

SECTION 02410

STORMWATER TREATMENT SYSTEM

PART 1 GENERAL

1.1 Description

- a. Work included: The Contractor, and/or a manufacturer selected by the Contractor and approved by the Engineer, shall furnish all labor, materials, equipment and incidentals required and install all precast concrete stormwater treatment systems and appurtenances in accordance with the Drawings and these specifications.

1.2 Quality Control Inspection

- a. The quality of materials, the process of manufacture, and the finished sections shall be subject to inspection by the Engineer. Such inspection may be made at the place of manufacture, or on the work site after delivery, or at both places, and the sections shall be subject to rejection at any time if material conditions fail to meet any of the specification requirements, even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the site shall be marked for identification and shall be removed from the site at once. All sections which have been damaged beyond repair during delivery will be rejected and, if already installed, shall be repaired to the Engineer's acceptance level, if permitted, or removed and replaced, entirely at the Contractor's expense.
- b. All sections shall be inspected for general appearance, dimensions, soundness, etc. The surface shall be dense, close textured and free of blisters, cracks, roughness and exposure of reinforcement.
- c. Imperfections may be repaired, subject to the acceptance of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final acceptance. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi (28 MPa) at the end of 7 days and 5,000 psi (34 MPa) at the end of 28 days when tested in 3 inch (76 mm) diameter by 6 inch (152 mm) long cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs.

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1.3 Submittals

- a. Shop Drawings: The Contractor shall be provided with dimensional drawings and, when specified, utilize these drawings as the basis for preparation of shop drawings showing details for construction, reinforcing, joints and any cast-in-place appurtenances. Shop drawings shall be annotated to indicate all materials to be used and all applicable standards for materials, required tests of materials and design assumptions for structural analysis. Shop drawings shall be prepared at a scale of not less than 3/16-inches per foot (1:75). Six (6) hard copies of said shop drawings shall be submitted to the Engineer for review and approval.

PART 2 PRODUCTS

2.1 Materials And Design

- a. Concrete for precast stormwater treatment systems shall conform to ASTM C 857 and C 858 and meet the following additional requirements:
 - (1) The wall thickness shall not be less than 6 inches (152 mm) or as shown on the dimensional drawings. In all cases the wall thickness shall be no less than the minimum thickness necessary to sustain HS20-44 (MS18) loading requirements as determined by a Licensed Professional Engineer.
 - (2) Sections shall have tongue and groove or ship-lap joints with a butyl mastic sealant conforming to ASTM C 990.
 - (3) Cement shall be Type II Portland cement conforming to ASTM C 150.
 - (4) All sections shall be cured by an approved method. Sections shall not be shipped until the concrete has attained a compressive strength of 4,000 psi (28 MPa) or until 5 days after fabrication and/or repair, whichever is the longer.
 - (5) Pipe openings shall be sized to accept pipes of the specified size(s) and material(s), and shall be sealed by the Contractor with a hydraulic cement conforming to ASTM C 595M
- b. Internal aluminum plate components shall be aluminum alloy 5052-H32 in accordance with ASTM B 209.
- c. Sealant to be utilized at the base of the swirl chamber shall be extruded EPDM.

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- d. Brick or masonry used to build the manhole frame to grade shall conform to ASTM C 32 or ASTM C 139 and shall be installed in conformance with all local requirements.
- e. Casting for manhole frames and covers shall be in accordance with ASTM A48, CL.30B and AASHTO M105. The manhole frame and cover shall be equivalent to Campbell Foundry Pattern #1009A or #1012D custom cast with the Vortechs. logo and the words “Vortechs. Stormwater Treatment System”.
- f. A bitumen sealant in conformance with ASTM C 990 shall be utilized in affixing the aluminum swirl chamber to the concrete vault.

2.2 Performance

Each stormwater treatment system shall adhere to the following performance specifications at the design treatment capacities, as listed below:

Table 2.2

Vortechs Design	Model Treatment Capacity (cfs)/(l/s)	Sediment Storage (yd³)/(m³)
1000	0 - 1.6 (0 - 45)	0.7 (0.54)
2000	1.6 - 2.8 (45-80)	1.2 (0.91)
3000	2.8 - 4.5 (80-125)	1.8 (1.38)
4000	4.5 - 6.0 (125-175)	2.4 (1.84)
5000	6.0 - 8.5 (175-240)	3.2 (2.45)
7000	8.5 - 11.0 (240-315)	4.0 (3.06)
9000	11.0 - 14.0 (315-400)	4.8 (3.67)
11000	14.0 - 17.5 (400-495)	5.6 (4.28)
16000	17.5 - 25.0 (495-710)	7.1 (5.43)

