

Stormwater Manufactured Treatment Devices (MTDs)

SCDOT Designation: SC-M-815-13 (8/11)

1.0 Stormwater Manufactured Treatment Devices

Stormwater Manufactured Treatment Devices (MTDs) function as stormwater treatment devices before stormwater runoff is discharged off-site or to receiving water bodies, and may be incorporated into a series of water quality best management practices to remove pollutants from stormwater runoff. MTDs are not designed, or intended to store a volume of water for water quality treatment. MTD Pollutant removal efficiencies are variable and are highly dependent on storm size, influent pollutant concentrations, rainfall intensity and other factors.

Use MTDs that minimize the long term water quality impacts from stormwater runoff from the SCDOT MS4 to the Maximum Extent Practicable (MEP). Use MTDs designed to filter and trap trash, sediment, totals suspended solids (TSS), oil and grease, metals, hydrocarbons and other pollutants. Provide MTDs that combine settling, filtration, and various biological processes into one controlled system. MTDs are classified in to three Types:

- MTD Type 1 - Separation Devices (Standard Stormwater MTD)
- MTD Type 2 - Filtration Devices (Impaired Water Bodies, TMDL Requirements)
- MTD Type 3 - Catch Basin Inserts (Limited Right-of-Way)

1.1 Design Criteria

Use MTDs designed to treat, at a minimum, the peak flow rate of the stormwater runoff from the **1.8-inch, 1-year, 24-hour storm event**, from the entire drainage area to the MTD. This is defined as the water quality event (WQE). This water quality event is distributed into the rainfall intensities in Table 1.

Table 1: Water Quality Event (WQE) Design Intensities

Frequency	a	b	c	i^1 (t_c 5 min) (in/hr)	i^1 (t_c 10 min) (in/hr)	i^1 (t_c 15 min) (in/hr)	i^1 (t_c 30 min) (in/hr)
Water Quality Design Storm	135.65	40.2	1.0863	2.16	1.93	1.74	1.34

¹ Where:

$$i = \frac{a}{(b + t_c)^c}$$

i = rainfall intensity (inches per hour)

Tc = time of concentration (minutes)

a, b, c = water quality event (WQE) coefficients

Use MTDs designed to treat the entire water quality event (WQE) with no by pass for a minimum **80%** Total Suspended Solids (TSS) removal efficiency. The WQE flow rate is a separate flow rate from the Level of Service (LOS) flow rate. In addition to meeting the required treatment efficiency for the WQE, the MTD must be capable of passing the specified LOS flow rate (i.e. 10-year storm event) without causing adverse hydraulic impact to upstream portions of the drainage system and without causing any re-suspension or scour of previously trapped pollutants, or the MTD may be required to be placed off-line.

Ensure site constraints (available right of way and available depth) allow the installation of a single MTD for design peak water quality flow rates up to 8 cfs. Additional MTDs may be required for water quality event flow rates greater than 8 cfs.

Ensure tail water conditions are accounted for in the MTD design.

When applicable, use MTDs designed to meet any other additional watershed, TMDL, or site-specific water quality requirements.

1.2 Materials

Ensure MTDs placed under roadways or traffic areas meet the requirements of **Section 719.2- Catch Basins, Drop Inlets, Manholes, Junction Boxes, and Spring Boxes.**

1.2.1 Stormwater Manufactured Treatment Devices (MTDs) Type 1

Use MTD Type 1 (separation devices, also referred to as hydrodynamic separators) designed and sized to treat, at a minimum, the stormwater runoff from the **1.8-inch, 1-year, 24-hour storm event**, to prevent pollutants from being transported downstream.

Use MTD Type 1 as the standard Stormwater MTD for general pollutant removal. Use MTD Type 1 that contains a sump for sediment deposition with a series of chambers, baffles or weirs to trap trash, oil, grease and other contaminants. MTD Type 1 may include a high flow bypass mechanism for rainfall events larger than the water quality event to prevent scouring and re-suspension of previously trapped pollutants.

MTD Type 1 not providing a high flow bypass mechanism must provide specific lab or field testing results verifying no re-suspension or scour of previously trapped pollutants during the Level of Service (LOS) design event for the MTD. Use MTD Type 1 with treatment elements or other upstream BMPs to remove trash, debris and other gross pollutants.

Use MTD Type 1 sized using area scaling with a maximum Hydraulic Loading Rate of **25 gpm/sf (0.0557 cfs/sf)**, and an optimal target Hydraulic Loading Rate of **20 gpm/sf (0.0446 cfs/sf)**. MTDs designed with higher Hydraulic Loading Rates must provide specific lab or field testing results verifying the required removal efficiency for the water quality event at the Hydraulic Loading Rate.

