WQ-10 Manufactured Treatment Device (MTD)

1.0 Manufactured Treatment Device

Stormwater Manufactured Treatment Devices (MTDs) function as stormwater treatment devices before stormwater runoff is discharged to Best Management Practices (BMPs), off-site, or to receiving water bodies, and may be incorporated into a series of water quality BMPs to remove pollutants from stormwater runoff. MTDs are applicable for commercial, industrial, and multifamily landuse types. MTDs are not designed, or intended to store a volume of water for water quality treatment. When the storage of a water quantity volume is required, additional or separate BMPs must be implemented. 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 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). Contains a sump for sediment deposition with a series of chambers, baffles or weirs to trap trash, oil, grease, and other contaminants.
- MTD Type 2 - Filtration Devices (Impaired Water Bodies, TMDL Requirements). Contains a sedimentation chamber and a filtering chamber. MTD Type 2 contains filter materials or vegetation to remove specific pollutants such as nitrogen, phosphorus, copper, lead, zinc, and bacteria.
- MTD Type 3 - Catch Basin Inserts (Limited Space). 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. MTD Type 3 must provide overflow features that do not reduce the original hydraulic capacity of the catch basin.

1.1 Sizing Criteria

MTDs are applicable for a maximum drainage area of 3.0 acres.

Size all MTDs to treat at a minimum the entire water quality event (WQE) with no by pass.

The WQE flow rate is a separate flow rate from the Level of Service (LOS) flow rate. In addition to treating the required 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 to meet any other additional watershed, TMDL, or site-specific water quality requirements.

1.1.1 Sizing for the Water Quality Event (WQE)

Size MTDs to treat, at a minimum, the peak flow rate of the stormwater runoff from the **1.8-*inch, 24-hour Type II storm event,*** from the entire drainage area to the MTD. This is defined as the water quality event (WQE). When applicable, use the 1-year 24-hour storm hydrograph and input 1.8 inches as the rainfall depth when performing hydrologic modeling. This water quality event is distributed into the rainfall intensities in Table 1.

Table 1: Water Quality Event (WQE) Design Intensities

Frequency	i (t_c 5 min) (in/hr)	i (t_c 10 min) (in/hr)	i (t_c 15 min) (in/hr)	i (t_c 30 min) (in/hr)
Water Quality Design Storm 1.8 in 24-hr Type II Storm event	2.16	1.93	1.74	1.34

1.2 Design

1.2.1 Design Specifications

The water quality design requirements for Greenville County require that all Stormwater runoff generated from a site is adequately treated before it is discharged.

The required MTD design methodology is to design MTDs on total suspended solids (TSS) removal efficiency based on annual loadings by particle class (clay, silt, small aggregate, sand, large aggregate). Use the Greenville County IDEAL Model or another model such as the USEPA overflow model to design MTDs to meet this criterion.

When used as a stand-alone BMP that is not part of a treatment train, design MTDs to trap a minimum of 85% TSS based on annual loadings.

Where MTDs are not able to meet the annual 85% TSS removal efficiency, they can provide excellent pre-treatment in a series of water quality control BMPs or inlet to permanent pool detention basins or Stormwater wetlands. When used as a part of a treatment series, design MTDs to trap TSS based on annual loadings by particle class (clay, silt, small aggregate, sand, large aggregate). In this situation, the MTD is not required to trap 85% TSS on annual loadings, but the entire treatment series must trap 85% TSS based on annual loadings.

1.2.2 Design MTDs in IDEAL

MTDs are designed and modeled in IDEAL as a User Defined BMP. The site specific loadings, site specific particle size distributions, and the ability of the MTD to trap the different particle classes significantly affect the annual TSS trapping efficiency results of each specific MTD.

IDEAL calculates the MTD TSS trapping efficiency through the input of the specific trapping efficiency of each different particle class (clay, silt, small aggregate, sand, large aggregate). Figure 1 shows the input form for the User Defined BMP in IDEAL. Where applicable, the user can also input the trapping efficiencies of nutrients and bacteria.