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Each stormwater treatment system shall include a circular aluminum “swirl chamber” (or “grit chamber”) with a tangential inlet to induce a swirling flow pattern that will accumulate and store settleable solids in a manner and a location that will prevent resuspension of previously captured particulates. Each swirl chamber diameter shall not be less than the diameter listed in Table 2.2 (neglecting chamber wall thickness). Each stormwater treatment system shall be of a hydraulic design that includes flow controls designed and certified by a professional engineer using accepted principles of fluid mechanics that raise the water surface inside the tank to a pre-determined level in order to prevent the re-entrainment of trapped floating contaminants. Each stormwater treatment system shall be capable of removing 80% of the **net annual Total Suspended Solids (TSS) load based on a 50-micron particle size**. Annual TSS removal efficiency models shall be based on documented removal efficiency performance from full scale laboratory tests. Annual TSS removal efficiency models shall only be considered valid if they are corroborated by independent third party field testing. Said field testing shall include influent and effluent composite samples from a minimum of ten storms at one location. Individual stormwater treatment systems shall have the Design Treatment Capacity listed in Table 2.2, and shall not re-suspend trapped sediments or re-entrain floating contaminants at flow rates up to and including the specified Design Treatment Capacity. Individual stormwater treatment systems shall have usable sediment storage capacity of not less than the corresponding volume listed in Table 2.2. The systems shall be designed such that the pump-out volume is less than 1/2 of the total system volume. The systems shall be designed to not allow surcharge of the upstream piping network during dry weather conditions. A water-lock feature shall be incorporated into the design of the stormwater treatment system to prevent the introduction of trapped oil and floatable contaminants to the downstream piping during routine maintenance and to ensure that no oil escapes the system during the ensuing rain event. Direct access shall be provided to the sediment and floatable contaminant storage chambers to facilitate maintenance. There shall be no appurtenances or restrictions within these chambers. Stormwater treatment systems shall be completely housed within one rectangular structure.

2.3 Manufacturer

Each stormwater treatment system shall be of a type that has been installed and used successfully for a minimum of 5 years. The manufacturer of said system shall have been regularly engaged in the engineering design and production of systems for the physical treatment of stormwater runoff during the aforementioned period. Each stormwater treatment system shall be a Vortechs™ System as manufactured by Vortechtechnics, Inc., 200 Enterprise Drive, Scarborough, Maine 04074, phone: 207-885-9830, fax: 207-885-9825; and as protected under U.S. Patent #5,759,415.

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PART 3 EXECUTION

3.1 Installation

- a. Each Stormwater Treatment System shall be constructed according to the sizes shown on the Drawings and as specified herein. Install at elevations and locations shown on the Drawings or as otherwise directed by the Engineer.
- b. Place the precast base unit on a granular subbase of minimum thickness of six inches (152 mm) after compaction or of greater thickness and compaction if specified elsewhere. The granular subbase shall be checked for level prior to setting and the precast base section of the trap shall be checked for level at all four corners after it is set. If the slope from any corner to any other corner exceeds 0.5% the base section shall be removed and the granular subbase material re-leveled.
- c. Prior to setting subsequent sections place bitumen sealant in conformance with ASTM C 990 along the construction joint in the section that is already in place.
- d. After setting the base and wall or riser sections, prepare to install the swirl chamber. Place the 3/4-inch thick by 3/4-inch wide butyl mastic seal vertically on the outside of the swirl chamber starting one inch above the bottom of the swirl chamber and continuing to a height equal to the elevation of the bottom of the upper aperture of the swirl chamber. The butyl mastic seal should abut the downstream side of the pre-drilled mounting holes that attach the swirl chamber to the long walls of the concrete vault. Next, install the extruded EPDM seal on the bottom edge of the 180 degree downstream section of the swirl chamber by first applying a bead of Sikaflex-1a polyurethane elastomeric sealant into the extruded slot then slide the seal onto the swirl chamber. The extruded seal should extend 3-inches upstream of the mounting holes, toward the inlet end of the vault. Set the swirl chamber into position and keep the seal approximately 1/2-inch above the floor of the concrete vault. Apply a continuous bead of Sikaflex-1a sealant under the cupped bottom of the seal. Set and anchor the circular swirl chamber by bolting the swirl chamber to the side walls of the concrete vault at the three (3) tangent points and at the inlet tab using HILTI brand stainless steel drop-in wedge anchors or equivalent 3/8-inch diameter by 2-3/4 inch minimum length at heights of approximately three inches (3") off the floor and at fifteen inch (15") intervals to approximately the same height of the butyl mastic sealant (at locations of pre-drilled holes in aluminum components). Apply a continuous bead of Sikaflex-1a sealant to the intersection of the inside bottom edge of the extruded seal and the vault floor.

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- e. Prior to setting the precast roof section, bitumen sealant equal to ASTM C 990 shall be placed along the top of the baffle wall, using more than one layer of mastic if necessary, to a thickness at least 1-inch (25 mm) greater than the nominal gap between the top of the baffle and the roof section. The nominal gap shall be determined either by field measurement or the shop drawings. After placement of the roof section has compressed the butyl mastic sealant in the gap, finish sealing the gap with an approved non-shrink grout on both sides of the gap using the butyl mastic as a backing material to which to apply the grout. Also apply non-shrink grout or Sikaflex-1a to the joints at the side edges of the baffle walls.
- f. After setting the precast roof section of the stormwater treatment system, set precast concrete manhole riser sections, to the height required to bring the cast iron manhole covers to grade, so that the sections are vertical and in true alignment with a 1/4-inch (6 mm) maximum tolerance allowed. Backfill in a careful manner, bringing the fill up in 6-inch (152 mm) lifts on all sides. If leaks appear, clean the inside joints and caulk with lead wool to the satisfaction of the Engineer. Precast sections shall be set in a manner that will result in a watertight joint. In all instances, installation of Stormwater Treatment Systems shall conform to ASTM specification C 891 "Standard Practice for Installation of Underground Precast Utility Structures".
- g. Holes made in the concrete sections for handling or other purposes shall be plugged with a nonshrink grout or by using grout in combination with concrete plugs.
- h. Where holes must be cut in the precast sections to accommodate pipes, do all cutting before setting the sections in place to prevent any subsequent jarring which may loosen the mortar joints. The Contractor shall make all pipe connections.