

SECTION 02541 – MANUFACTURED STORMWATER FILTERING DEVICE

PART 1 - GENERAL

1.1 Description of Work

This work shall consist of furnishing and installing a manufactured stormwater filtering device as defined by the Virginia Department of Environmental Quality (DEQ) Stormwater Design Practice 17: Filtering Devices, and in accordance with the requirements of the contract documents.

1.2 Related Work Specified Elsewhere

- A. Section 01330 – Submittal Procedures
- B. Section 01500 - Temporary Sediment and Erosion Control
- C. Section 02100 - Clearing and Grubbing
- D. Section 02200 - Earthwork
- E. Section 329200 - Seeding and Sodding
- F. Section 02500 - Gravity Sewers and Appurtenances
- G. Section 02505 - Storm Sewers and Appurtenance
- H. Section 03400 – Precast Concrete

1.3 American Society for Testing and Materials (ASTM) Reference Specifications

- A. ASTM C857: Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
- B. ASTM C858: Standard Specification of Underground Precast Concrete Utility Structures
- C. ASTM C478: Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
- D. ASTM C497: Standard Test Methods for Concrete Pipe, Manhole Sections or Tile
- E. ASTM C109: Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
- F. ASTM A615/A615M: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- G. ASTM D698: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort

- H. ASTM F628: Standard Specification for ABS Schedule 40 Plastic Drain, Waste and Vent Pipe with a Cellular Core
 - I. ASTM D1785: Standard Specification for PVC Plastic Pipe, Schedules 40, 80 & 120
 - J. ASTM D2466: Standard Specification for PVC Plastic Pipe Fittings, Schedule 40
 - K. ASTM A36: Standard Specification for Carbon Structural Steel
 - L. ASTM A48: Standard Specification for Gray Iron Castings
 - M. ASTM D4101: Standard Specification for Polypropylene Injection and Extrusion Materials
- 1.4 American Association of State Highway and Transportation Officials (AASHTO) Reference Specifications
- A. AASHTO M199: Standard Specification for Precast Reinforced Concrete Manhole Sections
- 1.5 Applicable Standards and Specifications
- A. Erosion and Sediment Control (Chapter 57 of the Arlington County Code)
 - B. Utilities (Chapter 26 of the Arlington County Code)
 - C. Stormwater Management (Chapter 60 of the Arlington County Code)
 - D. Chesapeake Bay Preservation Ordinance (Chapter 61 of the Arlington County Code)
 - E. Virginia Erosion and Sediment Control Handbook
 - F. Virginia Department of Environmental Quality Stormwater Design Practice 17: Filtering Devices
 - G. Arlington County Stormwater Management Ordinance Guidance Manual
 - H. Arlington County Planning and Field Guide for Erosion and Sediment Control
 - I. Arlington County Pre-Storm Erosion and Sediment Control Checklist
 - J. Arlington County Planning & Field Guide for Pollution Prevention (P2)
 - K. Arlington County Department of Parks and Recreation Design Standards
- 1.6 Submittals
- A. Contractor shall submit to the Project Officer shop drawings for the Stormwater filtration system structure, filter cartridges and accessory equipment. Drawings shall include principal dimensions, filter placement, location of piping and unit foundation.

