9.6 MANUFACTURED TREATMENT DEVICES

Manufactured treatment devices (MTD) are proprietary stormwater treatment systems used to address the stormwater quality impacts of land development. MTDs rely upon a variety of mechanisms to remove pollutants from stormwater runoff. When selecting an MTD for a particular site, the peak flow rate of the Water Quality Design Storm, the contributory drainage area, and the physical size limits of the MTD installation area must be known in advance. An MTD must have a Department-issued certification letter in order to be accepted for use and be sized in accordance with its published verification report. Currently, the total suspended solids (TSS) removal rate is either 50 or 80%, depending upon the individual certification of the device, which may be found at: http://www.njstormwater.org/treatment.html.

N.J.A.C. 7:8 Stormwater Management Rules - Design and Performance Standards		
	Nonstructural Strategy	Not Allowed
	Water Quantity	Not Allowed
GR	Groundwater Recharge	Not Allowed
%	Water Quality	50 or 80% TSS, depending upon posted NJDEP certification

Introduction

An MTD is a proprietary device used to treat stormwater runoff. There are three types of MTDs currently certified by the Department: hydrodynamic sedimentation (HDS) devices, filtration devices and subsurface settling ponds.

HDS devices are flow-through structures that remove pollutants by settling either by creating a swirling vortex, through the use of a baffle system or laminar plates, or a combination of those mechanisms. Filtration devices remove pollutants by passing stormwater through filter media, and subsurface settling ponds remove pollutants through sedimentation.

Finally, all MTDs must have a maintenance plan and, if privately owned, should be protected by easement, deed restriction, ordinance, or other legal measures that prevent its neglect, adverse alteration and removal.

Applications

The total suspended solids (TSS) removal rate for MTDs is based on NJDEP certification of each device. To receive credit for the NJDEP certified TSS removal rate, MTDs must be correctly sized. The most current MTD certifications with sizing information can be found on the Department's stormwater website at: http://www.njstormwater.org/treatment.html. Note that this certification list is subject to change. As technologies evolve, additional MTDs may become certified and get added to the list. Conversely, existing certifications may expire and be removed from the list. Therefore, it is important to check the website regularly when considering using an MTD in any type of site design.

Design Criteria

Basic Requirements

Presented below are general design criteria for MTDs; however, each MTD has additional design criteria based on the type of device and the model. For a full list of design criteria for a specific MTD, please refer to the certification documents at: http://www.njstormwater.org/treatment.html.

Flow Rate

- All MTDs must be selected based on the peak flow rate of the Water Quality Design Storm for the entire contributory drainage area to the MTD, which may have size restrictions. For more information on specific limitations refer the certification letter for that specific MTD.
- When calculating the flow rate using Natural Resource Conservation Service (NRCS) methodology, the Delmarva unit hydrograph may not be used. The standard unit hydrograph with a peak rate factor of 484 must be used in this calculation.
- When calculating the flow rate using the Rational Method, the intensity of the Water Quality Design Storm must be determined using the Rainfall Intensity-Duration Curve located in *Chapter 5: Computing Stormwater Runoff Rates and Volumes*. The correct intensity value to use is directly correlated to the computed time of concentration. As such, noting that the Water Quality Design Storm is defined as 1.25 inches of rain falling over a 2-hour time period, it is incorrect to utilize an average intensity of 0.625 inches/hour when sizing MTDs, because MTDs are based on peak flowrates, as opposed to runoff volumes. For the same reason, use of the Modified Rational Method is not allowable when sizing MTDs.
- Future connections to a system that includes an MTD are prohibited if the proposed maximum water quality treatment flow rate of the existing MTD would be exceeded.

Structural

- All devices subject to vehicular loading must be designed for at least HS-20 traffic loading at the surface.
- All joints and connections must be watertight.
- The manhole cover, or other approved permanent marker, must clearly indicate that it is a pollutant-trapping device.

Safety

All MTDs must be designed to safely convey overflows to downstream drainage systems. The design of the overflow structure must be sufficient to provide safe, stable discharge of stormwater in the event of an overflow. Safe and stable discharge minimizes the possibility of adverse impacts, including erosion and flooding in down-gradient areas. Therefore, discharge in the event of an overflow must be consistent with the Standards for Off-Site Stability found in the *Standards for Soil Erosion and Sediment Control* in New Jersey.