Use MTD Type 1 with the following properties:

- Designed for a minimum **80%** Total Suspended Solids (TSS) removal efficiency (ASTM D-3977-97 SSC) of coarse sand (125-micron-mean size, OK-110, or F-95 Silica Sand) for the peak flow rate from the water quality event for average influent concentrations ranging from 100 mg/L to 300 mg/L.
- Use settling, separation, swirling, and centrifugal force techniques to remove pollutants from storm water runoff.
- Contain no moving components that require an external power source such as electricity, gas powered engines or generators.

1.2.2 Stormwater Manufactured Treatment Devices (MTDs) Type 2

Use MTD Type 2 (filtration devices) designed and sized to treat, at a minimum, the stormwater runoff from the **1.8-inch, 1-year, 24-hour storm event**, to prevent pollutants from being transported downstream.

Use MTD Type 2 in areas with impaired receiving waters where high pollutant removal efficiencies are required. Use MTD Type 2 that contains a sedimentation chamber and a filtering chamber. Use MTD Type 2 that contains filter materials or vegetation to remove specific pollutants such as nitrogen,

phosphorus, copper, lead, zinc, and bacteria. Use MTD Type 2 with treatment elements or other upstream BMPs to remove trash, debris and other gross pollutants. Typical pollutant removal efficiencies are variable and are highly dependent on storm size, influent pollutant concentrations, rainfall intensity and other factors.

Use MTD Type 2 with the following properties:

- Designed for a minimum **80%** Total Suspended Solids (TSS) removal efficiency (ASTM D-3977-97 SSC) of Sil-Co-Sil 106 ground silica, or the NJDEP particle size distribution with a D50 of 67 microns for the peak flow rate from the water quality event for average influent concentrations ranging from 100 mg/L to 300 mg/L.
- Use filtering techniques to remove pollutants from storm water runoff.
- Are capable of removing the pollutants of concern for the receiving water body.
- Have typical removal capability for the pollutant of concern from test results as shown in Table 2.

Table 2: MTD Type 2 Typical Pollutant Removal Capability

PROPERTY	VALUE	PROPERTY	VALUE
Total Suspended Solids	≥ 80%	Metals	≥ 50%
Copper	≥ 50%	Lead	≥ 50%
Zinc	≥ 50%	Total Phosphorus	≥ 40%
Total Nitrogen	≥ 30%	Pathogens/Bacteria	≥ 75%
Oil & Grease	≥ 80%	Total Petroleum Hydrocarbons	≥ 80%

1.2.3 Stormwater Manufactured Treatment Devices (MTDs) Type 3

Use MTD Type 3 (catch basin inserts) where right of way space is limited and the installation of MTD Type 1 and Type 2 is not feasible. MTD Type 3 is not applicable for long stretches of linear highway projects containing many stormwater inlets.

Use MTD Type 3 designed for direct installation into storm drains to treat, at a minimum, the stormwater runoff from the **1.8-inch, 1-year, 24-hour storm event**, before it enters the primary storm sewer network or water quality treatment system.

Use MTD Type 3 that may contain filter media including polypropylene, porous polymers, treated cellulose, and activated carbon designed to absorb specific pollutants such as oil, grease, hydrocarbons and heavy metals.

Use MTD Type 3 that provides overflow features that do not reduce the original hydraulic capacity of the catch basin. Pollutant removal efficiencies vary and are highly dependent on storm size, influent pollutant concentrations, rainfall intensity and other factors.

Use MTD Type 3 with the following properties:

- Designed for a minimum **80%** Total Suspended Solids (TSS) removal efficiency (ASTM D-3977-97 SSC) of coarse sand (125-micron-mean size, OK-110, or F-95 Silica Sand) for the peak flow rate from the water quality event for average influent concentrations ranging from 100 mg/L to 300 mg/L.
- Use separation, settling, swirling, centrifugal force, and filtering techniques to remove pollutants from stormwater runoff.
- Contain no moving components that require external power sources such as electricity, gas powered engines or generators.

- Are capable of removing the pollutants of concern for the receiving water body.

1.2.4 Quality Assurance

Provide MTDs from a manufacturer listed on the most recent edition of *SCDOT Qualified Product List 78 Stormwater Manufactured Treatment Devices* in the appropriate category.

At the time of delivery, provide the RCE with a MTD packing list containing complete identification including, but not limited to, the following:

- Manufacturer's name and location.
- Manufacturer's telephone number and fax number.
- Manufacturer's e-mail address and web address.
- MTD name, model, and/or serial number.
- Certification that the specific MTD meets the physical and performance criteria of this specification.

Ensure that each MTD delivered bears identification including, but not limited to, the following:

- MTD name, model, and/or serial number.
- MTD structure number.

