

STANDARD SPECIFICATION STORMWATER QUALITY FILTER TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

Specifies requirements for construction and performance of an underground stormwater quality filter treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.

1.2 REFERENCE STANDARDS

NZS 3109:1997: Concrete construction
NZS 3114:1987: Specification for concrete surface finishes
AS/NZS 4058:2007: Precast concrete pipes (pressure and non-pressure)
AS 3996-2006: Access covers and grates
NZTA's Bridge Manual (May 2013)

1.3 SHOP DRAWINGS

Shop drawings for the structure and performance are to be submitted with each order to the contractor. Contractor shall forward shop drawing submittal to the consulting engineer for approval. Shop drawings are to detail the structure's precast concrete components.

1.4 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The device shall be cylindrical or rectangular and constructed from precast concrete riser and slab components or monolithic precast structure(s) manufactured to confirm to NZS 3109:1997, NZS 3114:1987 and/or AS/NZS 4058:2007, and installed to conform to any required state highway, municipal or local authority specifications.

2.1.2 Cartridge Deck The cylindrical concrete device shall include either a coated aluminum or fiberglass deck. The rectangular concrete device shall include a coated aluminum deck. In either instance, the insert shall be bolted and sealed watertight inside the precast concrete chamber. In each instance the insert shall serve as: (a) a horizontal divider between the lower treatment zone and the upper treated effluent zone; (b) a deck for attachment of filter cartridges such that the membrane filter elements of each cartridge extend into the lower treatment zone; (c) a platform for maintenance workers to service the filter cartridges; (d) a conduit for conveyance of treated water to the effluent pipe.

2.1.3 Membrane Filter Cartridges Filter cartridges shall be comprised of cylindrical membrane filter elements connected to a perforated head plate. The number of membrane filter elements per cartridge shall be eleven 2.75-inch (70-mm) diameter elements. The length of each filter element shall be a minimum 15 inches (381 mm). Each cartridge shall be fitted into the cartridge deck by insertion into a cartridge receptacle that is permanently mounted into the cartridge deck. Each cartridge shall be

secured by a cartridge lid that is threaded onto the receptacle. The maximum treatment flow rate of a filter cartridge shall be controlled by an orifice in the cartridge lid and based on a design flux rate (surface loading rate) determined by the maximum treatment flow rate per unit of filtration membrane surface area. The maximum flux rate shall be 0.21 gpm/ft² (0.142 lps/m²).

Each lightweight membrane filter cartridge shall allow for manual installation and removal. Each filter cartridge shall have filtration membrane surface area and dry installation weight as follows:

Filter Cartridge Length		Filtration Cartridge Membrane Surface Area	Filter Cartridge Dry Weight
in	mm	m ²	kg
15	381	9.8	4.5
27	686	17.7	6.6
40	1,016	26.2	8.9
54	1,372	35.4	11.4

2.1.4 Backwashing Cartridges. The filter device shall have a weir extending above the cartridge deck that encloses the high flow rate filter cartridges when placed in their respective cartridge receptacles within the cartridge deck. The weir shall collect a pool of filtered water during inflow events that subsequently automatically backwashes the high flow rate cartridges each time the inflow event subsides. All filter cartridges shall allow for filtration membrane rinsing to restore flow capacity and sediment capacity and extend cartridge service life.

2.1.5 Maintenance Access to Captured Pollutants. The filter device shall contain an opening(s) that provides suitable maintenance access for removal of accumulated floatable pollutants and sediment.

2.1.6 Bend Structure. The device shall be able to be used as a bend structure with minimum angles between inlet and outlet pipes of 90-degrees or less in the stormwater conveyance system.

2.1.7 Double-Wall Containment of Hydrocarbons. The cylindrical precast concrete device shall provide double-wall containment for hydrocarbon spill capture by a combined means of an inner wall of either aluminum or fiberglass, to a minimum depth of 12 inches (305 mm) below the cartridge deck, and the precast vessel wall.

2.1.8 Baffle. The filter device shall provide a baffle that extends from the underside of the cartridge deck to a minimum length equal to the length of the membrane filter elements. The baffle shall serve to protect the membrane filter elements from contamination by floatables. In the cylindrical device the baffle shall be a flexible continuous skirt secured to the fiberglass deck. In the rectangular device the baffle shall be a concrete or metal wall, secured to the precast chamber.

