Importance of MTD Sizing Criteria linked to Performance Verification

Stormwater Best Management Practices (BMPs) are utilized on sites of differing sizes and conditions. However, to ensure a relatively consistent level of performance equivalent to that identified in previous performance monitoring for any given type of BMP, critical sizing variables must be held constant.

Manufactured Treatment Devices (MTDs) are similar to non-proprietary stormwater BMPs in that they must be properly sized or they will not perform as intended. Like all types of BMPs, MTDs can be scaled up or down to accommodate different size drainage areas and water quality treatment criteria. In doing so, it is critical to maintain consistent hydraulic loading rates for a given MTD. There are a number of different evaluation programs for MTDs that utilize field and/or laboratory testing to establish performance capabilities. These programs document the appropriate hydraulic loading rate for a given MTD to meet water quality criteria within a suitable maintenance period. It is common practice for the approved hydraulic loading rate to be a condition of approval, which must be adhered to when designing an MTD for any given application.

There are many kinds of MTDs being marketed, but most can be classified as either settling (sedimentation) devices or filtration devices. The performance of settling devices is often governed predominantly by residence time, which is a function of the size of the device and the rate at which flow passes through it. The most common sizing approach for this class of MTD is to determine a specific hydraulic loading rate for the maximum settling surface area. This rate is typically expressed as gallons per minute treated per foot squared of settling surface area in the sedimentation device. For example, a device with 12 square feet of surface area in the sedimentation chamber and a rated capacity of 25gpm/ft^2, would have an actual treatment capacity of 300gpm. Filtration devices are also typically assigned a surface area specific loading rate, but in the case of filters the key variable is the surface area of the filtration media. It is common to assign a rate of xx gallons per minute per square foot of media filtration surface area capacity (gpm/ft^2). A filter rated for 2gpm/ft^2 of surface area and having 12ft^2 of filter surface has an actual treatment capacity of 24gpm.

Virginia DEQ's Guidance Memo No. 14-2009 for interim use of MTDs could easily add "maximum settling surface area specific load rate" or "gallons per minute per square foot of media filtration surface area capacity" for each MTD. The current memo does not include hydraulic loading rates or any other guidance for sizing the MTDs. However, this is important information for the person trying to select the most appropriate MTD(s) for a development site.

When an approved hydraulic loading rate is not identified and clearly linked to a performance evaluation, some MTD providers or engineers may design practices at hydraulic loading rates substantially higher than the rate at which the MTD was tested and for which performance was verified. This yields smaller MTDs per acre treated, but reduces the level of water quality protection. All else being equal, a smaller MTD (higher hydraulic loading rate) removes less Phosphorus and other pollutants and requires more frequent maintenance.

The lack of sizing criteria linked to the performance data for reviewed and approved BMPs in Virginia places the burden of trying to determine if a MTD is properly sized on local and state reviewers, many of whom do not have the time or expertise to address this issue. Additionally, the engineering community is subject to having to redesign MTDs when improper sizing is not addressed until a proposed plan is under review.

The Guidance document can quickly be improved by adding little more than a sentence or two about the appropriate hydraulic loading rates for the MTD listings on the Clearinghouse website.

Example: ***xxxx MTD should be designed not to exceed xx gpm/ft2 of surface area during the water quality flow, as calculated using the method prescribed in the VA Stormwater Management Manual*****.**

Alternatively, the design rates for each MTD can be listed in a column format along with the respective MTD on the Stormwater Clearinghouse website. The Clearinghouse was initially conceptualized for such additions to BMP design standards. DEQ can take advantage of existing and widely recognized infrastructure as a result.Simple solutions of this nature eliminate the challenges currently faced by all stakeholders and most importantly ensure that MTDs are performing as intended and protecting water quality.