Outflow

Blind connections to downstream facilities are prohibited. Any connection to downstream stormwater management facilities must include access points such as inspections ports and manholes, for visual inspection and maintenance, as appropriate, to prevent blockage of flow and ensure operation as intended. All entrance points must adhere to all Federal, State, County and municipal safety standards such as those for confined space entry.

Tailwater

The effects of tailwater must be considered based upon the MTD manufacturer's recommendations.

Access Requirements

An access roadway must be included in the design to facilitate monitoring and maintenance. If the access roadway is constructed of impervious material, take note that it may be subject to the stormwater quality, quantity, and/or groundwater recharge requirements at N.J.A.C. 7:8-5.4 and 5.5.

Sizing an MTD

The examples below illustrate how to size a manufactured treatment device to treat the runoff generated by the Water Quality Design Storm.

Example 1: The following parameters apply:

Area =	1 acre
CN Value =	98 (100% Impervious)
T_c=	6 minutes
Unit Hydrograph Peak Rate Factor =	484 (SCS)

Step #1: Runoff Calculations

Using the Natural Resource Conservation Service (NRCS) methodology, the Water Quality Design Storm runoff peak flow rate was calculated to be 2.93 cfs.

Step #2: Selecting the appropriate MTD model

The website http://www.njstormwater.org/treatment.html contains a table, shown on the following page, of the MTDs certified at the time of publication of this chapter. As the table shows, some MTDs currently have both field and laboratory verifications. In such a case, either verification may be used to size the MTD. Clicking on the word *certification* in the appropriate cell of the table will open the certification letter for that MTD, which includes either an example on how to size the MTD or a table with model numbers and allowable flow rates for each model. The information presented in the certification letter must be used to size the MTD.

Current Listing of Department Approved Stormwater MTDs

Stormwater Management Manufactured Treatment Devices Certified by NJDEP	MTD Laboratory Test Certifications	Field Test Certifications	Superseded Certifications	Certified TSS Removal Rate	Maintenance Plan
AquaFilter Filtration Chamber by AquaShield, Inc.		Certification	Superseded	80%	Plan
Aqua-Swirl Concentrator By Aqua-Shield. Inc.		Certification	Superseded	50%	Plan
Continuous Deflective Separator (CDS) Unit by CONTECH Stormwater Solutions, Inc.	Certification	Certification	Superseded	50%	Plan
Downstream Defender by Hydro International, Inc.	Certification		Superseded	50%	Plan
Dual Vortex Separator by Oldcastle Stormwater Solutions	Certificaton			50%	Plan
Filterra Bioretention System by Contech Engineered Solutions	Certification		Superseded	80%	Plan
Jellyfish Filter by Imbrium Systems Corporation		Certification	Superseded	80%	Plan
Media Filtration Systems by CONTECH Stormwater Solutions, Inc.		Certification	Superseded	80%	Appendix A
StormPro Stormwater Treatment Device by Environment 21, LLC	Certification			50%	
StormVault by Jensen Precast, Inc.		Certification	Superseded	80%	Appendix A
Stormwater Management StormFilter by CONTECH Stormwater Solutions, Inc.		Certification	Superseded	80%	Plan
Up-Flo Filter by Hydro International		Certification	Superseded	80%	Plan
Vortechs Stormwater Treatment System by CONTECH Stormwater Solutions, Inc		Certification	Superseded	50%	Plan

For this example, the following MTD models would be acceptable (this only includes MTDs certified as of the date of publication of this chapter and is not intended to either exclude MTDs that are certified afterward or allow the use of MTDs with certifications that have subsequently expired):

MTDs Certified for 50% TSS Removal		
MTD	**Model**	**Maximum Water Quality Treatment Flow Rate**
Aqua-Swirl	AS-7	3.55 cfs
CDS	CDS-8	3.7 cfs
Downstream Defender	8-ft	4.49 cfs
Dual Vortex Separator	DVS-84	3.06 cfs
StormPro	V816	5.17 cfs

MTDs Certified for 80% TSS Removal		
MTD	**Model**	**Maximum Water Quality Treatment Flow Rate**
Aqua-Filter	AF-7.7	3.55 cfs
Filterra	7 x 13	0.295 cfs*
Jellyfish Filter	JF-10-15-3	2.94 cfs
Media Filtration System	74 cartridges	2.96 cfs
StormFilter	88 - 15 gpm cartridges	2.94 cfs
StormVault	24 hour detention	N/A**
Up-Flo Filter	53 modules	2.95 cfs

For the Filterra device marked * above, a minimum of 10 units would be required to treat the water quality flow rate in this example. In any case where the water quality flow rate exceeds the maximum treatment capacity of an MTD, the flow can be diverted into multiple appropriately sized MTDs.