2.1.9 Sump The device shall include a minimum 24 inches (600 mm) of total sump depth below the bottom of the cartridges for sediment accumulation, unless otherwise specified in the shop drawings or by the design engineer.

2.2 PRECAST CONCRETE SECTIONS. All precast concrete components shall be manufactured to a minimum live load of HN loading, in accordance with NZTA's Bridge Manual (May 2013), or greater based on local regulatory specifications, unless otherwise modified or specified by the design engineer.

2.3 JOINTS. All precast concrete manhole configuration joints shall use butyl rubber manhole sealant or as per engineer approved alternatives to ensure oil resistance.

2.4 FRAME AND COVER. Frame and covers must be manufactured from cast-iron and as a minimum conform to AS 3996:2006 Class B for pedestrianized areas or Class D for vehicle trafficked situations.

2.5 DOORS AND HATCHES. If provided shall meet designated loading requirements at a minimum for incidental traffic.

2.5 CONCRETE. All concrete components shall be manufactured according to local specifications and shall meet the requirements of NZS 3114:1987, NZS 3109:1997 and/or AS/NZS 4058:2007.

2.7 INSPECTION. All precast concrete sections shall be inspected to ensure that dimensions, appearance and quality of the product meet local municipal specifications and NZS 3114:1987 and/or AS/NZS 4058:2007.

PART 3 – PERFORMANCE

3.1 GENERAL

- 3.1.1 Function - The stormwater quality filter treatment device shall function to remove pollutants by the following unit treatment processes; sedimentation, floatation, and membrane filtration.
- 3.1.2 Pollutants - The stormwater quality filter treatment device shall remove oil, debris, trash, coarse and fine particulates (TSS), particulate-bound pollutants, metals and nutrients from stormwater during runoff events.
- 3.1.3 Bypass - The stormwater quality filter treatment device shall typically utilize an external bypass to divert excessive flows unless otherwise modified or specified by the design engineer.
- 3.1.4 Treatment Flux Rate (Surface Loading Rate) – The stormwater quality filter treatment device shall treat 100% of the required water quality treatment design flow based on a maximum treatment flux rate (surface loading rate) across the membrane filter cartridges of 0.21 gpm/ft² (0.142 lps/m²).

3.2 FIELD TEST PERFORMANCE

At a minimum, the stormwater quality filter device shall have been field tested with a minimum 25 TARP qualifying storm events and field monitoring conducted according to the TARP field test protocol, and be NJCAT verified.

- 3.2.1 Suspended Solids Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median TSS removal efficiency of 85% and a minimum median SSC removal efficiency of 95%.
- 3.2.2 Fine Particle Removal - The stormwater quality filter treatment device shall have demonstrated the ability to capture fine particles as indicated by a minimum median removal efficiency of 75% for the particle fraction less than 25 microns, an effluent d₅₀ of 15 microns or lower for all monitored storm events.

- 3.2.3 Turbidity Reduction - The stormwater quality filter treatment device shall have demonstrated the ability to reduce the turbidity from influent from a range of 5 to 171 NTU to an effluent turbidity of 15 NTU or lower.
- 3.2.4 Nutrient (Total Phosphorus & Total Nitrogen) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Phosphorus removal of 55%, and a minimum median Total Nitrogen removal of 50%.
- 3.2.5 Metals (Total Zinc & Total Copper) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Zinc removal of 55%, and a minimum median Total Copper removal of 85%.

3.3 INSPECTION and MAINTENANCE

The manufacturer shall provide an Owner's Manual upon request.