Using the reported TSS removal efficiency provided from lab testing from the manufacturer, use Table 4 to determine the specific particle class (clay, silt, small aggregate, sand, large aggregate) to input into the User Defined BMP Inputs form in IDEAL.

Figure 1: User-Defined BMP Inputs

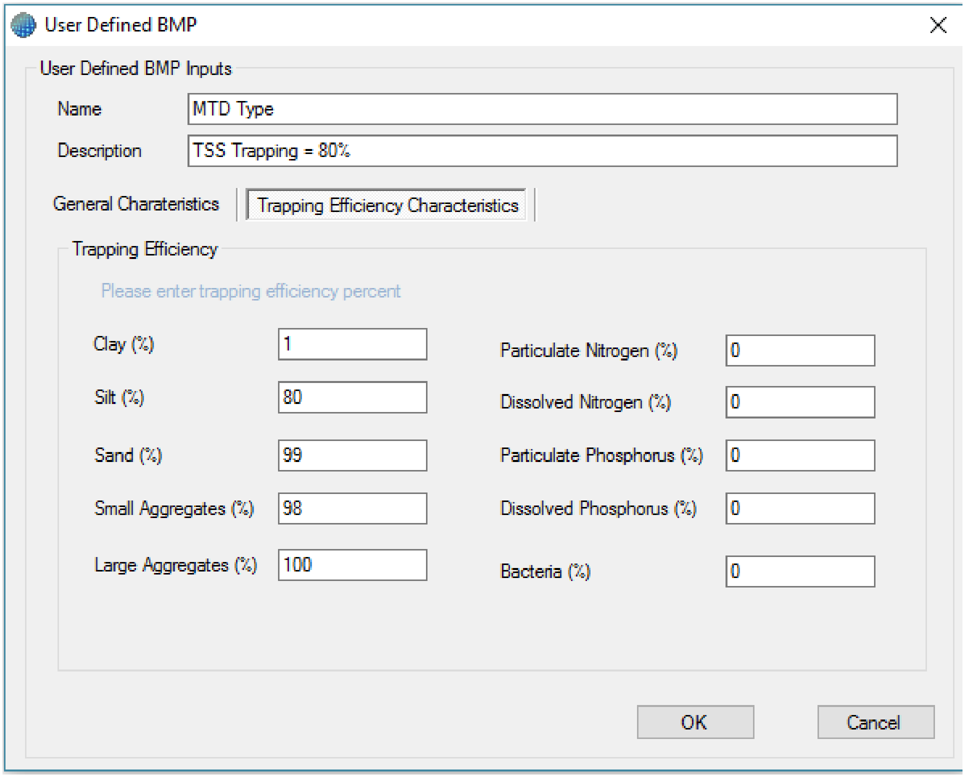

Table 2: TSS Table for Trapping Efficiency for User Input Particle Classes

Manufacturer Provided Lab TSS Trapping Efficiency (%)	Clay (%)	Silt (%)	Sand (%)	Small Aggregate (%)	Large Aggregate (%)
≥ 90	2	90	100	100	100
85	1.5	85	100	99	100
80	1	80	99	98	100
75	0.5	75	99	98	100
70	0	70	98	98	100
60	0	56	98	97	99
50	0	42	98	95	99
40	0	32	98	94.5	99
30	0	22	98	94	99
≤ 20	0	13	98	93	99

1.3 Materials

1.3.1 Material Design Specifications

- Use MTDs designed in accordance with the requirements of the latest *AASHTO LRFD Bridge Design Specifications*. Use MTDs with a HL-93 design live loading.
- Use Class 4000 concrete (minimum) for all MTD precast concrete elements.

- Use reinforcing bars conforming to the requirements of ASTM A706, Grade 60.