- B. Contractor shall submit Manufacturer's Installation Instructions to the Project Officer.
 - C. Contractor shall submit the manufacturer's Operation and Maintenance Manual to the Project Officer
 - D. Contractor must photo-document construction phases; Contractor must submit a clear, scanned copy of all material receipts and certifications; Contractor must schedule all required inspections.
 - E. The Contractor shall submit the following documentation electronically to the project officer with each progress payment request and within 30 business days of the post-construction meeting.
 - 1. Receipts and deliverables - the contractor shall submit materials delivery tickets for each material used in the manufactured stormwater filtering device construction. The tickets must be legible and if submitted electronically, scanned copies must be of at least 300 dpi resolution.
 - 2. Documentation - installation of each element (precast concrete vault, filters, pipe connections, etc.) shall be photographed and the corresponding elevation of each installed element shall be provided in the Final Topographic Survey. Photographs shall be of sufficient resolution and quality to clearly depict the intended subject. Photos shall be a minimum size of 300 dpi and 900 x 600 pixels in size. The following below-grade bmp elements shall be documented at a minimum:
 - a. Excavation extent
 - b. Installation of stone layer prior to vault placement
 - c. Installation of precast concrete vault including interior
 - d. Installation of each grade control structure (weir wall)
 - e. All pipe connections
 - f. Installation of filters (if removed and stored during construction) and/or removal of plugs and/or bypass systems.
 - F. Final Topographic Survey - at the end of construction, the contractor shall submit a field run topographic survey prepared by a licensed professional surveyor in electronic CAD file format. The survey shall include the following at a minimum:
 - 1. Inflow (inlets, curb cuts, etc.) elevations and locations
 - 2. All inlets and outlets.
 - 3. Grade control structure (such as weirs) elevations
 - 4. Associated storm structures and pipe connections
 - 5. Surface grading of the vault
- 1.7 Substitutions: Any proposed equal alternative product substitution to this specification must be submitted for review and approved by the Project Officer 10 days prior to bid opening. Review package should include maintenance instructions and third party reviewed performance data for both flow rate and pollutant removal. The system must be a manufactured stormwater filtering device awarded 50% TP removal efficiency by the Virginia Department of Environmental Quality (DEQ) and listed as such under Stormwater Design Practice 17: Filtering Devices in the Virginia Stormwater BMP Clearinghouse. <https://swbmp.vwrcc.vt.edu/>
- 1.8 Permits

For street right of way construction the Contractor shall obtain all necessary permits prior to initiating construction. The Contractor must implement the traffic control/maintenance of traffic (MOT) plan and pedestrian safety plan to include temporary pedestrian access and traffic control devices to include flag

persons, signage, keeping pathways clear of vehicles and equipment, etc. All must be in accordance with the US Department of Transportation Federal Highway Administration's "Manual on Uniform Traffic Control Devices" or the Virginia Department of Transportation's "Virginia Work Area Protection Manual."

PART 2 - PRODUCTS

2.1 Media Cartridge Filtration System

- A. Subject to compliance with requirements, provide products by the following or approved equivalent:
1. Contech Stormfilter with Phosphosorb Media
<https://www.conteches.com/>
- B. The Stormwater filtration system shall be of a type that has been installed and in use for a minimum of five (5) consecutive years preceding the date of installation of the system. The manufacturer shall have been, during the same consecutive five (5) year period, engaged in the engineering, design, and production of systems deployed for the treatment of storm water runoff and which have a history of successful production, acceptable to the Project Officer and the assigned maintenance staff.
- C. The entire system and each filter cartridge shall have the capacity to be inspected during dry weather to determine if replacement is necessary by the following indicators:
1. Sediment loading on the vault floor.
 - a. If >4" of accumulated sediment, maintenance is required.
 2. Sediment loading on top of the cartridge.
 - a. If >1/4" of accumulation, maintenance is required.
 3. Submerged cartridges.
 - a. If >4" of static water above cartridge bottom for more than 24 hours after end of rain event, maintenance is required. (Catch basins have standing water in the cartridge bay.)
 4. Plugged media.
 - a. While not required in all cases, inspection of the media within the cartridge may provide valuable additional information.
 - b. If pore space between media granules is absent, maintenance is required.
 5. Pronounced scum line.
 - a. If pronounced scum line ($\geq 1/4$ " thick) is present above top cap, maintenance is required.
- D. Each rechargeable, media-filled, filter cartridge shall incorporate a protective hood over the media cartridge and a siphon-actuated surface self-cleaning mechanism to increase the effective life of the filter media and to reduce the accumulation of material on the cartridge/media interface.
- E. Media filter cartridges shall operate at a predetermined flow rate through the use of an integrated flow control orifice located within each filter cartridge outlet manifold.
- F. The media-filled cartridges shall trap particulates (TSS) and have the capacity to adsorb pollutants such as dissolved metals, nutrients and hydrocarbons.