For the StormVault device marked ** above, TSS removal is a function of volume and detention time, and not the maximum water quality treatment flow rate. This unit is sized using a routing calculation, which is beyond the scope of this chapter.

Alternatively, example 1 can be calculated using the Rational Method.

Example 2: The following parameters apply:

Area =	1 acre
C Value =	0.99 (100% Impervious)
T_c=	10 minutes (min. value on the IDF curve)
Intensity=	3.2 inches/hour

Step #1: Runoff Calculations

First the Tc must be determined. In this example, the Tc is 10 minutes. This Tc must then be used to determine the intensity, which is done using the rainfall Intensity-Duration Curve for the Water Quality Design Storm located in *Chapter 5: Computing Stormwater Runoff Rates and Volumes.* Using the curve, the intensity is determined to be 3.2 inches/hour. Once the intensity is determined, the flow rate can be calculated with the following equation:

$$Q = C * I * A$$

Substituting the values noted above yields the following result:

$$Q = 0.99 * 3.2 * 1 = 3.17\ cfs$$

Step #2: Selecting the appropriate MTD model

The method for selecting the appropriate MTD model remains unchanged from example 1. As you can see, in this case, the Rational Method produces a slightly higher peak flowrate, which will require some of the MTD units to be slightly larger than what would be required if the calculations were performed with NRCS methodology as shown in example 1. Therefore, while using the Rational Method is simpler, it may be advantageous to use NRCS methodology in many cases. Furthermore the Rational Method may only be used for drainage areas of less than 20 acres.

Considerations

If an MTD is being considered for an outfall retrofit, it is essential to calculate the current Water Quality Design Storm flow rate based on the entire inflow drainage area at the outfall before selecting the MTD. Additionally, the annual cost of components may be a deciding factor in the selection process when considered over the life cycle of an MTD unit. For more information on components which require periodic replacement, refer to the Operations and Maintenance Manual for the MTD being evaluated for suitability.

Maintenance

Regular and effective maintenance is crucial to ensure effective MTD performance; in addition, maintenance plans are required for all stormwater management facilities associated with a major development. There are a number of required elements in all maintenance plans, pursuant to N.J.A.C. 7:8-5.8; these are discussed in more detail in *Chapter 8: Maintenance of Stormwater Management Measures*. Furthermore, maintenance activities are required through various regulations, including the New Jersey Pollutant Discharge Elimination System (NJPDES) rules, N.J.A.C. 7:14A. Specific maintenance requirements for MTDs are presented below; these requirements must be included in an MTD's maintenance plan.

General Maintenance

- All structural components must be inspected, at least once annually, for cracking, subsidence, spalling, erosion and deterioration.
- Components expected to receive and/or trap debris and sediment must be inspected for clogging at least twice annually.
- During inspections, the MTD must be examined for standing water. If standing water is present in the MTD, and standing water is not a component of the MTD design, corrective action must be taken and the maintenance manual must be revised to prevent similar failures in the future.
- Sediment removal should take place when all runoff has drained from the MTD.
- Disposal of debris, trash, sediment and other waste material must be done at suitable disposal/recycling sites and in compliance with all applicable local, state and federal waste regulations.
- The maintenance plan must indicate the maximum allowable level of oil, sediment and debris accumulation. These levels must be monitored during inspections to ensure that removal of these materials is performed when necessary.
- In addition to the requirements for maintenance listed above, maintenance in accordance with the MTD manufacturer's recommendations must be included in the maintenance manual and performed as indicated.

Vegetated Areas

- When using an MTD with vegetation, bi-weekly inspections are required when establishing/restoring vegetation.
- A minimum of one inspection during the growing season and one inspection during the non-growing season is required to ensure the health, density and diversity of the vegetation.
- Mowing/trimming of vegetation must be performed on a regular schedule based on specific site conditions; perimeter grass should be mowed at least once a month during growing season.
- Vegetative cover must be maintained at 85%; damage in excess of 50% must be addressed through replanting in accordance with the original specifications.

- Vegetated areas must be inspected at least once annually for erosion, scour and unwanted growth; any unwanted growth should be removed with minimum disruption to the remaining vegetation.
- All use of fertilizers, pesticides, mechanical treatments and other means to ensure optimum vegetation health must not compromise the intended purpose of the MTD.

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