- Use welded wire fabric meeting the requirements of AASHTO M55 and AASHTO M221, ASTM A185, or ASTM A497.

- Ensure all materials, manufacturing, testing and product performance for precast concrete components and accessories are in accordance with AASHTO M199 and accepted by the Engineer.

1.3.2 Detailing Requirements

- Ensure the base slab and any required separation slab concrete is poured monolithically with the wall or a water-stop cast into the bottom for the joint to the wall.

- Use tongue and groove joints. Ensure the size and amount of sealant is in accordance with the manufacturer's recommendations.

- Use an appropriate Steel manhole supplied by the manufacturer engraved with the unique MTD markings including the MTD Name and Model number.

1.3.3 Stormwater Manufactured Treatment Devices (MTDs) Type 1

Use MTD Type 1 (separation devices, also referred to as hydrodynamic separators) sized to treat, at a minimum, the stormwater runoff from the applicable Water Quality Event (WQE) to prevent pollutants from being transported downstream.

Use MTD Type 1 as the standard Stormwater MTD for 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 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 acceptable scaling methodologies based on the results of laboratory testing with a maximum Hydraulic Loading Rate of ***25 gpm/sf (0.0557 cfs/sf)***. MTDs scaled with higher Hydraulic Loading Rates must provide specific lab results verifying the required removal efficiency for the water quality event at the higher Hydraulic Loading Rate.

Use MTD Type 1 with the following properties:

- Lab testing results showing 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 Stormwater runoff.
- Contain no moving components that require an external power source such as electricity, gas powered engines or generators.

1.3.4 Stormwater Manufactured Treatment Devices (MTDs) Type 2

Use MTD Type 2 (filtration devices) sized to treat, at a minimum, the stormwater runoff from the applicable Water Quality Event (WQE) to prevent pollutants from being transported downstream.

MTD Type 2 may be required for unique Project constraints such as impaired water body's or TMDL watersheds. 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.

MTD Type 2 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 2 not providing a high flow bypass mechanism must provide specific lab 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 2 with treatment elements or other upstream BMPs to remove trash, debris and other gross pollutants.

Use MTD Type 2 sized using acceptable scaling methodologies based on the results of laboratory testing with a maximum Hydraulic Loading Rate of ***25 gpm/sf (0.0557 cfs/sf)***. MTDs scaled with higher Hydraulic Loading Rates must provide specific lab results verifying the required removal efficiency for the water quality event at the higher Hydraulic Loading Rate.

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:

- Lab testing results showing 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 Stormwater 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 3.

Table 3: 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%

1.3.5 Stormwater Manufactured Treatment Devices (MTDs) Type 3

MTD Type 3 (catch basin inserts) may be required for unique Project constraints. Use MTD Type 3 designed for direct installation into storm drain catch basins. Use MTD Type 3 sized for the specific catch basin they are inserted. Use MTD Type 3 designed to treat stormwater runoff 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.

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:

- Lab testing results showing a minimum **80%** Total Suspended Solids (TSS) removal efficiency (ASTM D-3977-97 SSC) for:
  - Coarse sand (125-micron-mean size, OK-110, or F-95 Silica Sand) with average influent concentrations ranging from 1,500 mg/L to 2,000 mg/L (6% target sediment to water concentration) using ASTM 7351 or equivalent laboratory testing methods.
  - Street sweeping sediment load (average particle size of 200 micron) with average influent concentrations ranging from 24,000 mg/L to 26,000 mg/L (2.5% target sediment to water concentration) using ASTM 7351 or equivalent laboratory testing methods.
- 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.