- G. At the design flow rate the maximum filter hydraulic loading rate is not to exceed 2.1 gallons per minute per square foot of filter surface area and the average contact time shall be no less than 35 seconds.
- H. The media cartridge filtration system shall consist of no less than 0.12 cubic feet of filter media for each 1-gallon per minute of water quality treatment flow.
- I. Filter cartridges shall be of a design that has demonstrated a minimum sediment retention capacity of 22 pounds of silty loam per cartridge in laboratory tests without a reduction in hydraulic capacity. Laboratory data shall be corroborated with field observations and/or data demonstrating equivalent or improved longevity without impacting normal hydraulic performance.
- J. The Filtration system shall be listed as having 50% TP removal efficiency on the Virginia Department of Environmental Quality (DEQ) Stormwater Design Practice 17: Filtering Devices in the Virginia Stormwater BMP Clearinghouse. <https://swbmp.vwrrc.vt.edu/>

2.2 Media Cartridge Filtration System Internal Components

- A. All internal components including ABS and PVC manifold piping, filter cartridge(s), filter media (as specified on the plans or by the Project Officer) shall be provided by the manufacturer. This includes sump covers, flow spreaders, energy dissipaters and outlet risers with scum baffles where appropriate.
- B. ABS manifold pipe shall meet ASTM F628. PVC manifold pipe shall meet ASTM D1785 and PVC fittings shall meet ASTM D2466.
- C. Filter cartridge bottom pan, inner ring, and hood shall be constructed from linear low-density polyethylene (LLDPE) or ABS. Filter cartridge screen shall consist of 1" x 1/2" welded wire fabric (16 gauge minimum) with a bonded PVC coating. Internal parts shall consist of ABS or PVC material. Siphon-priming float shall be constructed from high-density polyethylene (HDPE). All miscellaneous nuts, bolts, screws, and other fasteners shall be stainless steel or aluminum.
- D. An orifice plate shall be supplied with each cartridge to restrict flow rate to a maximum of 22.5 gpm at system design head or as specified on drawings.
- E. If a sump cover/overflow, baffle/inlet, sump/outlet, sump/inlet, tower/outlet overflow is provided, they shall be constructed of ABS and sealed to the interior vault walls and floor with a polyurethane construction sealant rated for use below the waterline, SikaFlex 1a or approved equivalent. Contractor to provide sealant material and installation unless completed prior to shipment
- F. Where an Underdrain Design is provided, the size of the underdrain will provide a minimum of 0.067 in² of underdrain cross sectional area per 1 gpm of design flow rate. (example: 105 gpm maximum design flow rate will require an underdrain with 7.035 in² of cross-sectional area, which is equal to one 3" diameter pipe).
- G. Filter media shall be provided by the same manufacturer as the Stormwater filtration system or an approved alternate source. Filter media shall consist of the following:

1. Media shall be made from Perlite pellets with activated alumina bound to the surface. The media pellets shall be granular and have a bulk density from 18 to 25 lb/ft³. The pellet size should range from that passing through a U.S. Standard ¼ inch sieve and retained on a #8 sieve.
 2. Perlite: Perlite shall be made of natural siliceous volcanic rock free of any debris or foreign matter. The perlite shall have a bulk density ranging from 6.5 to 8.5 lb/ft³ and particle sizes ranging from that passing through a 0.50 inch screen and retained on a U.S. Standard #8 sieve.
- H. Overflow Assembly (Where Provided):
1. Flow spreader shall be constructed of Linear Low-Density Polyethylene (LLDPE). Contractor to provide sealant material and installation unless completed prior to shipment.
 2. Energy dissipater shall be constructed of polyolefins. Contractor to provide sealant material and installation unless completed prior to shipment.
 3. Outlet riser with scum baffle shall be constructed of HDPE. Outlet riser shall have an outlet stub outside dimension (O.D.) of 12-inch diameter PVC, SDR 26 and a secondary outlet stub O.D. of 8-inch diameter PVC, SDR 26.
- 2.1 Steel Catch Basin & Roof Drain Components:
- A. Basin shall be all welded steel construction, fabricated from ASTM A36 ¼-inch steel and shall be designed to withstand AASHTO H-20 wheel loads when placed below ground in a location that could receive direct loading.
 - B. Basin Grate: Grating shall be ductile iron construction and shall meet AASHTO H-20 loading requirements, and shall be provided according to ASTM A48.
 - C. Basin Solid Lid (below ground system design): Solid lid shall be gray cast iron, treated with nonslip surfacing, and shall meet AASHTO H-20 loading requirements, and shall be provided according to ASTM A48.
 - D. Basin Solid Lid (above ground system design): Solid lids shall be PVC plate with pick holes. Covers to be cut as required for top inlet roof drain pipes.
- 2.3. Precast Concrete Structure Components:
- A. Precast concrete vault shall be provided according to ASTM C857 and C858. Precast concrete manhole shall be provided according to ASTM C478.
 - B. Vault and manhole joint sealant shall be Conseal CS-101 or approved equivalent.
 - C. If interior concrete baffle walls are provided, baffle walls shall be sealed to the interior vault walls and floor with a polyurethane construction sealant rated for use below the waterline, SikaFlex 1a or approved equivalent. Contractor to provide sealant material and installation unless completed prior to shipment.
 - D. Frames and covers shall be gray cast iron and shall meet AASHTO H-20 loading requirements and shall be provided according to ASTM A48.
 - E. Doors shall have hot-dipped galvanized frame and covers. Covers shall have diamond plate finish. Each door to be equipped with a recessed lift handle. Doors shall meet H-20 loading

requirements for incidental traffic, at a minimum, or per project specific traffic loading requirements.

- F. Steps shall be constructed of copolymer polypropylene conforming to ASTM D4101. Steps shall be driven into preformed or drilled holes once concrete is cured. Steps shall meet the requirements of ASTM C478 and AASHTO M199. The ½" Grade 60 deformed reinforcing bar shall meet ASTM A615, where required.
- G. Ladders shall be constructed of aluminum and steel reinforced copolymer polypropylene conforming to ASTM D4101. Ladder shall bolt in place. Ladder shall meet all ASTM C497 load requirements. Ladders provided upon request or where required, and shall not conflict with the operation and accessibility to perform maintenance of the Stormwater filtration system.

2.4. Contractor Provided Components (below ground installation):

- A. All contractor-provided components shall meet the requirements of this section, the plans specifications and contract documents. In the case of conflict, the more stringent specification shall apply.
- B. Sub-base: Crushed rock base material shall be six-inch minimum layer of ¾-inch minus rock. Compact undisturbed sub-grade materials to 95% of maximum density at +/-2% of optimum moisture content. Unsuitable material below sub-grade shall be replaced to Project Officer's approval.
- C. In-situ concrete, if required, shall have an unconfined compressive strength at 28 days of at least 3000 psi, with ¾-inch round rock, a 4-inch slump maximum, and shall be placed within 90 minutes of initial mixing.
- D. Silicone Sealant shall be pure RTV silicone conforming to Federal Specification Number TT S001543A or TT S00230C or Project Officer's approved.
- E. Grout shall be non-shrink grout meeting the requirements of Corps of Engineers CRD-C588. Specimens molded, cured and tested in accordance with ASTM C109 shall have minimum compressive strength of 6,200 psi. Grout shall not exhibit visible bleeding.
- F. For manhole systems, Contractor shall connect to 12-inch or 8-inch diameter outlet riser with Fernco flexible coupling or approved equal.
- G. Rebar used on applicable Catch Basin & Roof Drain systems shall meet ASTM A615M Grade 420 (60 ksi) or as otherwise specified in the general technical specifications.
- H. Backfill material shall be ¾-inch minus crushed rock or approved equivalent.