1.3 Construction Requirements

1.3.1 Shop Plans and Working Drawings

Submit Shop Plans, Working Drawings, detailed specifications, **and structural design** calculations from the manufacturer for approval prior to MTD installation. Ensure that the Shop Plans and specifications include installation drawings, and instructions that completely describe the MTD. Make certain Shop Plan and Working Drawing submittals conform to the requirements of *SCDOT 2007 Standard Specifications for Highway Construction Section 725, or latest revision*. Do not perform any work on the MTD until said plans have been accepted. Any work done or materials ordered before the acceptance of Shop Plans or Working Drawings is at the Contractor's risk.

1.3.2 Site Preparation

Proper site preparation is essential for MTD installation. Prepare the site per the design plans, SCDOT specifications, and the manufacturer's instructions.

1.3.3 Excavation

Refer to *SCDOT Supplemental Specification for Permanent Pipe Culverts (SC-M-714) or latest revision* for MTD excavation requirements.

1.3.4 Foundation

Refer to *SCDOT Supplemental Specification for Permanent Pipe Culverts (SC-M-714) or latest revision* for MTD foundation requirements.

1.3.5 Bedding

Refer to *SCDOT Supplemental Specification for Permanent Pipe Culverts (SC-M-714) or latest revision* for MTD bedding requirements.

For MTD bedding material, use either:

- Macadam or Marine Limestone Graded aggregate base from the most recent edition of *SCDOT Qualified Product List 2*, or
- Uniformly graded angular stone as large as #5 stone (Class 2 wrapped, vibrated).

1.3.6 Backfill

Refer to *SCDOT Supplemental Specification for Permanent Pipe Culverts (SC-M-714)* or latest revision for MTD backfill requirements.

Use the same material for MTD bedding and MTD structural backfill.

1.3.7 Assembly

Assemble MTDs in accordance with the manufacturer's written assembly instructions and in compliance with all OSHA, AASHTO, local, state, and federal codes and regulations. Erect shoring, bracing, or other devices necessary to achieve safe working conditions. Ensure the MTD bedding is protected from scour or movement during MTD installation.

A manufacturer's representative is required to provide specific MTD assembly instructions to the Contractor and verify the assembly for each of the manufacturer's specific MTD according to the manufacturer's design and assembly instructions.

Ensure proper site stabilization is achieved so MTDs function as designed. Do not use MTDs to trap eroded sediment from construction operations, unless the manufacturer has approved such use in writing. Install MTDs as the last stormwater runoff structures installed on site, or keep these MTDs off-line or isolated until final stabilization is achieved.

If MTDs are used for sediment control, provide written certification from the manufacturer that the device is clean and operating properly at the time a Notice of Termination is filed for the site.

1.3.8 Inspection and Maintenance

- Inspect and maintain all MTDs in accordance with the manufacturer's written recommendations.
- Prepare specific maintenance requirements and maintenance schedules for each MTD.
- Inspect MTDs at least bi-annually to ensure that the MTD is working properly.
- Maintain MTDs as required to maximize pollutant removal.
- Keep a maintenance log to track all MTD inspections and maintenance with the quantities of materials removed from each MTD. Lack of maintenance is the most common cause of failure for MTDs.
- Remove accumulated sediment and other trapped pollutants when the MTD becomes full. Typical removal of pollutants requires the use of a vacuum truck.

1.3.9 Acceptance

Obtain RCE acceptance and approval of all MTD installations. Obtain a letter from the manufacturer verifying the MTD assembly. When requested by the RCE, ensure that a manufacturer's representative is on-site to provide MTD assembly instructions or ensure the manufacturer has provided assembly training to the contractor for each manufacturer specific MTD.

1.4 Measurement

The quantity of the pay item Stormwater Manufactured Treatment Device (MTD) Type (1, 2, or 3) is measured by each (EA) MTD furnished and installed, complete, and accepted. The RCE may require written verification of the MTD assembly by a manufacturer's representative before the quantity is accepted.

1.5 Payment

Payment for Stormwater Manufactured Treatment Device (MTD) Type (1, 2, or 3) is full compensation for installing the MTD as specified or directed and includes furnishing; excavating; providing and placing bedding material; installing; making connection with stormwater pipe or drain including joint sealant; backfilling; disposing of surplus material; maintaining; inspecting; documentation of Quality Control and Quality Assurance programs; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, Specifications, and other terms of the Contract.

All traffic control necessary to perform MTD installation and post construction inspections are provided by the Prime Contractor. No separate payment is made for this traffic control.

Bid item numbers and descriptions are as follows:

Table 3: Bid Item Number

Bid Item Number	Description	Unit
7195551	Manufactured Treatment Device (MTD) Type 1	EA
7195552	Manufactured Treatment Device (MTD) Type 2	EA
7195553	Manufactured Treatment Device (MTD) Type 3	EA