1.3.6 Quality Assurance

Provide MTD Type 1 and MTD Type 3 from a manufacturer listed on the most recent edition of *SCDOT Qualified Product List 78 Stormwater Manufactured Treatment Devices* in the appropriate category. Provide MTD Type 2 from Table 4:

Table 4: Approved Type 2 MTDs

Manufacturer	Treatment Device	Website	Contact Number
AquaShield, Inc.	AquaFilter Filtration Chamber	www.aquashieldinc.com/	423-870-8888
BaySaver Technologies, Inc.	Bayfilter	www.baysaver.com/	1-800-BAYSAVER
Imbrium Systems Corporation	Jellyfish Filter	www.imbriumsystems.com/	416-960-9900
CONTECH Stormwater Solutions, Inc.	StormFilter	www.conteches.com/	800-338-1122
Hydro International	Up-Flo Filter	www.hydro-international.biz/us/	207-756-6200

At the time of delivery, provide the Engineer 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.

1.4 Construction Requirements

1.4.1 Working Drawings

Submit Working Drawings and Certification that the MTD meets the requirements of this *Specification* to the Engineer. Ensure the Working Drawings contain at a minimum the project name, MTD name and model and/or serial number, MTD dimensioning, MTD and storm sewer invert elevations, installation drawings, and instructions that completely describe the MTD. Do not perform any work on the MTD until the Working Drawings are accepted by the Engineer.

1.4.2 Site Preparation

Proper site preparation is essential for MTD installation. Prepare the site per the Plans, Specifications, and the manufacturer's instructions.

1.4.3 Precast MTD Installation

Perform precast MTD excavation, bed preparation, backfilling and compaction as required on the Plans, Specifications, manufacturer's instructions, or as directed by the Engineer for precast items.

Prepare and compact the MTD bed.

Ensure the elevation of the bedding material accommodates the elevation of all pipes connected to the MTD and the required MTD top elevation.

Place and level the MTD according the manufacturers requirements and to the elevations shown on the Working Drawings and Plans.

Install pipes and grout in place according to the storm sewer elevations, outfall elevations, pipe sizes, and the layout of the MTD as shown on the Plans. Ensure all lifting methods meet OSHA regulations.

Backfill and compact the MTD and all pipes as required on the Plans, Specifications, manufacturer's instructions, or as directed by the Engineer.

1.4.4 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.

Ensure that MTDs are designed and constructed in a manner that will not impact the integrity of the overall Project design and features such as grades, pedestrian facilities and other structures.

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.

1.4.5 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.

1.4.6 Acceptance

Obtain Engineer acceptance and approval of all MTD installations. Obtain a letter from the manufacturer verifying the MTD assembly. When requested by the Engineer, 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.

1.5 IDEAL Modeling

The County's preferred method of demonstrating compliance with its water quality standard is to use the IDEAL model. To facilitate use of this model, Section 1.2.2 and the table below show how to represent this BMP in the IDEAL model. Table 5 lists the parameters needed to successfully run the model and the parameters that affect the trapping efficiency of the BMP.

Table 5: IDEAL Modeling Guide

<table>
<tr><th colspan="3">MTD Modeling in IDEAL</th></tr>
<tr><td>What to Model as in IDEAL</td><td colspan="2">User Defined BMP</td></tr>
<tr><td>Similar BMPs</td><td colspan="2">Any BMP for which no other BMP Object is suitable and where a trapping efficiency is known or may be estimated as a percent.</td></tr>
<tr><td rowspan="4">Specifications Needed for IDEAL</td><td colspan="2">A reference for trapping efficiency and device capabilities</td></tr>
<tr><td colspan="2">Maximum flow rate and total volume the device can contain before going into bypass mode</td></tr>
<tr><td colspan="2">Maximum amount of dissolved nitrogen and phosphorous that can be trapped</td></tr>
<tr><td colspan="2">Trapping efficiency characteristics of the device</td></tr>
<tr><td rowspan="3">Parameters that Drive Performance</td><td>Feature</td><td>How Value Affects Sediment Trapping Efficiency (TE)</td></tr>
<tr><td>Max Flow Rate Before Bypass</td><td>Higher flow rate increases TE</td></tr>
<tr><td>Max Volume of Sediment Storage</td><td>Larger volume increases TE</td></tr>
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