3.3.1 FEATURES

The stormwater quality filter treatment device shall have the following features:

- 3.3.1.1 The membrane filter elements shall be designed to last a minimum one year under normal urban stormwater operation from a stable site prior to requiring maintenance or replacement.
- 3.3.1.2 Inspection which includes trash and floatables collection, sediment depth determination, and visible determination of backwash pool depth shall be easily conducted from grade.
- 3.3.1.3 Manual rinsing of the membrane filter elements of the filter cartridges shall be possible to restore the flow capacity and sediment capacity of the filter cartridges and therefore extend cartridge service life.
- 3.3.1.4 The filter device shall have a minimum 24 inches (600 mm) of sediment storage depth below the cartridges.
- 3.3.1.5 Sediment removal from the filter treatment device shall be conducted using a standard maintenance truck and vacuum apparatus, and a minimum one point of entry to the sump that is unobstructed by filter cartridges.
- 3.3.1.6 Filter cartridges shall be easily maintained without the use of additional lifting equipment.
- 3.3.1.7 The membrane filter elements shall be easily removable and rinse-able with low pressure (< 20 psi) clean water to extend cartridge service life.
- 3.3.1.8 When required the membrane filter elements can be easily replaced to fully restore the flow capacity and sediment capacity of the filter cartridges.

- 3.3.2 REPLACEMENT FILTER CARTRIDGE ITEMS When replacement membrane filter elements and/or other parts are required, only membrane filter elements and parts approved by the manufacturer for use with the stormwater quality filter device shall be installed to ensure proper operation.

PART 4 – EXECUTION

4.1 INSTALLATION Contractor shall take appropriate action to protect all of the devices' internal components throughout the installation and construction process. No lifting shall be conducted or lifting mechanisms shall be connected to or come into contact with the stormwater quality treatment devices' deck or cartridge receptacles.

4.1.1 PRECAST DEVICE CONSTRUCTION SEQUENCE

The installation of a precast concrete device should be installed to conform with any required state highway, municipal or local authority specifications. Construction of manholes shall conform to AS/NZS 4058:2007. Selected sections of a general specification that are applicable are summarized below.

The precast concrete device is installed in sections in the following sequence:

- aggregate base
- base slab
- treatment chamber and cartridge deck riser section(s)
- bypass section
- connect inlet and outlet pipes
- riser section and/or transition slab (if required)
- maintenance riser section(s) (if required)
- frame and access cover

4.1.2 The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

4.1.3 Adjustment of the stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary. Once the stormwater quality treatment device has been constructed, any lift holes must be plugged watertight with mortar or non-shrink grout.

4.1.4 Inlet and Outlet Pipes. Inlet and outlet pipes should be securely set into the device using approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight.

4.1.5 Frame and Cover Installation. Adjustment units (e.g. grade rings) should be installed to set the frame and cover at the required elevation. The adjustment units should be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover should be set in a full bed of mortar at the elevation specified.

4.3 MAINTENANCE ACCESS WALL

In some instances, the Maintenance Access Wall, if provided, shall require an extension attachment and sealing to the precast wall and cartridge deck at the job site, rather than at the precast facility. In this instance, installation, attachment and sealing of these components shall be performed according to instructions provided by the manufacturer.

4.4 DEVICE PROTECTION PRIOR TO FILTER CARTRIDGE INSTALLATION

Filter cartridges shall not be installed until the project site is clean and free of debris, by the contractor. The project site includes any surface that contributes storm drainage to the treatment

device. All impermeable surfaces shall be clean and free of dirt and debris. All catch basins, manholes and pipes shall be free of debris, dirt and sediments.

4.4.1 It is the contractor's full responsibility to properly protect the treatment device, and keep the device offline during construction.

4.4.1.1 The contractor may choose to plug both the inlet and outlet pipes to prevent stormwater from entering the device to fully protect the cartridges and system from construction debris and sediment.

4.4.1.2 The contractor must remove plugs to activate the device after the site has been fully stabilized post-construction, and device has been commissioned.

4.5 FILTER CARTRIDGE INSTALLATION

4.5.1 The Contractor shall confirm the project site and stormwater quality filter treatment device is clean and free of debris prior to pursuing cartridge installation. Filter cartridges and lids shall be installed in the cartridge deck only after the construction site is fully stabilized and the unit clean and free of debris by the contractor.

4.5.2 Contractor shall notify and coordinate with the manufacturer three weeks prior to requiring filter cartridges installed on site. Filter cartridges and lids, shall be delivered and installed to commission the stormwater quality filter treatment device.

4.5.3 Filter cartridge lids, shall be installed providing a water tight seal by ensuring the lid's male threads are aligned properly with the cartridge receptacle female threads, and by firmly twisting the cartridge lids 110 degrees minimum clockwise to seat the filter cartridge snugly in place.

END OF SECTION