3. PART 3 - EXECUTION

3.1 Construction

- A. Contractor shall report any conditions encountered during construction that are considered detrimental to Stormwater Filtering Device function including but not limited to: high groundwater, off-site sediment, unsuitable soils and inadequate drainage.
- B. Contractor shall secure the Stormwater Filtering Device from any runoff from the construction site or disturbed areas. Block curbs or inlets to divert upland drainage areas to prevent runoff from entering the excavated area prior to completion as determined by the project officer. Ensure that no site runoff enters the facility before the drainage area has been stabilized.
- C. Contractor shall ensure no sediment or debris be swept or blown into storm drains or Stormwater Filtering Device. Sediment or debris shall be swept up, bagged and disposed of offsite.

3.2 Suitable Weather

- A. Construction shall be suspended during periods of rainfall or snowmelt. Construction shall remain suspended if ponded water is present or if there is residual soil moisture due to increased potential for soil compaction.
- B. Secure the site from risk of precipitation damages in the event of rain (i.e., cover erodible surfaces such as slopes and edges); take action to divert stormwater away from the work area and temporarily cover all exposed soils with filter fabric or impermeable sheeting; cover all staged material in the event of rain and at the close of each work day.

3.3 Sequence of Construction

- A. Pre-Construction Meeting – the Project Officer shall schedule a Stormwater Filtering Device specific pre-construction meeting at the site. Contractor attendance is required.
- B. Precast Concrete Structure:
 - 1. Set precast structure on crushed rock base material that has been placed in maximum 6-inch lifts, loose thickness, and compacted to at least 95-percent of the maximum dry density as determined by the standard Proctor compaction test, ASTM D698, at moisture content of +/-2% of optimum water content.
 - 2. Structure floor shall slope 1/4 inch maximum across the width and slope downstream 1 inch per 12 foot of length. For manholes “Length” is defined by a line running from the invert of the outlet through the center of the manhole and “width” is the perpendicular to the “length”. Structure top finish grade shall be even with surrounding finish grade surface unless otherwise noted on plans.
 - 3. Inlet and outlet pipes shall be stubbed in and connected to precast concrete structure according to requirements and specifications. All connections to be watertight. If grout is used, Contractor to grout all inlet and outlet pipes flush with or protruding up to 2 inches into interior of structure.

