.05.1 Finish Grade and Permeant Features

- A. The contractor shall be responsible to survey finish grades and permanent features.
- B. All as-built survey drawings shall be stamped and signed by a professional surveyor, licensed in the Commonwealth of Virginia.