4. When required by the manufacturer's design, ballast shall be placed to the dimensions specified. Ballast shall not encase the inlet and/or outlet piping. Provide 12" clearance from outside diameter of pipes.
- C. Steel Catch Basin:
1. Catch basin floor shall slope 1/4 inch maximum across the width and slope downstream 1 inch per 12 foot of length. Catch basin top finish grade shall be even with surrounding finish grade surface unless otherwise noted on plans.
 2. Contractor shall prevent sediment and debris from entering the filter unit during construction.
 3. If necessary, the inlet chamber may be filled with clean water to assist in preventing flotation during construction until the structure is backfilled and the concrete collar is poured.
 4. Catch basin outlet shall be connected to downstream (and upstream, if applicable) piping using a flexible-type coupling.
 5. Concrete perimeter slab shall be constructed 1 foot wide and 6 inches thick. Slab shall include two #4 rebar hoops with minimum 6-inch overlap at closure. Allow 2-inch vertical spacing between hoops and minimum 2-inch clearance from concrete surfaces, or as directed by the Project Officer.
- D. Clean Up:
1. Remove all excess materials, rocks, roots, or foreign material, leaving the site in a clean, complete condition approved by the Project Officer. The project site shall be clean and free of dirt and debris and the inlet/outlet chamber(s) and filter chamber(s) shall be free of construction debris and sediment before allowing runoff to enter and place the system in operation. All filter components shall be free of any foreign materials including concrete and excess sealant.
 2. Where applicable, Contractor shall remove the temporary filter fabric around the inlet grate to place the system in operation.
 3. Where required, the 4-inch cleanout plug in the overflow weir wall shall remain in place for proper operation of the system.
- E. Filter Cartridges:
1. Filter cartridges shall be delivered installed in the structure, unless otherwise agreed upon with the manufacturer. Contractor shall take appropriate action to protect the cartridges from sediment and other debris during construction. The method ultimately selected shall be at Contractor's discretion and Contractor's risk. Methods for protecting the cartridges include, but are not limited to:
 - a. Remove cartridges from the structure and store appropriately. Cartridges shall be reinstalled to operate according to number 2 below.
 - b. If structure is equipped with underdrain bypass piping, Contractor may leave cartridges in the vault and allow stormwater entering collection system to bypass filter bay through underdrain bypass piping.
 - c. Leave cartridges in the structure and plug inlet and outlet pipe to prevent stormwater from entering the vault and provide means for stormwater to bypass the Stormwater filtration system.
 2. Filter cartridges shall not be placed in operation until the structure is clean and the project site is clean and stabilized (construction erosion control measures no longer required). The project site includes any surface that contributes storm drainage to the Stormwater filtration system. All impermeable surfaces shall be clean and free of dirt and debris. All catch basins, manholes and pipes shall be free of dirt and sediments. Contact the manufacturer

to assist with system activation and/or inspect the system for proper installation once site is clean and stabilized.

3. Contractor to install filter cartridges.
 - a. Filter Cartridges with ¼-Turn Connector Fittings: Tape shall be cleanly and completely removed from manifold fitting openings. ¼-turn connects shall be glued and inserted into all manifold fittings to be equipped with a filter cartridge. Filter cartridges shall be turned onto the connector until they reach the hard stop on the connector – approximately ¼ revolution, with care to not “over turn” the cartridge, or turn with such force to damage the hard stop mechanism. Plugs shall be inserted without glue in all manifold fittings not equipped with a filter cartridge.

3.4 Final Topographic Survey and Photo Documentation

- A. The Contractor shall provide a Final Topographic Survey and photographs per submittals section.

3.5 Construction Inspection

- A. The contractor shall be required to have the Project Officer inspect the project at critical stages of the construction of the facility. The contractor shall notify the project officer at least 48 hours in advance of the necessary inspection. The required inspections are:
 1. Following the excavation of the facility (prior to placement of the precast structure)
 2. Following the installation of the precast structure
 3. Prior to putting the system online (installation of the filters if removed and stored during construction and/or removing plugs and/or bypass system).

3.6 Certification Letter

- A. The contractor shall submit a Certification Letter for Proprietary BMP. The format of this letter shall follow the template of the most recent version of the Arlington County Stormwater Management Ordinance Guidance Manual.

3.7 Maintenance

- A. Maintenance and Inspection shall be performed in accordance with the manufacturer’s recommendations for maintenance and inspection in conjunction with Arlington County’s requirements for maintenance of manufactured stormwater filtering devices and DEQ requirements.
- B. Surface access for personnel and equipment for inspection and maintenance activities shall be provided.

1. PART 4 - MEASUREMENT AND PAYMENT

- A. Measurement of Manufactured Stormwater Filtering Device shall be lump sum. Payment shall include concrete vault and furnishing of all parts, components and equipment listed

in part 2 above, all excavation, compaction, and installation of the device complete and in place in accordance with manufacturers requirements.

- 4.2 Connection of the Manufactured Stormwater Filtering Device to the proposed storm sewer system on site shall be considered incidental to the installation of the device.

END OF SECTION 02541